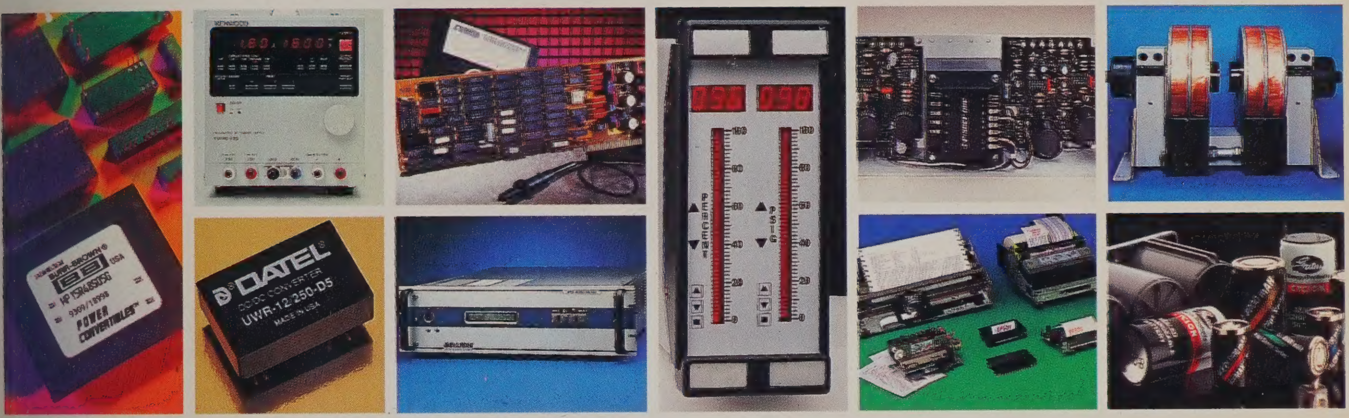
ISSN 0732-9016

eem 93 94

electronic engineers master catalog

VOLUME D



power sources, instrumentation, computer products, and equipment

36th EDITION

1100	Amplifier Assemblies, Instrumentation
1200	Antennas & Accessories
1300	Audio Equipment & Accessories
1900	Communications & Telemetry Equipment
2000	Computer Peripheral Equipment
2025	Computers (Mini/Micro/Boards)
2050	Computer Software
2200	Control Systems & Components
2325	Data Acquisition/Handling Systems & Accessories
2550	Environmental Test Equipment
2900	Instruments, Test & Measuring
2950	Panel Meters (Analog & Digital)
2975	Oscilloscopes
3000	Graphic Recording Instruments
3900	Batteries
4000	DC Power Supplies
4025	DC-DC Converters
4050	AC Power Supplies
4100	Production Equipment & Manufacturing Services
4900	Servomechanisms & Robotic Equipment

volume A Electronic components

volume B Electromechanical, electro-optical, and military components

volume C Interconnections, packaging, and hardware

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POWER CONVERSION
Bringing Power to World Class

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____ High Performance
____ General Purpose
____ Non-Isolated

AC/DC Switchers

____ General Purpose
____ Encapsulated
____ External
____ Modular Power
____ Medical
____ Linear

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COMPUTER™
PRODUCTS
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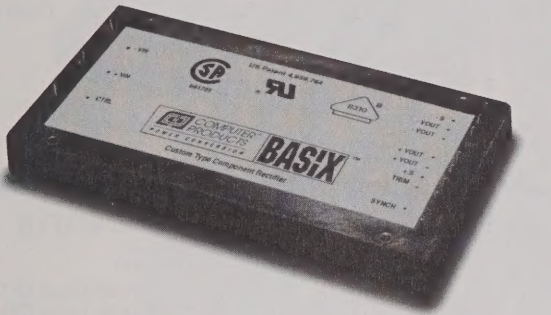
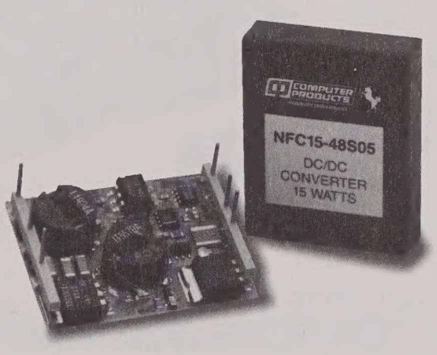
Bringing Power to World Class

Power Supplies


COMPUTER PRODUCTS
BASIX
Custom Type Component Rectifier

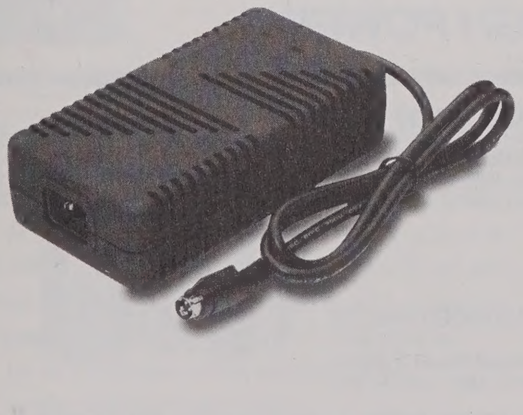
Innovation

resides not in what it is,
but in what it does


COMPUTER PRODUCTS
NFC15-48S05
DC/DC
CONVERTER
15 WATTS

Reliability

the odds of being the best are much
higher when you accept nothing less



Value

lies not in the promise,
but in the performance

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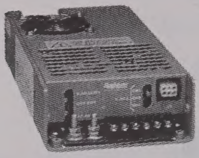
NATIONAL ACCOUNTS DIVISION, 47173 Benicia Street, Fremont, CA 94538, Telephone: (510) 657-6700, Fax: (510) 683-6400

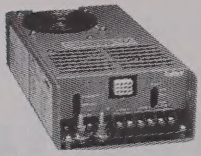
POWER SUPPLY SELECTION GUIDE

• AC TO DC • 0.99 POWER FACTOR OPTION • DC TO DC

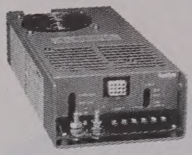
250 WATTS
SERIES 2A
2" x 4.5" x



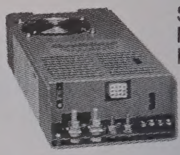
400 WATTS
SERIES 2B
2.5" x 5" x 10"



500 WATTS
SERIES 2C
2.5" x 5" x 11.5"



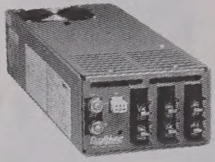
650 WATTS
SERIES 2D
2.5" x 5" x 14"



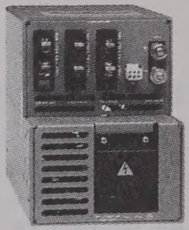
Single &
Multi-Outputs:
Page **D**•1812

LOW TO MEDIUM POWER

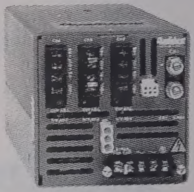
600/750 WATTS
SERIES 23/33
3" x 5" x 14.25"
4" x 5" x 14.25"
Single Output: Page **D**•1813
Multi-Outputs: Page **D**•1814



750 WATTS
SERIES 21
6.5" x 5" x 10"
Single Output: Page **D**•1813
Multi-Outputs: Page **D**•1814



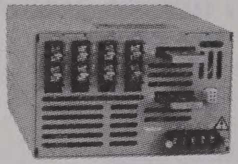
800-1000 WATTS
SERIES 28
5" x 5" x 11"
Single Output: Page **D**•1813
Multi-Outputs: Page **D**•1814



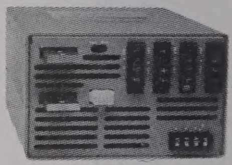
200-1500 WATTS
SERIES 4/OMEGA
2.5" x 5" x 5.6"
2.5" x 5" x 13.7" w/PFC
Single & Multi-Outputs: Page **D**•1810

Qualidyne
Qualidyne

1000-2000 WATTS
SERIES 31
5" x 8" x 11"/11.5"
5" x 8" x 12.5" w/PFC
Single Output: Page **D**•1813
Multi-Outputs: Page **D**•1814



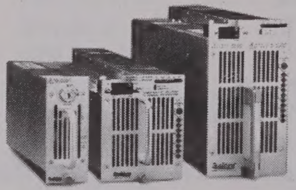
2000/3000 WATTS
SERIES 36
5" x 8" x 13.75" w/PFC
5" x 8" 15.5"
Single Output: Page **D**•1813
Multi-Outputs: Page **D**•1814



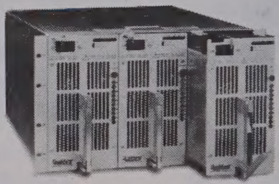
MEDIUM TO HIGH POWER

POWER SYSTEMS & PLUG-IN SUPPLIES

200-3000 WATTS
SERIES 4, 28, 31, 36
Single & Multi-Outputs:
Page **D**•1811 and **D**•1814



400-9000 WATTS
SERIES MPS
Modular Power Systems
Page **D**•1811 and **D**•1814



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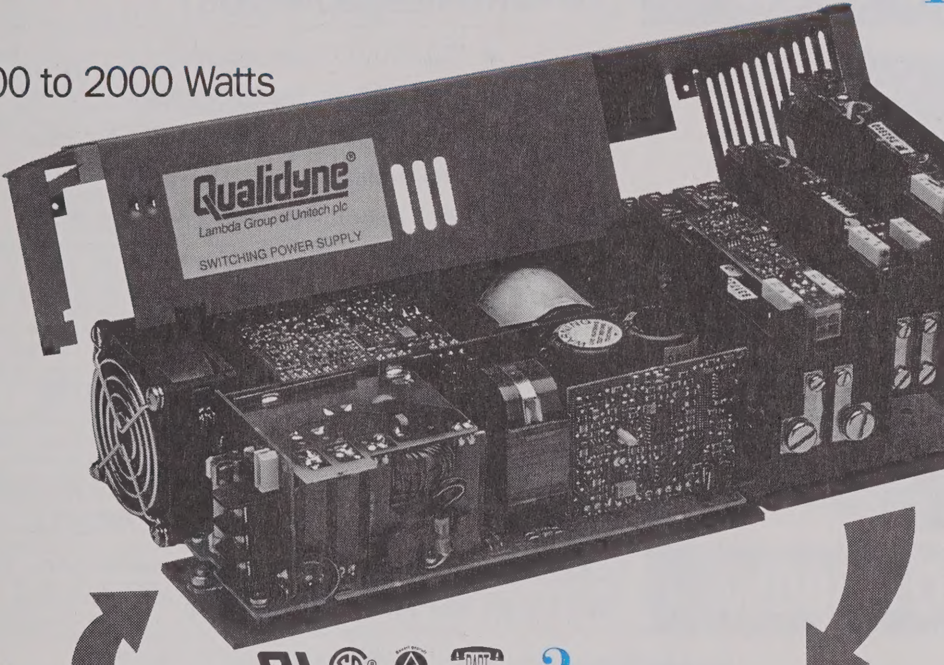
(619) 575-1100 • FAX: (619) 575-7185

SEE EEM PAGES **D**•1810 THRU **D**•1815

Simple As 1, 2, 3! Configure Your Own Modular Power Supply

200 to 2000 Watts



Shown: AC input with PFC, 600 Watts, 4-Outputs, 2.5" x 5" x 11" 4 Watts/in^3

1.

SELECT INPUT VOLTAGE	(CHECK ONE)
AC 115/230 VAC (Auto Select optional)	
AC with PFC 85-264 VAC (Meets IEC 555-2)	
DC (48 VDC)	

2.

SELECT DC OUTPUTS

Volts	Amps	Module	Quantity Needed
2-6V	25A	B	
2-6V	60A	A	
2-6V	100A	L	
5-15V	12A	C	
5-15V	24A	F	
5-15V (x2)	6A max*	E	
12-28V (x2)	3.5A max*	H	
12-28V	7A	D	
12-28V	15A	G	
25-60V	10A	J	

Select up to 8 DC output modules. *Total current from dual output module.

3.

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Now configuring your own power supply is as easy as filling in the blanks. Just tell us which input and which DC outputs you need and we'll put the modules in place. What could be simpler?

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- Parallel/Current-Share (optional)
- 200 to 2000 Watts
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- Power Factor Correction (IEC 555-2)

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SELECTION GUIDE

EEM PAGE

250 TO 650W
SINGLE & MULTI-OUTPUT, LOW PROFILE, LOW COST

- 120/240VAC (Strappable)
- Auto AC Line Select (Option)
- Approved to UL, CSA, VDE, EN Specs
- Low Profile
- Fully Regulated & Floating Outputs

D•1812

200 TO 1500W
SINGLE & MULTI-OUTPUT, USER CONFIGURABLE

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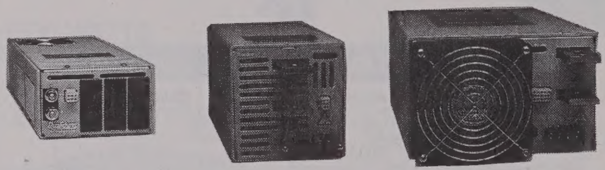
- 110/220VAC (Strappable)
- Power Factor Correction Per IEC555
- Low Leakage/EMI Class B
- Up to 10 Outputs
- Meets UL, CSA, BS, EN Specs
- Wide Range Adjustable Outputs

D•1810

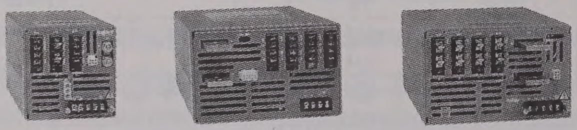
300 TO 3000W
SINGLE OUTPUT, MEDIUM TO HIGH POWER



- AC & DC Inputs
- Auto Current Share (Option)
- Universal 90 to 264VAC Input (Option)
- 0.99 Power Factor (Option)
- 2 to 56VDC Outputs
- Wide Range Adjustable Outputs

D•1813

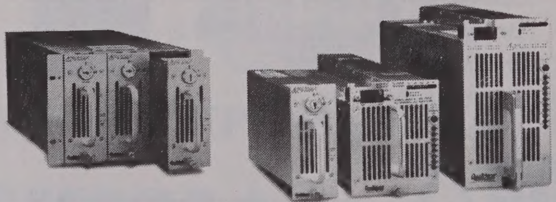
600 TO 2000W
MULTI-OUTPUT, STANDARD AND WIDE ADJUSTMENT RANGE MODELS



- AC &DC Inputs
- 0.99 Power Factor (Option)
- Up to 9 Outputs
- Current Sharing on All Outputs (Option)
- Universal Input, 90 to 264VAC (Option)

D•1814
D•1815

UP TO 9000W
PLUG-IN POWER SUPPLIES & POWER SYSTEMS



- AC & DC Inputs
- Zero System Down Time
- Up to 9 Outputs
- Hot Plug-In/Replacement
- Modular Construction
- 2 to 56 VDC Outputs

D•1811
D•1814

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how to use eem

The 36th edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other that that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in boldface type and page numbers are shown. Manufacturers appearing in lightface type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 37 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

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1200	Antennas & Accessories				D•1022
1300	Audio Equipment & Accessories				D•1026
1400*	Cabinets, Enclosures, Racks, & Chassis			C•1002	
1500*	Capacitors	A•1002			
1600	Chemical Compounds (Adhesives, Cleaners, Coatings)			C•1134	
1700	Circuit Boards (Printed), Materials, & Accessories			C•1135	
1800*	Coils, Chokes, & Inductors	A•1178			
1850	Cores, Magnets, & Ferrites	A•1316			
1900	Communications & Telemetry Equipment				D•1073
2000	Computer Peripheral Equipment				D•1078
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2050	Computer Software				D•1147
2100*	Connectors, Terminals, & Sockets			C•1138	
2200	Control Systems & Components				D•1149
2300*	Crystals, Oscillators, Crystal & Piezoelectric Filters	A•1324			
2325	Data Acquisition/Handling Systems & Accessories				D•1170
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* A Product Selection Guide precedes these Product Sections.

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Wellesley, MA 02181
(617) 239-1333
FAX: (617) 239-0558

New York, New Jersey & Southern Connecticut
The Druker Company
Research Park
338 Wall Street
Princeton, NJ 08540
(609) 921-3686
FAX: (609) 921-1853

Pennsylvania & Southeast
Hearst Business Communications, Inc.
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1100 E. Hector Street
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Conshohocken, PA 19428
(215) 941-0600
FAX: (215) 941-0335

Midwest
Pattis/3M
7161 N. Cicero Avenue
Lincolnwood, IL 60646
(708) 679-1100
FAX: (708) 679-5926

Southern California/ Nevada, Arizona, Utah & New Mexico
Media West
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Anaheim, CA 92807
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FAX: (714) 283-8165

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FAX: (408) 249-1384

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(617) 239-1333
FAX: (617) 239-0558

Japan
Interpress Inc.
Yamaji Sanbancho Bldg. 5th Floor
5-24, Sanbancho, Chiyoda-ku
Tokyo 102
81-33-234-2331
FAX: 81-33-234-2380

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Hearst Business Communications, Inc.
645 Stewart Avenue
Garden City, NY 11530
(516) 227-1300
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manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

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technical information: codes... miniglossaries...charts...

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† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

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† Astromec, Inc., Carson City, NV 89706	702-883-9226
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† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
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† Astromec, Inc., Carson City, NV 89706	702-883-9226
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† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Vasak Inds., Inc., El Segundo, CA 90245 .... 1-800-67-VASAK
Velmex, Inc., East Bloomfield, NY 14443 .... 716-657-6151;800-642-6446
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Adapters — See Connector Adapters (Vol. C), Plug Adapters (Vol. C), Socket Adapters (Vol. C), etc.
Adapters/Connectors, T.V. to Peripheral Equipment-2100 — *See Vol. C*
Adapters, GPIB, IEEE 488, etc.-2100 — *See Vol. C*
Adapters, Fiber Optic-2475 — *See Vol. B*

Adapters, Meter, Current Measurement-2900

EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 .... D•1688
§ Contact East, N. Andover, MA 01845 508-682-2000
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
§ Metermaster, Tempe, AZ 85282 602-431-0015
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100

Adapters, Modular Telephone-2100 — *See Vol. C*
Adapters, Power, US to other, etc.-2100 — *See Vol. C*
Adapters, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)
Adapters, Waveguide-3450 — *See Vol. A*
Adapters, RF (MIL)-2440 — *See Vol. B*
Adhesives, Conducting-1600 — *See Vol. C*
Adhesives, General Purpose-1600 — *See Vol. C*
Adhesives, Insulating-1600 — *See Vol. C*
Adhesives, Liquid Spray-1600 — *See Vol. C*
Adhesives, Optical-1600 — *See Vol. C*
Adhesives, UV Curing-1600 — *See Vol. C*
Adhesives, Wire Tacking-1600 — *See Vol. C*
Air Cleaners & Filters (Shielded & Unshielded)-2600 — *See Vol. C*
Air Conditioners (For Equipment)-2600 — *See Vol. C*

Alarms & Alarm Systems-2200

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 .... D•1026-1027
International Components Corp., Melville, NY 11747, 516-293-1500 .... D•1035
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 .... D•1051
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .... D•1053-1055
North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1130-1131
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364,1367
§ Projects Unlimited, Dayton, OH 45414, 513-890-1918 .... D•1057
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 .... D•1063
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2011
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .... D•1064
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 .... D•1068-1071
Action Instruments, San Diego, CA 92123 619-279-5726
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
AES Corp., Peabody, MA 01960 508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622
Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
American Assembly Inc., Florida, NY 10921 914-651-3433
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911 619-575-4011
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484 203-926-1777
† Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440 215-362-3500
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Corby Industries, Inc., Allentown, PA 18103 215-433-1412
§ Dancer Communications, Inc., Secane, PA 19018 215-543-8066
Dantel, Fresno, CA 93727 209-292-1111
Dataprobe, Englewood, NJ 07631 201-569-6464
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
§ DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
§Φ Dynamic Power Systems, Nesconset, NY 11767 .... 516-361-6771;1-800-422-0708
§ Edwards Co., Signaling Prods. Div., Farmington, CT 06034 203-678-0410
§Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
§† George Risk Industries, Inc., Kimball, NE 69145 308-235-4645
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408 1-800-328-5111
JEMA, Wilmette, IL 60091 708-251-3600
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 617-894-8700
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
† Kolin Inds., Inc., Pound Ridge, NY 10576 914-764-5775
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
§ Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 .... 800-336-2112;703-953-4751
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
† Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 803-249-5191
Medicam Technologies Inc., Hudson, NH 03051 603-886-9460
† Mep Controls, Bordentown, NJ 08505 609-298-7300
Metrix Instrument Co., Houston, TX 77043 713-461-2131
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
Omega Engineering, Stamford, CT 06907 800-826-6342
† Oven Industries, Mechanicsburg, PA 17055 717-766-0721
§ Poly-Planar Inc., Warminster, PA 18974 215-675-7805
PPM, Inc., Cleveland, OH 44122 1-800-899-4776
§ Precision Digital Corp., Natick, MA 01760 508-655-7300
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
§ Rodann Electronics Mfg. Co., Costa Mesa, CA 92626 .... 714-662-3232;800-366-7010
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
§ Sierra Monitor Corp., Milpitas, CA 95035 408-262-6611
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§† Sonicall, Inc., Signal Hill, CA 90806 213-490-2143
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Tektone Sound & Signal, Lake Park, FL 33403 407-844-2383
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Vibra-Metrics, Inc., Hamden, CT 06514 .... 203-288-6158;1-800-U-SENS-IT
Wheelock, Inc., Long Branch, NJ 07740 908-222-6880
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 813-646-3909
Xylog Corp., Hackensack, NJ 07601 201-489-4040

Alarms, Controls, Photoelectric-3700 — *See Vol. B*

Alarms, Static Level-4100

Approved Purification Corp., Stamford, CT 06907 203-357-0141
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ Endress & Hauser Instruments, Greenwood, IN 46143 .... 317-535-7138;800-428-4344
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
§ Testone Inc., Skippack, PA 19474-1589 215-584-9658

Alloys, Brazing-5400 — *See Vol. C*
Alloys, Metal/Ceramic-1600 — *See Vol. C*
Alphanumeric Readouts — See Tubes, Readout (Vol. A)

Alternators-4050

† Georator Corp., Manassas, VA 22110-5512, 800-523-9938 .... D•2261-2263
† American Electronics, Inc., Fullerton, CA 92631 714-871-3020
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† Pacific Scientific, Electro Kinetics Division, Santa Barbara, CA 93101 805-963-2055
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815 607-335-5000
§ Square D Co., Palatine, IL 60067 708-397-2600

Altimeters-2900

† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000

Aluminizers, Vacuum — See Deposition Equip. (Vol. D), Evaporation Equipment, Electronic Beam (Vol. D)

Amplifiers, AF-1300

† Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600 .... D•1006,1009
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1705
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 .... D•1299
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 .... D•1017
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 .... A•2506
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... D•1018,1201
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... D•1020
360 Systems, Tarzana, CA 91356, 818-342-3127 .... D•1072
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§† Aiphone, Bellevue, WA 98005 206-455-0510
Analog Systems, Tucson, AZ 85731-7389 602-290-1818
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191 800-357-5240
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
C-COR Elctrns., Inc., State College, PA 16801 .... 814-238-2461;800-233-2267
§ Celestion Industries, Inc., Holliston, MA 01746 508-429-6706
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Dantel, Fresno, CA 93727 209-292-1111
Dexter Research Ctr., Inc., Dexter, MI 48130 313-426-3921
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§† Elantec, Inc., Milpitas, CA 95035 .... 408-945-1323;800-333-6314
Electro Force Corp., Anaheim, CA 92806 714-774-3666
† Electro Optical Industries Inc., Santa Barbara, CA 93111 .... 805-964-6701 (ext. 280)
Elgar Electronics Corporation, San Diego, CA 92121 .... 619-450-0085;800-733-5427
§ Furman Sound, Inc., Greenbrae, CA 94904 415-927-1225
Geiger Electronics, Inc., Port Washington, NY 11050 516-767-0700
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 .... 800-263-9353;416-632-2996
§ Harris Corp., Dracon Div., Camarillo, CA 93012 805-987-9511
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
† Instruments, Inc., San Diego, CA 92111 619-571-1111
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
Julie Research Labs., New York, NY 10001 212-633-6625
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
† Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
† MDF Products Inc., Danbury, CT 06811 203-743-3579
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Norton Associates, Inc., Garden City, NY 11530 516-745-1411
Peca, Inc., Bensalem, PA 19020 215-245-1550
§ Perma Power Elctrns., Niles, IL 60714 312-763-0763
† Perry Amplifier, Brookline, MA 02146 617-734-0844
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Precision Electronics, Franklin Park, IL 60131 708-678-5350
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836 201-927-1766
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
§ University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 818-362-9516

Amplifiers, Antenna-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
C-COR Elctrns., Inc., State College, PA 16801 .... 814-238-2461;800-233-2267
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
§ Lance Industries, Sylmar, CA 91342-3832 818-367-1811
LF Engineering Company Inc., East Haven, CT 06512 203-467-3590
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Trontech, Inc., Eatontown, NJ 07724 908-542-1133
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Amplifiers, Compressor-1100

Gennum Corp., Burlington, ON, CANADA L7R 3Y3 .... 800-263-9353;416-632-2996
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
§ Opamp Labs, Inc., Los Angeles, CA 90038 213-934-3566
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Spectra Sonics, Ogden, UT 84405 801-392-7531

Amplifiers, Current, AC-1100

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... D•1005
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 .... D•1012,2269
§† Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO .... B•1275
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... D•1019-1021
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
California Instruments Corp., San Diego, CA 92123-1509 .... 619-279-8620; 800-4AC-POWER
Clarke-Hess Communications Research Corp., New York, NY 10011 212-255-2940
Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
CTS Corp, Microelectronics, W. Lafayette, IN 47906 317-463-2565
§† Elantec, Inc., Milpitas, CA 95035 .... 408-945-1323;800-333-6314
Geiger Electronics, Inc., Port Washington, NY 11050 516-767-0700
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
Julie Research Labs., New York, NY 10001 212-633-6625
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
† Modular Devices, Shirley, NY 11967 516-345-3100
NF Electronic Instruments, State College, PA 16801 814-237-5580
Norton Associates, Inc., Garden City, NY 11530 516-745-1411
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§ Pacific Scientific Co., Rockford, IL 61109 815-226-3100
† Perry Amplifier, Brookline, MA 02146 617-734-0844
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Vasak Inds., Inc., El Segundo, CA 90245 .... 1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404 310-393-0401

Amplifiers, DC-1100

† Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600 .... D•1006-1008
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
† Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 .... D•2314
† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1185
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600 .... D•1010
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1678
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 .... B•1936-1937
Glentek, Inc., El Segundo, CA 90245, 310-322-3026 .... B•1262
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO .... B•1271
§† Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO .... B•1274-1275
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1565
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... B•1968
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 .... D•1851
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 .... D•1017
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... D•1018
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1228
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2011
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... D•1019-1021
§ Action Instruments, San Diego, CA 92123 619-279-5726
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§† Aiphone, Bellevue, WA 98005 206-455-0510
† Analog Modules, Inc., Longwood, FL 32750-3426 407-339-4355
† Analog Systems, Tucson, AZ 85731-7389 602-290-1818
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
Bertsch U.S., Vista, CA 92083 619-727-7420
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
† CELCO, Mahwah, NJ 07430 201-327-1123
§† Comlinear Corp., Fort Collins, CO 80525 303-226-0500
DCT Instruments, Columbus, OH 43212 1-800-328-1028
† DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§† Elantec, Inc., Milpitas, CA 95035 .... 408-945-1323;800-333-6314
Geiger Electronics, Inc., Port Washington, NY 11050 516-767-0700
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440

Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
§ HBM, Inc., Marlboro, MA 01752	508-624-4500
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
Inertial Motors, Doylestown, PA 18901	215-345-1010
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Instrum, Monrovia, CA 91016	818-303-4210
Julie Research Labs., New York, NY 10001	212-633-6625
Keithley Instrs., Cleveland, OH 44139	800-552-1115
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
McFadden Systems, Inc., Santa Fe Springs, CA 90670	310-948-4414
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Metrum, Denver, CO 80217-5227	303-773-4700
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Modular Devices, Shirley, NY 11967	516-345-3100
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Motion Science Inc., San Jose, CA 95112	408-993-0300
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
Omega Engineering, Stamford, CT 06907	800-826-6342
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
† Performance Controls, Inc., Horsham, PA 19044	215-675-6500
† Perry Amplifier, Brookline, MA 02146	617-734-0844
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404	310-393-0401
§ Wheelock, Inc., Long Branch, NJ 07740	908-222-6880
§ Wieland Inc., Burgaw, NC 28425	919-259-5050

Amplifiers, Data — See Amplifiers, Instrumentation (Vol. D)

Amplifiers, Decade-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1003**
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550

Amplifiers, Deflection-Also See Yokes, Deflection, Oscilloscopes, etc.-1100

† **Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600**	**D•1006**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† CELCO, Mahwah, NJ 07430	201-327-1123
† Infodex, Inc., Wolcott, CT 06716	203-879-4944
† M.S. Kennedy Corp., Cicero, NY 13039	315-699-9201
† Modular Devices, Shirley, NY 11967	516-345-3100

Amplifiers, Differential-1100

Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600	**D•1006**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936-1937,1946**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018,1201**
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606	408-720-8737
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Instrum, Monrovia, CA 91016	818-303-4210
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
NF Electronic Instruments, State College, PA 16801	814-237-5580
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Ross Engineering Corp., Campbell, CA 95008	408-377-4621
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800

Amplifiers, Distribution-1100

† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1019**
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411**	**D•1077,1207**
§† Aiphone, Bellevue, WA 98005	206-455-0510
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ Covid, Inc., Tempe, AZ 85281	602-966-2221
Datachron Inc., Anaheim, CA 92805	714-385-1705
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
§ ESE, El Segundo, CA 90245	310-322-2136
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
MACOM, Inc., Lowell, MA 01851	617-272-3000
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325	818-993-0048
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504	818-840-6749
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
† Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Western Multiplex Corp., Belmont, CA 94002	415-592-8832

Amplifiers, Equalization-1300

§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018**
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§ Celestion Industries, Inc., Holliston, MA 01746	508-429-6706
§ ESE, El Segundo, CA 90245	310-322-2136
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
Precision Electronics, Franklin Park, IL 60131	708-678-5350
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260

Amplifiers, Fiber Optic-1100

§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782**	**B•1332**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1228**
Aborn Electronics Inc., San Jose, CA 95131	408-436-5444
Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
Swan Associates, New Haven, CT 06534	203-387-3917
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260

Amplifiers, FM, IF, Surface Mount-4800 — *See Vol. A*

Amplifiers, GaAs-3450 — *See Vol. A*

Amplifiers, IF-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1023**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1201**
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§† Amplifonix, Inc., Philadelphia, PA 19154	215-464-4000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
CTS Corporation, Elkhart, IN 46514	219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401

† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
† Microphase, Norwalk, CT 06856	203-866-8000
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
† Perry Amplifier, Brookline, MA 02146	617-734-0844
Phoenix Microwave, Telford, PA 18969	215-723-6011
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
§ Rodelco Electronics Corp., Ronkonkoma, NY 11779	516-981-0900
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
† TRM, Inc., Manchester, NH 03110	603-627-6000
† Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Instrumentation-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1002-1003**
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000**	**D•1185**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936-1937,1946**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1280**
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300**	**D•1299**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018,1201**
§† **Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311**	**A•2219**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Amptek, Inc., Bedford, MA 01730	617-275-2242
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
Data, Inc., Ft. Collins, CO 80525	303-493-1222
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
Elcon Instruments, Inc., Whessoe, Plc, Annapolis, MD 21401	410-280-6686
Φ Encore Electronics, Inc., Saratoga Springs, NY 12866	518-584-5354
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999	310-517-6000
† Hycomp, Inc., Marlborough, MA 01752	508-485-6300
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Instrum, Monrovia, CA 91016	818-303-4210
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† MDF Products Inc., Danbury, CT 06811	203-743-3579
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
† Modular Devices, Shirley, NY 11967	516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
† Paine Corporation, Seattle, WA 98144	206-329-8600;800-426-0366
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Ross Engineering Corp., Campbell, CA 95008	408-377-4621
RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
Sensor Corp., Scottdale, PA 15683	412-887-4080
Sensotec, Inc., Columbus, OH 43212	614-486-7723
Seven Mountains Sci. Inc. Boalsburg, PA 16827	814-466-6559
† Sipex Corp., Billerica, MA 01821	508-667-8700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
†# ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
# Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Amplifiers, Integrating-Also See Amplifiers, Operational; Integrators, Electronic-1100

§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
† Modular Devices, Shirley, NY 11967	516-345-3100
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929

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Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**D•1014**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1280**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2008-2011**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§† Amplifonix, Inc., Philadelphia, PA 19154	215-464-4000
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Cross Electronics, Warrendale, PA 15086	412-776-1591
Φ Encore Electronics, Inc., Saratoga Springs, NY 12866	518-584-5354
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
Instrum, Monrovia, CA 91016	818-303-4210
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Modular Devices, Shirley, NY 11967	516-345-3100
† Perry Amplifier, Brookline, MA 02146	617-734-0844
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
Trontech, Inc., Eatontown, NJ 07724	908-542-1133

§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ Wieland Inc., Burgaw, NC 28425	919-259-5050

Amplifiers, Limiting-1100

§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020-1021**
§ Action Instruments, San Diego, CA 92123	619-279-5726
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Solutions, Inc., National City, CA 91950	800-967-4267
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
Phoenix Microwave, Telford, PA 18969	215-723-6011
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
§ Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Line-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1002**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020-1021**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Dataprobe, Englewood, NJ 07631	201-569-6464
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
† Perry Amplifier, Brookline, MA 02146	617-734-0844
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ ROH, Portland Instrument, Glendale, CA 91201	818-500-0137
§ Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Western Multiplex Corp., Belmont, CA 94002	415-592-8832
§ Winegard Co., Burlington, IA 52601-2000	319-754-0600

Amplifiers, Lock-in-1100

† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
Evans Electronics, Berkeley, CA 94705	510-653-3083
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
NF Electronic Instruments, State College, PA 16801	814-237-5580
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040

Amplifiers, Logarithmic-1100

† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1005**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
CTS Corporation, Elkhart, IN 46514	219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Microphase, Norwalk, CT 06856	203-866-8000
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Modular Devices, Shirley, NY 11967	516-345-3100
† Perry Amplifier, Brookline, MA 02146	617-734-0844
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
Trontech, Inc., Eatontown, NJ 07724	908-542-1133

Amplifiers, Low Noise-1100

† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1005**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936-1937,1946**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018**
† **Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300**	**D•1020-1021**
Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
† Amptek, Inc., Bedford, MA 01730	617-275-2242
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† Comtech Microwave Corp, Comtech Telecommunications Corp., Melville, NY 11747	516-777-8900
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035	408-433-2222
HDS Inc., Reston, VA 22091	703-620-6200
Instrum, Monrovia, CA 91016	818-303-4210
† Linear Integrated Systems, Milpitas, CA 95035	408-263-8401
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Locus, Inc., State College, PA 16804	814-466-6275
† Locus, Kaman, State College, PA 16804	814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MACOM, Inc., Lowell, MA 01851	617-272-3000
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† MDF Products Inc., Danbury, CT 06811	203-743-3579
† Microwave Solutions, Inc., National City, CA 91950	800-967-4267
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
† Perry Amplifier, Brookline, MA 02146	617-734-0844
Phoenix Microwave, Telford, PA 18969	215-723-6011
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800

Amplifiers, Magnetic-1100

Fetco, Sanford, FL 32773, 407-321-3800	**A•2353**
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900	**A•2526**
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314	**A•2594**
Abbott Technologies, Inc., Sun Valley, CA 91352	818-504-0644;1-800-367-8200
† American Aerospace Controls, Farmingdale, NY 11735	516-694-5100
Atlas Engineering Corp., Dorchester, MA 02121	617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757	203-927-3541
† Bicron Electronics, Canaan, CT 06018	203-824-5125
Cross Electronics, Warrendale, PA 15086	412-776-1591
Electrocom Industries, S. Bend, IN 46615	219-232-2743
† EWC, Inc., Englishtown, NJ 07726	908-446-3110
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823	908-475-3207
† Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Keytronics, Inc., Endicott, NY 13760	607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006	818-574-1175
† Magnecomp, Inc., Pickens, SC 29671	803-878-4700
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
† Modular Devices, Shirley, NY 11967	516-345-3100
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Talema Electronic, Inc., Saint James, MO 65559	314-265-5500
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
† Torwico Elctrns. Inc., Lakewood, NJ 08701	908-364-1800
§† Zambre Co., Inc., Mountain View, CA 94043	415-968-9176

Amplifiers, Master Antenna — See Amplifiers, Distribution (Vol. D)

Amplifiers, Microphone – See Amplifiers, AF (Vol. D)
Amplifiers, Microwave-3450 – ***See Vol. A***

Amplifiers, Mixing-1300

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ... D•1017
§† Aiphone, Bellevue, WA 98005 ... 206-455-0510
§† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 ... 215-968-4271
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 ... 201-934-8500
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 ... 516-345-3100
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
§ Paso Sound Products, Pelham, NY 10803 ... 914-738-4800
§ Precision Electronics, Franklin Park, IL 60131 ... 708-678-5350
§ ROH, Portland Instrument, Glendale, CA 91201 ... 818-500-0137
§ Shure Brothers Inc., Evanston, IL 60202-3696 ... 708-866-2200
† Solid State Electronics Corp., Northridge, CA 91324 ... 818-993-8257
§ Spectra Sonics, Ogden, UT 84405 ... 801-392-7531
Systron-Donner Microwave Div., Sylmar, CA 91342 ... 818-362-9900
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 ... 609-424-5220
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
† TIW Systems, Inc., Sunnyvale, CA 94089 ... 408-734-3900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 ... 818-362-9516

Amplifiers, Multichannel-1100

Ectron Corp., San Diego, CA 92111-1980, 619-278-0600 ... D•1010
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ... D•1018
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 ... D•1019-1021
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ... A•1853
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
§† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
† Analog Modules, Inc., Longwood, FL 32750-3426 ... 407-339-4355
Avens Signal Equipment, Elmhurst, NY 11373 ... 718-335-1886
Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675 ... 714-493-8181
Gould Inc., Test and Measurement Group, Valley View, OH 44125 ... 216-328-7000
HBM, Inc., Marlboro, MA 01752 ... 508-624-4500
Instrum, Monrovia, CA 91016 ... 818-303-4210
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 ... 607-272-7640
LeCroy Corp., Chestnut Ridge, NY 10977 ... 914-425-2000
Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
† MCL, Inc., Bolingbrook, IL 60440-4999 ... 708-759-9500
Metrum, Denver, CO 80217-5227 ... 303-773-4700
MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 ... 615-483-8405
Pacific Instruments Inc., Concord, CA 94520 ... 510-827-9010
† Pro-Comm, Inc., Brick, NJ 08724 ... 908-206-0660
R. C. Electronics Inc., Goleta, CA 93117 ... 805-685-7770
§ Reliance Electric Co., Cleveland, OH 44117 ... 800-245-4501
Sensotec, Inc., Columbus, OH 43212 ... 614-486-7723
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 ... 408-744-9040
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342 ... 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291

Amplifiers, Narrow Band-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ... D•1023
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600 ... D•1010
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ... D•1018
† American Microwave Technology, Inc., Brea, CA 92621 ... 714-993-0802
Avens Signal Equipment, Elmhurst, NY 11373 ... 718-335-1886
C-COR Elctrns., Inc., State College, PA 16801 ... 814-238-2461;800-233-2267
Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
Dowty Avionics, Arcadia, CA 91006 ... 818-445-5955
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 ... 818-998-8281
Ehrhorn Technological Opers., Inc., Colorado Springs, COLORADO 80919-4101 ... 719-260-1191
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 ... 408-732-0880
† Frequency Electronics, Inc., Mitchel Field, NY 11553 ... 516-794-4500
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 ... 607-272-7640
† Locus, Inc., State College, PA 16804 ... 814-466-6275
† Locus, Kaman, State College, PA 16804 ... 814-466-6275
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 ... 813-347-2181
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 ... 408-434-3600
MACOM, Inc., Lowell, MA 01851 ... 617-272-3000
Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
† MCL, Inc., Bolingbrook, IL 60440-4999 ... 708-759-9500
† MDF Products Inc., Danbury, CT 06811 ... 203-743-3579
MicroSignals Inc., L.I.C., NY 11101 ... 718-937-7955;718-937-0391;800-648-2252
† Microwave Solutions, Inc., National City, CA 91950 ... 800-967-4267
† MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 ... 805-581-3950
Pacific Instruments Inc., Concord, CA 94520 ... 510-827-9010
† Perry Amplifier, Brookline, MA 02146 ... 617-734-0844
Phoenix Microwave, Telford, PA 18969 ... 215-723-6011
† Pro-Comm, Inc., Brick, NJ 08724 ... 908-206-0660
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 ... 516-242-1100
§† Systron-Donner Microwave Div., Sylmar, CA 91342 ... 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 ... 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
† TRAK Microwave Corp., Tampa, FL 33634 ... 813-884-1411
† Trontech, Inc., Eatontown, NJ 07724 ... 908-542-1133

Amplifiers, Null-1100

† Control Technology Co., Inc., Long Island City, NY 11101 ... 718-361-2133
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corp, Microelectronics, W. Lafayette, IN 47906 ... 317-463-2565

Amplifiers, Operational-1100

† Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600 ... D•1006-1008
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ... B•1314-1315
† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1185
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•1012
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... D•1016
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ... D•1017
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 ... B•2025
† Addacon Greensboro, Greensboro, NC 27407 ... 919-852-6200
† Advanced Analog, Intech, Santa Clara, CA 95050 ... 408-988-4930
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 ... 408-720-8737
Advanced Photonix, Inc., Camarillo, CA 93012 ... 805-484-2884
A E G Corporation, Basking Ridge, NJ 07920 ... 908-204-8900
§† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 ... 508-977-3000
† Analog Systems, Tucson, AZ 85731-7389 ... 602-290-1818
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 ... 516-589-5656
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Burr-Brown Corp., Tucson, AZ 85734 ... 602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
§† Comlinear Corp., Fort Collins, CO 80525 ... 303-226-0500
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906 ... 317-463-2565
† DEVAR, Inc., Bridgeport, CT 06605 ... 203-368-6751
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 ... 818-998-8281
§† Elantec, Inc., Milpitas, CA 95035 ... 408-945-1323;800-333-6314
§† Exar Corp., San Jose, CA 95161-9007 ... 408-434-6400
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 ... 800-263-9353;416-632-2996
§† Harris Semiconductor, Melbourne, FL 32902 ... 1-800-4 HARRIS
† Holt Inc., Irvine, CA 92718 ... 714-859-8800
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
† M.S. Kennedy Corp., Cicero, NY 13039 ... 315-699-9201
LeCroy Corp., Chestnut Ridge, NY 10977 ... 914-425-2000
† Linear Integrated Systems, Milpitas, CA 95035 ... 408-263-8401
§† Linear Technology Corp., Milpitas, CA 95035-7487 ... 408-432-1900
Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
Micro Networks, Unitrode Corporation, Worcester, MA 01606 ... 508-852-5400
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 ... 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 ... 407-574-0208
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 ... 516-345-3100
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 ... 602-244-6900
NEC Electronics, Inc., Mountain View, CA 94039-7241 ... 1-800-366-9782
§ NTE Electronics, Inc., Bloomfield, NJ 07003 ... 201-748-5089
Pacific Microtronics Corp., New York, NY 10021 ... 212-517-5622
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ... 408-730-0300;800-PENSTOCK
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 ... 717-323-4691
§† Raytheon Semiconductor, Mountain View, CA 94043 ... 408-522-7068
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 ... 615-641-2020
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 ... 214-466-6000
§† Silicon General, Garden Grove, CA 92641 ... 714-898-8121
§† Sipex Corp., Billerica, MA 01821 ... 508-667-8700
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
§† Teledyne Components, Mountain View, CA 94039-7267 ... 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248

Amplifiers, Operational, Surface Mount-4800 – ***See Vol. A***
Amplifiers, Parametric-3450 – ***See Vol. A***

Amplifiers, Peak Limiting-1100

§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 ... 215-968-4271
§† Comlinear Corp., Fort Collins, CO 80525 ... 303-226-0500
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 ... 800-263-9353;416-632-2996
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 ... 516-242-1100
Sensotec, Inc., Columbus, OH 43212 ... 614-486-7723
Systron-Donner Microwave Div., Sylmar, CA 91342 ... 818-362-9900

Amplifiers, Peak Sense & Hold-1100

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1185
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
† Analog Modules, Inc., Longwood, FL 32750-3426 ... 407-339-4355
§ DCT Instruments, Columbus, OH 43212 ... 1-800-328-1028
HBM, Inc., Marlboro, MA 01752 ... 508-624-4500
Ross Engineering Corp., Campbell, CA 95008 ... 408-377-4621
Sensotec, Inc., Columbus, OH 43212 ... 614-486-7723

Amplifiers, Phase-Lock Loop-1100

MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
† Alpha Industries, Inc., Woburn, MA 01801	617-935-5150
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Exar Corp., San Jose, CA 95161-9007	408-434-6400
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
NF Electronic Instruments, State College, PA 16801	814-237-5580

Amplifiers, Photocell — See Amplifiers, Transducer (Vol. D)

Amplifiers, Power-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1002**
† **Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600**	**D•1006-1009**
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1230**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2247**
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	**D•2250-2252**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133**	**D•2314**
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427**	**D•2257**
§ **ENI, Div. of Astec America, Inc., Rochester, NY 14623, 716-427-8300**	**D•1011**
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700**	**D•1012,2268**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2275**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1281**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
† **Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300**	**D•1019-1021**
Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§† Aiphone, Bellevue, WA 98005	206-455-0510
Alpha-M Corp., Dallas, TX 75229	214-406-0424
† American Microwave Technology, Inc., Brea, CA 92621	714-993-0802
† Analog Systems, Tucson, AZ 85731-7389	602-290-1818
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
Φ AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Bertsch U.S., Vista, CA 92083	619-727-7420
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Chloride El Paso, Chloride Power Elctrns., El Paso, TX 79906	915-592-9985
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
CTS Corporation, Elkhart, IN 46514	219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Dowty Avionics, Arcadia, CA 91006	818-445-5955
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
Ehrhorn Technological Opers., Inc., Colorado Springs, COLORADO 80919-4101	719-260-1191
§† Elantec, Inc., Milpitas, CA 95035	408-945-1323;800-333-6314
§ Electro Force Corp., Anaheim, CA 92806	714-774-3666
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
Geiger Electronics, Inc., Port Washington, NY 11050	516-767-0700
§ Harris Corp., Dracon Div., Camarillo, CA 93012	805-987-9511
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035	408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999	310-517-6000
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903	714-759-2952
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Instruments, Inc., San Diego, CA 92111	619-571-1111
M.S. Kennedy Corp., Cicero, NY 13039	315-699-9201
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
McFadden Systems, Inc., Santa Fe Springs, CA 90670	310-948-4414
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† MDF Products Inc., Danbury, CT 06811	203-743-3579
† Micro Systems, Inc., Ft. Walton Beach, FL 32548-3858	904-244-2332
† Microwave Solutions, Inc., National City, CA 91950	800-967-4267
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
Motion Science Inc., San Jose, CA 95112	408-993-0300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
† Perry Amplifier, Brookline, MA 02146	617-734-0844
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
§† Pyle Industries, Inc., Huntington, IN 46750	219-356-1200
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
Scientific Columbus Co., Columbus, OH 43228-4105	614-274-0400
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§ Ten-Tec, Inc., Sevierville, TN 37862	615-453-7172
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK

Amplifiers, Programmable Gain-1100

† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1005**
Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886	**A•1622**
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000**	**D•1185**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761	**A•1638-1639**
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•1012**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**D•1014**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018,1201**
Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
† Modular Devices, Shirley, NY 11967	516-345-3100
NF Electronic Instruments, State College, PA 16801	814-237-5580
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504	818-840-6749
† Sipex Corp., Billerica, MA 01821	508-667-8700
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800

Amplifiers, Public Address — See Amplifiers, AF (Vol. D)

Amplifiers, Pulse-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1002-1003**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1005**
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
§ **ENI, Div. of Astec America, Inc., Rochester, NY 14623, 716-427-8300**	**D•1011**
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•1012**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Marlow Industries, Inc., Dallas, TX 75238-1645, 214-340-4900	**C•1604**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† American Microwave Technology, Inc., Brea, CA 92621	714-993-0802
† Amptek, Inc., Bedford, MA 01730	617-275-2242

† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
CTS Corporation, Elkhart, IN 46514	219-293-7511
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
§ ESE, El Segundo, CA 90245	310-322-2136
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501	213-320-6160
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
† Perry Amplifier, Brookline, MA 02146	617-734-0844
Power Functions Engineering, Garland, TX 75042	214-278-0996
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
Products for Research, Danvers, MA 01923	508-774-3250
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Sensor Corp., Scottdale, PA 15683	412-887-4080
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
†# ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Pulse Limiting-1100

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**D•1005**
† Microwave Solutions, Inc., National City, CA 91950	800-967-4267
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Recording — See Amplifiers, AF (Vol. D)
Amplifiers, Resolver — See Amplifiers, Servo (Vol. D)

Amplifiers, RF-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1002-1003,1023**
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623, 716-427-8300	**D•1011**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1565**
Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300	**D•1299**
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2038**
† American Microwave Technology, Inc., Brea, CA 92621	714-993-0802
§† Amplifonix, Inc., Philadelphia, PA 19154	215-464-4000
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4	613-226-5772
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Ehrhorn Technological Opers., Inc., Colorado Springs, COLORADO 80919-4101	719-260-1191
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035	408-433-2222
HDS Inc., Reston, VA 22091	703-620-6200
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999	310-517-6000
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903	714-759-2952
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Locus, Inc., State College, PA 16804	814-466-6275
† Locus, Kaman, State College, PA 16804	814-466-6275
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501	213-320-6160
Matec Instruments, Inc., Hopkinton, MA 01748	508-435-9039
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† MDF Products Inc., Danbury, CT 06811	203-743-3579
† Microphase, Norwalk, CT 06856	203-866-8000
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† Microwave Solutions, Inc., National City, CA 91950	800-967-4267
§ Mirage/KLM, Morgan Hill, CA 95037	408-779-7363
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
† Perry Amplifier, Brookline, MA 02146	617-734-0844
P.G. Electronics Ltd., Weston, Ont., CANADA M9M2Z8	416-741-7682
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
Phoenix Microwave, Telford, PA 18969	215-723-6011
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
§ Rodelco Electronics Corp., Ronkonkoma, NY 11779	516-981-0900
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
†# ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Synergy Microwave Corporation, Paterson, NJ 07504	201-881-8800
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493	708-364-6104
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
§ Ten-Tec, Inc., Sevierville, TN 37862	615-453-7172
† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
† TRM, Inc., Manchester, NH 03110	603-627-6000
† Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
† Wenzel Associates, Inc., Austin, TX 78752	512-450-1400
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Amplifiers, Sample & Hold-1100

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	**D•1190**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
CTS Corporation, Elkhart, IN 46514	219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
DSP Technology, Fremont, CA 94538-7338	510-657-7555
HBM, Inc., Marlboro, MA 01752	508-624-4500
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§† Sipex Corp., Billerica, MA 01821	508-667-8700
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800

Amplifiers, Servo-4900

† Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600	**D•1006**
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771	**B•1240**
† Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133	**D•2314**

Glentek, Inc., El Segundo, CA 90245, 310-322-3026	**B•1262-1263**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1273,1275**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968, D•2316**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304**
† **Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300**	**D•1020**
# Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Advanced Technology Company, Vista, CA 92083	619-727-7430
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Bertsch U.S., Vista, CA 92083	619-727-7420
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Cherry Semiconductor Corp, East Greenwich, RI 02818	401-885-3600
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
§† Elantec, Inc., Milpitas, CA 95035	408-945-1323;800-333-6314
† Eltrol Corporation, Canoga Park, CA 91304	818-709-0131
§# Encoder Products, Sandpoint, ID 83864	208-263-8541
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
§ Galil Motion Control, Inc., Sunnyvale, CA 94086	408 746-2300
Geiger Electronics, Inc., Port Washington, NY 11050	516-767-0700
§ Gettys Corporation, an AEG Company, Racine, WI 53404	414-637-6591
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
McFadden Systems, Inc., Santa Fe Springs, CA 90670	310-948-4414
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
† Modular Devices, Shirley, NY 11967	516-345-3100
Motion Science Inc., San Jose, CA 95112	408-993-0300
§ Opamp Labs, Inc., Los Angeles, CA 90038	213-934-3566
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
† Performance Controls, Inc., Horsham, PA 19044	215-675-6500
† Perry Amplifier, Brookline, MA 02146	617-734-0844
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
§ Technology 80, Inc., Minneapolis, MN 55427	612-542-9545
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
§† Westamp, Santa Monica, CA 90404	310-393-0401

Amplifiers, Single Sideband-1900

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
† American Microwave Technology, Inc., Brea, CA 92621	714-993-0802
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Ehrhorn Technological Opers., Inc., Colorado Springs, COLORADO 80919-4101	719-260-1191
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
§ Mirage/KLM, Morgan Hill, CA 95037	408-779-7363
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
§ Ten-Tec, Inc., Sevierville, TN 37862	615-453-7172

Amplifiers, Strain Gauge — See Amplifiers, Transducer (Vol. D)

Amplifiers, Sweep-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1023**
American Microwave Technology, Inc., Brea, CA 92621	714-993-0802
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Amplifiers, Synchro-4900

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1173**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176,1178, 1181**
† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133**	**D•2314-2315**
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	**D•1190**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100**	**D•1208**
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Bertsch U.S., Vista, CA 92083	619-727-7420
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Modular Devices, Shirley, NY 11967	516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400

Amplifiers, Telemetering-1900

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
† Microphase, Norwalk, CT 06856	203-866-8000
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Thermocouple — See Amplifiers, Transducer (Vol. D)

Amplifiers, Track & Hold-1100

† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000**	**D•1185**
Acculin, Inc., Natick, MA 01760	508-650-1012
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Addacon Engineering, Greensboro, NC 27407	919-852-6200
Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
DSP Technology, Fremont, CA 94538-7338	510-657-7555
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
§† Sipex Corp., Billerica, MA 01821	508-667-8700

Amplifiers, Transducer-Also See Signal Conditioners-1100

† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100**	**B•1914**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1005**
Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000	**D•1027**
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902	**B•1315**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1928**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936-1937,1946**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761	**A•1639**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1997**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1101,1415**
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776**	**D•1315**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018,1201**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007-2011**
§ **Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-U-SENS-IT**	**B•2024**
† **Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811**	**B•2025**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
Advanced Process Controls, Woburn, MA 01801	617-932-9262
A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
§ American Advantech Corp., San Jose, CA 95122	408-293-6786
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Cross Electronics, Warrendale, PA 15086	412-776-1591
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
DCT Instruments, Columbus, OH 43212	1-800-328-1028
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
Dexter Research Ctr., Inc., Dexter, MI 48130	313-426-3921
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281

§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Elcon Instruments, Inc., Whessoe, Plc, Annapolis, MD 21401	410-280-6686
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ GSE, Core Inds., Farmington Hills, MI 48024	313-476-7875
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
HBM, Inc., Marlboro, MA 01752	508-624-4500
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Instrum, Monrovia, CA 91016	818-303-4210
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
KGS Electronics, Inc., Arcadia, CA 91006	818-574-1175
§ Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
Metrix Instrument Co., Houston, TX 77043	713-461-2131
Metrum, Denver, CO 80217-5227	303-773-4700
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
† Modular Devices, Shirley, NY 11967	516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
Norton Associates, Inc., Garden City, NY 11530	516-745-1411
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Opamp Labs, Inc., Los Angeles, CA 90038	213-934-3566
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
† Paine Corporation, Seattle, WA 98144	206-329-8600;800-426-0366
Panametrics, Waltham, MA 02154-3497	617-899-2719
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Perry Amplifier, Brookline, MA 02146	617-734-0844
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
Sensor Corp., Scottdale, PA 15683	412-887-4080
Sensotec, Inc., Columbus, OH 43212	614-486-7723
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§† Taber Industries, N. Tonawanda, NY 14120	716-694-4000;800-333-5300
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Techron Div., Crown Intl., Inc., Elkhart, IN 46517	219-294-8300
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

Amplifiers, Travelling Wave Tube-1100

Aydin Corp., Horsham, PA 19044	215-657-7510
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† EEV Inc., Elmsford, NY 10523	914-592-6050
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999	310-517-6000
† Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† LogiMetrics, Plainview, NY 11803	516-349-1700
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
†# ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
# Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Amplifiers, Ultrasonic-1100

† **Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600**	**D•1006**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ **ENI, Div. of Astec America, Inc., Rochester, NY 14623, 716-427-8300**	**D•1011**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018,1201**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020**
Amplifier Research, Souderton, PA 18964-9990	215-723-8181
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† Instruments, Inc., San Diego, CA 92111	619-571-1111
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
Matec Instruments, Inc., Hopkinton, MA 01748	508-435-9039
† MDF Products Inc., Danbury, CT 06811	203-743-3579
Panametrics, Waltham, MA 02154-3497	617-899-2719
† Perry Amplifier, Brookline, MA 02146	617-734-0844
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
§ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382	610-696-4710;800-323-1269
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958

Amplifiers, Video-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1023**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**B•1210,** **D•1005**
† **Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600**	**D•1006**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**A•2163**
A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Allen Avionics, Inc., Mineola, NY 11501	516-248-8080
† Analog Systems, Tucson, AZ 85731-7389	602-290-1818
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
§ ATV Research, Inc., Dakota City, NE 68731	402-987-3771
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
† CELCO, Mahwah, NJ 07430	201-327-1123
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
Colorgraphic Communications Corp., Atlanta, GA 30341	404-455-3921
§† Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ Covid, Inc., Tempe, AZ 85281	602-966-2221
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§† Elantec, Inc., Milpitas, CA 95035	408-945-1323;800-333-6314
§ ESE, El Segundo, CA 90245	310-322-2136
Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
† M.S. Kennedy Corp., Cicero, NY 13039	315-699-9201
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MDF Products Inc., Danbury, CT 06811	203-743-3579
† Microphase, Norwalk, CT 06856	203-866-8000
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
† Perry Amplifier, Brookline, MA 02146	617-734-0844
Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078	401-762-3800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072	206-481-8833
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§† Silicon General, Garden Grove, CA 92641	714-898-8121
§† Sipex Corp., Billerica, MA 01821	508-667-8700
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
† Third Domain, Inc., Tucson, AZ 85731-7568	602-290-1820
† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
Trontech, Inc., Eatontown, NJ 07724	908-542-1133
Video Automation Systems, Pound Ridge, NY 10576	914-764-4613

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Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**D•1005**
Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600	**D•1006-1009**
Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696	**D•1253**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
§† **Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311**	**A•2219**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Julie Research Labs., New York, NY 10001	212-633-6625
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§† Sipex Corp., Billerica, MA 01821	508-667-8700
Techron Div., Crown Intl., Inc., Elkhart, IN 46517	219-294-8300
§† Thaler Corp., Tucson, AZ 85737	602-742-5572
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586

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Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1002-1003,1023
† Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600 .... D•1006,1008
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600 .... D•1010
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623, 716-427-8300 .... D•1011
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400 .... D•1013
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 .... D•1291
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 .... D•1299
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 .... A•1725
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... A•2163
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... D•1018,1201
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1228
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... D•1019-1021
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
§† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Analog Modules, Inc., Longwood, FL 32750-3426 407-339-4355
† Analog Systems, Tucson, AZ 85731-7389 602-290-1818
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Avens Signal Equipment, Elmhurst, NY 11373 718-335-1886
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
CAL-AV Labs, Inc., Campbell, CA 95008 408-369-1000
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
§ C-COR Elctrns., Inc., State College, PA 16801 .... 814-238-2461;800-233-2267
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
§† Comlinear Corp., Fort Collins, CO 80525 303-226-0500
† Comtech Microwave Corp, Comtech Telecommunications Corp., Melville, NY 11747 516-777-8900
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Dantel, Fresno, CA 93727 209-292-1111
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Dowty Avionics, Arcadia, CA 91006 818-445-5955
DSP Technology, Fremont, CA 94538-7338 510-657-7555
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§ ESE, El Segundo, CA 90245 310-322-2136
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Gennum Corp., Burlington, ON, CANADA L7R 3Y3 .... 800-263-9353;416-632-2996
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† Instruments, Inc., San Diego, CA 92111 619-571-1111
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
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† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
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† Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
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MACOM, Inc., Lowell, MA 01851 617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
Matec Instruments, Inc., Hopkinton, MA 01748 508-435-9039
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MDF Products Inc., Danbury, CT 06811 203-743-3579
MicroSignals Inc., L.I.C., NY 11101 .... 718-937-7955;718-937-0391;800-648-2252
† Microwave Solutions, Inc., National City, CA 91950 800-967-4267
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Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Pacific Instruments Inc., Concord, CA 94520 510-827-9010
Peca, Inc. Bensalem, PA 19020 215-245-1550
† Perry Amplifier, Brookline, MA 02146 617-734-0844
Philips Components Discrete Products Div,, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Phoenix Microwave, Telford, PA 18969 215-723-6011
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
R.F. Power Labs., Inc., Kalmus Engineering Inc., Woodinville, WA 98072 206-481-8833
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Ten-Tec, Inc., Sevierville, TN 37862 615-453-7172
† TIW Systems, Inc., Sunnyvale, CA 94089 408-734-3900
† Trontech, Inc., Eatontown, NJ 07724 908-542-1133
†# Varian Microwave Equipment Products. Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Analyzers, AF-2900

Intronics, Inc., Canton, MA 02021, 800-367-0004 .... B•1081
Amber Electric Design, St. Laurent, PQ,, CANADA H4T 1V8 .... 514-333-8748; 800-361-3697
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
† Electro-Dynamics Dev. Co., Issaquah, WA 98027-4038 206-392-2493
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025 201-227-2000
§ Leader Instruments Corp., Hauppauge. NY 11788-3694 .... 516-231-6900; 1-800-645-5104
Marconi Instruments, Allendale, NJ 07401 201-934-9050
Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131 708-288-4471
† RE America, Westlake, OH 44145 216-871-7617
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960
Voice Identification, Somerville, NJ 08876 908-526-3408

Analyzers, Air Pollution-2550

Enviroplan, Roseland, NJ 07068 201-994-2300
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538 510-226-1329
§ Hiac/Royco, Pacific Scientific Co., Silver Spring, MD 20904 301-680-7000
Houston Atlas, Envirotech Controls, Inc., Kingwood, TX 77339-3804 713-348-1000
Lumidor Saftey Products, SafteyTek Corp., Miramar, FL 33025 305-433-7000
Process & Analytical Instruments Div., A Subsidiary of Ametek Inc., Pittsburgh, PA 15238 412-828-9040
§# Milton Roy Co, Process & Environ., Orange, CA 92665-4134 714-974-5560
Sensidyne, Inc., Clearwater, FL 34620 .... 813-530-3602;1-800-451-9444
Servomex Company, Inc., Norwood, MA 02062 617-769-7710
§ Sierra Monitor Corp., Milpitas, CA 95035 408-262-6611

Analyzers, Antenna Pattern-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1022
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
†Φ Nearfield Systems, Inc., Carson, CA 90745 310-518-4277
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220

Analyzers, Dielectric Constant-2900

Vitrek Corporation, San Diego, CA 92121, 619-586-1695 .... D•1333
Forte Technology, Inc., Norwood, MA 02062 617-769-9150
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369 909-392-5833
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
Rosemount Analytical Inc., Cedar Grove, NJ 07009 .... 800-222-2600 ext. 400

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AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
§ National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147,1302
# Alligator Technologies, Fountain Valley, CA 92708 714-850-9984
Analogic Corp., Peabody, MA 01960 508-977-3000
Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Data Environment, Inc., Portland, OR 97291 503-531-0765
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300 714-595-6030
§ Krenz Instruments, Inc., Bonsall, CA 92003 619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Marconi Instruments, Allendale, NJ 07401 201-934-9050
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
Nu Data, Inc., Little Silver, NJ 07739 908-842-5757
PERX,Inc., Corte Madera, CA 94925 415-927-0155
Phoenix Microsystems, Huntsville, AL 35806 205-922-1200
Spectral Innovations, Santa Clara, CA 95054-1807 408-727-1314
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

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Voltech, Inc., Ashland, MA 01721, 508-881-7329 .... D•1332

† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
§ Contact East, N. Andover, MA 01845 508-682-2000
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561

Analyzers, Fast Fourier Transform (FFT)-2900

§ National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
Analogic Corp., Peabody, MA 01960 508-977-3000
Bomem Inc., Quebec, CANADA G2E-5S5 .... 418-877-2944;1-800-888-FTIR
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
Spectral Innovations, Santa Clara, CA 95054-1807 408-727-1314
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960

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Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328,1331
Voltech, Inc., Ashland, MA 01721, 508-881-7329 .... D•1332
Xitron Technologies, San Diego, CA 92121, 619-458-9852 .... D•1335
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8 .... 514-333-8748; 800-361-3697
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
Avens Signal Equipment, Elmhurst, NY 11373 718-335-1886
AVO International, TBG, Dallas, TX 75237 214-333-3201
† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
† Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
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§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
RE America, Westlake, OH 44145 216-871-7617
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960

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Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Direct Conversion Technique, Inc., Chicago, IL 60641 312-283-1690
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
† Electro-Dynamics Dev. Co., Issaquah, WA 98027-4038 206-392-2493
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† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821 .... 508-671-9700;1-800-225-5765
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Φ Venable Industries, Inc., Austin, TX 78758 512-837-2888,800-262-2522
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Analyzers, Interference-2900

§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Omicron electronic, Hohenems, AUSTRIA A-6845 .... + /5576/4010-0
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 .... 201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778

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Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8 .... 514-333-8748; 800-361-3697
Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Omicron electronic, Hohenems, AUSTRIA A-6845 .... + /5576/4010-0
RE America, Westlake, OH 44145 216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800

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AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
Emulation Technology, Inc., Santa Clara, CA 95051, 408-982-0660 .... C•1321
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1292
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493 .... D•1304,1307
Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
§ Biomation, Cupertino, CA 95014-0718 408-988-6800
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Data Environment, Inc., Portland, OR 97291 503-531-0765
§ E & L Instruments, Interplex Electronics, Inc., New Haven, CT 06512 800-368-0880
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 203-624-3103
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HILEVEL Technology, Tustin, CA 92680 714-573-1888
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 602-968-6241
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
§ Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 .... 508 927-6575
§Φ Logic Beach Inc., La Mesa, CA 91941 619-698-3300
§ NCI, Huntsville, AL 35806 205-837-6667
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
PERX,Inc., Corte Madera, CA 94925 415-927-0155
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Step Engineering, Sunnyvale, CA 94088 408-733-7837
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
VMETRO, Inc., VMETRO as, Houston, TX 77079 713-584-0728
§† Ziatech, San Luis Obispo, CA 93401 805-541-0488

Analyzers, Magnetic-2900

§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 .... D•1334
Bell, F. W., Inc., Orlando, FL 32807 407-678-6900
GMW Associates, Redwood City, CA 94064 415-368-4884
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
Q-Card, Inc., Owings Mills, MD 21117-1634 410-581-0112
Sensor Corp., Scottdale, PA 15683 412-887-4080
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Analyzers, Microwave-3450 — *See Vol. A*

Analyzers, Modulation-2900

§ Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

Analyzers, Network-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1230
Voltech, Inc., Ashland, MA 01721, 508-881-7329 .... D•1332
§ Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
Direct Conversion Technique, Inc., Chicago, IL 60641 312-283-1690
† Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921 401-943-1164
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
† Giga-tronics, Inc., Sunnyvale, CA 94089 408-734-5780
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Φ Pioneer Magnetics, Santa Monica, CA 90404 310-829-6751
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
§ Telebyte Technology, Inc., Greenlawn, NY 11740 .... 516-423-3232;800-835-3298
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054 609-234-7900
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Analyzers, Noise-2900

Elgenco, Inc., Hurricane, UT 84737, 801-635-4954 .... D•1255
Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1298
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
Bearing Inspection, Santa Fe Springs, CA 90670 310-944-6251
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Marconi Instruments, Allendale, NJ 07401 201-934-9050

§ Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
† Raytheon Co., Electronic Components Division, Waltham, MA 02254	617-899-8400
RE America, Westlake, OH 44145	216-871-7617
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Analyzers, Phase & Voltage-2900

Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696	**D•1253**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1209**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328,1331**
Voltech, Inc., Ashland, MA 01721, 508-881-7329	**D•1332**
Φ Amptec Electronics, San Diego, CA 92128	619-578-7816
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
AVO International, TBG, Dallas, TX 75237	214-333-3201
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
Marconi Instruments, Allendale, NJ 07401	201-934-9050
NF Electronic Instruments, State College, PA 16801	814-237-5580
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
RE America, Westlake, OH 44145	216-871-7617
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
TEGAM, Inc., Madison, OH 44057	800-666-1010
Φ Venable Industries, Inc., Austin, TX 78758	512-837-2888,800-262-2522
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607	415-452-1936
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Analyzers, Power-2900

Φ **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1329**
Voltech, Inc., Ashland, MA 01721, 508-881-7329	**D•1332**
Xitron Technologies, San Diego, CA 92121, 619-458-9852	**D•1335**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Amptec Electronics, San Diego, CA 92128	619-578-7816
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020

Analyzers, Pulse-2900

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Analyzers, RF-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369	909-392-5833

Analyzers, Servo-4900

† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
International Test Instruments, Tustin, CA 92680	714-573-9000
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622
Φ Venable Industries, Inc., Austin, TX 78758	512-837-2888,800-262-2522

Analyzers, Signature-2900

§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
§ Vitec, Inc., Cleveland, OH 44122	1-800-321-6384

Analyzers, Sonic & Subsonic-2900

A. P. Circuit, Brooklyn, NY 11237	718-456-2717
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Voice Identification, Somerville, NJ 08876	908-526-3408

Analyzers, Spectrum-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1224-1225**
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1230**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1402-1403**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ **Marconi Instruments, Allendale, NJ 07401, 201-934-9050**	**D•1297**
Xitron Technologies, San Diego, CA 92121, 619-458-9852	**D•1335**
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
§ Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
Analogic Corp., Peabody, MA 01960	508-977-3000
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
A. P. Circuit, Brooklyn, NY 11237	718-456-2717
Ariel Corporation, Highland Pk., NJ 08904	908-249-2900
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
† Comstron A Div. of Aeroflex, Plainview, NY 1.1803	516-752-2351
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010	518-843-2600
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Φ IFR Sys. Inc., Wichita, KS 67215	316-522-4981
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Mathematical Systems Design, Inc., Los Angeles, CA 90064	310-479-7180
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ Omicron electronic, Hohenems, AUSTRIA A-6845	+ /5576/4010-0
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
PERX,Inc., Corte Madera, CA 94925	415-927-0155
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
RE America, Westlake, OH 44145	216-871-7617
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821	508-671-9700;1-800-225-5765
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Voice Identification, Somerville, NJ 08876	908-526-3408
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Analyzers, Time Interval-2900

§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ International Test Instruments, Tustin, CA 92680	714-573-9000
§Φ Logic Beach Inc., La Mesa, CA 91941	619-698-3300
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040

Analyzers, Transfer Function-2900

Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
NF Electronic Instruments, State College, PA 16801	814-237-5580
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901	804-977-8050
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Φ Venable Industries, Inc., Austin, TX 78758	512-837-2888,800-262-2522

Analyzers, Transient-2900

Analogic Corp., Peabody, MA 01960	508-977-3000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
RE America, Westlake, OH 44145	216-871-7617
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199

Analyzers, Ultrasonic-2900

§† Ansonics, Inc., Halfway, OR 97834	503-742-7475
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Matec Instruments, Inc., Hopkinton, MA 01748	508-435-9039
Metrix Instrument Co., Houston, TX 77043	713-461-2131
Panametrics, Waltham, MA 02154-3497	617-899-2719
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
†Φ U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325

Analyzers, Vibration-2900

Alpha-M Corp., Dallas, TX 75229	214-406-0424
American Hofmann Corp., Lynchburg, VA 24506	804-522-0300
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Atec, Inc., Houston, TX 77055	713-468-7971
Bearing Inspection, Santa Fe Springs, CA 90670	310-944-6251
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Kelmet, Inc., San Dimas, CA 91773	714-599-0954
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
Metrix Instrument Co., Houston, TX 77043	713-461-2131
PMC/BETA Ltd. Partnership, Natick, MA 01760	617-237-6920
§ QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§† Rockland Scientific Corporation, Princeton, NJ 08543	609-844-0800
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322
§ Vitec, Inc., Cleveland, OH 44122	1-800-321-6384

Analyzers, Video — See Analyzers, Spectrum (Vol. D)

Analyzers, Waveform-2900

Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1329**
Analogic Corp., Peabody, MA 01960	508-977-3000
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
International Test Instruments, Tustin, CA 92680	714-573-9000
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
PERX,Inc., Corte Madera, CA 94925	415-927-0155
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

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Annunciators-2200

CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1042**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261	**B•1175**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1366**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1120-1121**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
AdVoTech, Inc., Butler, PA 16001	412-283-4497
AES Corp., Peabody, MA 01960	508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911	619-575-4011
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
Automation Displays Inc., Eau Claire, WI 54703	715-834-9595
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154	617-894-8700
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
Mauell Corp., Dillsburg, PA 17019-0339	717-432-8686
§ Metra Corporation, San Jose, CA 95131	408-432-1110
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
† Stacoswitch, Costa Mesa, CA 92626	714-549-3041
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854	908-572-9512
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
§ Tektone Sound & Signal, Lake Park, FL 33403	407-844-2383
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Antenna Connectors-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† **Tru-Connector Corp., Peabody, MA 01960, 508-532-0775;1-800-262-9787;1-800-COAXTRU**	**C•1507**
† Antenna Specialists, The Allen Group, Cleveland, OH 44139	216-349-8400
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101	617-890-4750
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
§ H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960

Antenna Dummy Loads — See Dummy Loads (Vol. D)

Antenna Groups (MIL)-2440 – ***See Vol. B***

Antenna Rotators-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ Lance Industries, Sylmar, CA 91342-3832	818-367-1811
† Maury Microwave Corp., Ontario, CA 91764	909-987-4715
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
† Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
† Sage Laboratories, Inc., Natick, MA 01760	508-653-0844
† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900

Antenna Sets (MIL)-2440 – ***See Vol. B***

Antenna Switching Matrices-1200

CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
† Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
Dow-Key Microwave Corporation, Ventura, CA 93003	805-650-0260
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106

JEMA, Wilmette, IL 60091	708-251-3600
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
MarLee Switch Co., Upland, CA 91786	714-982-8988
† Micro Systems, Inc., Ft. Walton Beach, FL 32548-3858	904-244-2332
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
† Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Signal Switch Company, Corona, CA 91720	909-736-5404
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831

Antenna Towers-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
Andrew Corp., Orland Pk., IL 60462	800-255-1479
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† Microflect Co., Inc., Salem, OR 97309-0985	503-363-9267
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Stainless, Inc., N. Wales, PA 19454	215-699-4871

Antennas, Airborne-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
Andrew Corp., Orland Pk., IL 60462	800-255-1479
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Eastern Microwave, Winchester, MA 01890	617-721-9800
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electronic Space Systems Corp., Concord, MA 01742	508-369-7200
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
† MDM, Inc., Chatsworth, CA 91311	818-700-8400
§† Milliflect, Newark, CA 94560	510-791-5188
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
† Premier Microwave, Port Chester, NY 10573	914-939-8900
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
§ Sensor Systems, Inc., Chatsworth, CA 91311	818-341-5366
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0	613-258-5928
† Titchener, E. H., & Co., Binghamton, NY 13902-1706	607-772-1161
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Citizens Band — See Antennas, Whip & Accessories (Incl. Marine & Mobile Types) (Vol. D)

Antennas, Direction Finding-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
Glatzer Industries Corp., New Rochelle, NY 10801	914-576-2700
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
LF Engineering Company Inc., East Haven, CT 06512	203-467-3590
§† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
§ Milliflect, Newark, CA 94560	510-791-5188
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Premier Microwave, Port Chester, NY 10573	914-939-8900
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Sensor Systems, Inc., Chatsworth, CA 91311	818-341-5366
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0	613-258-5928
† Titchener, E. H., & Co., Binghamton, NY 13902-1706	607-772-1161
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Ground Plane-1200

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1022-1023**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Antenna Specialists, The Allen Group, Cleveland, OH 44139	216-349-8400
† Eastern Microwave, Winchester, MA 01890	617-721-9800
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
JEMA, Wilmette, IL 60091	708-251-3600
§ Kreckman, Herb, Co., Cresco, PA 18326	717-595-2212
† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0	613-258-5928
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Helical-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Andrew Corp., Orland Pk., IL 60462	800-255-1479
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
§† Centurion International, Inc., Lincoln, NE 68504	800-228-4563
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
† Eastern Microwave, Winchester, MA 01890	617-721-9800
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0	613-258-5928
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Log Periodic-1200

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1003,1022-1023**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Andrew Corp., Orland Pk., IL 60462	800-255-1479
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
Antenna Specialists, The Allen Group, Cleveland, OH 44139	216-349-8400
† Eastern Microwave, Winchester, MA 01890	617-721-9800
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010	518-843-2600
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
§ Lance Industries, Sylmar, CA 91342-3832	818-367-1811
LogiMetrics, Plainview, NY 11803	516-349-1700
§ Mirage/KLM, Morgan Hill, CA 95037	408-779-7363
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220	503-253-2000
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Loop-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
LF Engineering Company Inc., East Haven, CT 06512	203-467-3590
§ Palomar Engineers, Escondido, CA 92046	619-747-3343
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Sensor Systems, Inc., Chatsworth, CA 91311	818-341-5366
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Antennas, Microwave-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
† Alpha Industries, Inc., Woburn, MA 01801	617-935-5150
Andrew Corp., Orland Pk., IL 60462	800-255-1479
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
Communications & Energy Corp., E. Syracuse, NY 13057	315-452-0709
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
† Eastern Microwave, Winchester, MA 01890	617-721-9800
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010	518-843-2600
† Electronic Space Systems Corp., Concord, MA 01742	508-369-7200
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
† Gabriel Elctrns. Inc., Scarborough, ME 04070	207-883-5161
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505	310-539-6704
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
HDS Inc., Reston, VA 22091	703-620-6200
Lance Industries, Sylmar, CA 91342-3832	818-367-1811
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595	619-278-4100
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
† MDM, Inc., Chatsworth, CA 91311	818-700-8400
† Microwave Applications Group, Santa Maria, CA 93455	805-928-5711
§† Milliflect, Newark, CA 94560	510-791-5188
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Polyflon Company, Crane Co., New Rochelle, NY 10801	914-636-7222
Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
† Premier Microwave, Port Chester, NY 10573	914-939-8900

† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
† Sensor Systems, Inc., Chatsworth, CA 91311 818-341-5366
† Stainless, Inc., N. Wales, PA 19454 215-699-4871
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Antennas, Multiband, UHF/VHF-1200

Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 .... A•1625
JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024,1046
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
§† Centurion International, Inc., Lincoln, NE 68504 800-228-4563
§ Lance Industries, Sylmar, CA 91342-3832 818-367-1811
§† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913 508-388-5210
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§† Sensor Systems, Inc., Chatsworth, CA 91311 818-341-5366
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Antennas, Phased Array-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024
† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999 410-583-4000
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913 508-388-5210
† MDM, Inc., Chatsworth, CA 91311 818-700-8400
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
§ Mirage/KLM, Morgan Hill, CA 95037 408-779-7363
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

Antennas, Rhombic-1200

JEMA, Wilmette, IL 60091 708-251-3600
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165

Antennas, Satellite-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Lance Industries, Sylmar, CA 91342-3832 818-367-1811
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298 215-842-3675
† MDM, Inc., Chatsworth, CA 91311 818-700-8400
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Prodelin Corporation, Conover, NC 28613 704-464-4141
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
§ Sensor Systems, Inc., Chatsworth, CA 91311 818-341-5366
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
† TIW Systems, Inc., Sunnyvale, CA 94089 408-734-3900
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Antennas, Spiral-1200

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
† Eastern Microwave, Winchester, MA 01890 617-721-9800
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
JEMA, Wilmette, IL 60091 708-251-3600
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913 508-388-5210
† Premier Microwave, Port Chester, NY 10573 914-939-8900
RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
§† Sensor Systems, Inc., Chatsworth, CA 91311 818-341-5366
† Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

Antennas, Telescopic-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024-1025,1042-1043,1046
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
International Microelectronics, Arlington, TX 76003 817-473-1730
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911

Antennas, Whip & Accessories (Incl. Marine & Mobile Types-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024-1025,1046-1047
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Alexander Manufacturing Company, Mason City, IA 50402 .... 800-247-1821; 515-423-8955
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† Centurion International, Inc., Lincoln, NE 68504 800-228-4563
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
§† Sensor Systems, Inc., Chatsworth, CA 91311 818-341-5366
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

Antennas (MIL)-2440 – *See Vol. B*
Antenna Systems (MIL)-2440 – *See Vol. B*

Antistatic Devices, Blowers, Guns, etc.-4100

§† ACL Inc., Elk Grove Village, IL 60007 .... 708-981-9212;1-800-782-8420
# Amstat Industries, Inc., Glenview, IL 60025 708-998-6210
† Chapman Corp., Portland, ME 04104 207-773-4726
§ Clean Room Products, Inc., Ronkonkoma, NY 11779-6528 516-588-7000
† Contact East, N. Andover, MA 01845 508-682-2000
Dri-Dek Corporation, Naples, FL 33942 800-348-2398
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ Ideal Industries, Inc., Sycamore, IL 60178 815-895-5181
3M Telecom Markets Division, Austin, TX 78726 .... 512-984-3400;800-426-8626
§ Midstates Marketing, Inc., Indianapolis, IN 46202 317-639-9999
# Midwest Container Systems, Minneapolis, MN 55428 612-533-4532
§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Plastic Systems Inc., Marlboro, MA 01752-3004 508-485-7390
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
§ Simco Co., Hatfield, PA 19440 215-822-2171
§† Tech Spray, Inc., Amarillo, TX 79105 806-372-8523
Vortec Corporation Illinois Tool Works, Cincinnati, OH 45242 800-441-7475
§† Wescorp Static Control Products, Mountain View, CA 94041 415-969-7717
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137 708-469-7473

Antitheft Devices – See Alarms & Alarm Systems (Vol. D)
Armatures – See Motor & Generator Armatures, Rotors, Stators (Vol. B)

Arms & Manipulators, Robotic-4900

† Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
AlphaTest Corp., Mesa, AZ 85204-6597 602-545-5518
† ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Automation Component Technology, Fremont, CA 94538 .... 510-226-0900; 510-490-3587 (Sales)
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 607-772-7563
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Mercotac Inc., Carlsbad, CA 92009 619-431-7723
MOLEX, Inc., Lisle, IL 60532 708-969-4550
Rhino Robots, Inc., Champaign, IL 61824 217-352-8485
§† Seiko Instruments U.S.A., Inc., Robotics/Automation Div., Torrance, CA 90505 213-517-7850

Array Processors-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Analogic Corp., Peabody, MA 01960 508-977-3000
array Microsystems, Colorado Springs, CO 80906 719-540-7999
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Datacube, Inc., Danvers, MA 01923 508-777-4200
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Ektron Applied Imaging, Inc., Bedford, MA 01730 617-271-1940
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
Mercury Computer Systems, Inc., Chelmsford, MA 01824 508-256-1300
MicroWay Inc. Research Park, Kingston, MA 02364 508-746-7341
SKY Computers, Inc., Subsidiary of Analogic Corporation, Chelmsford, MA 01824 508-250-1920
Spectral Innovations, Santa Clara, CA 95054-1807 408-727-1314
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 401-847-8000

† Teledyne Microelectronics, Los Angeles, CA 90066 ...... 310-822-8229;310-305-0248
Array Sockets — See Sockets, Array (Vol. C)
Arresters, Electrical Surge — See Suppressors, Transient Voltage (Vol. B)
Arresters, Electrical Surge/Lightning (MIL)-2440 — *See Vol. B*
Artificial Loads — See Dummy Loads (Vol. D)

Assemblers/Disassemblers, Network-1900

Byte Craft Limited, Waterloo, Ont., CAN N2J 4E4 519-888-6911
D & L Electronics, Langhorne, PA 19047 800-942-3631
HILEVEL Technology, Tustin, CA 92680 714-573-1888
KelTech Inc., Roanoke, VA 24019 703-362-8466
3M Private Network Products, 3M, Austin, TX 78726 ...... 512-984-3400;800-426-8626
†# Tratec of California, Inc., Chula Vista, CA 91911 619-476-1155
United Technical Products, Fallsington, PA 19054 800-553-5300
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
Assembly & Fabrication Services (Incl. R & D) — See Services, Assembly & Fabrication (Vol. D)

Attenuators, Audio-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 ...... D•1028
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ...... A•1846
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ...... A•2093
† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ...... D•1056
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ...... D•1323
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ...... B•1815
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ...... 214-422-1844; 1-800-872-0044
Dantel, Fresno, CA 93727 209-292-1111
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
Duncan Electronics, Costa Mesa, CA 92626 714-545-8261
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Hewlett-Packard Company. Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ...... 516-231-6900; 1-800-645-5104
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ...... 516-957-8700;800-645-5516
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Tucker Electronics, Dallas, TX 75355-1419 ...... 214-348-8800;800-527-4642
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Vishay Resistors, Malvern, PA 19355 215-644-1300
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Attenuators, Audio (T, L, LL Pads)-4750 — *See Vol. A*
Attenuators, Coaxial-3450 — *See Vol. A*
Attenuators, Decade-3450 — *See Vol. A*
Attenuators, Fiber Optic-2475 — *See Vol. B*
Attenuators, Fixed-3450 — *See Vol. A*

Attenuators, IF-1900

† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ...... A•1846
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ...... A•1725
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ...... B•1815
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Marconi Instruments, Allendale, NJ 07401 201-934-9050
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
MicroSignals Inc., L.I.C., NY 11101 ...... 718-937-7955;718-937-0391;800-648-2252
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Phoenix Microwave, Telford, PA 18969 215-723-6011
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Shallco, Inc., Smithfield, NC 27577 ...... 919-934-3135; 1-800-876-3135
§ Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ...... 310-478-8224;800-776-7614
Tucker Electronics, Dallas, TX 75355-1419 ...... 214-348-8800;800-527-4642
Attenuators, Impedance Matching-3450 — *See Vol. A*
Attenuators, Logarithmic-3450 — *See Vol. A*
Attenuators, Microwave-3450 — *See Vol. A*
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Attenuators, RF-1900

§ ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103 ...... C•1287
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ...... A•1720,1865
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ...... A•2071
† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ...... A•1722, D•1275
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ...... A•1846
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ...... A•1725
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ...... B•1815
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ...... B•1619
Advanced Technical Materials, Inc., Patchogue, NY 11772 ...... 516-363-9018; 516-289-0363
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§ Coax Connection, Peekskill, NY 10566 914-736-1010
Compac, Holbrook, NY 11741 516-585-3400
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hameg Instruments, Oceanside, CA 92056 ...... 619-630-4080;800-247-1241
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
Marconi Instruments, Allendale, NJ 07401 201-934-9050
MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
Micro-Coax, Collegeville, PA 19426 215-489-3700
MicroSignals Inc., L.I.C., NY 11101 ...... 718-937-7955;718-937-0391;800-648-2252
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ...... 514-694-6666; 800-724-3911
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Phoenix Microwave, Telford, PA 18969 215-723-6011
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† RE America, Westlake, OH 44145 216-871-7617
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Signal Switch Company, Corona, CA 91720 909-736-5404
§ Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
Synergy Microwave Corporation, Paterson, NJ 07504 201-881-8800
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ...... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ...... 214-348-8800;800-527-4642
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000
Attenuators, Switchable-3450 — *See Vol. A*
Attenuators, Turret-3450 — *See Vol. A*
Attenuators, Variable-3450 — *See Vol. A*
Attenuators, Voltage Controlled-3450 — *See Vol. A*
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Attenuators (MIL), Fiber Optic-2440 — *See Vol. B*
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Audible Alarms & Transducers-Also see Piezoelectric Ceramics; Transducers, Audio-1300

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ...... D•1026-1027
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ...... D•1029
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ...... D•1030-1031
§ International Components Corp., Melville, NY 11747, 516-293-1500 ...... D•1033-1035
JEMA, Wilmette, IL 60091, 708-251-3600 ...... D•1024-1025,1046
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ...... D•1053-1055
§† North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 ...... A•1130-1131
Omega Engineering, Stamford, CT 06907, 800-826-6342 ...... B•1887
§ Projects Unlimited, Dayton, OH 45414, 513-890-1918 ...... D•1057
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ...... D•1061-1062
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ...... D•1064

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 .... D•1068-1071
§ Accutech Benchmark Services, Brick, NJ 08723 1-908-206-0026
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 215-666-1900
§† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
Relay Service Co., Chicago, IL 60651 312-252-2700
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
Sonicall, Inc., Signal Hill, CA 90806 213-490-2143
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Wheelock, Inc., Long Branch, NJ 07740 908-222-6880

Autoclaves-2550

Brinkmann Instruments, Inc., Westbury, NY 11590-0207 516-334-7500
Express Test Corp., Sunnyvale, CA 94088-3419 408-737-3555
† Tenney Engineering, Union, NJ 07083 908-686-7870

Automated Wafer Fabrication Systems — See Machines, Accessories, Semiconductor Machine (Vol. D)
Awls-5400 – *See Vol. C*
Backlight Panels, Electroluminescent-2450 – *See Vol. B*
Backpanel Interconnect Systems-3200 – *See Vol. C*
Backplane Wiring Services — See Services, Backplane Wiring (Vol. D)

Baffles, Speaker-1300

§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616 .... C•1081
U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984 .... C•1081
§† Abalon Precision Mfg., Bronx, NY 10459 .... 718-589-5682;1-800-888-ABALON
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191 800-357-5240
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 708-584-2300
§ Fourjay Industries, Dayton, OH 45413-0617 513-890-6444
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ Harris Corp., Dracon Div., Camarillo, CA 93012 805-987-9511
§ Hartley Products, Wilmington, NC 28406 919-392-0500
§ Paso Sound Products, Pelham, NY 10803 914-738-4800
† Permaluster, Inc., Burbank, CA 91504 .... 213-849-4543;213-849-6454
§ Quam-Nichols Co., Chicago, IL 60637 312-488-5800
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 818-362-9516

Ballasts — See Resistors, Ballast (Vol. A)
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Ballasts, Lighting, Magnetic-1850 – *See Vol. A*
Baluns — See Transformers, Matching (Vol. A)
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Barrier Blocks & Strips — See Terminal Blocks (Vol. C), Terminal Strips (Vol. C)
Barriers, Intrinsic Safety-2100 – *See Vol. C*
Bars, Shorting-3200 – *See Vol. C*

Baths, Controlled Temperature (Air & Liquid)-4100

† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
Brinkmann Instruments, Inc., Westbury, NY 11590-0207 516-334-7500
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
† Forma Scientific, Inc., Marietta, OH 45750 614-373-4763
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
§ Lab-Line Instruments, Melrose Park, IL 60160 708-450-2600
Omega Engineering, Stamford, CT 06907 800-826-6342
Products for Research, Danvers, MA 01923 508-774-3250
† Ransco Industries, Oxnard, CA 93033 805-487-7777
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
† Standard Environmental Systems, Inc., Totowa, NJ 07512 201-256-2200
† Tenney Engineering, Union, NJ 07083 908-686-7870

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Batteries, Alkaline Manganese-3900

†# Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 .... D•1423
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552 .... D•1431
§† Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 .... D•1435-1436
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 .... D•1450
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 .... D•1457
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 .... D•1459
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... D•1465
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1480,1482
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 .... D•1483
§# Adcour, Inc., Sharon, MA 02067 617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Battery Specialties, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 516-499-5155
†# Centurion International, Inc., Lincoln, NE 68504 800-228-4563
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 ... 619-438-2202
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
# House of Batteries, Huntington Beach, CA 92647 ...... 1-800-432-3385;714-375-0222
International Microelectronics, Arlington, TX 76003 817-473-1730
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Lyntronics, Inc., Deer Park, NY 11729 516-243-6397
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 .... 818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515 800-323-7307
§# Powell Electronics Inc., Philadelphia, PA 19101 215-365-1900
§# Powercard Corp., Waltham, MA 02159 617-890-6789
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
§† RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Tadiran Electronic Industries, Inc., Port Washington, NY 11050 516-621-4980
Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
# TNR Technical Inc., Altamonte Springs, FL 32714 407-682-4311
§ Varta Batteries, Inc., Elmsford, NY 10523 .... 914-592-2500;800-431-2154
§ West Electronic Sales Team, Huntington Beach, CA 92647 .... 714-375-6500; 310-495-5569

Batteries, Carbon Zinc-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 .... D•1423
Cell-Con, Inc., Exton, PA 19341, 215-363-8552 .... D•1431
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 .... D•1457
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1480,1482
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
†# Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
Battery Specialties, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 516-499-5155
§† Eveready Battery Co. Inc., St. Louis, MO 63164 314-982-2000
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
# House of Batteries, Huntington Beach, CA 92647 ...... 1-800-432-3385;714-375-0222
International Microelectronics, Arlington, TX 76003 817-473-1730
Lyntronics, Inc., Deer Park, NY 11729 516-243-6397
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 .... 818-781-0505;1-800-423-2664
§# Powercard Corp., Waltham, MA 02159 617-890-6789
Power Conversion, Inc., BTR, Elmwood Park, NJ 07407 201-796-4800
Pro Battery, Inc., Atlanta, GA 30340 800-451-7171
§† RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
TNR Technical Inc., Altamonte Springs, FL 32714 407-682-4311
Varta Batteries, Inc., Elmsford, NY 10523 .... 914-592-2500;800-431-2154

Batteries, Lead-Acid — See Batteries, Lead Acid, Valve Regulated (Vol. D), Batteries, Lead acid, Flooded

Batteries, Lead-Acid, Valve Regulated-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 .... D•1423
Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA) .... D•1428
CSB Battery of America Corporation, Ft. Worth, TX 76116, 817-732-2258 .... D•1434
# Eagle-Picher, Joplin, MO 64801, 417-623-8000 .... D•1443
§ Eagle-Picher, Seneca, MO 64865, 417-776-2256 .... D•1440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
§ Gates Energy Products, Industrial Battery Division, Warrensburg, MO 64093, 816-429-2165 .... D•1452-1453
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 .... D•1457
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 .... D•1459
Power-Sonic, Redwood City, CA 94063, 415-364-5001 .... D•1464
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... D•1465
Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1481-1482
T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 .... D•1483

§ Yuasa-Exide, Inc., Reading, PA 19601, 215-378-0333	**D•1485**
Avex Electronics, Bensalem, PA 19020	215-638-1515;800-345-1295
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000
† East Penn Manufacturing, Lyon Station, PA 19536	215-682-6361
# Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
§ IMC Power Sources, San Jose, CA 95112	408-441-9614
§ Johnson Controls Battery Group, Inc., Milwaukee, WI 53212	414-961-6500
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779	818-781-0505;1-800-423-2664
Nickel Metal Hydride, Downers Grove, IL 60515	800-323-7307
Rolls Battery Engineering, Salem, MA 01970	508-745-3333
§ TNR Technical Inc., Altamonte Springs, FL 32714	407-682-4311
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476

Batteries, Lead-Acid, Flooded-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955	**D•1423**
Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA)	**D•1428**
CSB Battery of America Corporation, Ft. Worth, TX 76116, 817-732-2258	**D•1434**
# Eagle-Picher, Joplin, MO 64801, 417-623-8000	**D•1443**
Eagle-Picher, Seneca, MO 64865, 417-776-2256	**D•1440**
Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639	**D•1448**
Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354	**D•1459**
Power-Sonic, Redwood City, CA 94063, 415-364-5001	**D•1464**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**D•1465**
Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004	**D•1481-1482**
T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307	**D•1483**
Yuasa-Exide, Inc., Reading, PA 19601, 215-378-0333	**D•1485**
Avex Electronics, Bensalem, PA 19020	215-638-1515;800-345-1295
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000
# Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
IMC Power Sources, San Jose, CA 95112	408-441-9614
§ Johnson Controls Battery Group, Inc., Milwaukee, WI 53212	414-961-6500
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
Nickel Metal Hydride, Downers Grove, IL 60515	800-323-7307
Rolls Battery Engineering, Salem, MA 01970	508-745-3333
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476

Batteries, Lead Dioxide-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955	**D•1423**
†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295	**D•1424**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639	**D•1448**
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
# Battery Specialties, Costa Mesa, CA 92626	714-755-0888;1-800-352-3706 (Toll free in CA)
Cell-Con, Inc., Exton, PA 19341	215-363-8552
† Eagle-Picher, Joplin, MO 64801	417-623-8000
§ Eagle-Picher, Seneca, MO 64865	417-776-2256
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
# House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714-375-0222
§# Johnson Controls Battery Group, Inc., Milwaukee, WI 53212	414-961-6500
# Power-Pak, Inc., Morton Grove, IL 60053	708-966-6000
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440

Batteries, Lithium-3900

†# Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955	**D•1423**
†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295	**D•1424-1425**
§† Battery Engineering, Inc., Hyde Park, MA 02136, 617-361-7555	**D•1426**
# Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA)	**D•1429**
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552	**D•1431,1433**
§† Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274	**D•1435**
†# Eagle-Picher, Joplin, MO 64801, 417-623-8000	**D•1443-1445**
§† Eagle-Picher, Seneca, MO 64865, 417-776-2256	**D•1441-1442**
†# Electrochem Industries, Wilson Greatbatch Ltd., Clarence, NY 14031, 716-759-5428	**D•1447**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639	**D•1448**
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000	**D•1451**
Gould Inc., Electronic Power Sources, Eastlake, OH 44095-4001, 1-800-722-7890	**D•1454**
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266	**D•1457**
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354	**D•1459**
§† Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800	**D•1462-1463**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**D•1465**
§† SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331	**D•1467-1468,1470-1471**
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173, 619-661-6620	**D•1472**
Tadiran Electronic Industries, Inc., Port Washington, NY 11050, 516-621-4980	**D•1477**
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004	**D•1480,1482**
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307	**D•1483**
§# Adcour, Inc., Sharon, MA 02067	617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
†# Bren-Tronics, Inc., Commack, NY 11725	516-499-5155
§† Catalyst Research, Mine Safety Appliances Co., Inc., Owings Mills, MD 21117	410-356-2400
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008	619-438-2202
# House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112	408-441-9614
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
Lyntronics, Inc., Deer Park, NY 11729	516-243-6397
§ Maxell Corp. of America, Fair Lawn, NJ 07410	201-794-5900
# Moli Energy Limited, Maple Ridge, B.C., CANADA V2X 9E7	604-465-7911/1-800-663-MOLI
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
# Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779	818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515	800-323-7307
§# Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
# Power-Pak, Inc., Morton Grove, IL 60053	708-966-6000
§ RAYOVAC Corporation, Madison, WI 53711-0960	608-275-4692
§† Renata, Richardson, TX 75081	214-234-8091
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
SAFT America Inc., Research & Development Center, Cockeysville, MD 21030	410-771-3200
† SAFT America Inc., Lithium Battery Div., Valdese, NC 28690	704-874-4111
§ TELTEC, INC., Minneapolis, MN 55425	612-854-9632
TNR Technical Inc., Altamonte Springs, FL 32714	407-682-4311
§† Varta Batteries, Inc., Elmsford, NY 10523	914-592-2500;800-431-2154
§ West Electronic Sales Team, Huntington Beach, CA 92647	714-375-6500; 310-495-5569
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379	203-599-1100

Batteries, Lithium Manganese Dioxide-3900

†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295	**D•1425**
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552	**D•1431,1433**
§† Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274	**D•1435,1437**
Eagle-Picher, Seneca, MO 64865, 417-776-2256	**D•1441**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639	**D•1448**
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000	**D•1451**
§† Gould Inc., Electronic Power Sources, Eastlake, OH 44095-4001, 1-800-722-7890	**D•1454**
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266	**D•1457**
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354	**D•1459**
§† Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800	**D•1462-1463**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**D•1465**
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331	**D•1469-1471**
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173, 619-661-6620	**D•1472**
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770	**D•1473**
§# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004	**D•1480,1482**
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307	**D•1483**
§# Adcour, Inc., Sharon, MA 02067	617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
# Battery Specialties, Costa Mesa, CA 92626	714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725	516-499-5155
†# Eagle-Picher, Joplin, MO 64801	417-623-8000
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503	310-782-5318
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
# Hoppecke Battery Systems, Inc., Bulter, NJ 07405	201-492-0045
# House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112	408-441-9614
Lyntronics, Inc., Deer Park, NY 11729	516-243-6397
§ Maxell Corp. of America, Fair Lawn, NJ 07410	201-794-5900
# Moli Energy Limited, Maple Ridge, B.C., CANADA V2X 9E7	604-465-7911/1-800-663-MOLI
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
# Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779	818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515	800-323-7307
§# Powercard Corp., Waltham, MA 02159	617-890-6789
§ RAYOVAC Corporation, Madison, WI 53711-0960	608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
TNR Technical Inc., Altamonte Springs, FL 32714	407-682-4311
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379	203-599-1100

Batteries, Lithium Thionyl Chloride-3900

Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295	**D•1425**
§† Battery Engineering, Inc., Hyde Park, MA 02136, 617-361-7555	**D•1426**
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552	**D•1431,1433**
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274	**D•1435**
§† Eagle-Picher, Joplin, MO 64801, 417-623-8000	**D•1443**

§† Eagle-Picher, Seneca, MO 64865, 417-776-2256 ... D•1441-1442
†# Electrochem Industries, Wilson Greatbatch Ltd., Clarence, NY 14031, 716-759-5428 ... D•1447
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1448
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 ... D•1459
§† Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800 ... D•1462-1463
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 ... D•1465
§ SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ... D•1467-1468,1470
§ Tadiran Electronic Industries, Inc., Port Washington, NY 11050, 516-621-4980 ... D•1477
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 ... D•1483
§# Adcour, Inc., Sharon, MA 02067 ... 617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 ... 619-480-4445
Battery Specialties, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 ... 516-499-5155
House of Batteries, Huntington Beach, CA 92647 ... 1-800-432-3385;714-375-0222
§ Lamp Technology, Inc., Bohemia, NY 11716 ... 516-567-1800
Lyntronics, Inc., Deer Park, NY 11729 ... 516-243-6397
§ Maxell Corp. of America, Fair Lawn, NJ 07410 ... 201-794-5900
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 ... 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ... 818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515 ... 800-323-7307
RAYOVAC Corporation, Madison, WI 53711-0960 ... 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 ... 408-943-0440
†# Tauber Elctrns. Inc., San Diego, CA 92117 ... 619-274-7242;1-800-927-0004
TNR Technical Inc., Altamonte Springs, FL 32714 ... 407-682-4311
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 ... 203-599-1100

Batteries, Mercury-3900

†# Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 ... D•1423
Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ... D•1431
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1448
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ... D•1457
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 ... D•1480,1482
§# Adcour, Inc., Sharon, MA 02067 ... 617-784-8123
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†# Avex Electronics, Bensalem, PA 19020 ... 215-638-1515;800-345-1295
Battery Specialties, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 ... 516-499-5155
§† Eveready Battery Co. Inc., St. Louis, MO 63164 ... 314-982-2000
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 ... 619-438-2202
# House of Batteries, Huntington Beach, CA 92647 ... 1-800-432-3385;714-375-0222
Lyntronics, Inc., Deer Park, NY 11729 ... 516-243-6397
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ... 818-781-0505;1-800-423-2664
Plainview Batteries, Inc., Plainview, NY 11803 ... 800-642-2354
Power-Pak, Inc., Morton Grove, IL 60053 ... 708-966-6000
Pro Battery, Inc., Atlanta, GA 30340 ... 800-451-7171
§ RAYOVAC Corporation, Madison, WI 53711-0960 ... 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 ... 408-943-0440
Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911
§ TELTEC, INC., Minneapolis, MN 55425 ... 612-854-9632
# TNR Technical Inc., Altamonte Springs, FL 32714 ... 407-682-4311
§† Varta Batteries, Inc., Elmsford, NY 10523 ... 914-592-2500;800-431-2154

Batteries, Mercury Oxide-3900

Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ... D•1431
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1448
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 ... D•1451
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ... D•1457
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 ... 619-480-4445
†# Alexander Manufacturing Company, Mason City, IA 50402 ... 800-247-1821; 515-423-8955
†# Avex Electronics, Bensalem, PA 19020 ... 215-638-1515;800-345-1295
Battery Specialties, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
House of Batteries, Huntington Beach, CA 92647 ... 1-800-432-3385;714-375-0222
Lyntronics, Inc., Deer Park, NY 11729 ... 516-243-6397
Plainview Batteries, Inc., Plainview, NY 11803 ... 800-642-2354
Pro Battery, Inc., Atlanta, GA 30340 ... 800-451-7171
§ RAYOVAC Corporation, Madison, WI 53711-0960 ... 608-275-4692
Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911
§ Total Concept Sales, Glendale, CA 91202-2896 ... 818-547-9476
Varta Batteries, Inc., Elmsford, NY 10523 ... 914-592-2500;800-431-2154

Batteries, Nickel Cadmium-3900

†# Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 ... D•1423
†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295 ... D•1424-1425
# Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA) ... D•1427
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ... D•1431-1432
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 ... D•1435,1438
†# Eagle-Picher, Joplin, MO 64801, 417-623-8000 ... D•1443
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1448
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 ... D•1451
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ... D•1457
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 ... D•1459-1461
§ Power-Sonic, Redwood City, CA 94063, 415-364-5001 ... D•1464
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 ... D•1465
§† SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ... D•1467,1469
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173, 619-661-6620 ... D•1472
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 ... D•1480-1482
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 ... D•1483
§† Yuasa-Exide, Inc., Reading, PA 19601, 215-378-0333 ... D•1485
§# Adcour, Inc., Sharon, MA 02067 ... 617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 ... 619-480-4445
Bomar Crystal Company, Middlesex, NJ 08846 ... 908-356-7787;800-526-3935
†# Bren-Tronics, Inc., Commack, NY 11725 ... 516-499-5155
†# Centurion International, Inc., Lincoln, NE 68504 ... 800-228-4563
Christie Electric Corp., Gardena, CA 90248 ... 310-715-1402
† Eagle-Picher, Seneca, MO 64865 ... 417-776-2256
East Penn Manufacturing, Lyon Station, PA 19536 ... 215-682-6361
Elgin Electronics, Erie, PA 16509-3570 ... 814-864-4921
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 ... 408-432-8331
§† Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114 ... 904-462-3911
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 ... 619-438-2202
# Hoppecke Battery Systems, Inc., Bulter, NJ 07405 ... 201-492-0045
# House of Batteries, Huntington Beach, CA 92647 ... 1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112 ... 408-441-9614
International Microelectronics, Arlington, TX 76003 ... 817-473-1730
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 ... 407-241-8600
§ Lamp Technology, Inc., Bohemia, NY 11716 ... 516-567-1800
Lyntronics, Inc., Deer Park, NY 11729 ... 516-243-6397
§† Marathon Power Technologies, Waco, TX 76714-8233 ... 817-776-0650
§ Mouser Electronics, Santee, CA 92071 ... 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 ... 800-346-6873
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 ... 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ... 818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515 ... 800-323-7307
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 ... 717-323-4691
§ Powell Electronics Inc., Philadelphia, PA 19101 ... 215-365-1900
# Power-Pak, Inc., Morton Grove, IL 60053 ... 708-966-6000
§ RAYOVAC Corporation, Madison, WI 53711-0960 ... 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 ... 408-943-0440
§† Saft America Inc., Power Sources Div., Valdosta, GA 31601 ... 912-247-2331
SAFT America Inc., Research & Development Center, Cockeysville, MD 21030 ... 410-771-3200
Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911
§ TELTEC, INC., Minneapolis, MN 55425 ... 612-854-9632
TNR Technical Inc., Altamonte Springs, FL 32714 ... 407-682-4311
§† Tungstone Batteries, Inc., Sharon, MA 02067 ... 617-784-2000
§† Varta Batteries, Inc., Elmsford, NY 10523 ... 914-592-2500;800-431-2154

Batteries, Nickel Metal Hydride-3900

Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA) ... D•1427
Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ... D•1431
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 ... D•1435,1438
Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 ... D•1459,1461
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 ... D•1465
T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 ... D•1483

Batteries, Rechargeable-3900

§† Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 ... D•1423
†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295 ... D•1424-1425
# Battery Specialties, Costa Mesa, CA 92626, 714-755-0888;1-800-352-3706 (Toll free in CA) ... D•1427-1428
# Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ... D•1432
§ CSB Battery of America Corporation, Ft. Worth, TX 76116, 817-732-2258 ... D•1434
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 ... D•1438
§† Eagle-Picher, Seneca, MO 64865, 417-776-2256 ... D•1440
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1448
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ... D•1457
# Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 ... D•1459-1460
§ Power-Sonic, Redwood City, CA 94063, 415-364-5001 ... D•1464
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 ... D•1465
§ SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ... D•1467

§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173, 619-661-6620 ..... D•1472
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... D•1473
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 ..... D•1480,1482
§† T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307 ..... D•1483
§† Yuasa-Exide, Inc., Reading, PA 19601, 215-378-0333 ..... D•1485
§# Adcour, Inc., Sharon, MA 02067 617-784-8123
†# Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
§ Audiotronics Corp., N. Hollywood, CA 91605 818-765-2645
Bomar Crystal Company, Middlesex, NJ 08846 ..... 908-356-7787;800-526-3935
†# Bren-Tronics, Inc., Commack, NY 11725 516-499-5155
†# Centurion International, Inc., Lincoln, NE 68504 800-228-4563
Christie Electric Corp., Gardena, CA 90248 310-715-1402
†# Eagle-Picher, Joplin, MO 64801 417-623-8000
§† East Penn Manufacturing, Lyon Station, PA 19536 215-682-6361
Energy, Ltd., Bladensburg, MD 20710 301-699-1144
§† Eveready Battery Co. Inc., St. Louis, MO 63164 314-982-2000
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
§† Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114 904-462-3911
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 619-438-2202
# Hoppecke Battery Systems, Inc., Bulter, NJ 07405 201-492-0045
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
§ IMC Power Sources, San Jose, CA 95112 408-441-9614
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§# Johnson Controls Battery Group, Inc., Milwaukee, WI 53212 414-961-6500
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Lyntronics, Inc., Deer Park, NY 11729 516-243-6397
§† Marathon Power Technologies, Waco, TX 76714-8233 817-776-0650
# Moli Energy Limited, Maple Ridge, B.C., CANADA V2X 9E7 ..... 604-465-7911/1-800-663-MOLI
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ..... 818-781-0505;1-800-423-2664
§† Nickel Metal Hydride, Downers Grove, IL 60515 800-323-7307
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Powell Electronics Inc., Philadelphia, PA 19101 215-365-1900
§# Powercard Corp., Waltham, MA 02159 617-890-6789
Power Conversion, Inc., BTR, Elmwood Park, NJ 07407 201-796-4800
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
§ RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
TNR Technical Inc., Altamonte Springs, FL 32714 407-682-4311
§† Tungstone Batteries, Inc., Sharon, MA 02067 617-784-2000
§ Varta Batteries, Inc., Elmsford, NY 10523 ..... 914-592-2500;800-431-2154
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Batteries, Silver Cadmium-3900

# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295 ..... D•1424
Battery Specialties, Costa Mesa, CA 92626 ..... 714-755-0888;1-800-352-3706 (Toll free in CA)
Cell-Con, Inc., Exton, PA 19341 215-363-8552
† Eagle-Picher, Seneca, MO 64865 417-776-2256
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
# Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Batteries, Silver Oxide-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 ..... D•1423
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ..... D•1448
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 ..... D•1451
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ..... D•1457
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... D•1467
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... D•1473
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 ..... D•1480,1482
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Battery Specialties, Costa Mesa, CA 92626 ..... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 516-499-5155
Cell-Con, Inc., Exton, PA 19341 215-363-8552
§† Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801 203-791-3274
†# Eagle-Picher, Joplin, MO 64801 417-623-8000
† Eagle-Picher, Seneca, MO 64865 417-776-2256
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 619-438-2202
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
Lyntronics, Inc., Deer Park, NY 11729 516-243-6397
§ Maxell Corp. of America, Fair Lawn, NJ 07410 201-794-5900
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ..... 818-781-0505;1-800-423-2664
Plainview Batteries, Inc., Plainview, NY 11803 800-642-2354
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
§ RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§† Varta Batteries, Inc., Elmsford, NY 10523 ..... 914-592-2500;800-431-2154
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Batteries, Silver Zinc-3900

†# Eagle-Picher, Joplin, MO 64801, 417-623-8000 ..... D•1443
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ..... D•1448
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... D•1473
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 ..... D•1480
§# Adcour, Inc., Sharon, MA 02067 617-784-8123
Battery Specialties, Costa Mesa, CA 92626 ..... 714-755-0888;1-800-352-3706 (Toll free in CA)
Cell-Con, Inc., Exton, PA 19341 215-363-8552
† Eagle-Picher, Seneca, MO 64865 417-776-2256
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 ..... 818-781-0505;1-800-423-2664
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601 912-247-2331
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
† Tungstone Batteries, Inc., Sharon, MA 02067 617-784-2000
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Batteries, Solar — See Cells, Photovoltaic (Vol. B)

Batteries, Standard Cell-3900

§† Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 ..... D•1423
†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295 ..... D•1424-1425
Cell-Con, Inc., Exton, PA 19341, 215-363-8552 ..... D•1431-1432
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 ..... D•1437-1438
†# Eagle-Picher, Joplin, MO 64801, 417-623-8000 ..... D•1443
Eagle-Picher, Seneca, MO 64865, 417-776-2256 ..... D•1441
Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 ..... D•1450
Gates Energy Products, Industrial Battery Division, Warrensburg, MO 64093, 816-429-2165 ..... D•1452
Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266 ..... D•1457
Plainview Batteries, Inc., Plainview, NY 11803, 800-642-2354 ..... D•1459-1461
Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800 ..... D•1462-1463
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 ..... D•1465
§ SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... D•1467-1469,1471
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
§# Contact East, N. Andover, MA 01845 508-682-2000
§ East Penn Manufacturing, Lyon Station, PA 19536 215-682-6361
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
The Eppley Laboratory, Inc., Newport, RI 02840 401-847-1020
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114 904-462-3911
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112 408-441-9614
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173 619-661-6620
Tadiran Electronic Industries, Inc., Port Washington, NY 11050 516-621-4980
†# Tauber Elctrns. Inc., San Diego, CA 92117 ..... 619-274-7242;1-800-927-0004
Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
TNR Technical Inc., Altamonte Springs, FL 32714 407-682-4311
†# Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Batteries, Thermal-3900

†# Avex Electronics, Bensalem, PA 19020, 215-638-1515;800-345-1295 ..... D•1425
† Eagle-Picher, Joplin, MO 64801, 417-623-8000 ..... D•1443
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... D•1467
† Eagle-Picher, Seneca, MO 64865 417-776-2256
# House of Batteries, Huntington Beach, CA 92647 ..... 1-800-432-3385;714-375-0222
# Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
SAFT America Inc., Research & Development Center, Cockeysville, MD 21030 410-771-3200

Batteries, Thin Format-3900

FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ..... D•1096
§† Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800 ..... D•1462
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... D•1467,1469

†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
House of Batteries, Huntington Beach, CA 92647 .... 1-800-432-3385;714-375-0222
NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Plainview Batteries, Inc., Plainview, NY 11803 800-642-2354
§# Powercard Corp., Waltham, MA 02159 617-890-6789
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440

Batteries, Zinc Air-3900

§† Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274 .... D•1435
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
§† Eveready Battery Co. Inc., St. Louis, MO 63164, 314-982-2000 .... D•1451
§# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1480,1482
§# Adcour, Inc., Sharon, MA 02067 617-784-8123
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
†# Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
Battery Specialties, Costa Mesa, CA 92626 .... 714-755-0888;1-800-352-3706 (Toll free in CA)
† Eagle-Picher, Seneca, MO 64865 417-776-2256
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 619-438-2202
# House of Batteries, Huntington Beach, CA 92647 .... 1-800-432-3385;714-375-0222
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 .... 818-781-0505;1-800-423-2664
Plainview Batteries, Inc., Plainview, NY 11803 800-642-2354
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
Pro Battery, Inc., Atlanta, GA 30340 800-451-7171
§ RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440

Batteries, Zinc Carbon-3900

# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
§# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1480
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
†# Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
Battery Specialties, Costa Mesa, CA 92626 .... 714-755-0888;1-800-352-3706 (Toll free in CA)
†# Bren-Tronics, Inc., Commack, NY 11725 516-499-5155
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
§† Eveready Battery Co. Inc., St. Louis, MO 63164 314-982-2000
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 619-438-2202
# House of Batteries, Huntington Beach, CA 92647 .... 1-800-432-3385;714-375-0222
†# NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559 612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 .... 818-781-0505;1-800-423-2664
§# Powercard Corp., Waltham, MA 02159 617-890-6789
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
§† RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
# TNR Technical Inc., Altamonte Springs, FL 32714 407-682-4311

Batteries, Zinc Chloride-3900

Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955 .... D•1423
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004 .... D•1480,1482
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Battery Specialties, Costa Mesa, CA 92626 .... 714-755-0888;1-800-352-3706 (Toll free in CA)
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
§† Eveready Battery Co. Inc., St. Louis, MO 63164 314-982-2000
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008 619-438-2202
# House of Batteries, Huntington Beach, CA 92647 .... 1-800-432-3385;714-375-0222
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779 .... 818-781-0505;1-800-423-2664
Plainview Batteries, Inc., Plainview, NY 11803 800-642-2354
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
Pro Battery, Inc., Atlanta, GA 30340 800-451-7171
§† RAYOVAC Corporation, Madison, WI 53711-0960 608-275-4692
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 408-943-0440
Varta Batteries, Inc., Elmsford, NY 10523 .... 914-592-2500;800-431-2154

Batteries, Zinc Oxide-3900

# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 .... D•1448
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Battery Specialties, Costa Mesa, CA 92626 .... 714-755-0888;1-800-352-3706 (Toll free in CA)
† Eagle-Picher, Seneca, MO 64865 417-776-2256
# House of Batteries, Huntington Beach, CA 92647 .... 1-800-432-3385;714-375-0222
Pro Battery, Inc., Atlanta, GA 30340 800-451-7171
Batteries (MIL)-2440 – *See Vol. B*
Battery Chargers — See Chargers, Battery (Vol. D), Power Supplies, Plug-in (Vol. D)
Battery Holders — See Connectors, Battery (Vol. C), Retainers, Battery (Vol. C)
Battery Plugs — See Connectors, Battery (Vol. C)
Beads, Shielding, Ferrite — See Shielding, Beads, Ferrite (Vol. C)
Beam Splitters-3700 – *See Vol. B*
Bearings-2500 – *See Vol. C*
Beepers — See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. D)

Bells, Buzzers, Gongs, Sirens & Aural Warning Devices-2200

§ Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 .... D•1026-1027
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 .... D•1029
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 .... D•1030
§ International Components Corp., Melville, NY 11747, 516-293-1500 .... D•1033-1036
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 .... D•1041
JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024-1025,1042-1043,1046
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 .... D•1051
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .... D•1054
§† North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1130
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 .... D•1056
§ Projects Unlimited, Dayton, OH 45414, 513-890-1918 .... D•1057
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 .... D•1062
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 .... D•1063
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .... D•1064
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 .... D•1068-1071
Accutech Benchmark Services, Brick, NJ 08723 1-908-206-0026
§ Adcour, Inc., Sharon, MA 02067 617-784-8123
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911 619-575-4011
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
Elna America, Inc., Cypress, CA 90630 714-761-8600
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626 .... 714-662-3232;800-366-7010
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Sonicall, Inc., Signal Hill, CA 90806 213-490-2143
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
†# Tauber Elctrns. Inc., San Diego, CA 92117 .... 619-274-7242;1-800-927-0004
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
§ Wheelock, Inc., Long Branch, NJ 07740 908-222-6880
Belts, Dial Drive — See Cords & Cable, Dial Drive (Vol. C)
Belts, Drive-2500 – *See Vol. C*
Benches, Consoles, Tables (Work Stations, Lab & Shop)-Also See Enclosures, Equipment and Panel Mounting-1400 – *See Vol. C*
Bends & Twists, Microwave-3450 – *See Vol. A*
Bezels & Escutcheons, Shielded & Unshielded-2400 – *See Vol. C*
Bimetals, Thermostatic-5300 – *See Vol. B*

Blackbody Radiation Sources-2900

Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
† Electro Optical Industries Inc., Santa Barbara, CA 93111 .... 805-964-6701 (ext. 280)
E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
† Graseby Infrared, Graseby PLC, Orlando, FL 32826 407-282-7700
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481 201-891-7330
Omega Engineering, Stamford, CT 06907 800-826-6342
Optronic Laboratories, Inc., Orlando, FL 32811 .... 407-422-3171;800-899-3171
Swan Associates, New Haven, CT 06534 203-387-3917
Blowers, Centrifugal-2600 – *See Vol. C*
Blowers, Tangential-2600 – *See Vol. C*

Board Computers & Subassemblies, Multibus Compatible-2025

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1175
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1184
Electronic Solutions, Zero Corporation, San Diego, CA 92121, 800-854-7086 .... C•1116-1117,1128-1133
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 .... D•1143
§ National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1198
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 .... C•1106
ADAC Corporation, Woburn, MA 01801 617-935-6668
§† Advanced Interconnections Corp., West Warwick, RI 02893 401-823-5200
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000

Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
BICC-VERO Electronics, Inc., Hamden, CT 06514 ...... 203-288-8001;1-800-242-2863
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393 612-881-6955
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Central Data Corp., Champaign, IL 61821 217-359-8010
§ Ciprico Inc., Plymouth, MN 55441 612-551-4000
Dage Precision Industries, Inc., Fremont, CA 94538 510-683-3930
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Diversified Technlg., Ridgeland, MS 39157 601-856-4121
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
GEN/COMP Inc., Canton, MA 02021 617-828-2008
Hybricon Corporation, Ayer, MA 01432 508-772-5422
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
§ International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
Knurr USA Inc., Knurr A.G., Simi Valley, CA 93063 805-526-7733
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
Megadata Corp., Bohemia, NY 11716 516-589-6800
Micro/sys, Glendale, CA 91208 818-244-4600
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 508-588-6110
Omnibyte Corp., West Chicago, IL 60185-3790 708-231-6880
§ Pacific Microcomputers, Fairway Optical Data Sys., Inc., Vista, CA 92083 619-727-9494
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Precicontact, Inc., Langhorne, PA 19047 215-757-1202
† Product Technology, Inc., Irvine, CA 92714 714-474-8998
Project Resources Inc., Wareham, MA 02571 508-295-7444
§† Radstone Technology, Montvale, NJ 07645 .... 201-391-2700;800-368-2738
SBE, Inc., San Ramon, CA 94583-1389 .... 510-355-2000;800-925-2666
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ Vector Electronic Co., Inc., Sylmar, CA 91342 .... 818-365-9661;800-423-5659
VMETRO, Inc., VMETRO as, Houston, TX 77079 713-584-0728
§ Xylogics, Inc., Burlington, MA 01803 800-225-3317
Zendex Corp., Dublin, CA 94568 510-828-3000
§ Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488

Board Computers & Subassemblies, NuBus Compatible-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .. D•1147,1198,1302**
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
TL Inds. Inc., Northwood, OH 43619 419-666-8144

Board Computers & Subassemblies, PC Bus Compatible-2025

Analogic Corp., Peabody, MA 01960, 508-977-3000 .... D•1170
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 .... D•1250
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1184
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1204-1205
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117,1125
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 .... D•1143
§† **Tempustech, Inc., Naples, FL 33942, 813-643-2424 .... D•1144**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1204-1205
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 .... C•1106
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1210
§ **Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 .... C•1675**
ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 .. 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
ADAC Corporation, Woburn, MA 01801 617-935-6668
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
# Alligator Technologies, Fountain Valley, CA 92708 714-850-9984
AMASCO, Torrance, CA 90501 310-781-9494
§ Ampro Computers,Inc., Sunnyvale, CA 94086 408-522-2100
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
Antona Corp., Los Angeles, CA 90024-5603 310-473-8995
§# Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
array Microsystems, Colorado Springs, CO 80906 719-540-7999
§ ATI Technologies Inc., Scarborough, Ont., CANADA M1W 3S2 416-756-0718
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393 612-881-6955
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
CGRS Microtech, Langhorne, PA 19047 215-757-0284
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Computer Dynamics Sales, Greer, SC 29650 803-877-8700
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8 .... 800-361-4914;514-333-1301
Datachron Inc., Anaheim, CA 92805 714-385-1705
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DDI Inc., Beverly, MA 01915-1703 508-927-7976
§ Diversified Technlg., Ridgeland, MS 39157 601-856-4121
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§# Encoder Products, Sandpoint, ID 83864 208-263-8541
HILEVEL Technology, Tustin, CA 92680 714-573-1888
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Imagenation Corporation, Vancouver, WA 98684 206-944-9131
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Industrial Computer Source, San Diego, CA 92131 619-271-9340
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Logical Design Group, Inc., Raleigh, NC 27607 919-851-1101
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
MCSI, Vista, CA 92083 619-598-2177
Micro Electronic Technologies, Hopkinton, MA 01748 508-435-9057
Micro/sys, Glendale, CA 91208 818-244-4600
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Monolithic Sys. Corp., Englewood, CO 80112 303-790-7400
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 508-588-6110
§ National Instruments, Austin, TX 78730-5039 512-794-0100
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Octagon Systems, Westminster, CO 80030 303-430-1500
Optivision, Inc., Davis, CA 95616 .... 916-757-4850;800-562-8934
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
Parsytec Inc., West Chicago, IL 60185 708-293-9500
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Precision MicroControl, San Diego, CA 92111 619-565-1500
Project Resources Inc., Wareham, MA 02571 508-295-7444
Qualogy Inc., San Jose, CA 95134 408-434-5200
Rapid Systems Inc., Seattle, WA 98103 206-547-8311
Rittal Corp., Springfield, OH 45504-9807 800-477-4000
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
Systronix Inc., Salt Lake City, UT 84152-6398 801-534-1017
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6 .... 514-437-5682; 800-387-4222
Vesta Technology, Inc., Wheat Ridge, CO 80033 303-422-8088
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945
§ WinSystems, Inc., Arlington, TX 76011 817-274-7553
Zaki Corporation, Marlboro, MA 01752 508-480-0201
Zendex Corp., Dublin, CA 94568 510-828-3000
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488

Board Computers & Subassemblies, Q Bus/Unibus Compatible-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 .... D•1143
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1198**
ADAC Corporation, Woburn, MA 01801 617-935-6668
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393 612-881-6955
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Codar Technology, Inc., Longmont, CO 80503 303-776-0472
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Digital Data Systems, Inc. (DDS), Ft. Lauderdale, FL 33313 305-792-3290
§ DILOG, Irvine, CA 92714 714-476-0303
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
GEN/COMP Inc., Canton, MA 02021 617-828-2008
§ GENROCO, Inc., Slinger, WI 53086-9501 414-644-8700
Hybricon Corporation, Ayer, MA 01432 508-772-5422
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
Mercury Computer Systems, Inc., Chelmsford, MA 01824 508-256-1300
Parsytec Inc., West Chicago, IL 60185 708-293-9500
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444

Board Computers & Subassemblies, S100 Bus Compatible-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1198**
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ Vector Electronic Co., Inc., Sylmar, CA 91342 .... 818-365-9661;800-423-5659

§ Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900

Board Computers & Subassemblies, STD Bus Compatible-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1198**
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 .... C•1106,1110
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1210
§ Adatek, Inc., Sandpoint, ID 83864 .... 208-263-1471;800-323-3343
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
AMASCO, Torrance, CA 90501 310-781-9494
Andufet Digital Corp., San Dimas, CA 91773 909-394-0171
Antona Corp., Los Angeles, CA 90024-5603 310-473-8995
§† Baradine Products Ltd., North Vancouver, B.C., CANADA V7L 4L3 604-988-9853
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Computer Dynamics Sales, Greer, SC 29650 803-877-8700
Cubit, Div. of Proteus Industries. Inc., Mountain View, CA 94041 415-962-8237
CYTEC Corp., Penfield, NY 14526 .... 716-381-4740;800-346-3117
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Datricon, Scientific Technologies, Inc., Hayward, CA 94544 510-471-9717
Davidge Corporation, Buellton, CA 93427 805-688-9598
DDI Inc., Beverly, MA 01915-1703 508-927-7976
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Electronic Design Engineering, Norco, CA 91760 909-735-1761
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
Enterprise Systems Corp., Dover, NH 03820 603-742-7363
HiTech Equipment Corp., San Diego, CA 92126 619-566-1892
Hybricon Corporation, Ayer, MA 01432 508-772-5422
Imagenation Corporation, Vancouver, WA 98684 206-944-9131
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
JF Microsystems, Pasco, WA 99301-9619 .... 509-297-4294;800-532-2737
Matrix Corp., Raleigh, NC 27610 919-231-8000
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032 317-846-1721
Micro/sys, Glendale, CA 91208 818-244-4600
Octagon Systems, Westminster, CO 80030 303-430-1500
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
§ Pro-Log Corp., Monterey, CA 93940 408-372-4593
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6 .... 514-437-5682; 800-387-4222
TL Inds. Inc., Northwood, OH 43619 419-666-8144
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
§ Vector Electronic Co., Inc., Sylmar, CA 91342 .... 818-365-9661;800-423-5659
Versalogic Corp., Eugene, OR 97402 800-824-3163
§ WinSystems, Inc., Arlington, TX 76011 817-274-7553
XYZ Electronics, McCordsville, IN 46055 317-335-2128
§ Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900
§† Ziatech, San Luis Obispo, CA 93401 805-541-0488

Board Computers & Subassemblies, VXI Bus Compatible-2025

Electronic Solutions, Zero Corporation, San Diego, CA 92121, 800-854-7086 .... C•1128-1133
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•2258
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1563
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 .... C•1111
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1209
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 .... C•1025
AMASCO, Torrance, CA 90501 .... -310-781-9494
Analogic Corp., Peabody, MA 01960 508-977-3000
BICC-VERO Electronics, Inc., Hamden, CT 06514 .... 203-288-8001;1-800-242-2863
CYTEC Corp., Penfield, NY 14526 .... 716-381-4740;800-346-3117
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Graham Electronic Manufacturing Inc., Escondido, CA 92025 .... 619-747-9177; 800-628-4095
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300 714-595-6030
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Knurr USA Inc., Knurr A.G., Simi Valley, CA 93063 805-526-7733
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 508-588-6110
§ National Instruments, Austin, TX 78730-5039 512-794-0100
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
Project Resources Inc., Wareham, MA 02571 508-295-7444
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Rittal Corp., Springfield, OH 45504-9807 800-477-4000
Schroff, Inc., Warwick, RI 02886 401-732-3770
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
VMETRO, Inc., VMETRO as, Houston, TX 77079 713-584-0728

Board Computers & Subassemblies, VME Bus Compatible-2025

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1184
Electronic Solutions, Zero Corporation, San Diego, CA 92121, 800-854-7086 .... C•1116-1117,1128-1133
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 .... D•1143
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1198**
† **Product Technology, Inc., Irvine, CA 92714, 714-474-8998 .... C•1673**
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 .... C•1106-1111
§ **Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 .... C•1025,1675**
Acromag Inc., Wixom, MI 48393-7037 313-624-1541
ADAC Corporation, Woburn, MA 01801 617-935-6668
§† Advanced Interconnections Corp., West Warwick, RI 02893 401-823-5200
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
AMASCO, Torrance, CA 90501 310-781-9494
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
§# Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
array Microsystems, Colorado Springs, CO 80906 719-540-7999
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Ballard Technology, Seattle, WA 98117 .... 206-782-8704;1-800-829-1553
BICC-VERO Electronics, Inc., Hamden, CT 06514 .... 203-288-8001;1-800-242-2863
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393 612-881-6955
Central Data Corp., Champaign, IL 61821 217-359-8010
§ Ciprico Inc., Plymouth, MN 55441 612-551-4000
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8 .... 800-361-4914;514-333-1301
Dage Precision Industries, Inc., Fremont, CA 94538 510-683-3930
Datachron Inc., Anaheim, CA 92805 714-385-1705
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† DY 4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Electronic Precision Technology Inc., Cambridge, MA 02140 617-661-2454
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Graham Electronic Manufacturing Inc., Escondido, CA 92025 .... 619-747-9177; 800-628-4095
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Hybricon Corporation, Ayer, MA 01432 508-772-5422
§ IICon Corporation, Morgan Hill, CA 95037 408-779-7466
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Indramat, The Rexroth Corp., Wood Dale, IL 60191 708-860-1010
Interlogic Industries, Melville, NY 11747-4294 516-420-8111
Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Knurr USA Inc., Knurr A.G., Simi Valley, CA 93063 805-526-7733
Logical Design Group, Inc., Raleigh, NC 27607 919-851-1101
Matrix Corp., Raleigh, NC 27610 919-231-8000
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
Mercury Computer Systems, Inc., Chelmsford, MA 01824 508-256-1300
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032 317-846-1721
Micro/sys, Glendale, CA 91208 818-244-4600
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 508-588-6110
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K 2M5 .... 613-592-0714;800-267-7231
Omnibyte Corp., West Chicago, IL 60185-3790 708-231-6880
§ Pacific Microcomputers, Fairway Optical Data Sys., Inc., Vista, CA 92083 619-727-9494
Parsytec Inc., West Chicago, IL 60185 708-293-9500
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Precicontact, Inc., Langhorne, PA 19047 215-757-1202
Precision MicroControl, San Diego, CA 92111 619-565-1500
Project Resources Inc., Wareham, MA 02571 508-295-7444
§† Radstone Technology, Montvale, NJ 07645 .... 201-391-2700;800-368-2738
Rittal Corp., Springfield, OH 45504-9807 800-477-4000
SBE, Inc., San Ramon, CA 94583-1389 .... 510-355-2000;800-925-2666
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
† SRT Electro-Optics, Inc., Birmingham, AL 35211 205-916-2929
† Star-Tron Corporation, Providence, RI 02909 401-274-5090
TL Inds. Inc., Northwood, OH 43619 419-666-8144
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444
VMETRO, Inc., VMETRO as, Houston, TX 77079 713-584-0728
§ Xylogics, Inc., Burlington, MA 01803 800-225-3317
§ Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900
§# Zitel Corporation, Milpitas, CA 95035 .... 408-321-9600;800-622-5020

Boards, Adapter, IBM PC-2000

§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... A•1695, D•1183**

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ...... D•1204
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117,1127-1129
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147,1198**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1101,1199
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1204
§ **Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ... C•1675,1679**
§ Adaptec, Inc., Milpitas, CA 95035 ... 408-945-8600
§ Ampro Computers,Inc., Sunnyvale, CA 94086 ... 408-522-2100
Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Andrew Corporation, Austin, TX 78746 ... 800-331-4144;512-314-3000
Antona Corp., Los Angeles, CA 90024-5603 ... 310-473-8995
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
Ballard Technology, Seattle, WA 98117 ... 206-782-8704;1-800-829-1553
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393 ... 612-881-6955
Cabletron Systems, Inc., Rochester, NH 03867 ... 603-332-9400
Computer Systems Technical Support, Anaheim, CA 92807 ... 714-632-1300
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 ... 617-273-5800
Dataq Instruments, Inc., Akron, OH 44333 ... 216-668-1444
Dianachart Inc., Rockaway, NJ 07866 ... 201-625-2299
§ EBY Company, Philadelphia, PA 19124 ... 215-537-4700
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 ... 609-259-8866
§# Encoder Products, Sandpoint, ID 83864 ... 208-263-8541
# Glasgal Communications, Inc., Northvale, NJ 07647 ... 201-768-8082
HILEVEL Technology, Tustin, CA 92680 ... 714-573-1888
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
Industrial Computer Source, San Diego, CA 92131 ... 619-271-9340
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 ... 914-373-9003
Keithley MetraByte, Taunton, MA 02780 ... 508-880-3000
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
Lextel, Inc., Wakefield, MA 01880 ... 617-245-5017
§ Opto 22, Temecula, CA 92590 ... 714-695-9299
Pacific Industrial Components Corp., See Altair Exchange Corp.
Parsytec Inc., West Chicago, IL 60185 ... 708-293-9500
PERX,Inc., Corte Madera, CA 94925 ... 415-927-0155
Redlake Corp., Morgan Hill, CA 95037 ... 408-779-6464
§ Strawberry Tree, Inc., Sunnyvale, CA 94086 ... 408-736-8800
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6 ... 514-437-5682; 800-387-4222
Vetra Systems Corp., Plainview, NY 11803 ... 516-454-6469

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Boards, Plug-in, Extender-3200 – *See Vol. C*
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Boards, Plug-in, Memory-3200 – *See Vol. C*

Boards, Plug-In, Multifunction I/O Boards-2000

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 .... D•1150
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1184
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1460-1461, D•1183**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ...... D•1204
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147,1302**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1204
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
ADAC Corporation, Woburn, MA 01801 ... 617-935-6668
Advanced Hardware Architectures, Inc., Moscow, ID 83843 ... 208-883-8000
Advanced Micro Computer, Ft. Lauderdale, FL 33309 ... 305-975-9515
Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Analogic Corp., Peabody, MA 01960 ... 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Andrew Corporation, Austin, TX 78746 ... 800-331-4144;512-314-3000
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
Burr-Brown Corp., Tucson, AZ 85734 ... 602-746-1111
California Automation Inc., San Diego, CA 92121 ... 619-452-1341
§ Capital Equipment Corporation, Burlington, MA 01803 ... 617-273-1818
Central Data Corp., Champaign, IL 61821 ... 217-359-8010
CGRS Microtech, Langhorne, PA 19047 ... 215-757-0284
Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
Colorgraphic Communications Corp., Atlanta, GA 30341 ... 404-455-3921
§ Contec Microelectronics USA, San Jose, CA 95131 .... 408-434-6767;1-800-888-8884
Data Translation, Inc., Marlboro, MA 01752 ... 508-481-3700
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 ... 513-866-3300
§ Diversified Technlg., Ridgeland, MS 39157 ... 601-856-4121
§ EBY Company, Philadelphia, PA 19124 ... 215-537-4700
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 ... 609-259-8866
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 ... 714-669-9473
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
§ Grayhill Inc., La Grange, IL 60525 ... 708-354-1040
† Hancock Electronics Corp., Hingham, MA 02043 ... 617-740-4190
Industrial Computer Source, San Diego, CA 92131 ... 619-271-9340
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 ... 914-373-9003
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705 .. 602-623-9801
§ Keithley MetraByte, Taunton, MA 02780 ... 508-880-3000
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
Logical Design Group, Inc., Raleigh, NC 27607 ... 919-851-1101
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
Mercury Computer Systems, Inc., Chelmsford, MA 01824 ... 508-256-1300
MicroDimensions, Inc., Mentor, OH 44060 ... 216-974-8070
Micro Electronic Technologies, Hopkinton, MA 01748 ... 508-435-9057
Micro Industries, Westerville, OH 43081-9486 ... 614-548-7878
Micro/sys, Glendale, CA 91208 ... 818-244-4600
Multi-Tech Systems, Inc., Mounds View, MN 55112 ...... 612-785-3500;800-328-9717
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 ... 508-588-6110
§ Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
Optelecom, Inc., Gaithersburg, MD 20877 ... 301-840-2121
Pacific Industrial Components Corp., See Altair Exchange Corp.
Parsytec Inc., West Chicago, IL 60185 ... 708-293-9500
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 ... 812-386-1000
Qualogy Inc., San Jose, CA 95134 ... 408-434-5200
Quatech Inc., Akron, OH 44311 ... 216-434-3154
Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
SBE, Inc., San Ramon, CA 94583-1389 ... 510-355-2000;800-925-2666
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 ... 214-466-6000
Spectral Innovations, Santa Clara, CA 95054-1807 ... 408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
§ Strawberry Tree, Inc., Sunnyvale, CA 94086 ... 408-736-8800
Support Electronics, Inc., Butler, NJ 07405-1367 ... 1-201-838-2755
Systronix Inc., Salt Lake City, UT 84152-6398 ... 801-534-1017
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 ... 905-851-9958
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
TL Inds. Inc., Northwood, OH 43619 ... 419-666-8144
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 ... 205-880-0444
XYZ Electronics, McCordsville, IN 46055 ... 317-335-2128

Boards, Plug-in Processor-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117,1127,1136-1137
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
Advanced Hardware Architectures, Inc., Moscow, ID 83843 ... 208-883-8000
§ AFE Technologies Inc., Charlottesville, VA 22901 ... 804-974-7801
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
† Cable & Computer Technology Inc., Anaheim, CA 92806 ... 714-937-1341
Central Data Corp., Champaign, IL 61821 ... 217-359-8010
Computer Systems Technical Support, Anaheim, CA 92807 ... 714-632-1300
§ Dallas Semiconductor, Dallas, TX 75244 ... 214-450-0400
Data Translation, Inc., Marlboro, MA 01752 ... 508-481-3700
Davidge Corporation, Buellton, CA 93427 ... 805-688-9598
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 ... 609-259-8866
§# Encoder Products, Sandpoint, ID 83864 ... 208-263-8541
Enterprise Systems Corp., Dover, NH 03820 ... 603-742-7363
General Digital Corp., Enfield, CT 06082 ... 203-741-7171
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
† Hancock Electronics Corp., Hingham, MA 02043 ... 617-740-4190
Industrial Computer Source, San Diego, CA 92131 ... 619-271-9340
§ Ironwood Elctrns., Inc., St. Paul, MN 55121 ... 612-431-7025
JF Microsystems, Pasco, WA 99301-9619 ... 509-297-4294;800-532-2737
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
§ Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 ... 508-927-6575
Logical Design Group, Inc., Raleigh, NC 27607 ... 919-851-1101
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
Mercury Computer Systems, Inc., Chelmsford, MA 01824 ... 508-256-1300
Micro Industries, Westerville, OH 43081-9486 ... 614-548-7878
Micro/sys, Glendale, CA 91208 ... 818-244-4600
§ MicroWay Inc. Research Park, Kingston, MA 02364 ... 508-746-7341
§ National Instruments, Austin, TX 78730-5039 ... 512-794-0100
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Optivision, Inc., Davis, CA 95616 ... 916-757-4850;800-562-8934
Parsytec Inc., West Chicago, IL 60185 ... 708-293-9500
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 ... 812-386-1000
Quatech Inc., Akron, OH 44311 ... 216-434-3154
SBE, Inc., San Ramon, CA 94583-1389 ... 510-355-2000;800-925-2666
†# Sheldon Instruments, Provo, UT 84604 ... 801-376-7861
SKY Computers, Inc., Subsidiary of Analogic Corporation, Chelmsford, MA 01824 ... 508-250-1920
Spectral Innovations, Santa Clara, CA 95054-1807 ... 408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
Support Electronics, Inc., Butler, NJ 07405-1367 ... 1-201-838-2755
# Techrand Corp. of America, Muskegon, MI 49444 ... 616-798-2930
XYZ Electronics, McCordsville, IN 46055 ... 317-335-2128
§† Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

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Bolometers, Infrared-2900

† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484 ... 203-926-1777
Micro-Ohm Corp., Duarte, CA 91010 ... 818-3575377
Servo Corporation of America, Hicksville, NY 11801-5259 ... 516-938-9700
Swan Associates, New Haven, CT 06534 ... 203-387-3917
† Thermometrics, Inc., Edison, NJ 08817-4695 ... 908-287-2870

Bolometers, Microwave-2900

† Alpha Industries, Inc., Woburn, MA 01801 ... 617-935-5150
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
† General Microwave Corporation, Amityville, NY 11701 ... 516-226-8900
Lucas Weinschel, Gaithersburg, MD 20884-6001 ... 301-948-3434

§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428

Bolts-2500 – *See Vol. C*

Bonding Equipment, Computer Controlled (Automatic), Die, Laser, TAB, Wedge, Wire-4100

Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 619-931-3000
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880 617-246-2040
Research Devices, Inc., Piscataway, NJ 08854 908-572-4800
§ Zevatech, Inc., Morrisville, NC 27560 919-460-0111

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Brakes, Magnetic-3500 – *See Vol. B*
Brakes, Mechanical-3500 – *See Vol. B*
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Bridges, Audio-1900

Dantel, Fresno, CA 93727 209-292-1111
† Electro-Dynamics Dev. Co., Issaquah, WA 98027-4038 206-392-2493
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Bridges, Capacitance-2900

§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .. D•1248
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1288
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231 216-349-0370
AVO International, TBG, Dallas, TX 75237 214-333-3201
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
§ Epic, Inc., New York, NY 10038 212-349-2470
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282 602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
RE America, Westlake, OH 44145 216-871-7617
Rutherford Research, Rutherford, NJ 07070 201-933-2091
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Bridges, Dissipation Factor-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231 216-349-0370
§ Epic, Inc., New York, NY 10038 212-349-2470
Haefely, Inc., Woodbridge, VA 22192 703-494-1900
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
Rosemount Analytical Inc., Cedar Grove, NJ 07009 .... 800-222-2600 ext. 400
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Bridges, Impedance-2900

§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .. D•1248
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231 216-349-0370
† Electro-Dynamics Dev. Co., Issaquah, WA 98027-4038 206-392-2493
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
Henricks Technologies, Inc., Forsyth, GA 31029 .... 912-993-1060;800-241-0806
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
Linear Research Inc., San Diego, CA 92110 619-299-0719
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Bridges, Inductance-2900

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Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
Linear Research Inc., San Diego, CA 92110 619-299-0719
§ Metermaster, Tempe, AZ 85282 602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
RE America, Westlake, OH 44145 216-871-7617
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Bridges, Kelvin-2900

§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .. D•1248
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Shalltronix Corp., Selma, NC 27576, 919-965-6346 .... D•1324
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
§ Epic, Inc., New York, NY 10038 212-349-2470
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Julie Research Labs., New York, NY 10001 212-633-6625
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Metermaster, Tempe, AZ 85282 602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Valhalla Scientific, San Diego, CA 92121 619-457-5576
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Bridges, LCR-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1288
MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 ..... D•1301
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Instek Corporation, City of Industry, CA 91745 818-336-6537
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
§ Metermaster, Tempe, AZ 85282 602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
RE America, Westlake, OH 44145 216-871-7617
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Bridges, Limit – See Bridges (Specific Types) (Vol. D)
Bridges, Megohm – See Bridges, Resistance (Vol. D)
Bridges, Programmable – See Bridges (Specific Types) (Vol. D)

Bridges, Q-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Bridges, Ratio – See Meters, Ratio (Vol. D)

Bridges, Resistance-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1280
Shalltronix Corp., Selma, NC 27576, 919-965-6346 .... D•1324
Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974 .... B•1909
§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Cambridge Technology, Inc., Watertown, MA 02172 617-923-1181
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
Dantel, Fresno, CA 93727 209-292-1111
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327

§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
Linear Research Inc., San Diego, CA 92110	619-299-0719
Meissner Industries, Dover, NJ 07801	201-366-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
RE America, Westlake, OH 44145	216-871-7617
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401	405-223-4773
† Space Electronics, Inc., Berlin, CT 06037	203-829-0001
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Valhalla Scientific, San Diego, CA 92121	619-457-5576
Vishay Resistors, Malvern, PA 19355	215-644-1300
Vitrek Corporation, San Diego, CA 92121	619-586-1695
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
Western Multiplex Corp., Belmont, CA 94002	415-592-8832

Bridges, RF-2900

† Eagle Wichita, Wichita, KS 67277, 316-942-5100	**A•1632**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
North Hills Signal Processing, Syosset, NY 11791	516-682-7740
§ Palomar Engineers, Escondido, CA 92046	619-747-3343
Teleplex, Inc., Alford Division, Woburn, MA 01801	617-935-8610
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652	714-494-9401
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Werlatone, Inc., Brewster, NY 10509	914-279-6187
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Bridges, Silicon Cell-4800 – *See Vol. A*

Bridges, Strain Gauge-2900

§ Action Instruments, San Diego, CA 92123	619-279-5726
A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
HBM, Inc., Marlboro, MA 01752	508-624-4500
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
Omega Engineering, Stamford, CT 06907	800-826-6342
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776

Bridges, Synchro & Resolver-2900

† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
TEGAM, Inc., Madison, OH 44057	800-666-1010
† Transmagnetics, Farmingdale, NY 11735	516-293-3100

Bridges, Telephone/Data-1900

Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700	**A•2519,2522**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
Artel Communications Corp., Hudson, MA 01749	508-562-2100
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
§ Conklin Instrument Corp., Pleasant Valley, NY 12569	914-635-2136
Dantel, Fresno, CA 93727	209-292-1111
§ Dataprobe, Englewood, NJ 07631	201-569-6464
§ DEK, Inc., St. Charles, IL 60174	708-377-2575
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Viking Electronics, Inc., Hudson, WI 54016	715-386-8861
Western Multiplex Corp., Belmont, CA 94002	415-592-8832

Bridges, Temperature-2900

Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1887**
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
Larson-Metercraft, El Cajon, CA 92020	619-258-8990
Minco Products, Minneapolis, MN 55432	612-571-3121
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199

Bridges, Wheatstone-2900

Shalltronix Corp., Selma, NC 27576, 919-965-6346	**D•1324**
§ Action Instruments, San Diego, CA 92123	619-279-5726
A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ Epic, Inc., New York, NY 10038	212-349-2470
General Resistance, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Meissner Industries, Dover, NJ 07801	201-366-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
† Space Electronics, Inc., Berlin, CT 06037	203-829-0001
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Valhalla Scientific, San Diego, CA 92121	619-457-5576

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Bulbs – See Lamps, Miniature & Subminiature (Vol. B)
Bumpers-2500 – *See Vol. C*
Burnishers, Contact-5400 – *See Vol. C*
Burnishers, Flexible Head-5400 – *See Vol. C*
Bus Bars, Surface Mount-3200 – *See Vol. C*
Bus Bars & Systems-3200 – *See Vol. C*
Bus Compatible Instruments – See Instruments, Test and Measuring, GPIB Compatible (Vol. D)
Bushings, Glass, Plastic, Metal, Rubber, etc.-2500 – *See Vol. C*
Busses, Multibus, Q Bus, S100 Bus, STD Bus – See Board Computers & Subassemblies (Vol. D)
Buzzers, Electronic – See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. D)
Cabinets – See Enclosures (Vol. C)
Cabinets, Plastic – See Enclosures, Nonmetallic (Vol. C)
Cabinets & Accessories, Metal – See Enclosures, Equipment & Panel Mounting (Vol. C)
Cable, Audio-6000 – *See Vol. C*
Cable, Battery Booster-6000 – *See Vol. C*
Cable, Biomedical Insrumentation-6000 – *See Vol. C*
Cable, Coaxial-6000 – *See Vol. C*
Cable, Communication-6000 – *See Vol. C*
Cable, Computer-6000 – *See Vol. C*
Cable, Data Transmission-6000 – *See Vol. C*
Cable, Dial – See Cords & Cable, Dial Drive (Vol. C)
Cable, FEP Insulated-6000 – *See Vol. C*
Cable, Fiber Optic/Cable Assemblies-2475 – *See Vol. B*
Cable, Flame Retardant-6000 – *See Vol. C*
Cable, Flat-6000 – *See Vol. C*
Cable, Heater-6000 – *See Vol. C*
Cable, High Temperature (Over 125°C)-6000 – *See Vol. C*
Cable, High Voltage (1,000 Volts & Over)-6000 – *See Vol. C*
Cable, IEEE 488 (GPIB)-6000 – *See Vol. C*
Cable, Instrumentation & Control-6000 – *See Vol. C*
Cable, Intercommunication & Sound System – See Cable, Audio (Vol. C)
Cable, Irradiated-6000 – *See Vol. C*
Cable, Low Capacitance-6000 – *See Vol. C*
Cable, Microphone-6000 – *See Vol. C*
Cable, Multiconductor-6000 – *See Vol. C*
Cable, Patient Monitoring – See Cable, Biomedical Insrumentation
Cable, Plenum-6000 – *See Vol. C*
Cable, Power-6000 – *See Vol. C*
Cable, Retractile – See Cords, Retractile (Vol. C)
Cable, Ribbon – See Cable, Flat (Vol. C)
Cable, Rotator Antenna – See Cable, Multiconductor (Vol. C)
Cable, Satellite-6000 – *See Vol. C*
Cable, Security-6000 – *See Vol. C*
Cable, Shielded-6000 – *See Vol. C*
Cable, Speaker-6000 – *See Vol. C*
Cable, Telephone-6000 – *See Vol. C*
Cable, TFE Insulated-6000 – *See Vol. C*
Cable, Thermocouple-6000 – *See Vol. C*
Cable, Transmission Line, Power-6000 – *See Vol. C*
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Cable, TV (Incl. Camera)-6000 – *See Vol. C*
Cable, Twisted Pair-6000 – *See Vol. C*
Cable, Welding-6000 – *See Vol. C*
Cable, Woven Conductor-6000 – *See Vol. C*
Cable & Assemblies (MIL)-2440 – *See Vol. B*

Cable & Connectors, Satellite Antennas-1200

† GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1750**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Advanced Technical Materials, Inc., Patchogue, NY 11772	516-363-9018; 516-289-0363
Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
Andrew Corp., Orland Pk., IL 60462	800-255-1479
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
CableStar, Incorporated, Glasgow, KY 42141	800-338-8223
† Cable Systems, Inc., The HVT Group, Everett, MA 02149	617-389-7080
Cat Wire and Cable Corp., Miami, FL 33150	305-836-3600
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
§ EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
§ International Components Corp., Melville, NY 11747	516-293-1500
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
JEMA, Wilmette, IL 60091	708-251-3600
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
MACOM, Inc., Lowell, MA 01851	617-272-3000
Mohawk/CDT, Leominster, MA 01453	508-537-9961;800-422-9961

Parlex Corporation, Methuen, MA 01844 508-685-4341
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
† Tru-Connector Corp., Peabody, MA 01960 .... 508-532-0775;1-800-262-9787; 1-800-COAXTRU
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 310-316-9984
† Veam, Litton Systems, Watertown, CT 06795 203-274-9681
Cable Assemblies & Harnesses-6000 – *See Vol. C*
Cable Assemblies, Microwave-3450 – *See Vol. A*

Cable Fault Locators-2900

Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910 .... D•1244-1245
Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
AVO International, TBG, Dallas, TX 75237 214-333-3201
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665 714-998-1961
Cabletest Products Co., Malden, MA 02148 617-665-2932
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Contact East, N. Andover, MA 01845 508-682-2000
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
Henricks Technologies, Inc., Forsyth, GA 31029 .... 912-993-1060;800-241-0806
Hipotronics Inc., Brewster, NY 10509 914-279-8091
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§ Laser Precision Corp., Utica, NY 13502 315-797-4449
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
3M Telecom Markets Division, Austin, TX 78726 .... 512-984-3400;800-426-8626
Phenix Technologies, Accident, MD 21520 301-746-8118
Techrand Corp. of America, Muskegon, MI 49444 616-798-2930
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000
Cable (MIL), Fiber Optic-2440 – *See Vol. B*
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Cable (MIL), RF-2440 – *See Vol. B*
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Calibration & Instrument Repair Services – See Services, Calibration & Instrument Repair (Vol. D)

Calibrators, Accelerometer-2900

Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 .... B•2025
Alpha-M Corp., Dallas, TX 75229 214-406-0424
Bently Nevada Corp., Minden, NV 89423 .... 800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675 714-493-8181
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043 716-684-0003
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§ Kistler Instruments Corp., Amherst, NY 14228-2171 716-691-5100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
† MB Dynamics Inc., Cleveland, OH 44146-1483 216-292-5850
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929

Calibrators, Attenuation-2900

Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696 .... D•1253
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Calibrators, Automated-2900

Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1278,1281
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Ectron Corp., San Diego, CA 92111-1980 619-278-0600
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
Xitron Technologies, San Diego, CA 92121 619-458-9852
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

Calibrators, Crystal-2900

PPM, Inc., Cleveland, OH 44122 1-800-899-4776
Rutherford Research, Rutherford, NJ 07070 201-933-2091

Calibrators, Current-2900

Φ Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696 .... D•1253
GMW Associates, Redwood City, CA 94064, 415-368-4884 .... B•1950-1951, D•1260
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1145
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266,1272
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1278,1281
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1283,1286
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1145
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329
Xitron Technologies, San Diego, CA 92121, 619-458-9852 .... D•1335
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Clarke-Hess Communications Research Corp., New York, NY 10011 212-255-2940
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Crystal Engineering Corp., Los Osos, CA 93402 .... 805-528-2155;800-444-1850
§ CYBRID INCORPORATED, Woodcliff Lake, NJ 07675 201-307-0426
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Holt Instrument, C.P.D. Engineering, Inc., Oconto, WI 54153 414-834-2222
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Lem Dynamp Inc., Grove City, OH 43123 614-871-6900
§ Martel Electronics, Windham, NH 03087 603-893-0886
§ Metermaster, Tempe, AZ 85282 602-431-0015
North Hills Signal Processing, Syosset, NY 11791 516-682-7740
Omega Engineering, Stamford, CT 06907 800-826-6342
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

Calibrators, Fluxmeter-2900

GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1260
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
§ Walker Scientific, Worcester, MA 01606 .... 508-852-3674;508-853-3232;800-962-4638

Calibrators, Frequency-2900

§† Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000 .... A•1339
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1186
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 .... A•1402
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1281
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
§ Dynalco Controls, Ft. Lauderdale, FL 33309 305-739-4300
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
FTS/AUSTRON, Austin, TX 78761-4766 512-251-2341
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
† PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053 215-355-6900
† PPM, Inc., Cleveland, OH 44122 1-800-899-4776
Rutherford Research, Rutherford, NJ 07070 201-933-2091
Spectracom Corporation, East Rochester, NY 14445-1484 716-381-4827
§ TrueTime, Inc., Santa Rosa, CA 95407 707-528-1230

Calibrators, LVDT-2900

† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 .... D•1176-1177
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
Omega Engineering, Stamford, CT 06907 800-826-6342
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Calibrators, Magnetic Field-2900

GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1260-1263
Magnos, Hudson, MA 01749, 508-562-1173 .... D•1296
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 .... D•1334
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
§ Tensor, Austin, TX 78761 512-251-4131

Calibrators, Meter-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1380
† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... A•1848
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2012
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1380
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329
Φ Electronic Development Corp., EDC, Boston, MA 02127-4198 617-268-9696
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538 510-226-1329
§ Metermaster, Tempe, AZ 85282 602-431-0015
Optronic Laboratories, Inc., Orlando, FL 32811 .... 407-422-3171;800-899-3171
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
Wavetek Corp., San Diego, CA 92123 619-279-2200

Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Xitron Technologies, San Diego, CA 92121	619-458-9852
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Calibrators, Oscilloscope-2900

Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329**
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
Julie Research Labs., New York, NY 10001	212-633-6625
§ Metermaster, Tempe, AZ 85282	602-431-0015
Omega Engineering, Stamford, CT 06907	800-826-6342
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Calibrators, Sound Level-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199

Calibrators, Sweep — See Generators, Sweep (Vol. D)

Calibrators, Synchro-2900

† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
TEGAM, Inc., Madison, OH 44057	800-666-1010
† Transmagnetics, Farmingdale, NY 11735	516-293-3100

Calibrators, Time Base-2900

§† Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000	**A•1339**
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1186**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1278**
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325	818-993-0048
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Calibrators, Transducer-2900

Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2011-2012**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328**
Advanced Process Controls, Woburn, MA 01801	617-932-9262
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Crystal Engineering Corp., Los Osos, CA 93402	805-528-2155;800-444-1850
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
HBM, Inc., Marlboro, MA 01752	508-624-4500
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† Kurz Instruments Inc., Monterey, CA 93940	800-424-7356
Martel Electronics, Windham, NH 03087	603-893-0886
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102	216-281-1100
§ Metermaster, Tempe, AZ 85282	602-431-0015
Omega Engineering, Stamford, CT 06907	800-826-6342
§ PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
Rotek Instrument Corp., Waltham, MA 02254	617-899-4611
Sensor Developments Inc., Lake Orion, MI 48361	313-391-3000
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
Xitron Technologies, San Diego, CA 92121	619-458-9852

Calibrators, Voltage-2900

Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Φ Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696	**D•1253**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1272**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1278,1281**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329**
Xitron Technologies, San Diego, CA 92121, 619-458-9852	**D•1335**
§ Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
§ Contact East, N. Andover, MA 01845	508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
The Eppley Laboratory, Inc., Newport, RI 02840	401-847-1020
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
General Resistance, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Holt Instrument, C.P.D. Engineering, Inc., Oconto, WI 54153	414-834-2222
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
† Koep Precision Standards, Inc., Tuckerton, NJ 08087	609-296-9686
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
§ Linear Instruments, Spectra Physics Analytical, Reno, NV 89523	702-746-2200
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
North Hills Signal Processing, Syosset, NY 11791	516-682-7740
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Rotek Instrument Corp., Waltham, MA 02254	617-899-4611
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
TEGAM, Inc., Madison, OH 44057	800-666-1010
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Calibrators, VSWR-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Direct Conversion Technique, Inc., Chicago, IL 60641	312-283-1690
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700

Calorimeters, Microwave-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
† Raytheon Co., Electronic Components Division, Waltham, MA 02254	617-899-8400
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

CAMAC Modules — See Modules, CAMAC (Vol. D)

Cameras, Data Recording-2325

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† CELCO, Mahwah, NJ 07430	201-327-1123
CIDTEC (CID Technologies Inc.), Liverpool, NY 13088	315-451-9410
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
# Heitz, Karl, Inc., Woodside, NY 11377	718-565-0004

Cameras, Digital Image Acquisition-2325

§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-784-4456
† CELCO, Mahwah, NJ 07430	201-327-1123
CIDTEC (CID Technologies Inc.), Liverpool, NY 13088	315-451-9410
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
§ Daitron, Inc., Tigard, OR 97223	503-620-2879
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
Eastman Kodak Company, Motion Analysis Systems Division, San Diego, CA 92121-1097	619-535-2908
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197	408-738-4266
Ektron Applied Imaging, Inc., Bedford, MA 01730	617-271-1940
Gordon Instruments, Inc., Orchard Park, NY 14127	716-662-5353;1-800-333-2672
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Cameras, Image Converter-1900

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
§ IR Scientific, Carlisle, MA 01741	508-667-7110
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
Spiricon, Inc., Logan, UT 84321	801-753-3729

Cameras, Infrared-2325

§† Aiphone, Bellevue, WA 98005	206-455-0510
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
§ Dage-MTI, Michigan City, IN 46360	219-872-5514
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† EEV Inc., Elmsford, NY 10523	914-592-6050
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
§ IR Scientific, Carlisle, MA 01741	508-667-7110
Loral Fairchild, Imaging Sensors, Milpitas, CA 95035-7407	408-433-2500
Spiricon, Inc., Logan, UT 84321	801-753-3729
Swan Associates, New Haven, CT 06534	203-387-3917
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711
† Xedar Corp., Boulder, CO 80301	303-443-6441

Cameras, Machine Vision-4100

† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-784-4456
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164

CIDTEC (CID Technologies Inc.), Liverpool, NY 13088 315-451-9410
†Cohu, Inc., Elctrns. Div., San Diego, CA 92123 619-277-6700
§DALSA INC., Waterloo, Ont., CANADA N2V 2E9 519-886-6000
§Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
†EEV Inc., Elmsford, NY 10523 914-592-6050
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821 508-671-5000
§Loral Fairchild, Imaging Sensors, Milpitas, CA 95035-7407 408-433-2500
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
#Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234 ... 310-921-7775
§Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265 .. 515-225-6933
§Zevatech, Inc., Morrisville, NC 27560 919-460-0111

Cameras, Oscilloscope-2975

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 .... A•1725
#BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
§Contact East, N. Andover, MA 01845 508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
#Heitz, Karl, Inc., Woodside, NY 11377 718-565-0004
Kikusui International Corp., Signal Hill, CA 90804-1203 ... 310-986-1677;800-545-8784
§Metermaster, Tempe, AZ 85282 602-431-0015
§PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670 818-365-0101
§†Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888
§Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Cameras, Television-1900

§Aiphone, Bellevue, WA 98005 206-455-0510
§Ampex Corp., Redwood City, CA 94063-3199 415-367-2011
†Ball Corporation, Industrial Systems Division, Mogadore, OH 44260 216-784-4456
CIDTEC (CID Technologies Inc.), Liverpool, NY 13088 315-451-9410
†Cohu, Inc., Elctrns. Div., San Diego, CA 92123 619-277-6700
§Dage-MTI, Michigan City, IN 46360 219-872-5514
ElectroPhysics Corp., Fairfield, NJ 07004 201-882-0211
Gordon Instruments, Inc., Orchard Park, NY 14127 ..... 716-662-5353;1-800-333-2672
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821 508-671-5000
Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501 310-328-6116
§Loral Fairchild, Imaging Sensors, Milpitas, CA 95035-7407 408-433-2500
Outland Technology Inc., Gretna, LA 70056 504-367-0104
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
†#Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234 ... 310-921-7775
§Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
Video Automation Systems, Pound Ridge, NY 10576 914-764-4613

Cameras, Television, Fiber Optic-1900

Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821 508-671-5000
§Loral Fairchild, Imaging Sensors, Milpitas, CA 95035-7407 408-433-2500
Stenning Instruments, Inc., Camarillo, CA 93010 805-484-4996
Capacitors, Feed-Thru-1500 – *See Vol. A*
Cans & Flat Packs, Integrated Circuit — See Packages, Integrated Circuit (Vol. A)
Cans, Capacitor, Relay, Semiconductor, Transformer, etc-2500 – *See Vol. C*
Capacitance Comparators — See Bridges, Capacitance (Vol. D)
Capacitor Hardware-2500 – *See Vol. C*
Capacitor Leakage Indicators — See Testers, Capacitor (Vol. D)
Capacitors, Chip (For Microcircuits)-1500 – *See Vol. A*
Capacitors, Energy Storage-1500 – *See Vol. A*
Capacitors, Fixed, AC (Incl. Motor Start)-1500 – *See Vol. A*
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Capacitors, Fixed, Tantalum Electrolytic-1500 – *See Vol. A*
Capacitors, Fixed, Vacuum-1500 – *See Vol. A*
Capacitors, Variable, Air-1500 – *See Vol. A*
Capacitors, Variable, Ceramic-1500 – *See Vol. A*
Capacitors, Variable, Film-1500 – *See Vol. A*
Capacitors, Variable, Gas Filled-1500 – *See Vol. A*
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Capacitors, Variable, Mica-1500 – *See Vol. A*
Capacitors, Variable, Padders & Trimmers-1500 – *See Vol. A*
Capacitors, Variable, Vacuum-1500 – *See Vol. A*
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Capacitors (MIL), Variable-2440 – *See Vol. B*
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Caps, Forms & Tapes, Heat Shrinkable-Also See Tubing, Heat Shrinkable-2500 – *See Vol. C*
Caps, Lenses, Indicator Light-2460 – *See Vol. B*
Caps, Wire Splicing — See Splicers, Wire (Vol. C)
Caps (MIL)-2440 – *See Vol. B*
Card Connectors, Surface Mount-2100 – *See Vol. C*

Card Equipment, Mark Sense-2000

Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500

Card Equip., Punch-2000

HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500

Card Equip., Reader-2000

Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 .... D•1087
§American Magnetics Corporation, Group 4, Carson, CA 90745 213-775-8651
Elcom Industries, Inc., St. Louis, MO 63132 314-429-3100
§Mag-Tek, Carson, CA 90746 213-631-8602
Q-Card, Inc., Owings Mills, MD 21117-1634 410-581-0112
Signal Research Inc., Titusville, NJ 08560 609-737-1917
THORN Automated Systems, Inc, THORN EMI, Westlake, OHIO 44145 216-871-9900
§Tokin America, Inc., San Jose, CA 95134 408-432-8020
XCP, Inc., Dryden, NY 13053 607-844-9143
§Xico, Inc., Chatsworth, CA 91311 818-709-4403

Card Equip., Reader/Punch-2000

Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Card Holders, Circuit Board — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. C)

Cards, Data Communication/Interfaces-2000

§Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1460-1461, D•1182
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1205,1374
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117,1122-1123,1127,1140
§National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147,1302
§Teka Interconnection Systems, Interplex Industries, Providence, RI 02907, 401-785-4110 .... C•1484-1486
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1205,1374
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 .... C•1674,1680
§Action Instruments, San Diego, CA 92123 619-279-5726
§Adatek, Inc., Sandpoint, ID 83864 .... 208-263-1471;800-323-3343
§AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
§Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
§Diversified Technlg., Ridgeland, MS 39157 601-856-4121
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
JF Microsystems, Pasco, WA 99301-9619 .... 509-297-4294;800-532-2737
§Keithley MetraByte, Taunton, MA 02780 508-880-3000
§Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820 908-549-9001
Matrix Corp., Raleigh, NC 27610 919-231-8000
Megadata Corp., Bohemia, NY 11716 516-589-6800
SBE, Inc., San Ramon, CA 94583-1389 .... 510-355-2000;800-925-2666
†Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
†#Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
†Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
XYZ Electronics, McCordsville, IN 46055 317-335-2128
Cards, Extender — See Extender Boards (Vol. D)

Cards, Linear Function-2000

Elgenco, Inc., Hurricane, UT 84737, 801-635-4954 .... D•1255
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§Action Instruments, San Diego, CA 92123 619-279-5726
Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
†CELCO, Mahwah, NJ 07430 201-327-1123
†Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108 203-528-9821
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
†Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
†Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
†Modular Devices, Shirley, NY 11967 516-345-3100
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950

Cards, Logic-2000

Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 .... D•1087
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1460-1461, D•1183
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
† Product Technology, Inc., Irvine, CA 92714, 714-474-8998 .... C•1673
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Douglas Electronics, Inc., San Leandro, CA 94577 510-483-8770
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108 203-528-9821
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
† Greenspring Computers, Inc., Menlo Park, CA 94025 415-327-1200
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
§ Intra-computer Inc., Jamacia, NY 11418 718-297-5500
† Logic Technology, Inc., Mtn. View, CA 94043 415-967-1007
§ Macrolink, Anaheim, CA 92807 714-777-8800
Matrix Corp., Raleigh, NC 27610 919-231-8000
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
Micro/sys, Glendale, CA 91208 818-244-4600
† Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369 909-392-5833
§† Onset Computer Corp., Pocasset, MA 02559-3450 508-563-9000
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
§ Pro-Log Corp., Monterey, CA 93940 408-372-4593
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900

Cards, Memory — See Memory Devices (Vol. D), Memory Systems (Vol. D)
Carriers — See Holders & Carriers, Chip (Vol. C)

Carrier Tape, Component-4100

# Thrust Industries, Inc., Haubstadt, IN 47639, 800-467-6730;812-768-6730 .... C•1668
Caristrap Internatonal, Inc., Chomedey, Laval, QUEBEC, CANADA H7SIN8 1-800-361-9466
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
† Electro Insulation Corp., Arlington Hgts., IL 60004 708-632-1020
Mutual Industries, Inc., Philadelphia, PA 19120 215-927-6000
The Pedro Companies, St. Paul, MN 55101 612-224-9491
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000

Cases, Equipment, Instrument, Meter (Portable) — See Enclosures, Portable, Metallic & Nonmetallic (Vol. C)
Cases, Equipment, Instrument, Meter (Stationary) — See Enclosures, Equipment & Panel Mounting (Vol. C)
Cases, Portable-1400 — ***See Vol. C***
Cases, Shielded — See Enclosures, Shielded (Vol. C)
Cases, Transit — See Enclosures, Shipping (Vol. C)
Casters-2500 — ***See Vol. C***

Castings, Die, Sand, Permanent Mold-4100

D & L Electronics, Langhorne, PA 19047 800-942-3631
§† FISHERCAST, Fisher Gauge Limited, Peterborough, Ont., CANADA K9J 6Y9 705-748-9522
Insulaton Components Associates, Inc., Downey, CA 90241 310-861-7268
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
United Technical Products, Fallsington, PA 19054 800-553-5300

Cathode-Ray Readout Tubes — See Tubes, Readout (Vol. A)

CATV Systems & Equipment-1900

Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 .... A•1625
§ EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 .... D•1073
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 .... A•1658-1659
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
§ C-COR Elctrns., Inc., State College, PA 16801 .... 814-238-2461;800-233-2267
D & P MFG. Inc., Chalfont, PA 18914 215-997-1200
Dotronix, New Brighton, MN 55112 612-633-1742
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
§ Johnson Controls Battery Group, Inc., Milwaukee, WI 53212 414-961-6500
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Manhattan Electric Cable Corporation, Rye, NY 10580 914-967-8000
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
Peca, Inc., Bensalem, PA 19020 215-245-1550
Prodelin Corporation, Conover, NC 28613 704-464-4141
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000
† Stainless, Inc., N. Wales, PA 19454 215-699-4871
§ Telemet, Geotel, Inc., Hauppauge, NY 11788 516-436-7260
Video Automation Systems, Pound Ridge, NY 10576 914-764-4613

Cavities, Microwave-3450 — ***See Vol. A***
Cells, Electrolytic (Timing) — See Timers, Electrolytic Cell (Vol. D)
Cells, Load-5500 — ***See Vol. B***
Cells, Photoconductive-3700 — ***See Vol. B***
Cells, Photoemissive-3700 — ***See Vol. B***
Cells, Photovoltaic-3700 — ***See Vol. B***
Cells, Solar — See Cells, Photovoltaic (Vol. B)
Cements — See Adhesives, (All Types) (Vol. C)

Chambers, Altitude-2550

† Bemco, Simi Valley, CA 93065 805-583-4970
§ CVC Products, Inc., Rochester, NY 14603 716-458-2550
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
† Ransco Industries, Oxnard, CA 93033 805-487-7777
† Standard Environmental Systems, Inc., Totowa, NJ 07512 201-256-2200
† Tenney Engineering, Union, NJ 07083 908-686-7870
† Thermodynamic Engineering Inc., Camarillo, CA 93012 805-484-0472
† Thermotron Inds., Holland, MI 49423 616-392-1491

Chambers, Anechoic-2550

Instruments for Industry, Inc., Ronkonkoma, NY 11779 516-467-8400
† LectroMagnetics Division, Los Angeles, CA 90016 .. 213-870-9383;USA 800-969-9383
Soundcoat Co., Inc., Deer Park, NY 11729-5701 516-242-2200
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Chambers, Environmental-2550

Sigma Systems Corp., San Diego, CA 92116, 619-283-3193 .... D•1211
Φ Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004 .... D•1212-1213
Alpha-M Corp., Dallas, TX 75229 214-406-0424
Alusett U.S.A., Inc., Peekskill, NY 10566 914-737-0120
Baker Co., Inc., Sanford, ME 04073 1-800-992-2537
† Bemco, Simi Valley, CA 93065 805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 .... 617-275-0850; 800-937-4688
Cybortronics Inc., Irvine, CA 92718 714-855-2814
§ Delta Design, San Diego, CA 92123-1111 619-292-5000
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
Environmental Stress Systems, Inc., Sonora, CA 95370 209-928-4900
ESS, Inc., Sonora, CA 95370 209-928-4900
Express Test Corp., Sunnyvale, CA 94088-3419 408-737-3555
Forma Scientific, Inc., Marietta, OH 45750 614-373-4763
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
† Gruenberg Oven Co., Williamsport, PA 17701 717-326-1755
Hotpack Corp., Philadelphia, PA 19154 .... 215-824-1700;800-523-3608
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
JC Systems, Inc., San Diego, CA 92121 619-793-7117
§ Lab-Line Instruments, Melrose Park, IL 60160 708-450-2600
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701 717-326-1770
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Ransco Industries, Oxnard, CA 93033 805-487-7777
§ Reliability Incorporated, Houston, TX 77218 713-492-0550
† Standard Environmental Systems, Inc., Totowa, NJ 07512 201-256-2200
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ Temptronic Corporation, Newton, MA 02158 617-969-2501
† Tenney Engineering, Union, NJ 07083 908-686-7870
† Thermodynamic Engineering Inc., Camarillo, CA 93012 805-484-0472
† Thermotron Inds., Holland, MI 49423 616-392-1491
† VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555

Chambers, Explosion-2550

Bemco, Simi Valley, CA 93065 805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
Hotpack Corp., Philadelphia, PA 19154 .... 215-824-1700;800-523-3608
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701 717-326-1770
† Standard Environmental Systems, Inc., Totowa, NJ 07512 201-256-2200
† Tenney Engineering, Union, NJ 07083 908-686-7870

Chambers, Fluid Conditioner-2550

† Bemco, Simi Valley, CA 93065 805-583-4970
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
Ransco Industries, Oxnard, CA 93033 805-487-7777
† Tenney Engineering, Union, NJ 07083 908-686-7870
Thermodynamic Engineering Inc., Camarillo, CA 93012 805-484-0472
VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555

Chambers, Humidity-2550

Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004 .... D•1212-1213
† Bemco, Simi Valley, CA 93065 805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
Express Test Corp., Sunnyvale, CA 94088-3419 408-737-3555
Forma Scientific, Inc., Marietta, OH 45750 614-373-4763
† Gruenberg Oven Co., Williamsport, PA 17701 717-326-1755
Hotpack Corp., Philadelphia, PA 19154 .... 215-824-1700;800-523-3608
§ Lab-Line Instruments, Melrose Park, IL 60160 708-450-2600

Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Ransco Industries, Oxnard, CA 93033	805-487-7777
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870
† Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472
† Thermotron Inds., Holland, MI 49423	616-392-1491
† Thunder Scientific Corp., Albuquerque, NM 87123	505-265-8701;800-872-7728

Chambers, Magnetic, Degaussing Coil-4525 – *See Vol. C*

Chambers, Pressure-2550

Bemco, Simi Valley, CA 93065	805-583-4970
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870

Chambers, Radiation-2550

Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Nordion International, Kanata, Ontario, CANADA K2K 1X8	613-592-2790
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223

Chambers, RFI/EMI-2550

† **Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000**	**C•1683**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
† LectroMagnetics Division, Los Angeles, CA 90016	213-870-9383;USA 800-969-9383
† Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139	708-307-7200
Tokin America, Inc., San Jose, CA 95134	408-432-8020

Chambers, Shock-2550

Φ **Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004**	**D•1212-1213**
† Bemco, Simi Valley, CA 93065	805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
§ Delta Design, San Diego, CA 92123-1111	619-292-5000
† Despatch Industries, Minneapolis, MN 55418	612-781-5363
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Ransco Industries, Oxnard, CA 93033	805-487-7777
† Sigma Systems Corp., San Diego, CA 92116	619-283-3193
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870
Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472
† Thermotron Inds., Holland, MI 49423	616-392-1491

Chambers, Space Simulation-2440 – *See Vol. B*

Chambers, Temperature-2550

Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Φ **Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004**	**D•1212-1213**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
† Bemco, Simi Valley, CA 93065	805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
Cybortronics Inc., Irvine, CA 92718	714-855-2814
§ Delta Design, San Diego, CA 92123-1111	619-292-5000
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
Environmental Stress Systems, Inc., Sonora, CA 95370	209-928-4900
ESS, Inc., Sonora, CA 95370	209-928-4900
Forma Scientific, Inc., Marietta, OH 45750	614-373-4763
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Gruenberg Oven Co., Williamsport, PA 17701	717-326-1755
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Hotpack Corp., Philadelphia, PA 19154	215-824-1700;800-523-3608
JC Systems, Inc., San Diego, CA 92121	619-793-7117
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770
Medicam Technologies Inc., Hudson, NH 03051	603-886-9460
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Omega Engineering, Stamford, CT 06907	800-826-6342
Products for Research, Danvers, MA 01923	508-774-3250
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Ransco Industries, Oxnard, CA 93033	805-487-7777
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Tenney Engineering, Union, NJ 07083	908-686-7870
Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472
† Thermotron Inds., Holland, MI 49423	616-392-1491
† VA-Tran Systems Inc., Chula Vista, CA 91911	619-423-4555

Chambers, Vacuum-2550

§† Abalon Precision Mfg., Bronx, NY 10459	718-589-5682;1-800-888-ABALON
† Aremco Products, Inc., Ossining, NY 10562	914-762-0685
† Astro Dynamics, Inc., Woburn, MA 01801	617-935-4944
† Bemco, Simi Valley, CA 93065	805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
CHA Industries, Fremont, CA 94538	510-683-8554
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854	203-853-9500
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
Forma Scientific, Inc., Marietta, OH 45750	614-373-4763
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
Hotpack Corp., Philadelphia, PA 19154	215-824-1700;800-523-3608
Ransco Industries, Oxnard, CA 93033	805-487-7777
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252	707-423-2100
† Tenney Engineering, Union, NJ 07083	908-686-7870
Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638

Chambers, Vibration-2550

† Bemco, Simi Valley, CA 93065	805-583-4970
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
† Despatch Industries, Minneapolis, MN 55418	612-781-5363
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
Ransco Industries, Oxnard, CA 93033	805-487-7777
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870
Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472
† Thermotron Inds., Holland, MI 49423	616-392-1491

Chambers (MIL)-2440 – *See Vol. B*

Character Recognition Equip., Magnetic Ink-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ American Magnetics Corporation, Group 4, Carson, CA 90745	213-775-8651

Character Recognition Equip., Optical-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Cognex Corp., Needham, MA 02194	617-449-6030
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009

Chargers, Battery-4000

† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900**	**D•2230-2231**
§ **Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955**	**D•1423**
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1568-1569**
† **Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500**	**D•1576**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**D•1583**
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1602**
§ **Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900**	**D•1608**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
† **D & B Power, Inc., Bayshore, NY 11706, 516-586-5955**	**D•1654-1655**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1663-1664**
EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1671**
Electromech, Inc., Irvington, NJ 07111, 201-318-7999	**D•1672**
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	**D•1673**
# **Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639**	**D•1448**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200	**D•1740**
† **Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525**	**D•1744,2266**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756,1758**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
† **Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800**	**D•1015**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837,2136**
† **Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337**	**D•1874,1877**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**D•1465**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270**	**D•1479,1945,1955**
†# **Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004**	**D•1480,1482**
Technical Devices, Dayton, OH 45414, 513-890-7881	**D•1957**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	**D•1998**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2306**
Yuasa-Exide, Inc., Reading, PA 19601, 215-378-0333	**D•1485**
Absopulse Electronics Ltd., Carp, Ont., CAN.K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
§† ACME-URDC, Inc., West Jordan, UT 84084	801-561-9385
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
AES Corp., Peabody, MA 01960	508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
Albar, Inc., Lynnwood, WA 98036	206-771-4006;800-822-5227
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
American Assembly Inc., Florida, NY 10921	914-651-3433
† American Monarch, Minneapolis, MN 55421	612-788-9161
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
† Avex Electronics, Bensalem, PA 19020	215-638-1515;800-345-1295
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341;800-645-2074
# Battery Specialties, Costa Mesa, CA 92626	714-755-0888;1-800-352-3706 (Toll free in CA)

Chargers, Battery-4000 (Cont'd)

§ Beaver Labs, Kingston, MA 02364	617-585-5666
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
§ Cal-Tek Engineering, Kingston, MA 02364	617-585-5666
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000
Cell-Con, Inc., Exton, PA 19341	215-363-8552
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
Circom Inc., Bensenville, IL 60106	708-595-4460
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Converter Concepts, Inc., Pardeeville. WI 53954	608-429-3000
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
§ CUI Stack Inc., Beaverton, OR 97005	503-643-4899
Deltona Transformer Corp., DeLand, FL 32724	904-736-7900
Domino, Inc., Fort Wayne, IN 46899	219-456-5512
§ East Penn Manufacturing, Lyon Station, PA 19536	215-682-6361
§ Elgin Electronics, Erie, PA 16509-3570	814-864-4921
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
Energy Systems, Vancouver, WA 98682	206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
Engineering Design & Sls., Danville, VA 24541	804-792-6405
§† Eveready Battery Co. Inc., St. Louis, MO 63164	314-982-2000
Forster Enterprises, Inc., Waterbury, CT 06708	203-574-3832
Friwo, Friemann & Wolf, Frederick, MD 21702	301-694-7479
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
GC International Inc., Plano, TX 75074	214-423-8411
Good-All Electric, Inc., Fort Collins, CO 80524	303-484-3080;800-826-7891
§ G P Batteries USA, Gold Peak International Ltd., Carlsbad, CA 92008	619-438-2202
† Hand Held Products, Inc., Charlotte, NC 28226	704-541-1380
§ HDR Power Systems, Inc., Hilliard, OH 43026	614-771-5500
Hoppecke Battery Systems, Inc., Bulter, NJ 07405	201-492-0045
House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112	408-441-9614
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968	215-666-1900
International Components Corp., Chicago, IL 60622	312-829-7101
§ Johnson Controls Battery Group, Inc., Milwaukee, WI 53212	414-961-6500
Lark Electronics, Inc., New York, NY 10040	212-569-0430
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
Luxtron Inc., Haverhill, MA 01830-4803	508-372-5211
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§ Magnetek Triad, Huntington, IN 46750	219-356-7100
† NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
Nesco Battery Systems, National Electro-Sales Corp., Van Nuys, CA 91406-3779	818-781-0505;1-800-423-2664
NIDEC Corporation, Torrington, CT 06790	203-482-4422
Plainview Batteries, Inc., Plainview, NY 11803	800-642-2354
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Conversion Products, Crystal Lake, IL 60014	815-459-9100
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power-Sonic, Redwood City, CA 94063	415-364-5001
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117	800-245-4501
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
RMS Techn., Newport News, VA 23606	804-873-0100
Rolls Battery Engineering, Salem, MA 01970	508-745-3333
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173	619-661-6620
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
§ Schauer Manufacturing, Cincinnati, OH 45242	513-791-3030
Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
§ Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476
† Tungstone Batteries, Inc., Sharon, MA 02067	617-784-2000
Unitrode Corp., Watertown, MA 02172	617-926-0404
§ Victor Engineering, San Clemente, CA 92673	714-366-2931
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
§† Xenotronix Inc., Valencia, CA 91355	805-257-4793
† Yardney Technical Products, Inc., Pawcatuck, CT 06379	203-599-1100

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Chassis, Metal-1400 — ***See Vol. C***
Chassis Slides — See Slides, Cabinet, Chassis (Vol. C)
Chassis (MIL), Electrical-2440 — ***See Vol. B***
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Chemicals, Antistatic — See Coatings, Antistatic (Vol. C)
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Chemicals, Epoxy Stripping-1600 — ***See Vol. C***
Chemicals, Etching-1700 — ***See Vol. C***
Chemicals, Fungicidal — See Coatings, Fungicidal (Vol. C)
Chemicals, Tin Plating-1700 — ***See Vol. C***
Chemicals, Wire Stripping-1600 — ***See Vol. C***
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Chokes, Waveguide-3450 — ***See Vol. A***
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Choppers-Also See Light Choppers-4050

† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Displaytech, Inc., Boulder, CO 80301	303-449-8933
† Duplicon, Inc., S. Boston, MA 02127	617-269-5859
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257

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Clamps (MIL), Cable-2440 — ***See Vol. B***
Cleaners, Magnetic Medium-1600 — ***See Vol. C***

Cleaners, Ultrasonic-4100

§† Alpha Metals, Jersey City, NJ 07304	201-434-6778
§† A.P.E. Corporation, Medford, NY 11763	516-654-1197
§ Clean Room Products, Inc., Ronkonkoma, NY 11779-6528	516-588-7000
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
† Contact East, N. Andover, MA 01845	508-682-2000
§ Fidelity Chemical Products Corp., Newark, NJ 07114	201-242-4110
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
§† L & R Mfg. Co., Kearny, NJ 07032	201-991-5330
† Miller-Stephenson Chem. Co., Inc., Danbury, CT 06810-0950	203-743-4447
† The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056	708-824-1133
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§† Sonicor Instrument Corp., Copiague, NY 11726	516-842-3344
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Tech Spray, Inc., Amarillo, TX 79105	806-372-8523
Transene, Rowley, MA 01969	508-948-2501
† U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325

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Clean Room Design & Construction-4100

Alusett U.S.A., Inc., Peekskill, NY 10566	914-737-0120
† Clean Room Products, Inc., Ronkonkoma, NY 11779-6528	516-588-7000
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770

Clean Room Equipment & Supplies-2550

§† ALFCO, Div. of Air Maze, Carpinteria, CA 93013	805-684-7651
† Baker Co., Inc., Sanford, ME 04073	1-800-992-2537
Baxter-Industrial Division, Valencia, CA 91355	805-253-7466
BayStat, Menlo Park, CA 94025	415-364-3205
Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
§† Chemtronics Inc., Hauppauge, NY 11788	516-582-3322;800-645-5244
§ Clauss Cutlery Co., Alco Industries, Fremont, OH 43420	419-332-7344;800-225-2877
† Clean Room Products, Inc., Ronkonkoma, NY 11779-6528	516-588-7000
§ Contact East, N. Andover, MA 01845	508-682-2000
† Controlled Environment Equipment Corp., Gorham, ME 04038	207-854-9126
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
† Gordon Brush Mfg. Co., Inc., Los Angeles, CA 90021-1786	213-627-6889
§† Hiac/Royco, Pacific Scientific Co., Silver Spring, MD 20904	301-680-7000
§ Inter Metro Industries Corp., Wilkes-Barre, PA 18705	717-825-2741
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
† Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
§ L & R Mfg. Co., Kearny, NJ 07032	201-991-5330
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770
† Micropump Corp., Vancouver, WA 98668-8975	206-253-2008
§ Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Plastic Systems Inc., Marlboro, MA 01752-3004	508-485-7390
§† Polygenex International Inc., Cary, NC 27512-1487	919-380-8100
Precision Tech. Sewing, Palo Alto, CA 94303	415-856-2128
§† Seiko Instruments U.S.A., Inc., Robotics/Automation Div., Torrance, CA 90505	213-517-7850

Sensidyne, Inc., Clearwater, FL 34620 ... 813-530-3602;1-800-451-9444
§† Simco Co., Hatfield, PA 19440 ... 215-822-2171
§† Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 ... 800-628-8862
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§ Tech Spray, Inc., Amarillo, TX 79105 ... 806-372-8523
† Tenney Engineering, Union, NJ 07083 ... 908-686-7870
VA-Tran Systems Inc., Chula Vista, CA 91911 ... 619-423-4555
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Clips & Holders, Fuse-Also See Panels, Fuse-2500 – *See Vol. C*
Clips, Battery - Also See Connectors, Battery-2100 – *See Vol. C*
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Clips, Fahnestock-2100 – *See Vol. C*
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Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 ... **C•1290**
§ **Emulation Technology, Inc., Santa Clara, CA 95051, 408-982-0660** ... **C•1321**
§ **ITT Pomona Electronics, Pomona, CA 91766, 909-469-2900** ... **C•1355**
Beta Automation, Inc., Newbury Park, CA 91320 ... 805-499-5785
§† E-Z Hook, Tektest Inc., Arcadia, CA 91006 ... 818-446-6175
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ Richard Hirschmann of America Inc., Riverdale, NJ 07457 ... 201-835-5002
3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Mueller Elec. Co., Cleveland, OH 44114 ... 216-771-5225
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
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Clips, Transistor & Diode — See Retainers, Transistor & Diode (Vol. C)
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Clocks, Time Keeping - Also See Oscillators, Clock-2200

§† **Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000** ... **A•1339**
§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665** ... **D•1151**
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ... **D•1116,1187-1189**
DCI Inc., Olathe, KS 66062, 913-782-5672 ... **D•1344**
§ **Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318** ... **A•1390,1394**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ... **A•1402**
† **FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341** ... **A•1405**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400** ... **A•1406**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT** ... **D•1361**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900** ... **D•1365**
Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ... **A•1481**
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411** ... **D•1077,1207**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... **D•1391**
§ AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
§ Benchmarq Microelectronics, Inc., Carrollton, TX 75006 ... 214-407-0011
§† Catalyst Research, Mine Safety Appliances Co., Inc., Owings Mills, MD 21117 ... 410-356-2400
Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
§ C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
Dantronics, Inc., St. Paul, MN 55126 ... 612-484-2108
Datachron Inc., Anaheim, CA 92805 ... 714-385-1705
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 ... 201-941-4455
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 708-584-2300
Electric Time Company, Inc., Medfield, MA 02052 ... 508-359-4396
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 ... 805-544-3800
§ ESE, El Segundo, CA 90245 ... 310-322-2136
§ Fox Electronics, Ft. Myers, FL 33905 ... 813-693-0099
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 ... 508-927-8220
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
† Holt Inc., Irvine, CA 92718 ... 714-859-8800
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 ... 818-889-3179
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 ... 215-666-1900
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
† Isotemp Research, Inc., Charlottesville, VA 22903 ... 804-295-3101
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
§ Lite-On Inc., Milpitas, CA 95035 ... 408-946-4873
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ NEL Frequency Controls, Inc., Burlington, WI 53105 ... 414-763-3591
† Piezo Technology Inc., Orlando, FL 32804 ... 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 ... 310-836-7900
RF Monolithics, Inc., Dallas, TX 75244 ... 214-233-2903
§ SARONIX, Palo Alto, CA 94303 ... 415-856-6900
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 ... 214-466-6000
Spectracom Corporation, East Rochester, NY 14445-1484 ... 716-381-4827
Spectrum Corp., Houston, TX 77075 ... 713-944-6200;1-800-392-5050(Sls)
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 ... 805-964-7791
Telegenix/Grim Corp., Cherry Hill, NJ 08034 ... 609-424-5220
§ TrueTime, Inc., Santa Rosa, CA 95407 ... 707-528-1230
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 ... 916-783-7878

Clocks & Controllers, Thermal-2200

§ AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
Gossen/Texmate, Vista, CA 92083-8397 ... 619-598-9899;1-800-394-8344
§ Jumo Process Control, Inc., Coatsville, PA 19320 ... 215-380-8002
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Texmate, Inc., Vista, CA 92083-8397 ... 619-598-9899
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 ... 916-783-7878
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Coatings, Electromagnetic Wave Absorbing-1600 – *See Vol. C*
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Coders, Telephone, Dial-1900

Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 ... 306-975-1080
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
§ Viking Electronics, Inc., Hudson, WI 54016 ... 715-386-8861
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Cold Plates — See Thermal Platforms (Vol. D)
Collection Systems (MIL)-2440 – *See Vol. B*
Collector Rings — See Slip Rings (Vol. B)

Collimators-2900

§ Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ... 805-964-6701 (ext. 280)
§ Optics for Research, Inc., Caldwell, NJ 07006 ... 201-228-4480
† Optima Precision, Inc., West Linn, OR 97068 ... 800-544-4118;503-638-2525
Combiners, Microwave — See Couplers, Microwave (Vol. A)
Communications Intelligence (Comint) Systems (MIL)-2440 – *See Vol. B*

Communications Systems, FM-1900

† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410 ... 407-622-3715
† A.R.F. Prods., Boulder, CO 80307-3128 ... 303-499-2946
ARS Inc., Orlando, FL 32809 ... 1-800-950-5633
§ Artel Communications Corp., Hudson, MA 01749 ... 508-562-2100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 ... 215-968-4271
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
Dowty Avionics, Arcadia, CA 91006 ... 818-445-5955
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2106
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 ... 613-226-4000
Glatzer Industries Corp., New Rochelle, NY 10801 ... 914-576-2700
§ Johnson, E. F., Co., Waseca, MN 56093 ... 1-800-247-8256
† LNR Communications, Inc., Hauppauge, NY 11788 ... 516-273-7111
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ... 44(582)471200
† MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
§ Monicor Electronic Corp., Ft. Lauderdale, FL 33309 ... 305-979-1907
Optelecom, Inc., Gaithersburg, MD 20877 ... 301-840-2121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035 ... 708-432-7915
§ Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 ... 317-545-4281
RF Industries Ltd. (Nuelink), San Diego, CA 92126 ... 619-549-6340;800-233-1728
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 ... 516-242-1100
† Solid State Electronics Corp., Northridge, CA 91324 ... 818-993-8257

§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Systems Alternatives, Maumee, OH 43537 419-891-1100

Communications Systems, Laser-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§ Artel Communications Corp., Hudson, MA 01749 508-562-2100
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 613-226-4000
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
H & L Instruments, Burlingame, CA 94010 415-342-7850
§ Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820 908-549-9001
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
† Ortel Corp., Alhambra, CA 91803 818-281-3636
RE America, Westlake, OH 44145 216-871-7617

Communications Module, Power Line LANs-1900

§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
Adaptive Networks, Cambridge, MA 02142 617-497-5150
§ Advanced Video Products, E-Systems, Westford, MA 01886 508-692-2020
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Systems Alternatives, Maumee, OH 43537 419-891-1100

Communication Systems, Megalinks-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100

Communication Systems, Megaplex-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710 510-527-6666
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749

Communications Systems, Microwave-3450 – *See Vol. A*

Communications Systems, Multiplex-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§ Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1218
† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 .... D•1074-1075
§† Aiphone, Bellevue, WA 98005 206-455-0510
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999 410-583-4000
§ Artel Communications Corp., Hudson, MA 01749 508-562-2100
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710 510-527-6666
§ Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
Control Module, Enfield, CT 06082 203-745-2433
§ Dataprobe, Englewood, NJ 07631 201-569-6464
† Dataproducts Corporation, Woodland Hills, CA 91367-2499 818-888-4014
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1 416-425-7800
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 613-226-4000
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359 617-826-0099
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Intra-computer Inc., Jamacia, NY 11418 718-297-5500
† Librascope Corp., Loral Corp., Glendale, CA 91201 818-244-6541
Loral Data Systems, Sarasota, FL 34230 813-371-0811
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595 619-278-4100
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
Modular Mining Systems, Inc., Tuscon, AZ 85706 602-746-9127
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Multi-Tech Systems, Inc., Mounds View, MN 55112 .... 612-785-3500;800-328-9717
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
§ Penril DataComm Networks, Gaithersburg, MD 20878 301-921-8600
§ Racal-Datacom, Sunrise, FL 33323-2899 .... 305-846-1601;1-800-RACAL-55
RE America, Westlake, OH 44145 216-871-7617
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
RFL Electronics Inc., Boonton, NJ 07005-0239 201-334-3100
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Systems Alternatives, Maumee, OH 43537 419-891-1100

Communications Systems, Telemetering-1900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1003,1022
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1116,1187-1189
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 .... A•1245
† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 .... D•1074-1075
AES Corp., Peabody, MA 01960 508-535-7310
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410 407-622-3715
ARS Inc., Orlando, FL 32809 1-800-950-5633
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ Bristol Babcock Inc., Watertown, CT 06795 .... 203-575-3000;800-395-5497
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
† Climatronics, Bohemia, NY 11716 516-567-7300
§ Dataprobe, Englewood, NJ 07631 201-569-6464
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
Loral Data Systems, Sarasota, FL 34230 813-371-0811
† Metraplex Corp., Frederick, MD 21701 301-662-8000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Monicor Electronic Corp., Ft. Lauderdale, FL 33309 305-979-1907
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
RFL Electronics Inc., Boonton, NJ 07005-0239 201-334-3100
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Systems Alternatives, Maumee, OH 43537 419-891-1100
Systran Corp., Dayton, OH 45432-3068 1-800-252-5601
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136 216-238-2550
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Communications Systems, Telephone-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 .... D•1074
§ Advanced Video Products, E-Systems, Westford, MA 01886 508-692-2020
§† Aiphone, Bellevue, WA 98005 206-455-0510
Anco Electronics, Inc., Rancho Cucamonga, CA 91730 .... 1-800-545-ANCO
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
§ Audiotronics Corp., N. Hollywood, CA 91605 818-765-2645
Aydin Corp., Horsham, PA 19044 215-657-7510
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323 407-994-3520
Cambridge Electronics Laboratories, Somerville, MA 02144 617-629-2805
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 708-981-6000
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710 510-527-6666
§ Conklin Instrument Corp., Pleasant Valley, NY 12569 .... 914-635-2136.
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 514-694-9320
Dantel, Fresno, CA 93727 209-292-1111
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178 404-457-5600
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 613-226-4000
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Intellitech, Kennesaw, GA 30144 404-514-7999
3M-Electronic Products Division, Austin, TX 78726 .... 1-800-225-5373 Sls. & Prod. Info.
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Northeast Innovations, Inc., Concord, NH 03302 603-736-8260
§ Penril DataComm Networks, Gaithersburg, MD 20878 301-921-8600
Phi Technologies, Inc., Oklahoma City, OK 73105 405-521-9000
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035 708-432-7915
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
§ Rhetorex, Inc., Campbell, CA 95008 408-370-0881
† RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821 .... 508-671-9700;1-800-225-5765
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
§ Tektone Sound & Signal, Lake Park, FL 33403 407-844-2383
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Viking Electronics, Inc., Hudson, WI 54016 715-386-8861
§ Visionary Electronics, San Francisco, CA 94118 415-751-8811
Voice Processing Corp., Cambridge, MA 02142 617-494-0100

Communicators, Digital-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§# General Security Inc., Lake Worth, FL 33461 407-533-0064
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082

RFL Electronics Inc., Boonton, NJ 07005-0239	201-334-3100
†# Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000

Commutators-3500 – ***See Vol. B***
Comparators, Analog — See Comparators, Voltage (Vol. D)
Comparators, Attenuation-3450 – ***See Vol. A***
Comparators, Capacitance — See Bridges, Capacitance (Vol. D)

Comparators, Digital-2900

DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1402-1403**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1376**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1267,1270-1272**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2012**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1368**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1376**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1330**
Anadex Inc., Camarillo, CA 93012	805-987-9660
† Atec, Inc., Houston, TX 77055	713-468-7971
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ ESE. El Segundo, CA 90245	310-322-2136
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
† Holt Inc., Irvine, CA 92718	714-859-8800
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Sensor Corp., Scottdale, PA 15683	412-887-4080
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070

Comparators, Dimension Calibrators-4100

Astrosystems, Inc., Lake Success, NY 11042	516-328-1600

Comparators, Frequency-2900

Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1402**
Autronics Corp., Arcadia, CA 91006	818-445-5470
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Datachron Inc., Anaheim, CA 92805	714-385-1705
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325	818-993-0048
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Sensor Corp., Scottdale, PA 15683	412-887-4080
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Comparators, Impedance — See Bridges, Impedance (Vol. D)
Comparators, Inductance — See Bridges, Inductance (Vol. D)

Comparators, Optical-2900

H & L Instruments, Burlingame, CA 94010	415-342-7850
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707/5717
§ Vision Engineering, Inc., New Milford, CT 06776	203-355-3776

Comparators, Phase-2900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1186**
Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325	818-993-0048
RE America, Westlake, OH 44145	216-871-7617
Sensor Corp., Scottdale, PA 15683	412-887-4080
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TRM, Inc., Manchester, NH 03110	603-627-6000

Comparators, Resistance — See Bridges, Resistance (Vol. D)

Comparators, Voltage-2900

TMP Inc., Santa Ana, CA 92705, 714-558-8028	**A•2580**
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606	408-720-8737
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† Analog Systems, Tucson, AZ 85731-7389	602-290-1818
Andufet Digital Corp., San Dimas, CA 91773	909-394-0171
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
CP Technology, Inc., Cupertino, CA 95014	408-996-8069
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
† Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
General Resistance, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
† Holt Inc., Irvine, CA 92718	714-859-8800
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
NEC Electronios, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
§† Raytheon Semiconductor, Mountain View, CA 94043	408-522-7068
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Signal Processing Technologies, Colorado Springs, CO 80907	719-528-2300
§† Silicon General, Garden Grove, CA 92641	714-898-8121
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Component Handling Equipment, Surface Mount-4100

Automated Production Concepts, Wayne, NJ 07470	201-831-8300
† Autosplice, Inc., San Diego, CA 92121	619-535-0077
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Manix Mfg. Inc., Warminster, PA 18974	215-957-6565
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
§† Tech Spray, Inc., Amarillo, TX 79105	806-372-8523
§ TRIGON/ADCOTECH, Dynatech, Milpitas, CA 95035	408-946-4300

Compounds, Encapsulating, Molding, Potting-Also See Plastic Raw Materials-1600 – ***See Vol. C***
Compounds, Insulating-3100 – ***See Vol. C***

Compression Systems, Image-2000

† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ New Media Graphics Corp., Billerica, MA 01821	508-663-0666
Optivision, Inc., Davis, CA 95616	916-757-4850;800-562-8934
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314

Computer-Aided Design Services — See Computers, CAD, CAM, & CAD/CAM (Vol. D), Services, Computer-Aided Design (Vol. D)
Computer Interfaces — See Interfaces, Computer
Computer Logic Circuits — See Cards, Logic (Vol. D), Circuits, Hybrid (Vol. A), Integrated Circuits (Vol. A), Modules, Logic (Vol. A)

Computer Systems, Ruggedized-2000

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1132-1133**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Action Instruments, San Diego, CA 92123	619-279-5726
ADAC Corporation, Woburn, MA 01801	617-935-6668
§ AFE Technologies Inc., Charlottesville, VA 22901	804-974-7801
AMASCO, Torrance, CA 90501	310-781-9494
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Corp., Horsham, PA 19044	215-657-7510
Barco Chromatics, Tucker, GA 30084	404-493-7000
† Codar Technology, Inc., Longmont, CO 80503	303-776-0472
§ Dataware Electronics Inc., Mukilteo, WA 98275	206-742-5000
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† DY 4 Systems Inc., Nepean, Ont., CANADA K2H 9J4	613-596-9911
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
General Digital Corp., Enfield, CT 06082	203-741-7171
†# Greenspring Computers, Inc., Menlo Park, CA 94025	415-327-1200
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Matrix Corp., Raleigh, NC 27610	919-231-8000
Micro Alliance, Inc., Vista, CA 92083	619-598-1900
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
Micro/sys, Glendale, CA 91208	818-244-4600
Modular Mining Systems, Inc., Tuscon, AZ 85706	602-746-9127
† NAVAN Corporation, Media, PA 19063	215-352-8464
† Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
§ Opto 22, Temecula, CA 92590	714-695-9299
§ Pro-Log Corp., Monterey, CA 93940	408-372-4593
Qualogy Inc., San Jose, CA 95134	408-434-5200
Rapid Systems Inc., Seattle, WA 98103	206-547-8311
WinSystems, Inc., Arlington, TX 76011	817-274-7553
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804
§† Ziatech, San Luis Obispo, CA 93401	805-541-0488

Computer Tape Recorders — See Recorders, Computer Data (Vol. D)
Computer Type Indicators — See Displays, Indicator Lights (Vol. B)

Computers, Analog & Hybrid-2025

Action Instruments, San Diego, CA 92123	619-279-5726
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
Keithley MetraByte, Taunton, MA 02780	508-880-3000
Zendex Corp., Dublin, CA 94568	510-828-3000

Computers, CAD, CAM, & CAD/CAM-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ **OrCAD, Hillsboro, OR 97124-7135, 503-690-9881**	**D•1148**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Aldec, Inc., Newbury Park, CA 91320	805-499-6867
Alden Computer Systems, Salem, MA 01970	508-744-1314
Circom Inc., Bensenville, IL 60106	708-595-4460
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Interlogic Industries, Melville, NY 11747-4294	516-420-8111
Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
§ Pixelworks, Inc., Hudson, NH 03051	603-880-1322
§ Quad Design Technology, Inc., Camarillo, CA 93010	805-988-8250
§† The Recorder Company, San Marcos, TX 78667	210-629-1400
TEAM Visionics Corporation, Santa Clara, CA 95054	408-562-0123
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
†# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984

Computers, Digital, Micro - Also See Board Computers and Subassemblies-2025

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1145**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1138-1139**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1145**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Action Instruments, San Diego, CA 92123	619-279-5726
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allen Systems, Columbus, OH 43221	614-488-7122
Ampro Computers,Inc., Sunnyvale, CA 94086	408-522-2100
† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
† Cable & Computer Technology Inc., Anaheim, CA 92806	714-937-1341
California Automation Inc., San Diego, CA 92121	619-452-1341
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Codar Technology, Inc., Longmont, CO 80503	303-776-0472
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850.800-937-4688
§ Dataprobe, Englewood, NJ 07631	201-569-6464
Digital Dynamics, Inc., Scotts Valley, CA 95066	408-438-4444
§ Diversified Technlg., Ridgeland, MS 39157	601-856-4121
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658	414-921-7100
§ Gimix, Inc., Northbrook, IL 60062-2406	708-559-0909
† Greenspring Computers, Inc., Menlo Park, CA 94025	415-327-1200
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Honeywell Information Systems, Waltham, MA 02154	617-895-6000
Industrial Computer Source, San Diego, CA 92131	619-271-9340
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
§ Intra-computer Inc., Jamacia, NY 11418	718-297-5500
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868	313-769-1780
§ LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
Matrix Corp., Raleigh, NC 27610	919-231-8000
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
Micro/sys, Glendale, CA 91208	818-244-4600
# Mitronics, Rolling Hills, CA 90274	310-377-2022
Octagon Systems, Westminster, CO 80030	303-430-1500
Omnibyte Corp., West Chicago, IL 60185-3790	708-231-6880
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
QSI Corporation, Salt Lake City, UT 84115	801-466-8770
§† Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660	714-833-4600
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6	514-437-5682; 800-387-4222
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116	215-464-9300
WinSystems, Inc., Arlington, TX 76011	817-274-7553
Zaki Corporation, Marlboro, MA 01752	508-480-0201
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Computers, Micro-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Action Instruments, San Diego, CA 92123	619-279-5726
Advanced Electronic Packaging, Huntington Beach, CA 92646	714-969-1150
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Allen Systems, Columbus, OH 43221	614-488-7122
Ampro Computers,Inc., Sunnyvale, CA 94086	408-522-2100
Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Andufet Digital Corp., San Dimas, CA 91773	909-394-0171
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
† Cable & Computer Technology Inc., Anaheim, CA 92806	714-937-1341
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computer Dynamics Sales, Greer, SC 29650	803-877-8700
§# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
§ Dataprobe, Englewood, NJ 07631	201-569-6464
Davidge Corporation, Buellton, CA 93427	805-688-9598
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GENROCO, Inc., Slinger, WI 53086-9501	414-644-8700
§ Gimix, Inc., Northbrook, IL 60062-2406	708-559-0909
§† GMR Co., Venice, CA 90291-3218	310-399-1490
† Greenspring Computers, Inc., Menlo Park, CA 94025	415-327-1200
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Honeywell Information Systems, Waltham, MA 02154	617-895-6000
Industrial Computer Source, San Diego, CA 92131	619-271-9340
§ International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
JF Microsystems, Pasco, WA 99301-9619	509-297-4294;800-532-2737
Matrix Corp., Raleigh, NC 27610	919-231-8000
Megadata Corp., Bohemia, NY 11716	516-589-6800
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
# MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
Micro/sys, Glendale, CA 91208	818-244-4600
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
† NAVAN Corporation, Media, PA 19063	215-352-8464
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Octagon Systems, Westminster, CO 80030	303-430-1500
Omnibyte Corp., West Chicago, IL 60185-3790	708-231-6880
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
Pacific Microcomputers, Fairway Optical Data Sys., Inc., Vista, CA 92083	619-727-9494
Parsytec Inc., West Chicago, IL 60185	708-293-9500
§ Pixelworks, Inc., Hudson, NH 03051	603-880-1322
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6	514-437-5682; 800-387-4222
§† Terminal Data Corp., Rockville, MD 20855	301-921-8282
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040	602-437-1520
§ WinSystems, Inc., Arlington, TX 76011	817-274-7553
XYZ Electronics, McCordsville, IN 46055	317-335-2128
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Computers, Micro, Ruggedized, for Industrial Applications-2000

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1145**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1132**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1101,1199,1415**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
† **Tempustech, Inc., Naples, FL 33942, 813-643-2424**	**D•1144**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1145**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Action Instruments, San Diego, CA 92123	619-279-5726
ADAC Corporation, Woburn, MA 01801	617-935-6668
§ AFE Technologies Inc., Charlottesville, VA 22901	804-974-7801

§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
Allen Systems, Columbus, OH 43221 ... 614-488-7122
Alpha Omega Computer Systems, Corvallis, OR 97333 ... 503-754-1911
Andufet Digital Corp., San Dimas, CA 91773 ... 909-394-0171
† ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
Computer Dynamics Sales, Greer, SC 29650 ... 803-877-8700
Digital Dynamics, Inc., Scotts Valley, CA 95066 ... 408-438-4444
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
ELMA Electronic Inc., Fremont, CA 94538 ... 510-656-3400
Enterprise Systems Corp., Dover, NH 03820 ... 603-742-7363
General Digital Corp., Enfield, CT 06082 ... 203-741-7171
§ Gimix, Inc., Northbrook, IL 60062-2406 ... 708-559-0909
† Hancock Electronics Corp., Hingham, MA 02043 ... 617-740-4190
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
HMW Enterprises, Inc., Waynesboro, PA 17268 ... 717-765-4690
IBI Systems Inc., Ft. Lauderdale, FL 33309 ... 305-978-9225
Industrial Computer Source, San Diego, CA 92131 ... 619-271-9340
Industrial CPU Systems, Intl., Santa Ana, CA 92707 ... 714-957-2815
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705 ... 602-623-9801
IPAC Grp., Bethel Pk., PA 15102 ... 412-831-9200
§ KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868 ... 313-769-1780
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 ... 508-927-6575
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
MCSI, Vista, CA 92083 ... 619-598-2177
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032 ... 317-846-1721
Micro/sys, Glendale, CA 91208 ... 818-244-4600
Modular Mining Systems, Inc., Tuscon, AZ 85706 ... 602-746-9127
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 ... 508-588-6110
Northern Precision Labs., Fairfield, NJ 07006 ... 201-227-4800
† Omnibyte Corp., West Chicago, IL 60185-3790 ... 708-231-6880
Parsytec Inc., West Chicago, IL 60185 ... 708-293-9500
§ Pro-Log Corp., Monterey, CA 93940 ... 408-372-4593
Qualogy Inc., San Jose, CA 95134 ... 408-434-5200
§ Rapid Systems Inc., Seattle, WA 98103 ... 206-547-8311
Support Electronics, Inc., Butler, NJ 07405-1367 ... 1-201-838-2755
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090
Teknor Microsystems Inc., Blainville, Que., CAN J7G 4G6 ... 514-437-5682; 800-387-4222
TL Inds. Inc., Northwood, OH 43619 ... 419-666-8144
Versalogic Corp., Eugene, OR 97402 ... 800-824-3163
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 ... 602-437-1520
WinSystems, Inc., Arlington, TX 76011 ... 817-274-7553
Xcel Controls, Inc., Mishawaka, IN 46544 ... 219-259-7804
Zendex Corp., Dublin, CA 94568 ... 510-828-3000
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

Computers, Mini-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117,1138-1139
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 ... 617-267-8600
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Honeywell Information Systems, Waltham, MA 02154 ... 617-895-6000
NAVAN Corporation, Media, PA 19063 ... 215-352-8464
§ NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000
§ Point 4 Data Corp., Tustin, CA 92680 ... 714-259-0777
Support Electronics, Inc., Butler, NJ 07405-1367 ... 1-201-838-2755
Zendex Corp., Dublin, CA 94568 ... 510-828-3000

Computers, Personal-2025

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 ... D•1231
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117,1138-1139
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
§# **National Instruments, Austin, TX 78730-5039, 512-794-0100 ... D•1302**
Accu-Tech Corporation, Roswell, GA 30076-3890 ... 404-751-9473;800-221-4767
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469 ... 617-275-0850;800-937-4688
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 ... 513-866-3300
Dianachart Inc., Rockaway, NJ 07866 ... 201-625-2299
Editron Systems Inc., Teaneck, NJ 07666 ... 201-837-0051
Fortron/Source Corp., Power Supplies, Livermore, CA 94550 ... 415-373-1008
§ Gimix, Inc., Northbrook, IL 60062-2406 ... 708-559-0909
# Glasgal Communications, Inc., Northvale, NJ 07647 ... 201-768-8082
GMR Co., Venice, CA 90291-3218 ... 310-399-1490
§ GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
HILEVEL Technology, Tustin, CA 92680 ... 714-573-1888
Honeywell Information Systems, Waltham, MA 02154 ... 617-895-6000
Industrial Computer Source, San Diego, CA 92131 ... 619-271-9340
§ International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 ... 508-927-6575
Megadata Corp., Bohemia, NY 11716 ... 516-589-6800
MEXITRONIX (Woman Owned), Kingman, AZ 86401 ... 602-757-9798
Mitronics, Rolling Hills, CA 90274 ... 310-377-2022
§ NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000
§ Pixelworks, Inc., Hudson, NH 03051 ... 603-880-1322
# Sheldon Instruments, Provo, UT 84604 ... 801-376-7861
Xerox Corporation, United States Customer Operations, Rochester, NY 14644 ... 800-832-6979
Zaki Corporation, Marlboro, MA 01752 ... 508-480-0201

Computer Sets (MIL), Digital Data-2440 – *See Vol. B*
Computer Software — See Software (Vol. D)
Computer Systems (MIL)-2440 – *See Vol. B*
Computing Equipment, Peripheral — See Converters, Digital To Paper Tape (Vol. D), Printers (Vol. D), Terminals, Data Display (Vol. D), etc.

Concentrators, Communications-1900

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
Accu-Tech Corporation, Roswell, GA 30076-3890 ... 404-751-9473;800-221-4767
§ Artel Communications Corp., Hudson, MA 01749 ... 508-562-2100
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
Cabletron Systems, Inc., Rochester, NH 03867 ... 603-332-9400
Control Module, Enfield CT 06082 ... 203-745-2433
§ Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 ... 1-800-888-LAN1;919-481-5100
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1 ... 416-425-7800
Fibronics International Inc., Communications Way, Pembroke, MA 02359 ... 617-826-0099
Glasgal Communications, Inc., Northvale, NJ 07647 ... 201-768-8082
§ Onan Power/Electronics, Minneapolis, MN 55344-3577 ... 612-943-4600
§ Penril DataComm Networks, Gaithersburg, MD 20878 ... 301-921-8600
Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3 ... 514-637-1186
RTS Systems, Telex Communications, Inc., Burbank, CA 91506 ... 818-566-6700

Conditioners, Power Line — See Regulators & Stabilizers, Voltage (Vol. D), Line Conditioners (Vol. D)
Conductive Elastomers-4525 – *See Vol. C*
Conductive Fabrics, Films & Tapes — See Fabrics, Conductive (Vol. C)
Conductive Floor Coatings & Cleaners-1600 – *See Vol. C*
Conductive Plastic Materials & Parts-4525 – *See Vol. C*
Conduit, Electrical-6000 – *See Vol. C*
Connecting Blocks, Data-2100 – *See Vol. C*
Connecting Blocks, Modular Telephones-2100 – *See Vol. C*
Connector Adapters-2100 – *See Vol. C*
Connector Assemblies, IEEE 488-GPIB-2100 – *See Vol. C*
Connector Backshells-2100 – *See Vol. C*
Connector Blocks, Mother Board-2100 – *See Vol. C*
Connector Boxes & Strips, Power Outlet-2500 – *See Vol. C*
Connectors, AC Power-2100 – *See Vol. C*
Connectors, Antenna — See Connectors, RF, Coaxial & Triaxial (Vol. C)
Connectors, Audio-2100 – *See Vol. C*
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§ Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	**D•2310**
† Electro Miniatures Corp., Moonachie, NJ 07074, 201-460-0510	**B•1251**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	**D•1942**
ACC Electronics Company, Echlin Inc., Independence, KS 67301	316-331-1000
† Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
Advanced Hardware Manufacturing, Inc., Fenton, MO 63026	314-343-3850
Altek Co., Torrington, CT 06790	203-482-7626
†# Altron, Inc., Anoka, MN 55303	612-427-7735
American Assembly Inc., Florida, NY 10921	914-651-3433
Amphenol Interconnect Products, LPL Technologies, Endicott, NY 13760	607-754-4444
# Array Connector Corporation, Miami, FL 33166-5598	305-591-7530
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
† Capewell Components, Cromwell, CT 06416	203-635-4045
Chloride El Paso, Chloride Power Elctrns., El Paso, TX 79906	915-592-9985
Circom Inc., Bensenville, IL 60106	708-595-4460
Clover Elctrns., Inc., Newnan, GA 30264	404-251-5323
Compac, Holbrook, NY 11741	516-585-3400
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379	508-580-0111
Controltek, Inc., Portland, OR 97229	503-641-0876
† Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
† Da-Tech Corp., Ivyland, PA 18974	215-322-9410
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
† Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540	609-259-8866
Electronic Devices, Inc., Yonkers, NY 10710	914-965-4400
Electronic Packaging System, Marion, IA 52302	319-377-3423
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
† Electronic Specialty Corp., Vancouver, WA 98685	206-574-5000
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
† FISHERCAST, Fisher Gauge Limited, Peterborough, Ont., CANADA K9J 6Y9	705-748-9522
Flexible Technologies, Arlon, E. Providence, RI 02914	401-434-2340
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Digital Corp., Enfield, CT 06082	203-741-7171
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
† Hutronix, Inc., Douglas, AZ 85607	602-364-2432
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
International Technologies, Inc., Warwick, RI 02888	401-781-5595
Jettron Products Inc., E. Hanover, NJ 07936	201-887-0571
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Kepro Circuit Systems, Fenton, MO 63026-2992	314-343-1630
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880	617-246-2040
Mep Controls, Bordentown, NJ 08505	609-298-7300
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
† Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733	802-247-6811
Oven Industries, Mechanicsburg, PA 17055	717-766-0721
† P C Express, Inc., Hudson, FL 34667	813-863-6114
PCI Ltd., San Jose, CA 95128	408-282-0200
Pine Instrument Co., Grove City, PA 16127	412-458-6391
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
Radio Television Products Corp., Douglas, AZ 85607	602-364-4438
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Southtronics, Inc., Marietta, GA 30066-6029	404-429-1000
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
† TL Inds. Inc., Northwood, OH 43619	419-666-8144
†# Tratec of California, Inc., Chula Vista, CA 91911	619-476-1155
Trionics, Inc., St. Charles, IL 60174	708-365-6570
Tri-Source Inc., Shelton, CT 06484	203-924-7030
† V R Industries, Inc., Warwick, RI 02886	401-732-6800
§ Wellex Corporation, Fremont, CA 94538	510-490-3263
Xetel Corporation, Austin, TX 78758	512-834-2266
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Controllers, Card Reader/Punch, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
GEN/COMP Inc., Canton, MA 02021	617-828-2008

Controllers, Card Reader/Punch, Standalone-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080

Controllers, Energy Conservation-2200

Control Resources Inc., Harvard, MA 01451, 508-772-4043	**C•1575**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1166**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	**D•2300**
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Bambeck Systems Inc., Santa Ana, CA 92705	714-250-3100;800 334-3101
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
California Automation Inc., San Diego, CA 92121	619-452-1341
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Comptus Inc., New Boston, NH 03070	603-487-5512
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
§ Letco International, New Braunfels, TX 78131-1200	1-800-222-9676
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
Systems Alternatives, Maumee, OH 43537	419-891-1100
† Xenotronix Inc., Valencia, CA 91355	805-257-4793

Controllers, Floppy Disk Drive, Add-in-2000

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Adaptec, Inc., Milpitas, CA 95035	408-945-8600
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Ciprico Inc., Plymouth, MN 55441	612-551-4000
§ DILOG, Irvine, CA 92714	714-476-0303
§ GENROCO, Inc., Slinger, WI 53086-9501	414-644-8700
Matrix Corp., Raleigh, NC 27610	919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
Micro/sys, Glendale, CA 91208	818-244-4600
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
XYZ Electronics, McCordsville, IN 46055	317-335-2128
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Controllers, Floppy Disk Drive, Standalone-2000

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Dataprobe, Englewood, NJ 07631	201-569-6464
Matrix Corp., Raleigh, NC 27610	919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
Zendex Corp., Dublin, CA 94568	510-828-3000

Controllers, Graphic Display-2450 – *See Vol. B*

Controllers, Hard Disk Drive, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Adaptec, Inc., Milpitas, CA 95035	408-945-8600
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Ciprico Inc., Plymouth, MN 55441	612-551-4000
§ Cirrus Logic, Inc., Fremont, CA 94538	510-623-8300

Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
§ DILOG, Irvine, CA 92714	714-476-0303
§ Distributed Processing Technology Corp., Maitland, FL 32751	407-830-5522
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501	414-644-8700
§ Macrolink, Anaheim, CA 92807	714-777-8800
Matrix Corp., Raleigh, NC 27610	919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
Micro/sys, Glendale, CA 91208	818-244-4600
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Point 4 Data Corp., Tustin, CA 92680	714-259-0777
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
§ Xylogics, Inc., Burlington, MA 01803	800-225-3317
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Controllers, Hard Disk Drive, Standalone-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Avasem Corporation, San Jose, CA 95126	408-297-1201
Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131	619-578-9100
§ Cirrus Logic, Inc., Fremont, CA 94538	510-623-8300
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
Digi-Data Corp., Jessup, MD 20794	301-498-0200
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Matrix Corp., Raleigh, NC 27610	919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Controllers, IEEE 488 (GPIB) Bus-2900

§ **National Instruments, Austin, TX 78730-5039, 512-794-0100**	**D•1147,1198,1302**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2288**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212-1213**
AMASCO, Torrance, CA 90501	310-781-9494
† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
Capital Equipment Corporation, Burlington, MA 01803	617-273-1818
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
DSP Technology, Fremont, CA 94538-7338	510-657-7555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§ Express Test Corp., Sunnyvale, CA 94088-3419	408-737-3555
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705	602-623-9801
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
KineticSystems Corp., Lockport, IL 60441	815-838-0005
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
L-Com Inc., N. Andover, MA 01845	508-682-6936
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
Micro Industries, Westerville, OH 43081-9486	614-548-7878
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Precision MicroControl, San Diego, CA 92111	619-565-1500
Prema Precision Electronics, Inc., Montclair, CA 91763	714-621-7292
Quatech Inc., Akron, OH 44311	216-434-3154
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
Research Inc., Minneapolis, MN 55424	612-941-3300
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
Sorensen Company, Paxton, IL 60957	800-525-2024
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Controllers, Magnetic Tape Drive, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Adaptec, Inc., Milpitas, CA 95035	408-945-8600
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131	619-578-9100
Ciprico Inc., Plymouth, MN 55441	612-551-4000
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
§ DILOG, Irvine, CA 92714	714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
§ ICI Inc., Placentia, CA 92670	714-579-7575
§ Macrolink, Anaheim, CA 92807	714-777-8800
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§ Xylogics, Inc., Burlington, MA 01803	800-225-3317

Controllers, Magnetic Tape Drive, Standalone-2000

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1186-1189**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000

Controllers, Memory Device, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	D•1117,1126
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501	414-644-8700
§ ICI Inc., Placentia, CA 92670	714-579-7575
§ Macrolink, Anaheim, CA 92807	714-777-8800
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Controllers, Memory Device, Standalone-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
General Digital Corp., Enfield, CT 06082	203-741-7171
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Controllers, Motion-4900

Advanced Technology Company, Vista, CA 92083, 619-727-7430	**C•1562-1573**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1276**
§ **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**D•1164-1165,2316**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
Andufet Digital Corp., San Dimas, CA 91773	909-394-0171
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Control Resources Inc., Harvard, MA 01451	508-772-4043
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Electronic Design Engineering, Norco, CA 91760	909-735-1761
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
§ GE Fanuc Automation North America Inc., Charlottesville, VA 22906	804-978-5000; 800-648-2001
General Controls Electronics Inc., Elk Grove Village, IL 60007	708-595-2152
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
§ Go Switch, Louisville, KY 40233	502-969-2386
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ Interloop, San Jose, CA 95131	408-922-0520
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
§ Mektronix Technology, Inc., Libertyville, IL 60048-2000	708-680-3300
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
Motion Science Inc., San Jose, CA 95112	408-993-0300
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
Performance Motion Devices, Chelmsford, MA 01824	508-256-1913
Precision MicroControl, San Diego, CA 92111	619-565-1500

Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
†# Systec, Inc., Minneapolis, MN 55421 612-788-9701
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
Transmagnetics, Farmingdale, NY 11735 516-293-3100
United Motion Technology, Santa Clara, CA 95054 ..... 408-970-9742;1-800-424-STEP
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488

Controllers, Paper Tape Reader/Punch, Add-in-2000

Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Dataprobe, Englewood, NJ 07631 201-569-6464
GEN/COMP Inc., Canton, MA 02021 617-828-2008
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097

Controllers, Paper Tape Reader/Punch, Standalone-2000

Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Dataprobe, Englewood, NJ 07631 201-569-6464
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097

Controllers, Plotter, Add-in-2000

Data Technology, Inc. Woburn, MA 01811 617-935-8820
Globetron Electronics Corp. Oakville, Ont. CAN L6J 4Z3 ..... 416-825-1335; 1-800-800-4606

Controllers, Plotter, Standalone-2000

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .. D•1231
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231

Controllers, Point-of-Sale Peripherals-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 ... C•1064
† **Telpar, Inc., Addison, TX 75001, 214-233-6631 ..... D•1113-1114**
Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231
Data Mega Inc., Mega Data, Bensenville, IL 60106 708-860-6501
§# Support Systems Intl. Corp., Richmond, CA 94804 510-234-9090
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000

Controllers, Power-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000 ..... D•1149
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2254-2255
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1473,1475
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1191
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... D•1851
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... B•1887, D•1166,1363
§ **Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000 ..... C•1056**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1209
Alpha Dist. Corp., Richfield, OH 44286 ..... 216-659-7100; 1-800-628-0841
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536 615-793-3900
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Control Resources Inc., Harvard, MA 01451 508-772-4043
§ Crompton Modutec, Manchester, NH 03109 ..... 603-669-5121;800-METERS-1
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 410-584-7400
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
Energy Systems, Vancouver, WA 98682 206-896-8310
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
† Glenro, Inc., Paterson, NJ 07501-1715 ..... 201-279-5900;800-922-0106
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 ..... 214-250-1647;1-800-677-5311
§ Go Switch, Louisville, KY 40233 502-969-2386
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
§ Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
Holt Inc., Irvine, CA 92718 714-859-8800
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
MACROAMP Inc., Ukiah, CA 95482 800-458-8892
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
† Modular Devices, Shirley, NY 11967 516-345-3100
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Oeco Corp., Milwaukie, OR 97222 503-659-7932
Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
Ratelco, Power Systems, Seattle, WA 98109-5589 206-624-7770
Research Inc., Minneapolis, MN 55424 612-941-3300
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Sylvania, Emissive Products/Process Heat, Exeter, NH 03833 603-772-4331
§ Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
† Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818 401-884-4188

Controllers, Printer, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Micro Electronic Business, Chicago, IL 60641, 312-539-2994 ..... D•1099
Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880 ..... D•1102-1104
§ **Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... D•1109**
Telpar, Inc., Addison, TX 75001, 214-233-6631 ..... D•1113-1114
§ Adaptec, Inc., Milpitas, CA 95035 408-945-8600
Andrew Corporation, Austin, TX 78746 ..... 800-331-4144;512-314-3000
§ Cirrus Logic, Inc., Fremont, CA 94538 510-623-8300
Data Engineering, Inc., Margate, FL 33063-3206 305-971-0400
Data Mega Inc., Mega Data, Bensenville, IL 60106 708-860-6501
GEN/COMP Inc., Canton, MA 02021 617-828-2008
§ GENROCO, Inc., Slinger, WI 53086-9501 414-644-8700
ICI Inc., Placentia, CA 92670 714-579-7575
§ Macrolink, Anaheim, CA 92807 714-777-8800
Mesa Technology, Peak Technologies, Columbia, MD 21045 ..... 410-992-0516; 410-992-0517
Printer Products, Boston, MA 02134 617-254-1200
Westrex Products, Boston, MA 02134 617-254-1200

Controllers, Printer, Standalone-2000

Axiohm, Inc., New Brighton, MN 55112, 612-638-9856 ..... D•1078
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Micro Electronic Business, Chicago, IL 60641, 312-539-2994 ..... D•1099
Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880 ..... D•1102-1104
§ **Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... D•1109**
† **Telpar, Inc., Addison, TX 75001, 214-233-6631 ..... D•1113-1114**
Andrew Corporation, Austin, TX 78746 ..... 800-331-4144;512-314-3000
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231
§ Cirrus Logic, Inc., Fremont, CA 94538 510-623-8300
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
Data Engineering, Inc., Margate, FL 33063-3206 305-971-0400
Data Mega Inc., Mega Data, Bensenville, IL 60106 708-860-6501
Mesa Technology, Peak Technologies, Columbia, MD 21045 ..... 410-992-0516; 410-992-0517
Printer Products, Boston, MA 02134 617-254-1200
Westrex Products, Boston, MA 02134 617-254-1200

Controllers, Programmable-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 ..... D•1150
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER ..... D•2251
C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657, 800-347-2484 ext. 4529 ..... B•1027
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516 ..... D•1251
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1068-1069
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... D•1182**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1376,1382
Gralex Industries, Norwood, NJ 07648, 800-486-4499 ..... D•1353
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ..... D•1357
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1298
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•1164-1165
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... D•1851**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... C•1792, D•1166
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ..... D•1364
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2286,2288
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 ... C•1064
Quantum Data Inc., Elgin, IL 60123, 708-888-0450 ..... D•1318
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004 ..... D•1212-1213
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1376,1382
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676 ..... D•2317**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 .. 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Adaptec, Inc., Milpitas, CA 95035 408-945-8600
§ Adatek, Inc., Sandpoint, ID 83864 ..... 208-263-1471;800-323-3343
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Andufet Digital Corp., San Dimas, CA 91773 909-394-0171
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
Aries Electronics, Frenchtown, NJ 08825 908-996-6841
§ Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Basicon, Inc., Portland, OR 97229 503-626-1012
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171 ... 617-328-3300;1-800-225-5280
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862 508-667-4111

Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
§ Centent Co., Santa Ana, CA 92707 714-979-6491
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536 615-793-3900
§ Chrono-log Corp., Havertown, PA 19083 800-247-6665
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
§ CVC Products, Inc., Rochester, NY 14603 716-458-2550
Data Mega Inc., Mega Data, Bensenville, IL 60106 708-860-6501
Dianachart Inc., Rockaway, NJ 07866 201-625-2299
Digital Dynamics, Inc., Scotts Valley, CA 95066 408-438-4444
† Digitec, Marion, OH 43302 614-387-3444
§ Divelbiss Corp., Fredericktown, OH 43019 614-694-9015
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 607-772-7563
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094 .... 414-261-4070;800-289-3866
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 .... 414-656-4011; 800-356-5077
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 410-584-7400
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
§# Encoder Products, Sandpoint, ID 83864 208-263-8541
§ Enerco, Inc., Seattle, WA 98108 206-762-1422
Energy Systems, Vancouver, WA 98682 206-896-8310
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ GE Fanuc Automation North America Inc., Charlottesville, VA 22906 .... 804-978-5000; 800-648-2001
General Digital Corp., Enfield, CT 06082 203-741-7171
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
Gordon Products, Brookfield, CT 06804 203-775-4501
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408 1-800-328-5111
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
JC Systems, Inc., San Diego, CA 92121 619-793-7117
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
§ Luft Instruments, Inc., Lincoln, MA 01773 617-259-9215
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
Matrix Corp., Indianapolis, IN 46241 317-248-2036
Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
§ McGill Electrical Product Group, Valparaiso, IN 46383 219-465-2200
† Mep Controls, Bordentown, NJ 08505 609-298-7300
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
Moore Products Co., Spring House, PA 19477 215-646-7400
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841 508-685-4900
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§† Nolatron, Harrisburg, PA 17111 717-564-3398
§ Norgren, Littleton, CO 80120-1663 303-794-2611
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
Oriental Motor USA Corp., Torrance, CA 90505-5217 310-515-2264
PPM, Inc., Cleveland, OH 44122 1-800-899-4776
Precision MicroControl, San Diego, CA 92111 619-565-1500
§ Pro-Log Corp., Monterey, CA 93940 408-372-4593
Quest Controls, Inc., Palmetto, FL 34221 813-729-4799
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
Ratelco, Power Systems, Seattle, WA 98109-5589 206-624-7770
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
SBE, Inc., San Ramon, CA 94583-1389 .... 510-355-2000;800-925-2666
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
§ Square D Co., Palatine, IL 60067 708-397-2600
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Support Electronics, Inc., Butler, NJ 07405-1367 1-201-838-2755
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Techniques, Inc., Englewood, NJ 07631 201-569-5900
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Tele-Denken Resources, Inc., Humble, TX 77346 713-852-5366
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Toshiba Instrumentation Div., Toshiba Intl. Corp., Tulsa, OK 74134 918-252-3548
§† Triconex Corp., Irvine, CA 92718 .... 714-768-3709; 800-325-2128 (outside Ca)
§ (UEC) United Electric Controls, Watertown, MA 02272-9143 617-926-1000
§ Uticor Technology, Bettendorf, IA 52722 319-359-7501
§ WestCon, Marion, OH 43302 614-382-5771
§ Xico, Inc., Chatsworth, CA 91311 818-709-4403
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488
§ Z-World Engineering, Davis, CA 95616 916-757-3737

Controllers, Protocol, Communications-2000

§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... D•1182
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 .... D•1074-1075
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 513-339-2241
Andrew Corporation, Austin, TX 78746 .... 800-331-4144;512-314-3000
§ AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
§ Cirrus Logic, Inc., Fremont, CA 94538 510-623-8300
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090 .... 708-541-6060; 800-GANDALF
Impulse Engineering, Goleta, CA 93117-1023 805-685-2030
Innovative Electronics, Inc., Dynatech Corporation, Miramar, FL 33025 .. 305-432-0300
JF Microsystems, Pasco, WA 99301-9619 .... 509-297-4294;800-532-2737
Megadata Corp., Bohemia, NY 11716 516-589-6800
Quatech Inc., Akron, OH 44311 216-434-3154
† Racal-Guardata, Inc., Herndon, VA 22070 703-471-0892
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SBE, Inc., San Ramon, CA 94583-1389 .... 510-355-2000;800-925-2666
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
§ Tele-Denken Resources, Inc., Humble, TX 77346 713-852-5366
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
§ Xico, Inc., Chatsworth, CA 91311 818-709-4403
§ Z-World Engineering, Davis, CA 95616 916-757-3737

Controllers, Terminal, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§† Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 .... D•1097
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 612-474-4500
Andufet Digital Corp., San Dimas, CA 91773 909-394-0171
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ DILOG, Irvine, CA 92714 714-476-0303
GEN/COMP Inc., Canton, MA 02021 617-828-2008
§ GENROCO, Inc., Slinger, WI 53086-9501 414-644-8700
ICI Inc., Placentia, CA 92670 714-579-7575
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
§ Macrolink, Anaheim, CA 92807 714-777-8800
Mesa Technology, Peak Technologies, Columbia, MD 21045 .... 410-992-0516; 410-992-0517
Micro/sys, Glendale, CA 91208 .... 818 244-4600
§ MicroWay Inc. Research Park, Kingston, MA 02364 508-746-7341
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
§ Xylogics, Inc., Burlington, MA 01803 800-225-3317

Controllers, Terminal, Standalone-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§† Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 .... D•1097
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1365
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 612-474-4500
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ DILOG, Irvine, CA 92714 714-476-0303
§ Divelbiss Corp., Fredericktown, OH 43019 614-694-9015
Energy Systems, Vancouver, WA 98682 206-896-8310
General Digital Corp., Enfield, CT 06082 203-741-7171
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Mesa Technology, Peak Technologies, Columbia, MD 21045 .... 410-992-0516; 410-992-0517
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433

§ Western Digital Corp., Irvine, CA 92718 ... 714-932-6000

Controls, Access-2200

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117,1126
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 ... B•1218
AES Corp., Peabody, MA 01960 ... 508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729 ... 516-586-4220
Elgin Electronics, Erie, PA 16509-3570 ... 814-864-4921
§ Enerco, Inc., Seattle, WA 98108 ... 206-762-1422
Quest Controls, Inc., Palmetto, FL 34221 ... 813-729-4799
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090
§ THORN Automated Systems, Inc, THORN EMI, Westlake, OHIO 44145 ... 216-871-9900
Xico, Inc., Chatsworth, CA 91311 ... 818-709-4403

Controls, AC Motor Speed, Variable Frequency-2200

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ... C•1562-1573
Control Resources Inc., Harvard, MA 01451, 508-772-4043 ... C•1575
† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ... D•2315**
Advanced Motion Controls, Inc., Princeton, WI 54968 ... 414-295-3500
American Control Technology, Inc., Elgin, IL 60123-1203 ... 708-468-6000
§ Baldor Electric Company, Fort Smith, AR 72902 ... 501-646-4711
§† Boston Gear, IMO Industries Inc., Quincy, MA 02171 ... 617-328-3300;1-800-225-5280
Cableform Inc., Troy, VA 22974 ... 804-589-8224
§ Drivecon Corporation, Libertyville, IL 60048 ... 708-918-1406
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 ... 414-656-4011; 800-356-5077
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 ... 410-584-7400
§ Electrol Co., York, PA 17405 ... 717-848-1722
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2106
Glentek, Inc., El Segundo, CA 90245 ... 310-322-3026
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 ... 416-825-1335; 1-800-800-4606
† GME Systems, Inc., Pittsburgh, PA 15090 ... 412-935-0440
Indramat, The Rexroth Corp., Wood Dale, IL 60191 ... 708-860-1010
Infranor, Naugatuck, CT 06770 ... 203-729-8258;800-BE-SERVO
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
§ KB Electronics, Brooklyn, NY 11207 ... 718-257-3300
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 ... 813-573-1900
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 ... 612-942-3600
Sandman Electric Co., Inc., Braintree, MA 02184 ... 617-848-2111
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538 ... 419-525-8500

Controls, Audio System Consoles-2200

§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ... D•1017**
† **Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 ... D•1074**
Applied Controls Co., Inc., Fairfield, NJ 07004 ... 201-227-5454
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ... 909-781-5500; 801-750-7200
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 ... 818-840-6749

Controls, Capacitance Operated-2200

§ ASI Instruments, Inc., Houston, TX 77024 ... 800-245-7056
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 ... 614-387-8827
§ Bindicator, Port Huron, MI 48061-0009 ... 313-987-2700
Capacitec, Inc., Ayer, MA 01432 ... 508-772-6033
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 ... 215-524-2000; 800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009 ... 313-987-2700
§ Gordon Products, Brookfield, CT 06804 ... 203-775-4501
International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673
Princo Instruments, Inc., Southampton, PA 18966 ... 215-355-1500
Square D. Company, Control Products, Knightdale, NC 27545 ... 919-266-3671

Controls, Carbon — See Potentiometers (Vol. A), Rheostats (Vol. A)

Controls, Computer Input, Joysticks, Mouse Devices, etc.-2000

§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1683**
CTI Electronics, Stratford, CT 06497, 203-386-9779 ... D•1086
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
† **Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 ... D•1163**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ... B•1968, D•1164-1165
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ... B•1849, D•1167**
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 ... A•2115
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 ... B•1852
† Adams Rite Products, Inc., Glendale, CA 91204 ... 818-241-5121
Amkey, Methuen, MA 01844 ... 508-975-5445
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 ... 508-699-9800
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ... 908-819-7070; 908-572-0500
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
§ Centent Co., Santa Ana, CA 92707 ... 714-979-6491
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
Enterprise Systems Corp., Dover, NH 03820 ... 603-742-7363
Flex-Key Corporation, Gloucester, MA 01930 ... 508-281-2040
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 ... 408-922-9000
§ Interaction Systems Inc., Watertown, MA 02172 ... 617-923-6001
§ Interactive Computer Products, Inc., Laguna Hills, CA 92653 ... 714-770-5332
Mektronix Technology, Inc., Libertyville, IL 60048-2000 ... 708-680-3300
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ... 203-855-9100;800-333-5762
† Microavionics Corp., Costa Mesa, CA 92626 ... 714-957-6904
† Orbit Instrument Corp., Hauppauge, NY 11788 ... 516-435-8300
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 ... 708-438-4000

Controls, Constant Impedance — See Attenuators (Vol. A)

Controls, Counting & Sorting-2200

§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ... D•1162**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
Applied Controls Co., Inc., Fairfield, NJ 07004 ... 201-227-5454
Applied Display & Control, Arlington Heights, IL 60005 ... 708-228-9690
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101 ... 718-361-2133
Controltek, Inc., Portland, OR 97229 ... 503-641-0876
§ Crouzet Corporation, Carrollton, TX 75006-2506 ... 214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
Curtis Industries, Milwaukee, WI 53234-3925 ... 414-649-4200
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
§ Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
Dynage/Controls, Inc., Canistota, SD 57012 ... 605-296-3487
§ Dynapar, Gurnee, IL 60031 ... 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
§ Hecon Corp., Eatontown, NJ 07724 ... 908-542-9200
HH Controls Co., Inc., Arlington, MA 02174 ... 617-646-2626
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 ... 803-249-5191
Micro Switch, A Honeywell Div., Freeport, IL 61032 ... 1-800-537-6945
Ocean Motions Co., Barrington, RI 02806 ... 401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
§ Redington Counters, Windsor, CT 06095 ... 203-688-6205
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
Sensor Corp., Scottdale, PA 15683 ... 412-887-4080
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149

Controls, DC Motor, Programmable-4900

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 ... D•1150
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 ... B•1240
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ... D•1191
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO ... B•1274-1277**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ... B•1298
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ... B•1968, D•1164-1165
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ... B•1299**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ... B•1304
§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ... B•1309**
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676 ... D•2317**
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 ... 603-882-1447
Advanced Motion Controls, Inc., Princeton, WI 54968 ... 414-295-3500
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
American Assembly Inc., Florida, NY 10921 ... 914-651-3433
American Control Technology, Inc., Elgin, IL 60123-1203 ... 708-468-6000
§ Baldor Electric Company, Fort Smith, AR 72902 ... 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ... 908-819-7070; 908-572-0500
§ Berkeley Process Control, Inc., Richmond, CA 94804 ... 510-236-3333
§ Bodine Electric Company, Chicago, IL 60618 ... 312-478-3515
§† Boston Gear, IMO Industries Inc., Quincy, MA 02171 ... 617-328-3300;1-800-225-5280
† Branmag, Inc., N. Tonawanda, NY 14120 ... 716-693-5994
Compact Power Company, Yorba Linda, CA 92686 ... 714-996-5826
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 ... 707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731 ... 516-261-3300
# Controltek, Inc., Portland, OR 97229 ... 503-641-0876
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
Dantronics, Inc., St. Paul, MN 55126 ... 612-484-2108
§ Design Components, Inc. (DCI), Franklin, MA 02038 ... 508-528-7300;800-341-4811
§ Electrol Co., York, PA 17405 ... 717-848-1722
Electronic Design Engineering, Norco, CA 91760 ... 909-735-1761
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2106
§ Encoder Products, Sandpoint, ID 83864 ... 208-263-8541
† GME Systems, Inc., Pittsburgh, PA 15090 ... 412-935-0440
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 ... 918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591 ... 914-631-0600
§† Industrial Devices Corporation, Novato, CA 94949-5728 ... 415-883-3535;800-747-0064
§ Industrial Indexing Systems, Inc., Victor, NY 14564 ... 716-924-9181
Infranor, Naugatuck, CT 06770 ... 203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 ... 703-639-9045
International Machine & Tool Corp., Warwick, RI 02888 ... 401-467-6905
† Maxon Precision Motors, Inc., Burlingame, CA 94010 ... 415-697-9614
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
Orbit Advanced Technologies, Horsham, PA 19044 ... 215-674-4220
Ormec Systems Corp., Rochester, NY 14625 ... 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109 ... 815-226-3100
† Performance Controls, Inc., Horsham, PA 19044 ... 215-675-6500

§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
Precision MicroControl, San Diego, CA 92111	619-565-1500
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
§ Technology 80, Inc., Minneapolis, MN 55427	612-542-9545
§ Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK

Controls, DC Regenerative-2200

§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070, 908-572-0500
§† Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
Cableform Inc., Troy, VA 22974	804-589-8224
Compact Power Company, Yorba Linda, CA 92686	714-996-5826
§ Electrol Co., York, PA 17405	717-848-1722
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ KB Electronics, Brooklyn, NY 11207	718-257-3300
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK

Controls, Density-2200

ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
† Automation Prods., Inc., Houston, TX 77008	713-869-0361
† Computer Instruments Corp., Westbury, NY 11590	516-876-8400
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056	708-803-5100
§ Lektra Laboratories Inc., Bronx, NY 10451	718-292-8243
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Schlumberger Industries, Tranducers Div., Houston, TX 77082	713-558-2587

Controls, Dimension-4100

§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Dynapar, Gurnee, IL 60031	312-662-2666
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700

Controls, Environmental Test Equipment-2550

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	D•1212-1213
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
AES Corp., Peabody, MA 01960	508-535-7310
Alpha-M Corp., Dallas, TX 75229	214-406-0424
American Assembly Inc., Florida, NY 10921	914-651-3433
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536	615-793-3900
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538	510-226-1329
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
JC Systems, Inc., San Diego, CA 92121	619-793-7117
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
Lumidor Saftey Products, SafteyTek Corp., Miramar, FL 33025	305-433-7000
Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
Omega Engineering, Stamford, CT 06907	800-826-6342
Ransco Industries, Oxnard, CA 93033	805-487-7777
Research Inc., Minneapolis, MN 55424	612-941-3300
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Tenney Engineering, Union, NJ 07083	908-686-7870
† Thermonics, Inc., Santa Clara, CA 95054	408-496-6838
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116	215-464-9300
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818	401-884-4188

Controls, Fader-1300

§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
CTS Corporation, Elkhart, IN 46514	219-293-7511
Duncan Electronics, Costa Mesa, CA 92626	714-545-8261
Noble U.S.A., Inc., Rolling Meadows, IL 60008	708-364-6038
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500

Controls, Fan Speed-2600 – *See Vol. C*

Controls, Fluid Conductivity-2200

Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1886-1887,2004, C•1792, D•1016,1314,1362-1363**
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Curtis Industries, Milwaukee, WI 53234-3925	414-649-4200
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700

Controls, Fluid Flow-2200

Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796,1886-1887, C•1792, D•1166,1314,1362-1363**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Accusonic Division, O.R.E. International Inc., Falmouth, MA 02541	508-548-5800
§ Action Instruments, San Diego, CA 92123	619-279-5726
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Analogic Corp., Peabody, MA 01960	508-977-3000
§ ASI Instruments, Inc., Houston, TX 77024	800-245-7056
† Astro Dynamics, Inc., Woburn, MA 01801	617-935-4944
§ Bellofram Corporation, Newell, WV 26050	304-387-1200;1-800-733-2356
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
† Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440	215-362-3500
Comptus Inc., New Boston, NH 03070	603-487-5512
† Computer Instruments Corp., Westbury, NY 11590	516-876-8400
Computer Instruments Div., Westbury, NY 11590	516-876-8400
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198	203-747-3000
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Harwil Corporation, Santa Monica, CA 90404	310-829-2310
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
Intek, Inc., Westerville, OH 43081	614-895-0301
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ IVEK Corp., N. Springfield, VT 05150	802-886-2238
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
† Kurz Instruments Inc., Monterey, CA 93940	800-424-7356
§ Luft Instruments, Inc., Lincoln, MA 01773	617-259-9215
§ Magnetrol International, Downers Grove, IL 60515-4499	708-969-4000
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786	305-973-6166
† Micropump Corp., Vancouver, WA 98668-8975	206-253-2008
Moore Products Co., Spring House, PA 19477	215-646-7400
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Parker Hannifin Corp., Cleveland, OH 44112-1290	800-272-7537;800-C-PARKER
§† Parker Hannifin Corp., Pneumatic Division, Richland, MI 49083	616-629-5000
§ Plant Specialties, Inc., Carrollton, TX 75011-0537	214-245-9673
† Pressure Controls, Inc., Belleville, NJ 07109	201-751-5002
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Research Inc., Minneapolis, MN 55424	612-941-3300
Schlumberger Industries, Tranducers Div., Houston, TX 77082	713-558-2587
§ Snaptite, Allied, Erie, PA 16506	814-838-3190
§ Square D Co., Palatine, IL 60067	708-397-2600
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550

Controls, Fluorescent Light Power-2200

§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359	215-837-0700

Controls, Frequency-2200

Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010	**D•2224-2225**
Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402-1403**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2288**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Analogic Corp., Peabody, MA 01960	508-977-3000
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
† Autronics Corp., Arcadia, CA 91006	818-445-5470
Comptus Inc., New Boston, NH 03070	603-487-5512
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§† CTS Corporation, Elkhart, IN 46514	219-293-7511
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Drivecon Corporation, Libertyville, IL 60048	708-918-1406
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757

Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Omega Engineering, Stamford, CT 06907 800-826-6342
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136 216-238-2550

Controls, Gas-2200

§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 .. 716-292-6050
§† Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§ Bellofram Corporation, Newell, WV 26050 .... 304-387-1200;1-800-733-2356
§ Bristol Babcock Inc., Watertown, CT 06795 .... 203-575-3000;800-395-5497
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
E-T-A Circuit Breakers, Niles, IL 60714 708-647-8303
JEMA, Wilmette, IL 60091 708-251-3600
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350,800-227-8766
† Pressure Controls, Inc., Belleville, NJ 07109 201-751-5002
Research Inc., Minneapolis, MN 55424 612-941-3300
§ Snaptite/Allied, Erie, PA 16506 814-838-3190

Controls, Humidity-2200

Control Resources Inc., Harvard, MA 01451, 508-772-4043 .... C•1575
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516 ..... D•1251
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004 ... D•1212
ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 .. 716-292-6050
AES Corp., Peabody, MA 01960 508-535-7310
§ Analogic Corp., Peabody, MA 01960 508-977-3000
Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
Automation Component Technology, Fremont, CA 94538 .... 510-226-0900; 510-490-3587 Sales)
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536 615-793-3900
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027 315-638-9598
§ Endress & Hauser Instruments, Greenwood, IN 46143 ... 317-535-7138;800-428-4344
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408 1-800-328-5111
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731 818-444-4000
JC Systems, Inc., San Diego, CA 92121 619-793-7117
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-973-8228
Omega Engineering, Stamford, CT 06907 800-826-6342
Panametrics, Waltham, MA 02154-3497 617-899-2719
Quest Controls, Inc., Palmetto, FL 34221 813-729-4799
Research Inc., Minneapolis, MN 55424 612-941-3300
Rosemount Analytical Inc., Cedar Grove, NJ 07009 .... 800-222-2600 ext. 400
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036 704-892-8872
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
† Thunder Scientific Corp., Albuquerque, NM 87123 .... 505-265-8701;800-872 7728
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818 401-884-4188

Controls, Ignitron Firing-2200

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Darrah Electric Company, Cleveland, OH 44102 .... 216 631 0912
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100

Controls, Joystick, Mouse Devices, etc. — See Controls, Computer Input (Vol. D)

Controls, Lamp Dimming, Flashing-2200

Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 .... D•2239
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•2136
† Accurate Electronics Corp., Elyria, OH 44036 .... 216-366-6330;1-800-334-5904
Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
§ Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Hughey & Phillips, Inc., Simi Valley, CA 93062 805-581-5591
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
International Configurations, Inc., Enfield, CT 06082 203-749-6380
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Spectrum Devices, Sugar Land, TX 77487-1586 713-242-6417
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§† Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561

Tempo Instrument, Inc., Commack, NY 11725 516-864-3700

Controls, Level, Dry Material-2200

§ Action Instruments, San Diego, CA 92123 619-279-5726
§ ASI Instruments, Inc., Houston, TX 77024 800-245-7056
† Automation Prods., Inc., Houston, TX 77008 713-869-0361
§ Bindicator, Port Huron, MI 48061-0009 313-987-2700
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Endress & Hauser Instruments, Greenwood, IN 46143 ... 317-535-7138;800-428-4344
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
§ Kistler-Morse, Redmond, WA 98073 206-881-8000
§ Magnetrol International, Downers Grove, IL 60515-4499 708-969-4000
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
Nuclear Research Corp., Warrington, PA 18976 215-343-5900
† Ocean Motions Co., Barrington, RI 02806 401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Penberthy, Inc., Prophetstown, IL 61277 815-537-2311
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580

Controls, Level, Liquid-2200

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516 ..... D•1251
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•1796,1886-1887, C•1792, D•1166,1314,1362-1363
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 .. 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Analogic Corp., Peabody, MA 01960 508-977-3000
§ ASI Instruments, Inc., Houston, TX 77024 800-245-7056
§† Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
† Automation Prods., Inc., Houston, TX 77008 713-869-0361
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
§ Bindicator, Port Huron, MI 48061-0009 313-987-2700
§ Bristol Babcock Inc., Watertown, CT 06795 .... 203-575-3000;800-395-5497
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536 615-793-3900
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
Computer Instruments Div., Westbury, NY 11590 516-876-8400
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
§ Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§† Dova Controls, Redmond, WA 98052-5165 206-881-7414
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Endress & Hauser Instruments, Greenwood, IN 46143 ... 317-535-7138;800-428-4344
E-T-A Circuit Breakers, Niles, IL 60714 708-647-8303
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009 313-987-2700
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§† Gunther, W., GmbH, D 8500 Numberg 82, GERMANY .... (0)911/65521 or 65520
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
§ Harwil Corporation, Santa Monica, CA 90404 310-829-2310
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
§ Kistler-Morse, Redmond, WA 98073 206-881-8000
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Mag-Con, St. Paul, MN 55113 612-633-8820
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
Magnetoelastic Devices, Pittsfield, MA 01201 413-445-5608
§ Magnetrol International, Downers Grove, IL 60515-4499 708-969-4000
Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 803-249-5191
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Moore Products Co., Spring House, PA 19477 215-646-7400

§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
† Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Parker Hannifin Corp., Refrigerating Specialties Division, Broadview, IL 60153	708-681-6300
Penberthy, Inc., Prophetstown, IL 61277	815-537-2311
§ Plant Specialties, Inc., Carrollton, TX 75011-0537	214-245-9673
§ PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
† Pressure Controls, Inc., Belleville, NJ 07109	201-751-5002
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Research Inc., Minneapolis, MN 55424	612-941-3300
Schlumberger Industries, Tranducers Div., Houston, TX 77082	713-558-2587
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ SOR, Inc., Lenexa, KS 66215	913-888-2630
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Controls, Machine Tool-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1276-1277**
† **Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590**	**D•1163**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•1164-1165**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
§ Action Instruments, San Diego, CA 92123	619-279-5726
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
AES Corp., Peabody, MA 01960	508-535-7310
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Ambi-Tech Inds., Hillsdale, NJ 07642	201-666-0504
American Assembly Inc., Florida, NY 10921	914-651-3433
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Curtis Industries, Milwaukee, WI 53234-3925	414-649-4200
Cyberpak Co., Romeoville, IL 60441	708-972-0707
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Data Instruments, Inc., Acton, MA 01720	800-332-3282
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
Electronic Design Engineering, Norco, CA 91760	909-735-1761
§ Furnas Elec., Batavia, IL 60510	708-879-6000
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658	414-921-7100
Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
IXYS Corp., San Jose, CA 95131-1109	408-435-1900
§ KB Electronics, Brooklyn, NY 11207	718-257-3300
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
§ Mektronix Technology, Inc., Libertyville, IL 60048-2000	708-680-3300
Mesur-Matic Elctrns., Peabody, MA 01960	508-745-7000
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
§† Nolatron, Harrisburg, PA 17111	717-564-3398
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
† Performance Controls, Inc., Horsham, PA 19044	215-675-6500
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
Precision MicroControl, San Diego, CA 92111	619-565-1500
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
§ Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Timeco, Inc., Huntington, WV 25705	304-523-5149
Westamp, Santa Monica, CA 90404	310-393-0401
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Controls, Moisture — See Controls, Humidity (Vol. D)

Controls, Motion, Digital-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771	**B•1240**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**D•1162**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1273,1276**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**D•1164-1165**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008	**A•2115**
§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1309**
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	**D•2317**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
Biomedical Technology, Triangle Biomedical Sciences, Inc., Durham, NC 27705	919-471-2237
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Cyberpak Co., Romeoville, IL 60441	708-972-0707
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Digital Motor, Inc., Portland, OR 97229-5501	503-629-9692
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
§ Electrol Co., York, PA 17405	717-848-1722
Electronic Design Engineering, Norco, CA 91760	909-735-1761
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
§ Galil Motion Control, Inc., Sunnyvale, CA 94086	408 746-2300
General Controls Electronics Inc., Elk Grove Village, IL 60007	708-595-2152
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591	914-631-0600
HMW Enterprises, Inc., Waynesboro, PA 17268	717-765-4690
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
§† Industrial Devices Corporation, Novato, CA 94949-5728	415-883-3535;800-747-0064
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Matrix Corp., Raleigh, NC 27610	919-231-8000
§ Mektronix Technology, Inc., Libertyville, IL 60048-2000	708-680-3300
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
Motion Science Inc., San Jose, CA 95112	408-993-0300
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
Oregon Micro Systems, Inc., Beaverton, OR 97006	503-644-4999;503-629-8081
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
Performance Motion Devices, Chelmsford, MA 01824	508-256-1913
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438	215-256-6601
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
§ Technology 80, Inc., Minneapolis, MN 55427	612-542-9545

§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
United Motion Technology, Santa Clara, CA 95054 ...... 408-970-9742;1-800-424-STEP
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Controls, Motor, PWM-2200

† **Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ...... B•1250**
Glentek, Inc., El Segundo, CA 90245, 310-322-3026 ...... B•1263
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1191
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO ...... B•1276-1277**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ...... D•1164-1165
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ...... D•1208
Advanced Motion Controls, Inc., Princeton, WI 54968 414-295-3500
Advanced Technology Company, Vista, CA 92083 619-727-7430
American Control Technology, Inc., Elgin, IL 60123-1203 708-468-6000
Automotion, Inc., Ann Arbor, MI 48108 313-662-7771
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
Cableform Inc., Troy, VA 22974 804-589-8224
§ Drivecon Corporation, Libertyville, IL 60048 708-918-1406
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 ...... 414-656-4011; 800-356-5077
Electrol Co., York, PA 17405 717-848-1722
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§ Furnas Elec., Batavia, IL 60510 708-879-6000
Geiger Electronics, Inc., Port Washington, NY 11050 516-767-0700
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Indramat, The Rexroth Corp., Wood Dale, IL 60191 708-860-1010
Infranor, Naugatuck, CT 06770 ...... 203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ KB Electronics, Brooklyn, NY 11207 718-257-3300
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779 516-467-5151
Motion Science Inc., San Jose, CA 95112 408-993-0300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841 508-685-4900
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
Performance Motion Devices, Chelmsford, MA 01824 508-256-1913
§ Phasetronics Inc. Motortronics Inc., Clearwater, FL 34622 813-573-1900
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438 215-256-6601
Precision MicroControl, San Diego, CA 92111 619-565-1500
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054 619-439-7500
Sandman Electric Co., Inc., Braintree, MA 02184 617-848-2111
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
§ Technology 80, Inc., Minneapolis, MN 55427 612-542-9545
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100

Controls, Motor Speed-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 ...... D•1150
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 ...... B•1240
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ...... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ...... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ...... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 ...... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 ...... B•1917
Control Resources Inc., Harvard, MA 01451, 508-772-4043 ...... C•1575
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ...... B•1456, C•1577
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ...... B•1473,1475
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ...... A•2078-2079
† **Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ...... B•1250**
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ...... A•2085
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1191
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO ...... B•1276**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ...... B•1298
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ...... B•1295, D•1164-1165
† Modular Devices, Shirley, NY 11967, 516-345-3100 ...... D•1837,2136
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ...... B•1299
NMB Technologies Inc., Chatsworth, CA 91311, 818-341-3355 ...... C•1630-1631
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ...... A•2442
§† Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ...... B•1309
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ...... D•1208
§ TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676 ...... D•2317
§ Action Instruments, San Diego, CA 92123 619-279-5726
Advanced Motion Controls, Inc., Princeton, WI 54968 414-295-3500
Advanced Technology Company, Vista, CA 92083 619-727-7430
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Alpha Dist. Corp., Richfield, OH 44286 ...... 216-659-7100; 1-800-628-0841
American Control Technology, Inc., Elgin, IL 60123-1203 708-468-6000
Anaheim Automation, Anaheim, CA 92801 714-992-6990
† Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
Atec, Inc., Houston, TX 77055 713-468-7971
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ...... 908-819-7070; 908-572-0500
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
§ Berkeley Process Control, Inc., Richmond, CA 94804 510-236-3333
Bertsch U.S., Vista, CA 92083 619-727-7420
Biomedical Technology, Triangle Biomedical Sciences, Inc., Durham, NC 27705 919-471-2237
§ Bodine Electric Company, Chicago, IL 60618 312-478-3515
§† Boston Gear, IMO Industries Inc., Quincy, MA 02171 ...... 617-328-3300;1-800-225-5280
Cableform Inc., Troy, VA 22974 804-589-8224
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
§ Centent Co., Santa Ana, CA 92707 714-979-6491
Compact Power Company, Yorba Linda, CA 92686 714-996-5826
Comptus Inc., New Boston, NH 03070 603-487-5512
Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Controltek, Inc., Portland, OR 97229 503-641-0876
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549 914-666-2971
Cyberpak Co., Romeoville, IL 60441 708-972-0707
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Digital Motor, Inc., Portland, OR 97229-5501 503-629-9692
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
§ Drivecon Corporation, Libertyville, IL 60048 708-918-1406
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 ...... 414-656-4011; 800-356-5077
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§† Electrol Co., York, PA 17405 717-848-1722
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§ Eliwell Inc., Baldwinsville, NY 13027 315-638-9598
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Galil Motion Control, Inc., Sunnyvale, CA 94086 ...... 408 746-2300
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Gossen/Texmate, Vista, CA 92083-8397 ...... 619-598-9899;1-800-394-8344
§ Go Switch, Louisville, KY 40233 502-969-2386
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
H D Systems, Inc., Hauppauge, NY 11788 516-231-6630
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Indramat, The Rexroth Corp., Wood Dale, IL 60191 708-860-1010
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
§† Industrial Devices Corporation, Novato, CA 94949-5728 ...... 415-883-3535;800-747-0064
Infranor, Naugatuck, CT 06770 ...... 203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 708-543-6200
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ KB Electronics, Brooklyn, NY 11207 718-257-3300
§ Linemaster Switch, Woodstock, CT 06281-0238 203-974-1000
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 803-249-5191
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Mesur-Matic Elctrns., Peabody, MA 01960 508-745-7000
Micronel U.S., Vista, CA 92083 619-727-7400
Motion Science Inc., San Jose, CA 95112 408-993-0300
§ Newport Electronics, Santa Ana, CA 92704-4426 ...... 714-540-4914;800-NEWPORT
§ Oriental Motor USA Corp., Torrance, CA 90505-5217 310-515-2264
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
Performance Motion Devices, Chelmsford, MA 01824 508-256-1913
§ Phasetronics Inc., Motortronics Inc., Clearwater, FL 34622 813-573-1900
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville PA 19438 215-256-6601
§ Plant Specialties, Inc., Carrollton, TX 75011-0537 214-245-9673
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Power Functions Engineering, Garland, TX 75042 214-278-0996
§ POWR-UPS Corp., Shirley, NY 11967 ...... 516-345-5700;1-800-333-POWR
Precision MicroControl, San Diego, CA 92111 619-565-1500
Quest Controls, Inc., Palmetto, FL 34221 813-729-4799
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054 619-439-7500
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Sierracin Magnedyne, Carlsbad, CA 92008 619-438-3321
† Sigma Electronics Inc., Houston, TX 77099 ...... 713-933-4700;800-874-7121
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Systems Research Laborotories, Arvin Calspan, Dayton, OH 45440 513-426-6000
§ Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
§ Torq Corp., Bedford, OH 44146 216-232-4100

Trionics, Inc., St. Charles, IL 60174	708-365-6570
Unitrode Corp., Watertown, MA 02172	617-926-0404
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
Voltex, Amityville, NY 11701	516-842-2772
§ Westamp, Santa Monica, CA 90404	310-393-0401
§ Westinghouse Electric Corp., Control Division, Oldsmar, FL 34667	813-855-4621
Xylog Corp., Hackensack, NJ 07601	201-489-4040

Controls, Oscillator-2200

† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
† **Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433**	**A•1504**
§† CTS Corporation, Elkhart, IN 46514	219-293-7511
§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
† Piezo Technology Inc., Orlando, FL 32804	407-298-2000
§ Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929

Controls, Photoelectric-2200

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1175**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1325**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
EG & G Vactec, St. Louis, MO 63132	314-423-4900
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
Enerco, Inc., Seattle, WA 98108	206-762-1422
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
§ Furnas Elec., Batavia, IL 60510	708-879-6000
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
HH Controls Co., Inc., Arlington, MA 02174	617-646-2626
§ Hughey & Phillips, Inc., Simi Valley, CA 93062	805-581-5591
§ IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
§ Intermatic, Spring Grove, IL 60081	815-675-2321
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Lektra Laboratories Inc., Bronx, NY 10451	718-292-8243
§† Mansfield & Green Division, A Subsidiary of Ametek Inc., Largo, FL 34643	813-536-7831
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522
† Xenotronix Inc., Valencia, CA 91355	805-257-4793
§ Xercon, Inc., Portland, OR 97207	503-292-8682

Controls, Positioning-4100

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161	**B•1917**
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600	**B•1917**
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000	**B•1917**
CTI Electronics, Stratford, CT 06497, 203-386-9779	**D•1086**
Data Technology, Inc., Woburn, MA 01811, 617-935-8820	**B•1931**
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131	**B•1250**
Farrand Controls, Ruhle Companies, Inc., Valhalla, NY 10595, 914-761-2600	**B•1949**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**D•1162**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1273-1274,1276-1277**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
† **Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590**	**D•1163**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1968, D•1164-1165**
† **Ocean Motions Co., Barrington, RI 02806, 401-246-1394**	**B•1980**
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561**	**B•1849, D•1167**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008	**A•2115**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1309**
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	**D•2317**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
§ Action Instruments, San Diego, CA 92123	619-279-5726
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Amkey, Methuen, MA 01844	508-975-5445
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Analog Systems, Tucson, AZ 85731-7389	602-290-1818
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Bellofram Corporation, Newell, WV 26050	304-387-1200;1-800-733-2356
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089	708-215-9600
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Compact Power Company, Yorba Linda, CA 92686	714-996-5826
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Cyberpak Co., Romeoville, IL 60441	708-972-0707
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Data Instruments, Inc., Acton, MA 01720	800-332-3282
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
§ Galil Motion Control, Inc., Sunnyvale, CA 94086	408 746-2300
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658	414-921-7100
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
§ Go Switch, Louisville, KY 40233	502-969-2386
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Hecon Corp., Eatontown, NJ 07724	908-542-9200
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
§† Industrial Devices Corporation, Novato, CA 94949-5728	415-883-3535;800-747-0064
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Instrumentation & Control Sys., ICS,Inc., Addison, IL 60101	708-543-6200
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056	708-803-5100
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
Mesur-Matic Elctrns., Peabody, MA 01960	508-745-7000
† Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900

Controls, Positioning-4100 (Cont'd)

† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
Ormec Systems Corp., Rochester, NY 14625	**716-385-3520**
§† **Pacific Scientific Co., Rockford, IL 61109**	**815-226-3100**
§ **Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636**	**412-744-4451**
† Performance Controls, Inc., Horsham, PA 19044	215-675-6500
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438	215-256-6601
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	**619-439-7500**
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ **Relay Specialties, Oakland, NJ 07436**	**201-337-1000**
§ **Reliance Electric Co., Cleveland, OH 44117**	**800-245-4501**
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
Servo-Tek Products Co., Hawthorne, NJ 07506	**201-427-3100**
† Sierracin/Magnedyne, Carlsbad CA 92008	619-438-3321
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ **Sunx Sensors/Imported by Ramco Elect. West Des Moines, IA 50265**	**515-225-6933**
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
§ **Toko America, Inc., Mt. Prospect, IL 60056**	**708-297-0070**
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
§ **TURCK Inc., Minneapolis, MN 55441-2656**	**612-553-9224;1-800-328-0580**
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116	215-464-9300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778	508-358-2777
§ Westamp, Santa Monica, CA 90404	310-393-0401

Controls, Pressure-2200

Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1928**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1356**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796,1886-1887, C•1792, D•1166,1314,1362-1363**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Analogic Corp., Peabody, MA 01960	508-977-3000
† Atec, Inc., Houston, TX 77055	713-468-7971
Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
§ Bellofram Corporation, Newell, WV 26050	304-387-1200:1-800-733-2356
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
† **Computer Instruments Corp., Westbury, NY 11590**	**516-876-8400**
Computer Instruments Div., Westbury, NY 11590	516-876-8400
† **Control Technology Co., Inc., Long Island City, NY 11101**	**718-361-2133**
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
Data Translation, Inc., Marlboro, MA 01752	**508-481-3700**
§ **DCT Instruments, Columbus, OH 43212**	**1-800-328-1028**
Dresser Instrument Div., Dresser Industries, Stratford, CT 06497	203-378-8281
§ **Dynisco, Sharon, MA 02067**	**617-784-8400**
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141	414-656-4011; 800-356-5077
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009	313-987-2700
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
§ ITT Conoflow, ITT Fluid Technology Corp., St. George, SC 29477	803-563-9281
§ IVEK Corp., N. Springfield, VT 05150	802-886-2238
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ **Jumo Process Control, Inc., Coatsville, PA 19320**	**215-380-8002**
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
§ **Meriam Instrument, Scott Fetzer, Cleveland, OH 44102**	**216-281-1100**
Microavionics Corp., Costa Mesa, CA 92626	**714-957-6904**
MICRO DATA SYSTEMS, Thomasville, GA 31799	**912-226-1709**
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786	305-973-6166
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Moore Products Co., Spring House, PA 19477	**215-646-7400**
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	**514-973-8228**
Norgren, Littleton, CO 80120-1663	**303-794-2611**
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Parker Hannifin Corp., Cleveland, OH 44112-1290	800-272-7537;800-C-PARKER
Parker Hannifin Corporation, Hydraulic Valve Division, Elyria, OH 44036-2026	216-366-5200
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
† **Pressure Controls, Inc., Belleville, NJ 07109**	**201-751-5002**
§ **Relay Specialties, Oakland, NJ 07436**	**201-337-1000**
Research Inc., Minneapolis, MN 55424	612-941-3300
§ **Snaptite/Allied, Erie, PA 16506**	**814-838-3190**
§ **Square D Co., Palatine, IL 60067**	**708-397-2600**
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
†# Systec, Inc., Minneapolis, MN 55421	612-788-9701
Tempo Instrument, Inc., Commack, NY 11725	**516-864-3700**
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
§ Total Temperature Instrumentation, Inc., Williston, VT 05495	802-863-0085
Trans Metrics, Inc., Solon, OH 44139	**216-248-2229**
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
Viatran Corporation, Grand Island, NEW YORK 14072	**716-773-1700**

Controls, Proportional-2200

§ **Douglas Randall, Pawcatuck, CT 06379, 203-599-2075**	**B•1473, D•1156-1157**
† **Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590**	**D•1163**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1361**
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008	**A•2115**
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	**D•2317**
§ **ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550**	**716-292-6050**
§ **Action Instruments, San Diego, CA 92123**	**619-279-5726**
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
† **Automation Prods., Inc., Houston, TX 77008**	**713-869-0361**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
Elma Engineering, Palo Alto, CA 94303	415-494-7303
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658	414-921-7100
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	**203-866-2573**
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
† **Industrial Control Co., Rockledge, FL 32955**	**407-259-7105**
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
§ **IVEK Corp., N. Springfield, VT 05150**	**802-886-2238**
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ **Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359**	**215-837-0700**
§† Kay-Ray Sensall, Inc., Mt. Prospect, IL 60056	708-803-5100
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
§ Machine Components Corp., Plainview, NY 11803	516-694-7222
Magnet Schultz of America, Westmont, IL 60559	708-789-0600
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733	802-247-6811
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
† **Oven Industries, Mechanicsburg, PA 17055**	**717-766-0721**
§ Payne Engineering, Scott Depot, WV 25560	304-757-7353
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622	813-573-1900
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
†# **Synetcom Digital Incorporated, Redondo Bch., CA 90278**	**310-379-2000**
Toshiba Instrumentation Div., Toshiba Intl. Corp., Tulsa, OK 74134	**918-252-3548**
† **Transmagnetics, Farmingdale, NY 11735**	**516-293-3100**
§ **West Instrument, A Mark IV Company, E. Greenwich, RI 02818**	**401-884-4188**

Controls, Proximity-Also See Controls, Capacitance Operated-2200

† **Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800**	**D•1015**
† **Ocean Motions Co., Barrington, RI 02806, 401-246-1394**	**B•1980**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
† Autronics Corp., Arcadia, CA 91006	818-445-5470
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089	708-215-9600
Capacitec, Inc., Ayer, MA 01432	508-772-6033
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536	615-793-3900
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
Curtis Industries, Milwaukee, WI 53234-3925	414-649-4200
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009	313-987-2700
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Gordon Products, Brookfield, CT 06804	203-775-4501
§ Go Switch, Louisville, KY 40233	502-969-2386
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
Norgren, Littleton, CO 80120-1663	303-794-2611
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Sensor Corp., Scottdale, PA 15683	412-887-4080
§ Snaptite/Allied, Erie, PA 16506	814-838-3190
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580

Controls, Remote-2200

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278,2281**
† **Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590**	**D•1163**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229**	**D•2300**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
† **Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220**	**D•1074**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Analogic Corp., Peabody, MA 01960	508-977-3000
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Bindicator, Port Huron, MI 48061-0009	313-987-2700
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
California Automation Inc., San Diego, CA 92121	619-452-1341
CGRS Microtech, Langhorne, PA 19047	215-757-0284
† Cohu, Inc., Elctrns. Div , San Diego, CA 92123	619-277-6700
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Dancer Communications, Inc., Secane, PA 19018	215-543-8066
Dantel, Fresno, CA 93727	209-292-1111
§ Dataprobe, Englewood, NJ 07631	201-569-6464
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
§ Electrol Co., York, PA 17405	717-848-1722
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
Electronic Design Engineering, Norco, CA 91760	909-735-1761
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009	313-987-2700
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
HDS Inc., Reston, VA 22091	703-620-6200
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
§† Industrial Devices Corporation, Novato, CA 94949-5728	415-883-3535;800-747-0064
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
§ Luft Instruments, Inc., Lincoln, MA 01773	617-259-9215
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
† Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
Quatech Inc., Akron, OH 44311	216-434-3154
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Square D Co., Palatine, IL 60067	708-397-2600
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Systems Alternatives, Maumee, OH 43537	419-891-1100
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818	401-884-4188

Controls, Run, Shutdown Command, Start-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•1164-1165**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229**	**D•2300**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Ambi-Tech Inds., Hillsdale, NJ 07642	201-666-0504
Anaheim Automation, Anaheim, CA 92801	714-992-6990
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Autronics Corp., Arcadia, CA 91006	818-445-5470
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ Bindicator, Port Huron, MI 48061-0009	313-987-2700
Cardinal Control Co., Kensington, CT 06037	203-828-6379
C-Tek Inc., Wakefield, MA 01880	617-246-1720
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009	313-987-2700
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§† Nolatron, Harrisburg, PA 17111	717-564-3398
Norgren, Littleton, CO 80120-1663	303-794-2611
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Square D Co., Palatine, IL 60067	708-397-2600
Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
Timeco, Inc., Huntington, WV 25705	304-523-5149

Controls, SCR-2200

BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590	**A•2296**
§ **Douglas Randall, Pawcatuck, CT 06379, 203-599-2075**	**D•1155**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300**	**D•1851**
§ **Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272**	**A•2175**
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1593**
§ **Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515**	**A•2220,2222-2223**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711

§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 .... 908-819-7070; 908-572-0500
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Basler Elec., Electronic Product Group, Highland, IL 62249 .... 618-654-2341; 800-645-2074
† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
§ Bodine Electric Company, Chicago, IL 60618 312-478-3515
Cableform Inc., Troy, VA 22974 804-589-8224
§ Centent Co., Santa Ana, CA 92707 714-979-6491
† Chromalox Instrs. & Controls, La Vergne, TN 37086-3536 615-793-3900
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 .... 414-656-4011; 800-356-5077
§ Electrol Co., York, PA 17405 717-848-1722
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
Elma Engineering, Palo Alto, CA 94303 415-494-7303
§ Furnas Elec., Batavia, IL 60510 708-879-6000
† Glenro, Inc., Paterson, NJ 07501-1715 .... 201-279-5900;800-922-0106
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
§ Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ KB Electronics, Brooklyn, NY 11207 718-257-3300
§† Kollmorgen Motion Technologies Group, Radford, VA 24141 .... 800-77-SERVO
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
MACROAMP Inc., Ukiah, CA 95482 800-458-8892
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 803-249-5191
† Mep Controls, Bordentown, NJ 08505 609-298-7300
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ POWR-UPS Corp., Shirley, NY 11967 .... 516-345-5700;1-800-333-POWR
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
Research Inc., Minneapolis, MN 55424 612-941-3300
† Sigma Electronics Inc., Houston, TX 77099 .... 713-933-4700;800-874-7121
§ Square D Co. Palatine, IL 60067 708-397-2600
Voltex, Amityville, NY 11701 516-842-2772
§† Westamp, Santa Monica, CA 90404 310-393-0401
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Xylog Corp., Hackensack, NJ 07601 201-489-4040

Controls, Sensing/Monitoring-Voltage, Phase, Frequency-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000 .... D•1149
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 .... D•2230
Advanced Control Sys., Hingham, MA 02043, 617-740-0223 .... D•1150
† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 .... B•1914-1915
Control Resources Inc., Harvard, MA 01451, 508-772-4043 .... C•1575
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1160
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1376
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .... D•1355-1357
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 .... B•1964-1966
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1376
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1390
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Analogic Corp., Peabody, MA 01960 508-977-3000
§ Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Autronics Corp., Arcadia, CA 91006 818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
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Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Centent Co., Santa Ana, CA 92707 714-979-6491
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
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† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Cross Electronics, Warrendale, PA 15086 412-776-1591
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
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Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
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§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
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Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
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Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
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§† Leach Corporation, Buena Pk., CA 90622-5032 714-739-0770
§ Letco International, New Braunfels, TX 78131-1200 1-800-222-9676
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514 803-249-5191
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
Omega Engineering, Stamford, CT 06907 800-826-6342
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 .... 510-471-9717;800-221-7060
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
† Sigma Electronics Inc., Houston, TX 77099 .... 713-933-4700;800-874-7121
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580
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Xylog Corp., Hackensack, NJ 07601 201-489-4040

Controls, Servo System-4900

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 .... D•1150
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 .... B•1240
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 .... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 .... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 .... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 .... B•1917
† Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 .... B•1250
§† Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO .... B•1274
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 .... B•1298
†# Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... B•1968, D•1164-1165
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 .... B•1299
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 .... B•1304
§ Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 .... B•1309
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
§ TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676 .... D•2317
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 612-474-4500
§ Adatek, Inc., Sandpoint, ID 83864 .... 208-263-1471;800-323-3343
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† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
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§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
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Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
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Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
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Dynapar, Gurnee, IL 60031 312-662-2666
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† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009 619-929-0749
§ Galil Motion Control, Inc., Sunnyvale, CA 94086 .... 408 746-2300
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100

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IXYS Corp., San Jose, CA 95131-1109 408-435-1900
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Performance Motion Devices, Chelmsford, MA 01824 508-256-1913
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
§ POWR-UPS Corp., Shirley, NY 11967 ..... 516-345-5700;1-800-333-POWR
Precision MicroControl, San Diego, CA 92111 619-565-1500
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054 619-439-7500
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
§ Technology 80, Inc., Minneapolis, MN 55427 612-542-9545
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
Vasak Inds., Inc., El Segundo, CA 90245 ..... 1-800-67-VASAK
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444
Westamp, Santa Monica, CA 90404 310-393-0401
† Wilson Company-Systems Division, Dallas, TX 75248 ..... 214-931-8666;800-580-1212

Controls, Stepping Motor-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 ..... **D•1150**
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600** ..... **B•1244-1245**
† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564** ..... **B•1268-1269**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... **B•1271**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... **B•1968, D•1164-1165**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561** ..... **B•1309**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 612-474-4500
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
§ American Advantech Corp., San Jose, CA 95122 408-293-6786
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070: 908-572-0500
§ Bodine Electric Company, Chicago, IL 60618 312-478-3515
§ Centent Co., Santa Ana, CA 92707 714-979-6491
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 707-584-7558
Cyberpak Co., Romeoville, IL 60441 708-972-0707
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
§ Design Components, Inc. (DCI), Franklin, MA 02038 ..... 508-528-7300;800-341-4811
Digital Motor, Inc., Portland, OR 97229-5501 503-629-9692
§ Divelbiss Corp., Fredericktown, OH 43019 614-694-9015
DSP Technology, Fremont, CA 94538-7338 510-657-7555
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691 714-583-9802
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
General Controls Electronics Inc., Elk Grove Village, IL 60007 708-595-2152
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
Industrial Computer Source, San Diego, CA 92131 619-271-9340
§† Industrial Devices Corporation, Novato, CA 94949-5728 .. 415-883-3535;800-747-0064
§ Interloop, San Jose, CA 95131 408-922-0520
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
Japanese Products Corp., Elmsford, NY 10523 914-592-8880
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
Matrix Corp., Raleigh, NC 27610 919-231-8000
Mesur-Matic Elctrns., Peabody, MA 01960 508-745-7000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
Motion Engineering, Inc., Santa Barbara, CA 93103 805-962-5409
Motion Science Inc., San Jose, CA 95112 408-993-0300
MTS Systems, Eden Prairie, MN 55344 612-937-4000
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841 508-685-4900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
§ Oriental Motor USA Corp., Torrance, CA 90505-5217 310-515-2264
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Parker Hannifin Corporation, Compumotor Division, Rohnert Park, CA 94928 707-584-7558
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410 203-271-6000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
Precision MicroControl, San Diego, CA 92111 619-565-1500
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
†# Systec, Inc., Minneapolis, MN 55421 612-788-9701
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
United Motion Technology, Santa Clara, CA 95054 ..... 408-970-9742;1-800-424-STEP
Unitrode Corp., Watertown, MA 02172 617-926-0404
§† Velmex, Inc., East Bloomfield, NY 14443 ..... 716-657-6151;800-642-6446
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Controls, Temperature-2200

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... **B•1860**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... **B•1916**
Control Resources Inc., Harvard, MA 01451, 508-772-4043 ..... C•1575
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516 ..... D•1251
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... **D•1344**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... **D•1155**
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1872-1873
Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000 ..... **B•1875**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 ..... D•1160
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1380,1382
Gralex Industries, Norwood, NJ 07648, 800-486-4499 ..... D•1353
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... **B•1879,1881**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ..... D•1355-1356
† Marlow Industries, Inc., Dallas, TX 75238-1645, 214-340-4900 ..... C•1602-1603, 1605
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1885
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ..... **B•1978, D•1359-1360**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1796,1886-1887, C•1792, D•1166,1314,1362-1363**
Philips Technologies, Airpax Protector Group, Frederick, MD 21701, 301-663-5141 ..... B•1891
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ..... B•1896-1897
Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610 ..... B•1898-1901
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193 ..... **D•1211**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004 ..... D•1212-1213
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1380,1382
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... **B•1389,1903**
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1904-1907
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200 ..... B•1908
§ **Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974** ..... **B•1909**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Action Instruments San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000

Alpha Dist. Corp., Richfield, OH 44286	216-659-7100; 1-800-628-0841
§ Alpha-M Corp., Dallas, TX 75229	214-406-0424
§ American Advantech Corp., San Jose, CA 95122	408-293-6786
§ Analogic Corp., Peabody, MA 01960	508-977-3000
# ARi Industries, Inc., Addison, IL 60101	708-953-9100;800-237-6725
Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Atec. Inc., Houston, TX 77055	713-468-7971
§ Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§† Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
§ Bayley Instrument Company, Kenwood, CA 95452	707-833-6014
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Biomedical Technology, Triangle Biomedical Sciences, Inc., Durham, NC 27705	919-471-2237
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
† Caig Laboratories, Rancho Bernardo, CA 92127-1904	619-451-1799
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
† Chatham Controls, Chatham, NJ 07928	201-635-8892
† Chromalox Instrs. & Controls, La Vergne, TN 37086-3536	615-793-3900
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
DGH Corporation, Manchester, NH 03108	603-622-0452
† Digitec, Marion, OH 43302	614-387-3444
Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Dynisco, Sharon, MA 02067	617-784-8400
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
Elma Engineering, Palo Alto, CA 94303	415-494-7303
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
† Force, Inc., Christiansburg, VA 24073	703-382-0462
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Gordon Products, Brookfield, CT 06804	203-775-4501
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
§ Hexacon Electric Co., Roselle Park, NJ 07204	908-245-6200
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
Isotemp Research, Inc., Charlottesville, VA 22903	804-295-3101
JC Systems, Inc., San Diego, CA 92121	619-793-7117
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359	215-837-0700
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Mag-Con, St. Paul, MN 55113	612-633-8820
§ Markat Div., Wild Oats Corp., N. Myrtle Bch., SC 29582-2514	803-249-5191
Matrix Corp., Indianapolis, IN 46241	317-248-2036
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Micro-Ohm Corp., Duarte, CA 91010	818-3575377
Minco Products, Minneapolis, MN 55432	612-571-3121
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
Moore Products Co., Spring House, PA 19477	215-646-7400
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733	802-247-6811
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Ogden Manufacturing Co., Arlington Heights, IL 60005	708-593-8050
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901	804-977-8050
† Oven Industries, Mechanicsburg, PA 17055	717-766-0721
§ Paktronics Controls, Inc., Ft. Worth, TX 76181	817-284-5241
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
§ Payne Engineering, Scott Depot, WV 25560	304-757-7353
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
§ Red Lion Controls, York, PA 17402	717-767-6511
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Research Inc., Minneapolis, MN 55424	612-941-3300
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796	617-527-4385
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Square D Co., Palatine, IL 60067	708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Sylvania, Emissive Products/Process Heat, Exeter, NH 03833	603-772-4331
† Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
†# Systec, Inc., Minneapolis, MN 55421	612-788-9701
TECA, ThermoElectric Cooling America Corp., Chicago, IL 60639	312-342-4900
§ Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562	919-636-5720
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800
† Thermonics, Inc., Santa Clara, CA 95054	408-496-6838
§ Total Temperature Instrumentation, Inc., Williston, VT 05495	802-863-0085
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000
Voltex, Amityville, NY 11701	516-842-2772
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818	401-884-4188
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909
† Williamson Corporation, Concord, MA 01742	508-369-9607

Controls, Timing -- See Timers (Vol. D)

Controls, Torque, Electronic-2200

† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•1164-1165**
§ Ambi-Tech Inds., Hillsdale, NJ 07642	201-666-0504
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§† B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Compact Power Company, Yorba Linda, CA 92686	714-996-5826
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141	414-656-4011; 800-356-5077
§ Electrol Co., York, PA 17405	717-848-1722
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
§ GSE, Core Inds., Farmington Hills, MI 48024	313-476-7875
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
§† Industrial Devices Corporation, Novato, CA 94949-5728	415-883-3535;800-747-0064
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ KB Electronics, Brooklyn, NY 11207	718-257-3300
§† Kollmorgen Motion Technologies Group, Radford, VA 24141	800-77-SERVO
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
§ POWR-UPS Corp., Shirley, NY 11967	516-345-5700;1-800-333-POWR
Precision MicroControl, San Diego, CA 92111	619-565-1500
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
Vibrac, Amherst, NH 03031	603-882-6777
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778	508-358-2777
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137	708-469-7473

Controls, Vibrator-2200

Douglas Randall, Pawcatuck, CT 06379	203-599-2075
# KB Electronics, Brooklyn, NY 11207	718-257-3300
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
§ Staco Energy Products Co., Dayton, OH 45403	513-253-1191

Thermotron Inds., Holland, MI 49423	616-392-1491

Controls, Voltage Regulating — See Regulators & Stabilizers, Voltage (Vol. D)

Controls, Volume & Tone — See Potentiometers (Vol. A), Rheostats (Vol. A)

Control Systems, Air Traffic-2200

† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220	**D•1075**
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
Megadata Corp., Bohemia, NY 11716	516-589-6800

Control Systems, Distributed Numerical-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Analogic Corp., Peabody, MA 01960	508-977-3000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Opto 22, Temecula, CA 92590	714-695-9299
Quatech Inc., Akron, OH 44311	216-434-3154
Research Inc., Minneapolis, MN 55424	612-941-3300
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
Toshiba Instrumentation Div., Toshiba Intl. Corp., Tulsa, OK 74134	918-252-3548

Control Systems, Robotics-4900

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041	**B•1300**
† Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
§ TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676	**D•2317**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
§ Action Instruments, San Diego, CA 92123	619-279-5726
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
American Assembly Inc., Florida, NY 10921	914-651-3433
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
§ Dynalloy, Inc., Irvine, CA 92715	714-476-1206
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
HDS Inc., Reston, VA 22091	703-620-6200
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
§† Industrial Devices Corporation, Novato, CA 94949-5728	415-883-3535;800-747-0064
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
ITF Corp., Buford, GA 30518	404-945-3844
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
MOLEX, Inc., Lisle, IL 60532	708-969-4550
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
§ Norgren, Littleton, CO 80120-1663	303-794-2611
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
† Performance Controls, Inc., Horsham, PA 19044	215-675-6500
Precision MicroControl, San Diego, CA 92111	619-565-1500
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§† Seiko Instruments U.S.A., Inc., Robotics/Automation Div., Torrance, CA 90505	213-517-7850
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
§† Silicon General, Garden Grove, CA 92641	714-898-8121
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
Technology 80, Inc., Minneapolis, MN 55427	612-542-9545
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Convection Cooling Packages, Semiconductor — See Heat Sinks, Semiconductor (Vol. C)

Converters, AC to DC (Nonrotary) — See Power Supplies, AC Input, DC Output (Vol. D)

Converters, Analog to Digital-2325

† Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930	**D•2067**
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600	**B•1917**
† BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414	**B•1917**
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1174**
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800	**B•1035**
† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1184-1185**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**D•1183**
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	**D•1190**
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1705**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1357**
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950	**D•1196**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1200-1202**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
Action Instruments, San Diego, CA 92123	619-279-5726
ADAC Corporation, Woburn, MA 01801	617-935-6668
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
† Addacon Greensboro, Greensboro, NC 27407	919-852-6200
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606	408-720-8737
# Alligator Technologies, Fountain Valley, CA 92708	714-850-9984
§ American Advantech Corp., San Jose, CA 95122	408-293-6786
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
§ Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Ariel Corporation, Highland Pk., NJ 08904	908-249-2900
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
Basicon, Inc., Portland, OR 97229	503-626-1012
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311	818-341-6161
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117	805-968-0782
† BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203	501-851-4000
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
CGRS Microtech, Langhorne, PA 19047	215-757-0284
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Cirrus Logic, Inc., Fremont, CA 94538	510-623-8300
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Computer Products, Inc, Process Automation, Pompano Beach, FL 33069	305-974-5500
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Covid, Inc., Tempe, AZ 85281	602-966-2221
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
§ Datricon, Scientific Technologies, Inc., Hayward, CA 94544	510-471-9717
DGH Corporation, Manchester, NH 03108	603-622-0452
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ duTec, Inc., Jackson, MI 49204-0964	800-248-1632
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658	414-921-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§† Harris Semiconductor, Melbourne, FL 32902	1-800-4 HARRIS
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090	408-727-6116
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ International Microtronics, Tucson, AZ 85714	602-748-7900
KineticSystems Corp., Lockport, IL 60441	815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Lutze, Inc., Charlotte, NC 28217-9805	704-357-8835;800-447-2371
Matrix Corp., Raleigh, NC 27610	919-231-8000
† Measurement Systems, Inc., Fairfield, CT 06430	203-336-4590
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
† Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
§† Micro Power Sys. Inc., Santa Clara, CA 95056	408-727-5350
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
§ National Instruments, Austin, TX 78730-5039	512-794-0100

§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Parsytec Inc., West Chicago, IL 60185 708-293-9500
PERX,Inc., Corte Madera, CA 94925 415-927-0155
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Prema Precision Electronics, Inc., Montclair, CA 91763 714-621-7292
Quatech Inc., Akron, OH 44311 216-434-3154
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
§ Rapid Systems Inc., Seattle, WA 98103 206-547-8311
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§† Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§† Sipex Corp., Billerica, MA 01821 508-667-8700
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§ Strawberry Tree, Inc., Sunnyvale, CA 94086 408-736-8800
†# Systec, Inc., Minneapolis, MN 55421 612-788-9701
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§† Thaler Corp., Tucson, AZ 85737 602-742-5572
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444
§† WestCon, Marion, OH 43302 614-382-5771
§ Wieland Inc., Burgaw, NC 28425 919-259-5050

Converters, Analog to Pulse-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1174
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2011
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Dymec Inc., Winchester, MA 01890 617-729-7870
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235 614-889-6152
† Measurement Systems, Inc., Fairfield, CT 06430 203-336-4590
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300

Converters, ASCII to Baudot-2325

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
§ Dataprobe, Englewood, NJ 07631 201-569-6464
Nu Data, Inc., Little Silver, NJ 07739 908-842-5757

Converters, ASCII to BCD-2325

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
§ Dataprobe, Englewood, NJ 07631 201-569-6464
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455

Converters, BCD to ASCII-2325

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900

Converters, Binary to BCD-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172-1173
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 .... D•1176-1177,1179-1180
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§ Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000

Converters, Binary to Decimal-2325

† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 .... D•1176-1177,1179-1180
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Converters, CRT Display-2000

Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 .... D•2233
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1656,1659
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 .... D•1686
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•2107
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700 .... D•1770-1771
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 .... A•1260-1261, D•1857
† Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858 .... D•1908-1909
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... D•1922
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3 905-660-9819
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
Dotronix, New Brighton, MN 55112 612-633-1742
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 516-293-4100
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174 904-677-7070
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 908-534-9007
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§† Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
ULTRAVOLT, Inc., Ronkonkoma, NY 11779 .... 800-876-POWER
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804

Converters, DC to DC, Less than 1 W Output-4025

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 .... D•2052-2055
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 .... D•2074-2075
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 .... D•1631,2090-2091,2093
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880 .... D•2096
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 .... D•2082
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1658-1659
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... D•1661
EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 .... D•1670
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 .... D•1686
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•2106
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561 .... D•1691,1695
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 .... A•1403
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331 .... D•1751, 1753
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100 .... D•2123
Intronics, Inc., Canton, MA 02021, 800-367-0004 .... D•2124-2125
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 .... D•2127
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 .... D•2128-2129
Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 .... A•2412
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1837,2136
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... D•1859,2137
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 .... D•2292-2294
Power Convertibles, a Burr-Brown Company, Tucson, AZ 85713, 1-800-548-6132 .... D•2077-2078,2080-2081
Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 .... A•2508
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858 .... D•1909
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087, 603-893-2330 .... D•2207
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 .... D•1845
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654 .... D•2210-2211
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 .... D•1946-1947
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272 .... D•2002
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER .... D•2015
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 .... D•2215
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 .... D•2218
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001 .... D•2042
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588 510-734-3060
Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
† Babcock, Inc., Orange, CA 92667 714-633-3700
Bertan High Voltage, Hicksville, NY 11801 516-433-3110
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Caritronics Inc., West Caldwell, NJ 07007 201-575-8916
CET Technology, Hudson, NH 03051 603-883-5912
Dexter Scientific, Palatka, FL 32177 904-328-2450
El Microcircuits, Inc., Mankato, MN 56001 507-345-5786

Electromech, Inc., Irvington, NJ 07111 201-318-7999
§ GC International Inc., Plano, TX 75074 214-423-8411
Green Engineering, Melrose, MA 02176 617-665-8994
§ International Power Sources, Inc., Ashland, MA 01721 508-881-7434
† Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 ... 414-228-5500
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5 416-630-8108
§ Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
TMP Inc., Santa Ana, CA 92705 714-558-8028
Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
Tumbler Technologies, Fremont, CA 94539 510-651-7724
§ Wall Industries, Exeter, NH 03833 603-778-2300

Converters, DC to DC, 1 to 5 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 5 to 10 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 10 to 15 W Output — See Converters DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 1 W to 300 W Output-4025

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 .... D•2052-2055
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512
§ Acon, Inc., South Easton, MA 02375, 508-230-8022 .... D•2058-2066
Acopian Technical Company, Easton, PA 18044, 215-258-5441 .... D•1517
† Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930 .... D•2067
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222 .... D•1553
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 .... D•1556
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725 .... D•1557
Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600 .... D•2068-2069
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 .... D•1574-1576,2056-2057
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 .... D•1585,1587
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 .... D•1592-1594
Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1602-1603,2071-2073
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 .... D•1604
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888 .... D•1610
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 .... D•1616
Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 .... D•2239
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 .... D•2074-2075
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 .... D•1618,1621-1622
§ Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411 .... D•2083-2089
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 .... A•2302
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665 .... D•1627
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 .... D•1631,1633,2090-2095
† Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880 .... D•2096-2097
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000 .... D•1646-1647
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144 .... D•1648-1650,2098
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 ... D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1184,2099,2101-2103
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1658-1659
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... D•1660-1661
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 .... D•1670-1671
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•2104-2105
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 .... D•1686
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... B•1048, D•1687,2106-2107
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561 ... D•1691-1696
Farnell Advance Power, Solon, OH 44139, 216-349-0755 .... D•1699,1701
§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 .... D•2109
Fetco, Sanford, FL 32773, 407-321-3800 .... A•2354
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 .... A•1403
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 .... D•1732
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1965
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 .... D•1191
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000 .... D•1750
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331 .... D•1751,1753-1755
§ International Power Sources, Inc., Ashland, MA 01721, 508-881-7434 .... D•2110-2111
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100 .... D•2112-2113,2117-2118,2121-2123
Intronics, Inc., Canton, MA 02021, 800-367-0004 .... D•2124-2125
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 .... D•2127
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 .... D•1756-1757
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712 .... D•1765
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 .... D•2128-2129
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700 .... D•1770-1771
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 .... D•1807,2276
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 .... D•1810
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... D•1816-1817,2130
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 .... B•1844, D•1826,2277
Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712 .... D•2131-2133,2135
Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 .... A•2412
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1837-1844,2136
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380 .... D•1846
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 .... D•1851
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 .... D•1854-1856
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... D•1859,2137
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 .... D•2292-2296
Power Convertibles, a Burr-Brown Company, Tucson, AZ 85713, 1-800-548-6132 .... D•2077-2081
§ Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 .... D•2186-2195
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 .... D•1896-1897
Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 .... A•2508
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858 .... D•1908-1909
† Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300 .... D•2199-2201
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 .... D•1917,2202-2205
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087, 603-893-2330 .... D•2207-2209
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 .... D•1845
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654 .... D•1918,2210-2211
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... D•1922
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872 .... D•1942
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 .... D•1946-1947
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 .. A•2565, D•1958
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 .... D•1960
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1965
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272 .... D•2002
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 .... D•2212-2214
Tri-Source Inc., Shelton, CT 06484, 203-924-7030 .... D•2009-2011
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER .... D•2013-2015
Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 .... D•2215
Voltex, Amityville, NY 11701, 516-842-2772 .... D•2217
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 .... D•2041,2218-2220
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001 .... D•2042-2043

Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 613-836-3511
† Adtech Power Inc., Anaheim, CA 92806 714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Alliance Electronics Corp., Wilsonville, OR 97070-0503 503-682-4976
Alpha Dist. Corp., Richfield, OH 44286 .... 216-659-7100; 1-800-628-0841
AMASCO, Torrance, CA 90501 310-781-9494
† Analog Modules, Inc., Longwood, FL 32750-3426 407-339-4355
Andufet Digital Corp., San Dimas, CA 91773 909-394-0171
† Babcock, Inc., Orange, CA 92667 714-633-3700
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 .. 416 298-0560
Cableform Inc., Troy, VA 22974 .... 804 589-8224
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5672
Caritronics Inc., West Caldwell, NJ 07007 201-575-8916
† CEC Electronics Corp., Hauppauge, NY 11788 516-582-4422
CET Technology, Hudson, NH 03051 603-883-5912
Controltek, Inc., Portland, OR 97229 503-641-0876
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549 914-666-2971
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 514-694-9320
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§† Delta Products Corporation, Fremont, CA 94538 510-770-0660
D1 International, Inc., Huntington, NY 11743 516-673-6866
Electromech, Inc., Irvington, NJ 07111 201-318-7999
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174 904-677-7070
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
§ GC International Inc., Plano, TX 75074 214-423-8411
Green Engineering, Melrose, MA 02176 617-665-8994
Henricks Technologies, Inc., Forsyth, GA 31029 .... 912-993-1060;800-241-0806
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706 717-824-4666
Keytronics, Inc., Endicott, NY 13760 607-754-5405
† Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 ... 414-228-5500
Mesa Power Systems, Escondido, CA 92029 619-489-8162
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571

Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Trends, Inc., Batavia, IL 60510	708-406-0900
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN	(03) 3775-9119
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
TMP Inc., Santa Ana, CA 92705	714-558-8028
Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Tumbler Technologies, Fremont, CA 94539	510-651-7724
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803	305-974-2442
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300

Converters, DC to DC, 30 to 50 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 50 to 200 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 100 to 300 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

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Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	D•1512
Advanced High Voltage Company, Tucson, AZ 85751. 602-721-2424;818-997-7222	D•1553
Advanced Power Solutions M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	D•1556
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	D•1557
† **Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500**	D•1574-1576,2056-2057
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221**	D•1585,1587
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	D•1592-1594
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1598-1599
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448	D•1604
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	D•1610
Bel Fuse, Jersey City, NJ 07302, 201-432-0463	D•2074-2075
§ **Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600**	D•1631,1633,2090-2091,2094-2095
Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	D•1646-1647
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	D•2082
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	D•1660-1661
† **EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521**	D•1670
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	D•1691
Fetco, Sanford, FL 32773, 407-321-3800	A•2354
† **HC Power Inc., Irvine, CA 92714-5716, 714-261-2200**	D•1738,1741
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	D•1191
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	D•1750
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	D•1751
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	D•2110
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	D•1765
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	D•1810,1813-1815
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	D•1816,2130
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	D•1837-1838,1843-1844,2136
NWL Transformers, Bordentown, NJ 08505, 609-298-7300	D•1851
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	D•1879-1881
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500	D•2186-2187,2191,2193
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	D•1896-1897
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•1917
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	D•1845
§ **Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654**	D•2211
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872**	D•1942
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2218-2220
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	D•2042
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724	908-389-7761
† Babcock, Inc., Orange, CA 92667	714-633-3700
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
Delta Products Corporation, Fremont, CA 94538	510-770-0660
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
Electromech, Inc., Irvington, NJ 07111	201-318-7999
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Farnell Advance Power, Solon, OH 44139	216-349-0755
Green Engineering, Melrose, MA 02176	617-665-8994
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706	717-824-4666
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Kappa Technologies, Inc., Rahway, NJ 07065	908-396-9400;1-800-223-0603
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
§† Nedap N.V., Groenlo, HOLLAND 7140 AA	+ 31-5440-71111
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
Power-One, Inc., Camarillo, CA 93012	805-987-8741
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803	305-974-2442
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000: 800-544-4636
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603-778-2300

Converters, DC to Sine/Cosine-2325

Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010	D•2225
† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820**	D•1491
§ **Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200**	D•1512,2228-2229
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	D•2230-2231
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	D•1173
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144	D•2260
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	D•2272
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	D•1807,2276
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950**	D•1196
† **Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500**	D•2284-2285
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100**	D•1208
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Belmont Instrument Corp., Billerica, MA 01821	508-663-0212
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
Elgar Electronics Corporation, San Diego, CA 92121	619-450-0085;800-733-5427
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§ Exeltech Inc., Ft. Worth, TX 76118	817-595-4969
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174	904-677-7070
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
Polyphase Instrument, Ft. Washington, PA 19034	215-643-6950
Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200

Converters, DC to Synchro-2325

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ...... D•1172-1173,1175**
Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ...... D•1176
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1190**
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444

Converters, Digital to Analog-2325

† **Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930 ...... D•2067**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ...... D•1172-1173**
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ...... D•1184**
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ...... D•1684**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ...... D•1183**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1190**
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ...... A•1705
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ...... D•1777
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ...... D•1357
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950 ...... D•1196**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ...... D•1016
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ...... D•1208**
Action Instruments, San Diego, CA 92123 619-279-5726
ADAC Corporation, Woburn, MA 01801 617-935-6668
§ Adatek, Inc., Sandpoint, ID 83864 ...... 208-263-1471;800-323-3343
† Addacon Greensboro, Greensboro, NC 27407 919-852-6200
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§ American Advantech Corp., San Jose, CA 95122 408-293-6786
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Avasem Corporation, San Jose, CA 95126 408-297-1201
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Basicon, Inc., Portland, OR 97229 503-626-1012
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
CGRS Microtech, Langhorne, PA 19047 215-757-0284
Cirrus Logic, Inc., Fremont, CA 94538 510-623-8300
Colorado Data Systems, Tektronix, Englewood, CO 80110 ...... 303-762-1640; 800-237-2831
Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
§ Covid, Inc., Tempe, AZ 85281 ...... 602 966-2221
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Datricon, Scientific Technologies, Inc., Hayward, CA 94544 510-471-9717
DGH Corporation, Manchester, NH 03108 603-622-0452
DSP Technology, Fremont, CA 94538-7338 510-657-7555
Durmitor Inc., King City, Ont., CANADA LOG 1K0 416-833-3148
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ...... (0)911/65521 or 65520
§† Harris Semiconductor, Melbourne, FL 32902 ...... 1-800-4 HARRIS
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Lutze, Inc., Charlotte, NC 28217-9805 ...... 704-357-8835;800-447-2371
Matrix Corp., Raleigh, NC 27610 919-231-8000
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032 317-846-1721
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
§† Micro Power Sys. Inc., Santa Clara, CA 95056 408-727-5350
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
§ National Instruments, Austin, TX 78730-5039 512-794-0100
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ Optrex/Satori, Torrance, CA 90503 310-214-1791
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
Parsytec Inc., West Chicago, IL 60185 708-293-9500
PERX,Inc., Corte Madera, CA 94925 415-927-0155
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Quatech Inc., Akron, OH 44311 216-434-3154
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§† Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§† Sipex Corp., Billerica, MA 01821 508-667-8700
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
Sorensen Company, Paxton, IL 60957 800-525-2024
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§ Strawberry Tree, Inc., Sunnyvale, CA 94086 408-736-8800
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ...... 310-822-8229;310-305-0248
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444
§ Wieland Inc., Burgaw, NC 28425 919-259-5050

Converters, Digital to Paper Tape-2000

Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8 ...... 800-361-4914;514-333-1301
§ Dataprobe, Englewood, NJ 07631 201-569-6464

Converters, Digital to Resolver-2325

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ...... D•1172-1175**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ...... D•1176-1177, 1180**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1190**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950 ...... D•1196**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ...... D•1208**
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444

Converters, Digital to Synchro-2325

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ...... D•1172,1174-1175**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ...... D•1176-1177, 1180**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ...... D•1191**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950 ...... D•1196-1197**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ...... D•1208**
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
KineticSystems Corp., Lockport, IL 60441 815-838-0005
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444

Converters, Frequency to Frequency-1900

† **Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ...... D•2224-2225**
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ...... D•2230-2231
† **Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 ...... D•2232,2234,2238-2239**
† **Avtel/Unitron, Dallas, TX 75238, 214-340-8600 ...... D•2241-2243**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ...... D•2248
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ...... D•2256
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ...... D•2099
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ...... D•2257-2258
† **Georator Corp., Manassas, VA 22110-5512, 800-523-9938 ...... D•2261-2263**
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ...... D•2268,2270-2271**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ...... D•2272-2273
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 ...... D•1807,2276
† **Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500 ...... D•2284-2285**
† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ...... D•2286**
† Advanced Power Designs Inc., Irvine, CA 92714 714-263-8605
AEL Defense Corp., Lansdale, PA 19446 215-822-2929

Converters, Frequency to Frequency-1900 (Cont'd)

§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
Avasem Corporation, San Jose, CA 95126 408-297-1201
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
§ Clary Corp., Precision Instrs. Div., Monrovia, CA 91016 818-359-4486
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
# Communication Solutions, Inc., Baltimore, MD 21237 410-574-4557
† Comtech Microwave Corp, Comtech Telecommunications Corp., Melville, NY 11747 516-777-8900
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Durmitor Inc., King City, Ont., CANADA LOG 1K0 416-833-3148
§ Falcon Electric, Monrovia, CA 91016 800-842-6940
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
† International Power Machines, Garland, TX 75042 800-527-1208
Kikusui International Corp., Signal Hill, CA 90804-1203 ..... 310-986-1677;800-545-8784
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Lowell, MA 01851 617-272-3000
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Powernetics LTD., Leics, ENG LE11 1DX 0509 214153
§† Power Star, Inc., Irvine, CA 92713 ..... 714-261-5377;800-854-9420
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3 514-637-1186
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
RGB Spectrum, Alameda, CA 94501 510-814-7000
Sandman Electric Co., Inc., Braintree, MA 02184 617-848-2111
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Converters, Frequency to Voltage-2325

† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ..... D•2230
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 ..... D•2232,2234,2238-2239
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ..... D•1315
§ Action Instruments, San Diego, CA 92123 619-279-5726
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Anadex Inc., Camarillo, CA 93012 805-987-9660
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Avtel/Unitron, Dallas, TX 75238 214-340-8600
Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440 215-362-3500
§ Clary Corp., Precision Instrs. Div., Monrovia, CA 91016 818-359-4486
§ Custom Micro Systems, Inc., Livonia, MI 48151 313-559-5397
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
Durmitor Inc., King City, Ont., CANADA LOG 1K0 416-833-3148
§ Falcon Electric, Monrovia, CA 91016 800-842-6940
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
Scientific Columbus Co., Columbus, OH 43228-4105 614-274-0400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 813-646-3909

Converters, Frequency, Logarithmic-4050

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Communication Solutions, Inc., Baltimore, MD 21237 410-574-4557

Converters, Frequency Shift Keying-1900

† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Dantel, Fresno, CA 93727 209-292-1111
§† Dataproducts New England, Inc., Wallingford, CT 06492 203-265-7151
† Electrocom Industries, S. Bend, IN 46615 219-232-2743

Converters, Graphic to Digital-2000

§ Audre, Inc., San Diego, CA 92127 619-451-2260
Princeton Electronic Products, North Brunswick, NJ 08902 908-297-4448
§ Summagraphics Corp., Seymour, CT 06483 203-881-5400

Converters, Multiplying, Analog to Digital & Digital to Analog-2325

Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930 ..... D•2067
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950 ..... D•1196
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1208
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
§† Micro Power Sys. Inc., Santa Clara, CA 95056 408-727-5350
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
§† Sipex Corp., Billerica, MA 01821 508-667-8700
§ Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Converters, Paper Tape to Magnetic Tape-2000

Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 513-339-2241

Converters, Phase-4050

† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... D•1851
Advanced Control Systems, Costa Mesa, CA 92626-4114 714-540-9010
Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Kikusui International Corp., Signal Hill, CA 90804-1203 ..... 310-986-1677;800-545-8784
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Pacific Power Source Corp., Huntington Bch., CA 92649 ..... 714-898-2691;800-854-2433
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Converters, Polar to Rectangular Coordinates-2325

Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 ..... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... D•1512
† Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ..... D•1142
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1208
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804

Converters, Power Frequency, Electronic-4050

† Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ..... D•2224-2225
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ..... D•2230
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 ..... D•2232-2234,2238-2239
† Avtel/Unitron, Dallas, TX 75238, 214-340-8600 ..... D•2242-2243
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ..... D•2244,2248
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ..... D•2256
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•1685,2257-2258
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•2268,2270-2271
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ..... D•2272-2273
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ..... D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 ..... D•1807,2276
† Modular Devices, Shirley, NY 11967, 516-345-3100 ..... D•1837,2136
† Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500 ..... D•2284-2285
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 ..... D•2291
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Bikor, Microsemi Corporation, Torrance, CA 90501 213-539-6320
California Instruments Corp., San Diego, CA 92123-1509 ..... 619-279-8620; 800-4AC-POWER
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5672
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000:800-526-5088
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
§ Drivecon Corporation, Libertyville, IL 60048 708-918-1406
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 310-635-9555
EWC, Inc., Englishtown, NJ 07726 908-446-3110
§ Exeltech Inc., Ft. Worth, TX 76118 817-595-4969
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
Kikusui International Corp., Signal Hill, CA 90804-1203 ..... 310-986-1677:800-545-8784
Magna-Power Electronics, Inc., Whippany, NJ 07981 201-428-1197
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 714-956-9200

† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Techron Div., Crown Intl., Inc., Elkhart, IN 46517	219-294-8300
Voltex, Amityville, NY 11701	516-842-2772

Converters, Power Frequency, Rotary-4050

† Georator Corp., Manassas, VA 22110-5512, 800-523-9938	**D•2262-2263**
Advanced Control Systems, Costa Mesa, CA 92626-4114	714-540-9010
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724	908-389-7761
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805	714-956-9200

Converters, Pressure to DC, Pressure to Frequency — See Transducers, Pressure (Vol. B)

Converters, Rectangular to Polar-2325

† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000

Converters, Resolver to Digital-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1172-1174**
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1179**
Farrand Controls, Ruhle Companies, Inc., Valhalla, NY 10595, 914-761-2600	**B•1949**
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950	**D•1196-1197**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444

Converters, Rotary — See Motor Generator Sets (Vol. D)

Converters, RS-232/RS-485-2325

§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1351**
§ National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1302**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Dova Controls, Redmond, WA 98052-5165	206-881-7414
Electronic Controls Design, Milwaukie, OR 97222	503-659-6100
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
§ Lutze, Inc., Charlotte, NC 28217-9805	704-357-8835;800-447-2371
§† Sipex Corp., Billerica, MA 01821	508-667-8700

Converters, Serial to Parallel/Parallel to Serial-2325

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
CableStar, Incorporated, Glasgow, KY 42141	800-338-8223
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Greenwich Instruments USA, Charlotte, NC 28205	704-376-1021
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
L-Com Inc., N. Andover, MA 01845	508-682-6936
§ National Instruments, Austin, TX 78730-5039	512-794-0100
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
PERX,Inc., Corte Madera, CA 94925	415-927-0155
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300

Converters, Synchro to Digital-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1172-1175**
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1179**
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	**D•1191**
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950	**D•1196-1197**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Computer Products. Inc, Process Automation, Pompano Beach, FL 33069	305-974-5500
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
KineticSystems Corp., Lockport, IL 60441	815-838-0005
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
† Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444

Converters, Synchro to Linear DC-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1172-1173,1175**
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1177, 1181**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Converters, Synchro to Sine/Cosine-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1173.1175**
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1177, 1181**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884 5200
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Converters, Telemetry-1900

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257

Converters, Thermal-5300 — ***See Vol. B***

Converters, UHF to VHF-1900

Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709	**A•1625**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1403**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† EIP Microwave, Inc., Milpitas, CA 95035	408-945-1477
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Converters, VLF to HF-1900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006	818-574-1175
LF Engineering Company Inc., East Haven, CT 06512	203-467-3590
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
† Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Palomar Engineers, Escondido, CA 92046	619-747-3343
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Converters, Voltage to Frequency-2325

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2258**
Endicott Research Group, Endicott, NY 13760, 607-754-9187	B•1048, D•1687.2106-2107
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807,2276**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
Anadex Inc. Camarillo, CA 93012	805-987-9660
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
† Autronics Corp., Arcadia, CA 91006	818-445-5470
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
§ duTec, Inc., Jackson, MI 49204-0964	800-248-1632
† Dymec Inc., Winchester, MA 01890	617-729-7870
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
Micro Networks, Unitrode Corporation, Worcester, MA 01606	508-852-5400
§† Raytheon Semiconductor, Mountain View, CA 94043	408-522-7068
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§† Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Converters (MIL) DC to DC-2440 – ***See Vol. B***
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Coolants, Circuit & Component — See Refrigerants, Spray (Vol. C)
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Cords, Patch-2100 – ***See Vol. C***
Cords, Power-6000 – ***See Vol. C***
Cords, Retractile-6000 – ***See Vol. C***
Cords, Speaker Extension — See Cable, Audio (Vol. C)
Cords, Telephone, Modular — See Cable, Telephone (Vol. C)
Cords, Twin Lead — See Cable, Multiconductor (Vol. C)
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Cords & Cord Sets, International-6000 – ***See Vol. C***
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Cores, Magnetic, Ferrite, Toroid-1850 – ***See Vol. A***
Cores, Magnetic, Ferrite, Yoke Section-1850 – ***See Vol. A***
Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-1850 – ***See Vol. A***
Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-1850 – ***See Vol. A***
Cores, Magnetic, Nickel-Iron, Toroid-1850 – ***See Vol. A***
Cores, Magnetic, Powdered Iron, Pot/Cup-1850 – ***See Vol. A***
Cores, Magnetic, Powdered Iron, Slug-1850 – ***See Vol. A***
Cores, Magnetic, Powdered Iron, Toroid-1850 – ***See Vol. A***
Cores, Magnetic, Powdered Permalloy, Toroid-1850 – ***See Vol. A***
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Counter/Timers-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665	**D•1151**
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549, 914-666-2971	**D•1158**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1349,1351**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1525**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283,1286**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1360**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1365**
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000	**D•1168**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390**
Acculex Corporation, Taunton, MA 02780	508-880-3660
§ Action Instruments, San Diego, CA 92123	619-279-5726
ADAC Corporation, Woburn, MA 01801	617-935-6668
Anadex Inc., Camarillo, CA 93012	805-987-9660
Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
Codar Technology, Inc., Longmont, CO 80503	303-776-0472
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
† Digitec, Marion, OH 43302	614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
Electronic Displays, Inc., Wood Dale, IL 60191	708-860-5838
ENM Company, Chicago, IL 60646	312-775-8400
§ ESE, El Segundo, CA 90245	310-322-2136
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Holt Inc., Irvine, CA 92718	714-859-8800
§ IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ Industrial Timer Co., Centerbrook, CT 06705	203-767-7130
§ International Microtronics, Tucson, AZ 85714	602-748-7900
International Test Instruments, Tustin, CA 92680	714-573-9000
ITF Corp., Buford, GA 30518	404-945-3844
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Prema Precision Electronics, Inc., Montclair, CA 91763	714-621-7292
Quatech Inc., Akron, OH 44311	216-434-3154
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Red Lion Controls, York, PA 17402	717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Spectrum Corp., Houston, TX 77075	713-944-6200;1-800-392-5050(Sls)
§ Square D Co., Palatine, IL 60067	708-397-2600

§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036	704-892-8872
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
Timeco, Inc., Huntington, WV 25705	304-523-5149
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Trumeter Company, Inc., New York, NY 10001	212-564-0666;800-537-2261
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661	916-783-7878
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Counters, Bidirectional-2200

DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000	**D•1168**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
† Atec, Inc., Houston, TX 77055	713-468-7971
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§ Chrono-log Corp., Havertown, PA 19083	800-247-6665
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Dynapar, Gurnee, IL 60031	312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ ESE, El Segundo, CA 90245	310-322-2136
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Red Lion Controls, York, PA 17402	717-767-6511
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Trumeter Company, Inc., New York, NY 10001	212-564-0666;800-537-2261
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661	916-783-7878
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005	314-532-5887

Counters, Coil Winding-2200

† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
Coil Winding Equipment Co., Oyster Bay, NY 11771	516-922-5660
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Dynapar, Gurnee, IL 60031	312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Trumeter Company, Inc., New York, NY 10001	212-564-0666;800-537-2261

Counters, Decade-2200

§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	**D•1351**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ ESE, El Segundo, CA 90245	310-322-2136
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500

Counters, Directional-2200

DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**D•1162**
Anadex Inc., Camarillo, CA 93012	805-987-9660
Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Dynapar, Gurnee, IL 60031	312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
§ ESE, El Segundo, CA 90245	310-322-2136
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
§ Red Lion Controls, York, PA 17402	717-767-6511
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Counters, Electromagnetic-2200

Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000	**D•1168**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§† Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
Electric Tachometer, Philadelphia, PA 19142	215-726-7723
§ Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Trumeter Company, Inc., New York, NY 10001	212-564-0666;800-537-2261

Counters, Event-2200

§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665**	**D•1151**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
† **Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740**	**D•1159**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437**	**D•1345**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**D•1162**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1360-1361**
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000	**D•1168**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
† Atec, Inc, Houston, TX 77055	713-468-7971
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549 914-666-2971
§† Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
† Digitec, Marion, OH 43302 614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094 ...... 414-261-4070;800-289-3866
Excel Technology Intl. Corp., Belle Mead, NJ 08502 908-874-4747
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
† Oxley Inc., Branford, CT 06405 203-488-1033
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410 203-271-6000
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Quatech Inc., Akron, OH 44311 216-434-3154
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§ Redington Counters, Windsor, CT 06095 203-688-6205
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectrum Corp., Houston, TX 77075 .... 713-944-6200;1-800-392-5050(Sls)
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Tenor Controls Comp, New Berlin, WI 53151 414-782-3800
† Velonex, Santa Clara, CA 95050 408-727-7370
§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Counters, Frequency-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .. D•1231
DCI Inc., Olathe, KS 66062, 913-782-5672 .... D•1344
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 .... B•1043
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 .... D•1345**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ...... D•1379
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537 .... D•1745**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1283,1286,1288
§ **Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1360-1361**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1379
§ Action Instruments, San Diego, CA 92123 619-279-5726
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
§ Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
Anadex Inc., Camarillo, CA 93012 805-987-9660
† Atec, Inc., Houston, TX 77055 713-468-7971
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
Coaxial Dynamics, Cleveland, OH 44135 .... 1-800-COAXIAL
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845 508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Custom Micro Systems, Inc., Livonia, MI 48151 313-559-5397
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
† Digitec, Marion, OH 43302 614-387-3444
DSP Technology, Fremont, CA 94538-7338 510-657-7555
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Eaton Corp, Durant Products, Watertown, WI 53094 ...... 414-261-4070;800-289-3866
§† EIP Microwave, Inc., Milpitas, CA 95035 408-945-1477
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Elpaz Instruments, Inc., Murrysville, PA 15668 412-327-8744
ENM Company, Chicago, IL 60646 312-775-8400
EPD Electronics, Inc., Gardena, CA 90247 310-515-4996
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 203-624-3103
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701 310-404-0101
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
§ HC Protek, Northvale, NJ 07647 201-767-7242
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
§ International Microtronics, Tucson, AZ 85714 602-748-7900
International Test Instruments, Tustin, CA 92680 714-573-9000
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441 815-838-0005
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Optoelectronics, Inc., Ft. Lauderdale, FL 33334 305-771-2050
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131 708-288-4471
§† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
§ Red Lion Controls, York, PA 17402 717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
† Sundstrand Data Control, Redmond, WA 98073-9701 206-885-3711
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044 1-800-523-3696
§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
† XL Microwave, Oakland, CA 94609 510-428-9488

Counters, Mechanical-2200

Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000 .... D•1168
† Abrams Instrument Corp., Lansing, MI 48910-3688 517-882-7211
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 .... 908-819-7070; 908-572-0500
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§† Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
§ Eaton Corp, Durant Products, Watertown, WI 53094 ...... 414-261-4070;800-289-3866
Electric Tachometer, Philadelphia, PA 19142 215-726-7723
ENM Company, Chicago, IL 60646 312-775-8400
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
§ IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
§ Metermaster, Tempe, AZ 85282 602-431-0015
# Meylan Corporation, Upper Montclair, NJ 07043-1844 201-744-6400
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410 203-271-6000
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
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§ Trumeter Company, Inc., New York, NY 10001 .... 212-564-0666;800-537-2261
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§ Eaton Corp, Durant Products, Watertown, WI 53094 ...... 414-261-4070;800-289-3866
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Macrodyne Inc., Clifton Pk., NY 12065 518-383-3800
† Nuclear Research Corp., Warrington, PA 18976 215-343-5900

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Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1325
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AVO International, TBG, Dallas, TX 75237 214-333-3201
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
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§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
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§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
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§ Trumeter Company, Inc., New York, NY 10001 ... 212-564-0666;800-537-2261

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§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345
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HEI, Inc., Optoelectronics Div., Victoria, MN 55386 ... 612-443-2500

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Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283**
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§ Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
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Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549	914-666-2971
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
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† Microphase, Norwalk, CT 06856	203-866-8000
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† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
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# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
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† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100**	**B•1914-1915**
† **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900**	**D•1152-1153,1237**
Best Technology Inc., Seattle, WA 98109, 206-382-1300	**B•1863**
† **Bicron Electronics, Canaan, CT 06018, 203-824-5125**	**B•1919**
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GMW Associates, Redwood City, CA 94064, 415-368-4884	**B•1951**
Isotek Corporation, Swansea, MA 02777, 508-673-2900	**A•1953-1955**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964-1966, D•1294**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1971**
† **Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561**	**B•1982-1986,1988-1990,1992-1993,1995,1998,2000-2001**
† **Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444**	**A•2454**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1589**
TMP Inc., Santa Ana, CA 92705, 714-558-8028	**A•1300**
U.R.D. America, Laguna Nigel, CA 92607, 714-831-0111	**D•1169**
§ **World Products Inc., Sonoma, CA 95476, 707-996-5201**	**A•2224**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Amptec Electronics, San Diego, CA 92128	619-578-7816
† Automatic Coil Corp., Miami, FL 33147	305-696-6660
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Cross Electronics, Warrendale, PA 15086	412-776-1591
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Electric Device, Canfield, OH 44406	216-533-1111
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† Electro National Corp., Canton, MS 39046	601-859-5511
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
§ Fee Fil-Mag, San Diego, CA 92123	619-569-6577
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ GC International Inc., Plano, TX 75074	214-423-8411
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Ion Physics Corporation, Atkinson, NH 03811	603-893-6687
† KRL/Bantry Components, Inc., Manchester, NH 03103	603-668-3210
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
MetriCor, Inc., Woodinville, WA 98072	206-483-5577
Omega Engineering, Stamford, CT 06907	800-826-6342
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577	415-577-7236
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
§ Relay Specialties, Oakland, NJ 07436	201-337-1000

Scientific Instruments, West Palm Beach, FL 33407 ... 407-881-8500
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ... 510-471-9717;800-221-7060
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 ... 214-466-6000
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
§ SSAC Incorporated, Baldwinsville, NY 13027 ... 315-638-1300
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
Texas Instruments, Connector Systems, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 508-699-3800
§ Time Mark Corp., Tulsa, OK 74116 ... 918-438-1220
§ Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
† Toroid Corp. of Maryland, Salisbury, MD 21801 ... 410-860-0300
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
Vishay Resistors, Malvern, PA 19355 ... 215-644-1300
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
† Wilmar Electronics, Inc., Torrance, CA 90505 ... 310-326-6668
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
World Products Inc., Systems Devices Grp., Sonoma 95476 ... 707-996-5201

Current Sources-4000

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ... D•1234
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 ... D•1247
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ... D•1656
Φ **Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696 ... D•1253**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 ... D•1678-1679
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1272
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2269,2271**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 ... D•2274
Julie Research Labs., New York, NY 10001, 212-633-6625 ... D•1279,1281
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ... D•2300**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1328
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 ... 203-281-3200
Analog Systems, Tucson, AZ 85731-7389 ... 602-290-1818
Φ AYA-Instruments, Inc., Pittsburgh, PA 15213 ... 412-622-5500
Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
Behlman Electronics Inc., Lake Success, NY 11042 ... 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 ... 805-642-0660
Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
California Instruments Corp., San Diego, CA 92123-1509 ... 619-279-8620; 800-4AC-POWER
† Christie Electric Corp., Gardena, CA 90248 ... 310-715-1402
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
Energy Systems, Vancouver, WA 98682 ... 206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 ... 310-635-9555
John Fluke Mfg. Co., Inc., Everett, WA 98203 ... 206-347-6100
Geiger Electronics, Inc., Port Washington, NY 11050 ... 516-767-0700
General Resistance, A Prime Technology Company, N. Branford, CT 06471 ... 203-481-5721
GMW Associates, Redwood City, CA 94064 ... 415-368-4884
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Keithley Instrs., Cleveland, OH 44139 ... 800-552-1115
Kikusui International Corp., Signal Hill, CA 90804-1203 ... 310-986-1677;800-545-8784
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 ... 609-296-9686
§† Linear Technology Corp., Milpitas, CA 95035-7487 ... 408-432-1900
MACROAMP Inc., Ukiah, CA 95482 ... 800-458-8892
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 ... 714-474-3900
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Optronic Laboratories, Inc., Orlando, FL 32811 ... 407-422-3171;800-899-3171
Phenix Technologies, Accident, MD 21520 ... 301-746-8118
§ Power Designs, Inc., Westbury, NY 11590 ... 516-333-6200
Scientific Instruments, West Palm Beach, FL 33407 ... 407-881-8500
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548 ... 904-244-0043
§ Voltex, Amityville, NY 11701 ... 516-842-2772
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 ... (415) 326-2151

Custom Molding Services, Plastics — See Services, Custom Molding, Plastics (Vol. D)
Cutters, Diagonal — See Cutters, Manual (Vol. C)
Cutters, Wire, Automatic — See Machines, Wire Measuring & Cutting (Vol. D)
Cutters, Wire, Manual-5400 – ***See Vol. C***

Dampers, Servo-4900

† Control Technology Co., Inc., Long Island City, NY 11101 ... 718-361-2133
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408 ... 1-800-328-5111
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 ... 818-889-3179
† Industrial Control Co., Rockledge, FL 32955 ... 407-259-7105
Soundcoat Co., Inc., Deer Park, NY 11729-5701 ... 516-242-2200
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 ... 516-586-5100

Dampers, Structural, Chassis, Panel, etc. — See Mounts, Shock & Vibration (Vol. C)

Data Acquisition & Reduction Systems-Also See Modules, Data Acquisition-2325

Analogic Corp., Peabody, MA 01960, 508-977-3000 ... D•1170
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000 ... D•1083
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1184-1185**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... D•1182-1183**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1145.1204-1205,1374-1375
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ... D•1190**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 ... D•1283,1285
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 ... D•1147,1198**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... C•1792, D•1101,1199,1415
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ... D•1200-1202
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1145,1204-1205.1374-1375
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411 ... D•1077,1207**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ... D•1208**
§Φ **Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385 ... D•1417**
Acromag Inc., Wixom, MI 48393-7037 ... 313-624-1541
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
ADAC Corporation, Woburn, MA 01801 ... 617-935-6668
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
§ Allen- Bradley Co., Div, of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
# Alligator Technologies, Fountain Valley, CA 92708 ... 714-850-9984
Alpha Omega Computer Systems, Corvallis, OR 97333 ... 503-754-1911
§ American Advantech Corp., San Jose, CA 95122 ... 408-293-6786
American Control Technology, Inc., Elgin, IL 60123-1203 ... 708-468-6000
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 ... 508-977-3000
Andufet Digital Corp., San Dimas, CA 91773 ... 909-394-0171
† Artronics Corporation, Portsmouth, NH 03802-5070 ... 603-433-3111
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
† Astro Dynamics, Inc., Woburn, MA 01801 ... 617-935-4944
† Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 ... 212-228-0900
Aydin Corp., Horsham, PA 19044 ... 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 ... 215-968-4271
Basicon Inc., Portland OR 97229 ... 503-626-1012
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 ... 800-523-2702;601-467-8231
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 ... 306-975-1080
Bently Nevada Corp., Minden, NV 89423 ... 800-227-5514;702-782-3611
Biomation Instruments, Almonte, Ont., CANADA K0A1A0 ... 613-256-2821
§ Bristol Babcock Inc., Watertown, CT 06795 ... 203-575-3000;800-395-5497
Burr-Brown Corp., Tucson, AZ 85734 ... 602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 ... 909-394-4410
CGRS Microtech, Langhorne, PA 19047 ... 215-757-0284
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940 ... 215-968-0660
† Climatronics, Bohemia, NY 11716 ... 516-567-7300
Colorado Data Systems, Tektronix, Englewood, CO 80110 ... 303-762-1640; 800-237-2831
§† Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 ... 305-974-5500
§ Contec Microelectronics USA, San Jose, CA 95131 ... 408-434-6767;1-800-888-8884
† Control Technology Co., Inc., Long Island City, NY 11101 ... 718-361-2133
Creare Inc., Hanover NH 03755 ... 603 643 3800
§ Cyber Sys., Inc., Anaheim, CA 92806 ... 714-502-6950
§ Dancer Communications, Inc., Seçane, PA 19018 ... 215-543-8066
† Datacom, Inc., Ft. Walton Beach, FL 32549 ... 904-244-6121
Data Environment, Inc., Portland, OR 97291 ... 503-531-0765
Dataq Instruments, Inc., Akron, OH 44333 ... 216-668-1444
Data Translation, Inc., Marlboro, MA 01752 ... 508-481-3700
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 ... 513-866-3300
DEPAC Corp., Rome, NY 13440 ... 315-339-1265
Dianachart Inc., Rockaway, NJ 07866 ... 201-625-2299
Digital Dynamics, Inc., Scotts Valley, CA 95066 ... 408-438-4444
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
† Digitec, Marion, OH 43302 ... 614-387-3444
DSP Technology, Fremont, CA 94538-7338 ... 510-657-7555
duTec, Inc., Jackson, MI 49204-0964 ... 800-248-1632
Dymec Inc., Winchester, MA 01890 ... 617-729-7870
Dynage/Controls, Inc., Canistota, SD 57012 ... 605-296-3487
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 ... 818-998-8281
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
§ Electro Rent Corp., Van Nuys, CA 91411 ... 800-688-1111
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2106
Eltek Corporation, Hagerstown, IN 47346 ... 317-489-6121
Environmental Telesis & Controls, Austin, TX 78718 ... 512-835-0330
ETM Electromatic Inc, Newark, CA 94560 ... 510-797-1100
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 ... 206-347-6100
Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 ... 203-624-3103
Gould Inc., Test and Measurement Group, Valley View, OH 44125 ... 216-328-7000
Gutwerk Instruments Inc., McKeesport, PA 15132 ... 412-672-3668
† Hancock Electronics Corp., Hingham, MA 02043 ... 617-740-4190
Harrel, Inc., E. Norwalk, CT 06855 ... 203-866-2573
HDS Inc., Reston, VA 22091 ... 703-620-6200

§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705	602-623-9801
§ Interactive Circuits Systems Ltd., Gloucester, Ont., CANADA K1J 9G2	613-749-9241; 1-800-267-9794
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ International Data Aquistion & Control, Inc., Amherst, NH 03031	603-673-0765
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
ITF Corp., Buford, GA 30518	404-945-3844
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
Lambert Engineering Inc., Bend, OR 97702-2181	503-388-2623
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
† Librascope Corp., Loral Corp., Glendale, CA 91201	818-244-6541
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
§Φ Logic Beach Inc., La Mesa, CA 91941	619-698-3300
Loral Data Systems, Sarasota, FL 34230	813-371-0811
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
§ Macrodyne Inc., Clifton Pk., NY 12065	518-383-3800
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
Meissner Industries, Dover, NJ 07801	201-366-1700
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
§ Metra Corporation, San Jose, CA 95131	408-432-1110
† Metraplex Corp., Frederick, MD 21701	301-662-8000
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§ Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
Microstar Laboratories, Inc., Bellevue, WA 98004	206-453-2345
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Neff Instr., Monrovia, CA 91016	818-357-2281
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
Octagon Systems, Westminster, CO 80030	303-430-1500
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
§ Opto 22, Temecula, CA 92590	714-695-9299
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
PERX,Inc., Corte Madera, CA 94925	415-927-0155
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245	213-322-9370
Pressure Systems, Inc., Hampton, VA 23666	804-865-1243
§ Pulse Instruments Co., Torrance, CA 90502	310-515-5330
Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
RMS Instruments, Mississauga, Ont., CAN L5T 1R2	416-564-5533
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821	508-671-9700;1-800-225-5765
SCOPE Incorporated, Reston, VA 22090	703-471-5600
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
§ Sierra Monitor Corp., Milpitas, CA 95035	408-262-6611
Signum, Inc., Watertown, MA 02172-3356	617-926-3566
§† Sipex Corp., Billerica, MA 01821	508-667-8700
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
†# Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
§ Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
Systems Data, Inc., Akron, OH 44321	216-666-0085
Systran Corp., Dayton, OH 45432-3068	1-800-252-5601
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
TCA, Montebello, CA 90640	213-726-0303
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4	514-694-9136
§ Westronics Inc. of Texas, A Baker Hughes Co., Ft. Worth, TX 76161	817-625-2311
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Data Collection Equipment, Hand Held-2000

Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**D•1088-1091**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1415**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
† **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202**	**D•1416**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Control Module, Enfield, CT 06082	203-745-2433
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
Epson America Inc., Component Sales Dept., Torrance, CA 90503	310-782-5318
† Hand Held Products, Inc., Charlotte, NC 28226	704-541-1380
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Kelmet, Inc., San Dimas, CA 91773	714-599-0954
§Φ Logic Beach Inc., La Mesa, CA 91941	619-698-3300
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Voice Connexion, Irvine, CA 92714	714-261-2366
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945

Data Collection Equipment, Modular-2000

Analogic Corp., Peabody, MA 01960, 508-977-3000	**D•1170**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Matrix Corp., Indianapolis, IN 46241, 317-248-2036	**D•1195**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1415**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389**
Acromag Inc., Wixom, MI 48393-7037	313-624-1541
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
† Cable & Computer Technology Inc., Anaheim, CA 92806	714-937-1341
California Automation Inc., San Diego, CA 92121	619-452-1341
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
† Climatronics, Bohemia, NY 11716	516-567-7300
Control Module, Enfield, CT 06082	203-745-2433
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
Data Environment, Inc., Portland, OR 97291	503-531-0765
Davidge Corporation, Buellton, CA 93427	805-688-9598
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
Environmental Telesis & Controls, Austin, TX 78718	512-835-0330
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
§Φ Logic Beach Inc., La Mesa, CA 91941	619-698-3300
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Monicor Electronic Corp., Ft. Lauderdale, FL 33309	305-979-1907
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415

Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
§ Sierra Monitor Corp., Milpitas, CA 95035	408-262-6611
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
§ Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
Systems Alternatives, Maumee, OH 43537	419-891-1100
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Visionary Electronics, San Francisco, CA 94118	415-751-8811
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Data Collection Equipment, Portable-2000

Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1411**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1415**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
† **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202**	**D•1416**
§ ACR Systems Inc., Surrey,B.C., CANADA V3W 4N8	604-591-1128
ADAC Corporation, Woburn, MA 01801	617-935-6668
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Climatronics, Bohemia, NY 11716	516-567-7300
Comptus Inc., New Boston, NH 03070	603-487-5512
Control Module, Enfield, CT 06082	203-745-2433
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
Data Environment, Inc., Portland, OR 97291	503-531-0765
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
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DSP Technology, Fremont, CA 94538-7338	510-657-7555
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Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Monicor Electronic Corp., Ft. Lauderdale, FL 33309	305-979-1907
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
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§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
TCA, Montebello, CA 90640	213-726-0303
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116	215-464-9300
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Data Compressors, Digital-2000

Avasem Corporation, San Jose, CA 95126	408-297-1201
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Loral Data Systems, Sarasota, FL 34230	813-371-0811
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311

Data Display Indicators — See Displays Indicator Lights (Vol. B)

Data Display Systems — See Displays, CRT (Vol. A), Terminals, Data Display (Vol. D)

Data Links, Fiber Optic-2475 – *See Vol. B*

Data Links, Optical-2000

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1207-1208, C•1163**
Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**B•1210**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1122-1123**
Aborn Electronics Inc., San Jose, CA 95131	408-436-5444
§Φ American Laser Systems, Inc., Santa Barbara, CA 93160	805-967-0423
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ Codenoll Technology Corp., Yonkers, NY 10701	914-965-6300
Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8	800-361-4914;514-333-1301
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Dymec Inc., Winchester, MA 01890	617-729-7870
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ KEL Connectors, Inc., KEL Corp., Sunnyvale, CA 94086	408-720-9044
Lextel, Inc., Wakefield, MA 01880	617-245-5017
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Optelecom, Inc., Gaithersburg, MD 20877	301-840-2121
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Systran Corp., Dayton, OH 45432-3068	1-800-252-5601
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444

Data Loggers-2325

Analogic Corp., Peabody, MA 01960, 508-977-3000	**D•1170**
† **Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000**	**D•1411**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700	**D•1098**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1101,1199,1314. 1415**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1202**
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Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512	**D•1108-1111**
§ **Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827**	**D•1112**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372**
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Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
§ American Advantech Corp., San Jose, CA 95122	408-293-6786
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
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Climatronics, Bohemia, NY 11716	516-567-7300
Comptus Inc., New Boston, NH 03070	603-487-5512
Computer Devices, Nutting Lake, MA 01865	508-663-4980
§ Dancer Communications, Inc., Secane, PA 19018	215-543-8066
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† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
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Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
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ITF Corp., Buford, GA 30518	404-945-3844
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
Kelmet, Inc., San Dimas, CA 91773	714-599-0954
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Lambert Engineering Inc., Bend, OR 97702-2181	503-388-2623

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§ Soltec Corp., San Fernando, CA 91340-1597 .... 818-365-0800;800-423-2344
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
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Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
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Xico, Inc., Chatsworth, CA 91311 818-709-4403

Data Recording, Hard Disk-2000

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Φ Western Graphtec, Inc., Irvine, CA 92718-2067 .... 714-770-6010;800-854-8385

Data Security Devices: Encryptors, Decryptors — See Security Systems, Data (Vol. D)
Data Switches — See Switches, Data (Vol. D)
Data Systems (MIL)-2440 — ***See Vol. B***
Data Translators — See Translators, Data
DCXO — See Oscillators, Digitally Compensated Crystal (Vol. A)

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Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1280
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§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
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§ Metermaster, Tempe, AZ 85282 602-431-0015
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
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§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
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Decade Boxes, Transformer-2900

† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Magnetico Inc., Holtsville, NY 11742 516-654-1166

Decalcomania-Also See Labels, Pressure Sensitive-2400 — ***See Vol. C***
Decapsulation Services — See Services, Decapsulation (Vol. D)
Decoders, Binary To Decimal — See Converters, Binary To Decimal (Vol. D)
Decoders, Digital To Analog — See Converters, Digital To Analog (Vol. D)

Decoders, Pulse-1900

† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1537
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300
Voice Identification, Somerville, NJ 08876 908-526-3408

Decoders, Readout — See Drivers & Decoders For Readouts (Vol. B)
Decoders, Telemetry — See Decoders, Tone (Vol. D)

Decoders, Tone-1900

Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
Aprotek, Rogue River, OR 97537 503-582-2120
† A.R.F. Prods., Boulder, CO 80307-3128 303-499-2946
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
Dantel, Fresno, CA 93727 209-292-1111
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Exar Corp., San Jose, CA 95161-9007 408-434-6400
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Kappa Technologies, Inc., Rahway, NJ 07065 .... 908-396-9400;1-800-223-0603
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
† Micro Systems, Inc., Ft. Walton Beach, FL 32548-3858 904-244-2332
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
Palomar Engineers, Escondido, CA 92046 619-747-3343
RFL Electronics Inc., Boonton, NJ 07005-0239 201-334-3100
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
Voice Identification, Somerville, NJ 08876 908-526-3408

Decoders, Video-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1186,1189
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234 310-921-7775
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Video Automation Systems, Pound Ridge, NY 10576 914-764-4613

Decontaminants — See Cleaners & Solvents (Vol. C)
Decoys (MIL), Buoy-2440 — ***See Vol. B***
Decoys (MIL), IR Flare-2440 — ***See Vol. B***
Decryptors — See Security Systems, Data (Vol. D)

Deep Drawn Metal Cases, Enclosures, Stampings — See Cases, Equipment, Instrument, Meter (Portable) (Vol. C), Cases Equipment, Instrument, Meter (Stationary) (Vol. C), Enclosures, Metal (Vol. C), Stampings (Vol. C)
Degaussers — See Demagnetizers (Vol. C), Coils, Degaussing (Vol. A)
Degreasers & Cleaners, Machine — See Machines, Cleaning & Degreasing (Vol. D)
Degreasing Chemicals — See Cleaners & Solvents (Vol. C)

Dehydrators-4100

Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Dielectric Communications, General Signal, Raymond, ME 04071 .... 207-655-4555; 800-341-9678
† Gabriel Elctrns. Inc., Scarborough, ME 04070 207-883-5161

Delay Generators — See Generators, Timing Digital (Vol. D)
Delay Lines, Active-2350 — *See Vol. A*
Delay Lines, CMOS-2350 — *See Vol. A*
Delay Lines, Cable-2350 — *See Vol. A*
Delay Lines, Digital-2350 — *See Vol. A*
Delay Lines, Distributed Constant (Fixed)-2350 — *See Vol. A*
Delay Lines, ECL-2350 — *See Vol. A*
Delay Lines, Lumped Constant (Fixed)-2350 — *See Vol. A*
Delay Lines, Programmable-2350 — *See Vol. A*
Delay Lines, SAW — See Surface Acoustic Wave Devices (Vol. A)
Delay Lines, TTL-2350 — *See Vol. A*
Delay Lines, Ultrasonic-2350 — *See Vol. A*
Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. A)
Delay Lines (MIL)-2440 — *See Vol. B*
Demagnetizers-1850 — *See Vol. A*

Demodulators-1900

† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† A.R.F. Prods., Boulder, CO 80307-3128 303-499-2946
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
† CATEL Telecommunications, Fremont, CA 94537 510-659-8988
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
§† Exar Corp., San Jose, CA 95161-9007 408-434-6400
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Loral Data Systems, Sarasota, FL 34230 813-371-0811
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
MicroSignals Inc., L.I.C., NY 11101 .... 718-937-7955;718-937-0391;800-648-2252
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Peca, Inc., Bensalem, PA 19020 215-245-1550
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§ Telemet, Geotel, Inc., Hauppauge, NY 11788 516-436-7260
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Demodulators, Magnetic-2200

† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Densitometers-2900

† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ Graphics Microsystems, Inc., Dallas, TX 75225 .... 214-340-4584;800-527-1207
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587

Deposition Equipment, Vacuum & Accessories-Also See Evaporation Equipment, Electron Beam-4100

Ceramaseal, New Lebanon, NY 12125 518-794-7800
CHA Industries, Fremont, CA 94538 510-683-8554
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854 203-853-9500
§ CVC Products, Inc., Rochester, NY 14603 716-458-2550
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004 201-882-8033
§ Ferrofluidics Corp., Nashua, NH 03061 603-883-9800
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
Jori Resources, Ventura, CA 93003 805-642-2266
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714 315-434-1100
Materials Research Corporation, Orangeburg, NY 10962 914-359-4200
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252 707-423-2100
§† ULVAC North America Corporation, Kennebunk, ME 04043 207-985-2973
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300

Desiccators — See Dehumidifiers (Vol. C)
Desks, Data Terminal — See Benches, Consoles, Tables (Vol. C)
Desoldering Tools & Equipment — See Soldering Accessories (Vol. C), Soldering Equip. (Vol. C), Soldering Guns (Vol. C), etc.
Detection & Ranging Systems (MIL)-2440 — *See Vol. B*
Detection Systems, Laser-3700 — *See Vol. B*

Detectors, Air Flow-2900

Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
Climatronics, Bohemia, NY 11716 516-567-7300
COLE-PARMER Instrument Company, Niles, IL 60714 708-647-7600
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
Intek, Inc., Westerville, OH 43081 614-895-0301
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ TIF Instruments, Inc., Miami, FL 33150 305-757-8811
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057

Detectors, Arc (for high power tubes)-2900

Gutwerk Instruments Inc., McKeesport, PA 15132, 412-672-3668 .... D•1161

Detectors, RF-2900

† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
MicroSignals Inc., L.I.C., NY 11101 .... 718-937-7955;718-937-0391;800-648-2252
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Detectors, Bar Code — See Readers, Bar Code (Vol. D)

Detectors, Coaxial-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 .... A•1725
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702 805-499-5902
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England .... 44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Detectors, Corona — See Testers, Corona (Vol. D)
Detectors, Crystal-2300 — *See Vol. A*
Detectors, Fiber Optic-2475 — *See Vol. B*

Detectors, Flaw & Defect-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518 .... D•1240
§ Advanced Video Products, E-Systems, Westford, MA 01886 508-692-2020
Autronics Corp., Arcadia, CA 91006 818-445-5470
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
A/Z-Tech, Inc. R&D Lab, Indiana Institute of Technlg., Fort Wayne, IN 46803 219-422-5561
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Direct Conversion Technique, Inc., Chicago, IL 60641 312-283-1690
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Panametrics, Waltham, MA 02154-3497 617-899-2719
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Techno Scientific Inc., Woodbridge, Ont, CANADA L4L 5Y9 905-851-9958
§ UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788

Detectors, GaAs-3450 – ***See Vol. A***

Detectors, Gas-2900

Chestec Corporation, Port Washington, NY 11050	516-883-1700
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538	510-226-1329
JEMA, Wilmette, IL 60091	708-251-3600
§ Laser Imaging Systems Inc., Punta Gorda, FL 33950	813-639-3533
Lumidor Saftey Products, SafteyTek Corp., Miramar, FL 33025	305-433-7000
§ Metermaster, Tempe, AZ 85282	602-431-0015
Servomex Company, Inc., Norwood, MA 02062	617-769-7710
§ Sierra Monitor Corp., Milpitas, CA 95035	408-262-6611
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325

Detectors, Impedance — See Meters, Impedance (Vol. D)
Detectors, Infrared-3700 – ***See Vol. B***

Detectors, Leak-2900

§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
§ Ansonics, Inc., Halfway, OR 97834	503-742-7475
Approved Purification Corp., Stamford, CT 06907	203-357-0141
Chestec Corporation, Port Washington, NY 11050	516-883-1700
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
§ Gow-Mac Instr. Co., Bound Brook, NJ 08805-0032	908-560-0600
Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
§ International Sensor Technology, Irvine, CA 92714	714-863-9999
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056	708-803-5100
§ Laser Imaging Systems Inc., Punta Gorda, FL 33950	813-639-3533
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714	315-434-1100
Lumidor Saftey Products, SafteyTek Corp., Miramar, FL 33025	305-433-7000
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
# MEGA Systems & Chemicals, Phoenix, AZ 85040	602-437-9105
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102	216-281-1100
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Process & Analytical Instruments Div., A Subsidiary of Ametek Inc., Pittsburgh, PA 15238	412-828-9040
Scott Specialty Gases, Inc., Plumsteadville, PA 18949-0130	215-766-8861
Sensidyne, Inc., Clearwater, FL 34620	813-530-3602;1-800-451-9444
§ Sierra Monitor Corp., Milpitas, CA 95035	408-262-6611
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
†Φ U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300

Detectors, Light Intensity — See Meters, Light, Nonphotographic (Vol. D)
Detectors, Magnetic — See Meters, Gauss (Vol. D)

Detectors, Metal, Handheld-4100

Allen Technology, Sutton, NE 68979	402-773-5285
† Infinetics Inc., Friskem Div., Wilmington, DE 19802	302-658-2471
§ Metermaster, Tempe, AZ 85282	602-431-0015

Detectors, Metal, Walk Through-4100

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Infinetics Inc., Friskem Div., Wilmington, DE 19802	302-658-2471
§ Metermaster, Tempe, AZ 85282	602-431-0015

Detectors, Microwave-3450 – ***See Vol. A***
Detectors, Null — See Indicators, Null (Vol. D)

Detectors, Phase Sensitive-2900

† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500**	**A•1725**
Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Autronics Corp., Arcadia, CA 91006	818-445-5470
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Evans Electronics, Berkeley, CA 94705	510-653-3083
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831	510-471-9717;800-221-7060
Silicon Sensors, Dodgeville, WI 53533	608-935-2707
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
Synergy Microwave Corporation, Paterson, NJ 07504	201-881-8800
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
Transmagnetics, Farmingdale, NY 11735	516-293-3100

Detectors, Photovoltaic — See Cells, Photovoltaic (Vol. B)

Detectors, RF-2900

Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
† Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
† EMC Technology Inc, Cherry Hill, NJ 08034	609-429-7800
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199	617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Metropole Products Inc., Stafford, VA 22554	703-659-2132
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369	909-392-5833
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
Peca, Inc., Bensalem, PA 19020	215-245-1550
† RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652	714-494-9401
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Detectors, Radiation-2900

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
† Graseby Infrared, Graseby PLC, Orlando, FL 32826	407-282-7700
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
Keithley Instrs., Cleveland, OH 44139	800-552-1115
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
† Nuclear Research Corp., Warrington, PA 18976	215-343-5900
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586
§ Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638

Detectors, Resistance Temperature (RTDs) — See Thermometers, Resistance (Vol. D)

Detectors, Standing Wave-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Direct Conversion Technique, Inc., Chicago, IL 60641	312-283-1690
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Maury Microwave Corp., Ontario, CA 91764	909-987-4715
† Microlab/FXR, Livingston, NJ 07039	201-992-7700
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801	617-935-8610
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070

Detectors, Tone-1900

§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
Frequency Devices, Inc., Haverhill, MA 01830	508-374-0761
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925

Detectors, Ultraviolet-2900

† **Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902**	**B•1312,1315**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1318**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§ EG & G Vactec, St. Louis, MO 63132	314-423-4900
Eltec Instruments Inc., Daytona Bch., FL 32120	904-253-5328
The Eppley Laboratory, Inc., Newport, RI 02840	401-847-1020
Galileo Electro-Optics Corp., Sturbridge. MA 01566-0550	508-347-9191
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
International Light, Newburyport, MA 01950-4092	508-465-5923
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Scientech, Inc., Boulder, CO 80303	303-444-1361;800-525-0522

Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707
Silonex Inc., Plattsburgh, NY 12901	518-561-3160
§† Spectronics Corp., Westbury, NY 11590	516-333-4840/1-800-274-8888
Spiricon, Inc., Logan, UT 84321	801-753-3729
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
Swan Associates, New Haven, CT 06534	203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586
§ UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788

Detectors, Vacuum-4100

Best Technology Inc., Seattle, WA 98109	206-382-1300
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102	216-281-1100
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811

Detectors,Vibration — See Transducers, Vibration (Vol. B)

Detectors, Video-2900

† Alan Industries Inc., Columbus, IN 47202	812-372-8869
† Colorado Video, Inc., Boulder, CO 80306	303-530-9580
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
† Metropole Products Inc., Stafford, VA 22554	703-659-2132
† Microphase, Norwalk, CT 06856	203-866-8000
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Detectors, Voltage-2900

Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060	**B•1595**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Autronics Corp., Arcadia, CA 91006	818-445-5470
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Ideal Industries, Inc., Sycamore, IL 60178	815-895-5181
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Mag-Con, St. Paul, MN 55113	612-633-8820
§ Metermaster, Tempe, AZ 85282	602-431-0015
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
§ Optrex/Satori, Torrance, CA 90503	310-214-1791
§† Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505	310-517-7770
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
TEGAM, Inc., Madison, OH 44057	800-666-1010
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Warren G-V, General Signal Corp., Whippany, NJ 07981	201-386-1200
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607	415-452-1936
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Detectors (MIL), IR-2440 – *See Vol. B*
Detectors (MIL), Radar-2440 – *See Vol. B*
DIACs-4800 – *See Vol. A*
Dials, Instrument, Metal, Plastic, etc.-2400 – *See Vol. C*
Dials, Turns Counting-2400 – *See Vol. C*

Dielectric Heating Equipment-4100

NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133	**A•1664**
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
Nemeth Engineering Associates, Inc., Crestwood, KY 40014	502-241-1502
§ Phenix Technologies, Accident, MD 21520	301-746-8118

Dielectrics — See Films (Vol. C), Insulation Materials (Vol. C)
Differentials, Mechanical — See Gears & Gear Mechanisms (Vol. B)
Digital Panel Meters — See Meters, Panel (Digital) (Vol. D)
Digital Tape Recorders — See Recorders, Computer Data (Vol. D)

Digitizers, Audio (Sonic)-2000

360 Systems, Tarzana, CA 91356, 818-342-3127	**D•1072**
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
§ Covox, Inc., Eugene, OR 97402	503-342-1271
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Mimic, Inc., Islington, MA 02090-0705	617-329-9593
Science Accessories Corp., Stratford, CT 06497	203-386-9978
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958

Digitizers, Video-2000

§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Colorado Video, Inc., Boulder, CO 80306	303-530-9580
Comlinear Corp., Fort Collins, CO 80525	303-226-0500
§ Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8	800-361-4914;514-333-1301
§ Dage-MTI, Michigan City, IN 46360	219-872-5514
§ Datacube, Inc., Danvers, MA 01923	508-777-4200
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Imagenation Corporation, Vancouver, WA 98684	206-944-9131
Imagraph Corp., Microfield Graphics, Chelmsford, MA 01824	508-256-4624
Imagraph Corp., Microfield Graphics, Chelmsford, MA 01824	508-256-4624
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
§ New Media Graphics Corp., Billerica, MA 01821	508-663-0666
Pixelogic Inc., Vancouver, WA 98684	206-253-5033
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000
# Recognition Concepts,Inc., Carson City, NV 89706	702-831-0473;1-800-243-8724
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Third Domain, Inc., Tucson, AZ 85731-7568	602-290-1820
# Vista Systems, Inc., Peabody, MA 01960	508-532-1971

Digitizers, Pencil Follower (Incl. Coordinate & Graphic)-2000

§ ALTEK Corporation, Silver Springs, MD 20904-7802	301-572-2555
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915	508-927-6575
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
§ Summagraphics Corp., Seymour, CT 06483	203-881-5400
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Touch Technology, Austin, TX 78746	512-328-9284

Digitizers, Transient & Waveform-2900

Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1288**
Analogic Corp., Peabody, MA 01960	508-977-3000
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Datacom, Inc., Ft. Walton Beach, FL 32549	904-244-6121
DSP Technology, Fremont, CA 94538-7338	510-657-7555
† Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915	508-927-6575
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800:800-767-4666
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
PERX,Inc., Corte Madera, CA 94925	415-927-0155
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Dimmers, Light — See Controls, Lamp Dimming, Flashing (Vol. D)
Diode Arrays (Incl. Photo)-3700 – *See Vol. B*
Diodes, Avalanche-4800 – *See Vol. A*
Diodes, Backward-4800 – *See Vol. A*
Diodes, Breakdown — See Diodes, Avalanche (Vol. A)
Diodes, Chip, Unpackaged-4800 – *See Vol. A*
Diodes, Electroluminescent (Radiating)-4800 – *See Vol. A*
Diodes, Frequency Multiplier-4800 – *See Vol. A*
Diodes, Germanium-4800 – *See Vol. A*
Diodes, Gunn-4800 – *See Vol. A*
Diodes, High Voltage (1,000 Volts & Over)-4800 – *See Vol. A*
Diodes, Hot Carrier-4800 – *See Vol. A*
Diodes, Impatt-4800 – *See Vol. A*
Diodes, Infrared-4800 – *See Vol. A*
Diodes, Laser-4800 – *See Vol. A*
Diodes, Light Emitting (LEDs)-3700 – *See Vol. B*
Diodes, Liquid Crystal (LCDs)-3700 – *See Vol. B*
Diodes, Microwave Detector-4800 – *See Vol. A*
Diodes, Microwave Mixer-4800 – *See Vol. A*
Diodes, Noise-4800 – *See Vol. A*
Diodes, Photoelectric-3700 – *See Vol. B*
Diodes, PIN-4800 – *See Vol. A*
Diodes, Power, Surface Mount-4800 – *See Vol. A*
Diodes, Schottky-4800 – *See Vol. A*
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Diodes, Switching-4800 – *See Vol. A*
Diodes, Switching, Surface Mount-4800 – *See Vol. A*
Diodes, Temperature Compensating-4800 – *See Vol. A*
Diodes, Trigger — See Diodes, Avalanche (Vol. A)
Diodes, Tuning, Surface Mount-4800 – *See Vol. A*
Diodes, Tunnel-4800 – *See Vol. A*
Diodes, Varactor-4800 – *See Vol. A*
Diodes, Varactor, Surface Mount-4800 – *See Vol. A*
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Diodes, Zener, Surface Mount-4800 – *See Vol. A*
Diodes (MIL)-2440 – *See Vol. B*

Diplexers, Antenna-1200
JEMA, Wilmette, IL 60091, 708-251-3600 D•1024
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 800-666-9655;315-463-2309
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666; 800-724-3911
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Direction Finding Sets & Systems (MIL)-2440 – *See Vol. B*

Discharge Systems, Energy-4000
Energy Systems, Vancouver, WA 98682 206-896-8310
† Maxwell Laboratories Inc., San Diego, CA 92123-1506 619-279-5100
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Ross Engineering Corp., Campbell, CA 95008 408-377-4621

Discriminators-1900
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 A•1537
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 A•1403
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 A•1417
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 A•1667
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Metraplex Corp., Frederick, MD 21701 301-662-8000
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Networks International Corporation, Lenexa, KS 66215 913-469-6494
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
† Teledyne Microelectronics, Los Angeles, CA 90066 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Disks, Alignment, Flexible Disk Drive-2000
§ AVA Instrumentation, Inc., Ben Lomond, CA 95005 408-336-2281
§ Contact East, N. Andover, MA 01845 508-682-2000
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888

Disks, Diagnostic, Flexible Disk Drive-2000
§ AVA Instrumentation, Inc., Ben Lomond, CA 95005 408-336-2281
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888

Disks, Magnetic 3½″-2000
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 D•1117
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 513-339-2241
§# Computerware, Inc., Vienna, VA 22182-2266 703-821-8200
§ Epson America, Inc./OEM Div., Torrance, CA 90503 310-787-6300
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503 310-782-5318
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 408-432-1300
Matrix Corp., Raleigh, NC 27610 919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045 410-992-0516; 410-992-0517
Mitronics, Rolling Hills, CA 90274 310-377-2022
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Disks, Magnetic, 5¼″ Flexible-2000
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 D•1117
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 513-339-2241
§# Computerware, Inc., Vienna, VA 22182-2266 703-821-8200
§ Epson America, Inc./OEM Div., Torrance, CA 90503 310-787-6300
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503 310-782-5318
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 408-432-1300
Matrix Corp., Raleigh, NC 27610 919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045 410-992-0516; 410-992-0517
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
Omega Engineering, Stamford, CT 06907 800-826-6342
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888
Recognition Concepts,Inc., Carson City, NV 89706 702-831-0473;1-800-243-8724
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Disks, Magnetic, 8″ Flexible-2000
§# Computerware, Inc., Vienna, VA 22182-2266 703-821-8200
LJ Technical Systems, Hauppauge, NY 11788 516-234-2100
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
§ NEC Technologies, INc., Boxborough, MA 01719 508-264-8000
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Disks, Magnetic, Front-loading Cartridge-2000
ICI Inc., Placentia, CA 92670 714-579-7575
Mesa Technology, Peak Technologies, Columbia, MD 21045 410-992-0516; 410-992-0517
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888

Disks, Magnetic, Pack-2000
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888

Disks, Magnetic, Top-loading Cartridge-2000
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888

Disks, Magnetic, Winchester Module-2000
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 D•1117
Mesa Technology, Peak Technologies, Columbia, MD 21045 410-992-0516; 410-992-0517
§ NEC Technologies, INc., Boxborough, MA 01719 508-264-8000
Peripherals, Costa Mesa, CA 92626 714-540-4925;800-468-6888
Zendex Corp., Dublin, CA 94568 510-828-3000
Disks, Memory, Flexible – See Memory Systems, Disk, Flexible (Vol. D)
Disks, Optical Encoder – See Encoders, Shaft Angle, Optical (Vol. B)
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Display Modules-2450 – *See Vol. B*
Display Power Supplies – See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)
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Displays, Dot Matrix-2450 – *See Vol. B*
Displays, Edge Lighted & Back Lighted-2450 – *See Vol. B*
Displays, Electroluminescent-2450 – *See Vol. B*
Displays, Electromagnetic-2450 – *See Vol. B*
Displays, Electromechanical-2450 – *See Vol. B*
Displays, Fiber Optic-2475 – *See Vol. B*
Displays, Graphic – See Displays, Dot Matrix (Vol. B)

Displays, Graphic Systems-2000
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 B•1019
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 B•1021
Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 B•1022
§† Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 B•1033
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 B•1041
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 B•1062
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 B•1071
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 B•1074-1075
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 D•1117
Intronics, Inc., Canton, MA 02021, 800-367-0004 B•1081
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 B•1088
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020 B•1094-1095
Optrex/Satori, Torrance, CA 90503, 310-214-1791 B•1102-1103
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 B•1113
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 B•1116-1117
Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 B•1125
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Applied Data Systems, Inc., Baltimore, MD 21202 800-541-2003;410-576-0335
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
† Aydin Corp., Horsham, PA 19044 215-657-7510
† CELCO, Mahwah, NJ 07430 201-327-1123
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 800-347-2484 ext. 4529

§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
The Hirol Company, Ft. Lauderdale, FL 33309 305-974-4900
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
§ Metra Corporation, San Jose, CA 95131 408-432-1110
§ New Media Graphics Corp., Billerica, MA 01821 508-663-0666
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Omnicomp Graphics Corp., Houston, TX 77043 713-464-2990
§ Pixelworks, Inc., Hudson, NH 03051 603-880-1322
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
VL Electronics, Inc., Los Angeles, CA 90010-1603 213-738-8700
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Head Up (HUD)-2450 – *See Vol. B*
Displays, Indicator Lights-2450 – *See Vol. B*
Displays, Intelligent-2450 – *See Vol. B*
Displays, Laser-2450 – *See Vol. B*
Displays, Light-emitting Diode (LED)-2450 – *See Vol. B*
Displays, Lighted Segment-2450 – *See Vol. B*
Displays, Liquid Crystal (LCD)-2450 – *See Vol. B*
Displays, Message-2450 – *See Vol. B*
Displays, Multifunction-2450 – *See Vol. B*
Displays, Planar Gas Discharge-2450 – *See Vol. B*
Displays, Plasma-2450 – *See Vol. B*
Displays, Programmable-2450 – *See Vol. B*
Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)-2450 – *See Vol. B*
Displays, Remote-2450 – *See Vol. B*
Displays, Status-2450 – *See Vol. B*
Displays, Storage Tube – See Displays, CRT (Vol. A)
Displays, Surface Mount-2450 – *See Vol. B*
Displays, Touch Sensitive (Infrared & Mechanical) – See Touch Monitors (Vol. D), Touch Panels (Vol. D), Touch Terminals (Vol. D)
Displays, Tube – See Tubes, Readout (Vol. A)
Displays, Vacuum Fluorescent-2450 – *See Vol. B*
Display Sets (MIL), Computer-2440 – *See Vol. B*
Dissipators, Heat – See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)
Distortion Analyzers, Indicators – See Analyzers, AF (Vol. D)

Distributed Control Systems & Components-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223 ..... D•1150
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 ..... B•1065**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1324
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
Analogic Corp., Peabody, MA 01960 508-977-3000
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
§ Covid, Inc., Tempe, AZ 85281 602-966-2221
E-T-A Circuit Breakers, Niles, IL 60714 708-647-8303
§ Industrial Service Technology, Grand Rapids, MI 49548 ..... 616-247-1033;800-835-2611
§ Intec Controls Corp., Walpole, MA 02081 508-660-1221
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
KineticSystems Corp., Lockport, IL 60441 815-838-0005
§ Luft Instruments, Inc., Lincoln, MA 01773 617-259-9215
Moore Products Co., Spring House, PA 19477 215-646-7400
Research Inc., Minneapolis, MN 55424 612-941-3300
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504 818-840-6749
§† Square D Co., Palatine, IL 60067 708-397-2600
§# Support Systems Intl. Corp., Richmond, CA 94804 510-234-9090
§ TA Engineering Co., Inc., Moraga, CA 94556 415-376-8500
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Transmagnetics, Farmingdale, NY 11735 516-293-3100

Dividers, Frequency-3450 – *See Vol. A*
Dividers, Power (LF, HF, VHF, UHF)-3450 – *See Vol. A*
Dividers, Power, Microwave-3450 – *See Vol. A*

Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing-2900

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ..... D•1234
§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1927
Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717 ..... D•1252
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 ..... D•1709
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ..... D•1266,1269
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 ..... D•1277**
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1278-1280
§ **K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957**
† **Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1853**
† **Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 ..... A•2454**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1594, D•1319**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ..... D•1922
§ **Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1925**
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bertan High Voltage, Hicksville, NY 11801 516-433-3110
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Del Electronics Corp., Valhalla, NY 10595 914-686-3600
§ EECO Div.,Transico Inc., Santa Ana, CA 92702-0659 714-835-6000
Electrical Standards Div., E.S.R.S., Inc., N. Hollywood, CA 91605 818-765-4224
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
John Fluke Mfg. Co., Inc.. Everett, WA 98203 206-347-6100
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 908-534-9007
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Haefely Inc., Woodbridge, VA 22192 703-494-1900
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Resistive Company, Boone, NC 28607 704-264-8861
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
† Mep Controls, Bordentown, NJ 08505 609-298-7300
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
Shalltronix Corp., Selma, NC 27576 919-965-6346
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
§ Vishay Resistors, Malvern, PA 19355 215-644-1300
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 ..... (415) 326-2151

Dome, Metal (for membrane switches)-5150 – *See Vol. B*
Doublers, Frequency – See Multipliers, Frequency (Vol. A)
Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800 – *See Vol. A*
Down Converters-3450 – *See Vol. A*
Drafting Machines-4200 – *See Vol. C*
Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 – *See Vol. C*
Drawers, Sliding-1400 – *See Vol. C*
Drills & Accessories, Manual & Power-5400 – *See Vol. C*
Drivers & Decoders For Readouts-2450 – *See Vol. B*

Drivers, Chopper-1100

§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ..... B•1309**
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
Bodine Electric Company, Chicago, IL 60618 312-478-3515
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
Oriental Motor USA Corp., Torrance, CA 90505-5217 310-515-2264
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Vasak Inds., Inc., El Segundo, CA 90245 ..... 1-800-67-VASAK

Drivers, Hardware & Software-2000

§ **Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 ..... D•1097**
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 ..... D•1147,1302**
§ Action Instruments, San Diego, CA 92123 619-279-5726
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Intec Controls Corp., Walpole, MA 02081 508-660-1221
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Matrix Corp., Raleigh, NC 27610 919-231-8000

Drivers, Nut-5400 – *See Vol. C*
Drivers, Solenoid-4550 – *See Vol. B*

Drivers, Speaker-1300

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... D•1067
AES Corp., Peabody, MA 01960 508-535-7310
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§† Hartley Products, Wilmington, NC 28406 919-392-0500

§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 ... 216-442-2286
§ MG Electronics, Hauppauge, NY 11788 ... 516-582-3400
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 ... 505-822-8801
§† MTX Oaktron, Monroe, WI 53566 ... 608-328-5560
§ Paso Sound Products, Pelham, NY 10803 ... 914-738-4800
§ Poly-Planar Inc., Warminster, PA 18974 ... 215-675-7805
§ Pyle Industries, Inc., Huntington, IN 46750 ... 219-356-1200
† Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911

Drivers, Switch-3450 – *See Vol. A*
Drivers, Tube – See Drivers & Decoders for Readouts (Vol. B)
Drives & Drive Mechanisms (Dial)-2400 – *See Vol. C*

Drives/Subsystems, Core Disk Emulator-2000

Computer Doctors, College Park, MD 20740 ... 1-800-RAM-STAR;301-474-3095

Drives/Subsystems, Disk, 3½″ Diskette-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117-1121
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
Computer Dynamics Sales, Greer, SC 29650 ... 803-877-8700
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
Zendex Corp., Dublin, CA 94568 ... 510-828-3000
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

Drives/Subsystems, Disk, 3¼″ Winchester-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
§ Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
Zendex Corp., Dublin, CA 94568 ... 510-828-3000
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488
§ Zitel Corporation, Milpitas, CA 95035 ... 408-321-9600;800-622-5020

Drives/Subsystems, Disk, 5¼″ Diskette-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
† Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
Zendex Corp., Dublin, CA 94568 ... 510-828-3000

Drives/Subsystems, Disk, 5¼″ Winchester-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
† Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
Matrix Corp., Raleigh, NC 27610 ... 919-231-8000
§ Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
Zendex Corp., Dublin, CA 94568 ... 510-828-3000
§ Zitel Corporation, Milpitas, CA 95035 ... 408-321-9600;800-622-5020

Drives, Subsystems, Disk, 8″ Diskette-2000

§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000
Zendex Corp., Dublin, CA 94568 ... 510-828-3000

Drives/Subsystems, Disk, 8″ Winchester-2000

Computer Dynamics Sales, Greer, SC 29650 ... 803-877-8700
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000
§ Point 4 Data Corp., Tustin, CA 92680 ... 714-259-0777
Zendex Corp., Dublin, CA 94568 ... 510-828-3000

Drives/Subsystems, Disk, 14″ Winchester-2000

§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000

Drives/Subsystems, Disk, Fixed-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 ... 508-588-6110
NEC Technologies, INc., Boxborough, MA 01719 ... 508-264-8000

Drives/Subsystems, Disk, Fixed/Removable-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
† Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
§ DILOG, Irvine, CA 92714 ... 714-476-0303
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401 ... 508-588-6110
Recognition Concepts,Inc., Carson City, NV 89706 ... 702-831-0473;1-800-243-8724
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

Drives/Subsystems, Disk Array-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
Mitronics, Rolling Hills, CA 90274 ... 310-377-2022
§ Zitel Corporation, Milpitas, CA 95035 ... 408-321-9600;800-622-5020

Drives/Subsystems, Magnetic Tape, ¼″ Cartridge-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§ Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131 ... 619-578-9100
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
§ GENROCO, Inc., Slinger, WI 53086-9501 ... 414-644-8700
§ Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
§ Point 4 Data Corp., Tustin, CA 92680 ... 714-259-0777
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090

Drives/Subsystems, Magnetic Tape, Cassette-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§ International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 ... D•1039
Amilon Corp., Woodside, NY 11377 ... 718-274-1794
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
§ DILOG, Irvine, CA 92714 ... 714-476-0303
† Memtec Corp., Salem, NH 03079 ... 603-893-8080
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000

Drives/Subsystems, Magnetic Tape, Reel-to-Reel-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
† Cable & Computer Technology Inc., Anaheim, CA 92806 ... 714-937-1341
§ Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131 ... 619-578-9100
† Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
§ Digi-Data Corp., Jessup, MD 20794 ... 301-498-0200
§ DILOG, Irvine, CA 92714 ... 714-476-0303
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
Mesa Technology, Peak Technologies, Columbia, MD 21045 ... 410-992-0516; 410-992-0517
Metrum, Denver, CO 80217-5227 ... 303-773-4700
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
† Qualstar Corp., Chatsworth, CA 91311 ... 818-882-5822
§ Shinano Kenshi Corp. (SKC), Culver City, CA 90230 ... 310-915-7300

Drives/Subsystems, Semiconductor Emulator-2000

† Tempustech, Inc., Naples, FL 33942, 813-643-2424 ... D•1144
§ Adtron Corporation, Mesa, AZ 85210 ... 602-926-9324
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§ Exar Corp., San Jose, CA 95161-9007 ... 408-434-6400
MCSI, Vista, CA 92083 ... 619-598-2177
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
Vermont Research Corp., N. Springfield, VT 05150 ... 802-886-2256
§ Zitel Corporation, Milpitas, CA 95035 ... 408-321-9600;800-622-5020

Dry Transfer Letters & Numbers – See Kits, Marking (Vol. C)
Ducts, Wiring-6000 – *See Vol. C*
Ducts, Fiber Optic-2475 – *See Vol. B*

Dummy Loads, Electronic-2900

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•1684
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 ... D•1809
Advanced Power Products, Menifee, CA 92584 ... 714-672-7704
† Alan Industries Inc., Columbus, IN 47202 ... 812-372-8869
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ... 203-743-9272; 800-627-7100
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 ... 203-281-3200
Antenna Specialists, The Allen Group, Cleveland, OH 44139 ... 216-349-8400
§ AVA Electronics Corporation, Drexel Hill, PA 19026 ... 215-284-2500
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
§† Bird Electronic Corp., Cleveland, OH 44139-2794 ... 216-248-1200
† Branmag, Inc., N. Tonawanda, NY 14120 ... 716-693-5994

Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302	716-278-2521
Coaxial Dynamics, Cleveland, OH 44135	1-800-COAXIAL
Compac, Holbrook, NY 11741	516-585-3400
† Connecticut Microwave Corp., Cheshire,, CT 06410	203-250-9678
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
† Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
Durmitor Inc., King City, Ont., CANADA L0G 1K0	416-833-3148
† Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
§† EMC Technology Inc, Cherry Hill, NJ 08034	609-429-7800
Energy Systems, Vancouver, WA 98682	206-896-8310
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
† Microlab/FXR, Livingston, NJ 07039	201-992-7700
† Micro Mode Prods., El Cajon, CA 92020	619-449-3844
§ Microwave Development Laboratories, Natick, MA 01760	508-655-0060
§† Microwave Filter Inc., East Syracuse, NY 13057-0486	315-437-3953;800-448-1666
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† NH Research, Irvine, CA 92714	714-474-3900
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Quartzite Processing, Inc., Malden, MA 02148	617-322-3611
Sivers IMA AB, Culver City, CA 90230	213-306-4248
Teleplex, Inc., Alford Division, Woburn, MA 01801	617-935-8610
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412

Dummy Loads, Microwave-2900

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
Communications & Energy Corp., E. Syracuse, NY 13057	315-452-0709
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Inmet Corporation, Ann Arbor, MI 48103	313-426-5553
† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
Microdry, Inc., Crestwood, KENTUCKY 40014	502-241-8933
† Micronetics, Hudson, NH 03051	603-883-2900
§ Midwest Microwave, Saline, MI 48176-9569	313-429-4773;800-521-4410
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
† Premier Microwave, Port Chester, NY 10573	914-939-8900
§ Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
† Quartzite Processing, Inc., Malden, MA 02148	617-322-3611
† RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760	508-653-0844
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411

Dummy Loads, Power-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1268,1270**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1809**
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900	**A•1991-1992**
Advanced Power Products, Menifee, CA 92584	714-672-7704
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
Energy Systems, Vancouver, WA 98682	206-896-8310
† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226	317-545-4281
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622

Dummy Loads, Programmable-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1270**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1809**
† PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Advanced Power Products, Menifee, CA 92584	714-672-7704
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Energy Systems, Vancouver, WA 98682	206-896-8310
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† NH Research, Irvine, CA 92714	714-474-3900
Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622

Dummy Loads, Resistive-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1268,1270**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1809**
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900	**A•1990-1992**
† PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Advanced Power Products, Menifee, CA 92584	714-672-7704
Alan Industries Inc., Columbus, IN 47202	812-372-8869
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
Energy Systems, Vancouver, WA 98682	206-896-8310
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
§ Inmet Corporation, Ann Arbor, MI 48103	313-426-5553
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† NH Research, Irvine, CA 92714	714-474-3900
§† Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047	818-707-2020

Dummy Loads (MIL), RF-2440 – *See Vol. B*
Duplexers, Microwave-3450 – *See Vol. A*

Duplexers, Nonmicrowave-1900

† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614	**A•1680**
† Antenna Specialists, The Allen Group, Cleveland, OH 44139	216-349-8400
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057	800-666-9655;315-463-2309
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
Metropole Products Inc., Stafford, VA 22554	703-659-2132
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226	317-545-4281
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165

Duplicators, Magnetic Tape-1300

† Chalco Engrg. Corp., Chalco Industries, Inc., Gardena, CA 90248-1898	213-321-0121; 213-323-5525
§ Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
Video Automation Systems, Pound Ridge, NY 10576	914-764-4613

Dust Covers – See Covers, Protective (Vol. C)
DVMs – See Meters, Volt, Digital (Vol. D)
Earphones – See Headphones (Vol. D)

Earth Stations, TV, Receive Only-1900

Andrew Corp., Orland Pk., IL 60462	800-255-1479
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Prodelin Corporation, Conover, NC 28613	704-464-4141

Earth Stations; TV, Receive/Transmit-1900

Andrew Corp., Orland Pk., IL 60462	800-255-1479
† Aydin Corp., Horsham, PA 19044	215-657-7510
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273

Edge Clips, Surface Mount-2500 – *See Vol. C*
Edge Connectors, Surface Mount-2100 – *See Vol. C*

Editing Equipment, Tape-1300

§ Ampex Corp., Redwood City, CA 94063-3199	415-367-2011
§ Microtran Co. Inc., Valley Stream, NY 11582-0236	516-561-6050

Ejectors & Extractors, PC Boards – See Pullers, Circuit Board (Vol. C)
Elastomers, Conductive – See Conductive Elastomers (Vol. C)
Elastomers, Heat Shrinkable – See Caps, Forms & Tapes, Heat Shrinkable (Vol. C)
Electret – See Microphones, Condenser (Vol. D)
Electrical Measurement & Test Services – See Services, Electrical Measurement & Test (Vol. D)
Electrodes, Electroplating – See Electroplating Equipment & Supplies (Vol. D)

Electrodes, High Voltage-2900
Deringer Mfg. Co., Mundelein, IL 60060 708-566-4100
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Phenix Technologies, Accident, MD 21520 301-746-8118
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Electromagnets-1850 – *See Vol. A*
Electronic Counter Countermeasures (ECCM) Fixes (MIL)-2440 – *See Vol. B*
Electronic Countermeasures (ECM) (MIL), Cruise Missiles-2440 – *See Vol. B*
ECM Sets (MIL)-2440 – *See Vol. B*
ECM Systems (MIL)-2440 – *See Vol. B*
ECM Systems (MIL), Deceptive-2440 – *See Vol. B*
Electronic Intelligence (Elint) (MIL)-2440 – *See Vol. B*
Electronic Loads — See Dummy Loads (Vol. D)
Electronic Support Measures (ESM) Sets (MIL)-2440 – *See Vol. B*
Electronic Warfare (EW) Sets (MIL)-2440 – *See Vol. B*

Electroplating Equipment & Supplies-4100
§† A.P.E. Corporation, Medford, NY 11763 516-654-1197
Auric Corp., Newark, NJ 07114 201-242-4100
Epsco Incorporated, Itasca, IL 60143-1120 708-250-0410
Fidelity Chemical Products Corp., Newark, NJ 07114 201-242-4110
§ HBS Equipment Corporation, Los Angeles, CA 90040 213-726-3033
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† Indium Corporation of America, Utica, NY 13502 .... 315-853-4900;1-800-4INDIUM
§ Kraft Dynatronix, Inc., Amery, WI 54001 .... 715-268-8118;800-826-7172
§ Luft Instruments, Inc., Lincoln, MA 01773 617-259-9215
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ PACE, Inc., Laurel, MD 20723-1990 301-490-9860
† Technic, Inc., Providence, RI 02940-9650 401-781-6100

Electrostatic Discharge Guns - Also See Generators, ESD-2900
Amstat Industries, Inc., Glenview, IL 60025 708-998-6210
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
† Haefely, Inc., Woodbridge, VA 22192 703-494-1900
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
KeyTek Instrument Corp., Wilmington, MA 01887 508-658-0880
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 .... 201-379-7778; 800-367-5566
† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
§ Simco Co., Hatfield, PA 19440 215-822-2171
§† Testone Inc., Skippack, PA 19474-1589 215-584-9658
Electrostatic Discharge (MIL)-2440 – *See Vol. B*
Elements, Sensing — See Transducers (Vol. B)
Eliminators, Battery — See Power Supplies, AC to DC Adapter (Vol. D)
Emitter Location & Identification System (MIL), Automatic Ground Transportable-2440 – *See Vol. B*
Emitters, Infrared-3700 – *See Vol. B*
Emitters, Fiber Optic-Also See Diodes, Laser-2475 – *See Vol. B*

Emulators, In-circuit-2900
Emulation Technology, Inc., Santa Clara, CA 95051, 408-982-0660 .... C•1321
† **Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493 .... D•1304-1309**
American Arium, Tustin, CA 92680-7207 714-731-1661
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
Applied Microsystems Corp., Redmond, WA 98052 206-882-2000
§ Baradine Products Ltd., North Vancouver, B.C., CANADA V7L 4L3 604-988-9853
HILEVEL Technology, Tustin, CA 92680 714-573-1888
HiTech Equipment Corp., San Diego, CA 92126 619-566-1892
Huntsville Microsystems, Inc., Huntsville, AL 35801 205-881-6005
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 508-927-6575
§Φ MetaLink Corporation, Chandler, AZ 85244 602-926-0797
Microtek International/Dev. Sys. Div., Hillsboro, OR 97124 503-645-7333
§† Onset Computer Corp., Pocasset, MA 02559-3450 508-563-9000
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Pentica Systems, Inc., Bedford, MA 01730 617-275-4419
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Signum Systems Corp., Thousand Oaks, CA 91360 805-371-4608
Softaid, Inc., Columbia, MD 21046 410-290-7760
Sophia Systems & Technology, Palo Alto, CA 94304 .... 415-493-6700;800-824-9294
§ Spectrum Signal Proc., Blaine, WA 98231-0025 .... 1-800-663-8986 (US);604-421-5422
† Step Engineering, Sunnyvale, CA 94088 408-733-7837
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
Thorson Engineering Co., Snohomish, WA 98290 206-334-4214
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
† Zaxtek, Irvine, CA 92714 .... 714-474-1170;800-421-0982

Emulators, RTS-2900
American Arium, Tustin, CA 92680-7207 714-731-1661
§ Signum Systems Corp., Thousand Oaks, CA 91360 805-371-4608
§ S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813 516-791-1175

Emulators, Terminal-2900
Industrial Computer Source, San Diego, CA 92131 619-271-9340
§ Micro-Integration Corp., Cumberland, MD 21502 800-832-4526
§ Multi-Tech Systems, Inc., Mounds View, MN 55112 .... 612-785-3500;800-328-9717
Encapsulating Materials — See Compounds, Encapsulating, Molding, Potting (Vol. C)
Encapsulation Services — See Services, Encapsulation (Vol. D)
Enclosures, Circuit Board, Module, & Relay Mounting-1400 – *See Vol. C*
Enclosures, CRT — See Mounts CRT (Vol. C)
Enclosures, Equipment & Panel Mounting-1400 – *See Vol. C*
Enclosures, Instrument-1400 – *See Vol. C*
Enclosures, Keyboard-1400 – *See Vol. C*
Enclosures, Metal-1400 – *See Vol. C*
Enclosures, Nonmetallic-1400 – *See Vol. C*
Enclosures, Portable - Also See Cases-1400 – *See Vol. C*
Enclosures, Power Distribution-1400 – *See Vol. C*
Enclosures, Shielded-1400 – *See Vol. C*
Enclosures, Shipping-1400 – *See Vol. C*
Enclosures, (MIL)-2440 – *See Vol. B*
Encoders, Digital — See Encoders, Shaft Angle (Vol. B)
Encoders, Displacement, Linear-3500 – *See Vol. B*
Encoders, Fiber Optic-2475 – *See Vol. B*
Encoders, Magnetic Strip-3500 – *See Vol. B*

Encoders, Proof-2000
VG Controls, Inc., Hewitt, NJ 07421, 201-853-4600 .... B•1855
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Encoders, Shaft Angle, Contacting-3500 – *See Vol. B*
Encoders, Shaft Angle, Magnetic-3500 – *See Vol. B*
Encoders, Shaft Angle, Optical-3500 – *See Vol. B*
Encoders, Shaft Position — See Encoders, Shaft Angle (Vol. B), Resolvers, Synchro (Vol. D)

Encoders, Tone-1900
† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1537**
VG Controls, Inc., Hewitt, NJ 07421, 201-853-4600 .... B•1855
† A.R.F. Prods., Boulder, CO 80307-3128 303-499-2946
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Dantel, Fresno, CA 93727 209-292-1111
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
Palomar Engineers, Escondido, CA 92046 619-747-3343
RFL Electronics Inc., Boonton, NJ 07005-0239 201-334-3100
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220

Encoders, Video-1900
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234 310-921-7775
Encoders, (MIL)-2440 – *See Vol. B*
Encryptors — See Security Systems, Data (Vol. D)
Engineering Reference Books — See Technical Books (Vol. D)

Energy Management Systems-2200
§ **Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152 .... A•2357**
# ASC Capacitors, Ogallala, NE 69153 308-284-3611
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
California Automation Inc., San Diego, CA 92121 619-452-1341
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408 1-800-328-5111
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
§ Intellitech, Kennesaw, GA 30144 404-514-7999
IPAC Grp., Bethel Pk., PA 15102 412-831-9200
Mep Controls, Bordentown, NJ 08505 609-298-7300
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 604-652-5118
Staco Energy Products Co., Dayton, OH 45403 513-253-1191
§ Via West Interface, Inc., Tucson, AZ 85705 .... 602-623-5716;1-800-266-5716
Environmental Testing Services — See Services, Environmental Testing (Vol. D)
Epoxies — See Compounds, Enscapsulating, Molding, Potting (Vol. C), Adhesives (Vol. C)

Equalizers, Audio-1300
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
§ Exar Corp., San Jose, CA 95161-9007 408-434-6400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
§ Furman Sound, Inc., Greenbrae, CA 94904 415-927-1225
† Hisonic, Inc., Olathe, KS 66051 913-782-0012

Hokuriku USA Ltd., Madison, AL 35758 ... 205-772-9620
† Kappa Technologies, Inc., Rahway, NJ 07065 ... 908-396-9400;1-800-223-0603
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 ... 516-345-3100
§ Precision Electronics, Franklin Park, IL 60131 ... 708-678-5350
† Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
§ Spectra Sonics, Ogden, UT 84405 ... 801-392-7531
Unholtz-Dickie Corp., Wallingford, CT 06492 ... 203-265-3929

Equalizers, Delay-1900

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ... A•1619
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ... A•1648-1649**
† Alpha Components, Mechanicsburg, PA 17055 ... 717-697-8595
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 ... 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ... 800-666-9655;315-463-2309
† Data Delay Devices, Clifton, NJ 07013-1915 ... 201-773-2299
† ESC Electronics Corp., Palisades Pk., NJ 07650 ... 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
† Frequency Selective Networks, Woodside, NY 11377 ... 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 ... 619-259-2600
† Kappa Technologies, Inc., Rahway, NJ 07065 ... 908-396-9400;1-800-223-0603
† LNR Communications, Inc., Hauppauge, NY 11788 ... 516-273-7111
† MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
† Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
Western Multiplex Corp., Belmont, CA 94002 ... 415-592-8832

Equalizers, Phase-1900

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ... A•1514
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ... A•1648**
† Alpha Components, Mechanicsburg, PA 17055 ... 717-697-8595
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 ... 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ... 800-666-9655;315-463-2309
† ESC Electronics Corp., Palisades Pk., NJ 07650 ... 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
† Frequency Selective Networks, Woodside, NY 11377 ... 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 ... 619-259-2600
† Kappa Technologies, Inc., Rahway, NJ 07065 ... 908-396-9400;1-800-223-0603
† Loral Microwave Narda, Hauppauge, NY 11788 ... 516-231-1700
§† Midwest Microwave, Saline, MI 48176-9569 ... 313-429-4773;800-521-4410
MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
† Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
† Teledyne Microwave, Mountain View, CA 94043 ... 415-968-2211
† Werlatone, Inc., Brewster, NY 10509 ... 914-279-6187

Erasers, Magnetic Tape (Bulk)-1300

§† Benjamin International, Inc., Lake Worth, FL 33461 ... 407-533-0064
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
§ Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005 ... 314-532-5887
Erasing Equipment, EPROM-3130 – *See Vol. A*
Escutcheons — See Bezels & Escutcheons (Vol. C)
Etchants, Fluorocarbon-1600 – *See Vol. C*
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Etching & Engraving — See Services, Metal Etching, Engraving (Vol. D)
Ethernet Extenders-2475 – *See Vol. B*

Evaporation Equipment, Electron Beam-4100

CHA Industries, Fremont, CA 94538 ... 510-683-8554
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854 ... 203-853-9500
§ CVC Products, Inc., Rochester, NY 14603 ... 716-458-2550
§ Ferrofluidics Corp., Nashua, NH 03061 ... 603-883-9800
Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525
Jori Resources, Ventura, CA 93003 ... 805-642-2266
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252 ... 707-423-2100
§† ULVAC North America Corporation, Kennebunk, ME 04043 ... 207-985-2973
Exciters — See Oscillators (Vol. A)
Exciters, Vibration — See Testers, Vibration (Vol. D)
Expanders, Data-2440 – *See Vol. B*
Expanders, Meter — See Multipliers, Meter (Vol. D)

Extender Boards, Electronic-2900

AZ-COM, Orinda, CA 94563-2206, 510-254-5400 ... D•1235
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ... C•1680

Extender Boards, Mini-2900

AZ-COM, Orinda, CA 94563-2206, 510-254-5400 ... D•1235
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ... C•1680

Extender Boards, Plain-2900

AZ-COM, Orinda, CA 94563-2206, 510-254-5400 ... D•1235
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ... C•1680
Extractors, Circuit Board, Tube — See Pullers, Circuit Board (Vol. C)
Extractors, DIP, IC, & Pin Grid Array-5400 – *See Vol. C*
Eyelets-2500 – *See Vol. C*
Fabrics, Conductive-4525 – *See Vol. C*

Facsimile Equipment-1900

† Alden Electronics, Inc., Westboro, MA 01581 ... 508-366-8851
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ Computer Peripherals Inc., Newbury Pk., CA 91320 ... 805-499-5751;800-854-7600
Electronic Modules, Inc., Dallas, TX 75238-1687 ... 214-340-6789
PUREDATA, Richmond Hill, Ont., CANADA L4B 1B4 ... 416-731-6444
Xerox Corporation, United States Customer Operations, Rochester, NY 14644 ... 800-832-6979
Fan Accessories-2600 – *See Vol. C*
Fan Guards-2600 – *See Vol. C*
Fans, Axial-2600 – *See Vol. C*
Fans, Propeller-2600 – *See Vol. C*
Fans, Tubeaxial-2600 – *See Vol. C*
Fans, Vaneaxial-2600 – *See Vol. C*
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Fasteners, Nonmetallic-2500 – *See Vol. C*
Fault Locators — See Detectors (Vol. D)

Feedhorns, Satellite Antenna-1200

JEMA, Wilmette, IL 60091, 708-251-3600 ... D•1024
Flann Microwave Inc., Cambridge, MA 02139 ... 1-800-937-3772
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 ... 310-539-6704
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ... 514-694-6666; 800-724-3911
§ Prodelin Corporation, Conover, NC 28613 ... 704-464-4141
Feedthrus & Seals, Environmental-2500 – *See Vol. C*
Ferrite Material & Parts-1850 – *See Vol. A*
Ferrules, Cable-end-2500 – *See Vol. C*
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Filters, Air (for Clean Room)-2550

# Absolute Filter Co., Ambler, PA 19002 ... 215-886-9176
# Absolute Filter Co., Ambler, PA 19002 ... 215-886-9176
§† ALFCO, Div. of Air Maze, Carpinteria, CA 93013 ... 805-684-7651
Baker Co., Inc., Sanford, ME 04073 ... 1-800-992-2537
Daitron, Inc., Tigard, OR 97223 ... 503-620-2879
§ Norgren, Littleton, CO 80120-1663 ... 303-794-2611
† Spira Manufacturing Corp., North Hollywood, CA 91605 ... 818-764-8222
Vortec Corporation Illinois Tool Works, Cincinnati, OH 45242 ... 800-441-7475
Filters, Air (for Disk Drives)-2750 – *See Vol. A*
Filters, Analog — See Filters, Continuously Variable (Vol. A)
Filters, Antenna-2750 – *See Vol. A*
Filters, Antialias-2750 – *See Vol. A*
Filters, Band Elimination-2750 – *See Vol. A*
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Filters, Band Reject, Band Stop — See Filters, Band Elimination (Vol. A)
Filters, Ceramic-2750 – *See Vol. A*
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Filters, Color, Panel Light - Also see Lenses, Readout & Display; Lenses, Filters, Windows, Infrared-2460 – *See Vol. B*
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Filters, Continuously Variable-2750 – *See Vol. A*
Filters, Crystal-2300 – *See Vol. A*
Filters, Delay-2750 – *See Vol. A*
Filters, Digital-2750 – *See Vol. A*
Filters, Digital, High Speed FFT/FIR-2750 – *See Vol. A*
Filters, Display-3700 – *See Vol. B*
Filters, EMI/RFI-2700 – *See Vol. A*
Filters, Equalizer-2750 – *See Vol. A*
Filters, Harmonic-2750 – *See Vol. A*
Filters, High Pass-2750 – *See Vol. A*
Filters, Hybrid-2750 – *See Vol. A*
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Filters, Ladder-2750 – *See Vol. A*
Filters, LAN-2750 – *See Vol. A*
Filters, LC-2750 – *See Vol. A*
Filters, Line — See Filters, EMI/RFI (Vol. A)
Filters, Linear Phase-2750 – *See Vol. A*
Filters, Low Pass-2750 – *See Vol. A*
Filters, Mechanical-2750 – *See Vol. A*
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Filters, Monolithic-2300 – *See Vol. A*
Filters, Notch — See Filters, Band Elimination (Vol. A)
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Filters, Programmable — See Filters, Variable (Vol. A)
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Filters, Single Sideband-2750 – *See Vol. A*
Filters, Surface Acoustic Wave (SAW)-2300 – *See Vol. A*
Filters, Synchronous Tracking-2750 – *See Vol. A*

Filters, Telemetering-1900

† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•1623**
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ... A•1633
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ... A•1648**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725

† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614	**A•1680**
Advanced Filter Devices, Inc., Carlsbad, CA 92009	619-438-2074
† Alpha Components, Mechanicsburg, PA 17055	717-697-8595
A. P. Circuit, Brooklyn, NY 11237	718-456-2717
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220	718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430	914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057	800-666-9655;315-463-2309
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016	213-936-6188
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Dantel, Fresno CA 93727	209-292-1111
§ De Coursey Engineering Laboratory, Culver City, CA 90230	1-310-397-9668
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232	513-542-5555
† ESC Electronics Corp., Palisades Pk., NJ 07650	201-947-0400
§ EWC, Inc., Englishtown, NJ 07726	908-446-3110
† Filter Products, Rockwell International, Costa Mesa, CA 92626	714-641-5311
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
† Frequency Selective Networks, Woodside, NY 11377	718-424-7500
† Hisonic, Inc., Olathe, KS 66051	913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
† Loral Microwave-Wavecom, Northridge, CA 91324	818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065	717-486-3411
Microwave Development Laboratories, Natick, MA 01760	508-655-0060
§ Microwave Filter Inc., East Syracuse, NY 13057-0486	315-437-3953;800-448-1666
† Networks International Corporation, Lenexa, KS 66215	913-469-6494
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034	215-643-6950
† Rockwell International, Costa Mesa, CA 92626	714-641-5311
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652	714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550	914-664-2050
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Filters, Tone, Telegraph-2750 – *See Vol. A*
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Filters, Variable-2750 – *See Vol. A*
Filters, Vestigial Sideband-2750 – *See Vol. A*
Filters, Video-2750 – *See Vol. A*
Filters, Waveguide-3450 – *See Vol. A*
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Flashers-2200

§ Amperite Co., Inc., Union City, NJ 07087, 201-864-9503	**B•1417**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**B•1556**
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060	**B•1595**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ American Electronic Components, Elkhart, IN 46514	219-264-1116
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Enerco, Inc., Seattle, WA 98108	206-762-1422
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
§ Hughey & Phillips, Inc., Simi Valley, CA 93062	805-581-5591
§ Industrial Devices, Inc., Hackensack, NJ 07601	201-489-8989
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Lark Electronics, Inc., New York, NY 10040	212-569-0430
§ Leecraft Mfg., Long Island City, NY 11101	718-392-8800
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
V R Industries, Inc., Warwick, RI 02886	401-732-6800
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

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Frequency Standards – See Standards, Frequency (Vol. D)
Frozen Epoxies – See Compounds, Encapsulating, Molding, Potting (Vol. C)

Furnaces, Electric-4100

† Ajax Magnethermic Corp., Warren, OH 44483	216-372-8511
† Applied Test Systems, Inc., Butler, PA 16001	412-283-1212
Aremco Products, Inc., Ossining, NY 10562	914-762-0685
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
§† L & L Special Furnace, Aston, PA 19014	610-459-9216
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
† Trent, Inc., Philadelphia, PA 19127	215-482-5000

Furnaces, Gas (Production)-4100

§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Furnaces, Infrared-4100

§ ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
§ ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
† Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200

Furnaces, Ultraviolet-4100

§ ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
§ ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
† American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788

Furnaces, Vacuum-4100

† Ajax Magnethermic Corp., Warren, OH 44483	216-372-8511
† Applied Test Systems, Inc., Butler, PA 16001	412-283-1212
Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854	203-853-9500
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973

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Fuseholders – See Clips & Holders, Fuse (Vol. B)
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Fuses, Failure Indicating-4300 – *See Vol. B*
Fuses, Fuseholders, Boxes & Panels (MIL)-2440 – *See Vol. B*
Fuses, International, 5x20 mm-4300 – *See Vol. B*
Galvanometers – See Meters, Galvanometer (Vol. D)
Gaskets – See Seals (Vol. C)
Gaskets, Shielding, RF-Also See Shields, RF-4525 – *See Vol. C*
Gas Sensors – See Detectors, Gas (Vol. D)
Gates, Computer Circuit (AND, OR, NOR, etc.) – See Cards, Logic (Vol. D)

Gauges, Centerhole, Flexible Disk-2900

§ Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800

Gauges, Displacement, Linear-5400 – *See Vol. C*

Gauges, Humidity-2900

Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1886**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1888**
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Panametrics, Waltham, MA 02154-3497	617-899-2719
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
† Thunder Scientific Corp., Albuquerque, NM 87123	505-265-8701;800-872-7728

Gauges, Ionization-2900

§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854	203-853-9500
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
The Fredericks Company, Huntingdon Valley, PA 19006	215-947-2500
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714	315-434-1100
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300

Gauges, Pressure-Also See Transducers, Pressure-2900

§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282	**B•1928**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA	**B•2014-2015**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372**
Advanced Process Controls, Woburn, MA 01801	617-932-9262

Aerodyne Controls Corporation, Ronkonkoma, NY 11779	516-737-1900
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§ Bellofram Corporation, Newell, WV 26050	304-387-1200;1-800-733-2356
† Bourns Instruments Inc., Riverside, CA 92507	714-781-5148
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
§ Crystal Engineering Corp., Los Osos, CA 93402	805-528-2155;800-444-1850
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
EMICO Inc., Manchester, NH 03109	603-669-5121
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
† Entran Devices, Fairfield, NJ 07004	201-227-1002;800-635-0650
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
Gentran, Safetytek Corp., Fremont, CA 94538	510-226-9343
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
HBM, Inc., Marlboro, MA 01752	508-624-4500
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714	315-434-1100
Lucas Nova Sensor, Lucas Industries, Fremont, CA 94539	510-490-9100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Martel Electronics, Windham, NH 03087	603-893-0886
Mensor Corporation, San Marcos, TX 78666	512-396-4200
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Netech Corporation, Hicksville, NY 11801	800-547-6557
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
Norgren, Littleton, CO 80120-1663	303-794-2611
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
# Sensor Products, Inc., E. Hanover, NJ 07936	201-884-1755
§† Trans Metrics, Inc., Solon, OH 44139	216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121

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Gauges, Temperature-2900

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314**
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
EMICO Inc., Manchester, NH 03109	603-669-5121
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Linear Instruments, Spectra Physics Analytical, Reno, NV 89523	702-746-2200
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121

Gauges, Torque-2900

Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777	**A•2129**
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Vibrac, Amherst, NH 03031	603-882-6777

Gearheads & Speed Reducers - Also see gears and gear mechanisms-3500 – *See Vol. B*

Gears & Gear Mechanisms (Precision)-2500 – *See Vol. C*

Generator Groups (MIL), Signal-2440 – *See Vol. B*

Generators, AM-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
Analogic Corp., Peabody, MA 01960	508-977-3000
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Q-Tech Corp., Culver City, CA 90232-3510	310-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† RE America, Westlake, OH 44145	216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Generators, AM/FM-2900

§ Hauman, Inc., San Jose, CA 95131, 408-434-0888	**D•1265**
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
§ Marconi Instruments, Allendale, NJ 07401, 201-934-9050	**D•1297**
Analogic Corp., Peabody, MA 01960	508-977-3000
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Elpaz Instruments, Inc., Murrysville, PA 15668	412-327-8744
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
§ Metermaster, Tempe, AZ 85282	602-431-0015
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
† Q-Tech Corp., Culver City, CA 90232-3510	310-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† RE America, Westlake, OH 44145	216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Generators, Arbitrary Waveform-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2275**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
Analogic Corp., Peabody, MA 01960	508-977-3000
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
NF Electronic Instruments, State College, PA 16801	814-237-5580
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
PERX,Inc., Corte Madera, CA 94925	415-927-0155
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
XYZ Electronics, McCordsville, IN 46055	317-335-2128

Generators, Audio-2900

§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	**D•1030-1032**
§ Hauman, Inc., San Jose, CA 95131, 408-434-0888	**D•1265**
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8	514-333-8748; 800-361-3697
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
§ Electrodata. Inc., Bedford Heights, OH 44128	216-663-3333
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844

§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Julie Research Labs., New York, NY 10001	212-633-6625
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
NF Electronic Instruments, State College, PA 16801	814-237-5580
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† RE America, Westlake, OH 44145	216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854	908-572-9512
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Generators, Bar, Dot & Crosshatch-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900,1-800-645-5104	**D•1293**
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† CELCO, Manwah, NJ 07430	201-327-1123
† Colorado Video, Inc., Boulder, CO 80306	303-530-9580
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Metermaster, Tempe, AZ 85282	602-431-0015
Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Generators, Baud Rate-1900

§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000	**A•1347**
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777	**A•1445**
SARONIX, Palo Alto, CA 94303, 415-856-6900	**A•1476**
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ M-Tron Industries, Yankton, SD 57078	605-665-9321
† Q-Tech Corp., Culver City, CA 90232-3510	310-836-7900

Generators, Character-2325

§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665	**D•1151**
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020	**B•1095**
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
Ampex Corp., Redwood City, CA 94063-3199	415-367-2011
§ Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ ESE, El Segundo, CA 90245	310-322-2136
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104

Generators, Color Bar-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
§ Contact East, N. Andover, MA 01845	508-682-2000
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Metermaster, Tempe, AZ 85282	602-431-0015
Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260

Generators, Digital Delay — See Generators, Timing, Digital (Vol. D)

Generators, Electrical Power-4000

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
Georator Corp., Manassas, VA 22110-5512, 800-523-9938	**D•2261-2263**
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724	908-389-7761
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
Energy Systems, Vancouver, WA 98682	206-896-8310
Forster Enterprises, Inc., Waterbury, CT 06708	203-574-3832
† Globe Motors, Dayton, OH 45404	513-228-3171
† Inertial Motors, Doylestown, PA 18901	215-345-1010
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† Pacific Scientific, Electro Kinetics Division, Santa Barbara, CA 93101	805-963-2055
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815	607-335-5000
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Generators, Electrostatic Discharge - Also See Electrostatic Discharge Guns-2900

†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
Plastic Capacitors, Inc., Chicago, IL 60639	312-489-2229
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Simco Co., Hatfield, PA 19440	215-822-2171
† Velonex, Santa Clara, CA 95050	408-727-7370

Generators, FM-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† RE America, Westlake, OH 44145	216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Generators, FM/Stereo-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
† RE America, Westlake, OH 44145	216-871-7617
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100

Generators, Frequency Synthesizer-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2275**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1809**
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
Programmed Test Sources, Littleton, MA 01460, 508-486-3008	**D•1316**
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411	**A•1854**
Anadex Inc., Camarillo, CA 93012	805-987-9660
Analogic Corp., Peabody, MA 01960	508-977-3000
Avasem Corporation, San Jose, CA 95126	408-297-1201
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
† Elpaz Instruments, Inc., Murrysville, PA 15668	412-327-8744
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Fox Electronics, Ft. Myers, FL 33905	813-693-0099
Hewlett-Packard Company. Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† Q-Tech Corp., Culver City, CA 90232-3510	310-836-7900

† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
§ Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Vann Instruments, Albuquerque, NM 87106	505-265-2498
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Western Multiplex Corp., Belmont, CA 94002	415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Generators, Function-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463	**A•1523,2284**
Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299	**A•1537**
Georator Corp., Manassas, VA 22110-5512, 800-523-9938	**D•2263**
§ **Hauman, Inc., San Jose, CA 95131, 408-434-0888**	**D•1265**
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700**	**D•2270**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2275**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1288**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1293**
§ Action Instruments, San Diego, CA 92123	619-279-5726
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Analogic Corp., Peabody, MA 01960	508-977-3000
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
§ Cal-Tek Engineering, Kingston, MA 02364	617-585-5666
† CELCO, Mahwah, NJ 07430	201-327-1123
§ Contact East, N. Andover, MA 01845	508-682-2000
§ E & L Instruments, Interplex Electronics, Inc., New Haven, CT 06512	800-368-0880
Elpaz Instruments, Inc., Murrysville, PA 15668	412-327-8744
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
Evans Electronics, Berkeley, CA 94705	510-653-3083
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
MTS Systems, Eden Prairie, MN 55344	612-937-4000
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
PCA Electronics, Sepulveda, CA 91343	818-892-0761
Prema Precision Electronics, Inc., Montclair, CA 91763	714-621-7292
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
Resonant Power Technology, San Jose, CA 95131-2102	408-441-0800
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
Shapiro Scientific Inst., Corona del Mar, CA 92625	714-675-1024
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Vann Instruments, Albuquerque, NM 87106	505-265-2498
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
† Velonex, Santa Clara, CA 95050	408-727-7370
§ Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
XYZ Electronics, McCordsville, IN 46055	317-335-2128

Generators, Gating/Timing-2900

† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100**	**D•1239**
† **Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900**	**A•1459**
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411**	**D•1077,1207**
CAL-AV Labs, Inc., Campbell, CA 95008	408-369-1000
Candela Laser Corporation, Wayland, MA 01778	508-358-7637
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§ Pacific Atlantic Elctrns., Patronix, Inc., El Cerrito, CA 94530	510-237-5837
Panametrics, Waltham, MA 02154-3497	617-899-2719
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Generators, Hall-4800 – *See Vol. A*

Generators, Harmonic-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	D•2275
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076	708-677-4700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
Vann Instruments, Albuquerque, NM 87106	505-265-2498

Generators, High Power Pulse-2900

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100**	**D•1239**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1678**
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Barth Electronics, Inc., Boulder City, NV 89005	702-293-1576
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cober Electronics, Stamford, CT 06902	203-327-0003
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
Instrument Research Co., Columbia, MD 21045	410-740-3411
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Ion Physics Corporation, Atkinson, NH 03811	603-893-6687
Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302

Generators, Impulse-2900

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248**
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
§ Contact East, N. Andover, MA 01845	508-682-2000
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
Instrument Research Co., Columbia, MD 21045	410-740-3411
Ion Physics Corporation, Atkinson, NH 03811	603-893-6687
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
Picosecond Pulse Labs, Inc., Boulder, CO 80306	303-443-1249
† Velonex, Santa Clara, CA 95050	408-727-7370

Generators, Infrared – See Lamps, Infrared (Vol. B)

Generators, Ion - Also see Static Eliminating Materials and Equipment; Generators ESD-2900

# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Semtronics Corp., Peachtree City, GA 30269	404-487-6681

Generators, Light Pulse-2900

† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100**	**D•1239**
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Generators, Low Frequency-2900

§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666**	**D•1248**
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
§ Action Instruments, San Diego, CA 92123	619-279-5726
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Analogic Corp., Peabody, MA 01960	508-977-3000
AVO International, TBG, Dallas, TX 75237	214-333-3201
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940

† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Julie Research Labs., New York, NY 10001 212-633-6625
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282 602-431-0015
NF Electronic Instruments, State College, PA 16801 814-237-5580
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160 203-853-4433
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

Generators, Marker-2900

†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
International Crystal Mfg., Oklahoma City, OK 73126-0330 .... 405-236-3741; 1-800-725-1426
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411

Generators, Microwave-3450 – *See Vol. A*

Generators, Noise, Random (Electrical)-2900

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•2258
Elgenco, Inc., Hurricane, UT 84737, 801-635-4954 .... D•1255
†Φ Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... A•1848, D•1298,1311
† Accu-Noise Lab, Marek Technology Inc., Danbury, CT 06811 203-743-3633
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
† Haefely, Inc., Woodbridge, VA 22192 703-494-1900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
† MDF Products Inc., Danbury, CT 06811 203-743-3579
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
NF Electronic Instruments, State College, PA 16801 814-237-5580
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836 201-927-1766
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415 6428
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
† Velonex, Santa Clara, CA 95050 408-727-7370
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

Generators, Optical Signal — See Generators, Light Pulse (Vol. D)

Generators, Phase-2900

Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1535
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1281
† Clarke-Hess Communications Research Corp., New York, NY 10011 212-255-2940
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Elpaz Instruments, Inc., Murrysville, PA 15668 412-327-8744
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Evans Electronics, Berkeley, CA 94705 510-653-3083
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
NF Electronic Instruments, State College, PA 16801 814-237-5580
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

Generators, Programmable, Function-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274-2275
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 .... D•1291
† Advanced Power Designs Inc., Irvine, CA 92714 714-263-8605
Analogic Corp., Peabody, MA 01960 508-977-3000
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Metermaster, Tempe, AZ 85282 602-431-0015
NF Electronic Instruments, State College, PA 16801 814-237-5580
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Generators, Programmable, Pulse-2900

§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1529,1535-1536
† Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
§† EIP Microwave, Inc., Milpitas, CA 95035 408-945-1477
ETM Electromatic Inc, Newark, CA 94560 510-797-1100
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
§ Metermaster, Tempe, AZ 85282 602-431-0015
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Velonex, Santa Clara, CA 95050 408-727-7370
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

Generators, Programmable, Synthesizers-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274-2275
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1293
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 .... D•1316
Analogic Corp., Peabody, MA 01960 508-977-3000
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§† EIP Microwave, Inc., Milpitas, CA 95035 408-945-1477
Elpaz Instruments, Inc., Murrysville, PA 15668 412-327-8744
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Giga-tronics, Inc., Sunnyvale, CA 94089 408-734-5780
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
NF Electronic Instruments, State College, PA 16801 814-237-5580
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Generators, Pseudorandom Bit Sequence (PRBS)-2900

§ Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
New Wave Instruments, Provo, UT 84604 801-373-4909
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

Generators, Pulse-2900

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 .... D•1234
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 .... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 .... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 .... B•1917
BEI Motion Systefns Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
† Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 .... D•1239
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .... D•1248
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1529,1535-1536
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 .... A•1390
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
§ Instek Corporation, City of Industry, CA 91745, 818-336-6537 .... D•1745
§ Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 .... A•1579
§ Action Instruments, San Diego, CA 92123 619-279-5726
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448

† Barth Electronics, Inc., Boulder City, NV 89005 702-293-1576
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203 501-851-4000
Bel Fuse, Jersey City, NJ 07302 201-432-0463
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
Cober Electronics, Stamford, CT 06902 203-327-0003
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
§ Dynapar, Gurnee, IL 60031 312-662-2666
Elpaz Instruments, Inc., Murrysville, PA 15668 412-327-8744
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
ETM Electromatic Inc, Newark, CA 94560 510-797-1100
Evans Electronics, Berkeley, CA 94705 510-653-3083
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 203-624-3103
§ HC Protek, Northvale, NJ 07647 201-767-7242
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hipotronics Inc., Brewster, NY 10509 914-279-8091
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
† Instrument Research Co., Santa Barbara, CA 93103 805-962-8336
Instrument Research Co., Columbia, MD 21045 410-740-3411
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300 714-595-6030
Ion Physics Corporation, Atkinson, NH 03811 603-893-6687
IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
KeyTek Instrument Corp., Wilmington, MA 01887 508-658-0880
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Pacific Atlantic Elctrns., Patronix, Inc., El Cerrito, CA 94530 510-237-5837
Panametrics, Waltham, MA 02154-3497 617-899-2719
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 516-273-9800
Resonant Power Technology, San Jose, CA 95131-2102 408-441-0800
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 .... 201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
Sensor Corp., Scottdale, PA 15683 412-887-4080
Seven Mountains Sci. Inc., Boalsburg, PA 16827 814-466-6559
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
† Velonex, Santa Clara, CA 95050 408-727-7370
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

Generators, Pulse, National Instrumentation Module (NIM)-2900

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 .... D•1234
† Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 .... D•1239
ETM Electromatic Inc, Newark, CA 94560 510-797-1100
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
† Velonex, Santa Clara, CA 95050 408-727-7370

Generators, RF-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1023
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1293
§ Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 .... D•1316
† Ajax Magnethermic Corp., Warren, OH 44483 216-372-8511
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Cober Electronics, Stamford, CT 06902 203-327-0003
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§ Contact East, N. Andover, MA 01845 508-682-2000
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Ehrhorn Technological Opers., Inc., Colorado Springs, COLORADO 80919-4101 719-260-1191
ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
International Crystal Mfg., Oklahoma City, OK 73126-0330 .... 405-236-3741; 1-800-725-1426
§ Kenwood U.S.A., Long Beach, CA 90810 310-761-8295
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
§ Metermaster, Tempe, AZ 85282 602-431-0015
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131 708-288-4471
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† RE America, Westlake, OH 44145 216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160 203-853-4433
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Generators, Sawtooth, Sine — See Generators, Function (Vol. D)

Generators, Signal-Also See Generators, Specific Type-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1281
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1288
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1293
§ Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297
†Φ Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2287,2289-2290
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 .... D•1316
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450 .... D•1318
§ Action Instruments, San Diego, CA 92123 619-279-5726
Analogic Corp., Peabody, MA 01960 508-977-3000
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§ Contact East, N. Andover, MA 01845 508-682-2000
Direct Sound Corporation, Boston, MA 02116 1-800-372-1616
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
† Giga-tronics, Inc., Sunnyvale, CA 94089 408-734-5780
§ HC Protek, Northvale, NJ 07647 201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Instek Corporation, City of Industry, CA 91745 818-336-6537
Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
§ Metermaster, Tempe, AZ 85282 602-431-0015
NF Electronic Instruments, State College, PA 16801 814-237-5580
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
RE America, Westlake, OH 44145 216-871-7617
Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
Spectral Innovations, Santa Clara, CA 95054-1807 408-727-1314
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428

Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
† Velonex, Santa Clara, CA 95050	408-727-7370
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109	317-788-9351
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Generators, Spectrum — See Generators, Sweep (Vol. D)

Generators, Spike-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
† Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
§† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Velonex, Santa Clara, CA 95050	408-727-7370

Generators, Square Wave — See Generators, Function (Vol. D)

Generators, Surge-2900

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
§† KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
§ Metermaster, Tempe, AZ 85282	602-431-0015
Resonant Power Technology, San Jose, CA 95131-2102	408-441-0800
§† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020

Generators, Sweep-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1293**
§ **Marconi Instruments, Allendale, NJ 07401, 201-934-9050**	**D•1297**
†Φ **Noise Com Inc., Paramus, NJ 07652, 201-261-8797**	**D•1311**
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
† CELCO, Mahwah, NJ 07430	201-327-1123
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§† EIP Microwave, Inc., Milpitas, CA 95035	408-945-1477
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076	708-677-4700
NF Electronic Instruments, State College, PA 16801	814-237-5580
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Simpson Electric Co., Elgin, IL 60120	708-697-2260
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
† Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109	317-788-9351
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Generators, Telephone Ringing-1900

Cambridge Electronics Laboratories, Somerville, MA 02144	617-629-2805
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
§ Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
§ Viking Electronics, Inc., Hudson, WI 54016	715-386-8861
Viking Industrial Products, Marlboro, MA 01752	508-481-4600

Generators, Time Code-2000

§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665**	**D•1151**
† **Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333**	D•1116,1186-1189
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391,** 813-884-1411	D•1077,1207
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ ESE, El Segundo, CA 90245	310-322-2136
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230

Generators, Timing, Digital-2000

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100**	**D•1239**
§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665**	**D•1151**
† **Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333**	**D•1116,1186-1189**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
† **TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411**	**D•1077,1207**
Bel Fuse, Jersey City, NJ 07302	201-432-0463
CAL-AV Labs, Inc., Campbell, CA 95008	408-369-1000
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ Dataprobe, Englewood, NJ 07631	201-569-6464
Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
§ ESE, El Segundo, CA 90245	310-322-2136
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300	714-595-6030
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Generators, Tone-2900

AES Corp., Peabody, MA 01960	508-535-7310
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
Communications & Energy Corp., E. Syracuse, NY 13057	315-452-0709
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
§ ESE, El Segundo, CA 90245	310-322-2136
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Sonicall, Inc., Signal Hill, CA 90806	213-490-2143
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854	908-572-9512
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Western Multiplex Corp., Belmont, CA 94002	415-592-8832
§ Wheelock, Inc., Long Branch, NJ 07740	908-222-6880

Generators, Tone Burst-2900

§ **Leader Instruments Corp., Hauppauge, NY 11788-3694,** 516-231-6900:1-800-645-5104	D•1293
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ ESE, El Segundo, CA 90245	310-322-2136
Krohn-Hite Corp., Avon, MA 02322	508-580-1660
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Generators, Transient Line Voltage-2900

Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274-2275**

General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020
† Velonex, Santa Clara, CA 95050	408-727-7370

Generators, UHF/VHF-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
Programmed Test Sources, Littleton, MA 01460, 508-486-3008	**D•1316**
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433	**A•1509**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Dowty Avionics, Arcadia, CA 91006	818-445-5955
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
† Q-Tech Corp., Culver City, CA 90232-3510	310-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

Generators, Ultrasonic-2900

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623	716-427-8300
Instrument Research Co., Santa Barbara, CA 93103	805-962-8336
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§† L & R Mfg. Co., Kearny, NJ 07032	201-991-5330
Matec Instruments, Inc., Hopkinton, MA 01748	508-435-9039
† The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056	708-824-1133
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Panametrics, Waltham, MA 02154-3497	617-899-2719
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§† Sonicor Instrument Corp., Copiague, NY 11726	516-842-3344
§ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382	610-696-4710;800-323-1269
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020

Generators, Video Test-2900

§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
† CELCO, Mahwah, NJ 07430	201-327-1123
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Team Systems, Santa Clara, CA 95051	408-720-8877

Generators, White Noise-2900

†Φ Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1298,1311**
† Accu-Noise Lab, Marek Technology Inc., Danbury, CT 06811	203-743-3633
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Koep Precision Standards, Inc., Tuckerton, NJ 08087	609-296-9686
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
† MDF Products Inc., Danbury, CT 06811	203-743-3579
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§ Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Φ Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Generators, Word-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ Adtron Instruments, Phoenix, AZ 85022	602-863-2250
Data Environment, Inc., Portland, OR 97291	503-531-0765
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300	714-595-6030
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000

† Micronetics, Hudson, NH 03051	603-883-2900
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
PERX,Inc., Corte Madera, CA 94925	415-927-0155
§ Pulse Instruments Co., Torrance, CA 90502	310-515-5330
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Step Engineering, Sunnyvale, CA 94088	408-733-7837

Geophysical Equip. — See Transducers (Vol. B)
Germanium — See Crystals, Semiconductor (Vol. A)
Glass Diode Sleeves-2500 — ***See Vol. C***
Glass Parts-2500 — ***See Vol. C***
Glues — See Adhesives (Vol. C)
Graphic Recording Instruments — See Recorders (Vol. D)

Graphic Recording Paper & Supplies-3000

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1199,1415**
§Φ Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
M-Tek, Pittsburgh, PA 15222	800-245-5101 ; 412-261-9030
§ PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
The Recorder Company, San Marcos, TX 78667	210-629-1400

Graphite Parts-2500 — ***See Vol. C***

Grilles & Accessories, Speaker-1300

§ Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400	**C•1063,1065**
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Fourjay Industries, Dayton, OH 45413-0617	513-890-6444
§ International Components Corp., Melville, NY 11747	516-293-1500
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297	216-442-2286
§ Quam-Nichols Co., Chicago, IL 60637	312-488-5800
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA N0B 2E0	519-696-2616
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900

Grilles, Metal, Plastic-2500 — ***See Vol. C***
Grommets & Bushings-2500 — ***See Vol. C***
Ground Fault Detectors & Accessories — See Detectors, Ground Fault (Vol. D)

Ground Strips-1900

Cut Craft, Inc., Ft. Worth, TX 76102, 817-332-6151	**C•1684**
ABL Electronics Supply, Inc., Peekskill, NY 10566	914-736-1010; 1-800-431-2103
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
The Hirol Company, Ft. Lauderdale, FL 33309	305-974-4900
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
§ Tech Spray, Inc., Amarillo, TX 79105	806-372-8523
Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659

Guides, Circuit Board-3200 — ***See Vol. C***

Gyros (All Types)-2200

† Humphrey, Inc., San Diego, CA 92123, 619-565-6631	**B•1956-1958**
Condor Pacific Inds., Inc., Canoga Park, CA 91304	818-347-8331
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
§† Systron-Donner Inertial Div., A BEI Electronics Company, Concord, CA 94518	510-671-6400

Hall Effect Devices — See Generators, Hall (Vol. B), Magnetoresistors, Hall (Vol. A), Multipliers, Hall (Vol. A), Probes, Hall (Vol. A), Switches, Hall Effect (Vol. B)

Handlers, Integrated Circuit (Automatic)-4100

Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
§ Delta Design, San Diego, CA 92123-1111	619-292-5000
§ Eraser Co., Syracuse, NY 13221	315-454-3237
Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
Milton Ross Co., Warrington, PA 18976	215-491-0600
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
§ Quality Automation, Inc., Anaheim, CA 92805	714-491-8535
Reliability Incorporated, Houston, TX 77218	713-492-0550
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
Testronics, McKinney, TX 75069	214-542-3111
† Thermonics, Inc., Santa Clara, CA 95054	408-496-6838
§ TRIGON/ADCOTECH, Dynatech, Milpitas, CA 95035	408-946-4300

Handles For Cabinets, Circuit Boards, Racks, etc.-2500 — ***See Vol. C***

Handsets, Chestsets, Headsets, etc.-1300

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
§† Audiosears, Stamford, NY 12167	607-652-7305;800-533-7863
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710	510-527-6666
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
† Roanwell, New York, NY 10014	212-989-1090
Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
† Stanton Magnetics, Inc., Plainview, NY 11803-1511	516-349-0235
§† Television Equipment Assocs., So. Salem, NY 10590-0393	914-763-8893

Hardware — See Fasteners (Vol. C), Clamps (Vol. C), Terminals (Vol. C), etc.
Hardware (MIL), Connector-2440 — *See Vol. B*
Harnesses, Wire — See Cable Assemblies & Harnesses (Vol. C)
Headers, Connector — See Connectors, Cable (Vol. C), Connectors, Flat Cable (Vol. C), etc.
Headers, DIP-2100 — *See Vol. C*
Headers, Hermetic — See Seals, Hermetic (Vol. C), Services, Hermetic Sealing (Vol. D)
Headers, Programmable-2100 — *See Vol. C*
Headers, Relay & Transformer-2100 — *See Vol. C*
Headers, Shrouded-2100 — *See Vol. C*
Headers, Socket-2100 — *See Vol. C*
Headers, Strip-2100 — *See Vol. C*
Headers, Transistor & Diode-2500 — *See Vol. C*

Headphones-1300

§ International Components Corp., Melville, NY 11747, 516-293-1500 ...... D•1036
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ...... D•1041
JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024-1025,1042-1044,1046-1047
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ...... D•1060,1062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ...... D•1067
Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577 510-351-3500
Audiosears, Stamford, NY 12167 ...... 607-652-7305;800-533-7863
§ Audiotronics Corp., N. Hollywood, CA 91605 818-765-2645
§† Centurion International, Inc., Lincoln, NE 68504 800-228-4563
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Grado Laboratories, Brooklyn, NY 11220 718-435-5340
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§† R-Columbia Prods. Co., Inc., Highland Park, IL 60035 708-432-7915
§ Recoton Corp., Long Island City, NY 11101 718-392-6442
† Roanwell, New York, NY 10014 212-989-1090
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911

Heads, Magnetic Recording-1300

§† International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 ... D•1039
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ...... D•1067
§ American Magnetics Corporation, Group 4, Carson, CA 90745 213-775-8651
† Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
Applied Magnetics, Goleta, CA 93117 805-683-5353
† Brush Industries Inc., Sunbury, PA 17801-0638 ...... 717-286-5611:800-233-0362
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
JEMA, Wilmette, IL 60091 708-251-3600
† Mag-Head Engineering Co., Minneapolis, MN 55427 612-545-1321
§† Michigan Magnetics, Vermontville, MI 49096 517-726-0590
Norton Associates, Inc., Garden City, NY 11530 516-745-1411
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

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Heat Dissipators — See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)

Heaters, Immersion-4100

Omega Engineering, Stamford, CT 06907, 800-826-6342 ...... B•2004
ARi Industries, Inc., Addison, IL 60101 ...... 708-953-9100;800-237-6725
Brinkmann Instruments, Inc., Westbury, NY 11590-0207 516-334-7500
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Science Electronics, Dayton, OH 45401-0986 513-859-5555
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Technic, Inc., Providence, RI 02940-9650 401-781-6100
† Trent, Inc., Philadelphia, PA 19127 215-482-5000

Heaters & Heating Elements (For Components & Equipment)-Also See Ovens-5300 — *See Vol. B*
Heat Exchangers & Systems-2600 — *See Vol. C*
Heat Guns, Production-5400 — *See Vol. C*
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Heat Sinks, Soldering-4600 — *See Vol. C*
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Heat Sinks (MIL)-2440 — *See Vol. B*
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Holders, Battery — See Retainers, Battery (Vol. C), Connectors, Battery (Vol. C)
Holders, Brush — See Brushes & Brush Assemblies (Vol. B)

Holders, Circuit Board (Production Type)-4100

§† Atlee Inc., North Andover, MA 01845, 508-681-1003 ...... C•1015,1671
§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ...... C•1537
§ Calmark Corp., San Gabriel, CA 91776, 818-287-0451 ...... C•1018
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572 ...... C•1022,1135
Unitrack Industries, Inc., Milford, DE 19963, 302-424-5050 ...... C•1114-1115
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ...... C•1674
§† A.P.E. Corporation, Medford, NY 11763 516-654-1197
BICC-VERO Electronics, Inc., Hamden, CT 06514 ...... 203-288-8001;1-800-242-2863
§† Bud Industries, Inc., Willoughby, OH 44094-0431 216-946-3200
§ Contact East, N. Andover, MA 01845 508-682-2000
† EMC Global Technologies Inc., Doylestown, PA 18901 215-340-0650
§ Eraser Co., Syracuse, NY 13221 315-454-3237
§† Fancort Industries, Inc., W. Caldwell, NJ 07006 201-575-0610
§ Fastex, Illinois Tool Works, Des Plaines, IL 60016 708-299-2222
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
§ Micro Electronic Systems, Inc., Bridgewater, CT 06752 203-350-5004
# Midwest Container Systems, Minneapolis, MN 55428 612-533-4532
MultiNational Resources, Inc., Bedford, NH 03110 603-622-3550
§ PACE, Inc., Laurel, MD 20723-1990 301-490-9860
§ PanaVise Products, Inc., Sparks, NV 89431 702-353-2900
Parsons Manufacturing, Menlo Park, CA 94025-1476 415-324-4726
§ Richco Plastic Co., Chicago, IL 60680 312-539-4060
Schroff, Inc., Warwick, RI 02886 401-732-3770
† Stevens Products, Inc., E. Orange, NJ 07019 201-672-2140
§† Technical Devices, Torrance, CA 90503 310-618-8437
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Teknational Inds., Inc., Rochester, NY 14620-1103 716-232-1291
† Titchener, E. H., & Co., Binghamton, NY 13902-1706 607-772-1161

Holders, Crystal-2300 — *See Vol. A*
Holders, Diode-2500 — *See Vol. C*
Holders, Fuse — See Clips & Holders, Fuse (Vol. B), Panels, Fuse (Vol. B)
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Holders, Test Lead-2900

§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
§ Metermaster, Tempe, AZ 85282 602-431-0015
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
§ Schurter, Inc., Petaluma, CA 94954 ...... 800-848-2600 ext.62
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990

Holders, Tube — See Retainers, Tube (Vol. A)
Holders & Carriers, Chip (Capacitor, IC, LSI)-2100 — *See Vol. C*
Holders & Carriers, IC, LSI (Packaged)-3130 — *See Vol. A*
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Housings, Terminal-1400 — *See Vol. C*
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Igniters, Electronic & Piezo-2300 — *See Vol. A*
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Imagers, Thermal-2900

§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§Φ Compix, Inc., Lake Oswego, OR 97035-4066 503-639-8496
ElectroPhysics Corp., Fairfield, NJ 07004 201-882-0211
Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ...... 215-781-0700; 800-523-8989
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481 201-891-7330
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Xedar Corp., Boulder, CO 80301 303-443-6441

Imagers, Charge-Coupled Devices-3700 — *See Vol. B*
IEEE 488 (GPIB) Bus — See Controllers, IEEE 488 (GPIB) (Vol. C), Cable, IEEE (Vol. D)
Impedance Comparators — See Bridges, Impedance (Vol. D)
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Inclinometers-2900

Midori America Corp., Fullerton, CA 92631, 714-449-0997 ...... A•2109
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 ... B•2021-2022, D•1327
§† Cascor, Inc., RJB Industries, Inc., Naples, FL 33942 813-643-6616
§ Contact East, N. Andover, MA 01845 508-682-2000
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
Ocean Motions Co., Barrington, RI 02806 401-246-1394
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Terra Technlg. Corp., Redmond, WA 98052 206-883-7300
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400

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Indexing Tables, Electromechanical-2400 — *See Vol. C*
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Indicators, Azimuth-3500 — *See Vol. B*
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Indicators, Distortion — See Analyzers, AF (Vol. D)

Indicators, Elapsed Time-2200

§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665 .... D•1151
§† Curtis Instruments, Inc., Mt. Kisco, NY 10549, 914-666-2971 .... D•1158
† Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1186
DCI Inc., Olathe, KS 66062, 913-782-5672 .... D•1344
† Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740 .... D•1159
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 .... B•1043
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1346,1348-1350
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1361
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000 .... D•1168
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1390
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
§† Cramer Co., Old Saybrook, CT 06475-1261 800-247-6784
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
† Digitec, Marion, OH 43302 614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
Electric Tachometer, Philadelphia, PA 19142 215-726-7723
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
EMICO Inc., Manchester, NH 03109 603-669-5121
§ ESE, El Segundo, CA 90245 310-322-2136
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
† The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
Gossen/Texmate, Vista, CA 92083-8397 .... 619-598-9899;1-800-394-8344
Gralex Industries, Norwood, NJ 07648 800-486-4499
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458 201-825-9696
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501 310-328-0060
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
§ J-B-T Instruments, Inc., New Haven, CT 06508-1818 203-776-1111
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
Meylan Corporation, Upper Montclair, NJ 07043-1844 201-744-6400
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
Omega Engineering, Stamford, CT 06907 800-826-6342
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Philips Technologies, North American Philips Corporation, Cheshire, CT 06410 203-271-6525
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410 203-271-6000
PPM, Inc., Cleveland, OH 44122 1-800-899-4776
§ Redington Counters, Windsor, CT 06095 203-688-6205
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036 704-892-8872
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Indicators, Electromechanical — See Indicators, Circuit Condition, On / Off (Vol. B)

Indicators, Frequency — See Meters, Frequency (Vol. D)

Indicators, Directional-2200

C-Tek Inc., Wakefield, MA 01880 617-246-1720
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Transmagnetics, Farmingdale, NY 11735 516-293-3100

Indicators, Illumination — See Meters, Light (Nonphotographic) (Vol. D)

Indicators, Instrument, Flag, Pointer, etc.-2450 — ***See Vol. B***

Indicators, Liquid Level-2200

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1348
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1145
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100 .... D•1312
† Ocean Motions Co., Barrington, RI 02806, 401-246-1394 .... B•1980
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1016,1314
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1145
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Analogic Corp., Peabody, MA 01960 508-977-3000
§ ASI Instruments, Inc., Houston, TX 77024 800-245-7056
† Automation Prods., Inc., Houston, TX 77008 713-869-0361
§ Bindicator, Port Huron, MI 48061-0009 313-987-2700
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940 215-968-0660
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
§ Genelco, Division of Bindicator, Port Huron, MI 48061-0009 313-987-2700
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Intek, Inc., Westerville, OH 43081 614-895-0301
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
§ Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Nuclear Research Corp., Warrington, PA 18976 215-343-5900
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Penberthy, Inc., Prophetstown, IL 61277 815-537-2311
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053 215-355-6900
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Sensotec, Inc., Columbus, OH 43212 614-486-7723
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Signal Systems International, Lavalette, NJ 08735 908-793-4668
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
Viatran Corporation, Grand Island, NEW YORK 14072 716-773-1700
§ Westronics Inc. of Texas, A Baker Hughes Co., Ft. Worth, TX 76161 817-625-2311

Indicators, Null-2900

Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
§ Greibach Instruments Div., Mt. Vernon, NY 10550 914-699-9717
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Julie Research Labs., New York, NY 10001 212-633-6625
§ Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ Metermaster, Tempe, AZ 85282 602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015

Indicators, Numeric Readout — See Tubes, Readout (Vol. A)

Indicators, Phase Rotation-2200

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1595
§ AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 815-397-7070
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220

Indicators, Phase Sequence-2200

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1595
§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
§ AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
AVO International, TBG, Dallas, TX 75237 214-333-3201
† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 815-397-7070
§ Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Metermaster, Tempe, AZ 85282 602-431-0015
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
TEGAM, Inc., Madison, OH 44057 800-666-1010

Indicators, Phase Sequence-2200 (Cont'd)

§ Time Mark Corp., Tulsa, OK 74116	918-438-1220

Indicators, Positioning-2200

American Electronic Components, Elkhart, IN 46514, 219-264-1116	**B•1711**
Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176**
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631	B•1956
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968, D•2316**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1971**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Atec, Inc., Houston, TX 77055	713-468-7971
Capacitec, Inc., Ayer, MA 01432	508-772-6033
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Data Instruments, Inc., Acton, MA 01720	800-332-3282
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
† Dupree, Inc., Chino, CA 91710	909-597-4889
§ Dynapar, Gurnee, IL 60031	312-662-2666
† Electric Tachometer, Philadelphia, PA 19142	215-726-7723
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198	203-747-3000
† Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
† Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516 234-3800
Sensor Corp., Scottdale, PA 15683	412-887-4080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116	215-464-9300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778	508-358-2777

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Indicators, Pressure — See Gauges, Pressure (Vol. D)
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Indicators, RF — See Meters, Frequency (Vol. D)
Indicators, Rotary Shaft Position — See Encoders, Shaft Angle (Vol. B)

Indicators, Servo-4900

† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133**	**D•2315**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1066**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968, D•2316**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
McFadden Systems, Inc., Santa Fe Springs, CA 90670	310-948-4414
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400

† Transmagnetics, Farmingdale, NY 11735	516-293-3100
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Indicators, Shorted Turn — See Testers, Coil (Vol. D)
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Indicators, Temperature — See Meters, Temperature (Vol. D)
Indicators, Temperature (Not Meter Type)-5300 — ***See Vol. B***

Indicators, Tilt-2200

American Electronic Components, Elkhart, IN 46514, 219-264-1116	**B•1711**
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905

Indicators, VSWR — See Meters, Standing Wave Ratio (Vol. D)
Indicators (MIL), Fault Locating-2440 — ***See Vol. B***
Inductance Comparators — See Bridges, Inductance (Vol. D)
Inductance Standards — See Standards, Inductance (Vol. D)
Induction Potentiometers — See Resolvers, Synchro (Vol. D)
Inductors — See Coils (Vol. A)
Inductors (MIL) — See Coils (MIL) (Vol. B)
Infrared Emitter Detectors — See Emitters/Detectors, Infrared (Vol. B)
Infrared (IR) Equipment (MIL)-2440 — ***See Vol. B***
Infrared Soldering — See Soldering Equipment, Infrared (Vol. D)
Inks for Thick Film Microcircuits-1700 — ***See Vol. C***

Input/Output Equipment, Voice-2000

Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
† **Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220**	**D•1074**
Cognitronics, Stamford, CT 06906	203-327-5307
† Mimic, Inc., Islington, MA 02090-0705	617-329-9593
§ Voice Connexion, Irvine, CA 92714	714-261-2366

Input/Output Switching Modules — See Modules, Control & Switching (Vol. D)
Inserters, DIP & IC — See Extractors, DIP & IC (Vol. C)

Insertion Loss Measurement Systems-2900

§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
† Maury Microwave Corp., Ontario, CA 91764	909-987-4715
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

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Inspection Systems, Visual, Surface Mount-4100

§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800
Automatix Inc., Billerica, MA 01821	506-667-7900
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-784-4456
Cognex Corp., Needham, MA 02194	617-449-6030
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ektron Applied Imaging, Inc., Bedford, MA 01730	617-271-1940
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Imaging Technology Inc., Bedford, MA 01730-1421	617-275-2700
Manncorp, Huntingdon Valley, PA 19006	215-364-6100
† Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
Volpi-MFG-USA, Auburn, NY 13021-1289	315-255-1737
§ Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Installation Equipment, Fiber Optic-2475 — ***See Vol. B***
Instrumentation, Fiber Optic-2475 — ***See Vol. B***

Instrumentation, High Voltage-2900

Vitrek Corporation, San Diego, CA 92121	619-586-1695

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Instrument Parts, Precision — See Bearings (Vol. C), Gears & Gear Mechanisms (Precision) (Vol. C)

Instruments, Test & Measuring, Cryogenic-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**B•1918**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212**
American Magnetics, Oak Ridge, TN 37831-2509	615-482-1056
Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Φ Lydall Inc., Manning Div., Troy, NY 12181	518-273-6320
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Research Inc., Minneapolis, MN 55424	612-941-3300
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§ TEGAM, Inc., Madison, OH 44057	800-666-1010

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Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1003,1224-1225**
Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226-1227**
Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886	**A•1620**
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1152,1236**
† Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100	**D•1239**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1619-1620,1623**
† Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940	**D•1246-1247**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Φ Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696	**D•1253**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1678**
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1684-1685,2257-2258**
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936,1947**
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259,1403**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761	**A•1638**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
Hauman, Inc., San Jose, CA 95131, 408-434-0888	**D•1265**
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•2271**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1278**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1767**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283**
§ Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295	**D•1407,1773**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289,1808-1809**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1292-1293**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300	**D•1299**
§ MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171	**D•1300,2283**
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950	**D•1197**
National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1198,1302**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1360**
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900	**D•1303**
Φ Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1298,1311**
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1199,1314**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2286,2289**
Programmed Test Sources, Littleton, MA 01460, 508-486-3008	**D•1316**
§† Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046	**D•1317**
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
§ ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305	**D•1320-1321**
† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202	**D•1416**
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
Φ Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1213**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1209**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329**
† Velonex, Santa Clara, CA 95050, 408-727-7370	**D•1388**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
§Φ Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**

Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
AMASCO, Torrance, CA 90501	310-781-9494
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Amptec Electronics, San Diego, CA 92128	619-578-7816
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231	216-349-0370
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
†Φ Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
# BEC Inc. Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bindicator, Port Huron, MI 48061-0009	313-987-2700
§ Biomation, Cupertino, CA 95014-0718	408-988-6800
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
CAL-AV Labs, Inc., Campbell, CA 95008	408-369-1000
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
California Instruments Corp., San Diego, CA 92123-1509	619-279-8620; 800-4AC-POWER
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
§ Contact East, N. Andover, MA 01845	508-682-2000
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
DSP Technology, Fremont, CA 94538-7338	510-657-7555
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
§ Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
Energy Systems, Vancouver, WA 98682	206-896-8310
Environmental Stress Systems, Inc., Sonora, CA 95370	209-928-4900
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
ESS, Inc.. Sonora, CA 95370	209-928-4900
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§ EXFO, E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
† Giga-tronics, Inc., Sunnyvale, CA 94089	408-734-5780
† Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
Φ IFR Sys. Inc., Wichita, KS 67215	316-522-4981
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
Instrum, Monrovia, CA 91016	818-303-4210
§ Interface, Inc., Scottsdale, AZ 85260	602-948-5555
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300	714-595-6030
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
ITF Corp., Buford, GA 30518	404-945-3844
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
L-Com Inc., N. Andover, MA 01845	508-682-6936
LDJ Electronics, Troy, MI 48099-0219	313-528-2202
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
† MDF Products Inc., Danbury, CT 06811	203-743-3579
Mensor Corporation, San Marcos, TX 78666	512-396-4200
§Φ MetaLink Corporation, Chandler, AZ 85244	602-926-0797
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micronetics, Hudson, NH 03051	603-883-2900
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MSI Electronics, Inc., Woodside, NY 11377	718-672-6500
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
PERX,Inc., Corte Madera, CA 94925	415-927-0155
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
§ PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
Prologic Systems, Broomfield, CO 80020	303-460-0103
§ Pulse Instruments Co., Torrance, CA 90502	310-515-5330
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† RE America, Westlake, OH 44145	216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821	508-671-9700;1-800-225-5765
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500

† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
# Sensor Products, Inc., E. Hanover, NJ 07936 201-884-1755
§ Soltec Corp., San Fernando, CA 91340-1597 .... 818-365-0800;800-423-2344
Sorensen Company, Paxton, IL 60957 800-525-2024
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600:800-343-1199
TEGAM, Inc., Madison, OH 44057 800-666-1010
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
§ (UEC) United Electric Controls, Watertown, MA 02272-9143 617-926-1000
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
UTI Instruments Co., San Jose, CA 95131 408-428-9400
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
Vektrex Electronic Systems, Inc., San Diego, CA 92126 619-578-6787
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300
§† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
§ WestCon, Marion, OH 43302 614-382-5771
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

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Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 .... A•1622
Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 .... A•1696, D•1087
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1285
MSD3, Morgan Hill, CA 95037, 800-541-3526;408-778-7267 .... A•1697
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1302**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
ADAC Corporation, Woburn, MA 01801 617-935-6668
§ Adtron Instruments, Phoenix, AZ 85022 602-863-2250
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Ancot, Menlo Park, CA 94025 415-322-5322
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
Ariel Corporation, Highland Pk., NJ 08904 908-249-2900
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§# Biomation, Cupertino, CA 95014-0718 408-988-6800
Data Environment, Inc., Portland, OR 97291 503-531-0765
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
Dianachart Inc., Rockaway, NJ 07866 201-625-2299
Electro Rent Corp., Van Nuys, CA 91411 800-688-1111
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
HILEVEL Technology, Tustin, CA 92680 714-573-1888
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705 602-623-9801
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
ITF Corp., Buford, GA 30518 404-945-3844
§† Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
§ Kenwood U.S.A., Long Beach, CA 90810 310-761-8295
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
§ Krenz Instruments, Inc., Bonsall, CA 92003 619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§Φ MetaLink Corporation, Chandler, AZ 85244 602-926-0797
Microvision Corp., Los Gatos, CA 95008 408-374-3158
MSD3, Morgan Hill, CA 95037 .... 800-541-3526;408-778-7267
Network Technologies Inc., Aurora, OH 44202 .... 216-562-7070/800-742-8324
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
§ Northeast Innovations, Inc., Concord, NH 03302 603-736-8260
† Ocean Motions Co., Barrington, RI 02806 401-246-1394
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Pacific Power Source Corp., Huntington Bch., CA 92649 .... 714-898-2691;800-854-2433
PERX,Inc., Corte Madera, CA 94925 415-927-0155
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Research Inc., Minneapolis, MN 55424 612-941-3300
Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818 .... 401-884-6800; 800-332-3202
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
SCHENCK PEGASUS Corporation, Troy, MI 48083 313-689-9000
§ SC Technology, Inc., Livermore, CA 94550 510-373-9230
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
§ Soltec Corp., San Fernando, CA 91340-1597 .... 818-365-0800;800-423-2344
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309 305-739-7004
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Vektrex Electronic Systems, Inc., San Diego, CA 92126 619-578-6787
VMETRO, Inc., VMETRO as, Houston, TX 77079 713-584-0728
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300
Φ Western Graphtec, Inc., Irvine, CA 92718-2067 .... 714-770-6010;800-854-8385

Instruments, Test & Measuring, VXIbus Compatible-2900

§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•1685,2257**
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147**
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900 .... D•1303
Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
† Advanced Power Designs Inc., Irvine, CA 92714 714-263-8605
AMASCO, Torrance, CA 90501 310-781-9494
Analogic Corp., Peabody, MA 01960 508-977-3000
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
CAL-AV Labs, Inc., Campbell, CA 95008 408-369-1000
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

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GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1262
Angus Electronics Co., Indianapolis, IN 46224 317-244-7611
Comlinear Corp., Fort Collins, CO 80525 303-226-0500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Evans Electronics, Berkeley, CA 94705 510-653-3083
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
# Indiana Microelectronics Center, Indiana Bus. Modernization & Technology Corp., Fort Wayne, IN 46825 219-482-8200
Infranor, Naugatuck, CT 06770 .... 203-729-8258;800-BE-SERVO
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Lem Dynamp Inc., Grove City, OH 43123 614-871-6900
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
§ Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228 .... +41(22)7941121
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
§ Vibra-Metrics, Inc., Hamden, CT 06514 .... 203-288-6158;1-800-U-SENS-IT
§ Walker Scientific, Worcester, MA 01606 .... 508-852-3674;508-853-3232;800-962-4638

Integrators, Mechanical & Electromechanical-2200

† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Infranor, Naugatuck, CT 06770 .... 203-729-8258;800-BE-SERVO
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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CTI Electronics, Stratford, CT 06497, 203-386-9779 .... D•1086
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .... B•1040
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1460-1461, D•1182**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074 .... D•1192-1193
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777
LEOCO (U.S.A.) Corporation, Fremont, CA 94538, 510-651-4700 .... C•1382
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
Matrix Corp., Indianapolis, IN 46241, 317-248-2036 .... D•1195
Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 .... D•1163
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100 .... D•1147,1198,1302**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1101,1199,1314

† **Telpar, Inc., Addison, TX 75001, 214-233-6631**	**D•1113**
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469	**B•1852**
§ **WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810**	**C•1519-1521**
§ **WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136**	**C•1520-1521**
† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1390-1391**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
Action Instruments, San Diego, CA 92123	619-279-5726
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
§ ALTEK Corporation, Silver Springs, MD 20904-7802	301-572-2555
§ American Advantech Corp., San Jose, CA 95122	408-293-6786
Amplifier Research, Souderton, PA 18964-9990	215-723-8181
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Bit 3 Computer Corporation, Minneapolis, MN 55431-1393	612-881-6955
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
† Cable & Computer Technology Inc., Anaheim, CA 92806	714-937-1341
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Covid, Inc., Tempe, AZ 85281	602-966-2221
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
§ Datatran Corp., Denver, CO 80223	303-778-0870
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
† DEI, Escondido, CA 92029	619-743-8344
DGH Corporation, Manchester, NH 03108	603-622-0452
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Eventide, Inc., Little Ferry, NJ 07643	201-641-1200
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
GEN/COMP Inc., Canton, MA 02021	617-828-2008
§ Greenwich Instruments USA, Charlotte, NC 28205	704-376-1021
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
HILEVEL Technology, Tustin, CA 92680	714-573-1888
HMW Enterprises, Inc., Waynesboro, PA 17268	717-765-4690
§ ICI Inc., Placentia, CA 92670	714-579-7575
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
§ IICon Corporation, Morgan Hill, CA 95037	408-779-7466
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Intelligent Interfaces, Inc., Stone Mountain, GA 30086	404-381-9891;1-800-842-0888
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ Interloop, San Jose, CA 95131	408-922-0520
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
KineticSystems Corp., Lockport, IL 60441	815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
L-Com Inc., N. Andover, MA 01845	508-682-6936
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§ Macrolink, Anaheim, CA 92807	714-777-8800
3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
Methode Electronics, Inc., Chicago, IL 60656	708-867-9600
§ MGR Industries Inc., Ft. Collins, CO 80524	303-221-2201
Micro/sys, Glendale, CA 91208	818-244-4600
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
Omnibyte Corp., West Chicago, IL 60185-3790	708-231-6880
§ Opto 22, Temecula, CA 92590	714-695-9299
Optrex/Satori, Torrance, CA 90503	310-214-1791
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
Quatech Inc., Akron, OH 44311	216-434-3154
RGB Spectrum, Alameda, CA 94501	510-814-7000
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505	310-517-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Simulex Corporation, Tustin, CA 92680	714-730-1500
§† Sipex Corp., Billerica, MA 01821	508-667-8700
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237
† Terminal Data Corp., Rockville, MD 20855	301-921-8282
† Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622
Transmagnetics, Farmingdale, NY 11735	516-293-3100
USAR Systems, Inc., New York, NY 10012	212-226-2042
Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659
§ Via West Interface, Inc., Tucson, AZ 85705	602-623-5716;1-800-266-5716
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Interfaces, Telex/Computer-1900

† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237

Interrupters & Detectors, Ground Fault-4300 – *See Vol. B*
Interrupters, Optoelectronic-3700 – *See Vol. B*
Interrupters, Photo-3700 – *See Vol. B*
Intervalometers – See Timers (Vol. D)
Inverters, DC to AC – See Power Supplies, AC Output (Vol. D)
Inverters (MIL), DC to AC-2440 – *See Vol. B*

Ion, implanter, medium current-4100

§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973

Isolators, Antenna-1200

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411**	**A•1856-1857**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226	317-545-4281

Isolators, Ferrite-3450 – *See Vol. A*

Isolators, High Voltage-4050

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1594**
† Dymec Inc., Winchester, MA 01890	617-729-7870
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
MACOM, Inc., Lowell, MA 01851	617-272-3000
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220

Isolators, Line-4050

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ **Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792**	**D•2255**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427**	**D•2259**
† **Georator Corp., Manassas, VA 22110-5512, 800-523-9938**	**D•2262-2263**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	**D•2266-2267**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2308-2309**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380	607-724-2484
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627	714-557-1636
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
§ Hammond Manufacturing Co., Buffalo, NY 14225	716-894-5710
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
Siltronics Ltd., Dover, MA 02030	617-329-4068
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696

Isolators, Microwave (all types)-3450 – *See Vol. A*

Isolators, Multi-channel-1900

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
† Dymec Inc., Winchester, MA 01890	617-729-7870
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
North Hills Signal Processing, Syosset, NY 11791	516-682-7740
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811

Isolators, Optoelectronic-3700 – *See Vol. B*

Isolators, Signal (I, V,)-1900

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**A•1847**
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1594**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† American Aerospace Controls, Farmingdale, NY 11735	516-694-5100
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
† Dymec Inc., Winchester, MA 01890	617-729-7870
Elcon Instruments, Inc., Whessoe, Plc, Annapolis, MD 21401	410-280-6686
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Martel Electronics, Windham, NH 03087	603-893-0886
† North Hills Signal Processing, Syosset, NY 11791	516-682-7740
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 813-646-3909
Isolators, Source — See Isolators, Line (Vol. D)

Isolator Systems, Multiplexed-1900

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1185
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900 .... B•1963
§ Action Instruments, San Diego, CA 92123 619-279-5726
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
IPAC Grp., Bethel Pk., PA 15102 412-831-9200
Jack Adapters (All Types)-2100 – *See Vol. C*
Jack Covers-2100 – *See Vol. C*
Jack Panel Assemblies & Access. — See Panels, Jack (Vol. C)
Jacks (All Types)-2100 – *See Vol. C*
Jacks, Coaxial-2100 – *See Vol. C*
Jacks, Modular Telephones-2100 – *See Vol. C*
Jacks (MIL)-2440 – *See Vol. B*
Jammers (MIL)-2440 – *See Vol. B*
Jamming Systems (MIL)-2440 – *See Vol. B*

Jigs And Fixtures, Chassis & Circuit Board-4100

ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
§† Fancort Industries, Inc., W. Caldwell, NJ 07006 201-575-0610
§ PanaVise Products, Inc., Sparks, NV 89431 702-353-2900
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Tracewell Enclosures, Inc., Westerville, OH 43081 .... 614-846-6175;800-848-4525
Vector Electronic Co., Inc., Sylmar, CA 91342 .... 818-365-9661;800-423-5659
Joint Compounds, Semiconductor — See Coatings, Compounds. Lubricants, etc., Heat Conductive (Vol. C)
Joints, Rotary, Fiber Optic-2475 – *See Vol. B*
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Joysticks, Inductive-2200

CTI Electronics, Stratford, CT 06497, 203-386-9779 .... D•1086
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .... A•2100-2101**
Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 .... D•1163
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 .... A•2115
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904

Joysticks, Potentiometer-2200

ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 .... A•2084
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .... A•2100-2102**
Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 .... D•1163
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 .... A•2115
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 .... 214-422-1844; 1-800-872-0044
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Penny & Giles, Santa Monica, CA 90401 310-393-1497

Joystick, Toggle Switch-2200

Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .... A•2100-2102
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 .... A•2115
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Jumpers, Bonding-2100 – *See Vol. C*
Jumpers, Circuit Board-2100 – *See Vol. C*
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Keyboards, Conductive Rubber-5150 – *See Vol. B*
Keyboards, Full Travel-5150 – *See Vol. B*
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Keyboards, Membrane-5150 – *See Vol. B*
Keyboards, Modular-5150 – *See Vol. B*
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Keyboards, Programmable-5150 – *See Vol. B*
Keyboards, Wireless-5150 – *See Vol. B*
Keyboards & Keypads (MIL)-2440 – *See Vol. B*

Keyers, Tone-1900

Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 .... D•1163
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Keypads-5150 – *See Vol. B*
Kits, Breadboarding (For Engineers)-4200 – *See Vol. C*
Kits, Connector-2100 – *See Vol. C*
Kits, Enclosure Prototyping-1400 – *See Vol. C*
Kits, Fiber Optic-2475 – *See Vol. B*
Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 – *See Vol. C*
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Kits, Printed Circuit-1700 – *See Vol. C*
Kits, Programming Board-4200 – *See Vol. C*
Kits, Shielding-4525 – *See Vol. C*
Kits, Terminal-2100 – *See Vol. C*
Kits, Training Aid-4200 – *See Vol. C*
Knobs, Cast, Molded, & Machined-2400 – *See Vol. C*
Knobs, Collet-2400 – *See Vol. C*
Knobs, Limit Stop-2400 – *See Vol. C*
Knobs, Locking, Control Shaft-2400 – *See Vol. C*
Knobs, Push to Turn-2400 – *See Vol. C*
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Laminates, Plastic Impregnated (Unclad)-2500 – *See Vol. C*
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Lamps, Exciter, Photographic-2460 – *See Vol. B*
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Lamps, Incandescent-2460 – *See Vol. B*
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Lamps, Magnifying, Inspection-4100

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
§ Contact East, N. Andover, MA 01845 508-682-2000
# Electra-Tec, Inc., Div. of Impert Industries, Inc., Otsego, MI 49078 .... 800-225-3532; 616-694-2058
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 602-968-6241
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
§† Luxo Corporation, Port Chester, NY 10573 .... 914-937-4433;800-222-5896
§ PACE, Inc., Laurel, MD 20723-1990 301-490-9860
§† Quality Technologies, Sunnyvale, CA 94086 408-720-1440
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§† Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Waldmann Lighting Co., Wheeling, IL 60090 .... 708-520-1060;800-634-0007
Lamps, Mercury Vapor-2460 – *See Vol. B*
Lamps, Nanopulse-2460 – *See Vol. B*
Lamps, Neon-2460 – *See Vol. B*
Lamps, Oil Tight-2460 – *See Vol. B*
Lamps, Press-to-Test-2460 – *See Vol. B*
Lamps, Projection-2460 – *See Vol. B*
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Lamps, Tritium (Hydrogen 3) Powered-2460 – *See Vol. B*
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Laser Systems-4100

† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... D•1573**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
ACI Components, Inc., Laguna Hills, CA 92653 714-588-9611
Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
§ BEA electro-optics, inc., Des Plaines, IL 60016 708-298-1420
Burleigh Instruments, Fishers, NY 14453-0755 716-924-9355
Chicago Laser Systems, Inc., Des Plaines, IL 60018 708-827-9620
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 408-764-4000
† Control Laser Corp., Orlando, FL 32809 407-438-2500
† D. O. Industries, Rochester, NY 14623 716-359-4000
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
Exatron Automatic Test Equip., San Jose, CA 95111 .... 408-629-7600;800-EXA-TRON
§† General Laser, Inc., Scottsdale, AZ 85260 602-991-0674
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
§† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407

Φ Marking Methods, Inc., Alhambra, CA 91803-1531	818-282-8823
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110	408-453-7373
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
† Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
Quantronix, Excel Technology, Hauppauge, NY 11788	516-273-6900
Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
Raytheon Co., Laser Products, Quincy, MA 02169	617-479-5300
§ RMF Products, Inc., Batavia, IL 60510	708-879-0020
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707/5717
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
Spectra-Physics Lasers Inc., Mountain View, CA 94039-7013	415-961-2550; 800-456-2552
Staffall Inc., Cranston, RI 02910	401-461-5554
Transonic Systems Inc., Ithaca, NY 14850	607-257-5300
U. S. Laser Corp., Wyckoff, NJ 07481	201-848-9200

Laser Components & Laser Accessories-3700 – *See Vol. B*
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Latches, Panels & Cabinets-2400 – *See Vol. C*
LCDs — See Diodes, Liquid Crystal (Vol. B)
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Lead Preparation Equipment, Surface Mount-4100

Automated Production Concepts, Wayne, NJ 07470	201-831-8300
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
Eastern Marking Machines, Hempstead, NY 11550	800-835-2393
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
† Manix Mfg. Inc., Warminster, PA 18974	215-957-6565
Manncorp, Huntingdon Valley, PA 19006	215-364-6100
Micro Electronic Systems, Inc., Bridgewater, CT 06752	203-350-5004
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
† Unit Design, Orange, CA 92665	714-282-8100

Leads, Test & Adapters-2900

§ ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103	**C•1287**
§ Emulation Technology, Inc., Santa Clara, CA 95051, 408-982-0660	**C•1321**
§ Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002	**C•1347**
Multi-Contact USA, Santa Rosa, CA 95403, 707-575-7575	**C•1422-1423**
Multi Products International, West Paterson, NJ 07424, 201-890-1344	**D•1848**
† Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
Alden Products Co., Brockton, MA 02403	508-583-0160
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
† Coax Connection, Peekskill, NY 10566	914-736-1010
Compac, Holbrook, NY 11741	516-585-3400
§ Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§† Excel Specialty Corp., Chicago, IL 60660	312-262-4781
§ E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
§† Keystone Electronics Corp., Astoria, NY 11105-2017	718-956-8900
§ Klein Tools, Inc., Chicago, IL 60659-9033	708-677-9500
§ Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Probe Master, Inc., San Diego, CA 92111	619-560-9676; 800-772-1519
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Test Probes, Inc., San Diego, CA 92121	619-552-2090
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015

LEDs — See Diodes, Light Emitting (LEDs) (Vol. B)
Lenses, Filters, Windows, Infrared - Also see Filters, Color, Panel light; Lenses, Readout & Display-3700 – *See Vol. B*
Lenses, Optical & Camera-3700 – *See Vol. B*
Lenses, Readout & Display - Also see Filters, Color, Panel light; Lenses, filters, Windows, Infrared-2450 – *See Vol. B*
Light Choppers-3700 – *See Vol. B*

Light Pens-2000

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542	**B•1135**
§† Design Technology, Santee, CA 92071	619-448-2888
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
† Interactive Computer Products, Inc., Laguna Hills, CA 92653	714-770-5332
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110	408-453-7373

Light Sources, Fiber Optic - Also see Generators, Light Pulse-2475 – *See Vol. B*
Light Sources, Infrared - Also see Generators, Light Pulse-3700 – *See Vol. B*
Light Sources, Photoelectric-3700 – *See Vol. B*
Light Sources, Stroboscopic-3700 – *See Vol. B*
Light Sources, Ultraviolet-3700 – *See Vol. B*
Lights, Indicator-2460 – *See Vol. B*
Lights, Panel — See Lights, Indicator (Vol. B)
Lights, Pilot — See Lights, Indicator (Vol. B)
Limit Stops — See Knobs, Limit Stop (Vol. C)
Limit Stops, Mechanical-2500 – *See Vol. C*
Limiters, Current-4300 – *See Vol. B*
Limiters, Microwave-3450 – *See Vol. A*
Limiters, Surge — See Suppressors, Transient Voltage (Vol. B)
Line Assemblies (MIL), RF Transmission-2440 – *See Vol. B*

Line Conditioners-4050

Amber Inds., Inc., Carrollton, TX 75006, 214-490-9801	**B•1343**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253-2255**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	**D•1655**
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2259**
† Georator Corp., Manassas, VA 22110-5512, 800-523-9938	**D•2262-2263**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200	**D•1738,1740**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	**D•2266-2267**
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•2270-2271**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**D•2273**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
Powervar, Inc., Lake Forest, IL 60045, 708-816-8585;800-369-7179	**D•2297-2299**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	**D•2300**
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191	**D•1936**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2308-2309**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460	508-486-9483
Albar, Inc., Lynnwood, WA 98036	206-771-4006;800-822-5227
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
§ Best Power Technology, Inc., Necedah, WI 54646	608-565-7200;800-356-5794
§ Brooks Electronics, Philadelphia, PA 19140	215-228-4433
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380	607-724-2484
§† Current Technology, Inc., Richardson, TX 75081-4802	214-238-5300
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
§† Deltec Elctrns. Corp., San Diego, CA 92110	619-291-4211;800-854-2658
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§ Falcon Electric, Monrovia, CA 91016	800-842-6940
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006	818-574-1175
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
§ Hammond Manufacturing Co., Buffalo, NY 14225	716-894-5710
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† International Power Machines, Garland, TX 75042	800-527-1208
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ MTE Corp., Menomonee Falls, WI 53051	414-253-8200
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
§† Oneac Corporation, Libertyville, IL 60048	708-816-6000,800-327-8801
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
§ PolyPhaser Corporation, Minden, NV 89423-9000	702-782-2511;800-325-7170
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ SL Waber, Inc., Mt. Laurel, NJ 08054	609-866-8888;800-257-8384
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863	618-262-5555
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
† Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9	403-259-3200
The Wiremold Company, W. Hartford, CT 06110	203-233-6251

Line Controlled Switches — See Switches, Data (Vol. D)
Liners, Tube Shield — See Shields, Tube (Vol. C)

LNA-LNB, Satellite Antennas-1200

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400

Loads, Electronic, Variable-Also See Dummy Loads-2900

Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1602
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1678
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•1684**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 .... D•1740
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266-1271
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 .... D•1315
TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 .... A•1855
§ Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Advanced Power Products, Menifee, CA 92584 714-672-7704
AMASCO, Torrance, CA 90501 310-781-9494
Bertan High Voltage, Hicksville, NY 11801 516-433-3110
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 416-298-0560
† Dielectric Communications, General Signal, Raymond, ME 04071 .... 207-655-4555; 800-341-9678
Energy Systems, Vancouver, WA 98682 206-896-8310
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
† Maccor, Inc., Tulsa, OK 74107 918-446-1874
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 .... 514-694-6666; 800-724-3911
† NH Research, Irvine, CA 92714 714-474-3900
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 .... 408-730-0300 800-PENSTOCK
§ Power/Mate Corporation, San Diego, CA 92110 .... 800-843-8544;619-299-3800
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548 904-243-3722
† Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Tru-Connector Corp., Peabody, MA 01960 .... 508-532-0775;1-800-262-9787; 1-800-COAXTRU
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Locators, Static-2900

§ ACL Inc., Elk Grove Village, IL 60007 .... 708-981-9212;1-800-782-8420
† Contact East, N. Andover, MA 01845 508-682-2000
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870

Locators, Open Short-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518 .... D•1240
Associated Research, Inc., Lake Bluff, IL 60044 708-295-3312
§ AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Hipotronics Inc., Brewster, NY 10509 914-279-8091
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Locks, Dial & Shaft-2400 – *See Vol. C*
Logic Cards (without Components) — See Boards, Plug-in (Vol. C)
Logic Circuits — See Cards. Logic (Vol. D), Modules, Logic (Vol. A)
Loudspeakers — See Speakers (Vol. D)
Louvers, Vents, & Windows (For Equipment) — See Enclosures, Equipment & Panel Mounting (Vol. C)
Lubricants-1600 – *See Vol. C*
Lugs, Terminal — See Terminals, Lug (Vol. C)
LVDTs — See Transducers, Displacement (Vol. B)

Machines & Accessories, Semiconductor Manufacturing-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
AZCO Corp., Elmwood Park, NJ 07407 201-791-1428
§† Casso-Solar Corp., Pomona, NY 10970 914-354-2500
† Control Laser Corp., Orlando, FL 32809 407-438-2500
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
† Fancort Industries, Inc., W. Caldwell, NJ 07006 201-575-0610
Headway Research, Inc., Garland, TX 75042 214-272-5431
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
Materials Research Corporation, Orangeburg, NY 10962 914-359-4200
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880 617-246-2040
† PTX-Pentronix Inc., Lincoln Park, MI 48146 313-388-3100
Quantum Chromodynamics, Inc., Torrance, CA 90501 310-320-5717
§† Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888
† Technic, Inc., Providence, RI 02940-9650 401-781-6100
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252 707-423-2100
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
§ Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Machines & Tools, Crimping — See Tools, Crimping & Swaging (Vol. C)

Machines, Automatic End Splice-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... C•1163
Autosplice, Inc., San Diego, CA 92121 619-535-0077

Machines, Capacitor Winding-4100

Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 410-574-4960

Machines, Cleaning & Degreasing-Also See Cleaners, Ultrasonic-4100

ACL Inc., Elk Grove Village, IL 60007 .... 708-981-9212;1-800-782-8420
§ American Metal Wash, Canonsburg, PA 15317 412-746-4203
§† A.P.E. Corporation, Medford, NY 11763 516-654-1197
§ Clean Room Products, Inc., Ronkonkoma, NY 11779-6528 516-588-7000
§† Cyclo-Tronics, Inc., Wauconda, IL 60084 708-526-0800
† Electronic Controls Design, Milwaukie, OR 97222 503-659-6100
Electrovert USA Corp., Grand Prairie, TX 75050 214-606-1900
† EMC Global Technologies Inc., Doylestown, PA 18901 215-340-0650
Φ# Exselect Engineering Ltd., Concord, Ont., CANADA LK42G2 416-738-4077
Φ# Glen Mills Inc., Clifton, NJ 07012 201-777-0777
Headway Research, Inc., Garland, TX 75042 214-272-5431
§ Hollis Automation, Esterline Corporation, Nashua, NH 03063 603-889-1121
§† L & R Mfg. Co., Kearny, NJ 07032 201-991-5330
§† Multicore Solders, Inc., Richardson, TX 75081 214-238-1224
† The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
§† Sonicor Instrument Corp., Copiague, NY 11726 516-842-3344
† Technic, Inc., Providence, RI 02940-9650 401-781-6100
§† Technical Devices, Torrance, CA 90503 310-618-8437
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Tech Spray, Inc., Amarillo, TX 79105 806-372-8523
† Unit Design, Orange, CA 92665 714-282-8100
†# Van Waters & Rogers Inc., Univar Corp., St. Paul, MN 55164-0004 612-774-9400
VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555
S.S White Technologies Inc., Piscataway, NJ 08854-3761 908-752-8300

Machines, Coil Winding-4100

§ Bachi, Inc., Itasca, IL 60143 708-773-5600
§ CCW Industries Inc., Bethel, CT 06801 203-744-6715
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 310-673-3245
Coil Winding Equipment Co., Oyster Bay, NY 11771 516-922-5660
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
EPM Corporation, Baltimore, MD 21221 410-686-7800
† Gorman Machine Corp., Brockton, MA 02401 508-588-2900
Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 410-574-4960
§ Productronics Inc., Fort Wayne, IN 46825 219-489-8201
† Samatic Winding Machine, Jenlor Ltd., Fayetteville, NY 13066 315-637-9080
Solatron Enterprises, Inglewood, CA 90302 213-678-4981

Machines, Component Handling, Feeding, Insertion & Sorting-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... C•1163
Automated Production Concepts, Wayne, NJ 07470 201-831-8300
Autosplice, Inc., San Diego, CA 92121 619-535-0077
Berg Electronics, Camp Hill, PA 17011 800-237-2374
Conforming Matrix, Toledo, OH 43611 419-729-3777
Creative Automation Co., Sun Valley, CA 91352 818-767-6220
§ Delta Design, San Diego, CA 92123-1111 619-292-5000
Die-Tech Inc., York Haven, PA 17370 717-938-6771
Electronic Precision Technology Inc., Cambridge, MA 02140 617-661-2454
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 914-241-1008
Exatron Automatic Test Equip., San Jose, CA 95111 .... 408-629-7600;800-EXA-TRON
† Fancort Industries, Inc., W. Caldwell, NJ 07006 201-575-0610
Kahle Engineering, Orange, NJ 07050 201-678-2020
† Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716 203-756-8847
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880 617-246-2040
§ Micro Electronic Systems, Inc., Bridgewater, CT 06752 203-350-5004
MOLEX, Inc., Lisle, IL 60532 708-969-4550
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 410-574-4960
§ Penn Engineering & Manufacturing Corp., Danboro, PA 18916 .... 215-766-8853; 800-237-4736
Ragen Systems, Inc.,.Ragen Corp., Warren, NJ 07059 908-561-4200
§Φ Royonic Inc., Valencia, CA 91355 805-257-0303
Solatron Enterprises, Inglewood, CA 90302 213-678-4981
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Thermonics, Inc., Santa Clara, CA 95054 408-496-6838
§ TRIGON/ADCOTECH, Dynatech, Milpitas, CA 95035 408-946-4300
Trio-Tech International, San Fernando, CA 91340 818-365-9200

Machines, Drilling, Laser-4100

† Aremco Products, Inc., Ossining, NY 10562 914-762-0685
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 408-764-4000
† Control Laser Corp., Orlando, FL 32809 407-438-2500
Coors Ceramics Co., Electronics, Golden, CO 80401 303-277-4591
MSI Micro-Machining Systems Inc., Santa Clara, CA 95052 408-727-0100
Raytheon Co., Laser Products, Quincy, MA 02169 617-479-5300
U. S. Laser Corp., Wyckoff, NJ 07481 201-848-9200

Machines, Hermetic Sealing-4100

† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862 508-667-4111
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 408-764-4000
† Control Laser Corp., Orlando, FL 32809 407-438-2500

Raytheon Co., Laser Products, Quincy, MA 02169 ... 617-479-5300
U. S. Laser Corp., Wyckoff, NJ 07481 ... 201-848-9200

Machines, Induction Heating (Electronic)-4100

Nemeth Engineering Associates, Inc., Crestwood, KY 40014 ... 502-241-1502

Machines, Lead Cutting & Forming-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
Automated Production Concepts, Wayne, NJ 07470 ... 201-831-8300
AZCO Corp., Elmwood Park, NJ 07407 ... 201-791-1428
Burndy Corporation, An FCI Company, Norwalk, CT 06856 ... 203-838-4444
Cold Header Machine Corp., Boca Raton, FL 33431 ... 407-393-3201
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
Electrovert USA Corp., Grand Prairie, TX 75050 ... 214-606-1900
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 ... 914-241-1008
§ Eraser Co., Syracuse, NY 13221 ... 315-454-3237
† Fancort Industries, Inc., W. Caldwell, NJ 07006 ... 201-575-0610
§ Harwil Corporation, Santa Monica, CA 90404 ... 310-829-2310
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
† Manncorp, Huntingdon Valley, PA 19006 ... 215-364-6100
§ Nepenthe, Inc., Palo Alto, CA 94303 ... 415-496-6666
† Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059 ... 908-561-4200
§† Technical Devices, Torrance, CA 90503 ... 310-618-8437
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990

Machines, Magnet Wire Twisting-4100

§ Eraser Co., Syracuse, NY 13221 ... 315-454-3237
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 ... 410-574-4960

Machines, Marking & Numbering-4100

Allen Avionics, Inc., Mineola, NY 11501 ... 516-248-8080
† Autoroll Machine Corporation, Middleton, MA 01949 ... 508-777-2160
§ BEA electro-optics, inc., Des Plaines, IL 60016 ... 708-298-1420
§† Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201 ... 1-800-537-8791
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
† Control Laser Corp., Orlando, FL 32809 ... 407-438-2500
§ Eastern Marking Machines, Hempstead, NY 11550 ... 800-835-2393
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 ... 708-547-5400
Exatron Automatic Test Equip., San Jose, CA 95111 ... 408-629-7600;800-EXA-TRON
Markem Corp., Keene, NH 03431 ... 603-352-1130
† Marking Methods, Inc., Alhambra, CA 91803-1531 ... 818-282-8823
§† Pioneer Components, Brooklyn, NY 11234 ... 718-444-3880
Quantum Chromodynamics, Inc., Torrance, CA 90501 ... 310-320-5717
Solatron Enterprises, Inglewood, CA 90302 ... 213-678-4981
Telesis Marking Systems, Inc., Chillocothe, OH 45601 ... 614-642-3200

Machines, Marking, Laser-4100

† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
Control Laser Corp., Orlando, FL 32809 ... 407-438-2500
Eastern Marking Machines, Hempstead, NY 11550 ... 800-835-2393
Exatron Automatic Test Equip., San Jose, CA 95111 ... 408-629-7600;800-EXA-TRON
§† General Laser, Inc., Scottsdale, AZ 85260 ... 602-991-0674
Φ Marking Methods, Inc., Alhambra, CA 91803-1531 ... 818-282-8823
Quantronix, Excel Technology, Hauppauge, NY 11788 ... 516-273-6900
Quantum Chromodynamics, Inc., Torrance, CA 90501 ... 310-320-5717
Raytheon Co., Laser Products, Quincy, MA 02169 ... 617-479-5300

Machines, Mask Alignment & Exposure-4100

Research Devices, Inc., Piscataway, NJ 08854 ... 908-572-4800

Machines, Metallizing, Vacuum — See Deposition Equipment, Vacuum & Accessories (Vol. D)

Machines, Plastic Molding-4100

Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927 ... 201-538-8500

Machines, Plating-4100

Darrah Electric Company, Cleveland, OH 44102 ... 216-631-0912
§ HBS Equipment Corporation, Los Angeles, CA 90040 ... 213-726-3033
§† Kepro Circuit Systems, Fenton, MO 63026-2992 ... 314-343-1630
§ Kraft Dynatronix, Inc., Amery, WI 54001 ... 715-268-8118;800-826-7172
† Technic, Inc., Providence, RI 02940-9650 ... 401-781-6100

Machines, Printed Circuit Drilling, Etching & Punching-4100

Aremco Products, Inc., Ossining, NY 10562 ... 914-762-0685
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
§† Cyclo-Tronics, Inc., Wauconda, IL 60084 ... 708-526-0800
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 ... 617-267-8600
§ Foredom Elec. Co., Blackstone Inds. Inc., Bethel, CT 06801 ... 203-792-8622
§† Kepro Circuit Systems, Fenton, MO 63026-2992 ... 314-343-1630

Machines, Terminal Installing-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
Autosplice, Inc., San Diego, CA 92121 ... 619-535-0077
† Berg Electronics, Camp Hill, PA 17011 ... 800-237-2374
Burndy Corporation, An FCI Company, Norwalk, CT 06856 ... 203-838-4444
§† FISHERTECH, Fisher Gauge Limited, Peterborough, Ontario, CANADA K9J 6Y9 ... 705-748-9522
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716 ... 203-756-8847
§ Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 ... 410-574-4960
† Nichifu America, Inc., Pottstown, PA 19464 ... 215-323-7120
§ Panduit Corp., Tinley Park, IL 60477-0981 ... 800-777-3300
† Patton-MacGuyer Inc., Providence, RI 02905 ... 401-941-6000
Sjoberg, C., & Son, Inc., Cranston, RI 02910 ... 401-461-8220
† U.S. Terminals Inc., Cincinnati, OH 45243 ... 513-561-8145

Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 ... 801-298-5900

Machines, Ultrasonic Bonding-4100

(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880 ... 617-246-2040
§† Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382 ... 610-696-4710;800-323-1269

Machines, Vibration Fatigue Testing — See Testers, Vibration (Vol. D)
Machines, Wafer Alignment — See Machines, Mask Alignment & Exposure (Vol. D)

Machines, Wire Marking, Manual & Automatic-4100

Autosplice, Inc., San Diego, CA 92121 ... 619-535-0077
§† Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201 ... 1-800-537-8791
Burndy Corporation, An FCI Company, Norwalk, CT 06856 ... 203-838-4444
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
Eastern Marking Machines, Hempstead, NY 11550 ... 800-835-2393
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 ... 914-241-1008
Eubanks Engineering, Monrovia, CA 91016 ... 818-357-7011
Garry Electronics, WPI, Salem, NJ 08079 ... 609-935-7603
§ Zippertubing Co., Los Angeles, CA 90061 ... 310-527-0488

Machines, Wire Measuring & Cutting-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
AZCO Corp., Elmwood Park, NJ 07407 ... 201-791-1428
Berg Electronics, Camp Hill, PA 17011 ... 800-237-2374
Burndy Corporation, An FCI Company, Norwalk, CT 06856 ... 203-838-4444
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 ... 914-241-1008
§ Eraser Co., Syracuse, NY 13221 ... 315-454-3237
Eubanks Engineering, Monrovia, CA 91016 ... 818-357-7011
Hanscom, H. F., Co., Inc., Providence, RI 02905 ... 401-941-1455
HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
§ Ideal Industries, Inc., Sycamore, IL 60178 ... 815-895-5181
† Manncorp, Huntingdon Valley, PA 19006 ... 215-364-6100
MOLEX, Inc., Lisle, IL 60532 ... 708-969-4550
§Φ Schleuniger, Inc., Manchester, NH 03101 ... 603-668-8117
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§† Western Electronic Products Co., San Clemente, CA 92673 ... 714-492-4677

Machines, Wire Stripping, Laser-4100

† Coherent General, Inc., Sturbridge, MA 01566 ... 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
§† General Laser, Inc., Scottsdale, AZ 85260 ... 602-991-0674
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
Quantum Chromodynamics, Inc., Torrance, CA 90501 ... 310-320-5717
Raytheon Co., Laser Products, Quincy, MA 02169 ... 617-479-5300
§† Western Electronic Products Co., San Clemente, CA 92673 ... 714-492-4677

Machines, Wire Wrapping — See Tools, Wire Wrapping (Vol. C)
Magazines (for packaging electronic devices), antistatic & conductive-2500 — ***See Vol. C***
Magnetic Materials — See Cores, Magnetic (All Types) (Vol. C), Ferrite Material & Parts (Vol. C)

Magnetizers-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... D•1237
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102 ... D•1295
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ... D•1334
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670 ... 800-262-4638; 800-525-3536
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 ... 805-527-0900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
The Electrodyne Company, Inc., Batavia, OH 45013 ... 513-732-2822
Jobmaster Corp., Randallstown, MD 21133-0207 ... 410-655-1400;1-800-642-1400
LDJ Electronics, Troy, MI 48099-0219 ... 313-528-2202
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 ... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 ... 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 ... 800-222-7846
§ Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020

Magnetodiodes — See Magnetoresistors, Hall (Vol. A)

Magnetometers-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... B•1918, D•1152,1236
† EMDS, Inc., Gaithersburg, MD 20877, 301-840-5710 ... D•1256
GMW Associates, Redwood City, CA 94064, 415-368-4884 ... D•1260-1263
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631 ... B•1956
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102 ... D•1295
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ... B•1336
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ... D•1334
Develco, Inc., San Jose, CA 95134-2306 ... 408-945-6500
§ EG&G Geometrics, Div. of EG&G Inc., Sunnyvale, CA 94089 ... 408-734-4616
† E M S Development Corp., Farmingdale, NY 11735 ... 516-293-7900
Enertech Consultants, Campbell, CA 95008 ... 408-866-7266
Jobmaster Corp., Randallstown, MD 21133-0207 ... 410-655-1400;1-800-642-1400
Lake Shore Cryotronics, Inc., Westerville, OH 43081 ... 614-891-2243
LDJ Electronics, Troy, MI 48099-0219 ... 313-528-2202
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 ... 310-391-7213;800-421-6692 (N. CA and out of state)
§Φ MEDA, Inc., Macintyre Electronics Design Assocs., Herndon, VA 22070 ... 703-471-1445
§ Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228 ... +41(22)7941121
RMS Instruments, Mississauga, Ont., CAN L5T 1R2 ... 416-564-5533
† Schonstedt Instrument Co., Reston, VA 22090 ... 703-471-1050

† Sundstrand Data Control, Redmond, WA 98073-9701	206-885-3711
§ Tensor, Austin, TX 78761	512-251-4131

Magnetoresistors, Hall-4800 – *See Vol. A*
Magnetrons — See Tubes, Microwave (Vol. A)
Magnets, Focusing — See Magnets, Permanent (Vol. C)
Magnets (Lab. Type)-1850 – *See Vol. A*
Magnets, Permanent-1850 – *See Vol. A*
Magnets, Superconducting-1850 – *See Vol. A*
Magnets (MIL), Permanent-2440 – *See Vol. B*

Magnifying Glasses, Inspection-4100

† Contact East, N. Andover, MA 01845	508-682-2000
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990

Manufacturing, Turnkey-4100

Altek Co., Torrington, CT 06790	203-482-7626
# Altron, Inc., Anoka, MN 55303	612-427-7735
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Chloride El Paso, Chloride Power Elctrns., El Paso, TX 79906	915-592-9985
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8	819-821-4524
Creative Automation Co., Sun Valley, CA 91352	818-767-6220
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
† EOG. INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Micro Industries, Westerville, OH 43081-9486	614-548-7878
SeaFab, Inc., Redmond, WA 98052	206-881-2778
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
Southtronics, Inc., Marietta, GA 30066-6029	404-429-1000
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Trionics, Inc., St. Charles, IL 60174	708-365-6570
U.R.D. America, Laguna Nigel, CA 92607	714-831-0111
USAPEX Corp., Santa Clara, CA 95051	408-982-9063
†# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Xetel Corporation, Austin, TX 78758	512-834-2266
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Markers, Dry Transfer — See Kits, Marking (Vol. C)
Markers, Identification — See Labels (Vol. C), Nameplates (Vol. B), Machines, Marking and Numbering (Vol. D)
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Markers, Terminal — See Kits, Marking, etc. (Vol. C)
Markers, Wire, Tab & Sleeve — See Wire Markers (Vol. C)

Mark Recognition Equipment, Optical-2000

Automatix Inc., Billerica, MA 01821	506-667-7900
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614-642-3200

Mask Alignment & Exposure Systems — See Machines, Mask Alignment & Exposure (Vol. D)
Masks, Solder-4600 – *See Vol. C*
Material, Permanent Magnet, Alnico-1850 – *See Vol. A*
Material, Permanent Magnet, Ceramic-1850 – *See Vol. A*
Material, Permanent Magnet, Rare Earth-1850 – *See Vol. A*
Materials, Shock, Noise, & Vibration Control-2500 – *See Vol. C*
Materials, Thick Film-1600 – *See Vol. C*

Matrices, Switching-Also See Boards, Programming-2000

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1666, C•1163**
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192-1193**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1562-1563,1565**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
Amber Inds., Inc., Carrollton, TX 75006	214-490-9801
DDI Inc., Beverly, MA 01915-1703	508-927-7976
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Keithley Instrs., Cleveland, OH 44139	800-552-1115
† MarLee Switch Co., Upland, CA 91786	714-982-8988
Matrix Corp., Indianapolis, IN 46241	317-248-2036
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
† Oxley Inc., Branford, CT 06405	203-488-1033
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
† Signal Switch Company, Corona, CA 91720	909-736-5404
† ST Olektron Systems, Signal Technology Corp., Webster, MA 01570	508-943-7440
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

Measuring Equipment, Fiber Optic, Attenuation & Bandwidth-2200

§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7, 418-683-0211;1-800-663-EXFO	**B•1211**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370:1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Media, Magnetic — See Disks, Magnetic (Vol. D), Tape, Magnetic (Vol. D)
Megaphones — See Amplifiers (Vol. D)

Memory Devices/Controllers, Bipolar, Add-in-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
† Eventide, Inc., Little Ferry, NJ 07643	201-641-1200
Intelligent Interfaces, Inc., Stone Mountain, GA 30086	404-381-9891;1-800-842-0888
Oupiin America, Inc., Simi Valley, CA 93065	805-520-0862
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926

Memory Devices/Controllers, Bipolar, Add-on-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
§ Terminal Data Corp., Rockville, MD 20855	301-921-8282
VMETRO, Inc., VMETRO as, Houston, TX 77079	713-584-0728

Memory Devices/Controllers, Bubble, Add-in-2000

Bubbl-Tec, Dublin, CA 94568	510-829-8705

Memory Devices/Controllers-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§ Benchmarq Microelectronics, Inc., Carrollton, TX 75006	214-407-0011
† Bubbl-Tec, Dublin, CA 94568	510-829-8705
# Recognition Concepts,Inc., Carson City, NV 89706	702-831-0473;1-800-243-8724

Memory Systems, Semiconductor-2000

FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331	**D•1096**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691	**A•2172**
§ Adtron Corporation, Mesa, AZ 85210	602-926-9324
Adtron Instruments, Phoenix, AZ 85022	602-863-2250
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Avasem Corporation, San Jose, CA 95126	408-297-1201
Basicon, Inc., Portland, OR 97229	503-626-1012
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Dallas Semiconductor, Dallas, TX 75244	214-450-0400
Data Engineering, Inc., Margate, FL 33063-3206	305-971-0400
Datakey, Inc., Burnsville, MN 55337	612-890-6850
Dataram Corp., Princeton, NJ 08543-7528	609-799-0071;800-822-0071
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428	714-898-0007; 800-64-CHIPS
† Digital Data Systems, Inc. (DDS), Ft. Lauderdale, FL 33313	305-792-3290
§ Diversified Technlg., Ridgeland, MS 39157	601-856-4121
† ELPAQ. Elmo Semiconductor, Burbank, CA 91504-1052	818-768-7500
† Librascope Corp., Loral Corp., Glendale, CA 91201	818-244-6541
§ Macrolink, Anaheim, CA 92807	714-777-8800
MCSI, Vista, CA 92083	619-598-2177
§ Micro Electronic Technologies, Hopkinton, MA 01748	508-435-9057
# Mitronics, Rolling Hills, CA 90274	310-377-2022
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
§† Monolithic Sys. Corp., Englewood, CO 80112	303-790-7400
§ Ramtron International Corporation, Colo. Springs, CO 80921	719-481-7000; 800-545-3726
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Vermont Research Corp., N. Springfield, VT 05150	802-886-2256
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040	602-437-1520
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Memory Systems, Tape-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Amilon Corp., Woodside, NY 11377	718-274-1794
Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Memtec Corp., Salem, NH 03079	603-893-8080

Metrum, Denver, CO 80217-5227 ... 303-773-4700
# Mitronics, Rolling Hills, CA 90274 ... 310-377-2022
Peripherals, Costa Mesa, CA 92626 ... 714-540-4925;800-468-6888
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
# Recognition Concepts,Inc., Carson City, NV 89706 ... 702-831-0473;1-800-243-8724

Message Repeaters, Telephone-1900

§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 ... 201-934-8500
Cognitronics, Stamford, CT 06906 ... 203-327-5307
§Φ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178 ... 404-457-5600
§ Viking Electronics, Inc., Hudson, WI 54016 ... 715-386-8861

Meter Cases — See Enclosures, Equipment & Panel Mounting (Vol. C)
Meter Controllers — See Relays, Meter (Vol. B)
Meter Expanders — See Multipliers, Meter (Vol. D)
Meters, Acceleration — See Accelerometers (Vol. B)

Meters, Admittance-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 ... 800-253-1230
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 ... 617-938-8390; 1-800-933-9319

Meters, Ampere, AC-2900

§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391 ... D•1223
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362 ... D•1339
§ Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... D•1153,1237
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 ... D•1246
† Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717 ... D•1252
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 ... D•1259
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 ... D•1350-1351
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1372,1377
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 ... D•1283-1285
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ... D•1355-1356
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ... B•1965, D•1294
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1358
† Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ... B•1982-1984,1990,1995,2001, D•1313
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ... D•1368
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721 ... D•1371
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1372,1377
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1328-1329
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390,1398-1399,1401
A & D Elec. Instrs., Glendale, NY 11385 ... 718-275-6516
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 ... 609-275-0220
Allen Technology, Sutton, NE 68979 ... 402-773-5285
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 ... 516-593-5600
Φ Amptec Electronics, San Diego, CA 92128 ... 619-578-7816
Analogic Corp., Peabody, MA 01960 ... 508-977-3000
Angus Electronics Co., Indianapolis, IN 46224 ... 317-244-7611
§ ARGA Controls, Pasadena, CA 91105 ... 213-682-3314
AVO International, TBG, Dallas, TX 75237 ... 214-333-3201
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 ... 404-979-5900
Bartlett Instrument Co., Ft. Madison, IA 52627 ... 319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 ... 617-894-6440
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 ... 603-749-6434
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
# Deltec Co., Norwalk, CA 90650 ... 310-926-2304
† Digitec, Marion, OH 43302 ... 614-387-3444
§ Dixson, Inc., Grand Junction, CO 81503 ... 303-244-1241
D1 International, Inc., Huntington, NY 11743 ... 516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019 ... 908-287-3680
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 ... 410-584-7400
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 ... 708-547-5400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 ... 516-334-0870
§ Eliwell Inc., Baldwinsville, NY 13027 ... 315-638-9598
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 ... 516-957-8700
EMICO Inc., Manchester, NH 03109 ... 603-669-5121
E-T-A Circuit Breakers, Niles, IL 60714 ... 708-647-8303
Fieldpiece Instruments, Buena Park, CA 90621 ... 714-992-1239
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 ... 416-825-1335; 1-800-800-4606
§ Greibach Instruments Div., Mt. Vernon, NY 10550 ... 914-699-9717
Gutwerk Instruments Inc., McKeesport, PA 15132 ... 412-672-3668
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 ... 614-275-0530
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108 ... 216-541-8060
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
† Ideal Precision Meter, Brooklyn, NY 11222 ... 212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716 ... 813-572-9010
§† International Instruments, A Prime Technology Company, N. Branford, CT 06471 ... 203-481-5721
§† International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020 ... 619-258-8990
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ... 516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 ... 508-365-3400
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301 ... 518-355-8300
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 ... 708-437-6444
§ Non-Linear Systems, San Diego, CA 92121 ... 619-535-2161
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
§† OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
Philips Technologies, Airpax Instruments, Cheshire, CT 06410 ... 203-271-6000
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 ... 604-652-5118
# Print Products Intl., Silver Spring, MD 20910 ... 301-587-7824;800-638-2020
† Q.V.S., Inc., East Orange, NJ 07017 ... 201-673-3996
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
† Sensitive Research Instruments, Mt. Vernon, NY 10550 ... 914-699-9717
§ Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
§ Sperry, A. W. Instruments, Smithtown, NY 11787 ... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
§ TIF Instruments, Inc., Miami, FL 33150 ... 305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987 ... 419-358-5015
† Velonex, Santa Clara, CA 95050 ... 408-727-7370
§ Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 ... 707-938-2121
§† WestCon, Marion, OH 43302 ... 614-382-5771
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607 ... 415-452-1936
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550 ... 914-699-9717

Meters, Ampere, DC-2900

§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391 ... D•1223
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362 ... D•1339
§ Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... D•1153,1237
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 ... D•1246-1247
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1340-1342
Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717 ... D•1252
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 ... D•1259
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 ... D•1350-1351
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1372,1377
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 ... D•1283-1285
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ... D•1355-1356
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ... B•1965, D•1294
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1358
† Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ... B•1985-1986,1989,1995,2001, D•1313
§ Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 ... D•1317
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ... D•1368
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... D•1067
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721 ... D•1371
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1372,1377
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1328-1329
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390,1398-1399,1401
A & D Elec. Instrs., Glendale, NY 11385 ... 718-275-6516
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 ... 609-275-0220
Amptec Electronics, San Diego, CA 92128 ... 619-578-7816
Analogic Corp., Peabody, MA 01960 ... 508-977-3000
AVO International, TBG, Dallas, TX 75237 ... 214-333-3201
Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 ... 404-979-5900
Bartlett Instrument Co., Ft. Madison, IA 52627 ... 319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 ... 617-894-6440
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 ... 603-749-6434
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
# Deltec Co., Norwalk, CA 90650 ... 310-926-2304
† Digitec, Marion, OH 43302 ... 614-387-3444
§ Dixson, Inc., Grand Junction, CO 81503 ... 303-244-1241
D1 International, Inc., Huntington, NY 11743 ... 516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019 ... 908-287-3680
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 ... 410-584-7400
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 ... 708-547-5400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 ... 516-334-0870
§ Eliwell Inc., Baldwinsville, NY 13027 ... 315-638-9598
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 ... 516-957-8700
EMICO Inc., Manchester, NH 03109 ... 603-669-5121
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 ... 203-848-9271

Meters, Ampere, DC-2900 (Cont'd)

Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
† Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§† International Microtronics, Tucson, AZ 85714	602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
§† OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Red Lion Controls, York, PA 17402	717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
† Velonex, Santa Clara, CA 95050	408-727-7370
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§† WestCon, Marion, OH 43302	614-382-5771
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550	914-699-9717

Meters, Ampere, RF-2900

Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1285**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
# BEC Inc./Certified Calibration Labs. Horsham, PA 19044	800-523-3808
§ Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Metermaster, Tempe. AZ 85282	602-431-0015
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015

Meters, Ampere, True RMS-2900

Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437**	**D•1345**
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1259**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	**D•1350-1351**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283,1285**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1356**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1965, D•1294**
Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1358**
PPM. Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Amptec Electronics, San Diego, CA 92128	619-578-7816
Analogic Corp., Peabody, MA 01960	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
AVO International, TBG, Dallas, TX 75237	214-333-3201
Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
§ Contact East, N. Andover, MA 01845	508-682-2000
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Digitec, Marion, OH 43302	614-387-3444
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
§ Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
Hewlett-Packard Company. Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§† International Microtronics, Tucson, AZ 85714	602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
Omega Engineering, Stamford, CT 06907	800-826-6342
§† OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550
§† WestCon. Marion, OH 43302	614-382-5771
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550	914-699-9717

Meters, Ampere Hour-2900

§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	**D•1351**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
Comptus Inc., New Boston, NH 03070	603-487-5512
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
§ HBS Equipment Corporation, Los Angeles, CA 90040	213-726-3033
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
§ Metermaster, Tempe, AZ 85282	602-431-0015
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Scientific Columbus Co., Columbus, OH 43228-4105	614-274-0400
† Technic, Inc., Providence, RI 02940-9650	401-781-6100
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121

Meters, Attenuation-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Meters, Audio Level-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377**
§ **Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673**	**D•1369**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721**	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Contact East, N. Andover, MA 01845	508-682-2000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516

§ Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ ESE, El Segundo, CA 90245	310-322-2136
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
§ Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Meters, Bar Graph-2950

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1384-1385**
† International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721	**D•1354**
§† OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1364-1365,1367**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1384-1385**
§ Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035	**B•1124-1125**
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389,1392-1396,1400-1401**
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§† Dixson, Inc., Grand Junction, CO 81503	303-244-1241
Excel Technology Intl. Corp., Belle Mead, NJ 08502	908-874-4747
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Idea, Inc., Brea, CA 92621	310-697-4332
§† I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§† International Microtronics, Tucson, AZ 85714	602-748-7900
ITF Corp., Buford, GA 30518	404-945-3844
§ Metermaster, Tempe, AZ 85282	602-431-0015
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
Mors Technologies Inc., Mors Group-France, Delson, Quebec, CANADA J0L 1G0	514-638-4150
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Sensotec, Inc., Columbus, OH 43212	614-486-7723
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
† UCE, Inc., Norwalk, CT 06854	203-838-7509

Meters, Battery Capacity-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372**
Christie Electric Corp., Gardena, CA 90248	310-715-1402
Comptus Inc., New Boston, NH 03070	603-487-5512
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549	914-666-2971
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ Metermaster, Tempe, AZ 85282	602-431-0015

Meters, Capacitance, Inductance-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
§ MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171	**D•1300-1301**
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231	216-349-0370
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369	909-392-5833
MSI Electronics, Inc., Woodside, NY 11377	718-672-6500
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253 1230
RE America, Westlake, OH 44145	216-871-7617
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Meters, Clamp-on-2900

§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391	**D•1223**
§ Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1153**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1399**
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
§ Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ Contact East, N. Andover, MA 01845	508-682-2000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
§ HC Protek, Northvale, NJ 07647	201-767-7242
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
§ Metermaster, Tempe, AZ 85282	602-431-0015
Omega Engineering, Stamford, CT 06907	800-826-6342
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
Transonic Systems Inc., Ithaca, NY 14850	607-257-5300
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607	415-452-1936

Meters, Coercivity-2900

§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638	**D•1334**

Meters, Conductance-2900

§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1350**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231	216-349-0370
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Engineered Systems & Designs, Newark, DE 19713	302-456-0446
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
§ Metermaster, Tempe, AZ 85282	602-431-0015
Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
Yellow Springs Instruments Co., Yellow Springs, OH 45387	800-765-4974

Meters, Counting Rate, Nuclear-2900

§ Gralex Industries, Norwood, NJ 07648, 800-486-4499	**D•1353**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1365**
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Electro Industries. Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Nuclear Measurements Group. Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
† Nuclear Research Corp., Warrington, PA 18976	215-343-5900

Meters, Decibel Indicating-2900

GMW Associates, Redwood City, CA 94064, 415-368-4884	**D•1262**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1368**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8	514-333-8748; 800-361-3697
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Contact East, N. Andover, MA 01845	508-682-2000
† Crompton Modutec. Manchester. NH 03109	603-669-5121:800-METERS-1
Davis Instrument Mfg. Co.. Inc.. Baltimore. MD 21215	800-368-2516
§ Dixson. Inc.. Grand Junction. CO 81503	303-244-1241
D1 International Inc.. Huntington. NY 11743	516-673-6866
§ Electrodata. Inc., Bedford Heights. OH 44128	216-663-3333
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford. IL 61109	815-397-7070
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp.. Signal Hill. CA 90804-1203	310-986-1677:800-545-8784
§ Leader Instruments Corp., Hauppauge. NY 11788-3694	516-231-6900: 1-800-645-5104
§ LFE Instruments. Mark IV Industries, Inc., Clinton. MA 01510-3099	508-365-3400
§ Metermaster. Tempe. AZ 85282	602-431-0015
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Q.V.S. Inc., East Orange, NJ 07017	201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
Shokai Far East Ltd.. Peekskill, NY 10566	914-736-3500
§ Simpson Electric Co.. Elgin. IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia. PA 19115	215-673-5600:800-343-1199
§ Techni-Tool. Plymouth Meeting. PA 19462	215-825-4990
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
§ Triplett Corporation Bluffton. OH 45817-9987	419-358-5015
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Meters, Deviation-2900

Gossen/Texmate. Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372.1379**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1370**
§ Shurite Meters, A Prime Technology Co., North Branford. CT 06471, 203-481-5721	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1379**
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390**
Beede Electrical Instrument Co., Inc.. Penacook, NH 03303	603-753-6362
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ I.M.C.. (International Microtronics Corp.). Tuscon. AZ 85714	602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§ Marconi Instruments. Allendale. NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Racal-Dana Instrs. Inc.. Irvine. CA 92718	714-859-8999
RE America, Westlake, OH 44145	216-871-7617

Meters, Digital ESR-2900

Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1947**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1346-1347, 1349-1351**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372**
§ OTTOTEK, IMC, Tucson. AZ 85714, 602-748-7900	**D•1365**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372**
Davis Instrument Mfg. Co., Inc.. Baltimore, MD 21215	800-368-2516
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100

Meters, Digital RPM-2900

§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1947**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1346-1347, 1349-1350**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1374**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1358,1361**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1365**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1374**
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1392**
Analogic Corp., Peabody, MA 01960	508-977-3000
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Comptus Inc., New Boston, NH 03070	603-487-5512
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
DCI Inc., Olathe, KS 66062	913-782-5672
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151:800-932-0489
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
§ Red Lion Controls, York, PA 17402	717-767-6511
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§† WestCon, Marion, OH 43302	614-382-5771

Meters, Digital, 2-wire, 4-20 mA Current Loop-2950

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1340-1342**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1040**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1937,1947**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1349-1351**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1374,1376-1377,1380-1383**
Gralex Industries, Norwood, NJ 07648, 800-486-4499	**D•1353**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1358,1361**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1365,1367**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1374,1376-1377,1380-1383**
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390**
Acculex Corporation, Taunton, MA 02780	508-880-3660
Amptec Electronics, San Diego, CA 92128	619-578-7816
Analogic Corp., Peabody, MA 01960	508-977-3000
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
DCI Inc., Olathe, KS 66062	913-782-5672
DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ I.M.C., (International Microtronics Corp.). Tuscon. AZ 85714	602-748-7900
International Instruments, A Prime Technology Company. N. Branford. CT 06471	203-481-5721
§† International Microtronics, Tucson, AZ 85714	602-748-7900
ITF Corp., Buford, GA 30518	404-945-3844
Keithley Instrs., Cleveland, OH 44139	800-552-1115
† Kurz Instruments Inc., Monterey, CA 93940	800-424-7356
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
§ Precision Digital Corp., Natick, MA 01760	508-655-7300
§ Red Lion Controls, York, PA 17402	717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

§ Wavetek Corp., San Diego, CA 92123 619-279-2200
§† WestCon, Marion, OH 43302 614-382-5771
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 813-646-3909

Meters, Dissolved Oxygen-2900

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ Engineered Systems & Designs, Newark, DE 19713 302-456-0446
Omega Engineering, Stamford, CT 06907 800-826-6342

Meters, Distortion & Noise-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1293**
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8 .... 514-333-8748; 800-361-3697
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
† Data Check Corporation, San Diego, CA 92126 619-578-0101
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
Marconi Instruments, Allendale, NJ 07401 201-934-9050
§ Metermaster, Tempe, AZ 85282 602-431-0015
NF Electronic Instruments, State College, PA 16801 814-237-5580
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131 708-288-4471
RE America, Westlake, OH 44145 216-871-7617
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

Meters, Edgewise-2950

§ **Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362 .... D•1339**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1386
§† **International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1365**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721 .... D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1386
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389,1397,1399-1400**
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 617-894-6440
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Deltec Co., Norwalk, CA 90650 310-926-2304
§† Dixson, Inc., Grand Junction, CO 81503 303-244-1241
D1 International, Inc., Huntington, NY 11743 516-673-6866
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
EMICO Inc., Manchester, NH 03109 603-669-5121
§ Greibach Instruments Div., Mt. Vernon, NY 10550 914-699-9717
Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
Philips Technologies, Airpax Instruments, Cheshire, CT 06410 203-271-6000
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015

Meters, Elapsed Time — See Indicators, Elapsed Time (Vol. D)

Meters, Electrometer-2900

Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1284-1285
§ Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
Nuclear Research Corp., Warrington, PA 18976 215-343-5900
§ Simco Co., Hatfield, PA 19440 215-822-2171
§ Trek, Incorporated, Medina, NY 14103-0728 716-798-3140

Meters, EMC — See Meters, RFI (Vol. D)

Meters, FM Deviation-2900

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RE America, Westlake, OH 44145 216-871-7617
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Field Strength-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1003,1023,1224-1225
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 .... D•1152,1236
GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1260-1261,1263
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721 .... D•1371**
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
Instruments for Industry, Inc., Ronkonkoma, NY 11779 516-467-8400
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228 .... +41(22)7941121
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
Peca, Inc., Bensalem, PA 19020 215-245-1550
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§† Semtronics Corp., Peachtree City, GA 30269 404-487-6681
† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Simco Co., Hatfield, PA 19440 215-822-2171
§ Trek, Incorporated, Medina, NY 14103-0728 716-798-3140
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ Walker Scientific, Worcester, MA 01606 .... 508-852-3674;508-853-3232;800-962-4638

Meters, Fluid Flow-2200

§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1358**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1393
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
Accusonic Division, O.R.E. International Inc., Falmouth, MA 02541 508-548-5800
§ Analogic Corp., Peabody, MA 01960 508-977-3000
† Astro Dynamics, Inc., Woburn, MA 01801 617-935-4944
Beck Systems Inc., Beck Technology, Saskatoon, SK. CAN S7L 5X5 306-975-1080
† Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440 215-362-3500
COLE-PARMER Instrument Company, Niles, IL 60714 708-647-7600
Comptus Inc., New Boston, NH 03070 603-487-5512
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
§ Dieterich Standard, A Dover Industries Company, Boulder, CO 80301 303-530-9600
† Digitec, Marion, OH 43302 614-387-3444
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§ Endress & Hauser Instruments, Greenwood, IN 46143 .... 317-535-7138;800-428-4344
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
§ Harwil Corporation, Santa Monica, CA 90404 310-829-2310
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
† Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
Marsh-McBirney, Inc., Frederick, MD 21701 .... 800-368-2723;301-874-5599
Moore Products Co., Spring House, PA 19477 215-646-7400
Omega Engineering, Stamford, CT 06907 800-826-6342
Panametrics, Waltham, MA 02154-3497 617-899-2719
Rosemount Analytical Inc., Cedar Grove, NJ 07009 .... 800-222-2600 ext. 400
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Scott Specialty Gases, Inc., Plumsteadville, PA 18949-0130 215-766-8861
Teledyne Gurley, Troy, NY 12181 .... 518-272-6300;800-759-1844
Toshiba Instrumentation Div., Toshiba Intl. Corp., Tulsa, OK 74134 918-252-3548
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057

Meters, Flux-2900

GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1260-1262
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102 .... D•1295
Magnos, Hudson, MA 01749, 508-562-1173 .... D•1296
§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 .... D•1334**
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670 .... 800-262-4638; 800-525-3536
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
§ MEDA, Inc., Macintyre Electronics Design Assocs., Herndon, VA 22070 703-471-1445
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
Omega Engineering, Stamford, CT 06907 800-826-6342
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717

Meters, Frequency-2900

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1340-1342
DCI Inc., Olathe, KS 66062, 913-782-5672 .... D•1344

Meters, Frequency-2900 (Cont'd)

Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1402**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372-1373,1381-1382**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1358**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
§† **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365,1367**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372-1373,1381**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329**
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1390-1391,1393,1400**
Acculex Corporation, Taunton, MA 02780	508-880-3660
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Alpha Industries, Inc., Woburn, MA 01801	617-935-5150
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
§ Analogic Corp., Peabody, MA 01960	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Comptus Inc., New Boston, NH 03070	603-487-5512
§ Contact East, N. Andover, MA 01845	508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Crompton Modutec, Manchester. NH 03109	603-669-5121;800-METERS-1
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Electro-Numerics, Inc., Temecula, CA 92590	909-699-2437
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§† International Microtronics, Tucson, AZ 85714	602-748-7900
§† J-B-T Instruments, Inc., New Haven, CT 06508-1818	203-776-1111
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Optoelectronics, Inc., Ft. Lauderdale, FL 33334	305-771-2050
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
† Premier Microwave, Port Chester, NY 10573	914-939-8900
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Red Lion Controls, York, PA 17402	717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
Simpson Electric Co., Elgin, IL 60120	708-697-2260
Sivers IMA AB, Culver City, CA 90230	213-306-4248
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§† WestCon, Marion, OH 43302	614-382-5771
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

Meters, Frequency Deviation-2900

§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	**D•1347**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1381**
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1367**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1381**
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121

Meters, Galvanometer-2900

Shalltronix Corp., Selma, NC 27576, 919-965-6346	**D•1324**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§ Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005	314-532-5887

Meters, Gauss-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1230**
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1152,1236**
GMW Associates, Redwood City, CA 94064, 415-368-4884	**D•1261**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372**
Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400;1-800-642-1400	**A•1320**
Magnelab, Boulder, CO 80301-4696, 303-442-6700	**A•2382**
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102	**D•1295**
Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372**
§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638**	**D•1334**
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cryomagnetics, Inc., Oak Ridge, TN 37830	615-482-9551
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Enertech Consultants, Campbell, CA 95008	408-866-7266
§ Holaday Industries, Inc., Eden Prairie, MN 55344	612-934-4920
LDJ Electronics, Troy, MI 48099-0219	313-528-2202
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104	800-525-3536
§ MEDA, Inc., Macintyre Electronics Design Assocs., Herndon, VA 22070	703-471-1445
Memtec Corp., Salem, NH 03079	603-893-8080
§ Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228	+41(22)7941121
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015	800-222-7846
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076	708-677-4700
Omega Engineering, Stamford, CT 06907	800-826-6342
§† OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900

Meters, Hand Held-2900

§ **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900**	**D•1152-1153,1236-1237**
§ **EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7, 418-683-0211;1-800-663-EXFO**	**B•1211**
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1259**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400;1-800-642-1400	**A•1320**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292-1293**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314**
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1398-1399**
ACL Inc., Elk Grove Village, IL 60007	708-981-9212;1-800-782-8420
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
§ Atkins Technical Inc., Gainesville, FL 32608	904-378-5555
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Crystal Engineering Corp., Los Osos, CA 93402	805-528-2155;800-444-1850
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§Φ MEDA, Inc., Macintyre Electronics Design Assocs., Herndon, VA 22070	703-471-1445
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015	800-222-7846
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369	909-392-5833
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Semtronics Corp., Peachtree City, GA 30269	404-487-6681
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471	203-481-5721
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§† WestCon, Marion, OH 43302	614-382-5771

Meters, Humidity-2900

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1888**
§ Atkins Technical Inc., Gainesville, FL 32608	904-378-5555
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Omega Engineering, Stamford, CT 06907	800-826-6342
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
Panametrics, Waltham, MA 02154-3497	617-899-2719
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
Stephens Analytical, Inc., Montreal, Que., CA H4S 1L1	514-332-1230
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
† Thunder Scientific Corp., Albuquerque, NM 87123	505-265-8701;800-872-7728

Meters, Illuminated Scale-2950

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1340-1342**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374	**B•1763**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**B•1978, D•1358,1361**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**C•1792**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365,1367**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1369-1370**
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721**	**D•1371**
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§ Contact East, N. Andover, MA 01845	508-682-2000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Dixson, Inc., Grand Junction, CO 81503	303-244-1241
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
EMICO Inc., Manchester, NH 03109	603-669-5121
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
† Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Simpson Electric Co.; Elgin, IL 60120	708-697-2260
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015

Meters, Impedance-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
† Data Check Corporation, San Diego, CA 92126	619-578-0101
† Electro-Dynamics Dev. Co., Issaquah, WA 98027-4038	206-392-2493
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
Keithley Instrs., Cleveland, OH 44139	800-552-1115
Linear Research Inc., San Diego, CA 92110	619-299-0719
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
RE America, Westlake, OH 44145	216-871-7617
Sescom, Inc., Henderson, NV 89015-4249	702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Meters, Kilovolt-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1385**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**D•1277**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289**
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300**	**D•1299**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1594, D•1319**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1385**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329,1331**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
§ Astec High Voltage, Ashland, MA 01721	508-881-8407
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Bertan High Voltage, Hicksville, NY 11801	516-433-3110
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
D1 International, Inc., Huntington, NY 11743	516-673-6866
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
Electrical Standards Div., E.S.R.S., Inc., N. Hollywood, CA 91605	818-765-4224
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
† Oram High Voltage, Dayton, TX 77535	409-258-5553
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
Rutherford Research, Rutherford, NJ 07070	201-933-2091
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Trek, Incorporated, Medina, NY 14103-0728	716-798-3140
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
† Velonex, Santa Clara, CA 95050	408-727-7370
Vitrek Corporation, San Diego, CA 92121	619-586-1695
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Meters, Laser Energy — See Monitors, Laser Energy (Vol. D)

Meters, Light (Nonphotographic)-2900

§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
§ BEA electro-optics, inc., Des Plaines, IL 60016	708-298-1420
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440

† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 815-397-7070
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
International Light, Newburyport, MA 01950-4092 508-465-5923
§ Metermaster, Tempe, AZ 85282 602-431-0015
Optronic Laboratories, Inc., Orlando, FL 32811 .... 407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788

Meters, Megohm-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226-1227
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1284
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 .... D•1315**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 .... D•1317**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773 .... D•1325
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1372
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329**
§ Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231 216-349-0370
§ AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
AVO International, TBG, Dallas, TX 75237 214-333-3201
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
D1 International, Inc., Huntington, NY 11743 516-673-6866
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 516-957-8700
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Gossen/Texmate, Vista, CA 92083-8397 .... 619-598-9899;1-800-394-8344
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 815-397-7070
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Hipotronics Inc., Brewster, NY 10509 914-279-8091
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Interelectronics Corp., Congers, NY 10920 .... 914-EL8-8000
Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
Multicore Solders, Inc., Richardson, TX 75081 214-238-1224
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 708-437-6444
Omega Engineering, Stamford, CT 06907 800-826-6342
† Oram High Voltage, Dayton, TX 77535 409-258-5553
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ Phenix Technologies, Accident, MD 21520 301-746-8118
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
† Q.V.S., Inc., East Orange, NJ 07017 201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† RE America, Westlake, OH 44145 216-871-7617
Rosemount Analytical Inc., Cedar Grove, NJ 07009 .... 800-222-2600 ext. 400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
§ Sperry, A. W. Instruments, Smithtowr., NY 11787 .... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
† Velonex, Santa Clara, CA 95050 408-727-7370
Vitrek Corporation, San Diego, CA 92121 619-586-1695
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136 216-238-2550

Meters, Microampere — See Meters, Ampere (Vol. D)

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Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1283,1286
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 .... D•1315**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1329-1330
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cambridge Technology, Inc., Watertown, MA 02172 617-923-1181
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Gossen/Texmate, Vista, CA 92083-8397 .... 619-598-9899;1-800-394-8344
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Linear Research Inc., San Diego, CA 92110 619-299-0719
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
NF Electronic Instruments, State College, PA 16801 814-237-5580
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Vitrek Corporation, San Diego, CA 92121 619-586-1695

Meters, Microwave-2900

Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1298
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
EPD Electronics, Inc., Gardena, CA 90247 310-515-4996
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Marconi Instruments, Allendale, NJ 07401 201-934-9050
§ Metermaster, Tempe, AZ 85282 602-431-0015
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 516-273-9800
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Modulation-2900

§ ARGA Controls, Pasadena, CA 91105 213-682-3314
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
RE America, Westlake, OH 44145 216-871-7617
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Moving Coil-2950

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1386-1387
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1386-1387
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389
Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Deltec Co., Norwalk, CA 90650 310-926-2304
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
D1 International, Inc., Huntington, NY 11743 516-673-6866
International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Metermaster, Tempe, AZ 85282 602-431-0015
Mitech ELectronics Corp., Otsego, MI 49078 616-694-9471
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550 914-699-9717

Meters, Moving Iron-2950

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1386-1387
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1386-1387
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Deltec Co., Norwalk, CA 90650 310-926-2304
D1 International, Inc., Huntington, NY 11743 516-673-6866
§ Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471 203-481-5721
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550 914-699-9717

Meters, Multifunction (Analog)-2900

§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1259**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1384,1386-1387
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 .... D•1299**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2012

Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1384,1386-1387
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1398**
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 617-894-6440
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845 508-682-2000
† Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Electronic Development Corp., EDC, Boston, MA 02127-4198 617-268-9696
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701 310-404-0101
Gralex Industries, Norwood, NJ 07648 800-486-4499
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
§ Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044 1-800-523-3696
† Vertox Co., Garden Grove, CA 92643 714-530-4541
§ Wavetek Corp., San Diego, CA 92123 619-279-2200

Meters, Multifunction (Digital)-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 .... D•1152
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 .... D•1246
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1259**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1376-1378,1380-1381
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266,1273
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537 .... D•1745**
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1278
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1283-1284,1288
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1292**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 .... D•1294
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 .... D•1299**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... B•1978**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1366
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... D•1319
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400 .... B•2012
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 .... D•1370
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1376-1378,1380-1382
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1398**
† Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
§ Analogic Corp., Peabody, MA 01960 508-977-3000
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 617-894-6440
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845 508-682-2000
§† Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
† Digitec, Marion, OH 43302 614-387-3444
D1 International, Inc., Huntington, NY 11743 516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 516-957-8700
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 203-624-3103
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701 310-404-0101
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
§ I.M.C. (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
§ Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
ITF Corp., Buford, GA 30518 404-945-3844
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
Prema Precision Electronics, Inc., Montclair, CA 91763 714-621-7292
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044 1-800-523-3696
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
§† WestCon, Marion, OH 43302 614-382-5771

Meters, Noise & Sound Level-2900

Φ **Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
§ Contact East, N. Andover, MA 01845 508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
# Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Nonconductive Coating Thickness-2900

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ Metermaster, Tempe, AZ 85282 602-431-0015

Meters, Null-2950

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1377
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 .... D•1299**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1377
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§† Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
D1 International, Inc., Huntington, NY 11743 516-673-6866
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
§ Greibach Instruments Div., Mt. Vernon, NY 10550 914-699-9717
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Julie Research Labs., New York, NY 10001 212-633-6625
Keithley Instrs., Cleveland, OH 44139 800-552-1115
Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ Metermaster, Tempe, AZ 85282 602-431-0015
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
† Q.V.S., Inc., East Orange, NJ 07017 201-673-3996
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Ohm-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226-1227
AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .... D•1231
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .... D•1248
DCI Inc., Olathe, KS 66062, 913-782-5672 .... D•1344
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 .... D•1345**
Fetco, Sanford, FL 32773, 407-321-3800 .... A•2352
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1259**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1377
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1283
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1289

§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1360**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365**
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776**	**D•1315**
Shalltronix Corp., Selma, NC 27576, 919-965-6346	**D•1324**
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721**	**D•1371**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1377**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1330**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cambridge Technology, Inc., Watertown, MA 02172	617-923-1181
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hypatia Inc., Hillsboro, OR 97123-9074	503-628-2936
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
§# Instrumentation Services, Inc., Minneapolis, MN 55427	612-544-8916
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900: 1-800-645-5104
Linear Research Inc., San Diego, CA 92110	619-299-0719
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
§† Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
RE America, Westlake, OH 44145	216-871-7617
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
Space Electronics, Inc., Berlin, CT 06037	203-829-0001
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
Vitrek Corporation, San Diego, CA 92121	619-586-1695
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§† Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550
§† WestCon, Marion, OH 43302	614-382-5771

Meters, Optical Power-2900

Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
§ Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ BEA electro-optics, inc., Des Plaines, IL 60016	708-298-1420
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Meters, Panel (Analog)-2950

§ **Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362**	**D•1339**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1380,1386-1387**
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721	**D•1354**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**D•1041**
† **Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300**	**D•1299**
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1363**
§ **Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673**	**D•1369-1370**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ **Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721**	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1376,1380,1386-1387**
§† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1389,1395-1397,1399-1400**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
§† Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ CUI Stack Inc., Beaverton, OR 97005	503-643-4899
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
# Deltec Co., Norwalk, CA 90650	310-926-2304
§† Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Electrol Co., York, PA 17405	717-848-1722
EMICO Inc., Manchester, NH 03109	603-669-5121
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109	815-397-7070
† Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
International Microelectronics, Arlington, TX 76003	817-473-1730
§ International Microtronics, Tucson, AZ 85714	602-748-7900
# Kimball Electronic Lab. Inc., Hialeah, FL 33016	305-822-5792
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Outland Technology Inc., Gretna, LA 70056	504-367-0104
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

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† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000**	**D•1340-1342**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437**	**D•1345**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1947**
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1259**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	D•1346-1351
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372-1373,1376-1378,1381-1383**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**D•1041**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1356**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**B•1978, D•1360-1361**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1362-1363**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365-1367**
§ **Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673**	**D•1368,1370**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372-1373,1376-1378,1381-1383**
† **Velonex, Santa Clara, CA 95050, 408-727-7370**	**D•1388**
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1389-1390,1395-1397**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Acculex Corporation, Taunton, MA 02780	508-880-3660

§ Action Instruments, San Diego, CA 92123	619-279-5726
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Anadex Inc., Camarillo, CA 93012	805-987-9660
§ Analogic Corp., Peabody, MA 01960	508-977-3000
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ Contact East, N. Andover, MA 01845	508-682-2000
§† Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
† Digitec, Marion, OH 43302	614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§† Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Electrol Co., York, PA 17405	717-848-1722
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
§† I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
ITF Corp., Buford, GA 30518	404-945-3844
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
# Kimball Electronic Lab. Inc., Hialeah, FL 33016	305-822-5792
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
Lincoln Instruments, Pomona, CA 91767	714-626-3399
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
§ Precision Digital Corp., Natick, MA 01760	508-655-7300
§ Red Lion Controls, York, PA 17402	717-767-6511
Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Transistor Devices, Inc., Randolph, NJ 07869	201-361-6622
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661	916-783-7878
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
§† WestCon, Marion, OH 43302	614-382-5771

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Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248**
§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1259**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964, D•1294**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Amptec Electronics, San Diego, CA 92128	619-578-7816
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
§† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Coaxial Dynamics, Cleveland, OH 44135	1-800-COAXIAL
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
† Giga-tronics, Inc., Sunnyvale, CA 94089	408-734-5780
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Valhalla Scientific, San Diego, CA 92121	619-457-5576
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

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Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1886, D•1362-1363**
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
§ Alpha-M Corp., Dallas, TX 75229	214-406-0424
Brinkmann Instruments, Inc., Westbury, NY 11590-0207	516-334-7500
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Engineered Systems & Designs, Newark, DE 19713	302-456-0446
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Gossen/Texmate, Vista, CA 92083-8397	619-598-9899;1-800-394-8344
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
Texmate, Inc., Vista, CA 92083-8397	619-598-9899

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Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226**
† **Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940**	**D•1247**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660	**D•1291**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1209**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1331**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1398**
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
§ Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
D1 International, Inc., Huntington, NY 11743	516-673-6866
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
† Elpaz Instruments, Inc., Murrysville, PA 15668	412-327-8744
Evans Electronics, Berkeley, CA 94705	510-653-3083
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Metermaster, Tempe, AZ 85282	602-431-0015
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
RE America, Westlake, OH 44145	216-871-7617
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
TEGAM, Inc., Madison, OH 44057	800-666-1010
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Meters, Plating Thickness-2900

Ocean Motions Co., Barrington, RI 02806	401-246-1394

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§ **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... D•1237**
† **Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 ... D•1246**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1385
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ... D•1294
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ... D•1313
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1385
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1328-1329,1331**
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1393,1400-1401**
§ AEMC Corporation, Boston, MA 02111 ... 617-451-0227;800-343-1391
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 ... 516-593-5600
Angus Electronics Co., Indianapolis, IN 46224 ... 317-244-7611
§ ARGA Controls, Pasadena, CA 91105 ... 213-682-3314
AVO International, TBG, Dallas, TX 75237 ... 214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213 ... 412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404 ... 415-570-5355
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† Boonton Electronics Corp., Randolph, NJ 07869 ... 201-584-1077
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 ... 603-749-6434
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
D1 International, Inc., Huntington, NY 11743 ... 516-673-6866
† Dranetz Technologies, Inc., Edison, NJ 08818-4019 ... 908-287-3680
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 ... 410-584-7400
Electrical Instrument Service, Mt. Vernon, NY 10550 ... 914-699-9717
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 ... 516-334-0870
§ Eliwell Inc., Baldwinsville, NY 13027 ... 315-638-9598
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235 ... 614-889-6152
Highland Technology, Inc., San Francisco, CA 94122 ... 415-753-5814
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
Marconi Instruments, Allendale, NJ 07401 ... 201-934-9050
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075 ... 716-334-7300
NF Electronic Instruments, State College, PA 16801 ... 814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 ... 708-437-6444
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 ... 604-652-5118
Rosemount Analytical Inc., Cedar Grove, NJ 07009 ... 800-222-2600 ext. 400
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
Scientific Columbus Co., Columbus, OH 43228-4105 ... 614-274-0400
Sensitive Research Instruments, Mt. Vernon, NY 10550 ... 914-699-9717
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
§ TIF Instruments, Inc., Miami, FL 33150 ... 305-757-8811

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IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
§ **MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 ... D•1300-1301**
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§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 ... 800-253-1230
Rutherford Research, Rutherford, NJ 07070 ... 201-933-2091
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
Scientific Columbus Co., Columbus, OH 43228-4105 ... 614-274-0400
Tucker Electronics, Dallas, TX 75355-1419 ... 214-348-8800;800-527-4642

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§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 ... D•1160,1347-1349**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1358,1361**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... D•1362-1363
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ... D•1365**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390
§ Analogic Corp., Peabody, MA 01960 ... 508-977-3000
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
Gralex Industries, Norwood, NJ 07648 ... 800-486-4499
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724 ... 908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 ... 818-341-5151
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
Vorne Industries, Inc., Chicago, IL 60631 ... 312-775-9440
§† WestCon, Marion, OH 43302 ... 614-382-5771

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§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1358**
§ AEMC Corporation, Boston, MA 02111 ... 617-451-0227;800-343-1391
Angus Electronics Co., Indianapolis, IN 46224 ... 317-244-7611
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
§ Dynapar, Gurnee, IL 60031 ... 312-662-2666
Evans Electronics, Berkeley, CA 94705 ... 510-653-3083
§† FOX METER INC., DeKalb, IL 60115 ... 815-758-7000
Gossen/Texmate, Vista, CA 92083-8397 ... 619-598-9899;1-800-394-8344
Gralex Industries, Norwood, NJ 07648 ... 800-486-4499
§† Guildline Instruments, Lake Mary, FL 32746 ... 407-333-3327
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ Non-Linear Systems, San Diego, CA 92121 ... 619-535-2161
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 ... 516-567-1100
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 ... 818-341-5151
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
Texmate, Inc., Vista, CA 92083-8397 ... 619-598-9899
Tucker Electronics, Dallas, TX 75355-1419 ... 214-348-8800;800-527-4642

Meters, Reflectometer-2900

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 ... 216-248-1200
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 ... 619-279-8034
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 ... 418-683-0211;1-800-663-EXFO
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
† Loral Microwave Narda, Hauppauge, NY 11788 ... 516-231-1700
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 ... 818-341-5151

Meters, Relay — See Relays, Meter (Vol. B)

Meters, Resistance-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 ... D•1226
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 ... D•1248
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 ... D•1284-1285
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ... D•1294
§ **MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 ... D•1300-1301**
§ **ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305 ... D•1320-1321**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1330
Vitrek Corporation, San Diego, CA 92121, 619-586-1695 ... D•1333
ACL Inc., Elk Grove Village, IL 60007 ... 708-981-9212;1-800-782-8420
§ AEMC Corporation, Boston, MA 02111 ... 617-451-0227;800-343-1391
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 ... 609-275-0220
§ Analogic Corp., Peabody, MA 01960 ... 508-977-3000
Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 ... 603-749-6434
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 ... 503-641-4141
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 ... 516-957-8700
Fieldpiece Instruments, Buena Park, CA 90621 ... 714-992-1239
§† FOX METER INC., DeKalb, IL 60115 ... 815-758-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
Hypatia Inc., Hillsboro, OR 97123-9074 ... 503-628-2936
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
Industrial Test Equipment Co., Inc., Port Washington, NY 11050 ... 516-883-1700
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ... 516-231-6900;1-800-645-5104
Linear Research Inc., San Diego, CA 92110 ... 619-299-0719
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 ... 716-765-2254
NF Electronic Instruments, State College, PA 16801 ... 814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 ... 708-437-6444
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 ... 715-723-1141
Plastic Systems Inc., Marlboro, MA 01752-3004 ... 508-485-7390
† PPM, Inc., Cleveland, OH 44122 ... 1-800-899-4776
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 ... 800-253-1230
§† Qualitec Technologies, Inc., Fremont, CA 94538 ... 510-498-1046
Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 ... 818-998-6500;800-732-3457
Space Electronics, Inc., Berlin, CT 06037 ... 203-829-0001
§ Spectrascan, Inc., Colorado Springs, CO 80907 ... 719-599-9254
§ TEGAM, Inc., Madison, OH 44057 ... 800-666-1010
Triplett Corporation, Bluffton, OH 45817-9987 ... 419-358-5015
§ Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
§† WestCon, Marion, OH 43302 ... 614-382-5771

Meters, RFI-2900

Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400 ... D•1013
† Basic Measuring Instruments, Foster City, CA 94404 ... 415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
§ Metermaster, Tempe, AZ 85282 602-431-0015
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

Meters, S Unit-2900

A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310

Meters, Slope — See Inclinometer (Vol. D)
Meters, Snap-around — See Meters, Clamp-on (Vol. D)

Meters, Standing Wave Ratio-2900

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Direct Conversion Technique, Inc., Chicago, IL 60641 312-283-1690
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Meters, Static Decay-2900

† Chapman Corp., Portland, ME 04104 207-773-4726
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038 215-887-2196
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634
Plastic Systems Inc., Marlboro, MA 01752-3004 508-485-7390
§ Simco Co., Hatfield, PA 19440 215-822-2171
§ Testone Inc., Skippack, PA 19474-1589 215-584-9658
§ Trek, Incorporated, Medina, NY 14103-0728 716-798-3140

Meters, Taut Band-2950

§ **Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362 .... D•1339**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 .... D•1369
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1397-1398,1400**
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
D1 International, Inc., Huntington, NY 11743 516-673-6866
Gossen/Texmate, Vista, CA 92083-8397 .... 619-598-9899;1-800-394-8344
† Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015

Meters, Temperature (Contacting)-2900

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1340-1342
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 .... D•1345**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1160**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1373,1380
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .... D•1355-1356
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... B•1978, D•1358-1361**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314,1362-1363
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1365,1367**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1373,1380
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389,1393,1396**
§ **Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974 .... B•1909**
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Acculex Corporation, Taunton, MA 02780 508-880-3660
Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
§ Analogic Corp., Peabody, MA 01960 508-977-3000
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§ Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
§ Contact East, N. Andover, MA 01845 508-682-2000
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
DCI Inc., Olathe, KS 66062 913-782-5672
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
† Digitec, Marion, OH 43302 614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
Electric Tachometer, Philadelphia, PA 19142 215-726-7723
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
§† Guildline Instruments Inc., Lake Mary, FL 32746 407-333-3327
§ Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731 818-444-4000
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 602-748-7900
† Instrulab, Dayton, OH 45404 513-223-2241
§ International Microtronics, Tucson, AZ 85714 602-748-7900
ITF Corp., Buford, GA 30518 404-945-3844
§ J-B-T Instruments, Inc., New Haven, CT 06508-1818 203-776-1111
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 602-968-6241
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
§ Martel Electronics, Windham, NH 03087 603-893-0886
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482 310-478-1134
§ Precision Digital Corp., Natick, MA 01760 508-655-7300
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796 617-527-4385
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
TEGAM, Inc., Madison, OH 44057 800-666-1010
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ TIF Instruments, Inc., Miami, FL 33150 305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 707-938-2121
WestCon, Marion, OH 43302 614-382-5771
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818 401-884-4188
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 813-646-3909
Xitron Technologies, San Diego, CA 92121 619-458-9852

Meters, Temperature, Dial type (Noncontacting) — See Pyrometers (Vol. D)

Meters, Temperature, Infrared-2900

§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538 510-226-0488
§ Metermaster, Tempe, AZ 85282 602-431-0015
Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
§ Raytek, Inc., Santa Cruz, CA 95060-1820 408-458-1110
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
† Williamson Corporation, Concord, MA 01742 508-369-9607

Meters, Thermal Transfer-2900

†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717

Meters, Time Interval — See Timers, Interval (Vol. D)

Meters, Vacuum Tube Volt (VTVM)-2900

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808

Ross Engineering Corp., Campbell, CA 95008	408-377-4621
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Meters, VAR-2900

Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2012**
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1393**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Amprobe Instrument, Core Industries, Inc., Lynbrook, NY 11563	516-593-5600
Amptec Electronics, San Diego, CA 92128	619-578-7816
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctms., Inc., Westbury, NY 11590	516-334-0870
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Gossen/Texmate, Vista, CA 92083-8397	619-598-9899;1-800-394-8344
† Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
Xitron Technologies, San Diego, CA 92121	619-458-9852

Meters, Vibration-2900

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
§ Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-U-SENS-IT	**B•2024**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Epic, Inc., New York, NY 10038	212-349-2470
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrix Instrument Co., Houston, TX 77043	713-461-2131
# Meylan Corporation, Upper Montclair, NJ 07043-1844	201-744-6400
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929

Meters, Volt, AC-2900

§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391	**D•1223**
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362	**D•1339**
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940	**D•1246**
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1340-1343**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
† Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1350**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1381,1385**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025	**D•1277**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283-1286**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1356**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964,1966, D•1294**
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300	**D•1299**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1360**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1368**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377,1381,1385**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1209**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329**
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390,1392,1398,1401**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Acculex Corporation, Taunton, MA 02780	508-880-3660
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8	514-333-8748; 800-361-3697
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ Analogic Corp., Peabody, MA 01960	508-977-3000
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845	508-682-2000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
# Deltec Co., Norwalk, CA 90650	310-926-2304
† Digitec, Marion, OH 43302	614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Electro Industries, Div. E.I. Elctms., Inc., Westbury, NY 11590	516-334-0870
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
EMICO Inc., Manchester, NH 03109	603-669-5121
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Fieldpiece Instruments, Buena Park, CA 90621	714-992-1239
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Gralex Industries, Norwood, NJ 07648	800-486-4499
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§† International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
International Microelectronics, Arlington, TX 76003	817-473-1730
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
Julie Research Labs., New York, NY 10001	212-633-6625
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
Omega Engineering, Stamford, CT 06907	800-826-6342
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Red Lion Controls, York, PA 17402	717-767-6511
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
† Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Speco Div. Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§† Transtector Systems, Inc., Hayden Lake, ID 83835	800-829-2901
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
† Velonex, Santa Clara, CA 95050	408-727-7370
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§† WestCon, Marion, OH 43302	614-382-5771
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550	914-699-9717

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§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391	**D•1223**

§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303, 603-753-6362	**D•1339**
Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940	**D•1246**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1340-1342**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
† Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1350**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1377,1382-1383**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283-1286**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964,1966, D•1294**
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300	**D•1299**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1358,1360-1361**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
§ Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046	**D•1317**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471, 203-481-5721	**D•1371**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1377,1382-1383**
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1390,1392,1396,1398,1401**
Acculex Corporation, Taunton, MA 02780	508-880-3660
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ Analogic Corp., Peabody, MA 01960	508-977-3000
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
# Deltec Co., Norwalk, CA 90650	310-926-2304
† Digitec, Marion, OH 43302	614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
EMICO Inc., Manchester, NH 03109	603-669-5121
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Gralex Industries, Norwood, NJ 07648	800-486-4499
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§† I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§† International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
International Microelectronics, Arlington, TX 76003	817-473-1730
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
Julie Research Labs., New York, NY 10001	212-633-6625
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Lincoln Instruments, Pomona, CA 91767	714-626-3399
§ Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
§ PolyPhaser Corporation, Minden, NV 89423-9000	702-782-2511;800-325-7170
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Red Lion Controls, York, PA 17402	717-767-6511
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
† Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Valhalla Scientific, San Diego, CA 92121	619-457-5576
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
† Velonex, Santa Clara, CA 95050	408-727-7370
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§† WestCon, Marion, OH 43302	614-382-5771

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Meters, Volt, Digital-2900

§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391	**D•1223**
† Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940	**D•1246**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1343**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1259**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1377,1381,1383**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025	**D•1277**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283-1286**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1356**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1966, D•1294**
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300	**D•1299**
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT	**D•1358,1360-1361**
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1362-1363**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1365**
Φ Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1594**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**D•1366**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1377,1381,1383**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329,1331**
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1390,1393**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
Acculex Corporation, Taunton, MA 02780	508-880-3660
§ Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
American Microsemiconductor, Inc., Madison, NJ 07940	201-377-9566
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ Analogic Corp., Peabody, MA 01960	508-977-3000
§ Astec High Voltage, Ashland, MA 01721	508-881-8407
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845	508-682-2000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
C-Tek Inc., Wakefield, MA 01880	617-246-1720
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DCI Inc., Olathe, KS 66062	913-782-5672
# Deltec Co., Norwalk, CA 90650	310-926-2304
† Digitec, Marion, OH 43302	614-387-3444
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D1 International, Inc., Huntington, NY 11743	516-673-6866
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ Gralex Industries, Norwood, NJ 07648	800-486-4499
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060

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§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
ITF Corp., Buford, GA 30518 ... 404-945-3844
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 ... 602-968-6241
Julie Research Labs., New York, NY 10001 ... 212-633-6625
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ... 516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 ... 508-365-3400
§ Lincoln Instruments, Pomona, CA 91767 ... 714-626-3399
Martel Electronics, Windham, NH 03087 ... 603-893-0886
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 ... 708-437-6444
§ Non-Linear Systems, San Diego, CA 92121 ... 619-535-2161
Oriel Corp., Stratford, CT 06497-0872 ... 203-377-8282
§ Precision Digital Corp., Natick, MA 01760 ... 508-655-7300
# Print Products Intl., Silver Spring, MD 20910 ... 301-587-7824;800-638-2020
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
† Sencore, Sioux Falls, SD 57107 ... 1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ... 516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787 ... 516-231-7050;800-645-5398
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§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§ TEGAM, Inc., Madison, OH 44057 ... 800-666-1010
§ TIF Instruments, Inc., Miami, FL 33150 ... 305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987 ... 419-358-5015
§ The Vector Group, Inc., Horsham, PA 19044 ... 1-800-523-3696
† Velonex, Santa Clara, CA 95050 ... 408-727-7370
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 ... 916-783-7878
§ Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
§† WestCon, Marion, OH 43302 ... 614-382-5771

Meters, Volt, Potentiometric-2900

Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717 ... D•1252
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ... D•1355-1356
Angus Electronics Co., Indianapolis, IN 46224 ... 317-244-7611
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 ... 815-637-3000
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
§ Bristol Babcock Inc., Watertown, CT 06795 ... 203-575-3000;800-395-5497
John Fluke Mfg. Co., Inc., Everett, WA 98203 ... 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 ... 815-758-7000
§† Guildline Instruments, Lake Mary, FL 32746 ... 407-333-3327
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
Sensitive Research Instruments, Mt. Vernon, NY 10550 ... 914-699-9717
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199

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Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717 ... D•1252
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 ... D•1259
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 ... D•1277
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 ... D•1299
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ... B•1594
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... D•1067
A & D Elec. Instrs., Glendale, NY 11385 ... 718-275-6516
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
Bartlett Instrument Co., Ft. Madison, IA 52627 ... 319-372-8366
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 ... 201-584-1077
Direct Conversion Technique, Inc., Chicago, IL 60641 ... 312-283-1690
† Gorman-Redlich Mfg. Co., Athens, OH 45701 ... 614-593-3150
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ Holaday Industries, Inc., Eden Prairie, MN 55344 ... 612-934-4920
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
† Q.V.S., Inc., East Orange, NJ 07017 ... 201-673-3996
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 ... 818-998-6500;800-732-3457
† Rohde & Schwarz, Inc., Lanham, MD 20706 ... 301-459-8800
Sensitive Research Instruments, Mt. Vernon, NY 10550 ... 914-699-9717
§ Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
Trilithic, Inc., Indianapolis, IN 46236 ... 800-344-2412
§ Triplett Corporation, Bluffton, OH 45817-9987 ... 419-358-5015
Tucker Electronics, Dallas, TX 75355-1419 ... 214-348-8800;800-527-4642

Meters, Volt, Sampling-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1372
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ... D•1365
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1372
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075 ... 716-334-7300
† Micro Instrument Company, Escondido, CA 92029 ... 619-746-2010

Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 ... 604-652-5118
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999

Meters, Volt, True RMS-2900

Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940 ... D•1246
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1340-1342
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 ... D•1259
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1372
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1273
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 ... D•1284,1286
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 ... D•1355-1356
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ... B•1966, D•1294
† Millivac Instruments, Inc., Schenectady, NY 12301, 518-355-8300 ... D•1299
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1358,1360-1361
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ... B•1999
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... D•1362-1363
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1372
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ... D•1328-1329
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1389,1392,1396,1400-1401
§ AEMC Corporation, Boston, MA 02111 ... 617-451-0227;800-343-1391
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8 ... 514-333-8748; 800-361-3697
Amptec Electronics, San Diego, CA 92128 ... 619-578-7816
Analogic Corp., Peabody, MA 01960 ... 508-977-3000
§ AVO Biddle Instruments, Blue Bell, PA 19422 ... 215-646-9200
AVO International, TBG, Dallas, TX 75237 ... 214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213 ... 412-622-5500
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 ... 201-984-1900
B & K Precision, Maxtec International Corp, Chicago, IL 60635 ... 312-889-1448
Bartlett Instrument Co., Ft. Madison, IA 52627 ... 319-372-8366
† Basic Measuring Instruments, Foster City, CA 94404 ... 415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 ... 603-749-6434
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
DCI Inc., Olathe, KS 66062 ... 913-782-5672
† Digitec, Marion, OH 43302 ... 614-387-3444
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 ... 201-941-4455
Dranetz Technologies, Inc., Edison, NJ 08818-4019 ... 908-287-3680
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 ... 708-547-5400
Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 ... 516-334-0870
§ Electro-Numerics, Inc., Temecula, CA 92590 ... 909-699-2437
E-T-A Circuit Breakers, Niles, IL 60714 ... 708-647-8303
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235 ... 614-889-6152
§† FOX METER INC., DeKalb, IL 60115 ... 815-758-7000
§ Gralex Industries, Norwood, NJ 07648 ... 800-486-4499
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
§† International Microtronics, Tucson, AZ 85714 ... 602-748-7900
Julie Research Labs., New York, NY 10001 ... 212-633-6625
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ... 516-231-6900; 1-800-645-5104
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 ... 508-365-3400
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Metrosonics, Inc., Rochester, NY 14692-3075 ... 716-334-7300
NF Electronic Instruments, State College, PA 16801 ... 814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007 ... 708-437-6444
§† OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 ... 604-652-5118
Precision Filters, Inc., Ithaca, NY 14850 ... 607-277-3550
Print Products Intl., Silver Spring, MD 20910 ... 301-587-7824;800-638-2020
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
RAG Electronics, Inc., Canoga Park, CA 91304 ... 818-998-6500;800-732-3457
† Rohde & Schwarz, Inc., Lanham, MD 20706 ... 301-459-8800
Ross Engineering Corp., Campbell, CA 95008 ... 408-377-4621
† Sencore, Sioux Falls, SD 57107 ... 1-800-736-2673; 605-339-0100
§ Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
TEGAM, Inc., Madison, OH 44057 ... 800-666-1010
§ Triplett Corporation, Bluffton, OH 45817-9987 ... 419-358-5015
§ The Vector Group, Inc., Horsham, PA 19044 ... 1-800-523-3696
§ Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
§† WestCon, Marion, OH 43302 ... 614-382-5771
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550 ... 914-699-9717
Xitron Technologies, San Diego, CA 92121 ... 619-458-9852

Meters, VU-2900

§ Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ... D•1369
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... D•1067
A & D Elec. Instrs., Glendale, NY 11385 ... 718-275-6516
Bartlett Instrument Co., Ft. Madison, IA 52627 ... 319-372-8366
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 ... 603-753-6362
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1

Dixson, Inc., Grand Junction, CO 81503	303-244-1241
D1 International, Inc., Huntington, NY 11743	516-673-6866
EMICO Inc., Manchester, NH 03109	603-669-5121
§ Furman Sound, Inc., Greenbrae, CA 94904	415-927-1225
† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§ International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
International Microtronics, Tucson, AZ 85714	602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Metermaster, Tempe, AZ 85282	602-431-0015
OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471	203-481-5721
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015

Meters, Watt-2900

§ **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900**	**B•1918, D•1237**
† **Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940**	**D•1246**
Electrical Instrument Service, Mt. Vernon, NY 10550, 914-699-9717	**D•1252**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1372,1377,1384-1385**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**D•1294**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2012**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1372,1377,1384-1385**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329,1331**
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550**	**D•1389,1393,1400**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Φ Amptec Electronics, San Diego, CA 92128	619-578-7816
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
Comptus Inc., New Boston, NH 03070	603-487-5512
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
D1 International, Inc., Huntington, NY 11743	516-673-6866
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Giga-tronics, Inc., Sunnyvale, CA 94089	408-734-5780
§ Greibach Instruments Div., Mt. Vernon, NY 10550	914-699-9717
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614 275-0530
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
International Light, Newburyport, MA 01950-4092	508-465-5923
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§ Metermaster, Tempe, AZ 85282	602-431-0015
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
Prodigit Electronics, Simi Valley, CA 93065	805-527-0888
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
† Scientech, Inc., Boulder, CO 80303	303-444-1361;800-525-0522
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
Voltech, Inc., Ashland, MA 01721	508-881-7329
§† WestCon, Marion, OH 43302	614-382-5771
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550	914-699-9717
Xitron Technologies, San Diego, CA 92121	619-458-9852

Meters, Watt Hour-2900

Clarke-Hess Communications Research Corp., New York, NY 10011, 212-255-2940	**D•1246**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1377,1384-1385**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1987, D•1313**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2012**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1377,1384-1385**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329**
A & D Elec. Instrs., Glendale, NY 11385	718-275-6516
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
AMASCO, Torrance, CA 90501	310-781-9494
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
AVO International, TBG, Dallas, TX 75237	214-333-3201
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Comptus Inc., New Boston, NH 03070	603-487-5512
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
Xitron Technologies, San Diego, CA 92121	619-458-9852

Meters, Watt, RF-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1377**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1377**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
Coaxial Dynamics, Cleveland, OH 44135	1-800-COAXIAL
† Giga-tronics, Inc., Sunnyvale, CA 94089	408-734-5780
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

Meters, Wave-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

Meters, Waveguide — See Meters, Microwave (Vol. D)
Meters (MIL)-2440 — ***See Vol. B***

Microcircuit Production Equip.-4100

AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ Eraser Co., Syracuse, NY 13221	315-454-3237
† Fancort Industries, Inc., W. Caldwell, NJ 07006	201-575-0610
Materials Research Corporation, Orangeburg, NY 10962	914-359-4200

Microcircuits — See Integrated Circuits (Specific Types) (Vol. A)
Microcircuits, Thick Film — See Circuits, Hybrid, Thick Film (Vol. A)
Microcircuits (MIL)-2440 — ***See Vol. B***
Microcircuits (MIL), Linear-2440 — ***See Vol. B***
Microcircuits (MIL), Low Power Schottky-2440 — ***See Vol. B***
Microcircuits (MIL), Memories, CMOS, Hybrids-2440 — ***See Vol. B***
Microcircuits (MIL), TTL, Schottky, Microprocessor-2440 — ***See Vol. B***

Microcomputer Boards-2025

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
Basicon, Inc., Portland, OR 97229	503-626-1012
Central Data Corp., Champaign, IL 61821	217-359-8010
Computer Dynamics Sales, Greer, SC 29650	803-877-8700

Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Davidge Corporation, Buellton, CA 93427	805-688-9598
§ GENROCO, Inc., Slinger, WI 53086-9501	414-644-8700
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Industrial Computer Source, San Diego, CA 92131	619-271-9340
JF Microsystems, Pasco, WA 99301-9619	509-297-4294;800-532-2737
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Matrix Corp., Raleigh, NC 27610	919-231-8000
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
Micro Industries, Westerville, OH 43081-9486	614-548-7878
Micro/sys, Glendale, CA 91208	818-244-4600
Octagon Systems, Westminster, CO 80030	303-430-1500
§ Pacific Microcomputers, Fairway Optical Data Sys., Inc., Vista, CA 92083	619-727-9494
§ Pro-Log Corp., Monterey, CA 93940	408-372-4593
Qualogy Inc., San Jose, CA 95134	408-434-5200
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Truevision, Indpls., IN 46256	317-841-0332
§ Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659
Vetra Systems Corp., Plainview, NY 11803	516-454-6469
Zendex Corp., Dublin, CA 94568	510-828-3000
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Micrometers — See Testers, Thickness (All Types) (Vol. D)

Microphone Accessories (Incl. Stands, Holders, Booms)-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024-1025,1045**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
† Audiosears, Stamford, NY 12167	607-652-7305;800-533-7863
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
# Heitz, Karl, Inc., Woodside, NY 11377	718-565-0004
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
† Roanwell, New York, NY 10014	212-989-1090
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516

Microphones, Bone Conduction-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§† Centurion International, Inc., Lincoln, NE 68504	800-228-4563
Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121

Microphones, Carbon-1300

ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**D•1041**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
† Audiosears, Stamford, NY 12167	607-652-7305;800-533-7863
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
† Roanwell, New York, NY 10014	212-989-1090
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911

Microphones, Cardioid-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
§ Audiotronics Corp., N. Hollywood, CA 91605	818-765-2645
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
§ Recoton Corp., Long Island City, NY 11101	718-392-6442
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200

Microphones, Ceramic-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**B•1976-1977**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
International Microelectronics, Arlington, TX 76003	817-473-1730
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113	505-822-8801
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
Sonicall, Inc., Signal Hill, CA 90806	213-490-2143

Microphones, Condenser (Incl. Electret)-1300

CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**D•1029**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**D•1041**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§† Aiphone, Bellevue, WA 98005	206-455-0510
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
§ Ercona, Patchogue, NY 11772	516-758-0700
International Microelectronics, Arlington, TX 76003	817-473-1730
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200

Microphones, Crystal-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1044-1045**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
International Microelectronics, Arlington, TX 76003	817-473-1730
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911

Microphones, Dynamic-1300

CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**D•1029**
ISL Products Int'l. Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	D•1041
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1042,1044-1045**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
† Audiosears, Stamford, NY 12167	607-652-7305;800-533-7863
§ Audiotronics Corp., N. Hollywood, CA 91605	818-765-2645
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
International Microelectronics, Arlington, TX 76003	817-473-1730
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
§ Recoton Corp., Long Island City, NY 11101	718-392-6442
† Roanwell, New York, NY 10014	212-989-1090
Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700:800-645-5516
§ Television Equipment Assocs., So. Salem, NY 10590-0393	914-763-8893

Microphones, Lavalier-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200

Microphones, Magnetic-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1044-1045**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
Audiosears, Stamford, NY 12167	607-652-7305;800-533-7863
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
§ Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516

Microphones, Omnidirectional-1300

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060,1062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500

Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
International Microelectronics, Arlington, TX 76003	817-473-1730
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
§ Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516

Microphones, Subminiature-1300

International Components Corp., Melville, NY 11747, 516-293-1500	**D•1038**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Ercona, Patchogue, NY 11772	516-758-0700
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500

Microphones, Velocity-1300

International Components Corp., Melville, NY 11747, 516-293-1500	**D•1038**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**

Microphones, Wireless-1300

ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**D•1041**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§† Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200

Microphones (MIL)-2440 — ***See Vol. B***
Microprocessor — See Integrated Circuits, Microprocessor (Vol. A)

Microprocessor Development Systems-2900

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304-1309**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
AMASCO, Torrance, CA 90501	310-781-9494
American Arium, Tustin, CA 92680-7207	714-731-1661
American Neuralogix, Inc., Sanford, FL 32771	407-322-5608
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
Applied Microsystems Corp., Redmond, WA 98052	206-882-2000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Atlanta Signal Processors, Inc., Atlanta, GA 30308	404-892-7265
Computer Dynamics Sales, Greer, SC 29650	803-877-8700
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
§ Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Intergraph Corp., Advanced Processor Division, Palo Alto, CA 94303	415-494-8800
Matrix Corp., Raleigh, NC 27610	919-231-8000
Micro/sys, Glendale, CA 91208	818-244-4600
Microtek International/Dev. Sys. Div., Hillsboro, OR 97124	503-645-7333
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401	508-588-6110
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
§ Pacific Microcomputers, Fairway Optical Data Sys., Inc., Vista, CA 92083	619-727-9494
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Signum Systems Corp., Thousand Oaks, CA 91360	805-371-4608
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
§ Star Semiconductor Corp., Warren, NJ 07059	908-647-9400
§ Star Semiconductor Corp., Warren, NJ 07059	908-647-9400
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Microscopes, Scanning, Laser, Acoustic-4100

Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
§ Carl Zeiss, Inc., Thornwood, NY 10594	800-233-2343

Microscopes-3700 — ***See Vol. B***

Microscopes, Measuring-2900

† CELCO, Mahwah, NJ 07430	201-327-1123
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707/5717
§† Vision Engineering, Inc., New Milford, CT 06776	203-355-3776
§ Carl Zeiss, Inc., Thornwood, NY 10594	800-233-2343

Microwave Comb Generator — See Generators, Microwave (Vol. D)
Microwave Integrated Circuits (MICs)-3450 — ***See Vol. A***
Microwave Receivers — See Receivers, Microwave (Vol. D)
Microwave Systems, Local Distribution-3450 — ***See Vol. A***
Mirrors, Front Surface-3700 — ***See Vol. B***
Mirrors, Rear Surface-3700 — ***See Vol. B***

Mixers, Audio-1300

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Furman Sound, Inc., Greenbrae, CA 94904	415-927-1225
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
§ Stanton Magnetics, Inc., Plainview, NY 11803-1511	516-349-0235
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516

Mixers, Microwave-3450 — ***See Vol. A***
Mixers, RF-3450 — ***See Vol. A***
Modems — See Modulator/Demodulators, Data (Vol. D)

Modems, Broadband RF-1900

Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223**
§ C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257

Modems, CATV-1900

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**A•1708**

Modems, Communications, Eliminator/Line Driver-1900

§ S.I. Tech, Batavia, IL 60510, 708-232-8640	**B•1229**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Dataprobe, Englewood, NJ 07631	201-569-6464
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
† DEI, Escondido, CA 92029	619-743-8344
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
§ Frequency Selective Networks, Woodside, NY 11377	718-424-7500
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ Greenwich Instruments USA, Charlotte, NC 28205	704-376-1021
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§ S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
§ UDS/Motorola, Inc., Motorola Information Systems Group, Huntsville, AL 35805-1993	205-430-8000

Modems, Communications, Line Receivers-1900

Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223-1225**
§ S.I. Tech, Batavia, IL 60510, 708-232-8640	**B•1229**
† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220	**D•1074**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311	818-718-6300
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ Computer Peripherals Inc., Newbury Pk., CA 91320	805-499-5751;800-854-7600
§ Dataprobe, Englewood, NJ 07631	201-569-6464
§ Frequency Selective Networks, Woodside, NY 11377	718-424-7500
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Micro Electronic Technologies, Hopkinton, MA 01748	508-435-9057
Microplex, Inc., Anaheim, CA 92806	714-634-1535
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§ Visionary Electronics, San Francisco, CA 94118	415-751-8811

Modems, Communications, Long Haul-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600

# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
§ Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† Electrocom Industries, S. Bend, IN 46615	219-232-2743
§ Frequency Selective Networks, Woodside, NY 11377	718-424-7500
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660	714-833-4600
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
§† Terminal Data Corp., Rockville, MD 20855	301-921-8282
§ UDS/Motorola, Inc., Motorola Information Systems Group, Huntsville, AL 35805-1993	205-430-8000
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311

Modems, Communications, Short Haul (Limited Distance)-1900

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**A•1708**
§ **S.I. Tech, Batavia, IL 60510, 708-232-8640**	**B•1229**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359	617-826-0099
† Force, Inc., Christiansburg, VA 24073	703-382-0462
§ Frequency Selective Networks, Woodside, NY 11377	718-424-7500
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
§ UDS/Motorola, Inc., Motorola Information Systems Group, Huntsville, AL 35805-1993	205-430-8000

Modems, FAX/PC, etc.-2000

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Aprotek, Rogue River, OR 97537	503-582-2120
§ ATI Technologies Inc., Scarborough, Ont., CANADA M1W 3S2	416-756-0718
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Cirrus Logic, Inc., Fremont, CA 94538	510-623-8300
# Comdata Corp., Morton Grove, IL 60053	708-470-9600
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
§ Micro Electronic Technologies, Hopkinton, MA 01748	508-435-9057
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
Sierra Semiconductor Corp., San Jose, CA 95132	408-263-9300
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311

Modems, Wireless-1900

ARS Inc., Orlando, FL 32809	1-800-950-5633
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
Megadata Corp., Bohemia, NY 11716	516-589-6800
§Φ Monicor Electronic Corp., Ft. Lauderdale, FL 33309	305-979-1907
Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Systems Alternatives, Maumee, OH 43537	419-891-1100

Modular Telephone Cords — See Cable, Telephone (Vol. D)
Modulation Transfer Analyzers — See Analyzers, Transfer Function (Vol. D)

Modulator/Demodulators, Data-2000

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1172**
† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133**	**D•2314**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121**	**B•1223**
§ **S.I. Tech, Batavia, IL 60510, 708-232-8640**	**B•1229**
† **Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220**	**D•1074**

§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
† Aprotek, Rogue River, OR 97537	503-582-2120
§ ATI Technologies Inc., Scarborough, Ont., CANADA M1W 3S2	416-756-0718
Avasem Corporation, San Jose, CA 95126	408-297-1201
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311	818-718-6300
† CATEL Telecommunications, Fremont, CA 94537	510-659-8988
† Climatronics, Bohemia, NY 11716	516-567-7300
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ Conklin Instrument Corp., Pleasant Valley, NY 12569	914-635-2136
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
† Electrocom Industries, S. Bend, IN 46615	219-232-2743
§† Exar Corp., San Jose, CA 95161-9007	408-434-6400
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Intra-computer Inc., Jamacia, NY 11418	718-297-5500
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Microplex, Inc., Anaheim, CA 92806	714-634-1535
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
§ Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§† Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
RE America, Westlake, OH 44145	216-871-7617
§ Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660	714-833-4600
§ Sierra Semiconductor Corp., San Jose, CA 95132	408-263-9300
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§† Silicon General, Garden Grove, CA 92641	714-898-8121
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300

Modulator/Demodulators, Laser-3700 – *See Vol. B*

Modulators, AM-1900

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1172**
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	**D•1073**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500**	**A•1725**
† CATEL Telecommunications, Fremont, CA 94537	510-659-8988
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Modulators, FM-1900

EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	**D•1073**
§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
† CATEL Telecommunications, Fremont, CA 94537	510-659-8988
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
Loral Data Systems, Sarasota, FL 34230	813-371-0811
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
RE America, Westlake, OH 44145	216-871-7617
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
Φ Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Modulators, Light-3700 – *See Vol. B*

Modulators, Magnetic-2200

† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100	B•1915
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1172**
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100

Modulators, Microwave-3450 – *See Vol. A*

Modulators, Phase-1900

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1172**

§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
General Microwave Corporation, Amityville, NY 11701	516-226-8900
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† Microwave Applications Group, Santa Maria, CA 93455	805-928-5711
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
Synergy Microwave Corporation, Paterson, NJ 07504	201-881-8800
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TRM, Inc., Manchester, NH 03110	603-627-6000
† Vectronics Microwave Corp., Middlesex, NJ 08846	908-356-2377
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Modulators, Pulse-3450 – *See Vol. A*

Modulators, RF-1900

EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	**D•1073**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
§† ATV Research, Inc., Dakota City, NE 68731	402-987-3771
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† CATEL Telecommunications, Fremont, CA 94537	510-659-8988
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
General Microwave Corporation, Amityville, NY 11701	516-226-8900
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Peca, Inc., Bensalem, PA 19020	215-245-1550
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
Synergy Microwave Corporation, Paterson, NJ 07504	201-881-8800
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TRM, Inc., Manchester, NH 03110	603-627-6000
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Modulators, Satellite Antennas-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400

Modulators, Video-2200

† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260

Modules, Amplifier-Also See Amplifiers, Specific Types-3130 – *See Vol. A*
Modules, Analog Multiplier-3130 – *See Vol. A*
Modules, Analog-to-Digital(A/D) Conversion-3130 – *See Vol. A*
Modules, Arithmetic (Binary)-3130 – *See Vol. A*

Modules, CAMAC-2900

§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**D•1183**
CAL-AV Labs, Inc., Campbell, CA 95008	408-369-1000
DSP Technology, Fremont, CA 94538-7338	510-657-7555
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
KineticSystems Corp., Lockport, IL 60441	815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000

Modules, Control & Switching-2200

Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
§ Crydom Company, Long Beach, CA 90805, 310-865-3536	**B•1464-1472**
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075	**A•2144**
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261	**A•2078-2079**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192-1193**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1525**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1563-1565**
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691	**A•2172**
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000	**B•1586-1587**
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272	**A•2175**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	**D•2300**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389**
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
Catalyst Research, Mine Safety Appliances Co., Inc., Owings Mills, MD 21117	410-356-2400
† CATEL Telecommunications, Fremont, CA 94537	510-659-8988
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
DDI Inc., Beverly, MA 01915-1703	508-927-7976
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
Energy Systems, Vancouver, WA 98682	206-896-8310
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Grayhill Inc., La Grange, IL 60525	708-354-1040
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800	609-896-0009
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ Interloop, San Jose, CA 95131	408-922-0520
§ International Rectifier Corp., El Segundo, CA 90245	310-322-3331
§ International Technologies, Inc., Warwick, RI 02888	401-781-5595
§ IXYS Corp., San Jose, CA 95131-1109	408-435-1900
KineticSystems Corp., Lockport, IL 60441	815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
§ Lutze, Inc., Charlotte, NC 28217-9805	704-357-8835;800-447-2371
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
† Modular Devices, Shirley, NY 11967	516-345-3100
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Opto 22, Temecula, CA 92590	714-695-9299
Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301;1-800-553-6374
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660	714-833-4600
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Semikron, Inc., Hudson, NH 03051-0066	603-883-8102;1-800-258-1308
†# Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4	514-694-9136
§ Weidmuller Inc., Richmond, VA 23236	804-794-2877

Modules, Data Acquisition-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1172**
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1177, 1181**
† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•1185**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1066,1069**
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**D•1182**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1145,1204-1205,1374-1375**
Gralex Industries, Norwood, NJ 07648, 800-486-4499	**D•1353**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1283,1285**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1218**
LMI Connectors Inc., Boca Raton, FL 33487-2710, 407-994-5896;800-247-0564	**C•1399**
Matrix Corp., Indianapolis, IN 46241, 317-248-2036	**D•1195**
§ National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1147,1302**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1886-1887,2004, C•1792, D•1101,1199,1314,1362-1363,1415**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1200-1202**
Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202	**D•1416**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1145,1204-1205,1374-1375**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1390**
§Φ Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ ADAC Corporation, Woburn, MA 01801	617-935-6668
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930

Modules, Data Acquisition-2325 (Cont'd)

Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
§ Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
American Control Technology, Inc., Elgin, IL 60123-1203 708-468-6000
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 513-339-2241
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Aydin Corp. Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Bas'con Inc., Portland, OR 97229 503-626-1012
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 708-981-6000
§† Computer Products, Inc. Process Automation, Pompano Beach, FL 33069 305-974-5500
§ Contec Microelectronics USA, San Jose, CA 95131 .... 408-434-6767;1-800-888-8884
Continental Resources, Inc. Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Control Module, Enfield, CT 06082 203-745-2433
§ Dancer Communications, Inc., Secane, PA 19018 215-543-8066
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
DGH Corporation, Manchester, NH 03108 603-622-0452
† Digitec, Marion, OH 43302 614-387-3444
DSP Technology, Fremont, CA 94538-7338 510-657-7555
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Dymec Inc., Winchester, MA 01890 617-729-7870
Eltek Corporation, Hagerstown, IN 47346 317-489-6121
E-T-A Circuit Breakers, Niles, IL 60714 708-647-8303
† Force, Inc., Christiansburg, VA 24073 703-382-0462
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
§ GW Instruments, Inc., Somerville, MA 02143 617-625-4096
H & L Instruments, Burlingame, CA 94010 415-342-7850
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705 .. 602-623-9801
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§ Interloop, San Jose, CA 95131 408-922-0520
§ International Data Aquistion & Control, Inc., Amherst, NH 03031 603-673-0765
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
Memodyne, Newton, MA 02164 .... 617-964-6556 (in MA);800-255-1510
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
§† Onset Computer Corp., Pocasset, MA 02559-3450 508-563-9000
§ Opto 22, Temecula, CA 92590 714-695-9299
Pacific Instruments Inc., Concord, CA 94520 510-827-9010
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
RMS Instruments, Mississauga, Ont., CAN L5T 1R2 416-564-5533
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
§ Sierra Monitor Corp., Milpitas, CA 95035 408-262-6611
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
§# Support Systems Intl. Corp., Richmond, CA 94804 510-234-9090
Systems Alternatives, Maumee, OH 43537 419-891-1100
Systran Corp., Dayton, OH 45432-3068 1-800-252-5601
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Velonex, Santa Clara, CA 95050 408-727-7370
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136
WestCon, Marion, OH 43302 614-382-5771
§ Xico, Inc., Chatsworth, CA 91311 818-709-4403
§ Zitel Corporation, Milpitas, CA 95035 .... 408-321-9600;800-622-5020

Modules, Data Retention-2325

F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1066,1069
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... D•1182
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1204-1205
Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202 .... D•1416
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1204-1205
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385 .... D•1417
Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
§ Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411

† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
Keithley MetraByte, Taunton, MA 02780 508-880-3000
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
§ Zitel Corporation, Milpitas, CA 95035 .... 408-321-9600;800-622-5020

Modules, DIN Interface-2100 – *See Vol. C*
Modules, Delay Line-2350 – *See Vol. A*
Modules, Digital-to-Analog(D/A) Conversion-3130 – *See Vol. A*
Modules, Display — See Display Modules (Vol. B)
Modules, Encoding/Decoding-3130 – *See Vol. A*
Modules, Filter-3130 – *See Vol. A*
Modules, I/O Relay-3130 – *See Vol. A*
Modules, Logic-Also See Cards; Circuits; Networks-3130 – *See Vol. A*
Modules, MIC-3130 – *See Vol. A*
Modules, Logic-3130 – *See Vol. A*

Modules, NIM-2900

† Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
Power Designs, Inc., Westbury, NY 11590 516-333-6200
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722

Modules, Oscillator-2300 – *See Vol. A*
Modules, Power Entry, Filtered-2700 – *See Vol. A*
Modules, RMS-to-DC Conversion-3130 – *See Vol. A*
Modules, Sample & Hold-3130 – *See Vol. A*
Modules, Switching-5100 – *See Vol. B*
Modules (MIL), Electronic-2440 – *See Vol. B*
Modules (MIL), Standard Electronic-2440 – *See Vol. B*
Molding Services — See Services, Molding (Vol. D)

Monitors, Current-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000 ..... D•1149
§ AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391 ..... D•1223
† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 .... B•1914-1915
§ Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 .... D•1153,1237
Bicron Electronics, Canaan, CT 06018, 203-824-5125 .... B•1919
Control Resources Inc., Harvard, MA 01451, 508-772-4043 .... C•1575
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 .... A•2309, B•1455,1927
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1160
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1382,1384-1385
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .. D•1355-1357
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900 .... B•1963
Magnelab, Boulder, CO 80301-4696, 303-442-6700 .... A•2379
† Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 .... B•1982-1986,1988-1990,1993-1995,1998,2000-2002
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... D•1314,1362-1363
† Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 .... A•2454
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1589
† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202 .... D•1416
† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1608
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1384-1385
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328-1329
§ Altech Corp., Flemington, NJ 08822-6000 908-806-9400
Amptec Electronics, San Diego, CA 92128 619-578-7816
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Autronics Corp., Arcadia, CA 91006 818-445-5470
AYA-Instruments, Inc., Pittsburgh, PA 15213 412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404 415-570-5355
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
† Electronic Specialty Corp., Vancouver, WA 98685 206-574-5000
§ Electro-Support Systems, Temecula, CA 92590 909-676-2751
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
EMICO Inc., Manchester, NH 03109 603-669-5121
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
† Ion Physics Corporation, Atkinson, NH 03811 603-893-6687
§ Linear Instruments, Spectra Physics Analytical, Reno, NV 89523 702-746-2200
† Logitek, Inc., Ronkonkoma, NY 11779 516-467-4200
Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
§ Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161 .... 414-421-4380;1-800-803-0444
† Sigma Electronics Inc., Houston, TX 77099 .... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300

§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Monitors, Data Link-1900

Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1410,1412**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Noise Com Inc., Paramus, NJ 07652	201-261-8797
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
Omega Engineering, Stamford, CT 06907	800-826-6342
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054	609-234-7900
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Monitors, Error Rate-1900

§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Noise Com Inc., Paramus, NJ 07652	201-261-8797
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Monitors, Frequency-2900

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721	**D•1354**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•2003**
† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1608,1613**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390**
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
† American Aerospace Controls, Farmingdale, NY 11735	516-694-5100
§ Analogic Corp., Peabody, MA 01960	508-977-3000
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Autronics Corp., Arcadia, CA 91006	818-445-5470
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
Codar Technology, Inc., Longmont, CO 80503	303-776-0472
Control Resources Inc., Harvard, MA 01451	508-772-4043
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
DCI Inc., Olathe, KS 66062	913-782-5672
† Digitec, Marion, OH 43302	614-387-3444
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† Electronic Specialty Corp., Vancouver, WA 98685	206-574-5000
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§† Leach Corporation, Buena Pk., CA 90622-5032	714-739-0770
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380:1 800-803-0444
Sensor Corp., Scottdale, PA 15683	412-887-4080
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Monitors, High Resolution-2000

Data Ray Corp., Westminster, CO 80234, 1-800-926-5556; 303-451-1300	**B•1028-1031**
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
Barco Chromatics, Tucker, GA 30084	404-493-7000
† Codar Technology, Inc., Longmont, CO 80503	303-776-0472
# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
§ Conrac Display Products, Inc., Duarte, CA 91010	818-303-0095
§ DataLux Corp., Winchester, VA 22602	703-662-1500
Electrohome Limited, Kitchener, Ontario, CANADA N2G 4J6	519-744-7111
§ Image Systems Corp., Hopkins, MN 55343	612-935-1171
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
The Recorder Company, San Marcos, TX 78667	210-629-1400
†# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Monitors, Humidity-2200

Control Resources Inc., Harvard, MA 01451, 508-772-4043	**C•1575**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1888**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212-1213**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Analogic Corp., Peabody, MA 01960	508-977-3000
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ Intra-computer Inc., Jamacia, NY 11418	718-297-5500
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
Omega Engineering, Stamford, CT 06907	800-826-6342
Stephens Analytical, Inc., Montreal, Que., CA H4S 1L1	514-332-1230
Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
† Thunder Scientific Corp., Albuquerque, NM 87123	505-265-8701;800-872-7728

Monitors, Laser Energy-2200

† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1573**
† Coherent General, Inc., Sturbridge, MA 01566	508-347-2681
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
† Scientech, Inc., Boulder, CO 80303	303-444-1361;800-525-0522
Swan Associates, New Haven, CT 06534	203-387-3917
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Monitors, Line & Program-1900

Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1376**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1376,1382**
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
Codar Technology, Inc., Longmont, CO 80503	303-776-0472
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
§ ROH, Portland Instrument, Glendale, CA 91201	818-500-0137
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Unitrode Corp., Watertown, MA 02172	617-926-0404

Monitors, Modulation-2900

Marconi Instruments, Allendale, NJ 07401, 201-934-9050	**D•1297**
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
RE America, Westlake, OH 44145	216-871-7617
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Monitors, Phase & Phase Angle-2900

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1614**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1210**
Xitron Technologies, San Diego, CA 92121, 619-458-9852	**D•1335**
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
AVO International, TBG, Dallas, TX 75237	214-333-3201
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611

Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
§ International Microtronics, Tucson, AZ 85714	602-748-7900
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
Ohio Semitronics, Inc., Columbus, OH 43212	614-486-9561
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
Valhalla Scientific, San Diego, CA 92121	619-457-5576

Monitors, Phase Sequence & Loss-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	A•2309, B•1455,1927
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1614**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Autronics Corp., Arcadia, CA 91006	818-445-5470
AVO International, TBG, Dallas, TX 75237	214-333-3201
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Go Switch, Louisville, KY 40233	502-969-2386
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Lark Electronics. Inc., New York, NY 10040	212-569-0430
§† Leach Corporation. Buena Pk., CA 90622-5032	714-739-0770
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129 2161	414-421-4380;1-800-803-0444
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Monitors, Power, AC & DC-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900**	**D•2230**
† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100**	**B•1915**
§ **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900**	**B•1918, D•1237**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1927**
§ **Gralex Industries, Norwood, NJ 07648, 800-486-4499**	**D•1353**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1555**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278,2281**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	B•1982-1990,1992,1994-1995,1999,2001
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1362-1363**
† **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202**	**D•1416**
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060	**B•1595**
† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1608,1613**
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525	C•1112
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1328-1329**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
AMASCO. Torrance, CA 90501	310-781-9494
Φ Amptec Electronics, San Diego, CA 92128	619-578-7816
Analogic Corp., Peabody, MA 01960	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
§ Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Contact East, N. Andover, MA 01845	508-682-2000
Control Resources Inc., Harvard, MA 01451	508-772-4043
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
† Electronic Specialty Corp., Vancouver, WA 98685	206-574-5000
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
Hickok Electrical Instrument Company, Cleveland, OH 44108	216-541-8060
International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ Intra-computer Inc., Jamacia, NY 11418	718-297-5500
Lambert Engineering Inc., Bend, OR 97702-2181	503-388-2623
Lark Electronics, Inc., New York, NY 10040	212-569-0430
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
MOTORTEST, Inc., Columbus, OH 43229	614-882-7821
§ MTE Corp., Menomonee Falls, WI 53051	414-253-8200
§† Oneac Corporation, Libertyville, IL 60048	708-816-6000,800-327-8801
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865	714-540-4229
Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
Unitrode Corp., Watertown, MA 02172	617-926-0404
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Monitors, Power, AF-1300

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590	516-334-0870
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100

Monitors, Power Failure-2200

Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1927**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278,2281**
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Codar Technology, Inc., Longmont, CO 80503	303-776-0472
§ Contact East, N. Andover, MA 01845	508-682-2000
Control Resources Inc., Harvard, MA 01451	508-772-4043
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Lark Electronics, Inc., New York, NY 10040	212-569-0430
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Oneac Corporation, Libertyville, IL 60048	708-816-6000,800-327-8801
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Monitors, Power, Microwave-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	D•1003,1023
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

Monitors, Power, RF-2900

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Coaxial Dynamics, Cleveland, OH 44135	1-800-COAXIAL
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
Marconi Instruments, Allendale, NJ 07401	201-934-9050
† Maury Microwave Corp., Ontario, CA 91764	909-987-4715
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9	416-727-0165
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

Monitors, Response Time-2900

Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	D•1395
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Ion Physics Corporation, Atkinson, NH 03811	603-893-6687

Monitors, Television, Fiberoptic-2475 – *See Vol. B*
Monitors, Temperature-Also See Controls, Temperature-5300 – *See Vol. B*

Monitors, Torque/Speed-2200

§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	D•1160
Control Resources Inc., Harvard, MA 01451	508-772-4043
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MOTORTEST, Inc., Columbus, OH 43229	614-882-7821
Torq Corp., Bedford, OH 44146	216-232-4100
Vibrac, Amherst, NH 03031	603-882-6777
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Monitors, Touch — See Touch Monitors (Vol. D)

Monitors, Vibration-2200

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
PMC/BETA Ltd. Partnership, Natick, MA 01760	617-237-6920
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322
§ Vitec, Inc., Cleveland, OH 44122	1-800-321-6384

Monitors, Video-1900

† **Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800**	B•1035
Data Ray Corp., Westminster, CO 80234, 1-800-926-5556; 303-451-1300	B•1028-1031
Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	B•1825
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	B•1012-1013,1080
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	D•1292-1293
Omni Vision Inc., Glendale Heights, IL 60139, 708-893-1720	B•1101
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
§ Aiphone, Bellevue, WA 98005	206-455-0510
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ ATV Research, Inc., Dakota City, NE 68731	402-987-3771
Aydin Corp., Horsham, PA 19044	215-657-7510
§# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
§ Conrac Display Products, Inc., Duarte, CA 91010	818-303-0095
§ Dage-MTI, Michigan City, IN 46360	219-872-5514
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ Dotronix, New Brighton, MN 55112	612-633-1742
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054	201-575-8666
Electrohome Limited, Kitchener, Ontario, CANADA N2G 4J6	519-744-7111
# Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
HMW Enterprises, Inc., Waynesboro, PA 17268	717-765-4690
§ IlCon Corporation, Morgan Hill, CA 95037	408-779-7466
Image Systems Corp., Hopkins, MN 55343	612-935-1171
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
§† Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
# Peter Parts & Assocs., Webster, NY 14580	716-265-2540
§ Pixelworks, Inc., Hudson, NH 03051	603-880-1322
§ SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638	310-802-8425
† Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Video Monitors, Inc., Dotronix, Inc., Eau Claire, WI 54703	715-834-7785
Wells-Gardner Elctrns. Corp., Chicago, IL 60639	312-252-8220

Monitors, Voltage — See Meters, Volt (Vol. D)
Monitors, Waveform — See Oscilloscopes (Vol. D)
Monitors (MIL), Data-2440 – *See Vol. B*
Motor & Generator Armatures, Rotors, Stators-3500 – *See Vol. B*
Motor Assemblies with Integral Tachometer/Encoder-3500 – *See Vol. B*
Motor Generator Sets-3500 – *See Vol. B*
Motorized Components — See Potentiometers, Motorized (Vol.), Rheostats, Motorized (Vol.), Transformers, Variable, Motorized

Motorized Micropositioners-4900

Dynamation Transducers Corporation, Holliston, MA 01746, 508-429-8440	A•2083
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	D•2317
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000

Motorized Potentiometers — See Potentiometers, Motorized

Motorized Translation Stages-4900

§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	D•2317
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451

Motor Speed Drives — See Controls, Motor Speed (Vol. D)
Motors, Brush, DC-3500 – *See Vol. B*
Motors, Brushless, DC-3500 – *See Vol. B*
Motors, Clock & Timing-3500 – *See Vol. B*
Motors, Control-3500 – *See Vol. B*
Motors, DC Timing-3500 – *See Vol. B*
Motors, Fractional Horsepower-3500 – *See Vol. B*
Motors, Gearhead-3500 – *See Vol. B*
Motors, Hysteresis-3500 – *See Vol. B*
Motors, Incremental, Stepping — See Motors, Stepping (Vol. B)
Motors, Induction-3500 – *See Vol. B*
Motors, Linear-3500 – *See Vol. B*
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Motors, Permanent Magnet-3500 – *See Vol. B*
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Motors, Servo-4900

Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	B•1241
† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671**	B•1917
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	B•1249
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131	B•1250
Glentek, Inc., El Segundo, CA 90245, 310-322-3026	B•1262-1264
Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564	B•1270
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	B•1271
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	B•1273
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	B•1278,1292
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	B•1298
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	B•1968, D•2316
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	B•1299-1300
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	B•1304-1305
§ **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	B•1307
§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	B•1308
Synektron Corporation, Portland, OR 97223, 503-684-3090	B•1310
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	D•2317
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Advanced Technology Company, Vista, CA 92083	619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
Bertsch U.S., Vista, CA 92083	619-727-7420
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Custom Servo Motors, New Ulm, MN 56073	507-354-1616
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§ Empire Magnetics, Rohnert Park, CA 94928	707-584-2801
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
GE Fanuc Automation North America Inc., Charlottesville, VA 22906	804-978-5000; 800-648-2001
§ Gettys Corporation, an AEG Company, Racine, WI 53404	414-637-6591
† Globe Motors, Dayton, OH 45404	513-228-3171
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
H D Systems, Inc., Hauppauge, NY 11788	516-231-6630
Hitachi America, Ltd., Tarrytown, NY 10591	914-631-0600
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inertial Motors, Doylestown, PA 18901	215-345-1010
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614

Micronel U.S., Vista, CA 92083 619-727-7400
Motor-Tronics, Inc., Vista, CA 92083 619-727-7425
† New England Affiliated Technologies. Instrument Industries. Lawrence. MA 01841 508-685-4900
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532 914-345-5150
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Powertron, Contraves Goerz Corp., Charlotte. NC 28210 704-525-8962
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054 619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416 .... 516-328-0200;328-3300
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400
Vasak Inds., Inc., El Segundo, CA 90245 .... 1-800-67-VASAK
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
§ Westamp, Santa Monica, CA 90404 310-393-0401

Motors, Squirrel Cage-3500 — *See Vol. B*
Motors, Stepping-3500 — *See Vol. B*
Motors, Synchronous-3500 — *See Vol. B*
Motors, Synchronous, Polarized — See Motors, Synchronous (Vol. B)
Motors, Timing — See Motors, Clock & Timing (Vol. B)
Motors, Torque (Incl. Torquers)-3500 — *See Vol. B*
Motors, Universal, AC or DC Operation-3500 — *See Vol. B*
Motors, (MIL)-2440 — *See Vol. B*

Mounts, Antenna-1200

BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1024
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Andrew Corp., Orland Pk., IL 60462 800-255-1479
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203 501-851-4000
† Craig Systems Corp., Eastern Technologies, Ltd., Amesbury, MA 01913-4848 508-388-5662
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
† Gabriel Elctrns. Inc., Scarborough, ME 04070 207-883-5161
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† Microflect Co., Inc., Salem, OR 97309-0985 503-363-9267
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000

Mounts, CRT & Accessories-2500 — *See Vol. C*
Mounts, Crystal-2300 — *See Vol. A*
Mounts, Integrated Circuit — See Sockets, Integrated Circuit (Vol. C), Boards, Plug-In (Vol. C)
Mounts, Microwave-3450 — *See Vol. A*
Mounts, Mobile Antenna — See Mounts, Antenna (Vol. D)

Mounts, Satellite Antennas-1900

Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Precision Specialties, Inc., Northridge. CA 91324 818-349-9774
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Mounts, Shock & Vibration-2500 — *See Vol. C*
Mounts, Transistor (Incl. Kits) — See Pads, Transistor Mounting (Vol. C)
Mouse Devices — See Controls, Computer Input (Vol. D)
Multibus Cards — See Board Computers & Subassemblies (Vol. D)

Multiplexers, Analog-2325

† Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1185
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074 .... D•1193
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1287
Matrix Corp., Indianapolis, IN 46241, 317-248-2036 .... D•1195
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1562
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1101,1199
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 .... B•1223,1226-1227
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364
§ Action Instruments, San Diego, CA 92123 619-279-5726
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478 716-265-1600
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Coastcom, Concord, CA 94520 510-825-7500
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
§ Conklin Instrument Corp., Pleasant Valley, NY 12569 914-635-2136
§# Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
CYBRID INCORPORATED, Woodcliff Lake, NJ 07675 201-307-0426
CYTEC Corp., Penfield, NY 14526 .... 716-381-4740;800-346-3117
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090 .... 708-541-6060; 800-GANDALF
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
GTE Supply, GTE, Irving, TX 75038 800-433-4837
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Interface Engineering Inc., Holbrook. MA 02343 617-986-2600
IPAC Grp., Bethel Pk., PA 15102 412-831-9200
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7 604-421-8733
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 .... 800-336-2112;703-953-4751
Loral Data Systems, Sarasota, FL 34230 813-371-0811
Loral Data Systems, Data Recorders, Sarasota, FL 34230 813-371-0811
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ National Instruments, Austin, TX 78730-5039 512-794-0100
§ Neff Instr., Monrovia, CA 91016 818-357-2281
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
§ Opto 22, Temecula, CA 92590 714-695-9299
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309 305-739-7004
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Tracer Electronics, Inc., Bloomfield, NJ 07003 201-338-1234
TTE, Incorporated, W. Los Angeles, CA 90064-1400 .... 310-478-8224;800-776-7614
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

Multiplexers, Digital-2325

† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172-1173
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074 .... D•1193
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1285,1287
Matrix Corp., Indianapolis, IN 46241, 317-248-2036 .... D•1195
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1562
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1101,1199
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 .... B•1223
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 .... B•1229
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Adatek, Inc., Sandpoint, ID 83864 .... 208-263-1471:800-323-3343
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478 716-265-1600
Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Atlantic Scientific Corporation, W. Melbourne, FL 32904 1-800-544-4737
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .... 800-523-2702;601-467-8231
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311 818-718-6300
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
§ Coastcom, Concord, CA 94520 510-825-7500
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
§ Conklin Instrument Corp., Pleasant Valley, NY 12569 914-635-2136
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
Dantel, Fresno, CA 93727 209-292-1111
† Dataproducts Corporation, Woodland Hills, CA 91367-2499 818-888-4014
§† Dataproducts New England, Inc., Wallingford, CT 06492 203-265-7151
DSP Technology, Fremont, CA 94538-7338 510-657-7555
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359 617-826-0099
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090 .... 708-541-6060; 800-GANDALF
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
GEN/COMP Inc., Canton, MA 02021 617-828-2008
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
IPAC Grp., Bethel Pk., PA 15102 412-831-9200
KineticSystems Corp., Lockport, IL 60441 815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007

Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
Loral Data Systems, Sarasota, FL 34230	813-371-0811
Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595	619-278-4100
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014	413-592-9123
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
Modular Mining Systems, Inc., Tuscon, AZ 85706	602-746-9127
§ Neff Instr., Monrovia, CA 91016	818-357-2281
§ Opto 22, Temecula, CA 92590	714-695-9299
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
§ Point 4 Data Corp., Tustin, CA 92680	714-259-0777
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
RFL Electronics Inc., Boonton, NJ 07005-0239	201-334-3100
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
Tracer Electronics, Inc., Bloomfield, NJ 07003	201-338-1234
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522
§ Wieland Inc., Burgaw, NC 28425	919-259-5050

Multiplexers, Fiber Optic-2475 – *See Vol. B*

Multiplexers, Frequency Division-1900

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7	604-421-8733
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001	916-638-5500
† Metraplex Corp., Frederick, MD 21701	301-662-8000
† Metropole Products Inc., Stafford, VA 22554	703-659-2132
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
† Reactel, Inc., Rockville, MD 20850	301-279-5535
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007

Multiplexers, Statistical-1900

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1	416-425-7800
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
§† Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
§ UDS/Motorola, Inc., Motorola Information Systems Group, Huntsville, AL 35805-1993	205-430-8000

Multiplexers, Time Division-1900

† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121**	**B•1223**
§ **S.I. Tech, Batavia, IL 60510, 708-232-8640**	**B•1229**
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311	818-718-6300
§ Coastcom, Concord, CA 94520	510-825-7500
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
† DEI, Escondido, CA 92029	619-743-8344
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
† Metraplex Corp., Frederick, MD 21701	301-662-8000
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
Tracer Electronics, Inc., Bloomfield, NJ 07003	201-338-1234
§ UDS/Motorola, Inc., Motorola Information Systems Group, Huntsville, AL 35805-1993	205-430-8000
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311

Multiplexers, Transmission-1900

§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**D•1183**
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223-1226**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540	609-259-8866
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
Marconi Instruments, Allendale, NJ 07401	201-934-9050
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
† Microphase, Norwalk, CT 06856	203-866-8000
† Reactel, Inc., Rockville, MD 20850	301-279-5535
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Transmagnetics, Farmingdale, NY 11735	516-293-3100

Multiplexers, Video-1900

Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223-1224**
§ Coastcom, Concord, CA 94520	510-825-7500
† Colorado Video, Inc., Boulder, CO 80306	303-530-9580
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540	609-259-8866
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Pixelogic Inc., Vancouver, WA 98684	206-253-5033
TTE, Incorporated, W. Los Angeles, CA 90064-1400	310-478-8224;800-776-7614

Multipliers, Analog-2325

Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
Action Instruments, San Diego, CA 92123	619-279-5726
Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analog Systems, Tucson, AZ 85731-7389	602-290-1818
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117	800-245-4501
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§† Silicon General, Garden Grove, CA 92641	714-898-8121
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

Multipliers, Channel Electron-2325

Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
§ K & M Electronics Inc., W. Springfield, MA 01089	413-781-1350
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709

Multipliers, Crystal-1900

† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411**	**A•1852**
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746

Multipliers, Diode-1900

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	**D•1630**
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	**A•2180**
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411**	**A•1853**
Electronic Devices, Inc., Yonkers, NY 10710	914-965-4400
MACOM, Inc., Lowell, MA 01851	617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042	214-272-7811
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746
† Voltage Multipliers, Inc., Visalia, CA 93291	209-651-1402
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Multipliers, Frequency-3450 – *See Vol. A*
Multipliers, Hall-4800 – *See Vol. A*

Multipliers, Magnetic Analog-2200

Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
† American Aerospace Controls, Farmingdale, NY 11735	516-694-5100
Bell, F. W., Inc., Orlando, FL 32807	407-678-6900

Multipliers, Meter-2900

Amptec Electronics, San Diego, CA 92128	619-578-7816
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717

Multipliers, Servo-4900

Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**

† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700

Nameplates-2400 – *See Vol. C*

Network Processors-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Aydin Corp., Horsham, PA 19044	215-657-7510
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113	612-638-7777
Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010

Networks, Computer, LAN-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1225**
§ S.I. Tech, Batavia, IL 60510, 708-232-8640	**B•1229**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Anco Electronics, Inc., Rancho Cucamonga, CA 91730	1-800-545-ANCO
§ Artel Communications Corp., Hudson, MA 01749	508-562-2100
† Aydin Corp., Horsham, PA 19044	215-657-7510
Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128	203-456-8000
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
California Automation Inc., San Diego, CA 92121	619-452-1341
§ Carol Cable Co., Highland Heights, KY 41076	606-572-8303,606-572-8000
§† Clearpoint Research Corp., Hopkinton, MA 01748	508-435-2000
§† Codenoll Technology Corp., Yonkers, NY 10701	914-965-6300
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
# Computer System Products, Minneapolis, MN 55447	612-476-6866:800-422-2537
§# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Cooper Industries/Belden Div., Richmond, IN 47375	317-983-5200;800-BELDEN-1
§ Digital Products, Inc., Waltham, MA 02154	617-647-1234;800-243-2333
§ Diversified Technlg., Ridgeland, MS 39157	601-856-4121
§ Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709	1-800-888-LAN1;919-481-5100
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Ergotron, Inc., Eagan, MN 55121	612-452-8135
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359	617-826-0099
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
General Electronic Materials Technology, Los Alamitos, CA 90720	714-761-5684
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ K & M Electronics Inc., W. Springfield, MA 01089	413-781-1350
§ Leviton Telcom, Leviton Manufacturing, Bothell, WA 98021-4416	206-485-4288; 206-486-2222
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Micro-Link Prods., Sea-ILAN Inc., Carmel, IN 46032	317-846-1721
§ Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§ Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
§ Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365
§ Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600
§ PUREDATA, Richmond Hill, Ont., CANADA L4B 1B4	416-731-6444
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Square D Co., Palatine, IL 60067	708-397-2600
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
Systran Corp., Dayton, OH 45432-3068	1-800-252-5601
§ Teleterminal Corp., Greenland, NH 03840	603-431-1200
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
§† Terminal Data Corp., Rockville, MD 20855	301-921-8282
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
§ Western Digital Corp., Irvine, CA 92718	714-932-6000
§ Xylogics, Inc., Burlington, MA 01803	800-225-3317
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Networks, Crossover, Attenuator (Audio)-1300

KOA Speer Electronics, Bradford, PA 16701, 814-362-5536	**A•1959**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454	**A•1987**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430	914-664-5591
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
Electronic Precision Components, Mt. Vernon, NY 10550-4430	914-664-2333
† Frequency Selective Networks, Woodside, NY 11377	718-424-7500
§ Hartley Products, Wilmington, NC 28406	919-392-0500
International Components Corp., Melville, NY 11747	516-293-1500
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297	216-442-2286
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
† TTE, Incorporated, W. Los Angeles, CA 90064-1400	310-478-8224;800-776-7614
Vishay Resistors, Malvern, PA 19355	215-644-1300

Networks, Digital Data, Equipment-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	D•1117,1134-1135,1140
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1225**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Adaptec, Inc., Milpitas, CA 95035	408-945-8600
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Cooper Industries/Belden Div., Richmond, IN 47375	317-983-5200;800-BELDEN-1
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1	416-425-7800
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Ergotron, Inc., Eagan, MN 55121	612-452-8135
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359	617-826-0099
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tree Technologies Corporation, Buffalo, NY 14228	716-688-4640
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311
Zaki Corporation, Marlboro, MA 01752	508-480-0201

Networks, Directional Antenna Phasing-1200

§† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Electronic Precision Components, Mt. Vernon, NY 10550-4430	914-664-2333
JEMA, Wilmette, IL 60091	708-251-3600
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
† Microwave Applications Group, Santa Maria, CA 93455	805-928-5711
† Premier Microwave, Port Chester, NY 10573	914-939-8900
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
† TRM, Inc., Manchester, NH 03110	603-627-6000
Vishay Resistors, Malvern, PA 19355	215-644-1300

Networks, Hybrid-4700 – *See Vol. A*
Networks, Hybrid Substrates-3130 – *See Vol. A*
Networks, Ladder-4700 – *See Vol. A*
Networks, LC-2700 – *See Vol. A*

Networks, Line Impedance Stabilization-1900

Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278,2281**
Anco Electronics, Inc., Rancho Cucamonga, CA 91730	1-800-545-ANCO
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806
Marc Enterprises, Laguna Niguel, CA 92677	714-249-0302
MICRO DATA SYSTEMS, Thomasville, GA 31799	912-226-1709
Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365
† Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
Sprague, Hudson, NH 03051	603-881-7200; 603-883-9774 (Mktg)
† Velonex, Santa Clara, CA 95050	408-727-7370

Networks, Matching-1900

§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700	**A•1877**
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536	**A•1959**
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900	**A•1648**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454	**A•1987**
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311	**A•2219**
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430	914-664-5591
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§† California Micro Devices, Inc., Milpitas, CA 95035	408-263-3214
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
Dale Electronics, Inc. Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
Electronic Precision Components, Mt. Vernon, NY 10550-4430	914-664-2333
† ESC Electronics Corp., Palisades Pk., NJ 07650	201-947-0400

† Frequency Selective Networks, Woodside, NY 11377	718-424-7500
General Resistance, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
§ IRC-Shallcross, Smithfield, NC 27577	919-934-5181
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501	818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103	603-668-3210
Marc Enterprises, Laguna Niguel, CA 92677	714-249-0302
† Microplex, Inc., Anaheim, CA 92806	714-634-1535
North Hills Signal Processing, Syosset, NY 11791	516-682-7740
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Premier Microwave, Port Chester, NY 10573	914-939-8900
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
Sprague, Hudson, NH 03051	603-881-7200; 603-883-9774 (Mktg)
† TTE, Incorporated, W. Los Angeles, CA 90064-1400	310-478-8224;800-776-7614
† Vishay Resistors, Malvern, PA 19355	215-644-1300
† Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811

Networks, Phase-2700 – ***See Vol. A***
Networks, Pulse Forming-2700 – ***See Vol. A***
Networks, Rejection — See Filters (Vol. A)
Networks, RC-4700 – ***See Vol. A***
Networks, Resistance-4700 – ***See Vol. A***
Networks, Resistance, Trimmer-4700 – ***See Vol. A***
Networks, Resistance, Voltage Divider-4700 – ***See Vol. A***
Networks, Video-2700 – ***See Vol. A***
Networks, (MIL), Resistance-2440 – ***See Vol. B***

Noise Sources-2900

Elgenco, Inc., Hurricane, UT 84737, 801-635-4954	**D•1255**
† **Noise Com Inc., Paramus, NJ 07652, 201-261-8797**	**A•1848, D•1298,1311**
† Accu-Noise Lab, Marek Technology Inc., Danbury, CT 06811	203-743-3633
† MDF Products Inc., Danbury, CT 06811	203-743-3579
† Micronetics, Hudson, NH 03051	603-883-2900
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Nuclear EMP (NEMP) Protectors-4300 – ***See Vol. B***
Null Detectors — See Indicators, Null (Vol. D)
NuBus Cards — See Board Computers & Subassemblies (Vol. D)
Nuts, Metal-2500 – ***See Vol. C***
Nuts, Plastic — See Fasteners, Nonmetallic (Vol. C)
Oils — See Lubricants (Vol. C)
Opamps — See Amplifiers, Operational (Vol. D)
Optical Breadboards-4200 – ***See Vol. C***
Optical Component Mounts & Accessories-3700 – ***See Vol. B***
Optical-Coupler Isolators — See Isolators, Opto (Vol. B)
Optical Design Service — See Services, Optical Design (Vol. D)

Optical Disk Drives-2000

Computer Devices, Nutting Lake, MA 01865	508-663-4980
§ Epson America, Inc./OEM Div., Torrance, CA 90503	310-787-6300
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110	408-453-7373

Optical Radiation Measuring-2900

M-Tron Industries, Yankton, SD 57078, 605-665-9321	**A•1431**
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Spectron Engineering Inc., Denver, CO 80223	303-733-1060

Optical Signal Sources — See Generators, Light Pulse (Vol. D)

Optical Time Domain Reflectometer (OTDR)-2900

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
§ Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626

Optocouplers-3700 – ***See Vol. B***

Oscillators, Audio (Module)-1300

Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510	**A•1425**
§ **Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566**	**D•1017**
† **Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900**	**A•1456**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Connor-Winfield Corp., Aurora, IL 60505-1335	708-851-4722
† Electronic Research Co., Overland Park, KS 66204	913-631-6700
Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
Frequency Devices, Inc., Haverhill, MA 01830	508-374-0761
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Greenray Inds., Inc., Mechanicsburg, PA 17055	717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065	717-486-3411
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
NF Electronic Instruments, State College, PA 16801	814-237-5580
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901	804-977-8050
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854	908-572-9512
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160	203-853-4433

Oscillators, Audio (Test) — See Generators, Audio (Vol. D)
Oscillators, Crystal, Clock-2300 – ***See Vol. A***
Oscillators, Crystal Controlled (Module)-2300 – ***See Vol. A***
Oscillators, Crystal, Digitally Compensated Crystal (DCXO)-2300 – ***See Vol. A***
Oscillators, Hybrid-2300 – ***See Vol. A***
Oscillators, Low Frequency (Module)-2300 – ***See Vol. A***
Oscillators, Microwave-3450 – ***See Vol. A***
Oscillators, Ovenized-2300 – ***See Vol. A***
Oscillators, Power (Module)-2300 – ***See Vol. A***
Oscillators, Programmable-2300 – ***See Vol. A***
Oscillators, Pulse (Module)-2300 – ***See Vol. A***
Oscillators, Pulse (Test) — See Generators, Pulse (Vol. D)
Oscillators, RC (Module)-2300 – ***See Vol. A***
Oscillators, RF (Module)-2300 – ***See Vol. A***
Oscillators, RF (Test) — See Generators, RF (Vol. D)
Oscillators, Sinusoidal (Module)-2300 – ***See Vol. A***
Oscillators, Sinusoidal (Test) — See Generators, Function (Vol. D)
Oscillators, Square Wave (Module)-2300 – ***See Vol. A***
Oscillators, Square Wave (Test) — See Generators, Function (Vol. D)
Oscillators, Sweep — See Generators, Sweep (Vol. D)

Oscillators, Telemetry-1900

Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777	**A•1447**
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
CTS Corporation. Elkhart, IN 46514	219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548	815-786-8411
Dantel, Fresno, CA 93727	209-292-1111
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232	513-542-5555
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
† Greenray Inds., Inc., Mechanicsburg, PA 17055	717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Isotemp Research, Inc., Charlottesville, VA 22903	804-295-3101
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065	717-486-3411
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901	804-977-8050
† Q-Tech Corp., Culver City, CA 90232-3510.	310-836-7900
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411

Oscillators, Temperature Compensated(TCXO)-2300 – ***See Vol. A***
Oscillators, Test Equipment — See Generators (Specific Types) (Vol. D)
Oscillators, Trigger Coherent-2300 – ***See Vol. A***
Oscillators, Tuning Fork Controlled - Also see Resonators-2300 – ***See Vol. A***
Oscillators, UHF/VHF (Module)-2300 – ***See Vol. A***
Oscillators, UHF/VHF (Test) — See Generators, UHF/VHF (Vol. D)
Oscillators, Ultrasonic (Test) — See Generators, Ultrasonic (Vol. D)
Oscillators, Voltage Controlled Crystal (VCXO)-2300 – ***See Vol. A***
Oscillators (MIL), Crystal &/or Ovens-2440 – ***See Vol. B***
Oscillators (MIL), VCO, Solid State, RF-2440 – ***See Vol. B***

Oscillographs, Direct Writing-3000

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
† Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Metrum, Denver, CO 80217-5227	303-773-4700
§ MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385

Oscilloscope Accessories-2975

§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
§ **ITT Pomona Electronics, Pomona, CA 91766, 909-469-2900**	**C•1355**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1409**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845	508-682-2000
§ CUI Stack Inc., Beaverton, OR 97005	503-643-4899

Oscilloscope Accessories-2975 (Cont'd)

† Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054	201-575-8666
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701	310-404-0101
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Omega Engineering, Stamford, CT 06907	800-826-6342
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Test Probes, Inc., San Diego, CA 92121	619-552-2090
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Oscilloscopes, Analog-2975

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1409**
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457

Oscilloscopes, Digital-2975

§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1403**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ **Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295**	**D•1407**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1409**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292**
Analogic Corp., Peabody, MA 01960	508-977-3000
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ HC Protek, Northvale, NJ 07647	201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ NCI, Huntsville, AL 35806	205-837-6667
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Omega Engineering, Stamford, CT 06907	800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Oscilloscopes, General Purpose-2975

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1409**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292**
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
† Contact East, N. Andover, MA 01845	508-682-2000
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054	201-575-8666
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
§ Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501	310-328-6116
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131	708-288-4471
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Oscilloscopes, High Frequency (Above 200 MHz)-2975

§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1403**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054	201-575-8666
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Omega Engineering, Stamford, CT 06907	800-826-6342
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Oscilloscopes, Low Frequency (DC to 3 MHz)-2975

John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100	**D•1403**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292**
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054	201-575-8666
† Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Omega Engineering, Stamford, CT 06907	800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Oscilloscopes, Mid Frequency (DC to 200 MHz)-2975

§ **John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100**	**D•1403**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
§ **Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295**	**D•1406-1407**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1409**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292**
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845 508-682-2000
† Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 516-957-8700
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701 310-404-0101
† Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501 310-328-6116
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ Krenz Instruments, Inc., Bonsall, CA 92003 619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Metermaster, Tempe, AZ 85282 602-431-0015
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711 608-271-3333
Omega Engineering, Stamford, CT 06907 800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Panasonic Factory Automation Co., Matsushita Elect. Corp. of America, Franklin Park, IL 60131 708-288-4471
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Oscilloscopes, Multibeam-2975

§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1403
Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 .... D•1406
Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
† Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501 310-328-6116
§ Metermaster, Tempe, AZ 85282 602-431-0015
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Oscilloscopes, Multiple Channel-2975

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .. D•1231
§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1403
Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 .... D•1406-1407
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1409
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1292
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845 508-682-2000
† Data Check Corporation, San Diego, CA 92126 619-578-0101
† Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 410-584-7400
† Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501 310-328-6116
§ Krenz Instruments, Inc., Bonsall, CA 92003 619-630-3488
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711 608-271-3333
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
Omega Engineering, Stamford, CT 06907 800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103 206-547-8311
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
† Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Oscilloscopes, Plug-in-2975

§ Metermaster, Tempe, AZ 85282 602-431-0015
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457

Oscilloscopes, Portable, Battery Operated-2975

John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1403
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1292
† Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501 310-328-6116
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 602-968-6241
§ Kenwood U.S.A., Long Beach, CA 90810 310-761-8295
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Non-Linear Systems, San Diego, CA 92121 619-535-2161
Omega Engineering, Stamford, CT 06907 800-826-6342
Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
§ Sperry, A. W. Instruments, Smithtown, NY 11787 .... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Oscilloscopes, Programmable-2975

§ John Fluke Mfg. Co., Inc., Everett, WA 98203, 206-347-6100 .... D•1403
§ Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 .... D•1406
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1409
Analogic Corp., Peabody, MA 01960 508-977-3000
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
† Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Metermaster, Tempe, AZ 85282 602-431-0015
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711 608-271-3333
Omega Engineering, Stamford, CT 06907 800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
† Tektronix, Inc., Wilsonville, OR 97070 800-835-9433

Oscilloscopes, Sampling-2975

Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1409
Analogic Corp., Peabody, MA 01960 508-977-3000
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
† Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Kenwood U.S.A., Long Beach, CA 90810 310-761-8295
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711 608-271-3333
Omega Engineering, Stamford, CT 06907 800-826-6342
Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103 206-547-8311
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Oscilloscopes, Storage-2975

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 .... D•1407
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1409
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 .... D•1292
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
Analogic Corp., Peabody, MA 01960 508-977-3000
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
§ Contact East, N. Andover, MA 01845 508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501	310-328-6116
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Omega Engineering, Stamford, CT 06907	800-826-6342
Orion Instruments, Inc., Menlo Park, CA 94025	415-327-8800;800-767-4666
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642

Oscilloscopes, Triggered Sweep-2975

Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295	**D•1407**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1409**
§ **Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104**	**D•1292**
§ B & K Precision, Maxtec International Corp. Chicago, IL 60635	312-889-1448
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Hitachi Denshi America Ltd., Test & Meas. Div., Torrance, CA 90501	310-328-6116
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Metermaster, Tempe, AZ 85282	602-431-0015
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Omega Engineering, Stamford, CT 06907	800-826-6342
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Rapid Systems Inc., Seattle, WA 98103	206-547-8311
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Oscilloscopes, Waveform Processing-2975

Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295	**D•1406**
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457

Outlets, Electrical — See Boxes, Junction, Outlets & Wall Plates (Vol. C)
Outlets, Power — See Connectors, AC Power (Vol. C)
Outlets, Power, International-2100 — *See Vol. C*

Ovens, Adhesive Caring-4100

§ ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
§ ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
Centech Corporation, Minneapolis, MN 55420	612-881-8245
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
Sikama International, Inc., Santa Barbara, CA 93117	805-683-6379
Sun Electronic Systems. Inc., Ft. Lauderdale, FL 33309	305-739-7004
Tenney Engineering, Union, NJ 07083	908-686-7870
§ Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Ovens, Aging, Burn-in, Life Test-2550

AZ-COM, Orinda, CA 94563-2206, 510-254-5400	**D•1235**
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Φ **Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004**	**D•1213**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Bemco, Simi Valley, CA 93065	805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
§ Delta Design, San Diego, CA 92123-1111	619-292-5000
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
† Gruenberg Oven Co., Williamsport, PA 17701	717-326-1755
Hotpack Corp., Philadelphia, PA 19154	215-824-1700;800-523-3608
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Milton Ross Co., Warrington, PA 18976	215-491-0600
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Ransco Industries, Oxnard, CA 93033	805-487-7777
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870
Thermotron Inds., Holland, MI 49423	616-392-1491
† Trent, Inc., Philadelphia, PA 19127	215-482-5000
† Trio-Tech International, San Fernando, CA 91340	818-365-9200

Ovens, Crystal & Component-2300 — *See Vol. A*

Ovens, Drying (for Electronic Instruments)-4100

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
Cober Electronics, Stamford, CT 06902	203-327-0003
† Despatch Industries, Minneapolis, MN 55418	612-781-5363
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
Hotpack Corp., Philadelphia, PA 19154	215-824-1700;800-523-3608
† Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701	717-326-1770
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Sikama International, Inc., Santa Barbara, CA 93117	805-683-6379
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
Tenney Engineering, Union, NJ 07083	908-686-7870
Thermotron Inds., Holland, MI 49423	616-392-1491
§ Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Ovens, Electric — See Furnaces, Electric (Vol. D)

Ovens, Vacuum-4100

† Bemco, Simi Valley, CA 93065	805-583-4970
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854	203-853-9500
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
Forma Scientific, Inc., Marietta, OH 45750	614-373-4763
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
The Grieve Corporation, Round Lake, IL 60073-9989	708-546-8225
Hotpack Corp., Philadelphia, PA 19154	215-824-1700;800-523-3608
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
† Standard Environmental Systems, Inc., Totowa, NJ 07512	201-256-2200
† Tenney Engineering, Union, NJ 07083	908-686-7870

Packages, Integrated Circuit-3130 — *See Vol. A*
Packaging Panels, Integrated Circuits — See Boards, Plug-in (Vol. C)
Packaging Services — See Services, Packaging (Vol. D)
Pads, L, T, & H — See Attenuators, Audio (Vol. D)
Pads, Transistor Mounting-2100 — *See Vol. C*
Paints, Conductive. Electric — See Coatings. Conductive, Electric (Vol. C)
Paints, Finishing-1600 — *See Vol. C*
Paints, Metallic, Conductive-1600 — *See Vol. C*
Paints, Radioactive — See Coatings, Radioactive (Vol. C)
Paints, Resistive-Also See Inks for Thick Film Microcircuits-1600 — *See Vol. C*
Panel Equipment — See Dials (Vol. C), Connectors (Vol. C), Jacks (Vol. C), Lights, Indicator (Vol. B), etc.
Panel Marking Kits — See Kits, Marking (Vol. C)
Panels, Fuse-4300 — *See Vol. B*
Panels, Electroluminescent Backlight, See Backlight Panels, Electroluminescent-2450 — *See Vol. B*
Panels, IC Packaging — See Boards, Plug-in (Vol. C)
Panels, Jack-2100 — *See Vol. C*
Panels, Metal — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)
Panels, Meter — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. C)
Panels, Patch — See Panels, Jack (Vol. C)
Panels, Power BUS for ICs-3200 — *See Vol. C*
Panels, Relay Rack — See Enclosures. Circuit Board, Module, & Relay Mounting (Vol. C)
Panels, Touch — See Touch Panels (Vol. D)

Paper Tape Equipment, Punch-2000

† Chalco Engrg. Corp., Chalco Industries. Inc., Gardena, CA 90248-1898	213-321-0121; 213-323-5525
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
Teleterminal Corp., Greenland, NH 03840	603-431-1200
# Trend DLC, Inc., East Hanover, NJ 07936	201-515-4935

Paper, Graphic Recording-3000

† **Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000**	**D•1410-1412**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
§ **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202**	**D•1416**
§Φ **Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385**	**D•1417**
† Alden Electronics, Inc., Westboro, MA 01581	508-366-8851
Computer Devices, Nutting Lake, MA 01865	508-663-4980
Computer Instruments Div., Westbury, NY 11590	516-876-8400
† Fitchburg Coated Products, Technographics, Inc., Scranton, PA 18501	717-347-2035
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Linear Instruments, Spectra Physics Analytical, Reno, NV 89523	702-746-2200
§ MFE Instruments. Stocker & Yale. Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
M-Tek, Pittsburgh, PA 15222	800-245-5101 ; 412-261-9030
Omega Engineering, Stamford, CT 06907	800-826-6342

§ PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101

Patch Boards — See Boards, Programming (Vol. C)
PC Bus Cards — See Board Computers & Subassemblies (Vol. D)
PC Instruments — See Instruments, Test & Measuring, Personal Computer (Vol. D)
Peak Sense & Hold Amplifiers — See Amplifiers, Peak Sense & Hold (Vol. D)
Peltier (Thermoelectric) Heat Pumps — See Cooling/Heating Modules, Thermoelectric (Vol. B)
Personal Computer Instruments — See Instruments, Test & Measuring, Personal Computer (Vol. D)
Phones — See Handsets, Chestsets, Headphones, Headsets, etc. (Vol. D)
Photocells & Phototubes — See Cells, Photoconductive (Vol. B)
Photodetectors, GaAs-3700 — ***See Vol. B***
Photodectectors, Silicon-3700 — ***See Vol. B***
Photoelectric Equipment — See Alarms, Controls, Photoelectric (Vol. B)
Photoelectric Tubes — See Cells. Photoconductive (Vol. B)
Photoemissive Detectors — See Cells, Photoemissive (Vol. B)
Photographic Services — See Services, Photographic (Vol. D)
Photometers — See Meters, Light (Vol. D)
Photomultiplier Tube Housings-4525 — ***See Vol. C***
Photoresistors-3700 — ***See Vol. B***
Photo Resists-4525 — ***See Vol. C***
Phototransistors, Surface Mount-4800 — ***See Vol. A***

Pick and Place Equipment, Automatic-4100

Anorad Corp., Hauppauge, NY 11788	516-231-1995
Aremco Products, Inc., Ossining, NY 10562	914-762-0685
§ Contact East, N. Andover, MA 01845	508-682-2000
Creative Automation Co., Sun Valley, CA 91352	818-767-6220
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875	908-805-1900
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
ITF Corp., Buford, GA 30518	404-945-3844
Manix Mfg. Inc., Warminster, PA 18974	215-957-6565
† Manncorp, Huntingdon Valley, PA 19006	215-364-6100
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880	617-246-2040
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Motion Science Inc., San Jose, CA 95112	408-993-0300
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Ocean Motions Co., Barrington, RI 02806	401-246-1394
† Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
Reliability Incorporated, Houston, TX 77218	713-492-0550
§ Royonic Inc., Valencia, CA 91355	805-257-0303
§† Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Pick and Place Equipment, Manual-4100

Automated Production Concepts, Wayne, NJ 07470	201-831-8300
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Cooper Tools, Raleigh, NC 27622	919-781-7200
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
† Manncorp, Huntingdon Valley, PA 19006	215-364-6100
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880	617-246-2040
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200

Pickups, Magnetic, Proximity, Torque, Vibration, etc. — See Transducers, Specific Type (Vol. B)

Pickups, Telephone (For Recording)-1300

§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
International Components Corp., Melville, NY 11747	516-293-1500
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511

Piezoelectric Ceramics-2300 — ***See Vol. A***
Pilot Lights — See Lights, Indicator (Vol. B)
Pin Grid Arrays — See Sockets, Pin Grid Array (Vol. C)
Pin Straighteners, Tube-5400 — ***See Vol. C***
Pins, Cotter, Dowel, Taper, etc.-2500 — ***See Vol. C***
Pins, Electrically Conductive-2100 — ***See Vol. C***
Pins, Mechanical-2500 — ***See Vol. C***
Plastic Raw Materials, Liquids, Pellets, Powders, Resins-1600 — ***See Vol. C***
Plastics, Custom Molding — See Services, Custom Molding, Plastic (Vol. D)
Plastics, Encapsulating — See Compounds, Encapsulating, Molding, Potting (Vol. C)
Plastics Fabrication — See Services, Plastics Fabrication (Vol. D)
Plastics, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C), Tubing, Heat Shrinkable (Vol. C)
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Plates, Instructional, Name, Silk Screen — See Nameplates (Vol. B)
Plates, Multihole-2500 — ***See Vol. C***
Platforms, Thermal — See Thermal Platforms (Vol. D)
Plating Services — See Services, Plating (Vol. D)
Players, Magnetic Tape — See Recorders, Magnetic Tape (Vol. D)
Pliers-5400 — ***See Vol. C***

Plotters/Hard-Copy Devices-2000

B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
† Allen Datagraph, Inc., Salem, NH 03079	603-893-1983
Computer Devices, Nutting Lake, MA 01865	508-663-4980
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
† Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Image Graphics, Inc., Shelton, CT 06484	203-926-0100
§ Kipp & Zonen, Enraf-Nonius, Bohemia, NY 11716	516-589-2885;800-645-1025
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Precision Image Corporation, Redwood City, CA 94063	415-366-8900; 1-800-338-3377
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§† The Recorder Company, San Marcos, TX 78667	210-629-1400
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385
Xerox Corporation, United States Customer Operations, Rochester, NY 14644	800-832-6979

Plotters, X-Y, & Accessories-3000

# Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Φ Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
† Allen Datagraph, Inc., Salem, NH 03079	603-893-1983
§ Contact East, N. Andover, MA 01845	508-682-2000
Data Technology, Inc., Woburn, MA 01811	617-935-8820
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Image Graphics, Inc., Shelton, CT 06484	203-926-0100
§ Kipp & Zonen, Enraf-Nonius, Bohemia, NY 11716	516-589-2885;800-645-1025
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Precision Image Corporation, Redwood City, CA 94063	415-366-8900; 1-800-338-3377
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§† The Recorder Company, San Marcos, TX 78667	210-629-1400
Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Summagraphics Corp., Seymour, CT 06483	203-881-5400
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
§ Via West Interface, Inc., Tucson, AZ 85705	602-623-5716;1-800-266-5716
Zeta Graphics Corp., Martinez, CA 94553	510-313-5900

Plug & Jack Sets-2100 — ***See Vol. C***
Plug Adapters-2100 — ***See Vol. C***
Plug Buttons-2500 — ***See Vol. C***
Plug Caps & Shells-2100 — ***See Vol. C***
Plugboard Programming Systems — See Boards, Programming (Vol. C)
Plugs, Coaxial-2100 — ***See Vol. C***
Plugs, Electrical (All Types)-2100 — ***See Vol. C***
Plugs, Fused-2100 — ***See Vol. C***
Plugs, Hole-2500 — ***See Vol. C***
Plugs, Power, International-2100 — ***See Vol. C***
Plugs (MIL)-2440 — ***See Vol. B***
Pointers, Dial-2400 — ***See Vol. C***
Polarizers-3700 — ***See Vol. B***

Polarizers, Satellite Antennas-1200

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024**

Position Control Systems, Servo — See Controls, Servo Systems (Vol. D)

Positioning Systems, Multiple Axis, Computer Guided-4900

§† Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO	**B•1273-1274,1276**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•1164, 2316**
§ TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676	**D•2317**
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§† B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
§ Centent Co., Santa Ana, CA 92707	714-979-6491
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875	908-805-1900
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115	801-486-2115

† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
§ Galil Motion Control, Inc., Sunnyvale, CA 94086 .... 408 746-2300
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Indramat, The Rexroth Corp., Wood Dale, IL 60191 708-860-1010
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
Infranor, Naugatuck, CT 06770 .... 203-729-8258;800-BE-SERVO
Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
ITF Corp., Buford, GA 30518 404-945-3844
† McFadden Systems, Inc., Santa Fe Springs, CA 90670 310-948-4414
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880 617-246-2040
Microvision Corp., Los Gatos, CA 95008 408-374-3158
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841 508-685-4900
Ocean Motions Co., Barrington, RI 02806 401-246-1394
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
Performance Motion Devices, Chelmsford, MA 01824 508-256-1913
Precision MicroControl, San Diego, CA 92111 619-565-1500
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 612-942-3600
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416 .... 516-328-0200;328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
Transmagnetics, Farmingdale, NY 11735 516-293-3100
§† Velmex, Inc., East Bloomfield, NY 14443 .... 716-657-6151;800-642-6446

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Posts, Harness Board-2500 – *See Vol. C*
Potentiometer Elements-4750 – *See Vol. A*
Potentiometers, Air Operated-4750 – *See Vol. A*
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Power Development Systems-4000

§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3 905-660-9819
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 619-575-1100
Pioneer Magnetics, Santa Monica, CA 90404 310-829-6751
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
§ Wall Industries, Exeter, NH 03833 603-778-2300

Power Distribution Modules-4000

† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 .... D•1592
Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1600-1601,2071-2072
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 .... D•1604
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2253-2255
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 .... C•1300
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 .... D•1738,1741
Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1549-1551,1554-1555
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 .... D•2278-2281
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... D•1834
§ Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000 .... C•1056-1057
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 .... C•1426,1432
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 .... D•2215
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§† Brooks Power Systems, Bensalem, PA 19020 .... 215-244-0264;1-800-523-1551
§ Cal-Tek Engineering, Kingston, MA 02364 617-585-5666
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054 408-980-5144
Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
Energy Systems, Vancouver, WA 98682 206-896-8310
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Everest Electronic Equipment, Buford, GA 30518 404-932-2900
Everest Electronic Equipment, Inc., Anaheim, CA 92806 714-634-2200
† International Power Machines, Garland, TX 75042 800-527-1208
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 619-575-1100
† Modular Devices, Shirley, NY 11967 516-345-3100
§† Oneac Corporation, Libertyville, IL 60048 708-816-6000,800-327-8801
Pioneer Magnetics, Santa Monica, CA 90404 310-829-6751
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Research Inc., Minneapolis, MN 55424 612-941-3300
Rogers Corporation, Power Distribution Div., Mesa, AZ 85205 602-830-3370
Semtech Corporation, Newbury Park, CA 91320 805-498-2111
SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 909-371-5751
§ Wall Industries, Exeter, NH 03833 603-778-2300
§ Walther Electric Corporation, WALTHER WERKE, Ferdinand Walther, E. Brunswick, NJ 08816 908-238-1166
WECO Electrical Connectors, Inc., Mooers, NY 12958 518-298-4810
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Power Line Monitor Printers – See Printers, Event (Vol. D)

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AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 .... D•2052-2055
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 .... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512
† Acopian Technical Company, Easton, PA 18044, 215-258-5441 .... D•1517
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725 .... D•1558-1559
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 .... D•1574-1575
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 .... D•1585-1589
Astec High Voltage, Ashland, MA 01721, 508-881-8407 .... D•1596-1597
§ Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1601,1603, 2071
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 .... D•1604-1607
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 .... D•1618-1619
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 .... D•2090-2091,2095
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 .... C•1300
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144 .... D•2098
Crydom Company, Long Beach, CA 90805, 310-865-3536 .... A•2136-2142
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1659
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 .... D•1709
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 .... C•1340
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 .... D•1810-1811,1813-1815
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 .... D•2278-2281
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1837-1838,1840-1841,1843-1844,2136
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380 .... D•1846
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2289-2290
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 .... D•2291
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 .... D•1882-1884,2292
§† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 .... D•2186,2192-2195
Power-One, Inc., Camarillo, CA 93012, 805-987-8741 .... D•1886
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 .... D•1916,2203
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... D•1922
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 .... D•1945-1954

Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 D•1960,1962
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 D•1967
Tri-Source Inc., Shelton, CT 06484, 203-924-7030 D•2010
§ **Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 D•2215**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001 D•2043
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 613-836-3511
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
Amptec Electronics, San Diego, CA 92128 619-578-7816
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
BASISTA/NIEC, Richfield, OH 44286 216-659-9287
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211 714-544-6665
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
Energy Systems, Vancouver, WA 98682 206-896-8310
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 201-288-4477; 800-447-5639
Falcon Electric, Monrovia, CA 91016 800-842-6940
Friwo, Friemann & Wolf, Frederick, MD 21702 301-694-7479
Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
Pioneer Magnetics, Santa Monica, CA 90404 310-829-6751
Power Designs, Inc., Westbury, NY 11590 516-333-6200
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Power Systems, Inc., Bloomfield, CT 06002 203-726-1300
PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
Power Trends, Inc., Batavia, IL 60510 708-406-0900
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§ Schurter, Inc., Petaluma, CA 94954 800-848-2600 ext.62
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087 603-893-2330
Semtech Corporation, Newbury Park, CA 91320 805-498-2111
Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Sola, Elk Grove Village, IL 60007-5666 708-439-2800
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
† Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
† Teledyne Microelectronics, Los Angeles, CA 90066 310-822-8229;310-305-0248
§ USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600
Voltex, Amityville, NY 11701 516-842-2772
WECO Electrical Connectors, Inc., Mooers, NY 12958 518-298-4810
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136
Wilmore Electronics Co., Inc., Hillsborough, NC 27278 919-732-9351
Xylog Corp., Hackensack, NJ 07601 201-489-4040

Power Receptacles — See Sockets, Power (Vol. C)

Power Supplies, AC to DC, High Voltage-4000

Acopian Technical Company, Easton, PA 18044, 215-258-5441 D•1517
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 D•1592**
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407 D•1596-1597**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 D•1623
§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 D•1248**
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 D•1658
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 D•1712-1713,1716,1718-1719,1721-1722,1728
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700 D•1770-1771
Kepco, Inc., Flushing, NY 11352, 718-461-7000 D•1777
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 D•1835
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751 D•1879,1881
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 D•1897
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 D•1922
§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872 D•1942**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 D•2041
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Advanced High Voltage Company, Tucson, AZ 85751 602-721-2424;818-997-7222
† B C Systems, Inc., Setauket, NY 11733 516-751-9370
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
† CELCO, Mahwah, NJ 07430 201-327-1123
Computer Power Supplies (CPS), Lake Oswego, OR 97035 503-684-8026
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054 408-980-5144
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Durmitor Inc., King City, Ont., CANADA L0G 1K0 416-833-3148
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 201-288-4477; 800-447-5639
Farnell Advance Power, Solon, OH 44139 216-349-0755
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174 904-677-7070
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
International Power Sources, Inc., Ashland, MA 01721 508-881-7434
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915 508-922-9300
Kikusui International Corp., Signal Hill, CA 90804-1203 310-986-1677;800-545-8784
Laser Magnetics, Chelmsford, MA 01824 508-250-1507
§ Metermaster, Tempe, AZ 85282 602-431-0015
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Oram High Voltage, Dayton, TX 77535 409-258-5553
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
Phenix Technologies, Accident, MD 21520 301-746-8118
† Power Ten, Inc., Sunnyvale, CA 94086 408-738-5959
Reich Associates, Inc., Lakehills, TX 78063 210-751-3220
Royal Enterprises Co., Simi Valley, CA 93063 805-522-8730;818-998-2455
Sandman Electric Co., Inc., Braintree, MA 02184 617-848-2111
Schott Corp., Wayzata, MN 55391 612-475-1173
Schott High Voltage, Salt Lake City, UT 84119 801-972-3690
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548 904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
ULTRAVOLT, Inc., Ronkonkoma, NY 11779 800-876-POWER
§ Wall Industries, Exeter, NH 03833 603-778-2300
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 617-938-8390; 1-800-933-9319
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

Power Supplies, AC to DC, Modular, Plug-in-4000

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 D•1513-1514
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 D•1554-1556
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 A•2266, D•1580-1583
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 D•1585-1586**
§ **Astec Standard Power, Oceanside, CA 92054, 619-757-1880 D•1602**
§ **Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 D•1609**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888 D•1610-1612
Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 D•2239
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 D•1618,1622-1623
§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 D•1653**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955 D•1654-1655
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 D•2099-2102
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 A•2321, D•1660-1664
§† **Electromech, Inc., Irvington, NJ 07111, 201-318-7999 D•1672**
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620 D•1673
Endicott Research Group, Endicott, NY 13760, 607-754-9187 B•1048
§ **EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 D•1688**
Geopower Inc., Ramsey, NJ 07446, 201-236-0156 D•1858
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 D•1731**
§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 D•1734-1735**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 D•1739
§ **International Power Sources, Inc., Ashland, MA 01721, 508-881-7434 D•2111**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 D•1757-1759
Kepco, Inc., Flushing, NY 11352, 718-461-7000 D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 D•1807,2276
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 D•1810-1815
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 D•1816,2130**
§ **LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1818,1820-1822,1824-1826**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 D•2279-2280
Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712 D•2131-2134
† **Modular Devices, Shirley, NY 11967, 516-345-3100 D•1837,1843**
§ **Multi Products International, West Paterson, NJ 07424, 201-890-1344 D•1848**
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 D•1851
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 D•2291
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 D•1859,2137
† **Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337 D•1874-1877**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751 D•1879
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 D•2186,2194
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788 D•1900-1901,1904-1905
Powertronix Corp., Foster City, CA 94404, 415-345-6800 A•2511
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800 D•1915
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1921**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 D•1937**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 D•1945,1949,1952-1955**

# Technical Devices, Dayton, OH 45414, 513-890-7881 ... D•1956
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1379
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888 ... D•1998-1999
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 ... C•1107,1110
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442 ... **D•2017**
Voltex, Amityville, NY 11701, 516-842-2772 ... D•2217
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041
AAK Corp, Haverhill, MA 01832 ... 508-373-3769;800-886-2225
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 ... 613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727 ... 716-968-2400
Acopian Technical Company, Easton, PA 18044 ... 215-258-5441
Adtech Power Inc., Anaheim, CA 92806 ... 714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057 ... 717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714 ... 714-263-8605
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3 ... 905-660-9819
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
BICC-VERO Electronics, Inc., Hamden, CT 06514 ... 203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501 ... 213-539-6320
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 ... 416-298-0560
Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
† CELCO, Mahwah, NJ 07430 ... 201-327-1123
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211 ... 714-544-6665
Computer Power Supplies (CPS), Lake Oswego, OR 97035 ... 503-684-8026
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054 ... 408-980-5144
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES ... (0271) 863781
§ CPS, Lake Oswego, OR 97035 ... 503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
C-S Electronic Sales, Inc., Frankfort, IN 46041 ... 317-659-1874
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 ... 416-826-1141
† Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600
† Delta Products Corporation, Fremont, CA 94538 ... 510-770-0660
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 ... 201-467-8100
Elgin Electronics, Erie, PA 16509-3570 ... 814-864-4921
Energy Systems, Vancouver, WA 98682 ... 206-896-8310
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 ... 310-635-9555
Engineering Design & Sls., Danville, VA 24541 ... 804-792-6405
EWC, Inc., Englishtown, NJ 07726 ... 908-446-3110
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 ... 516-293-4100
Friwo, Friemann & Wolf, Frederick, MD 21702 ... 301-694-7479
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Hameg Instruments, Oceanside, CA 92056 ... 619-630-4080;800-247-1241
HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
House of Batteries, Huntington Beach, CA 92647 ... 1-800-432-3385;714-375-0222
IMC Power Sources, San Jose, CA 95112 ... 408-441-9614
Industrial Electronic Resources, Corona, CA 91720 ... 909-734-1111;800-433-5160
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 ... 602-889-7600
§ James Electronics, Chicago, IL 60618 ... 312-463-6500
† Lambda Electronics Inc., Melville, NY 11747-3700 ... 516-694-4200
Mesa Power Systems, Escondido, CA 92029 ... 619-489-8162
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 ... 201-385-0500
§ MIL Electronics, Inc., Nashua, NH 03060 ... 603-882-3200
MPC, Div. of Consulting Systems, Danville, NH 03819 ... 603-642-5913;1-800-238-8380
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006 ... 503-646-4700
Nedap N.V., Groenlo, HOLLAND 7140 AA ... +31-5440-71111
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 ... 714-474-3900
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909 ... 407-831-2000
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 ... 206-881-1700
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 ... 813-573-1900
§ Philmore Manufacturing, Rockford, IL 61125-1386 ... 815-229-7773
§ Phoenix Contact Inc., Harrisburg, PA 17111 ... 717-944-1300
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 ... 714-975-1222
Power Designs, Inc., Westbury, NY 11590 ... 516-333-6200
PowerLine, Inc., Denver, CO 80210 ... 303-698-7883
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 ... 818-591-8189
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117 ... 800-245-4501
§ Reliance Electric Co., Cleveland, OH 44117 ... 800-245-4501
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO ... 519-696-2616
RO Associates, Inc., Sunnyvale, CA 94088 ... 408-744-1450
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ... 516-957-8700;800-645-5516
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
†# Tauber Elctrns. Inc., San Diego, CA 92117 ... 619-274-7242;1-800-927-0004
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
Technology Dynamics Inc., Bergenfield, NJ 07621 ... 201-385-0500
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248
§# Total Power International, Inc., Lowell, MA 01850 ... 508-453-7272
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 ... 909-371-5751
Tri-Source Inc., Shelton, CT 06484 ... 203-924-7030
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 ... 310-316-9984
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587 ... 510-429-7170
§ Wall Industries, Exeter, NH 03833 ... 603-778-2300
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 ... 617-938-8390; 1-800-933-9319
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 ... 514-694-9136
§ West Electronic Sales Team, Huntington Beach, CA 92647 ... 714-375-6500; 310-495-5569
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 ... 813-646-3909

Power Supplies, AC Input, Less than 1 W Output-4000

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 ... D•2052-2055
† Acopian Technical Company, Easton, PA 18044, 215-258-5441 ... D•1517
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222 ... D•1553
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... D•1580,1582-1583
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ... D•2244
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ... D•1653
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 ... D•2082
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955 ... D•1654
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... D•1660-1662
Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ... D•1734-1735
International Power Devices Inc., Boston, MA 02134, 617-782-3331 ... D•1751-1752
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ... D•1826
† Modular Devices, Shirley, NY 11967, 516-345-3100 ... D•1844
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700 ... D•1847
Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... D•1848
Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337 ... D•1875
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 ... D•1883
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ... D•1922
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 ... D•1963
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272 ... D•2002
Acme Electric Corporation, Cuba, NY 14727 ... 716-968-2400
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588 ... 510-734-3060
Alpha Dist. Corp., Richfield, OH 44286 ... 216-659-7100; 1-800-628-0841
American Monarch, Minneapolis, MN 55421 ... 612-788-9161
† Anadyne Power Supply Division, Santa Fe Springs, CA 90670-5216 ... 213-921-9364
† Arnold Magnetics, Camarillo, CA 93012 ... 805-484-4221
§ Ault, Incorporated, Minneapolis, MN 55428 ... 612-493-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Bertan High Voltage, Hicksville, NY 11801 ... 516-433-3110
§ Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
Cell-Con, Inc., Exton, PA 19341 ... 215-363-8552
Collmer Semiconductor, Inc., Dallas, TX 75244 ... 800-527-0251;214-233-1589
Computer Power Supplies (CPS), Lake Oswego, OR 97035 ... 503-684-8026
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033 ... 805-486-4565;
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054 ... 408-980-5144
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 ... 514-694-9320
Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714 ... 714-476-6070
† EMCO High Voltage Co., Sutter Creek, CA 95685 ... 209-223-3626;800-546-3680
Friwo, Friemann & Wolf, Frederick, MD 21702 ... 301-694-7479
GC International Inc., Plano, TX 75074 ... 214-423-8411
§ Hauman, Inc., San Jose, CA 95131 ... 408-434-0888
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
Jerome Industries Corp., Elizabeth, NJ 07201 ... 908-353-5700
Kenwood U.S.A., Long Beach, CA 90810 ... 310-761-8295
§ Kraft Dynatronix, Inc., Amery, WI 54001 ... 715-268-8118;800-826-7172
Lambda Electronics Inc., Melville, NY 11747-3700 ... 516-694-4200
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
MPC, Div. of Consulting Systems, Danville, NH 03819 ... 603-642-5913;1-800-238-8380
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Panasonic Industrial Co., Milpitas, CA 95035 ... 408-946-7200
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 ... 814-355-1521
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 ... 813-573-1900
PowerLine, Inc., Denver, CO 80210 ... 303-698-7883
Power-One, Inc., Camarillo, CA 93012 ... 805-987-8741
Power Systems, Inc., Bloomfield, CT 06002 ... 203-726-1300
Precise Sensors, Inc., Monrovia, CA 91016 ... 818-358-4578
Quality Power Systems Inc., Pearland, TX 77581 ... 713-997-1700;800-992-1701
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087 ... 603-893-2330
Semtech Corporation, Newbury Park, CA 91320 ... 805-498-2111
† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300

† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
†# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300
Wilmore Electronics Co., Inc., Hillsborough, NC 27278	919-732-9351
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

Power Supplies, 5 to 25 W Output — See Power Supplies, 1 W to 300 W Output (Vol. D)

Power Supplies, 25 to 150 W Output — See Power Supplies, 1 W to 300 W Output (Vol. D)

Power Supplies, 150 to 400 W Output — See Power Supplies, Greater Than 300 W Output (Vol. D)

Power Supplies, 1 W to 300 W Output-4000

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	**D•2052-2055**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644:1-800-367-8200	**D•1512-1513,1515**
† **Acopian Technical Company, Easton, PA 18044, 215-258-5441**	**D•1517**
§† **Adtech Power Inc., Anaheim, CA 92806, 714-634-9211**	**D•1549-1551**
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1554-1556**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1559**
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1561-1567,1570**
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574-1578**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**A•2266-2267, D•1580-1582**
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221**	**D•1585,1587**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592-1594**
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407**	**D•1596-1597**
§ **Astec Standard Power, Oceanside, CA 92054, 619-757-1880**	**D•1600-1603**
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448	**D•1605-1607**
Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900	**D•1608-1609**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1610-1613, 1615**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244-2245**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618-1622**
Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411	**D•1624**
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	**D•1625-1628**
§ **Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600**	**D•1631-1635,2090-2092**
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	**D•1636-1645**
Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	**D•1646-1647**
§ **Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144**	**D•1648-1650**
§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666**	**D•1651**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	**D•1654-1655**
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600**	**D•1656-1657**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1660-1664**
EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1670-1671**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1674,1677-1680,1682-1683**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1684-1685,2257**
EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680	**D•1686**
Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410	**D•1689**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691,1696-1697**
Farnell Advance Power, Solon, OH 44139, 216-349-0755	**D•1699-1704**
Fetco, Sanford, FL 32773, 407-321-3800	**A•2354**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1706-1707,1709**
Geopower Inc., Ramsey, NJ 07446, 201-236-0156	**D•1858**
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	**D•1712-1718,1720**
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000**	**D•1730**
Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	**D•1734-1735**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
§ **Hauman, Inc., San Jose, CA 95131, 408-434-0888**	**D•1737**
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•2268**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**D•2272**
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	**D•1747-1749**
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	**D•1751-1752**
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2110-2111**
Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**D•2112**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1757-1759**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1763**
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	**D•1765**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1767**
§ **Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295**	**D•1772-1775**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1808-1809**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1810-1813**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816-1817,2130**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**B•1844, D•2277**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	**D•1828**
† **Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712**	**D•2131-2132,2134-2135**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1832-1835**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837,1843-1844**
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	**D•1846**
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550	**D•1850**
§† **Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700**	**D•1847**
Multi Products International, West Paterson, NJ 07424, 201-890-1344	**D•1848**
† **NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900**	**D•1849**
NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
Oram High Voltage, Dayton, TX 77535, 409-258-5553	**D•1852**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**A•2443**
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521	**A•1261, D•1857**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337	**D•1874-1877**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	**D•1879,1881**
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885	**D•1882-1884**
† **Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500**	**D•2186**
§ **Power-One, Inc., Camarillo, CA 93012, 805-987-8741**	**D•1886-1895**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1896-1897**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1900-1905**
† **Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959**	**D•1907**
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	**D•1914-1915**
§ **Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616**	**D•1913**
† **RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450**	**D•1916-1917,2202**
§ **Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654**	**D•1918-1919,2211**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244**	**D•1937**
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740**	**D•1938-1940**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270**	**D•1948-1955**
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**A•2565, D•1958**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960-1963**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§ **Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888**	**D•1998-2001**
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272**	**D•2002**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2004-2006,2212**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2008-2011**
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	**D•2013**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2038**
§# **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984**	**D•1913**
Voltex, Amityville, NY 11701, 516-842-2772	**D•2217**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041,2306-2307**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2044-2047**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced High Voltage Company, Tucson, AZ 85751	602-721-2424;818-997-7222
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
A.L.E. Sys., Inc., Ashland, MA 01721	508-881-5252
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
American Monarch, Minneapolis, MN 55421	612-788-9161
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672

Candela Laser Corporation, Wayland, MA 01778 508-358-7637
† CEC, Orange, CA 92665 714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788 516-582-4422
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
Christie Electric Corp., Gardena, CA 90248 310-715-1402
Converter Power, Inc., Ipswich, MA 01938 508-356-2558
C-Tek Inc. Wakefield MA 01880 .... 617 246-1720
† CTS of Canada, Ltd., Streetsville. ONTARIO, CAN. L5M 1Y9 416-826-1141
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 514-694-9320
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Delta Products Corporation, Fremont, CA 94538 510-770-0660
Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 516-293-4100
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE .... (0256) 810808
Green Engineering, Melrose, MA 02176 617-665-8994
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
† HC Power Inc., Irvine, CA 92714-5716 714-261-2200
§ HC Protek, Northvale, NJ 07647 201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
Industrial Electronic Resources, Corona, CA 91720 .... 909-734-1111;800-433-5160
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167 805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
§ James Electronics, Chicago, IL 60618 312-463-6500
Keytronics, Inc., Endicott, NY 13760 607-754-5405
§ Kraft Dynatronix, Inc., Amery, WI 54001 .... 715-268-8118;800-826-7172
† Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
LH Research, Inc., Tustin, CA 92680 1-800-547-2537
§ Lutze, Inc., Charlotte, NC 28217-9805 .... 704-357-8835;800-447-2371
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 .... 714-956 9200
Mesa Power Systems, Escondido, CA 92029 619-489-8162
§ Metermaster, Tempe, AZ 85282 602-431-0015
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
Modular Devices Inc., Torrance, CA 90503 310-542-8561
§† Nedap N.V., Groenlo, HOLLAND 7140 AA .... +31-5440-71111
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
Onan Power/Electronics, Minneapolis, MN 55344-3577 612-943-4600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909 407-831-2000
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622 813-573-1900
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248 213-323-8120
§ Power General, Nidec Corp., Canton, MA 02021 617-828-6216
§ Power Solutions Inc., Pompano Bch., FL 33064 305-943-4110
Power Systems, Inc., Bloomfield, CT 06002 203-726-1300
† PPM, Inc., Cleveland, OH 44122 1-800-899-4776
† QPS Inc., Salem, NH 03079 603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
† Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402 805-528-5858
Ratelco, Power Systems, Seattle, WA 98109-5589 206-624-7770
Royal Enterprises Co., Simi Valley, CA 93063 .... 805-522-8730;818-998-2455
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
† Sorensen Company, Paxton, IL 60957 800-525-2024
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548 904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036 704-892-8872
† Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
Tecnetics Inc., Boulder, CO 80303 303-442-3837
Tower Electronics, Inc., Fridley, MN 55432 612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 909-371-5751
§ Tripp Lite, Chicago, IL 60610-4188 312-329-1777
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580
Urban Electronics, Dover, MA 02030 617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 .... 415-493-4000; 800-544-4636
§† Vicor Corp., Andover, MA 01810 508-470-2900
Viking Industrial Products, Marlboro, MA 01752 508-481-4600
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587 510-429-7170
§ Wall Industries, Exeter, NH 03833 603-778-2300
Westcor Corporation, Los Gatos, CA 95032 408-395-7050
WPI Group, Inc., Warner, NH 03278 603-456-3111

Power Supplies, 1000 to 1500 W Output — See Power Supplies, Greater Than 300 W Output (Vol. D)

Power Supplies, 1500 to 3000 W Output — See Power Supplies, Greater Than 300 W Output (Vol. D)

Power Supplies, Greater than 300 W Output-4000

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512-1513
Acopian Technical Company, Easton, PA 18044, 215-258-5441 .... D•1517
§† Adtech Power Inc., Anaheim, CA 92806, 714-634-9211 .... D•1549
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 .... D•2231
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 .... D•1554,1556
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725 .... D•1559
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355 .... D•1561
Applied Power Conversion, Technology Dynamics. Inc., Bergenfield, NJ 07621, 201-385-0500 .... D•1574-1578
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 .... D•1585,1587
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 .... D•1592-1594
§ Astec High Voltage, Ashland, MA 01721, 508-881-8407 .... D•1596
Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1598, 1600-1601
§ Autec Power Systems. Simi Valley. CA 93065. 805-522-0888 .... D•1610,1613
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341,800-645-2074 .... D•1617
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 .... D•2244-2245
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665 .... D•1625,1627-1629
Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 .... D•1631-1633,1635,2090
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565; .... D•1640-1641
Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000 .... D•1646-1647
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144 .... D•1648-1649
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .... D•1651
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 .... D•2082
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1656-1657
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... D•1661
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200 .... D•1665,1667
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 .... D•1671
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1674-1680,1682-1683
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•1684,2259
Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410 .... D•1689
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561 .... D•1697
Farnell Advance Power, Solon, OH 44139, 216-349-0755 .... D•1699-1704
Fetco, Sanford, FL 32773, 407-321-3800 .... A•2354
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 .... D•1706-1707
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 .... D•1712-1713,1719,1721-1729
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1965
† HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 .... D•1738-1739,1741
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 .... D•2268
§ Instek Corporation, City of Industry, CA 91745, 818-336-6537 .... D•1745
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 .... D•2272
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666 .... D•1749
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331 .... D•1751
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434 .... D•2110-2111
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095 .... D•1762-1763
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712 .... D•1765
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 .... D•1767-1769
§ Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 .... D•1772
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1808
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 .... D•1810-1815
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 .... D•1828
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... D•1832-1835
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1837,1843-1844
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700 .... D•1847
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900 .... D•1849
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 .... D•1851
Oram High Voltage. Dayton. TX 77535. 409-258-5553 .... D•1852
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751 .... D•1879-1881
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 .... D•2186
Power-One, Inc., Camarillo, CA 93012, 805-987-8741 .... D•1887,1892-1895
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 .... D•1896-1897
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788 .... D•1900
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959 .... D•1907
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800 .... D•1915
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616 .... D•1913

RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 ... D•1917
§ **Shindengen America Inc., Westlake VL, CA 91362, 800-634-3654 ... D•1919,2211**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ... D•1922
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740 ... D•1938-1941**
§ **Taltronics, Dimetrics, Inc.. Davidson, NC 28036, 704-892-8872 ... D•1942**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... D•1948**
† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 ... A•2565, D•1958**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 ... D•1020
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 ... D•1960,1962,1964
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1965
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272 ... D•2002**
Tracewell Enclosures, Inc.. Westerville, OH 43081, 614-846-6175;800-848-4525 ... C•1107-1108,1110
Tri-Source Inc., Shelton, CT 06484, 203-924-7030 ... D•2010-2011
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442 ... D•2017**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ... D•2037-2039
†# **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984 ... D•1913**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2306-2307
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001 ... D•2044-2046
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† Advanced Conversion Tech. Middletown, PA 17057 ... 717-939-2300
† **Advanced Power Designs Inc., Irvine, CA 92714 ... 714-263-8605**
A.L.E. Sys., Inc., Ashland, MA 01721 ... 508-881-5252
Alliance Electronics Corp., Wilsonville, OR 97070-0503 ... 503-682-4976
† **American Monarch, Minneapolis, MN 55421 ... 612-788-9161**
† Analog Modules, Inc. Longwood, FL 32750-3426 ... 407-339-4355
† **Avtel/Unitron, Dallas, TX 75238 ... 214-340-8600**
† Axel Electronics, Inc, Subsidiary of FPBSM Industries Inc., Rancho Dominquez CA 90220 ... 718-291-3900
† B C Systems, Inc., Setauket, NY 11733 ... 516-751-9370
#**BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808**
BICC-VERO Electronics, Inc. Hamden, CT 06514 ... 203-288-8001;1-800-242-2863
† Brandt Electronics, Inc., Mountain View, CA 94043 ... 415-967-4944
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Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5672
Candela Laser Corporation, Wayland, MA 01778 ... 508-358-7637
† **CEC Electronics Corp., Hauppauge, NY 11788 ... 516-582-4422**
Chloride Electro Networks Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
Christie Electric Corp., Gardena, CA 90248 ... 310-715-1402
Converter Power, Inc., Ipswich, MA 01938 ... 508-356-2558
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 ... 416-826-1141
Darrah Electric Company Cleveland, OH 44102 ... 216-631-0912
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
Deltron, inc., N Wales, PA 19454-9990 ... 215-699-9261
Elgin Electronics, Erie, PA 16509-3570 ... 814-864-4921
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 ... 516-293-4100
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 ... 818-574-1175
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE ... (0256) 810808
Green Engineering, Melrose, MA 02176 ... 617-665-8994
§ HC Protek, Northvale NJ 07647 ... 201 767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 ... 914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701 ... 914-423-6636
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
† **Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140**
IMC Power Sources, San Jose, CA 95112 ... 408-441-9614
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
ITT Power Systems Corp. ITT Corp., Tucson, AZ 85706 ... 602-889-7600
§ **Kraft Dynatronix, Inc., Amery, WI 54001 ... 715-268-8118;800-826-7172**
† Lambda Electronics Inc., Melville, NY 11747-3700 ... 516-694-4200
Laser Magnetics, Chelmsford, MA 01824 ... 508-250-1507
LH Research, Inc., Tustin, CA 92680 ... 1-800-547-2537
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 ... 714-956-9200
§ **Metermaster, Tempe, AZ 85282 ... 602-431-0015**
Modular Devices Inc., Torrance, CA 90503 ... 310-542-8561
Northern Ampower Corp., Novi, MI 48374 ... 313-349-4860
Onan Power/Electronics, Minneapolis, MN 55344-3577 ... 612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909 ... 407-831-2000
Pacific Power Source Corp., Huntington Bch., CA 92649 ... 714-898-2691;800-854-2433
§ Phasetronics Inc., Motortronics Inc., Clearwater, FL 34622 ... 813-573-1900
Phenix Technologies, Accident, MD 21520 ... 301-746-8118
Power General, Nidec Corp., Canton, MA 02021 ... 617-828-6216
† QPS Inc., Salem, NH 03079 ... 603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 ... 818-591-8189
Ratelco Power Systems, Seattle, WA 98109-5589 ... 206 624-7770
Schott Corp., Wayzata, MN 55391 ... 612 475-1173
Schroff, Inc., Warwick, RI 02886 ... 401-732-3770
† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
† **Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200**
† Sorensen Company, Paxton, IL 60957 ... 800-525-2024
† **ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548 ... 904-244-0043**
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
Teal Electronics Corporation San Diego, CA 92121 ... 619-558-9000
† **Technology Dynamics Inc., Bergenfield, NJ 07621 ... 201-385-0500**
§ Top-Link Computer Inc., Milpitas, CA 95035-8001 ... 408-946-7888
Tower Electronics, Inc., Fridley, MN 55432 ... 612-571-3737
† Transchem, Jetronics industries Inc., Corona, CA 91718 ... 909-371-5751
§ **Tripp Lite, Chicago, IL 60610-4188 ... 312-329-1777**
Urban Electronics, Dover MA 02030 ... 617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 ... 415-493-4000; 800-544-4636
§† Vicor Corp., Andover, MA 01810 ... 508-470-2900
§ **Wall Industries, Exeter, NH 03833 ... 603-778-2300**
Wayne Kerr Inc Farnell Electronics plc, Woburn, MA 01801 ... 617-938 8390; 1-800-933 9319
Westcor Corporation, Los Gatos, CA 95032 ... 408-395-7050
WPI Group, Inc., Warner, NH 03278 ... 603-456-3111

Power Supplies, Avalanche, Photodiodes-4000

Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 ... B•1163,1319
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER ... D•2015
American Monarch, Minneapolis, MN 55421 ... 612-788-9161
† **Analog Modules, Inc., Longwood, FL 32750-3426 ... 407-339-4355**
§ Astec High Voltage Ashland, MA 01721 ... 508 881 8407
† EMCO High Voltage Co., Sutter Creek, CA 95685 ... 209-223-3626;800-546 3680
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 ... 908-534-9007
† **Power Technology, Inc., Little Rock, AR 72219-1117 ... 501-568-1995**

Power Supplies, AC Output-4050

† Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ... D•2223-2225
† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 ... D•1491**
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... D•1512,2228-2229
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ **07927, 201-267-1900 ... D•2230-2231**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... D•1560
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, **201-385-0500 ... D•1575-1576**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2266, D•1581-1583
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 ... D•1586**
§ Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 ... D•1608
† **Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 ... D•2232-2235,2237**
† **Avtel/Unitron, Dallas, TX 75238, 214-340-8600 ... D•2241-2243**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ... D•2244-2245.2247,2249
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER ... D•2250-2252
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ... D•2256
§ Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ... **D•2253-2255**
† **D & B Power, Inc., Bayshore, NY 11706, 516-586-5955 ... D•1654**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... D•1660-1661
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ... D•1672
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620 ... D•1673
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 ... D•1678
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•1685,2257-2259**
† **Endicott Research Group, Endicott, NY 13760, 607-754-9187 ... B•1045-1048**
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144 ... D•2260
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 ... D•1688
§ Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410 ... D•1689
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 ... **D•1706**
Georator Corp., Manassas, VA 22110-5512, 800-523-9938 ... D•2261-2263
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ... D•2266-2267
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631 ... B•1958**
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2268-2271
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... D•2272-2273
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 ... **D•2274-2275**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000 ... D•1750
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 ... D•1807,2276
† **Kikusui International Corp., Signal Hill, CA 90804-1203,** 310-986-1677;800-545-8784 ... D•1808-1809
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444 ... B•1172
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ... B•1844, D•1821,1823,1825-1826,2277
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ... D•2278-2280
Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712 ... D•2131-2132
MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 ... D•2283
† Modular Devices, Shirley, NY 11967, 516-345-3100 ... D•1837,1843
§ Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... D•1848

† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900	**D•1303,1849**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•2284-2285**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691 800-854-2433	D•2286-2290
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**D•2291**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896-1897**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1904-1905**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	**D•2300**
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	**D•1913**
Singer Data Products, Inc., Bensenville, IL 60106, 708-860-6500	**D•1107**
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191	**A•2535**
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244	**D•1937**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945**
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020-1021**
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	**D•2001**
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622	**D•2003**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2038**
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	**D•1913**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041,2306-2307**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2043**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
Acme Electric Corporation, Cuba, NY 14727	716-968-2400
§ Adcour. Inc., Sharon, MA 02067	617-784-8123
Adtech Power Inc., Anaheim, CA 92806	714-634-9211
Advanced Control Systems, Costa Mesa, CA 92626-4114	714-540-9010
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
AMASCO, Torrance, CA 90501	310-781-9494
† American Monarch, Minneapolis, MN 55421	612-788-9161
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
† Autronics Corp., Arcadia, CA 91006	818-445-5470
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Basler Elec., Electronic Product Group, Highland, IL 62249	618-654-2341; 800-645-2074
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Belmont Instrument Corp., Billerica, MA 01821	508-663-0212
Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Bomar Interconnect Products, Ledgewood, NJ 07852	201-347-4040
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
Cambridge Electronics Laboratories, Somerville, MA 02144	617-629-2805
Cell-Con, Inc., Exton, PA 19341	215-363-8552
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Cross Electronics, Warrendale, PA 15086	412-776-1591
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
Delta Products Corporation, Fremont, CA 94538	510-770-0660
§ Dimensions Unlimited, Inc., St. Paul, MN 55110	612-770-5630
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
Electric Device, Canfield, OH 44406	216-533-1111
† Electronic Development Associates, Dix Hills, NEW YORK 11746	516-673-3881
Elma Engineering, Palo Alto, CA 94303	415-494-7303
E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224	716-655-0800
# E M D Electronics, Sigmatron L.P., Elk Grove Village, IL 60007	708-956-8000
Energy Systems, Vancouver, WA 98682	206-896-8310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
Engineering Design & Sls., Danville, VA 24541	804-792-6405
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627	714-557-1636
† ETM Electromatic Inc., Newark, CA 94560	510-797-1100
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§ Exeltech Inc., Ft. Worth, TX 76118	817-595-4969
Falcon Electric, Monrovia, CA 91016	800-842-6940
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006	818-574-1175
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
GENERAL POWER CORPORATION, Anaheim, CA 92815	714-956-9321
Golden Pacific Electronics, Inc, Placentia, CA 92670	714-993-6970
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
§ James Electronics, Chicago, IL 60618	312-463-6500
Jerome Industries Corp., Elizabeth, NJ 07201	908-353-5700
Litton Electron Devices, San Carlos, CA 94070	415-591-8411
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
Luxtron Inc., Haverhill, MA 01830-4803	508-372-5211
MACROAMP Inc., Ukiah, CA 95482	800-458-8892
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Magnetek Triad, Huntington, IN 46750	219-356-7100
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† Mep Controls, Bordentown, NJ 08505	609-298-7300
§ Metermaster, Tempe, AZ 85282	602-431-0015
Micro Power Intl., Inc., San Diego, CA 92126	619-271-0831;619-271-5942
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Irvine, CA 92714	714-474-3900
Oeco Corp., Milwaukie, OR 97222	503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
§ Optrex/Satori, Torrance, CA 90503	310-214-1791
† Oram High Voltage, Dayton, TX 77535	409-258-5553
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622	813-573-1900
Phenix Technologies, Accident, MD 21520	301-746-8118
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Conversion Products, Crystal Lake, IL 60014	815-459-9100
PowerLine, Inc., Denver, CO 80210	303-698-7883
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
† Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
Sanford-Miller Corp., Oceanside, NY 11572	516-763-0926;800-645-5900
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
Schott Corp., Wayzata, MN 55391	612-475-1173
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
Skyway Magnetics, Warner Springs, CA 92086-9714	619-782-3342
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
TMP Inc., Santa Ana, CA 92705	714-558-8028
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
† Transmagnetics, Farmingdale, NY 11735	516-293-3100
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
Uniplex Corp., St. Paul, MN 55117	612-490-1936
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Voltex, Amityville, NY 11701	516-842-2772
§ Wall Industries, Exeter, NH 03833	603-778-2300
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201
WPI Group Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040

Power Supplies, Analog Programmable-4000

Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**

† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Advanced High Voltage Company, Tucson, AZ 85751 ... 602-721-2424;818-997-7222
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 .. 416-298-0560
Computer Power Supplies (CPS), Lake Oswego, OR 97035 503-684-8026
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
EMCO High Voltage Co., Sutter Creek, CA 95685 .... 209-223-3626;800-546-3680
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 908-534-9007
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
§ Kenwood U.S.A., Long Beach, CA 90810 310-761-8295
Kikusui International Corp., Signal Hill, CA 90804-1203 ... 310-986-1677;800-545-8784
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 619-575-1100
Magna-Power Electronics, Inc., Whippany, NJ 07981 201-428-1197
§ Metermaster, Tempe, AZ 85282 602-431-0015
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
† Power Ten, Inc., Sunnyvale, CA 94086 408-738-5959
# Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
ULTRAVOLT, Inc., Ronkonkoma, NY 11779 .... 800-876-POWER
§ Xantrex Technology Inc., Bellingham, WA 98227-9754 206-671-2966

Power Supplies, Bipolar-4000

§ AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 ...... D•2052-2055
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 .... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512
§ Acon, Inc., South Easton, MA 02375, 508-230-8022 ..... D•2058-2059,2061-2066
Acopian Technical Company, Easton, PA 18044, 215-258-5441 .... D•1517
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 .... D•1618
§ Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411 .... D•1624
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 ... D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•2099-2101
EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 .... D•1670
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1678
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•1687
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ... B•1937,1946
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 .... D•1706
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 .... D•1716,1718
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331 ..... D•1751, 1755
Interpoint Corporation, Redmond, WA 98052, 206-882-3100 .... D•2112
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1808
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... D•1834-1835
† Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1837
NWL Transformers, Bordentown, NJ 08505, 609-298-7300 .... D•1851
Oram High Voltage, Dayton, TX 77535, 409-258-5553 .... D•1852
† Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 .... D•1882-1883
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741 .... D•1886
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 .... D•1916-1917
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... D•1922
§ Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740 .... D•1938-1939
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... D•1020
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 .... D•1960-1962
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 .... D•2037
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 .... D•2041,2306
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
American Monarch, Minneapolis, MN 55421 612-788-9161
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621 201-385-0500
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
Astec Standard Power, Oceanside, CA 92054 619-757-1880
Astro-Geo-Marine, Inc., Ventura, CA 93003 805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Bikor, Microsemi Corporation, Torrance, CA 90501 213-539-6320
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 .. 416-298-0560
† CEC Electronics Corp., Hauppauge, NY 11788 516-582-4422
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211 714-544-6665
Computer Power Supplies (CPS), Lake Oswego, OR 97035 503-684-8026
§ Computer Products/Power Conversion America, So. Boston, MA 02127 .... 800-733-9288;617-464-6600
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033 .... 805-486-4565;
§ CPS, Lake Oswego, OR 97035 503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
D & B Power, Inc., Bayshore, NY 11706 516-586-5955
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
§ Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electro-Mech Co., Colorado Springs, CO 80915 719-597-1620
Electrostatics, San Diego, CA 92111 619-279-1414
† EMCO High Voltage Co., Sutter Creek, CA 95685 .... 209-223-3626;800-546-3680
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
Energy Systems, Vancouver, WA 98682 206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 310-635-9555
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Industrial Electronic Resources, Corona, CA 91720 ...... 909-734-1111;800-433-5160
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167 .. 805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
§ Kraft Dynatronix, Inc., Amery, WI 54001 .... 715-268-8118;800-826-7172
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 619-575-1100
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
LH Research, Inc., Tustin, CA 92680 1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052 216-288-1122
Magna-Power Electronics, Inc., Whippany, NJ 07981 201-428-1197
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 908-283-4925
§ Martel Electronics, Windham, NH 03087 603-893-0886
§ Metermaster, Tempe, AZ 85282 602-431-0015
† Micro Power Intl., Inc., San Diego, CA 92126 .... 619-271-0831;619-271-5942
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
Modular Devices Inc., Torrance, CA 90503 310-542-8561
MPC, Div. of Consulting Systems, Danville, NH 03819 ... 603-642-5913;1-800-238-8380
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006 503-646-4700
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
NF Electronic Instruments, State College, PA 16801 814-237-5580
Northern Ampower Corp., Novi, MI 48374 313-349-4860
§ Opamp Labs, Inc., Los Angeles, CA 90038 213-934-3566
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Pioneer Magnetics, Santa Monica, CA 90404 310-829-6751
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248 213-323-8120
§ Power Designs, Inc., Westbury, NY 11590 516-333-6200
† Power Functions Engineering, Garland, TX 75042 214-278-0996
§ Power/Mate Corporation, San Diego, CA 92110 .... 800-843-8544;619-299-3800
† Power Supply Concepts Inc., Jupiter, FL 33458-8947 407-746-1800
Power Switch Corporation, Lodi, NJ 07644 201-478-5788
Power Systems, Inc., Bloomfield, CT 06002 203-726-1300
§ Pulse Instruments Co., Torrance, CA 90502 310-515-5330
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
Reich Associates, Inc., Lakehills, TX 78063 210-751-3220
§ Reliability Incorporated, Houston, TX 77218 713-492-0550
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087 .. 603-893-2330
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
Sola, Elk Grove Village, IL 60007-5666 708-439-2800
Sorensen Company, Paxton, IL 60957 800-525-2024
Taylor Electronics, Inc., Tempe, AZ 85283 602-838-4523
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 .... 708 803 6100
† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
§ Tidewater Technological, Newport News, VA 23601 804-874-2800
Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
Tri-Source Inc., Shelton, CT 06484 203-924-7030
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 .... 415-493-4000; 800-544-4636
§† Vicor Corp., Andover, MA 01810 508-470-2900
Viking Industrial Products, Marlboro, MA 01752 508-481-4600
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232:800-962-4638
§ Wall Industries, Exeter, NH 03833 603-778-2300
WPI Group, Inc., Warner, NH 03278 603-456-3111
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001
Xylog Corp., Hackensack, NJ 07601 201-489-4040

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† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 .... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512
Acopian Technical Company, Easton, PA 18044, 215-258-5441 .... D•1517
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 .... D•2230
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222 .... D•1553
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 .... D•1555

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	D•1560
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	D•1576
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	D•2232-2233
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	D•2245
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	D•2252
Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	D•1633.2090
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	D•1651
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	D•2099-2102
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	D•1673
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	D•1684
§ Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410	D•1689
Farnell Advance Power, Solon, OH 44139, 216-349-0755	D•1699,1703
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	D•1706
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	D•1720
GMW Associates, Redwood City, CA 94064, 415-368-4884	D•1263
Hauman, Inc., San Jose, CA 95131, 408-434-0888	D•1737
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	D•2269.2271
§ Instek Corporation, City of Industry, CA 91745, 818-336-6537	D•1745
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	D•1756
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	D•1766
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	D•1807
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	D•1808-1809
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	D•1828-1830
Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	D•1015
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	D•1832-1833,1835
† Modular Devices, Shirley, NY 11967, 516-345-3100	D•1837,2136
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900	D•1849
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	D•1886
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	D•1897
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959	D•1907
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	D•1910
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	D•1945
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	D•1020
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622	D•2003
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	D•2004
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	D•2015
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	D•2037-2038
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2041
§ AAK Corp, Haverhill, MA 01832	508-373-3769;800-886-2225
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† ACME-URDC, Inc., West Jordan, UT 84084	801-561-9385
§ Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
A.L.E. Sys., Inc., Ashland, MA 01721	508-881-5252
AMASCO, Torrance, CA 90501	310-781-9494
American Magnetics, Oak Ridge, TN 37831-2509	615-482-1056
† American Monarch, Minneapolis, MN 55421	612-788-9161
American Skynet Electronic Co., Milpitas, CA 95035	408-945-6355
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
§ Astec High Voltage, Ashland, MA 01721	508-881-8407
Astec Standard Power, Oceanside, CA 92054	619-757-1880
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
† Atlas Engineering Corp., Dorchester, MA 02121	617-445-7100
Ault, Incorporated, Minneapolis, MN 55428	612-493-1900
† Autronics Corp., Arcadia, CA 91006	818-445-5470
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Cardon Corp., Boston, MA 02116	617-267-1760
† CEC, Orange, CA 92665	714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
† CELCO, Mahwah, NJ 07430	201-327-1123
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Chloride Power Electronics, Caledonia, NY 14423	716-538-4421
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033	805-486-4565
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Converter Power, Inc., Ipswich, MA 01938	508-356-2558
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
CPS, Lake Oswego, OR 97035	503-684-8026
Cross Electronics, Warrendale, PA 15086	412-776-1591
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
† D & B Power, Inc., Bayshore, NY 11706	516-586-5955
Darrah Electric Company, Cleveland, OH 44102	216-631-0912
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Dynage Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
Electric Device, Canfield, OH 44406	216-533-1111
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
Electronic Measurements, Neptune, NJ 07753	908-922-9300
Elma Engineering, Palo Alto, CA 94303	415-494-7303
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Endicott Research Group, Endicott, NY 13760	607-754-9187
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
Energy Systems, Vancouver, WA 98682	206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
GC International Inc., Plano, TX 75074	214-423-8411
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
† Good-All Electric, Inc., Fort Collins, CO 80524	303-484-3080;800-826-7891
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
MACROAMP Inc., Ukiah, CA 95482	800-458-8892
Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
† Mep Controls, Bordentown, NJ 08505	609-298-7300
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Irvine, CA 92714	714-474-3900
Northern Ampower Corp., Novi, MI 48374	313-349-4860
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Optronic Laboratories Inc., Orlando, FL 32811	407-422-3171;800-899-3171
† Oram High Voltage, Dayton, TX 77535	409-258-5553
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Polytron Devices, Inc., Paterson, NJ 07544	201-345-5885
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
Seven Mountains Sci. Inc., Boalsburg, PA 16827	814-466-6559
Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828

† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
† Sorensen Company, Paxton, IL 60957	800-525-2024
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
†# Tauber Elctrns. Inc., San Diego, CA 92117	619-274-7242;1-800-927-0004
† Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Top-Link Computer Inc., Milpitas, CA 95035-8001	408-946-7888
Torotron Corp., Mt. Vernon, NY 10550	914-664-2050
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
§ Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638
§ Wall Industries, Exeter, NH 03833	603-778-2300
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4	514-694-9136
WPI Group, Inc., Warner, NH 03278	603-456-3111
† Xenotronix Inc., Valencia, CA 91355	805-257-4793
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001
Xylog Corp., Hackensack, NJ 07601	201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043	415-968-9176
Zytronics, Inc., Bedford, NH 03110	603-623-8888

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† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222	**D•1553**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1610**
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711	**D•1616**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2245**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618-1621**
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	**D•2252**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2254-2255**
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1651**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	**D•1655**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•2099-2102**
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	**D•1666-1667**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1677**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1706-1707**
Georator Corp., Manassas, VA 22110-5512, 800-523-9938	**D•2261-2263**
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	**D•1712-1715,1717-1718,1723-1726**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
§ Hauman, Inc., San Jose, CA 95131, 408-434-0888	**D•1737**
§ Instek Corporation, City of Industry, CA 91745, 818-336-6537	**D•1745**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1762-1763**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1766-1768**
Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295	**D•1772-1775**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1808-1809**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1817**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	**D•1828,1830**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1832-1834**
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900	**D•1849**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1895**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1897**
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959	**D•1907**
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	**D•1910**
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	**D•1916,2202**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945**
† Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	**D•1020**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2011**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2044-2045,2047**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
§ Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
Ajax Magnethermic Corp., Warren, OH 44483	216-372-8511
# Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
American Monarch, Minneapolis, MN 55421	612-788-9161
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
§ Astec High Voltage, Ashland, MA 01721	508-881-8407
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
Ault, Incorporated, Minneapolis, MN 55428	612-493-1900
† Avtel Unitron Dallas, TX 75238	214-340-8600
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Bay Components, Inc., Annapolis, MD 21403	410-268-0122
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
§ Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
C & C Jetronic, Inc., Allentown, NJ 08501	609-259-8855
† CEC Orange, CA 92665	714-637-2970
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
§ CPS, Lake Oswego, OR 97035	503-684-8026
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
Darrah Electric Company, Cleveland, OH 44102	216-631-0912
Deltona Transformer Corp., DeLand, FL 32724	904-736-7900
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
Electric Device, Canfield, OH 44406	216-533-1111
Electro-Mech Co., Colorado Springs, CO 80915	719-597-1620
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Endicott Research Group, Endicott, NY 13760	607-754-9187
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
Energy Systems, Vancouver, WA 98682	206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006	818-574-1175
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
† Good-All Electric, Inc., Fort Collins, CO 80524	303-484-3080;800-826-7891
Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
HC Power Inc., Irvine, CA 92714-5716	714-261-2200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-888-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Jerome Industries Corp., Elizabeth, NJ 07201	908-353-5700
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
LH Research Inc., Tustin, CA 92680	1-800-547-2537
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Marathon Power Technologies, Waco, TX 76714-8233	817-776-0650
Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Nedap N.V., Groenlo, HOLLAND 7140 AA	+ 31-5440-71111
NF Electronic Instruments, State College, PA 16801	814-237-5580
Northern Ampower Corp., Novi, MI 48374	313-349-4860
Oeco Corp., Milwaukie, OR 97222	503-659-7932
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Oram High Voltage, Dayton, TX 77535	409-258-5553
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
† Power Functions Engineering, Garland, TX 75042	214-278-0996
§ Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020

§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
Schott Corp., Wayzata, MN 55391	612-475-1173
Semtech Corporation, Newbury Park, CA 91320	805-498-2111
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700:800-645-5516
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Teco Corp., Winnisquam, NH 03289	603-524-1998
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
§ WECO Electrical Connectors, Inc., Kirkland. Quebec, CANADA H9H 3L4	514-694-9136
† Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811
WPI Group, Inc., Warner, NH 03278	603-456-3111
§ Xantrex Technology Inc., Bellingham, WA 98227-9754	206-671-2966

Power Supplies, DC Input, AC Output High Voltage-4050

Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010	**D•2224-2225**
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230-2231**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592**
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407**	**D•1596-1597**
† **Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500**	**D•2232-2233,2237**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1660-1661**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2257**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2275**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
§ **LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600**	**B•1844, D•2277**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	**D•1828**
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550	**D•1850**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1896-1897**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2306-2307**
American Monarch, Minneapolis, MN 55421	612-788-9161
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
# BEC Inc./Certified Calibration Labs. Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
Belmont Instrument Corp., Billerica, MA 01821	508-663-0212
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
Cambridge Electronics Laboratories, Somerville, MA 02144	617-629-2805
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
CVDS Inc., Pte. Claire.Que., CANADA H9R 1C2	514-694-9320
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224	716-655-0800
# E M D Electronics, Sigmatron L.P., Elk Grove Village, IL 60007	708-956-8000
§ Exeltech Inc., Ft. Worth, TX 76118	817-595-4969
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ Laube Technology, Woodland Hills, CA 91367	818-703-1188
Luxtron Inc., Haverhill, MA 01830-4803	508-372-5211
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Modular Devices, Shirley, NY 11967	516-345-3100
Oram High Voltage, Dayton, TX 77535	409-258-5553
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
† QPS Inc., Salem, NH 03079	603-893-5100
Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§ Tamura Corporation of America, Temecula, CA 92589-2230	909-699-1270
TMP Inc., Santa Ana, CA 92705	714-558-8028
Tri-Source Inc., Shelton, CT 06484	203-924-7030
Tumbler Technologies, Fremont, CA 94539	510-651-7724
Voltex, Amityville, NY 11701	516-842-2772
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Power Supplies, DC Input, DC Output — See Converters, DC to DC (Vol. D)

Power Supplies, Digital Programmable-4000

Datel, Inc., Mansfield. MA 02048-1194. 508-339-3000	**D•2099,2101-2102**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2257**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295	**D•1773**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1835**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
AMASCO, Torrance, CA 90501	310-781-9494
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677:800-545-8784
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
§ Metermaster, Tempe, AZ 85282	602-431-0015
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
§ Xantrex Technology Inc., Bellingham, WA 98227-9754	206-671-2966

Power Supplies, Disk Drive-4000

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**A•2266-2267**
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1602**
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	**D•1639,1642-1644**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740**	**D•1939**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
Absopulse Electronics Ltd. Carp, Ont., CAN K0A 1L0	613-836-3511
Advanced Power Solutions. M & L Enterprises Pleasanton, CA 94588	510-734-3060
# American Skynet Electronic Co., Milpitas, CA 95035	408-945-6355
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
§ Autec Power Systems, Simi Valley, CA 93065	805-522-0888
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
† CEC, Orange, CA 92665	714-637-2970
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
IMC Power Sources, San Jose, CA 95112	408-441-9614
§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
International Power Sources, Inc., Ashland, MA 01721	508-881-7434
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
§ LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Modular Devices Inc., Torrance, CA 90503	310-542-8561
Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
RO Associates, Inc., Sunnyvale, CA 94088	408-744-1450
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§ Tamura Corporation of America, Temecula, CA 92589-2230	909-699-1270
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5	416-630-8108
§ Top-Link Computer Inc., Milpitas, CA 95035-8001	408-946-7888
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

Power Supplies, Encapsulated-4000

§ AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	**D•2052,2054**
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
§ Acon, Inc., South Easton, MA 02375, 508-230-8022	**D•2058**
Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1555**
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	D•1576
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1589**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1592**
§ Astec High Voltage, Ashland, MA 01721, 508-881-8407	**D•1596-1597**
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711	**D•1616**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618**
§ Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411	**D•1624**
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	**D•1630**
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	**D•1635,2090**
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880	**D•2096-2097**
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	**D•1648**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•2099-2102**
Electromech, Inc., Irvington, NJ 07111, 201-318-7999	**D•1672**
† Endicott Research Group, Endicott, NY 13760, 607-754-9187	**B•1047, D•1687**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691,1694-1695**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	D•1706
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	**D•1751-1752**
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2110-2111**
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**A•1706, D•2112,2122-2123**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**D•2125**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756,1758**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816-1817**
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**D•1820,1824**
† Modular Devices, Shirley, NY 11967, 516-345-3100	**D•1837,1840-1843**
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	**D•1846**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
† Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885	**D•1882-1884**
§† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500	**D•2186,2192,2194-2195**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896-1897**
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•1916
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945**
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**A•2565, D•1958**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272	D•2002
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2212**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced High Voltage Company, Tucson, AZ 85751	602-721-2424;818-997-7222
† American Monarch, Minneapolis, MN 55421	612-788-9161
American Skynet Electronic Co., Milpitas, CA 95035	408-945-6355
† Anadyne Power Supply Division, Santa Fe Springs, CA 90670-5216	213-921-9364
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
§ Astec Standard Power, Oceanside, CA 92054	619-757-1880
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Babcock, Inc., Orange, CA 92667	714-633-3700
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Cambridge Electronics Laboratories, Somerville, MA 02144	617-629-2805
Cell-Con, Inc., Exton, PA 19341	215-363-8552
§ Centent Co., Santa Ana, CA 92707	714-979-6491
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§† CPS, Lake Oswego, OR 97035	503-684-8026
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
† D & B Power, Inc., Bayshore, NY 11706	516-586-5955
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Delta Products Corporation, Fremont, CA 94538	510-770-0660
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Engineering Design & Sls., Danville, VA 24541	804-792-6405
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Farnell Advance Power, Solon, OH 44139	216-349-0755
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889	908-534-9007
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
IMC Power Sources, San Jose, CA 95112	408-441-9614
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706	717-824-4666
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
† K & M Electronics Inc., W. Springfield, MA 01089	413-781-1350
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071	305-344-3682
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Magnetek Triad, Huntington, IN 46750	219-356-7100
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
Mesa Power Systems, Escondido, CA 92029	619-489-8162
§ MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Oram High Voltage, Dayton, TX 77535	409-258-5553
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Power Trends, Inc., Batavia, IL 60510	708-406-0900
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
† QPS Inc., Salem NH 03079	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402	805-528-5858
† Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† Schott High Voltage, Salt Lake City, UT 84119	801-972-3690
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Semtech Corporation, Newbury Park, CA 91320	805-498-2111
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803	516-349-8686
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
Teco Corp., Winnisquam, NH 03289	603-524-1998
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Transformer Technologies, Inc., Mt. Vernon, NY 10552	914-668-1600
Tumbler Technologies, Fremont, CA 94539	510-651-7724
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603-778-2300
Xylog Corp., Hackensack, NJ 07601	201-489-4040

Power Supplies, Enclosed-4000

§ AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	**D•2052-2055**
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512-1515,2228**
§ Acon, Inc., South Easton, MA 02375, 508-230-8022	**D•2058,2060-2066**
† Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
§† Adtech Power Inc., Anaheim, CA 92806, 714-634-9211	**D•1550-1551**
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230**
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222	**D•1553**
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1555-1556**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1559**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
# American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1561,1563,1570**

† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	D•1574-1578
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	D•1580-1581
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	D•1586,1589
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	D•1592
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1599-1601
Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900	D•1608
§ Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	D•1611-1613
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711	D•1616
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	D•2232-2237
† Avtel/Unitron, Dallas, TX 75238, 214-340-8600	D•2241
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074	D•1617
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	D•2244-2246
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	D•1618,1620,1622-1623
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	D•1625-1626,1629
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	D•1630
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	D•1633-1635,2090-2092
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	D•1636,1641,1645
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	D•2253,2255
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880	D•2096-2097
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	D•1646
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	D•1648
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	D•1651
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	D•2082
† D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	D•1655
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	D•2099-2102
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600	D•1659
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	A•2318, D•1661,1664
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	D•1665,1667
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	D•1670-1671
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999	D•1672
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	D•1675-1678,1681-1683
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	D•1684-1685,2257
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144	D•2260
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	D•1688
§ Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410	D•1689
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	D•1691,1696
Farnell Advance Power, Solon, OH 44139, 216-349-0755	D•1699-1700
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	D•1706-1707,1709
Geopower Inc., Ramsey, NJ 07446, 201-236-0156	D•1858
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	D•1714-1715,1718,1720-1722,1724-1729
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	D•1730,1732
Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	D•1734-1735
Hauman, Inc., San Jose, CA 95131, 408-434-0888	D•1737
† HC Power Inc., Irvine, CA 92714-5716, 714-261-2200	D•1738-1739,1741
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	D•2272-2273
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	D•1747-1749
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	D•1751
§ International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	D•2110-2111
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	D•2112
Intronics, Inc., Canton, MA 02021, 800-367-0004	D•2125
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	D•1756,1758, 1760
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	D•1762-1763
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	D•1766
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	D•1807,2276
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	D•1808-1809
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	D•1810-1815
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	D•1816-1817,2130
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	B•1844, D•1822,2277
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	D•1829-1830
Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	D•1015
† Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712	D•2135
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	D•1832-1835
† Modular Devices, Shirley, NY 11967, 516-345-3100	D•1837,1843-1844
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	D•1846
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550	D•1850
§ Multi Products International, West Paterson, NJ 07424, 201-890-1344	D•1848
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	D•2284-2285
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	D•1851
† Oram High Voltage, Dayton, TX 77535, 409-258-5553	D•1852-1853
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	D•2291
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521	D•1857
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	D•1859,2137
Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337	D•1874-1877
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	D•1879-1880
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500	D•2189-2190
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	D•1886,1892-1895
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	D•1896-1897
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	D•1904-1905
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959	D•1907
† Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	D•1908-1910
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	D•1914-1915
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	C•1081, D•1913
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•1916-1917,2202-2203
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654	D•1918-1919,2211
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	D•1921
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
Staco Energy Products Co., Dayton, OH 45403, 513-253-1191	A•2535, D•1936
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	D•1945
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	A•2565, D•1958
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	D•1020
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960,1962,1964
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	D•1998-2001
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272	D•2002
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	D•2004,2212
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	D•2008,2011
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	D•2013-2015
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442	D•2017
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	D•2037,2039
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	C•1081, D•1913
Voltex, Amityville, NY 11701, 516-842-2772	D•2217
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2041,2306-2307
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	D•2045-2047

Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
† American Monarch, Minneapolis, MN 55421	612-788-9161
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bay Components, Inc., Annapolis, MD 21403	410-268-0122
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
§ Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† CEC, Orange, CA 92665	714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Cell-Con, Inc., Exton, PA 19341	215-363-8552
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Converter Power, Inc., Ipswich, MA 01938	508-356-2558
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES	(0271) 863781
§† CPS, Lake Oswego, OR 97035	503-684-8026
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
† Delta Products Corporation, Fremont, CA 94538	510-770-0660
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
§ Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Endicott Research Group, Endicott, NY 13760	607-754-9187
Energy Systems, Vancouver, WA 98682	206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
Engineering Design & Sls., Danville, VA 24541	804-792-6405

† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Falcon Electric, Monrovia, CA 91016	800-842-6940
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
§ GC International Inc., Plano, TX 75074	214-423-8411
GENERAL POWER CORPORATION, Anaheim, CA 92815	714-956-9321
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
IMC Power Sources, San Jose, CA 95112	408-441-9614
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ James Electronics, Chicago, IL 60618	312-463-6500
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
† LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Magnetek Triad, Huntington, IN 46750	219-356-7100
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
Matrix Corp., Raleigh, NC 27610	919-231-8000
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Mesa Power Systems, Escondido, CA 92029	619-489-8162
MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
Modular Devices Inc., Torrance, CA 90503	310-542-8561
§† Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
Oeco Corp., Milwaukie, OR 97222	503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Panasonic Industrial Co., Milpitas, CA 95035	408-946-7200
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Precision Components, Inc., Wilmington, IL 60481	708-543-6448
† QPS Inc., Salem, NH 03079	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics; Calabasas, CA 91302	818-591-8189
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† Schott High Voltage, Salt Lake City, UT 84119	801-972-3690
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Shape Electronics, Inc.. The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
§ Switching Systems International, Placentia, CA 92670	714-996-0909;800-992-7740
Taylor Electronics, Inc., Tempe, AZ 85283	602-838-4523
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
† Teapo Electronic Corp. of America, Norcross, GA 30071	404-449-6220
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transformer Technologies, Inc., Mt. Vernon, NY 10552	914-668-1600
Urban Electronics, Dover, MA 02030	617-329-4068
§† Vicor Corp., Andover MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
§ Wall Industries, Exeter, NH 03833	603-778-2300
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040
† Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493	708-391-8700
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Ferroresonant-4000

Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1557**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
§ **Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792**	**D•2254-2255**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**A•2318, D•1660-1661**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1674,1678**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	**D•2267**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**D•2272-2273**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1896-1897**
§ **Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616**	**D•1913**
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**A•2565, D•1958**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2009,2011**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2038**
§# **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984**	**D•1913**
† ACME-URDC, Inc., West Jordan, UT 84084	801-561-9385
† American Monarch, Minneapolis, MN 55421	612-788-9161
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† CEC, Orange, CA 92665	714-637-2970
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Delta Products Corporation, Fremont, CA 94538	510-770-0660
Deltona Transformer Corp., DeLand, FL 32724	904-736-7900
Elgar Electronics Corporation, San Diego, CA 92121	619-450-0085;800-733-5427
§ Elgin Electronics, Erie, PA 16509-3570	814-864-4921
Elma Engineering, Palo Alto, CA 94303	415-494-7303
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
GC International Inc., Plano, TX 75074	214-423-8411
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359	215-837-0700
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
Magnetek Triad, Huntington, IN 46750	219-356-7100
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
§† Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301;1-800-553-6374
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700;800-992-1701
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Schott Corp., Wayzata, MN 55391	612-475-1173
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Voltex, Amityville, NY 11701	516-842-2772
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001
Xylog Corp., Hackensack, NJ 07601	201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043	415-968-9176
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, High Voltage-4000

Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2231**
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222	**D•1553**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1573**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592,1594**
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407**	**D•1596-1597**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244-2247**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618-1623**
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	**D•1630**
Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	**D•1635**
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600**	**D•1656-1659**

Power Supplies, High Voltage-4000 (Cont'd)

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... D•1661
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200 .... D•1667
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1674,1678,1682-1683
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 .... D•1686
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 .... D•1706-1709
Geopower Inc., Ramsey, NJ 07446, 201-236-0156 .... D•1858
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 .... D•1712-1729
Gossen Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1965
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434 .... D•2110-2111
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 .... D•1766-1769
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700 .... D•1770
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 .... D•1829-1830
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... D•1833-1835
Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•1844
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300** .... D•1851
Oram High Voltage, Dayton, TX 77535, 409-258-5553 .... D•1852-1853
† **Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521** .... A•1261, D•1857
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... D•1859,2137
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751 .... D•1879
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800** .... D•1896-1897
† **Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959** .... D•1907
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229** .... D•2300
† **Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858** .... D•1908-1909,1911
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... D•1922
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 .... A•2565, D•1958
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 .... D•1964
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1965
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER .... D•2013-2015
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 .... D•2037-2039
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 .... D•2041
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
A.L.E. Sys., Inc., Ashland, MA 01721 508-881-5252
American Monarch, Minneapolis, MN 55421 612-788-9161
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 416-298-0560
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5672
Candela Laser Corporation, Wayland, MA 01778 508-358-7637
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
Computer Power Supplies (CPS), Lake Oswego, OR 97035 503-684-8026
Converter Power, Inc., Ipswich, MA 01938 508-356-2558
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
CVDS Inc., Pte. Claire.Que., CANADA H9R 1C2 514-694-9320
Dexter Scientific, Palatka, FL 32177 904-328-2450
Elma Engineering, Palo Alto, CA 94303 415-494-7303
Farnell Advance Power, Solon, OH 44139 216-349-0755
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 516-293-4100
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE .... (0256) 810808
Haefely, Inc., Woodbridge, VA 22192 703-494-1900
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 617-894-8700
Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
Laser Magnetics, Chelmsford, MA 01824 508-250-1507
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Phenix Technologies, Accident, MD 21520 301-746-8118
Polytron Devices, Inc., Paterson, NJ 07544 201-345-5885
Power Designs, Inc., Westbury, NY 11590 516-333-6200
Power-One, Inc., Camarillo, CA 93012 805-987-8741
Power Systems, Inc., Bloomfield, CT 06002 203-726-1300
† QPS Inc., Salem, NH 03079 603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
Reich Associates, Inc., Lakehills, TX 78063 210-751-3220
Schott Corp., Wayzata, MN 55391 612-475-1173
Schott High Voltage, Salt Lake City, UT 84119 801-972-3690
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548 904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036 704-892-8872
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252 707-423-2100
§ Trek, Incorporated, Medina, NY 14103-0728 716-798-3140
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 .... 415-493-4000; 800-544-4636
§ Wall Industries, Exeter, NH 03833 603-778-2300

Power Supplies, Isolated-4000

§ AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225 .... D•2052, **2054-2055**
Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 .... D•2223
† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820** .... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... D•1512
§ Acon, Inc., South Easton, MA 02375, 508-230-8022 .... D•2058,2060-2066
† **Acopian Technical Company, Easton, PA 18044, 215-258-5441** .... D•1517
† **Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930** .... D•2067
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222 .... D•1553
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 .... D•1556
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725 .... D•1559
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 .... D•1560
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 .... D•1574-1575
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221** .... D•1589-1591
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407** .... D•1597
Astec Standard Power, Oceanside, CA 92054, 619-757-1880 .... D•1600
§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448** .... D•1604
§ **Autec Power Systems, Simi Valley, CA 93065, 805-522-0888** .... D•1610,1613
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 .... D•1616
† **Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500** .... D•2233
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074 .... D•1617
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 .... D•2244-2245,2249
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 .... D•1618
§ **Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411** .... D•1624
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 .... D•1630
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
§ **Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600** .... D•2092
§ **Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;** .... D•1636,1639,1642-1643
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2254-2255
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880 .... D•2096-2097
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .... D•1651
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 .... D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•2099-2100,2102
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 .... D•1658
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... D•1661
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200 .... D•1666
† **EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521** .... D•1671
Electromech, Inc., Irvington, NJ 07111, 201-318-7999 .... D•1672
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... D•1679,1681, 2104
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•1684,2259
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•1687
§ **EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996** .... D•1688
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561 .... D•1691,1693-1694,1696
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 .... D•1706
Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 .... D•1735
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1965
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 .... D•2267
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700** .... D•2268
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 .... D•2272-2273
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666 .... D•1747,1749
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331** .... D•1751-1752,1755
§ **International Power Sources, Inc., Ashland, MA 01721, 508-881-7434** .... D•2110-2111
† **Interpoint Corporation, Redmond, WA 98052, 206-882-3100** .... D•2112,2122

Intronics, Inc., Canton, MA 02021, 800-367-0004 .... **D•2125**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 .... **D•1756,1760**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095 .... **D•1762-1763**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 .... **D•1766**
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 .... **D•2128-2129**
Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... **D•1777**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... **D•1808-1809**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 .... **D•1810-1812**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .... **D•1357**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... **D•1816-1817,2130**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 .... **D•1828-1830**
Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800 .... **D•1015**
† **Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712** .... **D•2132-2133,2135**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... **D•1832**
† **Modular Devices, Shirley, NY 11967, 516-345-3100** .... **D•1837,1841,1843-1844**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... **D•2289**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... **D•1859,2137**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751 .... **D•1879-1880**
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 .... **D•1882-1884**
Power Convertibles, a Burr-Brown Company, Tucson, AZ 85713, 1-800-548-6132 .... **D•2077**
† **Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500** .... **D•2189-2190,2194-2195**
§ **Power-One, Inc., Camarillo, CA 93012, 805-987-8741** .... **D•1886,1892-1893**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788 .... **D•1901**
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 .... **D•1916**
§ **Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654** .... **D•2211**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 .... **D•1922**
Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 .... **D•1936**
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740** .... **D•1938-1939**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270** .... **D•1945,1947**
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 .... **D•1020**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 .... **D•1960**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... **D•1965**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... **D•1967**
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272** .... **D•2002**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030 .... **D•2009-2011**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442** .... **D•2017**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 .... **D•2037**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 .... **B•2025**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 .... **D•2041,2306**
† **Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001** .... **D•2045-2047**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727 716-968-2400
§ Action Instruments, San Diego, CA 92123 619-279-5726
§† Adtech Power Inc., Anaheim, CA 92806 714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Alliance Electronics Corp., Wilsonville, OR 97070-0503 503-682-4976
American Monarch, Minneapolis, MN 55421 612-788-9161
American Skynet Electronic Co., Milpitas, CA 95035 408-945-6355
Apex Microtechnology Corp., Tucson, AZ 85741 602-690-8600
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
† ATC Power Systems, Inc., Merrimack, NH 03054 603-429-0391
Atlas Energy Systems, Inc., Arcadia, CA 91007 818-575-0755
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
† Bikor, Microsemi Corporation, Torrance, CA 90501 213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 416-298-0560
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CEC Electronics Corp., Hauppauge, NY 11788 516-582-4422
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211 714-544-6665
† Christie Electric Corp., Gardena, CA 90248 310-715-1402
Marine Electric Systems Inc., Clifton, NJ 07014-1135 201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035 503-684-8026
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Converter Concepts, Inc., Pardeeville, WI 53954 608-429-3000
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054 408-980-5144
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES .... (0271) 863781
§ CPS, Lake Oswego, OR 97035 503-684-8026
Delta Products Corporation, Fremont, CA 94538 510-770-0660
§ Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
Electrostatics, San Diego, CA 92111 619-279-1414
† EMCO High Voltage Co., Sutter Creek, CA 95685 .... 209-223-3626;800-546-3680
Energy Systems, Vancouver, WA 98682 206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 310-635-9555
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 516-293-4100
GC International Inc., Plano, TX 75074 214-423-8411
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE .... (0256) 810808
HC Power Inc., Irvine, CA 92714-5716 714-261-2200
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
Industrial Electronic Resources, Corona, CA 91720 .... 909-734-1111;800-433-5160
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167 805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 602-889-7600
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071 305-344-3682
LH Research, Inc., Tustin, CA 92680 1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052 216-288-1122
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† Mep Controls, Bordentown, NJ 08505 609-298-7300
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ MIL Electronics, Inc., Nashua, NH 03060 603-882-3200
MPC, Div. of Consulting Systems, Danville, NH 03819 .... 603-642-5913;1-800-238-8380
§† Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006 503-646-4700
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
Nedap N.V., Groenlo, HOLLAND 7140 AA .... +31-5440-71111
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Oram High Voltage, Dayton, TX 77535 409-258-5553
Panel Components Corp., Oskaloosa, IA 52577 515-673-0097
§ Power Designs, Inc., Westbury, NY 11590 516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021 617-828-6216
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110 .... 800-843-8544;619-299-3800
Powernetics LTD., Leics, ENG LE11 1DX 0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064 305-943-4110
§† Power Star, Inc., Irvine, CA 92713 .... 714-261-5377;800-854-9420
† Power Ten, Inc., Sunnyvale, CA 94086 408-738-5959
† PPM, Inc., Cleveland, OH 44122 1-800-899-4776
#Print Products Intl., Silver Spring, MD 20910 .... 301-587-7824;800-638-2020
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3 514-637-1186
† QPS Inc., Salem, NH 03079 603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
Reich Associates, Inc., Lakehills, TX 78063 210-751-3220
§ Reliability Incorporated, Houston, TX 77218 713-492-0550
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721 508-879-8658
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087 603-893-2330
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 .... 708-620-8394; 1-800-367-5811
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
Sorensen Company, Paxton, IL 60957 800-525-2024
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
† Tecnetics Inc., Boulder, CO 80303 303-442-3837
§ Top-Link Computer Inc., Milpitas, CA 95035-8001 408-946-7888
Tower Electronics, Inc., Fridley, MN 55432 612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 909-371-5751
ULTRAVOLT, Inc., Ronkonkoma, NY 11779 .... 800-876-POWER
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 310-316-9984
§ The Vector Group, Inc., Horsham, PA 19044 1-800-523-3696
§† Vicor Corp., Andover, MA 01810 508-470-2900
§ Wall Industries, Exeter, NH 03833 603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW 0243-865991
† Westcor Corporation, Los Gatos, CA 95032 408-395-7050
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493 708-391-8700
Zytronics, Inc., Bedford, NH 03110 603-623-8888

Power Supplies, Lab (Incl. Metered Units)-4000

§ **AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225** .... **D•2053-2054**
† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900** .... **D•2230**
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355 .... **D•1561**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 .... **D•1581**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 .... **D•2244-2247,2249**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 .... **D•1618-1620,1623**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... **D•2256**
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600** .... **D•1656,1659**
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200 .... **D•1666**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 .... **D•1676-1678**

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•1685
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144 ... D•2260
§ Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410 ... D•1689
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 ... D•1713-1715.1717-1718.1720,1726
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1965
§ Hauman, Inc., San Jose, CA 95131, 408-434-0888 ... D•1737
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2271
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... D•2272-2273
Kaiser Systems. Inc., Inductotherm Industries, Inc.. Beverly. MA 01915, 508-922-9300 ... D•1767,1769
§ Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295 ... D•1773-1774
Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 ... D•1808-1809
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915. 201-385-0500 ... D•1832-1833
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ... D•1853
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ... D•2286,2288
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... D•1859,2137
† Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 ... D•1882
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616 ... C•1081, D•1913
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ... D•1922
§ Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ... A•2535, D•1936
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300 ... D•1021
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1965
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622 ... D•2003
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ... D•2037
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984 ... C•1081, D•1913
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ... D•1334
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041,2306
Abacus Controls Inc., Somerville, NJ 08876 ... 908-526-6010
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 ... 613-836-3511
A.L.E. Sys., Inc., Ashland, MA 01721 ... 508-881-5252
Alfa Electronics, Inc. Princeton. NJ 08543-8089 ... 609-275-0220
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621 ... 201-385-0500
Arnold Magnetics, Camarillo, CA 93012 ... 805-484-4221
§ Astec High Voltage, Ashland, MA 01721 ... 508-881-8407
Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600
† Astec Unitron, Dallas, TX 75238 ... 214-340-8600
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
§ B & K Precision. Maxtec International Corp, Chicago, IL 60635 ... 312-889-1448
Bay Components. Inc. Annapolis, MD 21403 ... 410-268-0122
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Behlman Electronics Inc., Lake Success. NY 11042 ... 516-328-1600
Burleigh Instruments, Fishers, NY 14453-0755 ... 716-924-9355
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154 ... 617-894-6440
Cal-Power Corp., Standard Magnetic Corp., Garden Grove. CA 92641 ... 714-379-5672
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 ... 408-730-4573; 1-800-828-3547
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
Collmer Semiconductor, Inc., Dallas, TX 75244 ... 800-527-0251;214-233-1589
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES ... (0271) 863781
§ CPS, Lake Oswego, OR 97035 ... 503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
EG & G Power Systems, Inc., Covina, CA 91724 ... 818-967-9521
Electric Device, Canfield, OH 44406 ... 216-533-1111
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
† EMCO High Voltage Co., Sutter Creek, CA 95685 ... 209-223-3626:800-546-3680
† ETM Electromatic Inc, Newark, CA 94560 ... 510-797-1100
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 ... 516-293-4100
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174 ... 904-677-7070
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 ... 516-352-2904
GENERAL POWER CORPORATION, Anaheim, CA 92815 ... 714-956-9321
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE ... (0256) 810808
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 ... 203-624-3103
§ Goldstar Precision Co. Ltd., Lucky Goldstar, Cerritos, CA 90701 ... 310-404-0101
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 ... 914-238-8462
High Voltage Technology Inc., Yonkers, NY 10701 ... 914-423-6636
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525
Hoffman Engineering Corp., Stamford, CT 06902 ... 203-325-8933
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
Interelectronics Corp., Congers. NY 10920 ... 914-EL8-8000
International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673
International Power Sources, Inc., Ashland. MA 01721 ... 508-881-7434
† Lambda Electronics Inc., Melville, NY 11747-3700 ... 516-694-4200
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ... 516-231-6900: 1-800-645-5104
Lectronic Research Labs., Inc., Camden. NJ 08104 ... 800-358-8378
LH Research, Inc., Tustin, CA 92680 ... 1-800-547-2537
§ LJ Technical Systems, Hauppauge, NY 11788 ... 516-234-2100
Magna-Power Electronics, Inc., Whippany, NJ 07981 ... 201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 ... 714-956-9200
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 ... 908-283-4925
† Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
§ Metermaster. Tempe, AZ 85282 ... 602-431-0015
§ Monroe Electronics, Inc., Lyndonville, NY 14098 ... 716-765-2254
Northern Ampower Corp., Novi, MI 48374 ... 313-349-4860
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
§ Plastic Capacitors, Inc., Chicago, IL 60639 ... 312-489-2229
§ Power Designs, Inc., Westbury, NY 11590 ... 516-333-6200
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110 ... 800-843-8544:619-299-3800
§ Power Solutions Inc., Pompano Bch., FL 33064 ... 305-943-4110
Power Star, Inc., Irvine, CA 92713 ... 714-261-5377:800-854-9420
† Power Technology, Inc., Little Rock, AR 72219-1117 ... 501-568-1995
† Power Ten, Inc., Sunnyvale, CA 94086 ... 408-738-5959
Prema Precision Electronics, Inc., Montclair, CA 91763 ... 714-621-7292
§† PTS Corporation, Bloomington, IN 47401 ... 812-824-9331
Quality Power Systems, Inc., Pearland. TX 77581 ... 713-997-1700:800-992-1701
RAG Electronics, Inc., Canoga Park, CA 91304 ... 818-998-6500:800-732-3457
† Ratelco, Power Systems, Seattle. WA 98109-5589 ... 206-624-7770
Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ... 708-620-8394; 1-800-367-5811
† Sorensen Company, Paxton, IL 60957 ... 800-525-2024
Stanford Resch. Sys., Inc. Sunnyvale. CA 94089 ... 408-744-9040
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600:800-343-1199
† Technipower, A Penril Co., Danbury, CT 06813 ... 203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621 ... 201-385-0500
Tecnetics Inc., Boulder, CO 80303 ... 303-442-3837
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
Tri-Mag, Inc., Visalia. CA 93291 ... 209-651-2222
Tri-Source Inc., Shelton, CT 06484 ... 203-924-7030
Tucker Electronics, Dallas, TX 75355-1419 ... 214-348-8800:800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044 ... 1-800-523-3696
Voltex, Amityville, NY 11701 ... 516-842-2772
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 ... 617-938-8390, 1-800-933-9319
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW ... 0243-865991
§ Xantrex Technology Inc., Bellingham, WA 98227-9754 ... 206-671-2966
Xylog Corp., Hackensack, NJ 07601 ... 201-489-4040

Power Supplies, Laser-4000

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 ... B•1210, D•1573
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 ... D•1592
§ Astec High Voltage, Ashland, MA 01721, 508-881-8407 ... D•1596
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 ... D•1618
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ... D•1630
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ... D•1656
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 ... D•1679,1682
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 ... D•1686
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 ... D•1766,1769
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... D•1859,2137
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ... D•2038-2039
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041
† Advanced Conversion Tech., Middletown, PA 17057 ... 717-939-2300
Advanced High Voltage Company, Tucson, AZ 85751 ... 602-721-2424:818-997-7222
A.L.E. Sys., Inc., Ashland, MA 01721 ... 508-881-5252
Converter Power, Inc., Ipswich, MA 01938 ... 508-356-2558
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 ... 908-534-9007
ITT Power Systems Corp. ITT Corp., Tucson, AZ 85706 ... 602-889-7600
Jerome Industries Corp., Elizabeth, NJ 07201 ... 908-353-5700
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 ... 619-575-1100
Magna-Power Electronics, Inc., Whippany, NJ 07981 ... 201-428-1197
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 ... 619-279-5100
Mid-Eastern Industries. Technology Dynamics Inc., Bergenfield. NJ 07621-2915 ... 201-385-0500
Oram High Voltage. Dayton. TX 77535 ... 409-258-5553
† Power Technology, Inc., Little Rock, AR 72219-1117 ... 501-568-1995
Precision Electro-Optics, Inc., Chatham, NJ 07928 ... 201-635-8811
Reich Associates, Inc., Lakehills, TX 78063 ... 210-751-3220
Schott Corp. Wayzata. MN 55391 ... 612-475-1173
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803 ... 516-349-8686
ULTRAVOLT, Inc., Ronkonkoma, NY 11779 ... 800-876-POWER

Power Supplies, Laser Diodes-4000

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 ... D•1573

† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819** ... D•1592

§ Astec High Voltage, Ashland, MA 01721, 508-881-8407 ... D•1596

† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680 ... D•1686

† **Modular Devices, Shirley, NY 11967, 516-345-3100** ... D•1844

Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... D•1859,2137

Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967

Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462

Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 ... 516-293-4100

Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE ... (0256) 810808

High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 ... 914-238-8462

ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 ... 602-889-7600

Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154 ... 619-575-1100

Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 ... 201-385-0500

Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006 ... 503-646-4700

Optima Precision, Inc., West Linn, OR 97068 ... 800-544-4118;503-638-2525

† Power Technology, Inc., Little Rock, AR 72219-1117 ... 501-568-1995

Precision Electro-Optics, Inc., Chatham, NJ 07928 ... 201-635-8811

Reich Associates, Inc., Lakehills, TX 78063 ... 210-751-3220

Wilmore Electronics Co., Inc., Hillsborough, NC 27278 ... 919-732-9351

Power Supplies, Linear-4000

§ **AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225** ... D•2054

† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820** ... D•1491

§ **Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200** ... D•1512,1514

† **Acopian Technical Company, Easton, PA 18044, 215-258-5441** ... D•1517

Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060 ... D•1556

A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725 .. D•1557,1559

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... D•1560

† **Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500** ... D•1574

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2266, D•1580,1583

§ **Astec Standard Power, Oceanside, CA 92054, 619-757-1880** ... D•1603

§ **Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900** ... D•1608-1609

Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ... D•2244 2247,2249

Bertan High Voltage, Hicksville, NY 11801, 516-433-3110 ... D•1618,1620,1622

§ **Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411** ... D•1624

California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER ... D•2250,2252

Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 ... D•1634-1635,2090-2091

§ **Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;** ... D•1637-1638,1642-1643

§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666** .. D•1651

§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899** ... D•1653

† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328** ... D•2082

† **D & B Power, Inc., Bayshore, NY 11706, 516-586-5955** ... D•1654-1655

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•2099-2102

† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600** ... D•1658

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... A•2318,2321, D•1660-1662,1664

§† **Electromech, Inc., Irvington, NJ 07111, 201-318-7999** ... A•2325, D•1672

Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620 ... D•1673

Electronic Measurements, Neptune, NJ 07753, 908-922-9300 ... D•1677

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•1684,2257

Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ... B•1936,1946

§ **Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410** ... D•1689

Farnell Advance Power, Solon, OH 44139, 216-349-0755 ... D•1699

Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 ... D•1706,1708

§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000** ... D•1732

§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970** ... D•1734

Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2268

Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 ... D•2274

Interpoint Corporation, Redmond, WA 98052, 206-882-3100 ... D•2112

Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ... D•1756-1757

Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 ... D•1766

Kepco, Inc., Flushing, NY 11352, 718-461-7000 ... D•1777,1801

† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784** ... D•1808-1809

† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200** ... D•1816,2130

§ **LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600** ... D•1820

Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500 ... D•1832-1835

† **Modular Devices, Shirley, NY 11967, 516-345-3100** ... D•1837,1844

MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380 ... D•1846

§ **Multi Products International, West Paterson, NJ 07424, 201-890-1344** ... D•1848

Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ... D•2288-2289

Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ... D•1857

Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... D•1859,2137

† **Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337** ... D•1874,1876

† **Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885** ... D•1882-1884

§ **Power-One, Inc., Camarillo, CA 93012, 805-987-8741** ... D•1886-1887,1895

† **Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959** ... D•1907

§ **Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616** ... C•1081, D•1913

Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ... D•1922

§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244** ... D•1937

§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872** ... D•1942

§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270** ... D•1945,1950-1951

Technical Devices, Dayton, OH 45414, 513-890-7881 ... D•1957

† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001** .. A•2565, D•1958

† **Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300** ... D•1020-1021

Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 ... D•1963

§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272** ... D•2002

Tri-Source Inc., Shelton, CT 06484, 203-924-7030 ... D•2008

Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ... D•2037

† **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984** ... C•1081, D•1913

Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041

† **Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001** ... D•2045-2047

§ Acme Electric Corporation, Cuba, NY 14727 ... 716-968-2400

§ Adcour, Inc., Sharon, MA 02067 ... 617-784-8123

§ Adtech Power Inc., Anaheim, CA 92806 ... 714-634-9211

† Advanced Analog, Intech, Santa Clara, CA 95050 ... 408-988-4930

† Advanced Conversion Tech., Middletown, PA 17057 ... 717-939-2300

† Advanced Power Designs Inc., Irvine, CA 92714 ... 714-263-8605

Alliance Electronics Corp., Wilsonville, OR 97070-0503 ... 503-682-4976

† American Monarch, Minneapolis, MN 55421 ... 612-788-9161

† Applied Controls Co., Inc., Fairfield, NJ 07004 ... 201-227-5454

† Arnold Magnetics, Camarillo, CA 93012 ... 805-484-4221

Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300

† Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600

A-Systems Inc., Charlottesville, VA 22902 ... 804-295-7200

§ Autec Power Systems, Simi Valley, CA 93065 ... 805-522-0888

§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100

§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400

Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 ... 404-979-5900

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 ... 312-889-1448

Behlman Electronics Inc., Lake Success, NY 11042 ... 516-328-1600

§ Bikor, Microsemi Corporation, Torrance, CA 90501 ... 213-539-6320

† Brandt Electronics, Inc., Mountain View, CA 94043 ... 415-967-4944

CEC Electronics Corp., Hauppauge, NY 11788 ... 516-582-4422

Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421

Chloride Power Electronics, Caledonia, NY 14423 ... 716-538-4421

† Christie Electric Corp., Gardena, CA 90248 ... 310-715-1402

Computer Power Supplies (CPS), Lake Oswego, OR 97035 ... 503-684-8026

§ Contact East, N. Andover, MA 01845 ... 508-682-2000

§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES ... (0271) 863781

§† CPS, Lake Oswego, OR 97035 ... 503-684-8026

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516

§ Deltron, Inc., N. Wales, PA 19454-9990 ... 215-699-9261

Dynapower Corporation, S. Burlington, VT 05407 ... 802-860-7200

EG & G Power Systems, Inc., Covina, CA 91724 ... 818-967-9521

Electric Device, Canfield, OH 44406 ... 216-533-1111

Electrostatics, San Diego, CA 92111 ... 619-279-1414

§ Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714 ... 714-476-6070

† EMCO High Voltage Co., Sutter Creek, CA 95685 ... 209-223-3626;800-546-3680

Encore Electronics, Inc., Saratoga Springs, NY 12866 ... 518-584-5354

Energy, Ltd., Bladensburg, MD 20710 ... 301-699-1144

Energy Systems, Vancouver, WA 98682 ... 206-896-8310

Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639

§ Entrelec Inc., Irving, TX 75038 ... 214-550-9025

† ETM Electromatic Inc, Newark, CA 94560 ... 510-797-1100

§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550 ... 415-373-1008

Friwo, Friemann & Wolf, Frederick, MD 21702 ... 301-694-7479

§ GC International Inc., Plano, TX 75074 ... 214-423-8411

Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE ... (0256) 810808

§ Golden Power Systems, Inc., Simi Valley, CA 93065 ... 805-582-4400

Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 ... 614-275-0530

§ Hauman, Inc., San Jose, CA 95131 ... 408-434-0888

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844

High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 ... 914-238-8462

High Voltage Technology Inc., Yonkers, NY 10701 ... 914-423-6636

Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091

Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525

† Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140

Industrial Electronic Resources, Corona, CA 91720 ... 909-734-1111;800-433-5160

Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640

Interelectronics Corp., Congers, NY 10920 ... 914-EL8-8000

International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673

§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167 .. 805-981-1188

Power Supplies, Linear-4000 (Cont'd)

§ **James Electronics, Chicago, IL 60618**	312-463-6500
Keithley Instrs, Cleveland, OH 44139	800-552-1115
Keltron Corp., Miniprinter, Security Systems Div., Waltham, MA 02154	617-894-8700
§ **Kenwood U.S.A., Long Beach, CA 90810**	310-761-8295
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118,800-826-7172
† **Lambda Electronics Inc., Melville, NY 11747-3700**	516-694-4200
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
§ **Lutze, Inc., Charlotte, NC 28217-9805**	704-357-8835;800-447-2371
MACROAMP Inc., Ukiah, CA 95482	800-458-8892
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
§ **Martel Electronics, Windham, NH 03087**	603-893-0886
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Mesa Power Systems, Escondido, CA 92029	619-489-8162
MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
§† **Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006**	503-646-4700
NF Electronic Instruments, State College, PA 16801	814-237-5580
NH Research, Incorporated, Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Northern Ampower Corp., Novi, MI 48374	313-349-4860
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
Oram High Voltage, Dayton, TX 77535	409-258-5553
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§ Power Mate Corporation, San Diego, CA 92110	800-843-8544 619-299-3800
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Power Switch Corporation, Lodi, NJ 07644	201-478-5788
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
§† Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301;1-800-553-6374
# **Print Products Intl., Silver Spring, MD 20910**	301-587-7824;800-638-2020
§ **Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3**	514-637-1186
† **QPS Inc., Salem, NH 03079**	603-893-5100
§ Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700 800-992-1701
† **Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302**	818-591-8189
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ **Reliability Incorporated, Houston, TX 77218**	713-492-0550
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080
Schaffner EMC Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schott Corp., Wayzata, MN 55391	612-475-1173
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Seven Mountains Sci. Inc., Boalsburg, PA 16827	814-466-6559
† **Shogyo International Corp., Great Neck, NY 11021-4799**	516-466-0911
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-345-1199
Taylor Electronics Inc., Tempe, AZ 85283	602-838-4523
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Teco Corp., Winnisquam, NH 03289	603-524-1998
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
† **Transchem, Jetronics Industries, Inc., Corona, CA 91718**	909-371-5751
† Transformer Technologies Inc., Mt. Vernon, NY 10552	914-668-1600
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Voltex, Amityville, NY 11701	516-842-2772
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Linear, Medical-4000

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**A•2266-2267**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	D•1594
Behlman Electronics, Inc., **Astrosystems, Ventura, CA 93003, 805-642-0660**	**D•2244**
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	**D•1637-1638,1642-1643**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	D•1654
Dynage Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	D•1662
Epsco Incorporated, Itasca, IL 60143-1120, 708-250-0410	**D•1689**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	D•1896-1897
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	D•2038-2039
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	D•2045

Power Supplies, Linear-4000 (Cont'd)

§ **Adtech Power Inc., Anaheim, CA 92806**	714-634-9211
Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588	510-734-3060
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503 682-4976
† American Monarch, Minneapolis, MN 55421	612-788-9161
Astec Standard Power, Oceanside, CA 92054	619-757-1880
§ **Ault, Incorporated, Minneapolis, MN 55428**	612-493-1900
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
§ **Calex Mfg. Co., Inc., Concord, CA 94520**	510-687-4411
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-6026
† EMCC High Voltage Co., Sutter Creek, CA 95685	209-223-3626,800-546-3680
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
Hipotronics Inc., Brewster, NY 10509	914-279-8091
§ International Power DC Power Supplies Inc., Oxnard, CA 93030-5167	805-981-1188
Jerome Industries Corp., Elizabeth, NJ 07201	908-353-5700
† **Lambda Electronics Inc., Melville, NY 11747-3700**	516-694-4200
§ **LZR Electronics, Inc., Gaithersburg, MD 20879**	301-921-4600
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
MPC, Div. of Consulting Systems, Danville, NH 03819	603-642-5913;1-800-238-8380
Oram High Voltage, Dayton, TX 77535	409-258-5553
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Designs, Inc., Westbury, NY 11590	516-333-6200
QPS Inc., Salem, NH 03079	603-893-5100
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402	805-528-5858
Schott Corp., Wayzata, MN 55391	612-475-1173
Sorensen Company, Paxton, IL 60957	800-525-2024
§ Taltronics Dimetrics, Inc., Davidson, NC 28036	704-892-8872
§ **Tamura Corporation of America, Temecula, CA 92589-2230**	909-699-1270
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
Tri-Source Inc., Shelton, CT 06484	203-924-7030
Urban Electronics, Dover, MA 02030	617-329-4068
§ **Wall Industries, Exeter, NH 03833**	603-778-2300

Power Supplies, Logic Level (Incl. Microprocessor) — See Power Supplies, AC Input, Up to 30 VDC Output (Vol. D)

Power Supplies, Microwave — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)

Power Supplies, Multiple Output-4000

§ AAK Corp., Haverhill, MA 01832, 508-373-3769,800-886-2225	D•2052-2055
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	D•1491
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	D•1512
§ **Acon, Inc., South Easton, MA 02375, 508-230-8022**	D•2058,2060-2066
† Acopian Technical Company, Easton, PA 18044, 215-258-5441	D•1517
§† Adtech Power Inc., Anaheim, CA 92806, 714-634-9211	D•1549-1551
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ **07927, 201-267-1900**	**D•2230**
Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930	D•2067
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	D•1555-1556
Aibar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	D•1560
# **American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355**	D•1562-1563,1570-1571
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, **201-385-0500**	**D•1574-1578**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	D•1580,1582-1583
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	D•1585-1587,1590
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592**
Astec High Voltage, Ashland, MA 01721, 508-881-8407	**D•1597**
§ Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1598-1601, **1603**
§ **Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900**	**D•1608-1609**
§ Autec Power Systems, Simi Valley, CA 93065 805-522-0888	D•1610-1611
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341,800-645-2074	D•1617
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	D•2244,2246-2247
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	D•1618
§ Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411	D•1624
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	**D•1625-1629**
§ Computer Products Power Conversion America, So. Boston, MA 02127, **800-733-9288;617-464-6600**	**D•1632,1634,2090-2092**
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	D•1636-1645
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	D•2253,2255
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880	D•2096-2097
§ **Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000**	D•1646-1647
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	D•1648-1650
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	D•2099-2101
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600**	D•1656,1659
Dynage Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	A•2321, D•1660-1661
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	D•1666

† **EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521**	**D•1670-1671**
§† **Electromech, Inc., Irvington, NJ 07111, 201-318-7999**	**D•1672**
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	**D•1673**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1678**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1684,2259**
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	**D•1688**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691,1693-1694,1696-1697**
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749	**A•2085**
Farnell Advance Power, Solon, OH 44139, 216-349-0755	**D•1699-1701,1704**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1706**
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	**D•1712-1713**
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000**	**D•1730,1732**
§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970**	**D•1734-1735**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	D•1965
§ **Hauman, Inc., San Jose, CA 95131, 408-434-0888**	**D•1737**
† **HC Power Inc., Irvine, CA 92714-5716, 714-261-2200**	**D•1738-1739,1741**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	**D•1747-1749**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	**D•1751-1755**
§ **International Power Sources, Inc., Ashland, MA 01721, 508-881-7434**	**D•2111**
† **Interpoint Corporation, Redmond, WA 98052, 206-882-3100**	**D•2112**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**D•2124-2125**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756-1757**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1762-1763**
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	**D•1765**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1766-1767**
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700	**D•1770-1771**
§ **Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295**	**D•1407,1772-1773**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777,1801**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1808**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1810-1812,1814-1815**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**D•1816-1817,2130**
§ **LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600**	**D•1820,1824**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	**D•1828-1830**
† **Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712**	**D•2131-2135**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834**
† **Modular Devices, Shirley, NY 11967. 516-345-3100**	**D•1837,1840-1841,1843-1844**
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	**D•1846**
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700	**D•1847**
§ **Multi Products International, West Paterson, NJ 07424, 201-890-1344**	**D•1848**
† **NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900**	**D•1849**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300**	**D•1851**
† **Oram High Voltage, Dayton, TX 77535, 409-258-5553**	**D•1853**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2288**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	**D•1879-1881**
† **Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885**	**D•1882-1883**
Power Convertibles, a Burr-Brown Company, Tucson, AZ 85713, 1-800-548-6132	**D•2077**
† **Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500**	**D•2186,2194-2195**
§ **Power-One, Inc., Camarillo, CA 93012, 805-987-8741**	**D•1886-1895**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1896-1897**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1899-1904**
† **Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959**	**D•1907**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229**	**D•2300**
† **Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858**	**D•1908-1911**
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	**D•1914-1915**
§ **Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616**	**C•1081, D•1913**
† **RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450**	**D•1916-1917,2202-2203**
§ **Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654**	**D•1918-1919**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
Staco Energy Products Co., Dayton, OH 45403, 513-253-1191	**D•1936**
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740**	**D•1938-1941**
§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872**	**D•1942**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270**	**D•1945,1947,1949-1950,1953**
† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001**	**A•2565, D•1958**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960-1964**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§ **Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888**	**D•1998**
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272**	**D•2002**
† **Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222**	**D•2004-2006,2212**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2008,2010**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2037-2038**
§# **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984**	**C•1081, D•1913**
Voltex, Amityville, NY 11701, 516-842-2772	**D•2217**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
† **Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001**	**D•2044-2047**

Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639	800-933-7725
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
AMASCO, Torrance, CA 90501	310-781-9494
Apex Microtechnology Corp., Tucson, AZ 85741	602-690-8600
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Babcock, Inc., Orange, CA 92667	714-633-3700
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bay Components, Inc., Annapolis, MD 21403	410-268-0122
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
BICC-VERO Electronics. Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
California Instruments Corp., San Diego, CA 92123-1509	619-279-8620; 800-4AC-POWER
† CEC, Orange, CA 92665	714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
Collmer Semiconductor, Inc., Dallas, TX 75244	800-527-0251;214-233-1589
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§ Contact East, N. Andover, MA 01845	508-682-2000
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES	(0271) 863781
§† CPS, Lake Oswego, OR 97035	503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
C-Tek Inc., Wakefield, MA 01880	617-246-1720
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
† D & B Power, Inc., Bayshore, NY 11706	516-586-5955
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Deltona Transformer Corp., DeLand, FL 32724	904-736-7900
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
Electrostatics, San Diego, CA 92111	619-279-1414
§ Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Endicott Research Group, Endicott, NY 13760	607-754-9187
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
Engineering Design & Sls., Danville, VA 24541	804-792-6405
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
Friwo, Friemann & Wolf, Frederick, MD 21702	301-694-7479
§ GC International Inc., Plano, TX 75074	214-423-8411
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
IMC Power Sources, San Jose, CA 95112	408-441-9614
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Integrity Technology Corporation, Santa Clara, CA 95050	408-262-8640
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ James Electronics, Chicago, IL 60618	312-463-6500
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071	305-344-3682
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172

† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Mesa Power Systems, Escondido, CA 92029	619-489-8162
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Power Intl., Inc., San Diego, CA 92126	619-271-0831;619-271-5942
§ MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
Modular Devices Inc., Torrance, CA 90503	310-542-8561
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
Oeco Corp., Milwaukie, OR 97222	503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Panasonic Industrial Co., Milpitas, CA 95035	408-946-7200
Phenix Technologies, Accident, MD 21520	301-746-8118
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
Power Conversion Products, Crystal Lake, IL 60014	815-459-9100
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
† Power Functions Engineering, Garland, TX 75042	214-278-0996
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
PowerLine, Inc., Denver, CO 80210	303-698-7883
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
Precision Components, Inc., Wilmington, IL 60481	708-543-6448
† Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301;1-800-553-6374
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700;800-992-1701
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schott Corp., Wayzata, MN 55391	612-475-1173
Schott High Voltage, Salt Lake City, UT 84119	801-972-3690
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Seven Mountains Sci. Inc., Boalsburg, PA 16827	814-466-6559
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
Taylor Electronics, Inc., Tempe, AZ 85283	602-838-4523
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Temescal/Airco Coating Technology, The BOC Group, Inc., Fairfield, CA 94533-0252	707-423-2100
§ Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley. MN 55432	612-571-3737
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
† Transformer Technologies, Inc., Mt. Vernon, NY 10552	914-668-1600
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
Urban Electronics, Dover, MA 02030	617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040
† Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493	708-391-8700
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Open Frame-4000

Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512-1514**
§ Adtech Power Inc., Anaheim, CA 92806, 714-634-9211	**D•1549**
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1554**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
# American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1561-1567,1571-1572**
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574-1576**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1592**
§ Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1600-1601**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1610-1611, 1615**
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074	**D•1617**
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	**D•1625-1626,1629**
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	**D•1630**
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288:617-464-6600	**D•1631-1632,1634,2092**
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	**D•1636-1645**
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	**D•1646-1647**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**A•2318, D•1660-1661**
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	**D•1665**
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	**D•1673**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691,1697**
Farnell Advance Power, Solon, OH 44139, 216-349-0755	**D•1699-1700,1702-1704**
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	**D•1727,1729**
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**D•1730-1731**
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	**D•1747-1749**
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	**D•1751**
§ International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2110**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756**
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	**D•1765**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**D•1820-1821**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834-1835**
† Modular Devices, Shirley, NY 11967, 516-345-3100	**D•1837,1844**
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700	**D•1847**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1886,1888,1894-1895**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896-1897**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1900,1902-1903**
† Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	**D•1911**
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	**C•1081, D•1913**
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654	**D•1919**
§ Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740	**D•1938-1941**
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	**D•1942**
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945,1948,1951**
# Technical Devices, Dayton, OH 45414, 513-890-7881	**D•1956**
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**A•2565, D•1958**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960-1962**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	**D•1999-2001**
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272	**D•2002**
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2005-2006**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2008**
UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442	**D•2017**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2037**
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	**C•1081, D•1913**
Voltex, Amityville, NY 11701, 516-842-2772	**D•2217**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2043-2044,2046-2047**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
AMASCO, Torrance, CA 90501	310-781-9494
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
Arnold Magnetics, Camarillo, CA 93012	805-484-4221
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400

Bay Components, Inc., Annapolis, MD 21403	410-268-0122
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Bertsch U.S., Vista, CA 92083	619-727-7420
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
† CEC, Orange, CA 92665	714-637-2970
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES	(0271) 863781
§ CPS, Lake Oswego, OR 97035	503-684-8026
C-Tek Inc., Wakefield, MA 01880	617-246-1720
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
D & B Power, Inc., Bayshore, NY 11706	516-586-5955
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
† Delta Products Corporation, Fremont, CA 94538	510-770-0660
Deltona Transformer Corp., DeLand, FL 32724	904-736-7900
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
§† Electromech, Inc., Irvington, NJ 07111	201-318-7999
Electrostatics, San Diego, CA 92111	619-279-1414
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
§ EPD Electronics, Inc., Gardena, CA 90247	310-515-4996
§ Falcon Electric, Monrovia, CA 91016	800-842-6940
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
§ GC International Inc., Plano, TX 75074	214-423-8411
§ Golden Pacific Electronics, Inc, Placentia, CA 92670	714-993-6970
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
IMC Power Sources, San Jose, CA 95112	408-441-9614
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrity Technology Corporation, Santa Clara, CA 95050	408-262-8640
Interlogic Industries, Melville, NY 11747-4294	516-420-8111
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
§ International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ James Electronics, Chicago, IL 60618	312-463-6500
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Magnetek Triad, Huntington, IN 46750	219-356-7100
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Modular Devices Inc., Torrance, CA 90503	310-542-8561
Nedap N.V., Groenlo, HOLLAND 7140 AA	+ 31-5440-71111
Oeco Corp., Milwaukie, OR 97222	503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
† Oram High Voltage, Dayton, TX 77535	409-258-5553
Panasonic Industrial Co., Milpitas, CA 95035	408-946-7200
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
PowerLine, Inc., Denver, CO 80210	303-698-7883
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
QPS Inc., Salem, NH 03079	603-893-5100
§ Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700;800-992-1701
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
Resonant Power Technology, San Jose, CA 95131-2102	408-441-0800
RO Associates, Inc., Sunnyvale, CA 94088	408-744-1450
Schott Corp., Wayzata, MN 55391	612-475-1173
Schroff, Inc., Warwick, RI 02886	401-732-3770
Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
Staco Energy Products Co., Dayton, OH 45403	513-253-1191
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
† Teapo Electronic Corp. of America, Norcross, GA 30071	404-449-6220
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Teco Corp., Winnisquam, NH 03289	603-524-1998
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
Transformer Technologies, Inc., Mt. Vernon, NY 10552	914-668-1600
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043	415-968-9176
† Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493	708-391-8700
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Photomultiplier — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)

Power Supplies, Plug-In-4000

§ **AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225**	**D•2052-2053, 2055**
§ **Acon, Inc., South Easton, MA 02375, 508-230-8022**	**D•2058-2066**
† **Acopian Technical Company, Easton, PA 18044, 215-258-5441**	**D•1517**
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1556**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1557-1559**
# **American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355**	**D•1564, 1571**
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574,1576-1577**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**D•1582-1583**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592**
§ **Astec High Voltage, Ashland, MA 01721, 508-881-8407**	**D•1597**
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1602**
§ **Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900**	**D•1608-1609**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1611**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618**
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	**D•1630**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253-2255**
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	**D•1648,1650**
§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**D•1653**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	**D•1654-1655**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	**D•2099-2100**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**A•2318, D•1660-1662**
§† **Electromech, Inc., Irvington, NJ 07111, 201-318-7999**	**A•2325, D•1672**
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	**D•1673**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936,1946**
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	**D•1688**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691-1692**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1708**
Geopower Inc., Ramsey, NJ 07446, 201-236-0156	**D•1858**
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000**	**D•1731**
§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970**	**D•1734-1735**
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	**D•1753-1755**
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2110-2111**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756-1758, 1760**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1811-1814**
§ **LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600**	**B•1844, D•1818-1826,2277**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837,1843**
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	**D•1846**
§ **Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337**	**D•1874-1876**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	**D•1879**
† **Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885**	**D•1882**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1897**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229**	**D•2300**
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	**D•1910-1911**
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	**C•1081**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**A•2534, D•1921**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244**	**D•1937**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270**	**A•2579, D•1945-1947**
# **Technical Devices, Dayton, OH 45414, 513-890-7881**	**D•1956-1957**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272**	**D•2002**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2011**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
§# **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984**	**C•1081**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041,2306**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Action Instruments, San Diego, CA 92123	619-279-5726

§ Adcour, Inc., Sharon, MA 02067	617-784-8123
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Anaheim Automation, Anaheim, CA 92801	714-992-6990
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4	416-844-6681
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Cell-Con, Inc., Exton, PA 19341	215-363-8552
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ CPS, Lake Oswego, OR 97035	503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Diversified Technlg., Ridgeland, MS 39157	601-856-4121
§ Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521	312-775-3600
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
Elgar Electronics Corporation, San Diego, CA 92121	619-450-0085;800-733-5427
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
§ Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Engineering Design & Sls., Danville, VA 24541	804-792-6405
Ensign Corp., Burr Ridge, IL 60521	708-325-9343
EWC, Inc., Englishtown, NJ 07726	908-446-3110
Friwo, Friemann & Wolf, Frederick, MD 21702	301-694-7479
§ GC International Inc., Plano, TX 75074	214-423-8411
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
# House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714-375-0222
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706	717-824-4666
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ James Electronics, Chicago, IL 60618	312-463-6500
§† JMK, Inc., Amherst, NH 03031	603-886-4100
Kappa Technologies, Inc., Rahway, NJ 07065	908-396-9400;1-800-223-0603
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071	305-344-3682
§ Laube Technology, Woodland Hills, CA 91367	818-703-1188
† Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Microtran Co. Inc., Valley Stream, NY 11582-0236	516-561-6050
§ MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
§ Multi Products International, West Paterson, NJ 07424	201-890-1344
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Omega Engineering, Stamford, CT 06907	800-826-6342
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
§ Opamp Labs, Inc., Los Angeles, CA 90038	213-934-3566
† Optima Electronic Packaging Systems, Tucker, GA 30084-5088	404-496-4000
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
# Peter Parts & Assocs., Webster, NY 14580	716-265-2540
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Conversion Products, Crystal Lake, IL 60014	815-459-9100
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
PowerLine, Inc., Denver, CO 80210	303-698-7883
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
Power-One, Inc., Camarillo, CA 93012	805-987-8741
† Precision Components, Inc., Wilmington, IL 60481	708-543-6448
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Reliability Incorporated, Houston, TX 77218	713-492-0550
RF Electronics, Inc., Irvine, CA 92714-5517	714-263-0661
RO Associates, Inc., Sunnyvale, CA 94088	408-744-1450
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
Schott Corp., Wayzata, MN 55391	612-475-1173
Schroff, Inc., Warwick, RI 02886	401-732-3770
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§† Skyway Magnetics, Warner Springs, CA 92086-9714	619-782-3342
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863	618-262-5555
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Taylor Electronics, Inc., Tempe, AZ 85283	602-838-4523
Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
USAPEX Corp., Santa Clara, CA 95051	408-982-9063
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
Xylog Corp., Hackensack, NJ 07601	201-489-4040
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Precision, Low Noise-4000

Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222	**D•1553**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1592**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244-2247**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618-1623**
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	**D•2252**
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	**D•1627**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1661**
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	**D•1667**
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680	**D•1686**
§ Hauman, Inc., San Jose, CA 95131, 408-434-0888	**D•1737**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	**D•1751**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1768**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1808**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816-1817,2130**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1832**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1886**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1899**
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	**D•1914-1915**
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	**D•1916**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1961,1963**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	**D•2013,2015**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2037-2038**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
# American Skynet Electronic Co., Milpitas, CA 95035	408-945-6355
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§ Computer Products/Power Conversion America, So. Boston, MA 02127	800-733-9288;617-464-6600
§† CPS, Lake Oswego, OR 97035	503-684-8026
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
Energy Systems, Vancouver, WA 98682	206-896-8310
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706	717-824-4666
Intronics, Inc., Canton, MA 02021	800-367-0004
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ Kenwood U.S.A., Long Beach, CA 90810	310-761-8295
§ Koep Precision Standards, Inc., Tuckerton, NJ 08087	609-296-9686
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
§ Metermaster, Tempe, AZ 85282	602-431-0015
MPC, Div. of Consulting Systems, Danville, NH 03819	603-642-5913;1-800-238-8380
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
NF Electronic Instruments, State College, PA 16801	814-237-5580
Northern Ampower Corp., Novi, MI 48374	313-349-4860
Oram High Voltage, Dayton, TX 77535	409-258-5553
Panasonic Industrial Co., Milpitas, CA 95035	408-946-7200
Polytron Devices, Inc., Paterson, NJ 07544	201-345-5885

Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667 9500
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ **Power Solutions Inc., Pompano Bch., FL 33064**	305-943-4110
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
† **Power Ten, Inc., Sunnyvale, CA 94086**	408-738-5959
† **QPS Inc., Salem, NH 03079**	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402	805-528-5858
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
Tri-Source Inc., Shelton, CT 06484	203-924-7030
Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Walker Scientific, Worcester MA 01606	508-852-3674;508-853-3232;800-962-4638
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
§ Xantrex Technology Inc., Bellingham, WA 98227 9754	206-671-2966
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471 4001
Zytronics, Inc., Bedford NH 03110	603-623-8888

Power Supplies, Printed Circuit Board Mounting-4000

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	**D•2052-2054**
§ Acon, Inc., South Easton, MA 02375, 508-230-8022	D•2058-2059,2064-2066
Acopian Technical Company, Easton, PA 18044, 215-258-5441	D•1517
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1564-1566,1570**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	D•1592
§ Astec High Voltage, Ashland, MA 01721, 508-881-8407	D•1596-1597
§ Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1602
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In **Can.:1-800-553-2448**	**D•1604-1607**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	D•1611
Bel Fuse, Jersey City, NJ 07302, 201-432-0463	**D•2074-2075**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618,1621**
Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411	**D•1624**
EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1670**
Electromech, Inc., Irvington, NJ 07111, 201-318-7999	D•1672
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620	D•1673
Electronic Measurements, Neptune NJ 07753, 908-922-9300	D•2105
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626;800-546-3680	D•1686
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	D•1753-1755
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	D•2110
Intronics, Inc., Canton, MA 02021, 800-367-0004	D•2124-2125
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	D•1756
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837,1840,1843,2136**
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700	D•1847
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	D•1859,2137
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885	D•1882-1884
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•2202
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	D•1942
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	D•1946-1947
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960
Todd Products Corp., Brentwood, NY 11717 516-231-3366	D•1967
Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	D•1999-2000
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	D•2212
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	D•2013-2014
Voltex, Amityville, NY 11701, 516-842-2772	D•2217
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2046**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588	510-734-3060
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
§ Computer Products Power Conversion America, So. Boston, MA 02127	800-733-9288;617-464-6600
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Delta Products Corporation, Fremont, CA 94538	510-770-0660
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Kappa Technologies, Inc., Rahway, NJ 07065	908-396-9400;1-800-223-0603
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766	603-448-3444
§ LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
Panel Components Corp., Oskaloosa, IA 52577	515-673-0097
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
Power Trends, Inc., Batavia, IL 60510	708-406-0900
Semtech Corporation, Newbury Park, CA 91320	805-498-2111
Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
TDK Corporation of America, Electronic Components & Material, Mount Prospect IL 60056	708-803-6100
Tower Electronics, Inc., Fridley MN 55432	612-571-3737
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603 778-2300
Wilmore Electronics Co., Inc., Hillsborough, NC 27278	919-732-9351

Power Supplies, Printed Circuit Card-4000

§ AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	D•2052-2053
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	D•1564-1567,1570-1571
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	D•1576
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1602
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In **Can.:1-800-553-2448**	**D•1604-1607**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1611**
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	D•1646-1647
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	D•1648
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	D•2082
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	D•2105
† **Endicott Research Group, Endicott, NY 13760, 607-754-9187**	**B•1047, D•1687**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	D•1691-1696
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	**D•1751-1755**
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2110-2111**
Interpoint Corporation, Redmond, WA 98052, 206-882-3100	D•2112
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	D•1756
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	D•1765
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816**
† Modular Devices, Shirley, NY 11967, 516-345-3100	D•1837,1840,1843
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	D•1846
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	D•1859,2137
† Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885	D•1882-1884
† **Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500**	**D•2192-2193**
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	D•1886
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1897**
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	D•1914-1915
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•2202
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654	D•1918-1919,2211
§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872**	**D•1942**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	D•1945
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	D•2001
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272	D•2002
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622	D•2003
Voltex, Amityville, NY 11701, 516-842-2772	D•2217
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2041,2306
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
Adtech Power Inc., Anaheim, CA 92806	714 634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
AES Corp., Peabody, MA 01960	508-535-7310
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639	800-933-7725
Anaheim Automation, Anaheim, CA 92801	714-992-6990
† Arnold Magnetics, Camarillo, CA 93012	805 484-4221
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
§ Calex Mfg. Co., Inc. Concord, CA 94520	510 687-4411
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Cherokee International Inc., Core Industries Tustin, CA 92680-7211	714-544 6665
§ Computer Products/Power Conversion America, So. Boston, MA 02127	800-733-9288;617-464-6600
§ Condor D.C. Power Supplies Inc., Oxnard, CA 93033	805-486-4565
CPS, Lake Oswego, OR 97035	503-684-8026
C-Tek Inc., Wakefield, MA 01880	617-246-1720
D & B Power, Inc., Bayshore, NY 11706	516-586-5955
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600

Power Supplies, Printed Circuit Card-4000 (Cont'd)

† Delta Products Corporation, Fremont, CA 94538	510-770-0660
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
§ E & L Instruments, Interplex Electronics, Inc., New Haven, CT 06512	800-368-0880
§† Electromech, Inc., Irvington, NJ 07111	201-318-7999
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
Electrostatics, San Diego, CA 92111	619-279-1414
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
Golden Pacific Electronics, Inc, Placentia, CA 92670	714-993-6970
† High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706	717-824-4666
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071	305-344-3682
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
§ LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
Mesa Power Systems, Escondido, CA 92029	619-489-8162
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
§ MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§ Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
Taylor Electronics, Inc., Tempe, AZ 85283	602-838-4523
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Tri-Source Inc., Shelton, CT 06484	203-924-7030
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
§ Wall Industries, Exeter, NH 03833	603-778-2300
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4	514-694-9136
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050
WPI Group, Inc., Warner, NH 03278	603-456-3111
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001
Xylog Corp., Hackensack, NJ 07601	201-489-4040
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Programmable-4000

† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820**	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900**	**D•2230**
Advanced High Voltage Company, Tucson, AZ 85751, 602-721-2424;818-997-7222	**D•1553**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1557**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**D•1573**
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1603**
§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448**	**D•1604**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244-2246**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618-1619,1621**
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	**D•2250-2252**
§ **Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;**	**D•1641**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600**	**D•1656-1657,1659**
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	**D•1666-1667**
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	**D•1677-1679, 1681**
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427**	**D•1684-1685,2257-2258**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1706-1709**
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	**D•1714-1718,1729**
Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241	**D•1404**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1272**
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700**	**D•2271**
§ **Instek Corporation, City of Industry, CA 91745, 818-336-6537**	**D•1745**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	**D•2111**
JETA Power Systems, Inc., Signal Hill. CA 90806, 310-427-0095	**D•1762-1763**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1766-1769**
§ **Kenwood U.S.A., Long Beach, CA 90810, 310-761-8295**	**D•1772-1774**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1808-1809**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197	**D•1828-1830**
Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	**D•1015**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1832-1833**
MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171	**D•2283**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837,1844**
† **NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900**	**D•1303,1849**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300**	**D•1851**
† **Oram High Voltage, Dayton, TX 77535, 409-258-5553**	**D•1853**
† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433**	**D•2286,2288-2289**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1886,1892-1893,1895**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1896-1897**
† **Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959**	**D•1907**
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	**D•1922**
† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001**	**A•2565, D•1958**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
† **Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622**	**D•2003**
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	**D•2015**
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	**D•2037-2038**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2046**
AAK Corp, Haverhill, MA 01832	508-373-3769;800-886-2225
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
AES Corp., Peabody, MA 01960	508-535-7310
AMASCO, Torrance, CA 90501	310-781-9494
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Autronics Corp., Arcadia, CA 91006	818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Babcock, Inc., Orange, CA 92667	714-633-3700
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§ Contact East, N. Andover, MA 01845	508-682-2000
§† CPS, Lake Oswego, OR 97035	503-684-8026
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
Electric Device, Canfield, OH 44406	216-533-1111
Φ Electronic Development Corp., EDC, Boston, MA 02127-4198	617-268-9696
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Energy Systems, Vancouver, WA 98682	206-896-8310
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100

Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
Gossen/Texmate, Vista, CA 92083-8397	619-598-9899;1-800-394-8344
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Melcher, Inc., Melcher AG, Chelmsford, MA 01824	800-828-9712
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
† NH Research, Irvine, CA 92714	714-474-3900
Northern Ampower Corp., Novi, MI 48374	313-349-4860
Oeco Corp., Milwaukie, OR 97222	503-659-7932
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
Power Switch Corporation, Lodi, NJ 07644	201-478-5788
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Pulse Instruments Co., Torrance, CA 90502	310-515-5330
Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700;800-992-1701
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sorensen Company, Paxton, IL 60957	800-525-2024
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
§† Vicor Corp., Andover, MA 01810	508-470-2900
Voltex, Amityville, NY 11701	516-842-2772
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
§ Xantrex Technology Inc., Bellingham, WA 98227-9754	206-671-2966
Xylog Corp., Hackensack, NJ 07601	201-489-4040
Zytronics, Inc., Bedford, NH 03110	603-623-8888

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Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1557,1559**
# **American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355**	**D•1572**
† **Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500**	**D•1574,1576**
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074	**D•1617**
§ **Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600**	**D•2090**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	**D•1691**
† **HC Power Inc., Irvine, CA 92714-5716, 714-261-2200**	**D•1738,1741**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1762**
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	**D•1765**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1811,1813-1814**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834-1835**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837**
§ **Power-One, Inc., Camarillo, CA 93012, 805-987-8741**	**D•1886**
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	**D•1916**
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**D•1959**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§# **Total Power International, Inc., Lowell, MA 01850, 508-453-7272**	**D•2002**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2011**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Adtech Power Inc., Anaheim, CA 92806	714-634-9211
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588	510-734-3060
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
§ Astec Standard Power, Oceanside, CA 92054	619-757-1880
§ Autec Power Systems, Simi Valley, CA 93065	805-522-0888
§ Beaver Labs, Kingston, MA 02364	617-585-5666
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6	416-298-0560
§ Cal-Tek Engineering, Kingston, MA 02364	617-585-5666
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§ CPS, Lake Oswego, OR 97035	503-684-8026
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
Energy, Ltd., Bladensburg, MD 20710	301-699-1144
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
International Power Sources, Inc., Ashland, MA 01721	508-881-7434
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Modular Devices Inc., Torrance, CA 90503	310-542-8561
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
† Power Ten, Inc., Sunnyvale, CA 94086	408-738-5959
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sorensen Company, Paxton, IL 60957	800-525-2024
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036	704-892-8872
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Urban Electronics, Dover, MA 02030	617-329-4068
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Voltex, Amityville, NY 11701	516-842-2772
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

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† **Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010**	**D•2223**
† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900**	**D•2230**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592**
§ **Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792**	**D•2253,2255**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427**	**D•2257,2259**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**D•2272-2273**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•2284-2285**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
† **Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622**	**D•2003**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
AES Corp., Peabody, MA 01960	508-535-7310
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639	800-933-7725
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
†# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
† American Monarch, Minneapolis, MN 55421	612-788-9161
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
Astec Standard Power, Oceanside, CA 92054	619-757-1880
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Beaver Labs, Kingston, MA 02364	617-585-5666
§ Best Power Technology, Inc., Necedah, WI 54646	608-565-7200;800-356-5794
Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
§ Cal-Tek Engineering, Kingston, MA 02364	617-585-5666
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000

Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§ Contact East, N. Andover, MA 01845	508-682-2000
§† Control Technology, Inc., Oklahoma City, OK 73116	405-840-3163
§ Converter Concepts, Inc., Pardeeville, WI 53954	608-429-3000
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
§† Cuesta Systems Corporation, San Luis Obispo, CA 93401	805-541-4160; 800-332-3440
§† Deltec Elctrns. Corp., San Diego, CA 92110	619-291-4211;800-854-2658
EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
§ Falcon Electric, Monrovia, CA 91016	800-842-6940
† FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341
§† Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
§ Golden Pacific Electronics, Inc, Placentia, CA 92670	714-993-6970
† Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Jerome Industries Corp., Elizabeth, NJ 07201	908-353-5700
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
§Φ Logic Beach Inc., La Mesa, CA 91941	619-698-3300
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
§ Lortec Power Systems, Inc., Elyria, OH 44035-2214	216-327-5050
Luxtron Inc., Haverhill, MA 01830-4803	508-372-5211
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Mep Controls, Bordentown, NJ 08505	609-298-7300
§ Metermaster, Tempe, AZ 85282	602-431-0015
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
† NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
Perma Power Elctrns., Niles, IL 60714	312-763-0763
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
# Power-Pak, Inc., Morton Grove, IL 60053	708-966-6000
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
QPS Inc., Salem, NH 03079	603-893-5100
† Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
§ Relay Specialties. Oakland, NJ 07436	201-337-1000
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131	408-943-0440
Sanford-Miller Corp., Oceanside, NY 11572	516-763-0926;800-645-5900
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
Spectra Lux Corp., Kirkland, WA 98034	206-823-6857
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Sutton Designs, Inc., Ithaca, NY 14850	800-326-8119
†# Tauber Elctrns. Inc., San Diego, CA 92117	619-274-7242;1-800-927-0004
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
Tri-Source Inc., Shelton, CT 06484	203-924-7030
† Tungstone Batteries, Inc., Sharon, MA 02067	617-784-2000
Urban Electronics, Dover, MA 02030	617-329-4068
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
The Wiremold Company, W. Hartford, CT 06110	203-233-6251
† Xenotronix Inc., Valencia, CA 91355	805-257-4793
Xylog Corp., Hackensack, NJ 07601	201-489-4040

Power Supplies, Submodular-4000

§ **AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225**	**D•2052-2055**
† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820**	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
† **Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900**	**D•2230**
† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221**	**D•1585-1589**
† **Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819**	**D•1592**
§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448**	**D•1604**
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	**D•1610-1611**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1618**
§ **Calex Mfg. Co., Inc., Concord, CA 94520, 510-687-4411**	**D•1624**
§ **Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600**	**D•1633**
† **Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328**	**D•2082**
† **Del Electronics Corp., Valhalla, NY 10595, 914-686-3600**	**D•1659**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1661**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1685**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070	**D•1706,1708**
§ **International Power Devices Inc., Boston, MA 02134, 617-782-3331**	**D•1751**
† **Interpoint Corporation, Redmond, WA 98052, 206-882-3100**	**D•2112**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837**
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	**D•1846**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300**	**D•1851**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2289**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**A•2443**
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	D•1886
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229**	**D•2300**
† **RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450**	**D•2202**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960,1962**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
† **Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622**	**D•2003**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2004-2006,2212**
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	**D•2014**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp. Ont., CAN K0A 1L0	613-836-3511
§† Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588	510-734-3060
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621	201-385-0500
§ Astec Standard Power, Oceanside, CA 92054	619-757-1880
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
† Babcock, Inc., Orange, CA 92667	714-633-3700
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
CPS, Lake Oswego, OR 97035	503-684-8026
D & B Power, Inc., Bayshore, NY 11706	516-586-5955
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089	408-734-2020
Electronic Measurements, Neptune, NJ 07753	908-922-9300
Electrostatics, San Diego, CA 92111	619-279-1414
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
Endicott Coil Co., Inc., Binghamton, NY 13905	607-797-1263
Endicott Research Group, Endicott, NY 13760	607-754-9187
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
Friwo, Friemann & Wolf, Frederick, MD 21702	301-694-7479
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
Magnetek Triad, Huntington, IN 46750	219-356-7100
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Nedap N.V., Groenlo, HOLLAND 7140 AA	+31-5440-71111
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Opamp Labs, Inc., Los Angeles, CA 90038	213-934-3566
† Polytron Devices, Inc., Paterson, NJ 07544	201-345-5885
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
Power Designs, Inc., Westbury, NY 11590	516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
† Power Supply Concepts Inc., Jupiter, FL 33458-8947	407-746-1800
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
Power Trends, Inc., Batavia, IL 60510	708-406-0900
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
§ Switching Systems International, Placentia, CA 92670	714-996-0909:800-992-7740
† Technipower, A Penril Co., Danbury, CT 06813	203-748-7001
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586
Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
Urban Electronics, Dover, MA 02030	617-329-4068
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

Power Supplies, Switching-4000

† **Abbott Electronics, Los Angeles, CA 90034, 310-202-8820**	**D•1491**
§ **Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200**	**D•1512-1513,1515**
§ **Acon, Inc., South Easton, MA 02375, 508-230-8022**	**D•2058-2062,2064-2066**
Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**

§† Adtech Power Inc., Anaheim, CA 92806, 714-634-9211	D•1549
Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930	D•2067
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	D•1554-1556
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	D•1557,1559
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	D•1560
# American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	D•1561-1567,1570-1572
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	D•1574-1577
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	D•1585-1591
† Ascent Power Technology, Concord, Ont.. CANADA L4K3C3, 905-660-9819	D•1592
§ Astec Standard Power, Oceanside, CA 92054, 619-757-1880	D•1599-1601
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448	D•1604
§ Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900	D•1608
Autec Power Systems, Simi Valley, CA 93065, 805-522-0888	D•1610
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	D•2232
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074	D•1617
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	D•2244,2249
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	D•1618-1619,1621
California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	D•2250
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211, 714-544-6665	D•1625-1629
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	D•1631-1634,2090-2092
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800	B•1035
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	D•1639-1641,1644-1645
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	D•2253
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880	D•2096-2097
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	D•1646-1647
§ Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054, 408-980-5144	D•1648-1649
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	D•2082
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000	D•2099
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600	D•1656-1657,1659
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	A•2318,2321, D•1660-1662,1664
Dynapower Corporation, S. Burlington, VT 05407, 802-860-7200	D•1666
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	D•1670-1671
Electronic Measurements, Neptune, NJ 07753, 908-922-9300	D•1674-1675,1679-1680,1682,2104
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	D•1684,2257-2258
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996	D•1688
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561	D•1691-1697
Farnell Advance Power, Solon, OH 44139, 216-349-0755	D•1699-1704
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007	D•1712,1729
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	D•1730-1732
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	D•1735
† HC Power Inc., Irvine, CA 92714-5716, 714-261-2200	D•1738-1739
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	D•2272
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	D•1747
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	D•1751-1752
§ International Power Sources, Inc., Ashland, MA 01721, 508-881-7434	D•2110-2111
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	D•2112
Intronics, Inc., Canton, MA 02021, 800-367-0004	D•2125
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	D•1757-1759
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	D•1762-1763
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	D•1765
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	D•1766-1768
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603	D•2128-2129
Keltron Corp., High Voltage Power Supplies & Industrial Printers, Waltham, MA 02154, 617-894-8700	D•1770-1771
Kepco, Inc., Flushing, NY 11352, 718-461-7000	D•1777
KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	D•1807
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	D•1808
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	D•1810-1813,1815
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	D•1357
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	D•1816-1817,2130
§ LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	D•1818-1820
† Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	D•1015
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	D•2278
† Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712	D•2131-2134
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	D•1834-1835
† Modular Devices, Shirley, NY 11967, 516-345-3100	D•1837,1843
MPC, Div. of Consulting Systems, Danville, NH 03819, 603-642-5913;1-800-238-8380	D•1846
§† Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700	D•1847
Multi Products International, West Paterson, NJ 07424, 201-890-1344	D•1848
Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566	D•1017
† Oram High Voltage, Dayton, TX 77535, 409-258-5553	D•1853
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	D•2289
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	A•2443, D•2291
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	D•1859,2137
Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337	D•1876
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	D•1879-1881
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	D•1886,1888-1891,1894-1895
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	D•1896-1897
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	D•1899
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959	D•1907
Resonant Power Technology, San Jose, CA 95131-2102, 408-441-0800	D•1914-1915
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	C•1081
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	D•1916
§ Shindengen America Inc., Westlake Vl., CA 91362, 800-634-3654	D•1918-1919,2211
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686	D•1922
§ Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740	D•1938-1939
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	D•1942
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	D•1945,1948-1949,1954
†# Tauber Elctrns. Inc., San Diego, CA 92117, 619-274-7242;1-800-927-0004	D•1480,1482
# Technical Devices, Dayton, OH 45414, 513-890-7881	D•1956-1957
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	A•2565, D•1958
Techron Div., Crown Intl., Inc., Elkhart, IN 46517, 219-294-8300	D•1021
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960,1962,1964
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	D•1999
§# Total Power International, Inc., Lowell, MA 01850, 508-453-7272	D•2002
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525	C•1108-1109
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	A•1612,1614, D•2004-2006
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	D•2008,2011
ULTRAVOLT, Inc., Ronkonkoma, NY 11779, 800-876-POWER	D•2013-2015
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442	D•2017
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300	D•2037
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	C•1081
Voltex, Amityville, NY 11701, 516-842-2772	D•2217
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2041,2306
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	D•2044,2046

AAK Corp, Haverhill, MA 01832	508-373-3769;800-886-2225
Absopulse Electronics Ltd., Carp, Ont, CAN K0A 1L0	613-836-3511
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
† ACME-URDC, Inc., West Jordan, UT 84084	801-561-9385
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Advanced Power Designs Inc., Irvine, CA 92714	714-263-8605
A.L.E. Sys., Inc., Ashland, MA 01721	508-881-5252
Alliance Electronics Corp., Wilsonville, OR 97070-0503	503-682-4976
AMASCO, Torrance, CA 90501	310-781-9494
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
Aslan Computer Corporation, S. El Monte, CA 91733	818-575-5271
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
† Autronics Corp., Arcadia, CA 91006	818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Babcock, Inc., Orange, CA 92667	714-633-3700
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
Bay Components, Inc., Annapolis, MD 21403	410-268-0122
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
Brown Applied Technology Inc., Scarborough,Ont. CANADA M1P 4S6	416-298-0560
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
Candela Laser Corporation, Wayland, MA 01778	508-358-7637
† CEC, Orange, CA 92665	714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Converter Power, Inc., Ipswich, MA 01938	508-356-2558
§† Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES	(0271) 863781
§† CPS, Lake Oswego, OR 97035	503-684-8026
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141

CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2	514-694-9320
† Delta Products Corporation, Fremont, CA 94538	510-770-0660
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Dotronix, New Brighton, MN 55112	612-633-1742
Electromech, Inc., Irvington, NJ 07111	201-318-7999
† Electronic Development Associates, Dix Hills, NEW YORK 11746	516-673-3881
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
† Electro Physics Co., Inc., Waukegan, IL 60085	708-249-5801
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
§ Elpac Power Systems, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
Friwo, Friemann & Wolf, Frederick, MD 21702	301-694-7479
§ GC International Inc., Plano, TX 75074	214-423-8411
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
Glentek, Inc., El Segundo, CA 90245	310-322-3026
§ Golden Power Systems, Inc., Simi Valley, CA 93065	805-582-4400
Green Engineering, Melrose, MA 02176	617-665-8994
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
§ IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
IMC Power Sources, San Jose, CA 95112	408-441-9614
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Integrity Technology Corporation, Santa Clara, CA 95050	408-262-8640
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ James Electronics, Chicago, IL 60618	312-463-6500
† K & M Electronics Inc., W. Springfield, MA 01089	413-781-1350
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154	617-894-8700
KNIGHTFIRE TECHNOLOGY, Coral Springs, FL 33071	305-344-3682
§ Kraft Dynatronix, Inc., Amery, WI 54001	715-268-8118;800-826-7172
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Laser Magnetics, Chelmsford, MA 01824	508-250-1507
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† Mep Controls, Bordentown, NJ 08505	609-298-7300
Mesa Power Systems, Escondido, CA 92029	619-489-8162
Micro Power Intl., Inc., San Diego, CA 92126	619-271-0831;619-271-5942
§† MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
Modular Devices Inc., Torrance, CA 90503	310-542-8561
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† NH Research, Irvine, CA 92714	714-474-3900
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
Oeco Corp., Milwaukie, OR 97222	503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909	407-831-2000
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Panasonic Industrial Co., Milpitas, CA 95035	408-946-7200
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
Perma Power Elctrns., Niles, IL 60714	312-763-0763
† Polytron Devices, Inc., Paterson, NJ 07544	201-345-5885
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714	714-975-1222
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248	213-323-8120
§† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821	508-667-9500
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
† Power Functions Engineering, Garland, TX 75042	214-278-0996
§ Power General, Nidec Corp., Canton, MA 02021	617-828-6216
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
§† Power/Mate Corporation, San Diego, CA 92110	800-843-8544;619-299-3800
Powemetics LTD., Leics, ENG LE11 1DX	0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Precision Components, Inc., Wilmington, IL 60481	708-543-6448
§† Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301;1-800-553-6374
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
§ Quality Power Systems, Inc., Pearland, TX 77581	713-997-1700;800-992-1701
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
† Reich Associates, Inc., Lakehills, TX 78063	210-751-3220
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Royal Enterprises Co., Simi Valley, CA 93063	805-522-8730:818-998-2455
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schott Corp., Wayzata, MN 55391	612-475-1173
Schott High Voltage, Salt Lake City, UT 84119	801-972-3690
§ Semiconductor Circuits, Inc., Astec America, Inc., Windham, NH 03087	603-893-2330
Semtech Corporation, Newbury Park, CA 91320	805-498-2111
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714	619-782-3342
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† Sorensen Company, Paxton, IL 60957	800-525-2024
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
Taylor Electronics, Inc., Tempe, AZ 85283	602-838-4523
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
† Teapo Electronic Corp. of America, Norcross, GA 30071	404-449-6220
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
§ Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Urban Electronics, Dover, MA 02030	617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
§† Vicor Corp., Andover, MA 01810	508-470-2900
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050
WPI Group, Inc., Warner, NH 03278	603-456-3111
Xylog Corp., Hackensack, NJ 07601	201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043	415-968-9176
† Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493	708-391-8700
Zytronics, Inc., Bedford, NH 03110	603-623-8888

Power Supplies, Switching, Battery Backup-4000

A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1559**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**D•1560**
# American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1561**
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574-1577**
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1585**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1592**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244**
Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	**D•1633-1634**
Conversion Devices, Inc., Brockton, MA 02401, 508-559-0880	**D•2096-2097**
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	**D•1646-1647**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1662**
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1671**
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2257,2259**
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1403**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**D•2272**
International Power Devices Inc., Boston, MA 02134, 617-782-3331	**D•1751**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1757**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1762-1763**
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712	**D•1765**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1810**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•2130**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834**
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700	**D•1847**
Pioneer Magnetics, Santa Monica, CA 90404, 310-829-6751	**D•1879-1881**
§ Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1886,1894-1895**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1897**
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788	**D•1899**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
§ Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888	**D•1999**
Tri-Source Inc. Shelton, CT 06484, 203-924-7030	**D•2008-2010**

§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442 ... D•2017
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041,2306
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 ... 613-836-3511
§ Adcour, Inc., Sharon, MA 02067 ... 617-784-8123
§ Adtech Power Inc., Anaheim, CA 92806 ... 714-634-9211
Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600
§ AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
† ATC Power Systems, Inc., Merrimack, NH 03054 ... 603-429-0391
Ault, Incorporated, Minneapolis, MN 55428 ... 612-493-1900
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
§ Beaver Labs, Kingston, MA 02364 ... 617-585-5666
Behlman Electronics Inc., Lake Success, NY 11042 ... 516-328-1600
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 ... 416-298-0560
§ Cal-Tek Engineering, Kingston, MA 02364 ... 617-585-5666
† CEC, Orange, CA 92665 ... 714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788 ... 516-582-4422
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211 ... 714-544-6665
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 ... 416-299-6666
§ CSB Battery of America Corporation, Ft. Worth, TX 76116 ... 817-732-2258
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 ... 416-826-1141
§† Cuesta Systems Corporation, San Luis Obispo, CA 93401 ... 805-541-4160; 800-332-3440
Energy, Ltd., Bladensburg, MD 20710 ... 301-699-1144
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 ... 310-635-9555
ETM Electromatic Inc, Newark, CA 94560 ... 510-797-1100
Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 ... 516-293-4100
GC International Inc., Plano, TX 75074 ... 214-423-8411
§ Golden Power Systems, Inc., Simi Valley, CA 93065 ... 805-582-4400
† Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140
IMC Power Sources, San Jose, CA 95112 ... 408-441-9614
Industrial Electronic Resources, Corona, CA 91720 ... 909-734-1111;800-433-5160
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706 ... 602-889-7600
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 ... 617-894-8700
LH Research, Inc., Tustin, CA 92680 ... 1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052 ... 216-288-1122
Magna-Power Electronics, Inc., Whippany, NJ 07981 ... 201-428-1197
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 ... 714-956-9200
Melcher, Inc., Melcher AG, Chelmsford, MA 01824 ... 800-828-9712
Mesa Power Systems, Escondido, CA 92029 ... 619-489-8162
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
Nedap N.V., Groenlo, HOLLAND 7140 AA ... +31-5440-71111
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344-3577 ... 612-943-4600
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248 ... 213-323-8120
Power Conversion Products, Crystal Lake, IL 60014 ... 815-459-9100
Power Designs, Inc., Westbury, NY 11590 ... 516-333-6200
Powernetics LTD., Leics, ENG LE11 1DX ... 0509 214153
§ Power Solutions Inc., Pompano Bch., FL 33064 ... 305-943-4110
Power Systems, Inc., Bloomfield, CT 06002 ... 203-726-1300
§ Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3 ... 514-637-1186
QPS Inc., Salem, NH 03079 ... 603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 ... 818-591-8189
Ratelco, Power Systems, Seattle, WA 98109-5589 ... 206-624-7770
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
§ Reliability Incorporated, Houston, TX 77218 ... 713-492-0550
RO Associates, Inc., Sunnyvale, CA 94088 ... 408-744-1450
§ Rose Electronics, Inc., Energy Products Group, San Jose, CA 95131 ... 408-943-0440
Schaefer, Inc., Schaefer GmBH, Ashland, MA 01721 ... 508-879-8658
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Schroff Inc., Warwick, RI 02886 ... 401-732-3770
† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ... 609-866-8888;800-257-8384
Sutton Designs, Inc., Ithaca, NY 14850 ... 800-326-8119
Switching Power Inc., Ronkonkoma, NY 11779 ... 516-981-7231
§ Taitronics, Dimetrics, Inc., Davidson, NC 28036 ... 704-892-8872
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
† Technology Dynamics Inc., Bergenfield, NJ 07621 ... 201-385-0500
Tower Electronics, Inc., Fridley, MN 55432 ... 612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 ... 909-371-5751
Urban Electronics, Dover, MA 02030 ... 617-329-4068
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 ... 310-316-9984
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054 ... 408-496-6273
§† Vicor Corp., Andover, MA 01810 ... 508-470-2900
Viking Industrial Products, Marlboro, MA 01752 ... 508-481-4600
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW ... 0243-865991
† Xenotronix Inc., Valencia, CA 91355 ... 805-257-4793
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 ... 619-471-4001
Zytronics, Inc., Bedford, NH 03110 ... 603-623-8888

Power Supplies, Switching, Medical-4000

Adtech Power Inc., Anaheim, CA 92806, 714-634-9211 ... D•1550-1551
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... D•1560
# American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355 ... D•1561
† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 ... B•1210
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 ... D•1574
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 ... D•1592
Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 ... D•1608
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ... D•2244,2249
§ Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600 ... D•1632
§ Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565; ... D•1636,1640-1641,1644
§ Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000 ... D•1646-1647
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666 ... D•1749
Joule Power, Inc., Boxborough, MA 01719, 508-263-9712 ... D•1765
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100 ... D•1810
Modular Devices, Shirley, NY 11967, 516-345-3100 ... D•1837
§† Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006, 503-646-4700 ... D•1847
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... D•1859,2137
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 ... D•1897
§ Switching Systems International, Placentia, CA 92670, 714-996-0909;800-992-7740 ... D•1938
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108 ... D•1960
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ... D•1967
Tri-Source Inc., Shelton, CT 06484, 203-924-7030 ... D•2011
§ UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442 ... D•2017
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ... D•2038
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 ... 613-836-3511
Advanced Conversion Tech., Middletown, PA 17057 ... 717-939-2300
Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588 ... 510-734-3060
Alliance Electronics Corp., Wilsonville, OR 97070-0503 ... 503-682-4976
Behlman Electronics Inc., Lake Success, NY 11042 ... 516-328-1600
Brown Applied Technology Inc., Scarborough,Ont., CANADA M1P 4S6 ... 416-298-0560
† CEC, Orange, CA 92665 ... 714-637-2970
† CEC Electronics Corp., Hauppauge, NY 11788 ... 516-582-4422
Computer Power Supplies (CPS), Lake Oswego, OR 97035 ... 503-684-8026
Converter Power, Inc., Ipswich, MA 01938 ... 508-356-2558
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 ... 514-694-9320
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
† EMCO High Voltage Co., Sutter Creek, CA 95685 ... 209-223-3626;800-546-3680
HC Power Inc., Irvine, CA 92714-5716 ... 714-261-2200
IMC Power Sources, San Jose, CA 95112 ... 408-441-9614
Jerome Industries Corp., Elizabeth, NJ 07201 ... 908-353-5700
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915 ... 508-922-9300
† Lambda Electronics Inc., Melville, NY 11747-3700 ... 516-694-4200
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 ... 714-956-9200
Modular Devices Inc., Torrance, CA 90503 ... 310-542-8561
Orlando Development Center, Micro Energy Inc., Longwood, FL 32750-4909 ... 407-831-2000
Pioneer Magnetics, Santa Monica, CA 90404 ... 310-829-6751
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 ... 714-975-1222
Power Components Co., Vanguard Electronics Co., Gardena, CA 90248 ... 213-323-8120
Power Designs, Inc., Westbury, NY 11590 ... 516-333-6200
§ Power General, Nidec Corp., Canton, MA 02021 ... 617-828-6216
§ Power Solutions Inc., Pompano Bch., FL 33064 ... 305-943-4110
Power Ten, Inc., Sunnyvale, CA 94086 ... 408-738-5959
QPS Inc., Salem, NH 03079 ... 603-893-5100
Tecnetics Inc., Boulder, CO 80303 ... 303-442-3837
Tower Electronics, Inc., Fridley, MN 55432 ... 612-571-3737
Urban Electronics, Dover, MA 02030 ... 617-329-4068
§† Vicor Corp., Andover, MA 01810 ... 508-470-2900
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 ... 619-471-4001

Power Supplies, Uninterruptible (UPS)-4050

† Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ... D•2223-2224
Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 ... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... D•1512,2228-2229
# Acon, Inc., South Easton, MA 02375, 508-230-8022 ... D•2058
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ... D•2230-2231
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... D•1560
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 ... D•1574,1576
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... D•1604
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500 ... D•2232-2233
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 ... D•2244,2249
§ Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ... D•2253,2255
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 ... D•2082
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•2257,2259
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144 ... D•2260
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ... D•2266
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... D•2272-2273
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ... D•1756

KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175	**D•1807**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834**
† **Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500**	D•2284-2285
† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433**	**D•2286-2287,2290**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1894-1895**
† **Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800**	**D•1897**
Powervar, Inc., Lake Forest, IL 60045, 708-816-8585;800-369-7179	**D•2297-2299**
§† **Staco Energy Products Co., Dayton, OH 45403, 513-253-1191**	**D•1936**
§† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001**	**D•1959**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
† **Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622**	**D•2003**
Tri-Source Inc., Shelton, CT 06484, 203-924-7030	**D•2008-2010**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	D•2306-2307
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
§ AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460	508-486-9483
† American Monarch, Minneapolis, MN 55421	612-788-9161
† Arnold Magnetics, Camarillo, CA 93012	805-484-4221
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
§ Beaver Labs, Kingston, MA 02364	617-585-5666
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
§ Best Power Technology, Inc., Necedah, WI 54646	608-565-7200;800-356-5794
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
† Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
§ Brooks Electronics, Philadelphia, PA 19140	215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020	215-244-0264;1-800-523-1551
Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
§ Cal-Tek Engineering, Kingston, MA 02364	617-585-5666
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462	215-828-9000
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
§ Chloride Power Electronics, Caledonia, NY 14423	716-538-4421
§† Clary Corp., Precision Instrs. Div., Monrovia, CA 91016	818-359-4486
Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§ Contact East, N. Andover, MA 01845	508-682-2000
§† Control Technology, Inc., Oklahoma City, OK 73116	405-840-3163
§ Converter Concepts, Inc., Pardeeville, WI 53954	608-429-3000
Coutant Lambda Ltd., Ilfracombe, Devon, ENGLAND EX34 8ES	(0271) 863781
Criterion Instrs., Ltd. Scarborough, Ont., CAN M1P4W8	416-299-6666
§ CSB Battery of America Corporation, Ft. Worth, TX 76116	817-732-2258
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
§† Cuesta Systems Corporation, San Luis Obispo, CA 93401	805-541-4160; 800-332-3440
§† Current Technology, Inc., Richardson, TX 75081-4802	214-238-5300
§† Deltec Elctrns. Corp., San Diego, CA 92110	619-291-4211;800-854-2658
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
§Φ Dynamic Power Systems, Nesconset, NY 11767	516-361-6771;1-800-422-0708
§ EFI Electronics Corp., Salt Lake City, UT 84119	801-977-9009;800-877-1174
EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
§ Emerson Computer Power, Irvine, CA 92718	714-457-3600
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627	714-557-1636
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§ Falcon Electric, Monrovia, CA 91016	800-842-6940
§ Fortron/Source Corp., Power Supplies, Livermore, CA 94550	415-373-1008
§ Furman Sound, Inc., Greenbrae, CA 94904	415-927-1225
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006	818-574-1175
§† Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
§ GENERAL POWER CORPORATION, Anaheim, CA 92815	714-956-9321
§ Golden Pacific Electronics, Inc, Placentia, CA 92670	714-993-6970
§ HDR Power Systems, Inc., Hilliard, OH 43026	614-771-5500
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† International Power Machines, Garland, TX 75042	800-527-1208
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359	215-837-0700
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
LH Research, Inc., Tustin, CA 92680	1-800-547-2537
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
§ Lortec Power Systems, Inc., Elyria, OH 44035-2214	216-327-5050
Luxtron Inc., Haverhill, MA 01830-4803	508-372-5211
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805	714-956-9200
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
† Mep Controls, Bordentown, NJ 08505	609-298-7300
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Modular Devices, Shirley, NY 11967	516-345-3100
§† Oneac Corporation, Libertyville, IL 60048	708-816-6000,800-327-8801
§† Perma Power Elctrns., Niles, IL 60714	312-763-0763
Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
Powernetics LTD., Leics, ENG LE11 1DX	0509 214153
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
† Power Systems & Controls, Inc., Richmond, VA 23230	804-355-2803
† Preferred Electronics, Inc., Westfield, MA 01086	413-568-2301,1-800-553-6374
# Print Products Intl., Silver Spring, MD 20910	301-587-7824,800-638-2020
§† Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
QPS Inc., Salem, NH 03079	603-893-5100
§ Rola, Specialties, Oakland, NJ 07436	201-337-1000
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117	800-245-4501
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Schaefer Inc., Schaefer GmBH, Ashland, MA 01721	508-879-8658
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394, 1-800-367-5811
§ Shindengen America Inc., Westlake VL, CA 91362	800-634-3654
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
§ SL Waber, Inc., Mt. Laurel, NJ 08054	609-866-8888:800-257-8384
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Sutton Designs, Inc., Ithaca, NY 14850	800-326-8119
Switching Power Inc., Ronkonkoma, NY 11779	516-981-7231
†# Tauber Elctrns. Inc., San Diego, CA 92117	619-274-7242;1-800-927-0004
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Top-Link Computer Inc., Milpitas, CA 95035-8001	408-946-7888
§# Total Concept Sales, Glendale, CA 91202-2896	818-547-9476
Tower Electronics, Inc., Fridley, MN 55432	612-571-3737
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
§† Transtector Systems, Inc., Hayden Lake, ID 83835	800-829-2901
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
† Tungstone Batteries, Inc., Sharon, MA 02067	617-784-2000
§ Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9	403-259-3200
Urban Electronics, Dover, MA 02030	617-329-4068
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§ Viteq Corp., Lanham, MD 20706	301-731-0400
§ Volgen America, Inc., Tokyo Keidenki Co., Ltd., Union City, CA 94587	510-429-7170
§ Wall Industries, Exeter, NH 03833	603-778-2300
Weir Elctrns. Ltd., Bognor Regis, West Sussex, ENG PO 22 9RW	0243-865991
The Wiremold Company, W. Hartford, CT 06110	203-233-6251
† Xenotronix Inc., Valencia, CA 91355	805-257-4793
Xylog Corp., Hackensack, NJ 07601	201-489-4040

Power Supplies, Universal Input-4000

Advanced Power Solutions, M & L Enterprises, Pleasanton, CA 94588, 510-734-3060	**D•1554-1556**
A.J.'s Power Source, Inc., Land-O-Lakes, FL 34639, 800-933-7725	**D•1559**
# **American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355**	**D•1562-1563**
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1576-1577**
Astec Standard Power, Oceanside, CA 92054, 619-757-1880	**D•1600-1601**
§ **Autec Power Systems, Simi Valley, CA 93065, 805-522-0888**	**D•1613-1614**
Basler Elec., Electronic Product Group, Highland, IL 62249, 618-654-2341;800-645-2074	**D•1617**
Computer Products/Power Conversion America, So. Boston, MA 02127, 800-733-9288;617-464-6600	**D•1631-1632**
Converter Concepts, Inc., Pardeeville, WI 53954, 608-429-3000	**D•1646**
Farnell Advance Power, Solon, OH 44139, 216-349-0755	**D•1699,1704**
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**D•1731**
Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	**D•1735**
Integrated Power Designs, Inc., Wilkes-Barre, PA 18706, 717-824-4666	**D•1747-1749**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756-1757**
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154, 619-575-1100	**D•1813-1814**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**D•1818-1822**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1894-1895**
§ **Switching Systems International, Placentia, CA 92670, 714-996-0909:800-992-7740**	**D•1938-1941**
§ **Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872**	**D•1942**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1961**
§ **Top-Link Computer Inc., Milpitas, CA 95035-8001, 408-946-7888**	**D•1998-2000**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2004-2006**
§ **UNIPOWER CORPORATION, Pompano Bch., FL 33069-4803, 305-974-2442**	**D•2017**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Brown Applied Technology, Inc., Scarborough, Ont., CANADA M1P 4S6	416-298-0560
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Green Engineering, Melrose, MA 02176	617-665-8994
International Power Sources, Inc., Ashland, MA 01721	508-881-7434
Onan Power/Electronics, Minneapolis, MN 55344-3577	612-943-4600
Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
§ Power Solutions Inc., Pompano Bch., FL 33064	305-943-4110
Power Ten, Inc., Sunnyvale, CA 94086	408-738-5959
Schott Corp., Wayzata, MN 55391	612-475-1173
§ Shindengen America Inc., Westlake VL, CA 91362	800-634-3654
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
Viking Industrial Products, Marlboro, MA 01752	508-481-4600
Westcor Corporation, Los Gatos, CA 95032	408-395-7050

Power Supplies, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)
Power Supplies, Welding, Electroplating — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)
Power Supplies (MIL), DC-2440 — ***See Vol. B***
Power Supplies (MIL), AC-2440 — ***See Vol. B***
Power Supplies for Displays — See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)

Power Supply Interfaces & Accessories-4000

AAK Corp, Haverhill, MA 01832, 508-373-3769;800-886-2225	**D•2052**
† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**A•2266**
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1586,1588,1591**
Bertan High Voltage, Hicksville, NY 11801, 516-433-3110	**D•1619**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1684-1685,2258-2259**
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**D•1731**
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•2271**
§ International Power Devices Inc., Boston, MA 02134, 617-782-3331	**D•1751-1752**
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700	**D•1756**
JETA Power Systems, Inc., Signal Hill, CA 90806, 310-427-0095	**D•1762-1763**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300	**D•1769**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1809**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278,2281**
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521	**D•1857**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	**D•2300**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**D•1921**
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**D•1959**
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3	905-660-9819
Astro-Geo-Marine, Inc., Ventura, CA 93003	805-654-8300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Autec Power Systems, Simi Valley, CA 93065	805-522-0888
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
§ Brooks Electronics, Philadelphia, PA 19140	215-228-4433
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
Cherokee International, Inc., Core Industries, Tustin, CA 92680-7211	714-544-6665
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
§ Computer Products/Power Conversion America, So. Boston, MA 02127	800-733-9288;617-464-6600
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033	805-486-4565;
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ CPS, Lake Oswego, OR 97035	503-684-8026
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089	408-734-2020
§ Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
Electronic Measurements, Neptune, NJ 07753	908-922-9300
§ Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
GENERAL POWER CORPORATION, Anaheim, CA 92815	714-956-9321
Green Engineering, Melrose, MA 02176	617-665-8994
§ HBS Equipment Corporation, Los Angeles, CA 90040	213-726-3033
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hoppecke Battery Systems, Inc., Bulter, NJ 07405	201-492-0045
Industrial Electronic Resources, Corona, CA 91720	909-734-1111;800-433-5160
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
ITT Power Systems Corp, ITT Corp., Tucson, AZ 85706	602-889-7600
Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Lambda Qualidyne Inc., Lambda Group of Unitech, plc, San Diego, CA 92154	619-575-1100
Lorain Products, Reliance Electric, Lorain, OH 44052	216-288-1122
MACROAMP Inc., Ukiah, CA 95482	800-458-8892
Marconi Instruments, Allendale, NJ 07401	201-934-9050
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
† Perry Amplifier, Brookline, MA 02146	617-734-0844
† Polytron Devices, Inc., Paterson, NJ 07544	201-345-5885
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Schott Corp., Wayzata, MN 55391	612-475-1173
§ SL Waber, Inc., Mt. Laurel, NJ 08054	609-866-8888;800-257-8384
† Sorensen Company, Paxton, IL 60957	800-525-2024
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Sutton Designs, Inc., Ithaca, NY 14850	800-326-8119
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
Unitrode Corp., Watertown, MA 02172	617-926-0404
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

Power Supply Test Equipment — See Testers, Power Supply (Vol. D)

Preamplifiers-1100

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181	**D•1003**
Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	**D•1176-1177**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1018**
† Amptek, Inc., Bedford, MA 01730	617-275-2242
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Locus, Kaman, State College, PA 16804	814-466-6275
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967	516-345-3100
† Modular Devices, Shirley, NY 11967	516-345-3100
NF Electronic Instruments, State College, PA 16801	814-237-5580
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Opamp Labs, Inc., Los Angeles, CA 90038	213-934-3566
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
§ Palomar Engineers, Escondido, CA 92046	619-747-3343
Panametrics, Waltham, MA 02154-3497	617-899-2719
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Perry Amplifier, Brookline, MA 02146	617-734-0844
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
† Stanton Magnetics, Inc., Plainview, NY 11803-1511	516-349-0235
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ Winegard Co., Burlington, IA 52601-2000	319-754-0600

Prebonding Etchants — See Chemicals, Etching (Vol. C)
Preforms, Precious Metal-2500 — ***See Vol. C***
Preforms, Soldering-4600 — ***See Vol. C***

Prescalers-2900

§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964	408-988-3500
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
Hecon Corp., Eatontown, NJ 07724	908-542-9200
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Preselector-Mixers-3450 — ***See Vol. A***

Preselectors-1900

§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666	**A•1658-1659**
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
† Microlab/FXR, Livingston, NJ 07039	201-992-7700
† Microphase, Norwalk, CT 06856	203-866-8000
Pole/Zero Corporation, West Chester, OH 45069	513-870-9060
† Premier Microwave, Port Chester, NY 10573	914-939-8900
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† UTE Microwave, Asbury Park, NJ 07712	908-922-1009

Pressure Indicators — See Gauges, Pressure (Vol. D)
Pressure Vessels — See Chambers, Pressure (Vol. D)
Pressurization Units — See Chambers, Pressure (Vol. D)
Printed Circuits & Printed Circuit Materials (MIL)-2440 — ***See Vol. B***

Printers, Bar Code Label-2000

Axiohm, Inc., New Brighton, MN 55112, 612-638-9856	**D•1078-1080**
Micro Electronic Business, Chicago, IL 60641, 312-539-2994	**D•1099**
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770	**D•1106**
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512	**D•1109**
§ Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827	**D•1112**
§ Telpar, Inc., Addison, TX 75001, 214-233-6631	**D•1113**
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
# Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
§ Contact East, N. Andover, MA 01845	508-682-2000

Printers, Bar Code Label-2000 (Cont'd)

# Current Components, Inc., Middleton, MD 21769	301-473-5333
§ DH Print, Div. of DH Technology, Riverton, WY 82501	307-856-4821
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ EPC Identification Sys., Rohnert Park, CA 94928	707-585-8811
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
† Markem Corp., Keene, NH 03431	603-352-1130
§ MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
§ Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
§ Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Practical Automation, Inc., Shelton, CT 06484	203-929-5381
Singer Data Products, Inc., Bensenville, IL 60106	708-860-6500
§ Zebra Technologies Corporation, Vernon Hills, IL 60061-3109	708-634-6700

Printers, Daisywheel-2000

Micro Electronic Business, Chicago, IL 60641, 312-539-2994	**D•1099**
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Miltope Corp., Melville, NY 11747	516-420-0200

Printers, Digital-2000

† **Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000**	**D•1410,1412**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700	**D•1098**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1360**
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512	**D•1108-1111**
§ **Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827**	**D•1112**
Telpar, Inc., Addison, TX 75001, 214-233-6631	**D•1113**
Anadex Inc., Camarillo, CA 93012	805-987-9660
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Data Mega Inc., Mega Data, Bensenville, IL 60106	708-860-6501
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
§† Di/An Controls, Inc., Brockton, MA 02401	508-599-8000
† Digitec, Marion, OH 43302	614-387-3444
§ Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
§ Hecon Corp., Eatontown, NJ 07724	908-542-9200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Honeywell Information Systems, Waltham, MA 02154	617-895-6000
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
§ International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
§ Lasertechnics, Inc., Albuquerque, NM 87113	505-822-1123
† Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
§ Metrum, Denver, CO 80217-5227	303-773-4700
# Mitronics, Rolling Hills, CA 90274	310-377-2022
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Omega Engineering, Stamford, CT 06907	800-826-6342
Omniprint, Inc., Irvine, CA 92718	714-457-0229;800-878-6880
Panasonic Industrial Company, Custom Peripheral Dept., Secaucus, NJ 07094	201-392-6313
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245	213-322-9370
Xerox Corporation, United States Customer Operations, Rochester, NY 14644	800-832-6979

Printers, Dot Matrix Impact-2000

§ **CBM America Corp., Santa Monica, CA 90404, 310-828-8245**	**D•1084-1085**
Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**D•1088-1094**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1378,1382**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ **Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700**	**D•1098**
Micro Electronic Business, Chicago, IL 60641, 312-539-2994	**D•1099**
§ **Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880**	**D•1102-1104**
Singer Data Products, Inc., Bensenville, IL 60106, 708-860-6500	**D•1107**
§ **Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512**	**D•1108-1111**
§ **Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827**	**D•1112**
§† **Telpar, Inc., Addison, TX 75001, 214-233-6631**	**D•1113-1115**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1378,1382**
# Acculex Corporation, Taunton, MA 02780	508-880-3660
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
Anadex Inc., Camarillo, CA 93012	805-987-9660
§† Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201	1-800-537-8791
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
C-Tek Inc., Wakefield, MA 01880	617-246-1720
# Current Components, Inc., Middleton, MD 21769	301-473-5333
Data Mega Inc., Mega Data, Bensenville, IL 60106	708-860-6501
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
§ DH Print, Div. of DH Technology, Riverton, WY 82501	307-856-4821
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
† Digitec, Marion, OH 43302	614-387-3444
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
Epson America Inc., Component Sales Dept., Torrance, CA 90503	310-782-5318
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Genicom Corp., Waynesboro, VA 22980	703-949-1471
Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ Hewlett-Packard Company. Direct Marketing Organization. Santa Clara, CA 95051-8059	800-452-4844
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
MFI, Los Angeles, CA 90025	310-447-6633;800-533-2297
§ Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
† Miltope Corp., Melville, NY 11747	516-420-0200
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
§# Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
§ Practical Automation, Inc., Shelton, CT 06484	203-929-5381
Printer Products, Boston, MA 02134	617-254-1200
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614-642-3200
§ Westrex Products, Boston, MA 02134	617-254-1200

Printers, Event-3000

Axiohm, Inc., New Brighton, MN 55112, 612-638-9856	**D•1078**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
§ **Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700**	**D•1098**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827	**D•1112**
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
AES Corp., Peabody, MA 01960	508-535-7310
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
§† Di/An Controls, Inc., Brockton, MA 02401	508-599-8000
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hecon Corp., Eatontown, NJ 07724	908-542-9200
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
Practical Automation, Inc., Shelton, CT 06484	203-929-5381
Texmate, Inc., Vista, CA 92083-8397	619-598-9899

Printers, Ink Jet/Bubble-2000

Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**D•1088-1091**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880	**D•1102-1104**
Singer Data Products, Inc., Bensenville, IL 60106, 708-860-6500	**D•1107**
§ **Telpar, Inc., Addison, TX 75001, 214-233-6631**	**D•1113**
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850:800-937-4688
§† Dataproducts Corporation. Woodland Hills, CA 91367-2499	818-888-4014
Epson America Inc., Component Sales Dept. Torrance CA 90503	310-782-5318
Φ# Equipment Remarketing Company. Boston Financial & Equity Corporation. Boston, MA 02215	617-267-8600
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
Markem Corp., Keene, NH 03431	603-352-1130
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614-642-3200

Printers, Laser-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
Eastern Marking Machines, Hempstead, NY 11550	800-835-2393
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Lasertechnics, Inc., Albuquerque, NM 87113	505-822-1123
# Mitronics, Rolling Hills, CA 90274	310-377-2022
§ Xerox Corporation, United States Customer Operations, Rochester, NY 14644	800-832-6979

Printers, Line — See Printers, Digital (Vol. D)

§—Product sold through distributors †—Product meets MIL specs Φ—Rentals #—Value Added Reseller

Printers, Page-2000

† **Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000**	**D•1410,1412**
Micro Electronic Business, Chicago, IL 60641, 312-539-2994	**D•1099**
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
§† Dataproducts New England, Inc., Wallingford, CT 06492	203-265-7151
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
† Miltope Corp., Melville, NY 11747	516-420-0200
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
§ Seiko Insts. USA, Inc., Graphic Devices & Systems Div., San Jose, CA 95131	408-922-5800

Printers, Screen, Stencil-4100

† Aremco Products, Inc., Ossining, NY 10562	914-762-0685
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
† Autoroll Machine Corporation, Middleton, MA 01949	508-777-2160
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
Micro Electronic Systems, Inc., Bridgewater, CT 06752	203-350-5004
† Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
§ Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Printers, Solder, Paste, Surface Mount-4100

† Autoroll Machine Corporation, Middleton, MA 01949	508-777-2160
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
§† Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
† Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
§ Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Printers, Thermal-2000

Axiohm, Inc., New Brighton, MN 55112, 612-638-9856	**D•1078-1081**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
§ **CBM America Corp., Santa Monica, CA 90404, 310-828-8245**	**D•1084-1085**
Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**D•1088-1091**
General Scanning Recorder Products Division, Arlington, MA 02174, 617-641-2702	**D•1413**
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700	**D•1098**
Micro Electronic Business, Chicago, IL 60641, 312-539-2994	**D•1099**
§ **Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880**	**D•1102-1104**
§ **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770**	**D•1106**
§ **Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512**	**D•1109**
§ **Syntest Corp., Marlboro, MA 01752-9973, 508-481-7827**	**D•1112**
§† **Telpar, Inc., Addison, TX 75001, 214-233-6631**	**D•1113-1115**
Acculex Corporation, Taunton, MA 02780	508-880-3660
§ Adcour, Inc., Sharon, MA 02067	617-784-8123
† Alden Electronics, Inc., Westboro, MA 01581	508-366-8851
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
§ Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201	1-800-537-8791
Computer Devices, Nutting Lake, MA 01865	508-663-4980
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Control Module, Enfield, CT 06082	203-745-2433
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
# Current Components, Inc., Middleton, MD 21769	301-473-5333
Data Mega Inc., Mega Data, Bensenville, IL 60106	708-860-6501
† Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
§ DH Print, Div. of DH Technology, Riverton, WY 82501	307-856-4821
† Digitec, Marion, OH 43302	614-387-3444
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
Epson America Inc., Component Sales Dept., Torrance, CA 90503	310-782-5318
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
† Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
Hecon Corp., Eatontown, NJ 07724	908-542-9200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
§ Kipp & Zonen, Enraf-Nonius, Bohemia, NY 11716	516-589-2885;800-645-1025
§ Lasertechnics, Inc., Albuquerque, NM 87113	505-822-1123
Markem Corp., Keene, NH 03431	603-352-1130
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
† Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
§ MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
† Miltope Corp., Melville, NY 11747	516-420-0200
§† Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
Panasonic Industrial Company, Custom Peripheral Dept., Secaucus, NJ 07094	201-392-6313
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
Practical Automation, Inc., Shelton, CT 06484	203-929-5381
§† The Recorder Company, San Marcos, TX 78667	210-629-1400
Singer Data Products, Inc., Bensenville, IL 60106	708-860-6500
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
§ Tamura Corporation of America, Temecula, CA 92589-2230	909-699-1270
§ Team Systems, Santa Clara, CA 95051	408-720-8877
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385
§ Zebra Technologies Corporation, Vernon Hills, IL 60061-3109	708-634-6700

Printing, Dry Transfer — See Kits, Marking (Vol. C)

Probe Cards, Semiconductor Testing-4100

† Accuprobe, Inc., Salem, MA 01970	508-745-7878
AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
GGB Industries, Inc., Picoprobe Division, Naples, FL 33941	813-643-4400
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Probes, Hall-4800 — *See Vol. A*

Probes, High Voltage (1,000 Volts & Over)-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226-1227**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1594, D•1319**
Alden Products Co., Brockton, MA 02403	508-583-0160
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Barth Electronics, Inc., Boulder City, NV 89005	702-293-1576
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bertan High Voltage, Hicksville, NY 11801	516-433-3110
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
† Contact East, N. Andover, MA 01845	508-682-2000
§† CPS, Lake Oswego, OR 97035	503-684-8026
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889	908-534-9007
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hameg Instruments, Oceanside, CA 92056	619-630-4080:800-247-1241
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
§ Richard Hirschmann of America Inc., Riverdale, NJ 07457	201-835-5002
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Ion Physics Corporation, Atkinson, NH 03811	603-893-6687
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† Pearson Electronics, Inc., Palo Alto, CA 94303	415-494-6444
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577	415-577-7236
# Print Products Intl., Silver Spring, MD 20910	301-587-7824;800-638-2020
§ Probe Master, Inc., San Diego, CA 92111	619-560-9676; 800-772-1519
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Rutherford Research, Rutherford, NJ 07070	201-933-2091
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Test Probes, Inc., San Diego, CA 92121	619-552-2090
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Valhalla Scientific, San Diego, CA 92121	619-457-5576
Vitrek Corporation, San Diego, CA 92121	619-586-1695
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Probes, IC-2900

Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571	C•1291
Emulation Technology, Inc., Santa Clara, CA 95051, 408-982-0660	**C•1321**
§ **Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002**	C•1347
AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
GGB Industries, Inc., Picoprobe Division, Naples, FL 33941	813-643-4400
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
§ Metermaster, Tempe, AZ 85282	602-431-0015
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Probes, Logic Test-2900

Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571	C•1291

§ **Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002 .... C•1347**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
† Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
Data Environment, Inc., Portland, OR 97291 503-531-0765
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ E & L Instruments, Interplex Electronics, Inc., New Haven, CT 06512 800-368-0880
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509 203-624-3103
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
§ Metermaster, Tempe, AZ 85282 602-431-0015
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
§ Probe Master, Inc., San Diego, CA 92111 .... 619-560-9676; 800-772-1519
§ Shattuck Industries, Santa Cruz, CA 95060 408-427-3122
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Wavetek Corp., San Diego, CA 92123 619-279-2200

Probes, Microwave-3450 – *See Vol. A*

Probes, Oscilloscopes-2975

Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 .... D•1234
§ **Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 .... C•1291,1540**
§ **ITT Pomona Electronics, Pomona, CA 91766, 909-469-2900 .... C•1355**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... D•1314
† Avex Electronics, Bensalem, PA 19020 .... 215-638-1515;800-345-1295
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 .... 408-730-4573; 1-800-828-3547
† Contact East, N. Andover, MA 01845 508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 .... 617-275-0850; 800-937-4688
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
† Dumont Oscilloscope, E & R Electronics, Inc., Parsippany, NJ 07054 201-575-8666
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757 516-957-8700
E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
GGB Industries, Inc., Picoprobe Division, Naples, FL 33941 813-643-4400
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
§ HC Protek, Northvale, NJ 07647 201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086 800-538-8787
§ Instek Corporation, City of Industry, CA 91745 818-336-6537
Ion Physics Corporation, Atkinson, NH 03811 603-893-6687
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Kikusui International Corp., Signal Hill, CA 90804-1203 .... 310-986-1677;800-545-8784
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
picosecond ATE Inc., Beaverton, OR 97075 503-641-3295
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
§† Probe Master, Inc., San Diego, CA 92111 .... 619-560-9676; 800-772-1519
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Sencore, Sioux Falls, SD 57107 .... 1-800-736-2673; 605-339-0100
§ H H Smith, NT-T Inc., Meadville, PA 16335 814-724-6440
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Probes, RF-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1022-1023
Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 .... C•1291
ITT Pomona Electronics, Pomona, CA 91766, 909-469-2900 .... C•1355
AlphaTest Corp., Mesa, AZ 85204-6597 602-545-5518
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
§ Contact East, N. Andover, MA 01845 508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
† Dielectric Communications, General Signal, Raymond, ME 04071 .... 207-655-4555; 800-341-9678
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
§ Endress & Hauser Instruments, Greenwood, IN 46143 .... 317-535-7138;800-428-4344
E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Ion Physics Corporation, Atkinson, NH 03811 603-893-6687
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Metermaster, Tempe, AZ 85282 602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Probe Master, Inc., San Diego, CA 92111 .... 619-560-9676; 800-772-1519
Probe-Rite, Inc., Santa Clara, CA 95052 408-727-0100
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
TEGAM, Inc., Madison, OH 44057 800-666-1010
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
† Tru-Connector Corp., Peabody, MA 01960 .... 508-532-0775;1-800-262-9787; 1-800-COAXTRU

Probes, Temperature-2900

Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541 .... B•1858-1859
Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 .... B•1860,1862
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 .... B•1864-1865
§† **Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000 .... B•1875**
§ **Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 .... B•1876-1878**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .... B•1879
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... B•1978, D•1358-1359,1361**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... B•1887,2005, C•1792
Quality Thermistor, Boise, ID 83709, 208-377-3373 .... B•1892-1893
† **Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610 .... B•1898-1901**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 .... B•1389,1903
§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 .... B•1904-1905,1907**
§ **Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974 .... B•1910**
§ AEMC Corporation, Boston, MA 02111 .... 617-451-0227;800-343-1391
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Automation Component Technology, Fremont, CA 94538 .... 510-226-0900; 510-490-3587 (Sales)
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
§ Bayley Instrument Company, Kenwood, CA 95452 707-833-6014
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
† Climatronics, Bohemia, NY 11716 516-567-7300
COLE-PARMER Instrument Company, Niles, IL 60714 708-647-7600
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Contact East, N. Andover, MA 01845 508-682-2000
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080
† Digitec, Marion, OH 43302 614-387-3444
§ Dill Instruments Inc., Kalamazoo, MI 49005 616-388-5708
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
§ Eliwell Inc., Baldwinsville, NY 13027 315-638-9598
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
Hameg Instruments, Oceanside, CA 92056 .... 619-630-4080;800-247-1241
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
§ HC Protek, Northvale, NJ 07647 201-767-7242
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
# HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731 818-444-4000
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
Larson-Metercraft, El Cajon, CA 92020 619-258-8990
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Micro Technical Industries, San Clemente, CA 92672 714-366-1752

† Minco Products, Minneapolis, MN 55432	612-571-3121
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733	802-247-6811
† Oven Industries, Mechanicsburg, PA 17055	717-766-0721
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
§ Probe Master, Inc., San Diego, CA 92111	619-560-9676; 800-772-1519
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
† Relco Products, Denver, CO 80237	303-756-1143
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815	607-335-5000
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
† Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
TEGAM, Inc., Madison, OH 44057	800-666-1010
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695	908-287-2870
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000
§† Victory Engineering Corp., Springfield, NJ 07081	201-379-5900
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300	512-244-1956

Probes, Test Lead-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226-1227**
§ **Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571**	**C•1290-1291,1540**
GMW Associates, Redwood City, CA 94064, 415-368-4884	**D•1260-1261**
§ **Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002**	**C•1347**
§ **ITT Pomona Electronics, Pomona, CA 91766, 909-469-2900**	**C•1355**
Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800	**C•1696**
Multi-Contact USA, Santa Rosa, CA 95403, 707-575-7575	**C•1423**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314**
† **Projects Unlimited, Dayton, OH 45414, 513-890-1918**	**D•1057**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**C•1455**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**C•1475**
Autoswage Products, Shelton, CT 06484	203-929-1401
† Avex Electronics, Bensalem, PA 19020	215-638-1515;800-345-1295
§ B & K Precision, Maxtec International Corp. Chicago, IL 60635	312 889 1448
# BEC Inc. Certified Calibration Labs, Horsham, PA 19044	800 523 3808
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§ Contact East, N. Andover, MA 01845	508-682-2000
§† Daburn Electronics & Cable Corp. Northvale, NJ 07647	201 768-5400
§ EBY Company, Philadelphia, PA 19124	215-537-4700
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
Hameg Instruments, Oceanside, CA 92056	619-630-4080;800-247-1241
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
HP Direct, Hewlett-Packard, Sunnyvale, CA 94086	800-538-8787
§ Interconnect Devices Inc., Kansas City, KS 66106	913 342 5544
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
§† Keystone Electronics Corp., Astoria, NY 11105-2017	718-956-8900
§ Klein Tools, Inc., Chicago, IL 60659-9033	708 677-9500
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516 231 6900, 1-800-645-5104
§ 3M-Electronic Products Division, Austin, TX 78726	1-800 225-5373 Sls & Prod Info.
§ Metermaster, Tempe, AZ 85282	602-431-0015
Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
§ Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
§ Ostby-Barton Test Probes, Warwick, RI 02886	401-739-7310
§† Probe Master, Inc., San Diego, CA 92111	619-560-9676; 800 772-1519
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Test Probes, Inc., San Diego, CA 92121	619-552-2090
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Western Elctrn. Comps. Corp., Camarillo, CA 93012	805-482-8002
§ "World" Test Systems, Inc., Waynesboro, VA 22980	703-949-6753

Process Control Systems-2200

Advanced Control Sys., Hingham, MA 02043, 617-740-0223	**D•1150**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1356**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Matrix Corp., Indianapolis, IN 46241, 317-248-2036	**D•1195**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•1164**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796, D•1166**
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1364**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1213**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
AMP-AKZO Corporation, Chadds Ford, PA 19317	215-459-2800
† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
§ Analogic Corp., Peabody, MA 01960	508-977-3000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
Bambeck Systems Inc., Santa Ana, CA 92705	714-250-3100;800 334-3101
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
California Automation Inc., San Diego, CA 92121	619-452-1341
Chromalox Instrs. & Controls, La Vergne, TN 37086-3536	615-793-3900
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Cross Electronics, Warrendale, PA 15086	412-776-1591
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
Digital Dynamics, Inc., Scotts Valley, CA 95066	408-438-4444
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
DSP Technology, Fremont, CA 94538-7338	510-657-7555
Dynage Controls, Inc. Canistota, SD 57012	605-296-3487
Dynapar, Gurnee, IL 60031	312 662-2666
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227	303-987-2441
† Elnik Systems, IPM. Inc., Fairfield, NJ 07004	201-882-8033
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Gimix, Inc., Northbrook, IL 60062-2406	708-559-0909
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
Instrumentation & Control Sys. ICS Inc. Addison, IL 60101	708 [illegible]
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705	602 623 9801
§ International Data Aquistion & Control, Inc., Amherst, NH 03031	603-673-0765
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Keithley MetraByte, Taunton MA 02780	508 880 3000
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Matrix Corp., Raleigh, NC 27610	919-231-8000
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
Moore Products Co., Spring House, PA 19477	215-646-7400
Octagon Systems, Westminster, CO 80030	303-430-1500
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696	914 693 9001
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Rapid Systems Inc., Seattle, WA 98103	206 547-8311
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599 9254
§ Square D Co. Palatine, IL 60067	708 397 2600
Struthers Dunn, Inc. and Hi-G Co. Inc. Pitman, NJ 08071-0901	609 589 7500
§ Techmation, Inc. Tempe, AZ 85282	602 968 9946
TL Inds. Inc., Northwood OH 43619	419 666 8144
Tridyne Process Systems, DBI Industries So. Burlington VT 05403	802-863-6873
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
Validyne Engineering Corporation, Northridge, CA 91324	818 886-2057
Versalogic Corp., Eugene, OR 97402	800-824-3163
Viable Systems Inc., Sherborn, MA 01770	508-653-7665
Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550

Processors, Array — See Array Processors (Vol. D)

Processors, Communications, Front End-1900

IBM United States, US OEM Marketing, White Plains, NY 10604, 1-800-968-8643	**D•1117,1128**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
§ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178	404-457-5600
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† NCR Comten, Inc., NCR Corp. St. Paul, MN 55113	612-638-7777
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010

Processors, Communications, Message Switching-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
† Aydin Corp., Horsham, PA 19044	215-657-7510
§ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178	404-457-5600
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113	612-638-7777
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010

Processors, Communications, Network Node-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Aydin Corp., Horsham, PA 19044	215-657-7510
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1	416-425-7800
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113	612-638-7777
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000 800-925-2666
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
§ Western Digital Corp., Irvine, CA 92718	714-932-5000

Processors, Communications, Standalone-1900

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113	612-638-7777
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666

Processors, Display-2000

Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1038**
Omniprint, Inc., Irvine, CA 92718, 714-457-0229;800-878-6880	**D•1102-1103**
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† Greenspring Computers, Inc., Menlo Park, CA 94025	415-327-1200
Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448

Processors, Image-2000

AMASCO, Torrance, CA 90501	310-781-9494
Analogic Corp., Peabody, MA 01960	508-977-3000
Antona Corp., Los Angeles, CA 90024-5603	310-473-8995
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
array Microsystems, Colorado Springs, CO 80906	719-540-7999
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Avelem, Gargilesse, FRANCE 36190	33 54478672
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-794-4456
# Biomation Instruments, Almonte, Ont., CANADA K0A1A0	613 256 2821
§ Dage-MTI, Michigan City, IN 46360	219-872-5514
§ Datacube, Inc., Danvers, MA 01923	508-777-4200
Data Translation, Inc., Marlboro, MA 01752	508 481 3700
† DBA Systems, Inc., Melbourne, FL 32902-0550	407-727 0660
Dolan-Jenner Inds., Woburn, MA 01801	617 935 7444
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197	408 738-4266
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452 2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Image Graphics, Inc., Shelton, CT 06484	203-926 0100
Imaging Technology Inc., Bedford, MA 01730-1421	617-275-2700
Lixi, Inc., Downers Grove, IL 60515	708-620-4646
Mathematical Systems Design, Inc., Los Angeles, CA 90064	310-479-7180
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
MicroPlot Systems, Columbus, OH 43229	614-882-4786
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000
# Recognition Concepts,Inc., Carson City, NV 89706	702-831-0473;1-800-243-8724
# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
Signum, Inc., Watertown, MA 02172-3356	617-926-3566
Synoptics, Ltd., Paragon Towers, Newton, MA 02164	617-527-1461
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614 642 3200
Third Domain, Inc., Tucson, AZ 85731-7568	602-290-1820
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
Vicom Systems, Inc., Fremont, CA 94538	415-498-3200
Vista Systems, Inc., Peabody, MA 01960	508-532-1971
Visual Information Technologies, Inc.(UITEC), Plano, TX 75075	214 596 5600; 800-325-6467

Processors, Video Signal-1900

Analogic Corp., Peabody, MA 01960	508-977-3000
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
Computer Devices, Nutting Lake, MA 01865	508-663-4980
Covid, Inc., Tempe, AZ 85281	602-966-2221
§ Datacube, Inc., Danvers, MA 01923	508-777-4200
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000
# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
§ Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Production Equipment, Extenders — See Extender Boards (Vol. D)
Program Board Connectors — See Connectors, Plug-in, Program Board (Vol. C)

Programmers, Cam & Drum-2200

American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Techniques, Inc., Englewood, NJ 07631	201-569-5900
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800

Programmers, Matrix Boards — See Boards, Programming (Vol. C)

Programmers, Power-2200

Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2258**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2278**
Energy Systems, Vancouver, WA 98682	206-896-8310
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900

Programmers, Power Supply-4000

§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427**	**D•1684-1685,2257**
† **Kikusui International Corp., Signal Hill, CA 90804-1203,** 310-986-1677;800-545-8784	**D•1808**
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900	**D•1849**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691,800-854-2433	**D•2288,2290**
American Magnetics, Oak Ridge, TN 37831-2509	615-482-1056
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
California Instruments Corp., San Diego, CA 92123-1509	619-279-8620: 800-4AC-POWER
Electronic Measurements, Neptune, NJ 07753	908-922-9300
Energy Systems, Vancouver, WA 98682	206-896-8310
ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254

Programmers, PROM & Logic Array-3130 — ***See Vol. A***
PROM Programmers — See Programmers, PROM & Logic Array (Vol. A)
Protectors, Brownout-4300 — ***See Vol. B***
Protectors, Surge — See Suppressors, Transient Voltage (Vol. B)

Protocol Converters-1900

§ **National Instruments, Austin, TX 78730-5039, 512-794-0100**	**D•1147**
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469	**B•1852**
Aeroflex Laboratories Inc., ARX Inc., Plainview, NY 11803	516-694-6700
Andrew Corporation, Austin, TX 78746	800-331-4144;512-314-3000
Continental Resources, Inc., Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Digital Products, Inc., Waltham, MA 02154	617-647-1234,800-243-2333
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ Instrumentation Services, Inc., Minneapolis, MN 55427	612-544-8916
KGS Electronics, Inc., Arcadia, CA 91006	818-574-1175
§ Lutze, Inc., Charlotte, NC 28217-9805	704-357-8835:800-447-2371
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400:800-426-8626
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122

Prototype Boards, Extenders — See Extender Boards (Vol. D)
Prototyping Equipment, Circuit Board-4200 — ***See Vol. C***
Proximity Transducers — See Current Sensors (Vol. D), Transducers, Volt, etc. (Vol. B)

Public Address Systems-1300

§† Aiphone, Bellevue, WA 98005	206-455-0510
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191	800-357-5240
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
Cabletorm Inc., Troy, VA 22974	804-589-8224
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Compact Power Company, Yorba Linda, CA 92686	714-996-5826
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Furman Sound, Inc., Greenbrae, CA 94904	415-927-1225
† Infinetics Inc., Friskem Div., Wilmington, DE 19802	302-658-2471
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800

MG Electronics, Hauppauge, NY 11788	516-582-3400
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Spectra Sonics, Ogden, UT 84405	801-392-7531
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516

Pullers, Circuit Board-5400 – *See Vol. C*

Pullers, Tube-5400 – *See Vol. C*

Pulleys-2500 – *See Vol. C*

Pulsers, Diode – See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)

Pulsers, Logic Test-2900

§ Contact East, N. Andover, MA 01845	508-682-2000
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870

Pumps, Vacuum-4100

§† Air-Vac Engrg., Milford, CT 06460	203-874-2541
§† A.P.E. Corporation, Medford, NY 11763	516-654-1197
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Brailsford & Co., Inc., Rye, NY 10580	914-967-1820
Brinkmann Instruments, Inc., Westbury, NY 11590-0207	516-334-7500
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854	203-853-9500
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342	818-362-7151
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300

Punches, Chassis-5400 – *See Vol. C*

Pyrometers, Infrared-2900

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1363**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
§ Epic, Inc., New York, NY 10038	212-349-2470
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007	215-781-0700; 800-523-8989
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
§ Metermaster, Tempe, AZ 85282	602-431-0015
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481	201-891-7330
§ Raytek, Inc., Santa Cruz, CA 95060-1820	408-458-1110
† Williamson Corporation, Concord, MA 01742	508-369-9607

Pyrometers, Optical, Noninfrared-5300 – *See Vol. B*

Pyrometers, Recording-2900

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1363**
§ Atkins Technical Inc., Gainesville, FL 32608	904-378-5555
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
† Williamson Corporation, Concord, MA 01742	508-369-9607

Q Bus Cards – See Board Computers & Subassemblies (Vol. D)

Quartz, Fused-2300 – *See Vol. A*

Quartz, Raw – See Crystals, Quartz (Vol. A)

Racks, Aging – See Ovens, Aging, Burn-in, Life Test (Vol. D)

Racks, Cabinet – See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Circuit Board – See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Desk & Console – See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Module – See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Relay & Mounting – See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Radar Systems (MIL)-2440 – *See Vol. B*

Radar System Components-3450 – *See Vol. A*

Radio Communications Systems – See Communications Systems (Vol. D)

Radiographic Equip. – See X-ray Inspection Equip. (Vol. D)

Radiometers-2900

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§ American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
§ BEA electro-optics, inc., Des Plaines, IL 60016	708-298-1420
§ Efos Inc., Mississauga, Ont., CAN L4Z 2E8	416-568-4268
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
International Light, Newburyport, MA 01950-4092	508-465-5923
† KLC/Karl Lambrecht Corp., Chicago, IL 60618	312-472-5442
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
Mathematical Systems Design, Inc., Los Angeles, CA 90064	310-479-7180
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481	201-891-7330
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
§† Spectronics Corp., Westbury, NY 11590	516-333-4840/1-800-274-8888
Swan Associates, New Haven, CT 06534	203-387-3917

Radomes & Windows, Microwave-3450 – *See Vol. A*

Reactors, Charging-5600 – *See Vol. A*

Reactors, Epitaxial – See Machines & Accessories, Semiconductor Manufacturing (Vol. D)

Reactors, Filter-5600 – *See Vol. A*

Reactors (MIL)-2440 – *See Vol. B*

Readers, Badge-2000

§ American Magnetics Corporation, Group 4, Carson, CA 90745	213-775-8651
Computerwise, Olathe, KS 66062	913-829-0600
Control Module, Enfield, CT 06082	203-745-2433
§ Corby Industries, Inc., Allentown, PA 18103	215-433-1412
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
§† PERCON, Inc., Eugene, OR 97402-9153	1-800-8-PERCON;503-344-1189
Signal Research Inc., Titusville, NJ 08560	609-737-1917
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Readers, Bar Code-2000

Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1824**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Computerwise, Olathe, KS 66062	913-829-0600
# Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
Control Module, Enfield, CT 06082	203-745-2433
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
General Digital Corp., Enfield, CT 06082	203-741-7171
† Hand Held Products, Inc., Charlotte, NC 28226	704-541-1380
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
Interactive Computer Products, Inc., Laguna Hills, CA 92653	714-770-5332
§ Lazerdata Corporation, Orlando, FL 32804	1-800-843-2700
MCSI, Vista, CA 92083	619-598-2177
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
MFI, Los Angeles, CA 90025	310-447-6633;800-533-2297
§ Neuron Electronics, Inc., Torrance, CA 90503	213-793-1300;1-800-FON-4-NEI
§ Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
§† PERCON, Inc., Eugene, OR 97402-9153	1-800-8-PERCON;503-344-1189
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Voice Connexion, Irvine, CA 92714	714-261-2366
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945

Readers, Character-2000

§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844

Readers, Magnetic Card-2000

Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
Control Module, Enfield, CT 06082	203-745-2433
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
MCSI, Vista, CA 92083	619-598-2177
§ Neuron Electronics, Inc., Torrance, CA 90503	213-793-1300;1-800-FON-4-NEI
Omega Engineering, Stamford, CT 06907	800-826-6342
Thomson Passive Components Corp., Woodland Hills, CA 91367	818-887-1010
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Readers, Magnetic Stripe Card-2000

Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1824**
§ American Magnetics Corporation, Group 4, Carson, CA 90745	213-775-8651
Computerwise, Olathe, KS 66062	913-829-0600
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
§ Mag-Tek, Carson, CA 90746	213-631-8602
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
§ PERCON, Inc., Eugene, OR 97402-9153	1-800-8-PERCON;503-344-1189
Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
Q-Card, Inc., Owings Mills, MD 21117-1634	410-581-0112
THORN Automated Systems, Inc, THORN EMI, Westlake, OHIO 44145	216-871-9900
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Readers, Punched Card-2000

Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
§ Neuron Electronics, Inc., Torrance, CA 90503	213-793-1300;1-800-FON-4-NEI
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Signal Research Inc., Titusville, NJ 08560	609-737-1917
† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331

Readers, Punched Tape-2000

† Chalco Engrg. Corp., Chalco Industries, Inc., Gardena, CA 90248-1898	213-321-0121; 213-323-5525
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Signal Research Inc., Titusville, NJ 08560	609-737-1917
Teleterminal Corp., Greenland, NH 03840	603-431-1200

Readers, Static Card-2000

† Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331

Readers, Time Code-2000

§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665	**D•1151**
† Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	D•1116.1186-1189
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
† TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411	**D•1077,1207**
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ ESE, El Segundo, CA 90245	310-322-2136
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230

Readouts — See Tubes, Readout (Vol. A)

Reamers-5400 — *See Vol. C*

Receivers, AM/FM (Incl. Precision Test)-2900

§† Aiphone, Bellevue, WA 98005	206-455-0510
Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
CP Technology, Inc., Cupertino, CA 95014	408-996-8069
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Optoelectronics, Inc., Ft. Lauderdale, FL 33334	305-771-2050
Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Precision Electronics, Franklin Park, IL 60131	708-678-5350
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516

Receivers, Communication-1900

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AEROCOM, Miami, FL 33133	305-448-6503
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999	410-583-4000
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
† Colorado Video, Inc., Boulder, CO 80306	303-530-9580
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
EVI, Inc., Columbia, MD 21046	410-290-1919
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595	619-278-4100
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MACOM, Inc., Lowell, MA 01851	617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
§ Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226	317-545-4281
RF Industries Ltd. (Nuelink), San Diego, CA 92126	619-549-6340:800-233-1728
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers, Fiber Optic-2475 — *See Vol. B*

Receivers, Field Intensity, Microwave — See Receivers, Microwave (Vol. D)

Receivers, Fixed Frequency-2900

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AEROCOM, Miami, FL 33133	305-448-6503
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
ARS Inc., Orlando, FL 32809	1-800-950-5633
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
† Communications Sys. Technology Inc. Hermosa Beach, CA 90254	213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MACOM, Inc., Lowell, MA 01851	617-272-3000
MicroSignals Inc., L.I.C., NY 11101	718-937-7955;718-937-0391;800-648-2252
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
RF Industries Ltd. (Nuelink), San Diego, CA 92126	619-549-6340;800-233-1728
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers, Frequency Shift-1900

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AEROCOM, Miami, FL 33133	305-448-6503
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Dantel, Fresno, CA 93727	209-292-1111
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† Electrocom Industries, S. Bend, IN 46615	219-232-2743
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
MACOM, Inc., Lowell, MA 01851	617-272-3000
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626

Receivers, Global Positioning Satellite (GPS)-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1187-1189**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411	**D•1077,1207**
Ball Corp., Efratom Division, Irvine, CA 92718-1605	714-770-5000
Datachron Inc., Anaheim, CA 92805	714-385-1705
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010

Receivers, Headphone — See Handsets, etc. (Vol. D)

Receivers, Laser-1900

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**D•1005**
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995

Receivers, Loran & Omega-1900

FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
LOCUS, Inc., Madison, WI 53704	608-244-0500
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626

Receivers, Microwave-3450 — *See Vol. A*

Receivers, Monitoring, Communications-1900

Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	B•1825
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AEROCOM, Miami, FL 33133	305-448-6503
# Communication Solutions, Inc., Baltimore, MD 21237	410-574-4557
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800

† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Glatzer Industries Corp., New Rochelle, NY 10801	914-576-2700
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Marconi Instruments, Allendale, NJ 07401	201-934-9050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers, NBS-2900

Ball Corp., Efratom Division, Irvine, CA 92718-1605	714-770-5000
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ Chrono-log Corp., Havertown, PA 19083	800-247-6665
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ ESE, El Segundo, CA 90245	310-322-2136
§ TrueTime, Inc., Santa Rosa, CA 95407	707-528-1230
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers, Telemetry-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1186**
ARS Inc., Orlando, FL 32809	1-800-950-5633
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Monicor Electronic Corp., Ft. Lauderdale, FL 33309	305-979-1907
RF Industries Ltd. (Nuelink), San Diego, CA 92126	619-549-6340;800-233-1728
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626

Receivers, Tone-1900

§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
§† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Electrocom Industries, S. Bend, IN 46615	219-232-2743
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Optoelectronics, Inc., Ft. Lauderdale, FL 33334	305-771-2050
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Sonicall, Inc., Signal Hill, CA 90806	213-490-2143

Receivers, TV — See Monitors, Video (Vol. D)
Receivers (MIL)-2440 — ***See Vol. B***
Receivers (MIL), Elint-2440 — ***See Vol. B***
Receivers (MIL), ESM-2440 — ***See Vol. B***
Receivers (MIL), Fiber Optic-2440 — ***See Vol. B***
Receivers (MIL), Radio-2440 — ***See Vol. B***
Receivers (MIL), Surveillance-2440 — ***See Vol. B***
Receptacles — See Connectors (Vol. C), Jacks (Vol.), Sockets
Receptacles, Power — See Sockets, Power (Vol. C)

Recognition & Response Equipment, Speech-2000

§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Covox, Inc., Eugene, OR 97402	503-342-1271
§Φ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178	404-457-5600
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
† Mimic, Inc., Islington, MA 02090-0705	617-329-9593
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§ Rhetorex, Inc., Campbell, CA 95008	408-370-0881
§ Sierra Semiconductor Corp., San Jose, CA 95132	408-263-9300
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
§ Voice Connexion, Irvine, CA 92714	714-261-2366
Voice Processing Corp., Cambridge, MA 02142	617-494-0100

Recorders, Cartridge, Bubble Memory-2000

† Miltope Corp., Melville, NY 11747	516-420-0200
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Projector Recorder Belt Corp., Whitewater, WI 53190	1-800-533-9654

Recorders, Cassette, Data-4000

† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
NF Electronic Instruments, State College, PA 16801	814-237-5580
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415

Recorders, Computer Data-2000

†Φ **Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000**	**D•1410-1412**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
General Scanning Recorder Products Division, Arlington, MA 02174, 617-641-2702	**D•1413**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# **Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER**	**D•1414**
§Φ **Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385**	**D•1417**
§ ACR Systems Inc., Surrey,B.C., CANADA V3W 4N8	604-591-1128
Amilon Corp., Woodside, NY 11377	718-274-1794
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† CELCO, Mahwah, NJ 07430	201-327-1123
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
§ Digi-Data Corp., Jessup, MD 20794	301-498-0200
§ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178	404-457-5600
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Image Graphics, Inc., Shelton, CT 06484	203-926-0100
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
Metrum, Denver, CO 80217-5227	303-773-4700
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245	213-322-9370
Projector Recorder Belt Corp., Whitewater, WI 53190	1-800-533-9654
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960

Recorders, Electrostatic-3000

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960

Recorders, Event/Multievent-3000

Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1410-1412**
General Scanning Recorder Products Division, Arlington, MA 02174, 617-641-2702	**D•1413**
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314,1415**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
† **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818,** 401-884-6800;800-332-3202	**D•1416**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1398**
Φ **Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385**	**D•1417**
AES Corp., Peabody, MA 01960	508-535-7310
Altek Co., Torrington, CT 06790	203-482-7626
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
§† Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Data, Inc., Ft. Collins, CO 80525	303-493-1222
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
DSP Technology, Fremont, CA 94538-7338	510-657-7555
Electric Tachometer, Philadelphia, PA 19142	215-726-7723
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§Φ Instrumented Sensor Technology, Inc., Okemos, MI 48864	517-349-8487
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
Larson-Metercraft, El Cajon, CA 92020	619-258-8990
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Linear Instruments, Spectra Physics Analytical, Reno, NV 89523	702-746-2200
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Mauell Corp., Dillsburg, PA 17019-0339	717-432-8686

Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
Metrum, Denver, CO 80217-5227	303-773-4700
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
Pacer Systems, Inc., Billercia, MA 01821	508-667-8800
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Reproduction Technologies Inc., Bristol, IN 46507-0790	219-848-5233
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Recorders, FM — See Recorders, Magnetic Tape (Vol. D)

Recorders, Graphic-2900

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1230**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1398**
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390

Recorders, Hard Disk-2000

360 Systems, Tarzana, CA 91356, 818-342-3127	**D•1072**
† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401

Recorders, Magnetic Tape-2000

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622	**D•1039**
Amilon Corp., Woodside, NY 11377	718-274-1794
§ Ampex Corp., Redwood City, CA 94063-3199	415-367-2011
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Audiotronics Corp., N. Hollywood, CA 91605	818-765-2645
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131	619-578-9100
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Data, Inc., Ft. Collins, CO 80525	303-493-1222
§ Digi-Data Corp., Jessup, MD 20794	301-498-0200
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
† Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
† Memtec Corp., Salem, NH 03079	603-893-8080
Metrum, Denver, CO 80217-5227	303-773-4700
Pacer Systems, Inc., Billercia, MA 01821	508-667-8800
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245	213-322-9370
Projector Recorder Belt Corp., Whitewater, WI 53190	1-800-533-9654
† Reproduction Technologies Inc., Bristol, IN 46507-0790	219-848-5233
§† Saylor Electronics Int'l, Inc., Carson City, NV 89706	702-883-4184
†# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
TCA, Montebello, CA 90640	213-726-0303
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
Vidco, Inc., Beaverton, OR 97005	503-641-1804

Recorders, Polar-3000

Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1398,1401**
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
§ Interface Engineering Inc., Holbrook, MA 02343	617-986-2600

Recorders, Program Loading-2000

Amilon Corp., Woodside, NY 11377	718-274-1794
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373	513-339-2241
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
§ Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
§ Westronics Inc. of Texas, A Baker Hughes Co., Ft. Worth, TX 76161	817-625-2311

Recorders, Pyrometer — See Pyrometers, Recording (Vol. D)

Recorders, Sound Level-1300

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1231**
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Toshiba Instrumentation Div., Toshiba Intl. Corp., Tulsa, OK 74134	918-252-3548

Recorders, Strip Chart-3000

†Φ Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1410-1412**
B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
General Scanning Recorder Products Division, Arlington, MA 02174, 617-641-2702	**D•1413**
# Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	**D•1414**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**C•1792, D•1101,1199,1314**
† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202	**D•1416**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1398,1401**
§Φ Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
† Allen Datagraph, Inc., Salem, NH 03079	603-893-1983
AMASCO, Torrance, CA 90501	310-781-9494
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§ Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Climatronics, Bohemia, NY 11716	516-567-7300
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
Comptus Inc., New Boston, NH 03070	603-487-5512
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ DEVAR, Inc., Bridgeport, CT 06605	203-368-6751
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
§ Dieterich Standard, A Dover Industries Company, Boulder, CO 80301	303-530-9600
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
Electric Tachometer, Philadelphia, PA 19142	215-726-7723
† Elnik Systems, IPM, Inc., Fairfield, NJ 07004	201-882-8033
Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Kipp & Zonen, Enraf-Nonius, Bohemia, NY 11716	516-589-2885;800-645-1025
§ Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915	508-927-6575
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Linear Instruments, Spectra Physics Analytical, Reno, NV 89523	702-746-2200
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Metermaster, Tempe, AZ 85282	602-431-0015
# Meylan Corporation, Upper Montclair, NJ 07043-1844	201-744-6400
§ MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Moore Products Co., Spring House, PA 19477	215-646-7400
M-Tek, Pittsburgh, PA 15222	800-245-5101 ; 412-261-9030
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
§ PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
§† The Recorder Company, San Marcos, TX 78667	210-629-1400
RMS Instruments, Mississauga, Ont., CAN L5T 1R2	416-564-5533
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
Total Temperature Instrumentation, Inc., Williston, VT 05495	802-863-0085
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ The Vector Group, Inc., Horsham, PA 19044	1-800-523-3696
Vidco, Inc., Beaverton, OR 97005	503-641-1804
§ Westronics Inc. of Texas, A Baker Hughes Co., Ft. Worth, TX 76161	817-625-2311

Recorders, Thermal Array-3000

†Φ Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1410-1412**
Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313	**A•2119**
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
ERNI Components, Richmond, VA 23236	804-794-6367
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
§ MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
RMS Instruments, Mississauga, Ont., CAN L5T 1R2	416-564-5533
† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818	401-884-6800; 800-332-3202
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385

Recorders, Vibration-3000

Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000	**D•1410-1412**
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
Western Graphtec, Inc., Irvine, CA 92718-2067, 714-770-6010;800-854-8385	**D•1417**
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611

§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940 215-968-0660
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§Φ Instrumented Sensor Technology, Inc., Okemos, MI 48864 517-349-8487
Kelmet, Inc., San Dimas, CA 91773 714-599-0954
Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711 608-271-3333
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086 408-496-0960

Recorders, Video-1900

§ Ampex Corp., Redwood City, CA 94063-3199 415-367-2011
Computer Devices, Nutting Lake, MA 01865 508-663-4980
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
† Loral Data Systems, Data Recorders, Sarasota, FL 34230 813-371-0811
Metrum, Denver, CO 80217-5227 303-773-4700
† Miltope Corp., Melville, NY 11747 516-420-0200
Recognition Concepts,Inc., Carson City, NV 89706 ..... 702-831-0473;1-800-243-8724
† Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234 ... 310-921-7775
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
† Video Automation Systems, Pound Ridge, NY 10576 914-764-4613

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Recorders (MIL), RHAW-2440 – *See Vol. B*
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Rectifiers, Copper Oxide-4800 – *See Vol. A*
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Rectifiers, General Purpose, Surface Mount-4800 – *See Vol. A*
Rectifiers, Germanium-4800 – *See Vol. A*
Rectifiers, Schottky, Surface Mount-4800 – *See Vol. A*
Rectifiers, Selenium-4800 – *See Vol. A*
Rectifiers, Silicon-4800 – *See Vol. A*
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Rectifiers, Surface Mount-4800 – *See Vol. A*
Rectifiers, Ultrafast-4800 – *See Vol. A*
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Reels, Tape — See Tape Recording Accessories (Vol. D)
Reference Books — See Technical Books (Vol. D)

References, DC Voltage-2900

Φ **Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696 .... D•1253**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1272
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1278-1279,1281
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 .... A•2227
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 .... 605-296 3462
Electrical Instrument Service, Mt. Vernon, NY 10550 914-699-9717
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ Power Designs, Inc., Westbury, NY 11590 516-333-6200
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§† Thaler Corp., Tucson, AZ 85737 602-742-5572
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

Refrigerants, Spray-1600 – *See Vol. C*
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Refrigerators, Environmental Test-2550

† Blue M, A General Signal Company, Blue Island, IL 60406 708-385-9000
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
§ Forma Scientific, Inc., Marietta, OH 45750 614-373-4763
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
Hotpack Corp., Philadelphia, PA 19154 .... 215-824-1700;800-523-3608
§ Lab-Line Instruments, Melrose Park, IL 60160 708-450-2600
Ransco Industries, Oxnard, CA 93033 805-487-7777
§ Temptronic Corporation, Newton, MA 02158 617-969-2501
† Tenney Engineering, Union, NJ 07083 908-686-7870
§† VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555

Regulators, Current-4000

Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 .... D•2267
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 .... D•2271**
§ **Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777**
Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1587
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761
Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
† Autronics Corp., Arcadia, CA 91006 818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bikor, Microsemi Corporation, Torrance, CA 90501 213-539-6320
† CELCO, Mahwah, NJ 07430 201-327-1123
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
§ Computer Power Inc., High Bridge, NJ 08829 .... 908-638-8000;800-526-5088
Cross Electronics, Warrendale, PA 15086 412-776-1591
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Energy Systems, Vancouver, WA 98682 206-896-8310
GMW Associates, Redwood City, CA 94064 415-368-4884
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
MACROAMP Inc., Ukiah, CA 95482 800-458-8892
Mag-Con, St. Paul, MN 55113 612-633-8820
Melcher, Inc., Melcher AG, Chelmsford, MA 01824 800-828-9712
† Mep Controls, Bordentown, NJ 08505 609-298-7300
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Phenix Technologies, Accident, MD 21520 301-746-8118
§ Power Designs, Inc., Westbury, NY 11590 516-333-6200
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
Sorensen Company, Paxton, IL 60957 800-525-2024
§† Staco Energy Products Co., Dayton, OH 45403 513-253-1191
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561

Regulators, Frequency-4050

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•2256-2259**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500 .... D•2284-2285
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 .... D•1896
Powervar, Inc., Lake Forest, IL 60045, 708-816-8585;800-369-7179 .. D•2297,2299
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761
Basler Elec., Electronic Product Group, Highland, IL 62249 .... 618-654-2341; 800-645-2074
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
§ Computer Power Inc., High Bridge, NJ 08829 .... 908-638-8000;800-526-5088
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
† Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Sola, Elk Grove Village, IL 60007-5666 708-439-2800

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800 — *See Vol. A*

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 .... A•2256
Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 .... D•1574
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 .... D•1583
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
† **Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2253-2255**
Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
§ **Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•2258**
† **Georator Corp., Manassas, VA 22110-5512, 800-523-9938 .... D•2262-2263**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 .... D•2267
† **Interpoint Corporation, Redmond, WA 98052, 206-882-3100 .... D•2112**
Kaiser Systems, Inc., Inductotherm Industries, Inc., Beverly, MA 01915, 508-922-9300 .... D•1769
§ **Kepco, Inc., Flushing, NY 11352, 718-461-7000 .... D•1777**
Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 .... A•2374
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 .... D•2281
Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712 ... D•2133-2134
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800 .... D•1896
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300**
§ **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 .... A•2180**
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 .... A•2536
§† **Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 .... D•1936**
§† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 .... A•2565, D•1958-1959**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 .... A•2585
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041
ACD-Elcor Products, Bethel, CT 06801 203-743-3510
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
§ Adtech Power Inc., Anaheim, CA 92806 714-634-9211
§ AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761

† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Arnold Magnetics, Camarillo, CA 93012	805-484-4221
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
† Autronics Corp., Arcadia, CA 91006	818-445-5470
Avel Transformers Inc., New Milford, CT 06776	203-355-4711
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
Berkshire Transformer Corp., Kent, CT 06757	203-927-3541
Bikor, Microsemi Corporation, Torrance, CA 90501	213-539-6320
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
Comptus Inc., New Boston, NH 03070	603-487-5512
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380	607-724-2484
§† Current Technology, Inc., Richardson, TX 75081-4802	214-238-5300
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
§Φ Dynamic Power Systems, Nesconset, NY 11767	516-361-6771;1-800-422-0708
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
§ Exar Corp., San Jose, CA 95161-9007	408-434-6400
§ Furman Sound, Inc., Greenbrae, CA 94904	415-927-1225
GBC. Inc., Lamp Division, Ocean, NJ 07712	908-774-8502
§ Hammond Manufacturing Co., Buffalo, NY 14225	716-894-5710
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hycomp, Inc., Marlborough, MA 01752	508-485-6300
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
Mag-Con, St. Paul, MN 55113	612-633-8820
§ Magnetek Triad, Huntington, IN 46750	219-356-7100
† Magnetico Inc., Holtsville, NY 11742	516-654-1166
† Mep Controls, Bordentown, NJ 08505	609-298-7300
§† Micron Industries, Hillside, IL 60162	708-547-0900
† Micropac Inds., Inc., Garland, TX 75040	214-272-3571
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390	602-941-6300
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915	201-385-0500
† Modular Devices, Shirley, NY 11967	516-345-3100
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
† Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
† NWL Transformers, Bordentown, NJ 08505	609-298-7300
Oeco Corp., Milwaukie, OR 97222	503-659-7932
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
Phenix Technologies, Accident, MD 21520	301-746-8118
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
Pico Electronics, Inc., Mt. Vernon, NY 10552	914-699-5514;800-431-1064
Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
§ Power Designs, Inc., Westbury, NY 11590	516-333-6200
Power-One, Inc., Camarillo, CA 93012	805-987-8741
Power Trends, Inc., Batavia, IL 60510	708-406-0900
† PTC Transformers, Bordentown, NJ 08505	609-298-8200
Sanken Electric USA Corp., Hoffman Estates, IL 60195	708-519-1717
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505	310-517-7770
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§† Silicon General, Garden Grove, CA 92641	714-898-8121
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697	407-848-4311
† Sorensen Company, Paxton, IL 60957	800-525-2024
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863	618-262-5121
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9	403-259-3200
Unitrode Corp., Watertown, MA 02172	617-926-0404
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
Victoreen, Inc., Solon, OH 44139-3395	216-248-9300;216-248-9043
Voltex, Amityville, NY 11701	516-842-2772
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001
Zenith Magnetics, Zenith Electronics Corp., Glenview, IL 60025-2493	708-391-8700

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Relays, Crystal Can, 1/2 Crystal Can-4500 – ***See Vol. B***
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Relays, Differential-4500 – ***See Vol. B***
Relays, Frequency Selective-4500 – ***See Vol. B***
Relays, General Purpose-4500 – ***See Vol. B***
Relays, High Voltage (500 Volts & Over)-4500 – ***See Vol. B***
Relays, Hybrid-4500 – ***See Vol. B***
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Relays, Mercury-Wetted Contacts-4500 – ***See Vol. B***
Relays, Meter-4500 – ***See Vol. B***
Relays, Motor Start-4500 – ***See Vol. B***
Relays, Opto-isolated-4500 – ***See Vol. B***
Relays, Phase Sensing-4500 – ***See Vol. B***
Relays, Plug-in-4500 – ***See Vol. B***
Relays, Power-4500 – ***See Vol. B***
Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500 – ***See Vol. B***
Relays, Programmable-4500 – ***See Vol. B***
Relays, RF (Incl. Antenna & Coaxial)-4500 – ***See Vol. B***
Relays, Reed-4500 – ***See Vol. B***
Relays, Reed, Surface Mount-4500 – ***See Vol. B***
Relays, Sealed(Hermetic)-4500 – ***See Vol. B***
Relays, Solid State-4500 – ***See Vol. B***
Relays, Stepping-4500 – ***See Vol. B***
Relays, Telephone-4500 – ***See Vol. B***
Relays, Thermal-4500 – ***See Vol. B***
Relays, Time Delay-4500 – ***See Vol. B***
Relays, Transistor & DIP Case Types — See Relays, Printed Circuit Mounting (Vol. B)
Relays, Vacuum-4500 – ***See Vol. B***
Relays, Voltage Sensitive-4500 – ***See Vol. B***
Relays (MIL)-2440 – ***See Vol. B***

Rental & Lease Equipment-2900

Φ AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1228-1229,1232-1233**
Φ Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Elan Systems, Inc., Morgan Hill, CA 95037	800-541-3526
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
†Φ Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
†Φ Microwave Filter Inc., East Syracuse, NY 13057-0486	315-437-3953;800-448-1666
MSD3, Morgan Hill, CA 95037	800-541-3526,408-778-7267
MSD3, Morgan Hill, CA 95037	800-541-3526,408-778-7267
Φ Tucker Electronics, Dallas, TX 75355-1419	214-348-8800,800-527-4642

Repair Equipment, Surface Mount-4100

Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000	**B•1496**
† ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
† ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
A.P.E. Corporation, Medford, NY 11763	516-654-1197
EI & S, Prime Technology Inc., North Branford, CT 06471	203-481-5721
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
§ Nu-Concept Systems, Colmar, PA 18915	215-822-8400;800-762-4278
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
§† Plato Products, Inc., Industry, CA 91748	818-965-8044;800-423-4510
† Ungar, Rubbermaid Office Products Group, Buena Park, CA 90621	714-994-2510

Repair Services, Surface Mount Equipment-4100

† ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
† ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
ATE Super Techs, Pompano Beach, FL 33064	800-780-6343;305-941-6343; 305-973-0996
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
§ Nu-Concept Systems, Colmar, PA 18915	215-822-8400:800-762-4278
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
† Zevatech, Inc., Morrisville, NC 27560	919-460-0111

Repeaters, Pulse — See Transponders (Vol. D)

Repeaters, Servo-4900

† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transmagnetics, Farmingdale, NY 11735	516-293-3100

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Resistors, Bulk Ceramic-4700 – ***See Vol. A***
Resistors, Carbon Film-4700 – ***See Vol. A***
Resistors, Ceramic Core-4700 – ***See Vol. A***
Resistors, Ceramic Metal (Cermet)-4700 – ***See Vol. A***

Resistors, Chip (For Microcircuits)-4700 – ***See Vol. A***
Resistors, Composition, Carbon-4700 – ***See Vol. A***
Resistors, Decade-4700 – ***See Vol. A***
Resistors, Deposited Carbon-4700 – ***See Vol. A***
Resistors, Disk, Rod & Tube-4700 – ***See Vol. A***
Resistors, Film, Metallized & Nonmetallized-4700 – ***See Vol. A***
Resistors, Flame Retardant-4700 – ***See Vol. A***
Resistors, Flux Sensitive-4700 – ***See Vol. A***
Resistors, Foil, Ultraprecision-4700 – ***See Vol. A***
Resistors, Four Terminal-4700 – ***See Vol. A***
Resistors, Fuse-4300 – ***See Vol. B***
Resistors, Glass-4700 – ***See Vol. A***
Resistors, Heat Sink Encased – See Resistors, Integral Heat Dissipator (Vol. A)
Resistors, High Frequency-4700 – ***See Vol. A***
Resistors, High Megohm (Over 22 Megohms)-4700 – ***See Vol. A***
Resistors, High Temperature (Over 125°C)-4700 – ***See Vol. A***
Resistors, High Voltage (1,000 Volts & Over)-4700 – ***See Vol. A***
Resistors, Hot Molded-4700 – ***See Vol. A***
Resistors, Integral Heat Dissipator-4700 – ***See Vol. A***
Resistors, Low Temperature Coefficient-4700 – ***See Vol. A***
Resistors, Metal Film-4700 – ***See Vol. A***
Resistors, Metal Glazed-4700 – ***See Vol. A***
Resistors, Metal Oxide-4700 – ***See Vol. A***
Resistors, Microwave-4700 – ***See Vol. A***
Resistors, Negative Temperature Coefficient-4700 – ***See Vol. A***
Resistors, Noninductive-4700 – ***See Vol. A***
Resistors, Oil Filled-4700 – ***See Vol. A***
Resistors, Plug-in-4700 – ***See Vol. A***
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Resolvers, Synchro-4900

BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172-1174
ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 .... D•1190-1191
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1278,1291
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100 .... D•1312
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208-1210
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203 501-851-4000
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
Fasco Motors Group, Chesterfield, MO 63017 314-532-3505
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
† Magtech Controls, Vemitron Corporation, San Diego, CA 92173 619-662-2235
§ Namco Controls Corporation, Mentor, OH 44060 216-946-9900
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400

Resonators, Ceramic-2300 – ***See Vol. A***
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Resonators, SAW-2300 – ***See Vol. A***
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Retainers, Relay-2500 – ***See Vol. C***
Retainers, Transistor & Diode-2500 – ***See Vol. C***
Retainers, Tube-2500 – ***See Vol. C***
Reticles-3700 – ***See Vol. B***
Retractors & Carriers – See Cable Retractors (Vol. C)

RFI Measuring Equipment-2900

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1003,1022-1023,1224-1225
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400 .... D•1013
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Φ IFR Sys. Inc., Wichita, KS 67215 316-522-4981
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 .... 617-938-8390; 1-800-933-9319

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RFI Testing Services – See Services, Electrical Measurement & Test (Vol. D)
Rheostats-4750 – ***See Vol. A***
Rheostats, Motorized-4750 – ***See Vol. A***

Ribbons for Printers-2000

Aspen Imaging, International, Inc., Lafayette, CO 80026-9300 .... 303-666-5750; 1-800-955-5555
† Astro-Med, Inc., W. Warwick, RI 02893 401-828-4000
§† Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201 1-800-537-8791
§# Computerware, Inc., Vienna, VA 22182-2266 703-821-8200
§† Dataproducts Corporation, Woodland Hills, CA 91367-2499 818-888-4014
# Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641 312-539-6045
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
§ Zebra Technologies Corporation, Vernon Hills, IL 60061-3109 708-634-6700

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Rivets-2500 – ***See Vol. C***
Robotic Pick & Place – See Arms & Manipulators, Robotic (Vol. D)
Robotics – See Arms & Manipulators, Robotic (Vol. D), Control Systems, Robotic (Vol. D)

Robots, Machine Vision-4900

† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
Ball Corporation, Industrial Systems Division, Mogadore, OH 44260 216-784-4456
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Mercotac Inc., Carlsbad, CA 92009 619-431-7723
Rhino Robots, Inc., Champaign, IL 61824 217-352-8485
§† Seiko Instruments U.S.A., Inc., Robotics/Automation Div., Torrance, CA 90505 213-517-7850
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
Xenon Corp., Woburn, MA 01801 617-938-3594

Robots, Pick and Place-4900

† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 607-772-7563
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† Manncorp, Huntingdon Valley, PA 19006 215-364-6100
Mercotac Inc., Carlsbad, CA 92009 619-431-7723
MOLEX, Inc., Lisle, IL 60532 708-969-4550
Norgren, Littleton, CO 80120-1663 303-794-2611
Ocean Motions Co., Barrington, RI 02806 401-246-1394
Rhino Robots, Inc., Champaign, IL 61824 217-352-8485
§ Royonic Inc., Valencia, CA 91355 805-257-0303
§† Seiko Instruments U.S.A., Inc., Robotics/Automation Div., Torrance, CA 90505 213-517-7850
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970

Robots, X-Y-Z-4900

Ocean Motions Co., Barrington, RI 02806, 401-246-1394 .... B•1980
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
ITF Corp., Buford, GA 30518 404-945-3844
Rhino Robots, Inc., Champaign, IL 61824 217-352-8485
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416 516-328-3970
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958

Rods, Ground-2500 – ***See Vol. C***
Rotators – See Antenna Rotators (Vol. D)
Rotors, Motor & Generator – See Motor & Generator Armatures, Rotors, Stators (Vol. B)
Rubber, Conductive-1600 – ***See Vol. C***
Rubber Guards (For Equipment) – See Bumpers (Vol. C)
Rubber, Silicone-1600 – ***See Vol. C***
Satellite Antennas – See Antennas, Satellite (Vol. D)

Satellite Earth Stations, Transmit & Receive-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1116,1187-1189
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Comtech Microwave Corp, Comtech Telecommunications Corp., Melville, NY 11747 516-777-8900
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
§ Electronic Specialists, Natick, MA 01760 .... 508-655-1532;800-225-4876
† LogiMetrics, Plainview, NY 11803 516-349-1700
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Prodelin Corporation, Conover, NC 28613 704-464-4141
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010

† TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273

Scale Expanders, Meter — See Multipliers, Meter (Vol. D)

Scalers, Binary, Decade-2325

† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176,1180**
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Dynapar, Gurnee, IL 60031	312-662-2666
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
† Nuclear Research Corp., Warrington, PA 18976	215-343-5900

Scales, Dial-2400 – *See Vol. C*

Scales, Electronic (Counting/Weighing)-2900

Advanced Process Controls, Woburn, MA 01801	617-932-9262
BLH Electronics, Inc. Canton, MA 02021-9111	617-821-2000
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
Extech Instruments Corp. Waltham, MA 02154	617-890-7440
† Fairbanks Scales:Fairbanks Inc., St. Johnsbury, VT 05819	800-451-4107; 802-748-5111
General Electronic Materials Technology, Los Alamitos, CA 90720	714-761-5684
§† Kistler-Morse, Redmond, WA 98073	206-881-8000
§ Scientech, Inc. Boulder, CO 80303	303-444-1361;800-525-0522
Tridyne Process Systems, DBI Industries, So. Burlington, VT 05403	802-863-6873

Scanners, Bar Code — See Readers, Bar Code (Vol. D)

Scanners, Crossbar-1900

§ Computer Peripherals Inc., Newbury Pk., CA 91320	805-499-5751;800-854-7600
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
Information Transfer Inc. Bloomfield, NY 14469	716-657-7074
Matrix Corp. Indianapolis, IN 46241	317-248-2036
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301

Scanners, Fiber Optic-2475 – *See Vol. B*

Scanners, Flying Spot-1900

† CELCO, Mahwah, NJ 07430	201-327-1123
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151

Scanners, Infrared-2900

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484	203-926-1777
§† Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Control Module, Enfield, CT 06082	203-745-2433
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007	215-781-0700, 800-523-8989
§ Lazerdata Corporation, Orlando, FL 32804	1-800-843-2700
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Sitronic GmbH, Steyregg, AUSTRIA	732-640-591-0
§ Xedar Corp., Boulder, CO 80301	303-443-6441

Scanners, Instrument, Input/Output-2900

Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	D•1193
Julie Research Labs., New York, NY 10001, 212-633-6625	D•1280
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	D•1283
Linseis, Inc., Princeton Junction, NJ 08550, 609-799-6282;800-RECORDER	D•1414
Matrix Corp., Indianapolis, IN 46241, 317-248-2036	**D•1195**
Omega Engineering, Stamford, CT 06907, 800-826-6342	D•1101,1166,1199
§ Action Instruments, San Diego, CA 92123	619-279-5726
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
† Atec, Inc., Houston, TX 77055	713-468-7971
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
Extech Instruments Corp. Waltham, MA 02154	617-890-7440
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
HBM Inc., Marlboro, MA 01752	508-624-4500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
§ Lazerdata Corporation, Orlando, FL 32804	1-800-843-2700
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
MiNT Systems Corporation, Milpitas, CA 95035-6262	408-262-7171
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Precision Filters, Inc., Ithaca, NY 14850	607-277-3550
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
§ Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Scanners, Optical-2900

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
# Audre, Inc., San Diego, CA 92127	619-451-2260
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
Cambridge Technology, Inc., Watertown, MA 02172	617-923-1181
† CELCO, Mahwah, NJ 07430	201-327-1123
Clarostat Sensors and Controls Group, BYR PLC; Plano, TX 75075	214-422-1844; 1-800-872-0044
Control Module, Enfield, CT 06082	203-745-2433
† DBA Systems, Inc., Melbourne, FL 32902-0550	407-727-0660
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Efector, Inc. a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
Ektron Applied Imaging, Inc., Bedford, MA 01730	617-271-1940
FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
§ Fujitsu America, Inc. Computer Products Group, San Jose, CA 95134	408-432-1300
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
§ Houston Instrument, AMETEK, Inc., Austin, TX 78753	512-835-0900
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
§ Lazerdata Corporation, Orlando, FL 32804	1-800-843-2700
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
† Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
§ Sitronic GmbH, Steyregg, AUSTRIA	732-640-591-0
§ Summagraphics Corp., Seymour, CT 06483	203-881-5400
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614-642-3200

Scanners, Optical, Page-2000

§ Sitronic GmbH, Steyregg, AUSTRIA	732-640-591-0
† Terminal Data Corp., Rockville, MD 20855	301-921-8282

Scanners, Reed-2900

Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Information Transfer Inc. Bloomfield, NY 14469	716-657-7074
Matrix Corp., Indianapolis, IN 46241	317-248-2036
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
Omega Engineering, Stamford, CT 06907	800-826-6342
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Scissors-5400 – *See Vol. C*
Scope Dollies — See Carts & Dollies, Instrument & Equipment (Vol. C)
SCRs — See Thyristors (Vol. A)
SCR Firing Controls — See Controls, SCR (Vol. D)

Scramblers, Data-2325

# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
New Wave Instruments, Provo, UT 84604	801-373-4909
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175

Scramblers/Descramblers, Video-1900

Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709	**A•1625**
HDS Inc., Reston, VA 22091	703-620-6200

Scramblers, Speech-1900

Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000

Screening, Mesh, Conductive (Incl. Copper)-4525 – *See Vol. C*
Screens, Printed Circuit-1700 – *See Vol. C*
Screwdrivers-5400 – *See Vol. C*
Screws, Lead, Feed & Translatory — See Drives & Drives Mechanisms (Dial) (Vol. C)
Screws, Fastening-2500 – *See Vol. C*
Scribers-5400 – *See Vol. C*

Scribers, Wafer-Also See Machines & Accessories, Semiconductor Manufacturing-4100

† Control Laser Corp., Orlando, FL 32809	407-438-2500
§ Moody Tools, Inc., E. Greenwich, RI 02818-0230	401-885-0911
U. S. Laser Corp., Wyckoff, NJ 07481	201-848-9200

Sealers — See Coatings (Vol. C)

Sealing Equipment, Metal to Glass/Ceramic-4100

† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111

Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100

Seals & Feedthrus, Environmental — See Feedthrus & Seals, Environmental (Vol. C)
Seals, Ceramic To Metal-2500 – ***See Vol. C***
Seals, Glass To Metal-2500 – ***See Vol. C***
Seals, Hermetic-Also See Services, Hermetic Sealing-2500 – ***See Vol. C***
Seals, Microwave — See Gaskets, Shielding, RF (Vol. C), Seals, Waveguide (Vol. A)
Seals, Pressure Sensitive-2500 – ***See Vol. C***
Seals, Waveguide-3450 – ***See Vol. A***
Search Unit, Magnetic Tape — See Tape Search Equipment (Vol. D)

Security Systems, Access Control-2000

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**D•1028**
AES Corp., Peabody, MA 01960	508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
§ Corby Industries, Inc., Allentown, PA 18103	215-433-1412
Datakey, Inc., Burnsville, MN 55337	612-890-6850
Davidge Corporation, Buellton, CA 93427	805-688-9598
Domino, Inc., Fort Wayne, IN 46899	219-456-5512
Elcom Industries, Inc., St. Louis, MO 63132	314-429-3100
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
# Heitz, Karl, Inc., Woodside, NY 11377	718-565-0004
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
Identatronics, Inc., Elk Grove Village, IL 60007-2082	708-437-2654;1-800-323-5403
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5	613-592-0714;800-267-7231
§† Racal-Guardata, Inc., Herndon, VA 22070	703-471-0892
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
§ THORN Automated Systems, Inc, THORN EMI, Westlake, OHIO 44145	216-871-9900
Urban Electronics, Dover, MA 02030	617-329-4068
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Security Systems, Data-2325

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**D•1028**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
AES Corp., Peabody, MA 01960	508-535-7310
§† Aiphone, Bellevue, WA 98005	206 455 0510
§ Artel Communications Corp., Hudson, MA 01749	508-562-2100
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8	800-361-4914;514-333-1301
Datakey, Inc., Burnsville, MN 55337	612-890-6850
§ Ergotron, Inc., Eagan, MN 55121	612-452-8135
HDS Inc., Reston, VA 22091	703-620-6200
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5	613-592-0714;800-267-7231
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
§† Racal-Guardata, Inc., Herndon, VA 22070	703-471-0892
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
§† Terminal Data Corp., Rockville, MD 20855	301-921-8282
Urban Electronics, Dover, MA 02030	617-329-4068
§ Via West Interface, Inc., Tucson, AZ 85705	602-623-5716;1-800-266-5716
§† Western Datacom Co., Inc., Westlake, OH 44145	216-835-1510;800-262-3311

Seismographs-2900

§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
§ EG&G Geometrics, Div. of EG&G Inc., Sunnyvale, CA 94089	408-734-4616
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
Terra Technlg. Corp., Redmond, WA 98052	206-883-7300

Seizers-5400 – ***See Vol. C***
Selsyns — See Motors, Synchronous (Vol. B)
Semiconductor Material — See Crystals, Semiconductor (Vol. A)

Semiconductor Wafer Fabrication, Assembling (Packaging)-4100

§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311	**A•2219**
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
Advanced Power Technology, Bend, OR 97702	503-382-8028
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§ Continental Device India Limited, New Delhi, INDIA 110028	536150-53 (4 lines)
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Hughes Semiconductor Products Ctr., M/S B1250, Newport Beach, CA 92663	714-759-2665
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188	708-668-8886
MACOM, Inc., Lowell, MA 01851	617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
§† Micrel Semiconductor, San Jose, CA 95131	408-944-0800
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Standard Microsystems, Hauppauge, NY 11788	516-273-3100
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868

Semiconductor Wafer Fabrication, Designing (Topological)-4100

† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
Advanced Power Technology, Bend, OR 97702	503-382-8028
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
† Holt Inc., Irvine, CA 92718	714-859-8800
Hughes Semiconductor Products Ctr., M/S B1250, Newport Beach, CA 92663	714-759-2665
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Standard Microsystems, Hauppauge, NY 11788	516-273-3100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Toko America, Inc., Mt. Prospect;, IL 60056	708-297-0070
Zetex, Inc., Zetex plc., Commack, NY 11725	516-543-7100

Semiconductor Wafer Fabrication, Maskmaking (Tooling)-4100

Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Hughes Semiconductor Products Ctr., M/S B1250, Newport Beach, CA 92663	714-759-2665
MACOM, Inc., Lowell, MA 01851	617-272-3000
Quantronix, Excel Technology, Hauppauge, NY 11788	516-273-6900
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Standard Microsystems, Hauppauge, NY 11788	516-273-3100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070

Semiconductor Wafer Fabrication, Processing-4100

Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
Advanced Power Technology, Bend, OR 97702	503-382-8028
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302	716-278-2521
† Dionics, Westbury, NY 11590	516-997-7474
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Headway Research, Inc., Garland, TX 75042	214-272-5431
† Holt Inc., Irvine, CA 92718	714-859-8800
Hughes Semiconductor Products Ctr., M/S B1250, Newport Beach, CA 92663	714-759-2665
§† Linear Technology Corp., Milpitas, CA 95035-7487	408-432-1900
MACOM, Inc., Lowell, MA 01851	617-272-3000
Materials Research Corporation, Orangeburg, NY 10962	914-359-4200
§† Micrel Semiconductor, San Jose, CA 95131	408-944-0800
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
MSI Electronics, Inc., Woodside, NY 11377	718-672-6500
Research Inc., Minneapolis, MN 55424	612-941-3300
† Standard Microsystems, Hauppauge, NY 11788	516-273-3100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal, San Diego, CA 92123	619-279-4500
† Universal Semiconductor Inc., San Jose, CA 95112	408-436-1906
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
§ Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Semiconductor Wafer Fabrication, Testing/Trimming-4100

Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
Advanced Power Technology, Bend, OR 97702	503-382-8028
Bermar Corp., Research Triangle Park, NC 27709	919-489-4316
† Control Laser Corp., Orlando, FL 32809	407-438-2500
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
Gennum Corp., Burlington, ON, CANADA L7R 3Y3	800-263-9353;416-632-2996
Hughes Semiconductor Products Ctr., M/S B1250, Newport Beach, CA 92663	714-759-2665
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188	708-668-8886
MACOM, Inc., Lowell, MA 01851	617-272-3000
§† Micrel Semiconductor, San Jose, CA 95131	408-944-0800
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
MSI Electronics, Inc., Woodside, NY 11377	718-672-6500
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§† Spectronics Corp., Westbury, NY 11590	516-333-4840/1-800-274-8888
† Standard Microsystems, Hauppauge, NY 11788	516-273-3100
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070

Veeco Instruments Inc., Plainview, NY 11803 ... 516-349-8300

Semiconductors — See Diodes (Vol. A), Rectifiers (Vol. A), Transistors (Vol. A)

Sensors — See Transducer Listings (Vol. B)

Sensors, Acoustic-2200

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. B•1326,1976
Projects Unlimited, Dayton, OH 45414, 513-890-1918 ... D•1057
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 ... 404-981-6225
† International Transducer Corp., Channel Technologies, Inc., Santa Barbará, CA 93111 ... 805-683-2575
† Ocean Motions Co., Barrington, RI 02806 ... 401-246-1394
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 ... 914-693-9001
Polaroid Corp., Cambridge, MA 02139 ... 800-225-1618
Servo Corporation of America, Hicksville, NY 11801-5259 ... 516-938-9700
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 ... 905-851-9958
†Φ U. E. Systems, Inc., Elmsford, NY 10523 ... 914-592-1220;800-223-1325

Sensors, Air Flow-5500 – *See Vol. B*
Sensors, Angle Measuring-5500 – *See Vol. B*
Sensors, CCD Image-3700 – *See Vol. B*

Sensors, Chemical-2200

Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550 ... 508-347-9191
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538 ... 510-226-1329
† Process & Analytical Instruments Div., A Subsidiary of Ametek Inc., Pittsburgh, PA 15238 ... 412-828-9040

Sensors, Fiber Optic-2475 – *See Vol. B*

Sensors, Hall Effect-2200

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 ... B•1662
† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ... B•1914-1915
American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1711
† Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... B•1918, D•1152-1153,1236-1237
§ George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ... B•1324,1970,1973
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 .... B•1987,2002
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•1283
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1302
U.R.D. America, Laguna Nigel, CA 92607, 714-831-0111 ... D•1169
Active Control Instrumentation, Key Largo, FL 33037 ... 305-451-1000
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 ... 508-795-1300
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670 ... 800-262-4638; 800-525-3536
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ... 214-422-1844: 1-800-872-0044
Control Resources Inc., Harvard, MA 01451 ... 508-772-4043
§ Go Switch, Louisville, KY 40233 ... 502-969-2386
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 ... 614-891-2243
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 ... 800-222-7846
Midori America Corp., Fullerton, CA 92631 ... 714-449-0997
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 ... 602-244-6900
§† Optek Technology Inc., Carrollton, TX 75006 ... 214-323-2200
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 ... 503-638-1000
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 ... 219-563-2191
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

Sensors, Light-3700 – *See Vol. B*
Sensors, Liquid Flow-5500 – *See Vol. B*
Sensors, Liquid Level-Also See Transducers, Liquid Level-5500 – *See Vol. B*
Sensors, Moisture-5500 – *See Vol. B*
Sensors, Proximity — See Transducers, Proximity (Vol. B)
Sensors, Temperature-Also See Bolometers; Thermistors Transducers-5500 – *See Vol. B*
Sequence Controllers — See Controllers, Programmable (Vol. D)

Services, Acoustical, Consulting-4100

Elite Electronic Engineering Co., Downers Grove, IL 60515 ... 708-495-9770
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 ... 206-364-7881

Services, Assembly & Fabrication (Incl. R&D) - Also see Services, Metal Parts Fabrication; Services, Printed Circuit Products-4100

† Alden Products Co., Brockton, MA 02403, 508-583-0160 ... C•1148
Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ... A•2259
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
† Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000 ... C•1683
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819 ... D•1593-1594
† Cabtron Systems, Inc., Northbrook, IL 60062, 708-498-6090 ... C•1017
DCI Inc., Olathe, KS 66062, 913-782-5672 ... B•1032
§† Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563 ... D•2310
† EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572 ... C•1022
Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ..... A•2324-2325, D•1672
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181 .. C•1026,1028
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ... D•1449
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
† GSI Corp., Timonium, MD 21093, 410-252-1768 ... C•1750
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ... A•1704-1705
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ... C•1354
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ... B•1839
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1841
Leading Edge, Minnetonka, MN 55343, 612-936-7744 ... B•1171
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 ... D•1143
† Modular Devices, Shirley, NY 11967, 516-345-3100 ... D•1837
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553 ... C•1764
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629 ... C•1137
† Product Technology, Inc., Irvine, CA 92714, 714-474-8998 ... C•1673
Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872 ... D•2313
† Abrams Instrument Corp., Lansing, MI 48910-3688 ... 517-882-7211
ACC Electronics Company, Echlin Inc., Independence, KS 67301 ... 316-331-1000
Accurate Electronics Corp., Elyria, OH 44036 ... 216-366-6330;1-800-334-5904
Accu-Tronics Mfg., Inc., St. Paul, MN 55110 ... 612-653-1961
† Advanced Conversion Tech., Middletown, PA 17057 ... 717-939-2300
† Advanced Hardware Manufacturing, Inc., Fenton, MO 63026 ... 314-343-3850
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
†# Aerospace Systems, Communication Cable Inc., Fairmont, MN 56031 ... 507-235-3355
† Alexandria Extrusion Co., Alexandria, MN 56308 ... 612-763-6537
Alpha Metals, Jersey City, NJ 07304 ... 201-434-6778
† Altek Co., Torrington, CT 06790 ... 203-482-7626
†# Altron, Inc., Anoka, MN 55303 ... 612-427-7735
AMBIT Associates, Santa Clara, CA 95051-2311 ... 408-241-5767
† Amco Engineering, Schiller Pk., IL 60176 ... 708-671-6670;800-833-3156
American Assembly Inc., Florida, NY 10921 ... 914-651-3433
American Microwave Technology, Inc., Brea, CA 92621 ... 714-993-0802
AMP-AKZO Corporation, Chadds Ford, PA 19317 ... 215-459-2800
Andon Elctrns. Corp., Lincoln, RI 02865 ... 401-333-0388
Apollo Magnetics Corp., Los Angeles, CA 90057 ... 213-381-2500
Applied Controls Co., Inc., Fairfield, NJ 07004 ... 201-227-5454
† Apsco, Inc., Mentor, OH 44060 ... 216-352-8961
Aries Electronics, Frenchtown, NJ 08825 ... 908-996-6841
† Artronics Corporation, Portsmouth, NH 03802-5070 ... 603-433-3111
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
† Assembly Specialists, Chelmsford, MA 01824 ... 508-250-5900
† Associated Spring, Barnes Grp., Bristol, CT 06010 ... 203-583-1331
Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300
A-Systems Inc., Charlottesville, VA 22902 ... 804-295-7200
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
Automation Component Technology, Fremont, CA 94538 ... 510-226-0900; 510-490-3587 (Sales)
Autosplice, Inc., San Diego, CA 92121 ... 619-535-0077
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 ... 212-228-0900
† B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ... 908-819-7070; 908-572-0500
Bel Hybrids & Magnetics, Bel Fuse Inc., Indianapolis, IN 46268 ... 317-876-0044
Berg Electronics, Camp Hill, PA 17011 ... 800-237-2374
Blatek, Inc., State College, PA 16801 ... 814-231-2085;814-231-2086
† Branmag, Inc., N. Tonawanda, NY 14120 ... 716-693-5994
§† Bud Industries, Inc., Willoughby, OH 44094-0431 ... 216-946-3200
Burbank Sheet Metal Works Inc., Burbank, CA 91502 ... 818-846-0316
† Cabletest Products Co., Malden, MA 02148 ... 617-665-2932
† Capewell Components, Cromwell, CT 06416 ... 203-635-4045
† Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
Caribbean Assemblies, Inc., Wintersprings, FL 32708 ... 407-327-0602
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 ... 602-940-0740
† Colt Technology Corp., Lenexa, KS 66219 ... 913-888-1673
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 ... 416-292-4463
Compas, Ogdensburg, NY 13669 ... 315-393-3573
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 ... 508-580-0111
Computer Systems Technical Support, Anaheim, CA 92807 ... 714-632-1300
§ Com-2, Inc., Saline, MI 48176 ... 313-429-9027
Connectronics Corp., Toledo, OH 43607 ... 419-537-0020
§ Control Cable, Inc., Baltimore, MD 21244 ... 410-298-4411
Controltek, Inc., Portland, OR 97229 ... 503-641-0876
Corby Industries, Inc., Allentown, PA 18103 ... 215-433-1412
Corlund Electronics Corp., Newbury Park, CA 91320 ... 805-499-6877
Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
CVDS Inc., Pte. Claire,Que., CANADA H9R 1C2 ... 514-694-9320
D & P MFG. Inc., Chalfont, PA 18914 ... 215-997-1200
† Danmar Inds., Moorpark, CA 93021 ... 1-805-529-3788
† Datacom, Inc., Ft. Walton Beach, FL 32549 ... 904-244-6121
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 ... 617-273-5800
Da-Tech Corp., Ivyland, PA 18974 ... 215-322-9410
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089 ... 408-734-2020
Deltron, Inc., N. Wales, PA 19454-9990 ... 215-699-9261
Design Automation, Inc., Lexington, MA 02173-3992 ... 617-862-8998
† Detoronics Corporation, S. El Monte, CA 91733 ... 818-579-7130
Devere and Lau Company, Anaheim, CA 92802 ... 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 ... 310-457-7912
† Diagostic Instrument Corp., Ayer, MA 01432 ... 508-772-4572
Die-Tech Inc., York Haven, PA 17370 ... 717-938-6771
Digital Data Systems, Inc. (DDS), Ft. Lauderdale, FL 33313 ... 305-792-3290
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
† Diversified Systems, Inc., Indianapolis, IN 46268 ... 317-299-9547
Dowty Avionics, Arcadia, CA 91006 ... 818-445-5955

§ Dynaroll Corporation, San Fernando, CA 91340	818-837-3456
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electronic Connectors, Inc., Reading, PA 19602	215-374-3796
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
Electronics Systems, Inc., Sioux Falls, SD 57117	605-338-6868
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134	708-232-9611
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§† Excel Specialty Corp., Chicago, IL 60660	312-262-4781
§† FISHERTECH, Fisher Gauge Limited, Peterborough, Ontario, CANADA K9J 6Y9	705-748-9522
Flextronics International, Fremont, CA 94538	510-226-3539
† Force, Inc., Christiansburg, VA 24073	703-382-0462
GECO, Millheim, PA 16854	814-349-5555
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Digital Corp., Enfield, CT 06082	203-741-7171
† General Elec. Co., Electromaterials Dept., Coshocton, OH 43812	614-622-5310
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Grand Transformer, Inc., Grand Haven, MI 49417	616-842-5430
Green Engineering, Melrose, MA 02176	617-665-8994
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
HDS Inc., Reston, VA 22091	703-620-6200
§ Hobson Bros., Chicago, IL 60630-3884	312-283-3600
Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Hughes Electronics Products Corp., Livonia, MI 48150	313-427-8310
† Hybrid Designs, Inc., Costa Mesa, CA 92626	714-557-9933
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
IM/D, E.P.E. Corp., Manchester, NH 03101	603-669-5224
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Injectorall Electronics (Woman Owned), Bohemia, NY 11716	516-563-3388
§ Inservco, Inc., LaGrange, OH 44050	1-216-355-5102
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Integrity Technology Corporation, Santa Clara, CA 95050	408-262-8640
§ International Resistive Company, Boone, NC 28607	704-264-8861
† Jettron Products Inc., E. Hanover, NJ 07936	201-887-0571
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Kalmus & Assocs., Inc., Broadview, IL 60153	708-343-7004
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
Ken-Tron Mfg., Inc., Owensboro, KY 42301	502-684-0431
Leecraft Mfg., Long Island City, NY 11101	718-392-8800
† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
§† Magnetic Technologies Corp., Rochester, NY 14625	716-385-9010
† Max Levy Autograph Inc., Philadelphia, PA 19144-4298	215-842-3675
§ McKenzie Technology, Fremont, CA 94538	510-651-2700
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880	617-246-2040
Meissner Industries, Dover, NJ 07801	201-366-1700
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
MicroTek, Inc., Chicopee, MA 01020	413-594-5116
† MOLDCON Div. of Contex Electronics, W. Springfield, MA 01089	413-736-0371
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Monolithic Sys. Corp., Englewood, CO 80112	303-790-7400
Morris Enterprises, Sepulveda, CA 91343	818-894-9103
† Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
† National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
§ Nepenthe, Inc., Palo Alto, CA 94303	415-496-6666
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
† NKR Precision Manufacturing, Harriman, NY 10926	914-782-8562
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
NWL Transformers, Bordentown, NJ 08505	609-298-7300
Omnibyte Corp., West Chicago, IL 60185-3790	708-231-6880
† P C Express, Inc., Hudson, FL 34667	813-863-6114
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
§† Polygenex International Inc., Cary, NC 27512-1487	919-380-8100
Power Systems, Inc., Bloomfield, CT 06002	203-726-1300
Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
Presco, Inc., Woodbridge, CT 06525	203-397-8722
† Qualtronics Corp., Inc., Palm, PA 18070-0468	215-679-0900
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059	908-561-4200
Ramcom Systems, Torrance, CA 90503	310-214-8601
RCD Components, Inc., Manchester, NH 03109	603-669-0054
† Reactel, Inc., Rockville, MD 20850	301-279-5535
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO	519-696-2616
† RMS Techn., Newport News, VA 23606	804-873-0100
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505	310-517-7770
SFE Technologies, San Fernando, CA 91340	818-365-9411
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
Siltronics Ltd., Dover, MA 02030	617-329-4068
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Southtronics, Inc., Marietta, GA 30066-6029	404-429-1000
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
Storm Products Co., Hinsdale, IL 60521	708-323-9121
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Taurus Electronics, Inc., N. Smithfield, RI 02895	401-769-2625
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
TL Inds. Inc., Northwood, OH 43619	419-666-8144
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
†# Tratec of California, Inc., Chula Vista. CA 91911	619-476-1155
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
Trionics, Inc., St. Charles, IL 60174	708-365-6570
Tri-Source Inc., Shelton, CT 06484	203-924-7030
†# Tri-Tech Electronics, Inc., Orlando, FL 32817	407-277-2131
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659
Veetronix, Inc., Lexington, NE 68850	308-324-4600
Vern Kiebler Electronics, Inc., Wheaton, IL 60187	708-668-5407
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
† Video Automation Systems, Pound Ridge, NY 10576	914-764-4613
† Waters Instruments Inc., Rochester, MN 55903	507-252-3700
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
Xetel Corporation, Austin, TX 78758	512-834-2266
Zercom Corporation, Merrifield, MN 56465-0084	218-765-3151
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Assembly, Surface Mount Technology-4100

† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882	A•1668,1665
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	B•1207, C•1163
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	D•1593-1594
Bel Hybrids & Magnetics, Bel Fuse Inc., Indianapolis, IN 46268, 317-876-0044	A•1692
§† Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	D•2310
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500	A•1700-1702
Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400	A•1407
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	D•1117,1141
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	A•1704
Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424	A•1712
† Product Technology, Inc., Irvine, CA 92714, 714-474-8998	C•1673
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	D•1942-1943,2313
ACC Electronics Company, Echlin Inc., Independence, KS 67301	316-331-1000
# Accu-Tronics Mfg., Inc., St. Paul, MN 55110	612-653-1961
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
Advanced Electronic Packaging, Huntington Beach, CA 92646	714-969-1150
† Advanced Hardware Manufacturing, Inc., Fenton, MO 63026	314-343-3850
§ ALTEK Corporation, Silver Springs, MD 20904-7802	301-572-2555
†# Altron, Inc., Anoka, MN 55303	612-427-7735
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
Apsco, Inc., Mentor, OH 44060	216-352-8961
Argo Transdata Corp., Clinton, CT 06413-0554	203-669-2233
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Berg Electronics, Camp Hill, PA 17011	800-237-2374
CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Caribbean Assemblies, Inc., Wintersprings, FL 32708	407-327-0602
Circom Inc., Bensenville, IL 60106	708-595-4460
Clover Elctrns., Inc., Newnan, GA 30264	404-251-5323
† Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Compas, Ogdensburg, NY 13669	315-393-3573
§ Com-2, Inc., Saline, MI 48176	313-429-9027
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Controltek, Inc., Portland, OR 97229	503-641-0876

† Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
† Da-Tech Corp., Ivyland, PA 18974	215-322-9410
† Diagostic Instrument Corp., Ayer, MA 01432	508-772-4572
Die-Tech Inc., York Haven, PA 17370	717-938-6771
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
§ El Microcircuits, Inc., Mankato, MN 56001	507-345-5786
Electra-ssembly, Lancer Chemical, Warren, RI 02885	401-245-5493
† Electro-Mech Components, Inc., South El Monte, CA 91733-3689	818-442-7180
Electronic Components & Materials, GTE Sylvania, Warren, PA 16365	814-726-6500
Electronics Systems, Inc., Sioux Falls, SD 57117	605-338-6868
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Entra Corporation, Indianapolis, IN 46256	317-849-8270
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
Flextronics International, Fremont, CA 94538	510-226-3539
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
IM/D, E.P.E. Corp., Manchester, NH 03101	603-669-5224
§ Inservco, Inc., LaGrange, OH 44050	1-216-355-5102
International Resistive Company, Boone, NC 28607	704-264-8861
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
§ Manu-Tronics, Inc., Kenosha, WI 53142-7799	414-947-7700
§ McKenzie Technology, Fremont, CA 94538	510-651-2700
Micro Industries, Westerville, OH 43081-9486	614-548-7878
MOLEX, Inc., Lisle, IL 60532	708-969-4550
MTI International Inc., Menomonee Falls, WI 53051	414-783-6080
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
OMNI Switch USA, Inc., Phoenix, AZ 85027	602-582-0629
† P C Express, Inc., Hudson, FL 34667	813-863-6114
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
Presco, Inc., Woodbridge, CT 06525	203-397-8722
Project Resources Inc., Wareham, MA 02571	508-295-7444
† Qualtronics Corp., Inc., Palm, PA 18070-0468	215-679-0900
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
RCD Components, Inc., Manchester, NH 03109	603-669-0054
† Resistance Technology Inc., St. Paul, MN 55112	612-636-9770
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
† SCOPE Incorporated, Reston, VA 22090	703-471-5600
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Taurus Electronics, Inc., N. Smithfield, RI 02895	401-769-2625
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
TL Inds. Inc., Northwood, OH 43619	419-666-8144
Trionics, Inc., St. Charles, IL 60174	708-365-6570
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Vern Kiebler Electronics, Inc., Wheaton, IL 60187	708-668-5407
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
Xetel Corporation, Austin, TX 78758	512-834-2266

Services, Backplane Wiring - Also see Services, Wire Wrapping; Services, Cable Assembly - Also see Services, Crimping; Services, Wire Cutting & Stripping-4100

Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	**D•2310**
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473	**C•1672**
† GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1750**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
† Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659	**C•1025,1675**
# Accu-Tronics Mfg., Inc., St. Paul, MN 55110	612-653-1961
Altek Co., Torrington, CT 06790	203-482-7626
American Assembly Inc., Florida, NY 10921	914-651-3433
Andon Elctrns. Corp., Lincoln, RI 02865	401-333-0388
† Apsco, Inc., Mentor, OH 44060	216-352-8961
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Augat/RDI, Carol Stream, IL 60188	708-682-4100
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
Caribbean Assemblies, Inc., Wintersprings, FL 32708	407-327-0602
§ Com-2, Inc., Saline, MI 48176	313-429-9027
§† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
† Datawrap, Inc., Wakefield, MA 01880	617-246-5757
† Da-Tech Corp., Ivyland, PA 18974	215-322-9410
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
Electronic Connection Corp., Bloomfield, CT 06002	203-243-3356
Electronic Connectors, Inc., Reading, PA 19602	215-374-3796
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Hybricon Corporation, Ayer, MA 01432	508-772-5422
Injectorall Electronics (Woman Owned), Bohemia, NY 11716	516-563-3388
† Interlogic Industries, Melville, NY 11747-4294	516-420-8111
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Mupac Corp., Carlo Gavazzi Co., Brockton, MA 02401	508-588-6110
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
§ Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
† Project Resources Inc., Wareham, MA 02571	508-295-7444
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
† Reactel, Inc., Rockville, MD 20850	301-279-5535
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
† Taurus Electronics, Inc., N. Smithfield, RI 02895	401-769-2625
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060	603-889-5156
Trionics, Inc., St. Charles, IL 60174	708-365-6570
Tri-Source Inc., Shelton, CT 06484	203-924-7030
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
# Unitrek Corporation, Vancouver, WA 98661	206-699-7277
Urban Electronics, Dover, MA 02030	617-329-4068
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
† V R Industries, Inc., Warwick, RI 02886	401-732-6800
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525
§ Zercom Corporation, Merrifield, MN 56465-0084	218-765-3151

Services, Board Assembly-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Andon Elctrns. Corp., Lincoln, RI 02865, 401-333-0388	**C•1257**
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223	**B•1063**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1524**
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1705**
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400	**B•1839**
Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
† S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500	**C•1082-1083**
§ Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	**D•1942-1943,2313**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
ACC Electronics Company, Echlin Inc., Independence, KS 67301	316-331-1000
Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
# Accu-Tronics Mfg., Inc., St. Paul, MN 55110	612-653-1961
† Advanced Hardware Manufacturing, Inc., Fenton, MO 63026	314-343-3850
Altek Co., Torrington, CT 06790	203-482-7626
Alternative Manufacturing, Inc., Winthrop, ME 04364-200	207-377-9377
†# Altron, Inc., Anoka, MN 55303	612-427-7735
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
American Assembly Inc., Florida, NY 10921	914-651-3433
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
Apsco, Inc., Mentor, OH 44060	216-352-8961
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Capewell Components, Cromwell, CT 06416	203-635-4045
Cardinal Control Co., Kensington, CT 06037	203-828-6379
Caribbean Assemblies, Inc., Wintersprings, FL 32708	407-327-0602
Chloride El Paso, Chloride Power Elctrns., El Paso, TX 79906	915-592-9985
Circom Inc., Bensenville, IL 60106	708-595-4460
Clover Elctrns., Inc., Newnan, GA 30264	404-251-5323
† Colt Technology Corp., Lenexa, KS 66219	913-888-1673
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Com-2, Inc., Saline, MI 48176	313-429-9027
Controltek, Inc., Portland, OR 97229	503-641-0876
† Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
D & P MFG. Inc., Chalfont, PA 18914	215-997-1200
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Dexter Scientific, Palatka, FL 32177	904-328-2450
† Diagostic Instrument Corp., Ayer, MA 01432	508-772-4572
† Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
Doran Manufacturing Co., Cincinnati, OH 45225	513-681-5424
† Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
El Microcircuits, Inc., Mankato, MN 56001	507-345-5786
Electro-Mech Co., Colorado Springs, CO 80915	719 597-1620
Electronic Components & Materials, GTE Sylvania, Warren, PA 16365	814-726-6500
Electronic Connection Corp., Bloomfield, CT 06002	203-243-3356

Electronic Connectors, Inc., Reading, PA 19602	215-374-3796
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
Electronics Systems, Inc., Sioux Falls, SD 57117	605-338-6868
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Entra Corporation, Indianapolis, IN 46256	317-849-8270
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
Flextronics International, Fremont, CA 94538	510-226-3539
† Force, Inc., Christiansburg, VA 24073	703-382-0462
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
# GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
Hughes Electronics Products Corp., Livonia, MI 48150	313-427-8310
† Hutronix, Inc., Douglas, AZ 85607	602-364-2432
IM/D, E.P.E. Corp., Manchester, NH 03101	603-669-5224
Injectorall Electronics (Woman Owned), Bohemia, NY 11716	516-563-3388
§ Inservco, Inc., LaGrange, OH 44050	1-216-355-5102
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Integrity Technology Corporation, Santa Clara, CA 95050	408-262-8640
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Loranger Intl. Corp., Warren, PA 16365	814-723-2250
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
§ Manu-Tronics, Inc., Kenosha, WI 53142-7799	414-947-7700
Micro Industries, Westerville, OH 43081-9486	614-548-7878
† Mitech ELectronics Corp., Otsego, MI 49078	616-694-9471
† Modular Devices, Shirley, NY 11967	516-345-3100
MTI International Inc., Menomonee Falls, WI 53051	414-783-6080
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
OMNI Switch USA, Inc., Phoenix, AZ 85027	602-582-0629
Oven Industries, Mechanicsburg, PA 17055	717-766-0721
Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365
† P C Express, Inc., Hudson, FL 34667	813-863-6114
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
Project Resources Inc., Wareham, MA 02571	508-295-7444
Quality Thermistor, Boise, ID 83709	208-377-3373
† Qualtronics Corp., Inc., Palm, PA 18070-0468	215-679-0900
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
Radio Television Products Corp., Douglas, AZ 85607	602-364-4438
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
RCD Components, Inc., Manchester, NH 03109	603-669-0054
RMS Techn., Newport News, VA 23606	804-873-0100
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
Siltronics Ltd., Dover, MA 02030	617-329-4068
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
Southtronics, Inc., Marietta, GA 30066-6029	404-429-1000
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
† Taurus Electronics, Inc., N. Smithfield, RI 02895	401-769-2625
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
†# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
TL Inds. Inc., Northwood, OH 43619	419-666-8144
Trionics, Inc., St. Charles, IL 60174	708-365-6570
Tri-Source Inc., Shelton, CT 06484	203-924-7030
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Vern Kiebler Electronics, Inc., Wheaton, IL 60187	708-668-5407
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
† V R Industries, Inc., Warwick, RI 02886	401-732-6800
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525
Xetel Corporation, Austin, TX 78758	512-834-2266
XYZ Electronics, McCordsville, IN 46055	317-335-2128
§ Zercom Corporation, Merrifield, MN 56465-0084	218-765-3151
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Cable & Harness Assembly-4100

§ ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103	**C•1706-1707**
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**C•1340, D•1732**
† GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1750**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**C•1354**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**C•1759-1761**
Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740	**A•2441**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
# Accu-Tronics Mfg., Inc., St. Paul, MN 55110	612-653-1961
† Advanced Hardware Manufacturing, Inc., Fenton, MO 63026	314-343-3850
Alden Products Co., Brockton, MA 02403	508-583-0160
Altek Co., Torrington, CT 06790	203-482-7626
†# Altron, Inc., Anoka, MN 55303	612-427-7735
† American Electronic Components, Elkhart, IN 46514	219-264-1116
Amphenol Interconnect Products, LPL Technologies, Endicott, NY 13760	607-754-4444
Applied Design Company, Minneapolis, MN 55413	612-378-0094
Apsco, Inc., Mentor, OH 44060	216-352-8961
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Autec Power Systems, Simi Valley, CA 93065	805-522-0888
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
Berg Electronics, Camp Hill, PA 17011	800-237-2374
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
CableStar, Incorporated, Glasgow, KY 42141	800-338-8223
† Cable Systems, Inc., The HVT Group, Everett, MA 02149	617-389-7080
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
Circom Inc., Bensenville, IL 60106	708-595-4460
Clover Elctrns., Inc., Newnan, GA 30264	404-251-5323
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379	508-580-0111
Components Electronics Corp., Lewisberry, PA 17339	717-938-4151
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Com-2, Inc., Saline, MI 48176	313-429-9027
§ Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Controltek, Inc., Portland, OR 97229	503-641-0876
† Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
Covid, Inc., Tempe, AZ 85281	602-966-2221
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Custom Computer Cable, Inc., Eden Prairie, MN 55344	612-941-5651;1-800-343-5553
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089	408-734-2020
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Die-Tech Inc., York Haven, PA 17370	717-938-6771
† Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
Electro Insulation Corp., Arlington Hgts., IL 60004	708-632-1020
Electro-Mech Co., Colorado Springs, CO 80915	719-597-1620
† Electro-Mech Components, Inc., South El Monte, CA 91733-3689	818-442-7180
† Electro Miniatures Corp., Moonachie, NJ 07074	201-460-0510
Electronic Connection Corp., Bloomfield, CT 06002	203-243-3356
Electronic Connectors, Inc., Reading, PA 19602	215-374-3796
Electronic Packaging System, Marion, IA 52302	319-377-3423
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
†# ELMEC, Inc., Technautic Corp., Chandler, AZ 85226	602-961-7100
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Entra Corporation, Indianapolis, IN 46256	317-849-8270
Epsco Incorporated, Itasca, IL 60143-1120	708-250-0410
† Excel Specialty Corp., Chicago, IL 60660	312-262-4781
† Fema Elctrns. Corp., E. Brunswick, NJ 08816	908-238-1223
† The First Electronics Corp., Boston, MA 02125	617-288-2430
General Cable Co., Highland Hts., KY 41076	606-572-8616
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
† Hutronix, Inc., Douglas, AZ 85607	602-364-2432
§ JH America, Inc., JBT International, Inc., Torrance, CA 90501	310-328-0051
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
Loranger Intl. Corp., Warren, PA 16365	814-723-2250
† Manger Electric Company, Inc., Stamford, CT 06902	203-348-7761
Meritec, Associated Enterprises, Painesville, OH 44077	216-354-3148
MicroTek, Inc., Chicopee, MA 01020	413-594-5116
Mitech ELectronics Corp., Otsego, MI 49078	616-694-9471
† Modular Devices, Shirley, NY 11967	516-345-3100
§ MOLEX, Inc., Lisle, IL 60532	708-969-4550
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
§ ODU-USA, Inc., ODU-Kontakt GmbH, Germany, Camarillo, CA 93012	805-484-0540
§ Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365

Philadelphia Insulated Wire Co. Inc., General Cable Corporation, Highland Heights, KY 40176	606-572-8306;800-257-8357
Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
† Product Technology, Inc., Irvine, CA 92714	714-474-8998
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
RDI Elctrns., Inc., Mamaroneck, NY 10543	914-777-7000
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO	519-696-2616
Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Taurus Electronics, Inc., N. Smithfield, RI 02895	401-769-2625
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
†# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
§ TELTEC, INC., Minneapolis, MN 55425	612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
† Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300
†# Tratec of California, Inc., Chula Vista, CA 91911	619-476-1155
Trionics, Inc., St. Charles, IL 60174	708-365-6570
Tri-Source Inc., Shelton, CT 06484	203-924-7030
†# Tri-Tech Electronics, Inc., Orlando, FL 32817	407-277-2131
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
# Unitrek Corporation, Vancouver, WA 98661	206-699-7277
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
§† Virginia Plastics Co., Roanoke, VA 24015-0577	703-375-0100
† V R Industries, Inc., Warwick, RI 02886	401-732-6800
# V-Tron Electronics Corp., S. Attleboro, MA 02703	508-761-9100
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
§ Zercom Corporation, Merrifield, MN 56465-0084	218-765-3151

Services, Calibration & Instrument Repair-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1273**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007-2012**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
AVO International, TBG, Dallas, TX 75237	214-333-3201
† Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
† Crozier Metrlogy Labs. Inc., Wheeling, IL 60090	708-520-9085
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449	716-652-3600
Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
† EG & G Flow Technology, Inc., Phoenix, AZ 85072	602-437-1315
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
† Electrical Standards Div., E.S.R.S., Inc., N. Hollywood, CA 91605	818-765-4224
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
Enviroplan, Roseland, NJ 07068	201-994-2300
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
G.C. Industries, SafetyTek Corporation, Fremont, CA 94538	510-226-1329
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
§ Greenwich Instruments USA, Charlotte, NC 28205	704-376-1021
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
Holt Instrument, C.P.D. Engineering, Inc., Oconto, WI 54153	414-834-2222
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Φ Industrial Service Technology, Grand Rapids, MI 49548	616-247-1033;800-835-2611
§# Instrumentation Services, Inc., Minneapolis, MN 55427	612-544-8916
Julie Research Labs., New York, NY 10001	212-633-6625
Kimball Electronic Lab. Inc., Hialeah, FL 33016	305-822-5792
† Koep Precision Standards, Inc., Tuckerton, NJ 08087	609-296-9686
† Kurz Instruments Inc., Monterey, CA 93940	800-424-7356
Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
Lem Dynamp Inc., Grove City, OH 43123	614-871-6900
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Maury Microwave Corp., Ontario, CA 91764	909-987-4715
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
†# MDS Calibration Lab. Inc., Ft. Walton Beach, FL 32548	904-664-1234
§ Metermaster, Tempe, AZ 85282	602-431-0015
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
† Noise Com Inc., Paramus, NJ 07652	201-261-8797
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
§ PTS Corporation, Bloomington, IN 47401	812-824-9331
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
Stephens Analytical, Inc., Montreal, Que., CA H4S 1L1	514-332-1230
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
†# Thunder Scientific Corp., Albuquerque, NM 87123	505-265-8701;800-872-7728
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
† Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811

Services, Coating-4100

MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
Phoenix Wire, Inc., S. Hero, VT 05486, 802-372-4561	**C•1802**
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501**	**A•2013**
Alexandria Metal Finisher, Inc., Lorton, VA 22079	703-643-1636
Alpha Metals, Jersey City, NJ 07304	201-434-6778
Altek Co., Torrington, CT 06790	203-482-7626
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Barr Associates, Inc., Westford, MA 01886	508-692-7513
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Com-2, Inc., Saline, MI 48176	313-429-9027
† Diagostic Instrument Corp., Ayer, MA 01432	508-772-4572
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† E/M Corporation, W. Lafayette, IN 47906	317-497-6346
† Evaporated Coatings, Inc., Willow Grove, PA 19090	215-659-3080
§ Flexible Technologies, Arlon, E. Providence, RI 02914	401-434-2340
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
† KLC/Karl Lambrecht Corp., Chicago, IL 60618	312-472-5442
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
Molecu-Wire, Farmingdale, NJ 07727	908-938-9473
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
† Oxley Inc., Branford, CT 06405	203-488-1033
† Plummer Precision Optics, Pennsburg, PA 18073	215-679-6272
† Polygenex International Inc., Cary, NC 27512-1487	919-380-8100
Rogers Corporation, Circuit Materials Div., Chandler, AZ 85244	602-963-4584
† Southwall Technologies Inc., Palo Alto, CA 94303	415-962-9111
† Specialty Coating Systems, Inc., Indianapolis, IN 46241	317-244-1200
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807	714-630-7127
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal. San Diego, CA 92123	619-279-4500
United Foam Plastics, Georgetown, MA 01833	508-352-2200
§# U.S. Power Converting Company/Relco. Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
§ Wescorp Static Control Products, Mountain View, CA 94041	415-969-7717
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
Wontronics, Los Angeles, CA 90039	213-660-6230
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900

Services, Component Testing & Screening-4100

Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	**D•2310**
GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1750**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1273**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Communications & Energy Corp., E. Syracuse, NY 13057	315-452-0709
§ Com-2, Inc., Saline, MI 48176	313-429-9027
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Detroit Testing Laboratory, Inc., Warren, MI 48090-0869	313-754-9000
† Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
Epic Resins, General Fiberglass Supply, Inc., Waukesha, WI 53186	414-521-2255
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
Green Engineering, Melrose, MA 02176	617-665-8994

Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
Reliability Incorporated, Houston, TX 77218	713-492-0550
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
† Torwico Elctrns. Inc., Lakewood, NJ 08701	908-364-1800
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868

Services, Computer-Aided Design (CAD)-Also See Computers, CAD, CAM, & CAD/CAM-4100

Alden Products Co., Brockton, MA 02403, 508-583-0160	**C•1148**
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1023**
§† **Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563**	**D•2310**
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181	**C•1026,1028**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
LXD, Inc., Cleveland, OH 44146, 216-786-8700	**B•1087**
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844	**B•1846**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042	**A•2601**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Addacon Greensboro, Greensboro, NC 27407	919-852-6200
Advanced Electronic Packaging, Huntington Beach, CA 92646	714-969-1150
Alden Computer Systems, Salem, MA 01970	508-744-1314
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Berg Electronics, Camp Hill, PA 17011	800-237-2374
Burbank Sheet Metal Works Inc., Burbank, CA 91502	818-846-0316
† CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Circom Inc., Bensenville, IL 60106	708-595-4460
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
# Cross Electronics, Warrendale, PA 15086	412-776-1591
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
† Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
§ El Microcircuits, Inc., Mankato, MN 56001	507-345-5786
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
† EMDS, Inc., Gaithersburg, MD 20877	301-840-5710
Entra Corporation, Indianapolis, IN 46256	317-849-8270
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
Fastex Distributor Business, Illinois Tool Works, Des Plaines, IL 60016	708-350-8200
† Flex-Link Products, Inc., San Fernando, CA 91340	818-898-1451
Flextronics International, Fremont, CA 94538	510-226-3539
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
IM/D, E.P.E. Corp., Manchester, NH 03101	603-669-5224
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Inservco, Inc., LaGrange, OH 44050	1-216-355-5102
Interlogic Industries, Melville, NY 11747-4294	516-420-8111
# KelTech Inc., Roanoke, VA 24019	703-362-8466
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
† Metro Circuits, PJC Technologies, Inc., Rochester, NY 14613	716-254-2980
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Micro Industries, Westerville, OH 43081-9486	614-548-7878
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
PADS Software, Inc., Littleton, MA 01460	508-486-9521
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
† Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
Presco, Inc., Woodbridge, CT 06525	203-397-8722
† Proto Systems, Alpharetta, GA 30201	404-475-1330;800-331-1797
Quality Research Company, Spokane, WA 99207-9632	509-924-6895
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302	703-471-1600
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
† SURON Maagan Michael, D.N. Menashe 37805, ISRAEL	06-394211
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
TL Inds. Inc., Northwood, OH 43619	419-666-8144
Trend Circuits, Fremont, CA 94538-6148	510-651-1150
Trionics, Inc., St. Charles, IL 60174	708-365-6570
# Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659
V R Industries, Inc., Warwick, RI 02886	401-732-6800
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525
Xetel Corporation, Austin, TX 78758	512-834-2266
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Computer Programming - Also see Services, Computer Systems, Specific Classification-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304-1307**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
California Automation Inc., San Diego, CA 92121	619-452-1341
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
Custom Logic, Crestline, CA 92325	909-338-4059
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Encoder Products, Sandpoint, ID 83864	208-263-8541
Flex-Key Corporation, Gloucester, MA 01930	508-281-2040
General Digital Corp., Enfield, CT 06082	203-741-7171
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
Haverly Systems, Inc., Denville, NJ 07834	201-627-1424
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Presco, Inc., Woodbridge, CT 06525	203-397-8722
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Sygenex Inc., Redmond, WA 98052	206-881-5500
Systems Data, Inc., Akron, OH 44321	216-666-0085
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
Tree Technologies Corporation, Buffalo, NY 14228	716-688-4640
TSSI, Beaverton, OR 97005	503-643-9281
# Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202

Services, Computer Systems, Builders-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1141**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
California Automation Inc., San Diego, CA 92121	619-452-1341
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
† Datacom, Inc., Ft. Walton Beach, FL 32549	904-244-6121
Da-Tech Corp., Ivyland, PA 18974	215-322-9410
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Encoder Products, Sandpoint, ID 83864	208-263-8541
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Flextronics International, Fremont, CA 94538	510-226-3539
§ GMR Co., Venice, CA 90291-3218	310-399-1490
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
# MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
Presco, Inc., Woodbridge, CT 06525	203-397-8722
§† Terminal Data Corp., Rockville, MD 20855	301-921-8282
Trionics, Inc., St. Charles, IL 60174	708-365-6570

Services, Computer Systems, Consulting-2050

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
California Automation Inc., San Diego, CA 92121	619-452-1341
CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844

Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128 818-988-5290
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Editron Systems Inc., Teaneck, NJ 07666 201-837-0051
Encoder Products, Sandpoint, ID 83864 208-263-8541
Entra Corporation, Indianapolis, IN 46256 317-849-8270
§ GMR Co., Venice, CA 90291-3218 310-399-1490
Haverly Systems, Inc., Denville, NJ 07834 201-627-1424
HiTech Equipment Corp., San Diego, CA 92126 619-566-1892
Impulse Engineering, Goleta, CA 93117-1023 805-685-2030
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Industrial Electronics Corp., Warren, MI 48089 313-759-4450
LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143
MEXITRONIX (Woman Owned), Kingman, AZ 86401 602-757-9798
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113 612-638-7777
Parsytec Inc., West Chicago, IL 60185 708-293-9500
Presco, Inc., Woodbridge, CT 06525 203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051 814-453-5452
Sygenex Inc., Redmond, WA 98052 206-881-5500
Systems Data, Inc., Akron, OH 44321 216-666-0085
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
Tree Technologies Corporation, Buffalo, NY 14228 716-688-4640
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210 602-833-5202
§ Zitel Corporation, Milpitas, CA 95035 .... 408-321-9600;800-622-5020

Services, Computer Systems, Integrators-2050

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 612-474-4500
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
† Aydin Corp., Horsham, PA 19044 215-657-7510
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Datacom, Inc., Ft. Walton Beach, FL 32549 904-244-6121
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128 818-988-5290
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
Editron Systems Inc., Teaneck, NJ 07666 201-837-0051
Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178 404-457-5600
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
Encoder Products, Sandpoint, ID 83864 208-263-8541
† EOG, INC., OMX, INC., Hunt Valley, MD 21031 410-785-3000
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
HDS Inc., Reston, VA 22091 703-620-6200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HiTech Equipment Corp., San Diego, CA 92126 619-566-1892
IICon Corporation, Morgan Hill, CA 95037 408-779-7466
Impulse Engineering, Goleta, CA 93117-1023 805-685-2030
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143
Matrix Corp., Raleigh, NC 27610 919-231-8000
MEXITRONIX (Woman Owned), Kingman, AZ 86401 602-757-9798
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
NAVAN Corporation, Media, PA 19063 215-352-8464
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113 612-638-7777
Parsytec Inc., West Chicago, IL 60185 708-293-9500
Presco, Inc., Woodbridge, CT 06525 203-397-8722
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
SCOPE Incorporated, Reston, VA 22090 703-471-5600
†# Sheldon Instruments, Provo, UT 84604 801-376-7861
Systems Data, Inc., Akron, OH 44321 216-666-0085
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
TL Inds. Inc., Northwood, OH 43619 419-666-8144
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210 602-833-5202
§ Zitel Corporation, Milpitas, CA 95035 .... 408-321-9600;800-622-5020

Services, Consulting, Chemical Analysis-4100

† Gardiner Solder Co., Div. of Gardiner Metal Co., Chicago, IL 60632 312-847-0100
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143

Services, Consulting, Data Processing-4100

ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ CMV Software Specialists Inc., Sioux Falls, SD 57102 605-338-6645
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128 818-988-5290
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

Services, Consulting, Drafting-4100

Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181 ...... C•1026
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
Buckeye Stamping Co., Columbus, OH 43207 614-445-8433
† CDRL Data, Inc., Phoenix, AZ 85027-2823 602-582-8844
Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
Cross Electronics, Warrendale, PA 15086 412-776-1591
D & P MFG. Inc., Chalfont, PA 18914 215-997-1200
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818 219-489-2511
Philips Circuit Assemblies, Tampa, FL 33614-2797 813-933-5113
Quality Research Company, Spokane, WA 99207-9632 509-924-6895
Support Electronics, Inc., Butler, NJ 07405-1367 1-201-838-2755
Technetics Corporation, Indianapolis, IN 46250 .... 317-842-5377;800-467-8324
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Trend Circuits, Fremont, CA 94538-6148 510-651-1150
Wire Graphics, Inc., Farmingdale, NY 11735 516-293-1525

Services, Consulting, Engineering-4100

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 .... A•2256, D•1560
American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355 ..... D•1572
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... C•1163
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 .... D•1583
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1023
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 .... A•1625
ebm Industries, Inc., Farmington, CT 06034, 203-674-1515 .... C•1578
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181 ...... C•1026
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
McKenzie Technology, Fremont, CA 94538, 510-651-2700 .... C•1415
Micro Industries, Westerville, OH 43081-9486, 614-548-7878 .... D•1143
Ocular Inc., Richardson, TX 75081, 214-437-3888 .... B•1096
Product Technology, Inc., Irvine, CA 92714, 714-474-8998 .... C•1673
Teka Interconnection Systems, Interplex Industries, Providence, RI 02907, 401-785-4110 .... C•1485-1487
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351 ... D•2041
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
Advanced Motion Controls, Inc., Princeton, WI 54968 414-295-3500
Alliance Laboratories, Inc., Redwood City, CA 94063 415-366-8220
Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
AMBIT Associates, Santa Clara, CA 95051-2311 408-241-5767
American Control Technology, Inc., Elgin, IL 60123-1203 708-468-6000
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078 404-979-5900
Baranti Group Inc., Markham, Ont., CAN L3R 2W6 416-479-0148
§ Beta Review, Inc., Millwood, VA 22646 703-837-1436
Buckeye Stamping Co., Columbus, OH 43207 614-445-8433
† CAD Engrg. & Assembly Inc., Mentor, OH 44060 216-255-7744
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
† CDRL Data, Inc., Phoenix, AZ 85027-2823 602-582-8844
† Clean Room Products, Inc., Ronkonkoma, NY 11779-6528 516-588-7000
Colt Technology Corp., Lenexa, KS 66219 913-888-1673
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
Controls Unlimited, Inc., Perry, OH 44081 216-259-2500
Creare Inc., Hanover, NH 03755 603-643-3800
Cross Electronics, Warrendale, PA 15086 412-776-1591
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
D & P MFG. Inc., Chalfont, PA 18914 215-997-1200
Design Automation, Inc., Lexington, MA 02173-3992 617-862-8998
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Dexter Scientific, Palatka, FL 32177 904-328-2450
Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
Durmitor Inc., King City, Ont., CANADA LOG 1K0 416-833-3148
East Controls, Hanover Park, IL 60103 708-837-7709
Editron Systems Inc., Teaneck, NJ 07666 201-837-0051
Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronic Development Associates, Dix Hills, NEW YORK 11746 516-673-3881
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4 403-450-5370
Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5485
Electro-Support Systems, Temecula, CA 92590 909-676-2751
Elite Electronic Engineering Co., Downers Grove, IL 60515 708-495-9770
Energy Systems, Vancouver, WA 98682 206-896-8310
Entra Corporation, Indianapolis, IN 46256 317-849-8270
EPH Engineering Associates, Inc., Orem, UT 84058 801-226-1383

Everest Electronic Equipment, Buford, GA 30518	404-932-2900
EWC. Inc., Englishtown, NJ 07726	908-446-3110
FJA Industries, Santa Clara, CA 95052	408-727-0100
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Digital Corp., Enfield, CT 06082	203-741-7171
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
Green Engineering, Melrose, MA 02176	617-665-8994
HDS Inc., Reston, VA 22091	703-620-6200
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
HiTech Equipment Corp., San Diego, CA 92126	619-566-1892
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
† Lockheed Sanders, Inc., Nashua, NH 03061-2004	603-885-3602
LOCUS, Inc., Madison, WI 53704	608-244-0500
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
† Micropump Corp., Vancouver, WA 98668-8975	206-253-2008
†# Microwave Design Svcs., Inc., Ft. Walton Beach, FL 32548	904-664-1234
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Multipower, Inc., Spectrum Electronics Corp., Beaverton, OR 97006	503-646-4700
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Dirk A. Nelson, P.E.- Consulting Engineer, Glenwood Springs, CO 81601	303-945-7005
NWL Transformers, Bordentown, NJ 08505	609-298-7300
PC Transformer Corp., West Babylon, NY 11704	516-491-3300
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
Presco, Inc., Woodbridge, CT 06525	203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302	703-471-1600
Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
TL Inds. Inc., Northwood, OH 43619	419-666-8144
Tree Technologies Corporation, Buffalo, NY 14228	716-688-4640
Trend Circuits, Fremont, CA 94538-6148	510-651-1150
Tri-Source Inc., Shelton, CT 06484	203-924-7030
# Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
§† Video Automation Systems, Pound Ridge, NY 10576	914-764-4613
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525
§ Zitel Corporation, Milpitas, CA 95035,	408-321-9600;800-622-5020

Services, Consulting, Patent Development-4100

Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
FJA Industries, Santa Clara, CA 95052	408-727-0100
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302	703-471-1600
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202

Services, Consulting, Production-4100

American Skynet Electronic Co., Milpitas, CA 95035, 408-945-6355	**D•1572**
Teka Interconnection Systems, Interplex Industries, Providence, RI 02907, 401-785-4110	**C•1485-1487**
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
Dexter Scientific, Palatka, FL 32177	904-328-2450
Electro-Support Systems, Temecula, CA 92590	909-676-2751
Energy Systems, Vancouver, WA 98682	206-896-8310
Entra Corporation, Indianapolis, IN 46256	317-849-8270
FJA Industries, Santa Clara, CA 95052	408-727-0100
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
†# Microwave Design Svcs., Inc., Ft. Walton Beach, FL 32548	904-664-1234
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
† P C Express, Inc., Hudson, FL 34667	813-863-6114
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Trend Circuits, Fremont, CA 94538-6148	510-651-1150
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Consulting, Research & Development-4100

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227	**A•2256, D•1560**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313	**D•1583**
Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1593**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506	**A•1931**
§† **Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563**	**D•2310**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
AMP-AKZO Corporation, Chadds Ford, PA 19317	215-459-2800
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Baranti Group Inc., Markham, Ont., CAN L3R 2W6	416-479-0148
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
† CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Creare Inc., Hanover, NH 03755	603-643-3800
D & P MFG. Inc., Chalfont, PA 18914	215-997-1200
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Dexter Scientific, Palatka, FL 32177	904-328-2450
Digital Dynamics, Inc., Scotts Valley, CA 95066	408-438-4444
Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
East Controls, Hanover Park, IL 60103	708-837-7709
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Electronic Development Associates, Dix Hills, NEW YORK 11746	516-673-3881
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
# Electrostatic Consulting Assocs., Groton, MA 01450	508-448-5485
Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
Energy Systems, Vancouver, WA 98682	206-896-8310
Enertech Consultants, Campbell, CA 95008	408-866-7266
Entra Corporation, Indianapolis, IN 46256	317-849-8270
EPH Engineering Associates, Inc., Orem, UT 84058	801-226-1383
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134	708-232-9611
FJA Industries, Santa Clara, CA 95052	408-727-0100
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
Green Engineering, Melrose, MA 02176	617-665-8994
HDS Inc., Reston, VA 22091	703-620-6200
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
§ Inservco, Inc., LaGrange, OH 44050	1-216-355-5102
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
LOCUS, Inc., Madison, WI 53704	608-244-0500
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Magna-Power Electronics, Inc., Whippany, NJ 07981	201-428-1197
MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
Micro Industries, Westerville, OH 43081-9486	614-548-7878
† Micropump Corp., Vancouver, WA 98668-8975	206-253-2008
†# Microwave Design Svcs., Inc., Ft. Walton Beach, FL 32548	904-664-1234
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
MOLEX, Inc., Lisle, IL 60532	708-969-4550
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
NAVAN Corporation, Media, PA 19063	215-352-8464
Dirk A. Nelson, P.E.- Consulting Engineer, Glenwood Springs, CO 81601	303-945-7005

Ocean Motions Co., Barrington, RI 02806	401-246-1394
Parsytec Inc., West Chicago, IL 60185	708-293-9500
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
† Polygenex International Inc., Cary, NC 27512-1487	919-380-8100
Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
Presco, Inc., Woodbridge, CT 06525	203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
† Research Specialists, Cleveland, OH 44145	216-871-8909
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302	703-471-1600
Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Systems Data, Inc., Akron, OH 44321	216-666-0085
Systronix Inc., Salt Lake City, UT 84152-6398	801-534-1017
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
Tree Technologies Corporation, Buffalo, NY 14228	716-688-4640
Trend Circuits, Fremont, CA 94538-6148	510-651-1150
Tri-Source Inc., Shelton, CT 06484	203-924-7030
† Ultran Laboratories, Boalsburg, PA 16827	814-466-6200
Vektrex Electronic Systems, Inc., San Diego, CA 92126	619-578-6787
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
§† Video Automation Systems, Pound Ridge, NY 10576	914-764-4613
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Crimping - Also see Services, Wire Cutting & Stripping-4100

§ **ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103**	**C•1707**
† **Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161**	**C•1700**
† **E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473**	**C•1672**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Altek Co., Torrington, CT 06790	203-482-7626
†# Altron, Inc., Anoka, MN 55303	612-427-7735
American Assembly Inc., Florida, NY 10921	914-651-3433
§ American Wire & Electronics, Costa Mesa, CA 92626	714-957-5738
AMP, Harrisburg, PA 17105	717-564-0100;800-522-6752
† Apsco Inc. Mentor OH 44060	216-352-8961
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
Autosplice, Inc., San Diego, CA 92121	619-535-0077
Berg Electronics, Camp Hill, PA 17011	800-237-2374
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Com-2, Inc., Saline, MI 48176	313-429-9027
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
§ Custom Computer Cable, Inc., Eden Prairie, MN 55344	612-941-5651;1-800-343-5553
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089	408-734-2020
Electronic Coil Corp., Bloomfield, CT 06002	203-243-5233
Electronic Connection Corp., Bloomfield, CT 06002	203-243-3356
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Entra Corporation, Indianapolis, IN 46256	317-849-8270
General Cable Co., Highland Hts., KY 41076	606-572-8616
† GSI Corp., Timonium, MD 21093	410-252-1768
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
† Manger Electric Company, Inc., Stamford, CT 06902	203-348-7761
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
MicroTek, Inc., Chicopee, MA 01020	413-594-5116
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Quest Controls, Inc., Palmetto, FL 34221	813-729-4799
† Reactel, Inc., Rockville, MD 20850	301-279-5535
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Trionics, Inc., St. Charles, IL 60174	708-365-6570
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
# Unitrek Corporation, Vancouver, WA 98661	206-699-7277
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
# V-Tron Electronics Corp., S. Attleboro, MA 02703	508-761-9100
† Waters Instruments Inc., Rochester, MN 55903	507-252-3700
† Wontronics, Los Angeles, CA 90039	213-660-6230

Services, Cryogenic-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Creare Inc., Hanover, NH 03755	603-643-3800
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
TL Inds. Inc., Northwood, OH 43619	419-666-8144

Services, Custom Cable Fabrication-6000 – ***See Vol. C***

Services, Custom Molding, Plastics – See Services, Plastic Fabrication & Molding (Vol. D)

Services, Data Processing, Consulting – See Services, Consulting, Data Processing (Vol. D)

Services, Decapsulation/Encapsulation-4100

† Aerospace Systems, Communication Cable Inc., Fairmont, MN 56031	507-235-3355
Altek Co., Torrington, CT 06790	203-482-7626
† American Chemical, Inc., Minneapolis, MN 55408-1047	612-374-1767
† Aremco Products, Inc., Ossining, NY 10562	914-762-0685
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
† Bacon Industries, Inc., Watertown, MA 02172-2399	617-926-2550
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Endicott Coil Co., Inc., Binghamton, NY 13905	607-797-1263
The Fredericks Company, Huntingdon Valley, PA 19006	215-947-2500
Glenmarc Manufacturing Inc., Vernon Hills, IL 60061	708-634-6080:800-323-5350
† Hedrich USA, Inc., Charlotte, NC 28217	704-522-0006
Isolation Products, Inc., Sunnyvale, CA 94086	408-730-4672
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
Manger Electric Company, Inc., Stamford, CT 06902	203-348-7761
Milton Ross Co., Warrington, PA 18976	215-491-0600
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
Trionics, Inc., St. Charles, IL 60174	708-365-6570

Services, Documentation (Incl. Technical Writing)-4100

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1273**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
† CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
† Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
Futuretech, Auburndale, MA 02166	617-965-3834
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
§ GTE Testmark Labs, GTE Industry Sls., Irving, TX 75015	214-718-7124
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Systronix Inc., Salt Lake City, UT 84152-6398	801-534-1017
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Education/Training-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
GP Training Systems, GPS Technologies, Inc., Pottstown, PA 19464	215-327-8800
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
Learning Group International, Los Angeles, CA 90045-0028	800-421-8166; 310-417-8888
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Spectrum Control, Inc., Erie, PA 16506	814-835-4000
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
Test Systems, Inc., Phoenix, AZ 85021	602-861-1010

Services, Electrical Measurement & Test-4100

Altran Corporation, Crystal Lake, IL 60014, 815-455-5650	**A•2259**
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Φ **AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123**	**D•1228**
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473	**C•1672**
GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1750**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1273**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566	**A•1602, D•1322**
Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	**D•2313**
Amador, New Brighton, MN 55112-1891	612-631-2487
APX Technologies Inc., Hicksville, NY 11801	516-433-1313
Aspen Test Engrg., Inc., Boulder, CO 80301	303-530-1466
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900

† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
† Detoronics Corporation, S. El Monte, CA 91733	818-579-7130
Detroit Testing Laboratory, Inc., Warren, MI 48090-0869	313-754-9000
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
Electronic Development Associates, Dix Hills, NEW YORK 11746	516-673-3881
Electronics Systems, Inc., Sioux Falls, SD 57117	605-338-6868
† Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
# Electrostatic Consulting Assocs., Groton, MA 01450	508-448-5485
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
Gabriel Elctrns. Inc., Scarborough, ME 04070	207-883-5161
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Green Engineering, Melrose, MA 02176	617-665-8994
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
§† High Rel Group, San Jose, CA 95131	408-321-6400
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
Industrial Electronics Corp., Warren, MI 48089	313-759-4450
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
Koep Precision Standards, Inc., Tuckerton, NJ 08087	609-296-9686
† LCR Electronics-Hopkins Engineering, Norristown, PA 19401	215-278-0840
§ Manu-Tronics, Inc., Kenosha, WI 53142-7799	414-947-7700
Marketech, Inc., Elk River, MN 55330-7034	612-441-8664
†# MDS Calibration Lab. Inc., Ft. Walton Beach, FL 32548	904-664-1234
§† Micrel Semiconductor, San Jose, CA 95131	408-944-0800
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
† Radiometrics Midwest Corp., Lombard, IL 60148	708-932-7262
Reliability Incorporated, Houston, TX 77218	713-492-0550
† Ross Engineering Corp., Campbell, CA 95008	408-377-4621
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
Rutherford Research, Rutherford, NJ 07070	201-933-2091
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
† Spectrum Control, Inc., Erie, PA 16506	814-835-4000
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
† Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Electroplating — See Services, Plating (Vol. D)

Services, EMI/RFI Testing-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
† **Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000**	**C•1683**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136, 717-424-8510	**C•1687**
† **Spectrum Control, Inc., Erie, PA 16506, 814-835-4000**	**A•1679**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Amador, New Brighton, MN 55112-1891	612-631-2487
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888	617-935-4850
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Detroit Testing Laboratory, Inc., Warren, MI 48090-0869	313-754-9000
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electronic Packaging System, Marion, IA 52302	319-377-3423
† Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139	708-307-7200
† Lockheed Sanders, Inc., Nashua, NH 03061-2004	603-885-3602
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
† Radiometrics Midwest Corp., Lombard, IL 60148	708-932-7262
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868

Services, Encapsulation — See Services, Decapsulation/Encapsulation (Vol. D)

Services, Environmental Testing-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Amador, New Brighton, MN 55112-1891	612-631-2487
APX Technologies Inc., Hicksville, NY 11801	516-433-1313
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
† Cody Electronics, Inc., Santa Clara, CA 95054	408-496-5700
Cybortronics Inc., Irvine, CA 92718	714-855-2814
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449	716-652-3600
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
† Detoronics Corporation, S. El Monte, CA 91733	818-579-7130
Detroit Testing Laboratory, Inc., Warren, MI 48090-0869	313-754-9000
Eagle-Picher, Joplin, MO 64801	417-623-8000
† Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
Elite Electronic Engineering Co., Downers Grove, IL 60515	708-495-9770
Enviroplan, Roseland, NJ 07068	201-994-2300
Express Test Corp., Sunnyvale, CA 94088-3419	408-737-3555
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
Green Engineering, Melrose, MA 02176	617-665-8994
§ GTE Testmark Labs, GTE Industry Sls., Irving, TX 75015	214-718-7124
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
§† High Rel Group, San Jose, CA 95131	408-321-6400
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
Loranger Intl. Corp., Warren, PA 16365	814-723-2250
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065	717-486-3411
§† Micrel Semiconductor, San Jose, CA 95131	408-944-0800
† Micro Technical Industries, San Clemente, CA 92672	714-366-1752
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Quality Thermistor, Boise, ID 83709	208-377-3373
† Q.V.S.. Inc., East Orange, NJ 07017	201-673-3996
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
§# Milton Roy Co, Process & Environ., Orange, CA 92665-4134	714-974-5560
Rutherford Research, Rutherford, NJ 07070	201-933-2091
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
† Torwico Elctrns. Inc., Lakewood, NJ 08701	908-364-1800
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
VA-Tran Systems Inc., Chula Vista, CA 91911	619-423-4555
† Yardney Technical Products, Inc., Pawcatuck, CT 06379	203-599-1100

Services, Equipment Leasing/Rental-4100

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123	**D•1228-1229,1232**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212-1213**
† Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
† Coherent General, Inc., Sturbridge, MA 01566	508-347-2681
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
†Φ Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
†Φ Microwave Filter Inc., East Syracuse, NY 13057-0486	315-437-3953;800-448-1666
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Terminal Data Corp., Rockville, MD 20855	301-921-8282

Services, Fluorocarbon Etching-4100

§ W.L. Gore & Associates, Inc., Flagstaff, AZ 86003-3000	602-526-3030; 1-800-344-3644

Services, Failure Analysis — See Services, Reliability (Vol. D)

Services, Fiberoptics, Consulting-4100

Aborn Electronics Inc., San Jose, CA 95131	408-436-5444
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
† Force, Inc., Christiansburg, VA 24073	703-382-0462
Futuretech, Auburndale, MA 02166	617-965-3834

LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 .... 800-336-2112;703-953-4751
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
Presco, Inc., Woodbridge, CT 06525 203-397-8722
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302 703-471-1600
† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

Services, Hermetic Sealing-4100

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... A•1931
Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000 .... A•1710
Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 .... A•1712
† Alberox Corporation, New Bedford, MA 02745 508-995-1725
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
Ceramaseal, New Lebanon, NY 12125 518-794-7800
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Connector Industries of America Div., Microdot Mfg., Cincinnati, OH 45215 513-772-3680
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
§† Electrical Industries Corp., Murray Hill, NJ 07974 908-464-3200
Hermetic Seal Corp., Rosemead, CA 91770 213-283-0411
§† High Rel Group, San Jose, CA 95131 408-321-6400
HiTemp Technologies, Inc., San Jose, CA 95131-1101 408-922-0740
† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
PAVE Technology Co., Inc., Dayton, OH 45414-3445 513-890-1100
§† Solid State Testing, Inc., Burlington, MA 01803 617-272-0972
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
† Vertek Intl. Inc., San Diego, CA 92173 619-661-6868
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Services, High Vacuum-4100

Alberox Corporation, New Bedford, MA 02745 508-995-1725
† Bemco, Simi Valley. CA 93065 805-583-4970
§ CVC Products, Inc., Rochester, NY 14603 716-458-2550
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887 .... 508-658-5410:800-848-9800
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841 508-685-4900
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807 714-630-7127
† Veeco Instruments Inc., Plainview, NY 11803 516-349-8300

Services, Instrument Calibration — See Services, Calibration & Instrument Repair (Vol. D)

Services, Instrument Design (Industrial)-4100

Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 .... B•2017
Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872 .... D•1943
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
Altek Co., Torrington, CT 06790 203-482-7626
Amptec Electronics, San Diego, CA 92128 619-578-7816
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Astro-Geo-Marine, Inc., Ventura, CA 93003 805-654-8300
A-Systems Inc., Charlottesville, VA 22902 804-295-7200
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Baranti Group Inc., Markham, Ont., CAN L3R 2W6 416-479-0148
† Branmag, Inc., N. Tonawanda, NY 14120 716-693-5994
Colt Technology Corp., Lenexa, KS 66219 913-888-1673
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Da-Tech Corp., Ivyland, PA 18974 215-322-9410
Design Automation, Inc., Lexington, MA 02173-3992 617-862-8998
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Electronic Design Engineering, Norco, CA 91760 909-735-1761
Electronic Development Associates, Dix Hills, NEW YORK 11746 516-673-3881
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO 613-724-1993
Green Engineering, Melrose, MA 02176 617-665-8994
§ GTE Testmark Labs, GTE Industry Sls., Irving, TX 75015 214-718-7124
Industrial Electronics Corp., Warren, MI 48089 313-759-4450
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
§ Inservco, Inc., LaGrange, OH 44050 1-216-355-5102
§# Instrumentation Services, Inc., Minneapolis, MN 55427 612-544-8916
Kenmar/TSI, Raleigh, NC 27604 919-876-6049
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304 803-578-2143
LOCUS, Inc., Madison, WI 53704 608-244-0500
§ Macrodyne Inc., Clifton Pk., NY 12065 518-383-3800
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 414-228-5500
Meissner Industries, Dover, NJ 07801 201-366-1700
†# Microwave Design Svcs., Inc., Ft. Walton Beach, FL 32548 904-664-1234
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915 201-385-0500
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-973-8228
Ocean Motions Co., Barrington, RI 02806 401-246-1394
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
Presco, Inc., Woodbridge, CT 06525 203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051 814-453-5452
Ramcom Systems, Torrance, CA 90503 310-214-8601
Rutherford Research, Rutherford, NJ 07070 201-933-2091
Sensor Corp., Scottdale, PA 15683 412-887-4080
Support Electronics, Inc., Butler, NJ 07405-1367 1-201-838-2755
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
Tree Technologies Corporation, Buffalo, NY 14228 716-688-4640
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210 602-833-5202

Services, Integration, Computer Systems — See Services, Computer Systems, Integrators (Vol. D)

Services, Ion Implantation-4100

Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000

Services, Laser, Consulting-4100

† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 .... A•2013**
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 408-764-4000
Control Laser Corp., Orlando, FL 32809 407-438-2500
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Devere and Lau Company, Anaheim, CA 92802 310-457-7912
Futuretech, Auburndale, MA 02166 617-965-3834
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
Presco, Inc., Woodbridge, CT 06525 203-397-8722
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302 703-471-1600
Xenon Corp., Woburn, MA 01801 617-938-3594

Services, Magnetics-4100

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... A•2234
Ad-Vance Magnetics, Inc., Rochester, IN 46975, 219-223-3158 .... C•1682
† **Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000 .... C•1683**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 .... A•2266-2267
Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 .... A•1213
Electromech, Inc., Irvington, NJ 07111, 201-318-7999 .... A•2324
Fetco, Sanford, FL 32773, 407-321-3800 .... A•2353
Magnelab, Boulder, CO 80301-4696, 303-442-6700 .... A•2382
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 .... A•1251
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102 .... D•1295
The Mushield Co. Inc., Goffstown, NH 03045, 603-666-4433 .... C•1698
Plitron Manufacturing, Inc., Downsview. Ont., CAN M3J 2N5, 416-667-9914 .... A•2506
Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 .... A•1576
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 .... A•2526
Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 .... A•2508
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 .... A•2536
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 .... A•2566-2567
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 .... A•2578
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 .... A•2594
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 .... A•2600-2601
ZMAN Magnetics, Kent, WA 98032, 206-251-8064 .... A•2606
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
Albar, Inc., Lynnwood, WA 98036 .... 206-771-4006;800-822-5227
American Magnetics, Carterville, IL 62918 618-985-4838
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bicron Electronics, Canaan, CT 06018 203-824-5125
Caribbean Assemblies, Inc., Badsprings, FL 32708 407-327-0602
Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
Design Automation, Inc., Lexington, MA 02173-3992 617-862-8998
Eagle Magnetic Company, Inc., Indianapolis, IN 46224 317-297-1030
Green Engineering, Melrose, MA 02176 617-665-8994
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
§† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
Norton Associates, Inc., Garden City, NY 11530 516-745-1411
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Steward, Inc., Chattanooga, TN 37401 615-867-4100
Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

Services, Measurement & Test, Electrical — See Services, Electrical Measurements & Test (Vol. D), Services, Environmental Testing

Services, Measuring — See Services, Instrument Calibration (Vol. D), Services, Testing & Measuring

Services, Metal Etching, Engraving-4100

Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 .... A•1302
† American Etching & Mfg., Pacoima, CA 91331-2796 818-896-1187
† Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
§# Arkay Engravers, Inc., Ronkonkoma, NY 11779 516-467-7795
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010

Controls Unlimited, Inc., Perry, OH 44081	216-259-2500
The Cutting Edge, Controls Unlimited Inc., Perry, OH 44081	1-800-962-2376
† George Risk Industries, Inc., Kimball, NE 69145	308-235-4645
Insulaton Components Associates, Inc., Downey, CA 90241	310-861-7268
† JRW Industries, Inc., Harrisburg, PA 17110	717-236-1418
† Marking Methods, Inc., Alhambra, CA 91803-1531	818-282-8823
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
† Meco Precision/Inds. Inc., Bridgeport, CT 06607	203-333-4900
† Micro-Etch Products, Inc., Stratford, CT 06497	203-378-8610
§† Miller Dial Corp., El Monte, CA 91731	818-444-4555
† Products Engrg. Corp., Azusa, CA 91702-5131	818-969-5879
† SURON Maagan Michael, D.N. Menashe 37805, ISRAEL	06-394211
† Tech-Etch, Inc., Plymouth, MA 02360	508-747-0300
Telesis Marking Systems, Inc., Chillocothe, OH 45601	614-642-3200
S.S White Technologies Inc., Piscataway, NJ 08854-3761	908-752-8300
Wontronics, Los Angeles, CA 90039	213-660-6230
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900

Services, Metal Parts Fabrication-4100

Amco Engineering, Schiller Pk., IL 60176, 708-671-6670;800-833-3156	**C•1574**
† **Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000**	**C•1683**
Andon Elctrns. Corp., Lincoln, RI 02865, 401-333-0388	**C•1257**
Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1594**
Atlee Inc., North Andover, MA 01845, 508-681-1003	**C•1015,1671**
† **EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572**	**C•1022**
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181	**C•1026,1028**
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200	**B•1828, C•1042**
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645	**B•1832**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**C•1354,1753**
JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257	**C•1531**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1289**
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1842**
Mechatronics Inc., Mercer Island, WA 98040, 206-232-4800	**C•1610**
The Mushield Co. Inc., Goffstown, NH 03045, 603-666-4433	**C•1698**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
§ **Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616**	**C•1081**
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525	**C•1109-1110**
§† **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984**	**C•1081**
§† Abalon Precision Mfg., Bronx, NY 10459	718-589-5682;1-800-888-ABALON
† Accumet Engineering, Hudson, MA 01749	508-568-8311
Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
Acme Model Engineering Co., Ridgefield, NJ 07657	201-943-7650
† Alden Products Co., Brockton, MA 02403	508-583-0160
† Alexandria Extrusion Co., Alexandria, MN 56308	612-763-6537
† American Aluminum, Mountainside, NJ 07092	908-233-3500
† American Etching & Mfg., Pacoima,, CA 91331-2796	818-896-1187
Apollo Magnetics Corp., Los Angeles, CA 90057	213-381-2500
† Associated Spring, Barnes Grp., Bristol, CT 06010	203-583-1331
† Astro Dynamics, Inc., Woburn, MA 01801	617-935-4944
Autec Power Systems, Simi Valley, CA 93065	805-522-0888
Autoswage Products, Shelton, CT 06484	203-929-1401
§† Berg, W. M., Inc., East Rockaway, NY 11518	516-599-5010
BICC-VERO Electronics, Inc., Hamden, CT 06514	203-288-8001;1-800-242-2863
Boker's, Inc., Minneapolis, MN 55406-1937	612-729-9365
† Braxton Mfg., Watertown, CT 06795	203-274-6781
§ Brooks Electronics, Philadelphia, PA 19140	215-228-4433
§† Bud Industries, Inc., Willoughby, OH 44094-0431	216-946-3200
Burbank Sheet Metal Works Inc., Burbank, CA 91502	818-846-0316
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
† Compac, Holbrook, NY 11741	516-585-3400
§ Damac Products, Inc., Santa Fe Springs, CA 90670	310-946-0881
Delbert Blinn Co., Inc., Pomona, CA 91769	909-629-3900
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Deringer Mfg. Co., Mundelein, IL 60060	708-566-4100
Electronic Components & Materials, GTE Sylvania, Warren, PA 16365	814-726-6500
§† Electronic Enclosures, Div. Wyle Laboratories, El Segundo, CA 90245	310-643-8181
Electronic Packaging System, Marion, IA 52302	319-377-3423
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§† FISHERCAST, Fisher Gauge Limited, Peterborough, Ont., CANADA K9J 6Y9	705-748-9522
§† FISHERTECH, Fisher Gauge Limited, Peterborough, Ontario, CANADA K9J 6Y9	705-748-9522
Framar Metal Products Co., Inc., Kenilworth, NJ 07033	908-241-0710
Gabriel Elctrns. Inc., Scarborough, ME 04070	207-883-5161
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Devices Co., Inc., Indianapolis, IN 46239-0100	317-897-7000,1-800-626-9484
† GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514	914-238-8462
§ Hobson Bros., Chicago, IL 60630-3884	312-283-3600
§ Hoffman Engineering, Anoka, MN 55303	612-421-2240
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
Jettron Products Inc., E. Hanover, NJ 07936	201-887-0571
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Kam Components, Inc., Nesconset, NY 11767	516-585-0666
Ken-Tron Mfg., Inc., Owensboro, KY 42301	502-684-0431
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
§† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162	310-391-7213;800-421-6692 (N. CA and out of state)
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716	203-756-8847
† Meco Precision/Inds. Inc., Bridgeport, CT 06607	203-333-4900
† Micro-Etch Products, Inc., Stratford, CT 06497	203-378-8610
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
§† Miller Dial Corp., El Monte, CA 91731	818-444-4555
Molecu-Wire, Farmingdale, NJ 07727	908-938-9473
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
† NKR Precision Manufacturing, Harriman, NY 10926	914-782-8562
† Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Precision Extrusions, Inc., Bensenville, IL 60106	708-766-0340
§† PTS Corporation, Bloomington, IN 47401	812-824-9331
Quantum Scientific Inc., Toronto, ONT M8W 4Y4	416-503-8555;800-268-6000
Rose Enclosures Sys., Inc., Frederick, MD 21701-8353	301-696-9800
Shamrock Plastics & Rubber, Inc., Indianapolis, IN 46218	317-543-3540; 800-382-4635
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
† Sjoberg, C., & Son, Inc., Cranston, RI 02910	401-461-8220
† Sko-Die, Inc., Morton Grove, IL 60053	708-965-1130
H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
Staver Co., Inc., Bay Shore, NY 11706-9998	516-666-8000
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
SURON Maagan Michael, D.N. Menashe 37805, ISRAEL	06-394211
Tech-Etch, Inc., Plymouth, MA 02360	508-747-0300
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
Techmar Corp., Marina Del Rey, CA 90292	310-827-8897
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Ten-Tec, Inc., Sevierville, TN 37862	615-453-7172
† Titchener, E. H., & Co., Binghamton, NY 13902-1706	607-772-1161
TL Inds. Inc., Northwood, OH 43619	419-666-8144
United Technical Products, Fallsington, PA 19054	800-553-5300
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145
† Wilkinson, Westlake Village, CA 91359	818-889-0050;800-822-4653
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900

Services, Metallizing (Incl. Electroforming)-4100

Electro-Films, Inc., Warwick, RI 02886, 401-738-9150	**A•1721,1932**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025	**A•2001**
Alberox Corporation, New Bedford, MA 02745	508-995-1725
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
Ceramaseal, New Lebanon, NY 12125	518-794-7800
† Craig Systems Corp., Eastern Technologies, Ltd., Amesbury, MA 01913-4848	508-388-5662
Flexible Technologies, Arlon, E. Providence, RI 02914	401-434-2340
Frequency Electronics, Inc., Mitchel Field, NY 11553	516-794-4500
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hermetic Seal Corp., Rosemead, CA 91770	213-283-0411
HiTemp Technologies, Inc., San Jose, CA 95131-1101	408-922-0740
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
† United Supertek, Inc., San Jose, CA 95131-1101	408-922-0730

Services, Microprocessor Development - Also see Services, PROM & Array Programming-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Altek Co., Torrington, CT 06790	203-482-7626
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Baranti Group Inc., Markham, Ont., CAN L3R 2W6	416-479-0148
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Corby Industries, Inc., Allentown, PA 18103	215-433-1412
Custom Logic, Crestline, CA 92325	909-338-4059
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Entra Corporation, Indianapolis, IN 46256	317-849-8270
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
HiTech Equipment Corp., San Diego, CA 92126	619-566-1892
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179

Industrial Electronics Corp., Warren, MI 48089	313-759-4450
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
# KelTech Inc., Roanoke, VA 24019	703-362-8466
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
LOCUS, Inc., Madison, WI 53704	608-244-0500
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Micro Industries, Westerville, OH 43081-9486	614-548-7878
Monolithic Sys. Corp., Englewood, CO 80112	303-790-7400
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Presco, Inc., Woodbridge, CT 06525	203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Ramcom Systems, Torrance, CA 90503	310-214-8601
RMS Techn., Newport News, VA 23606	804-873-0100
Sensor Corp., Scottdale, PA 15683	412-887-4080
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
§# Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202

Services, Molding/Casting - Also see Services, Plastic Fabrication & Molding-4100

† **Alden Products Co., Brockton, MA 02403, 508-583-0160**	**C•1148**
† **AME Corporation, Towaco, NJ 07082-0195, 201-263-1700**	**B•1663**
† **ECS Composites, Grants Pass, OR 97526, 503-476-8871**	**C•1021**
§ **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
† **Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571**	**C•1358**
JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257	**C•1531**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**C•1761**
† **National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611**	**C•1768**
Simco, Miami, FL 33177, 305-233-9900;800-780-9090	**C•1096**
Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
† Aerospace Systems, Communication Cable Inc., Fairmont, MN 56031	507-235-3355
† Amerex, Riverside, CA 92507	909-686-1400
American Chemical, Inc., Minneapolis, MN 55408-1047	612-374-1767
Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
† Applied Plastics Technology, Bristol, RI 02809	401-253-0200
Arrem Plastics, Inc., Addison, IL 60101	708-628-2450
§† Atlantic Optical Moulding, Webster, MA 01570	508-943-1746
Cardinal Prods., Inc., Santa Ana, CA 92704	714-546-1224
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379	508-580-0111
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
Delbert Blinn Co., Inc., Pomona, CA 91769	909-629-3900
§ Dynacast Inc., Yorktown Heights, NY 10598	914-962-6300
EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
† Electro Miniatures Corp., Moonachie, NJ 07074	201-460-0510
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
† FISHERCAST, Fisher Gauge Limited, Peterborough, Ont., CANADA K9J 6Y9	705-748-9522
§† FISHERTECH, Fisher Gauge Limited, Peterborough, Ontario, CANADA K9J 6Y9	705-748-9522
Homalite, Whitco, Inc., Wilmington, DE 19804	302-652-3686
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112:703-953-4751
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
Milton Ross Co., Warrington, PA 18976	215-491-0600
† MOLDCON Div. of Contex Electronics, W. Springfield, MA 01089	413-736-0371
† Moldtronics, Inc., Downers Grove, IL 60515	708-968-7000
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
§ Nepenthe, Inc., Palo Alto, CA 94303	415-496-6666
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153	215-365-8400
Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365
Plasticorp, Harbor City, CA 90710	310-539-9530
Polestar Plastics, Inc., State College, PA 16801	814-238-2400
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
RDI Elctrns., Inc., Mamaroneck, NY 10543	914-777-7000
Reliance Plastics & Packaging, Passaic, NJ 07055	201-473-7200
Robison Electronics, San Luis Obispo, CA 93403-8121	805-544-8000
§† Rose Enclosures Sys., Inc., Frederick, MD 21701-8353	301-696-9800
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
† S & S Associates, Inc., San Luis Obispo, CA 93401	805-544-2500
† SAS Industries Inc., Manorville, NY 11949	516-727-1441;1-800-544-5238
Security Plastics, Inc., Miami Lakes, FL 33014	305-823-5440
Shin-Etsu Polymer America, Inc., Union City, CA 94587	510-475-9000
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
† Skydyne Div., AAR Mfg., Port Jervis, NY 12771	914-856-6655;800-428-CASE
Star-Tron Corporation, Providence, RI 02909	401-274-5090
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
†# Tratec of California, Inc., Chula Vista, CA 91911	619-476-1155
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
Useco Div., Litton Inds, Van Nuys, CA 91409	818-786-6381
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
# Veetronix, Inc., Lexington, NE 68850	308-324-4600
§ Wescorp Static Control Products, Mountain View, CA 94041	415-969-7717

Services, Optical Design-4100

Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1324**
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075	214-422-1844; 1-800-872-0044
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† D. O. Industries, Rochester, NY 14623	716-359-4000
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
† KLC/Karl Lambrecht Corp., Chicago, IL 60618	312-472-5442
Noll, J. A. Co., Monroeville, PA 15146	412-856-7566
Oxley Inc., Branford, CT 06405	203-488-1033
Science & Engrg. Consultants, Inc., Reston, VA 22091-5302	703-471-1600
Spectron Engineering Inc., Denver, CO 80223	303-733-1060
Walker Scientific, Worcester, MA 01606	508-852-3674;508-853-3232;800-962-4638

Services, Packaging-4100

BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392	**A•2133**
† **ECS Composites, Grants Pass, OR 97526, 503-476-8871**	**C•1021**
Electro-Films, Inc., Warwick, RI 02886, 401-738-9150	**A•1932-1933**
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181	**C•1026**
† **Gemini Inc., Cannon Falls, MN 55009, 507-263-3957;800-533-3631**	**C•1046**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
† **International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111**	**A•1704-1705**
Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000	**A•1710**
Serco Products Division:Serco Mold, Inc., Covina, CA 91723, 818-331-0517;800-843-8172(Calif.)	**C•1090-1091**
§ ADE, Inc., Chicago, IL 60633	312-646-3400
Advanced Electronic Packaging, Huntington Beach, CA 92646	714-969-1150
AMP-AKZO Corporation, Chadds Ford, PA 19317	215-459-2800
Augat/RDI, Carol Stream, IL 60188	708-682-4100
Cardinal Prods., Inc., Santa Ana, CA 92704	714-546-1224
Caristrap Internatonal, Inc., Chomedey, Laval, QUEBEC, CANADA H7SIN8	1-800-361-9466
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Die-Tech Inc., York Haven, PA 17370	717-938-6771
Dynacast Inc., Yorktown Heights, NY 10598	914-962-6300
†# Eagle-Picher, Joplin, MO 64801	417-623-8000
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Gordon, L., Packaging, Baltimore, MD 21230	410-539-6537
Graham Electronic Manufacturing Inc., Escondido, CA 92025	619-747-9177; 800-628-4095
§† Hardigg Cases, Hardigg Industries, South Deerfield, MA 01373	413-665-2163
HiTemp Technologies, Inc., San Jose, CA 95131-1101	408-922-0740
§† IEC Electronics Corp., Newark, NY 14513	315-331-7742
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188	708-668-8886
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
† Modular Devices, Shirley, NY 11967	516-345-3100
MultiNational Resources, Inc., Bedford, NH 03110	603-622-3550
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
Packaging Plus, Inc., Minneapolis, MN 55432	612-574-9909
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153	215-365-8400
Parsons Manufacturing, Menlo Park, CA 94025-1476	415-324-4726
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
† Project Resources Inc., Wareham, MA 02571	508-295-7444
Quantum Scientific Inc., Toronto, ONT M8W 4Y4	416-503-8555;800-268-6000
§ Reliance Plastics & Packaging, Passaic, NJ 07055	201-473-7200
† Resistance Technology Inc., St. Paul, MN 55112	612-636-9770
Siltronics Ltd., Dover, MA 02030	617-329-4068
Skydyne Div., AAR Mfg., Port Jervis, NY 12771	914-856-6655;800-428-CASE
† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Technology Design Inc., Bellevue, WA 98006	206-455-9822
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060	603-889-5156
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
§† Tra-Con, Inc., Medford, MA 02155	617-391-5550
United Foam Plastics, Georgetown, MA 01833	508-352-2200
Vector Electronic Co., Inc., Sylmar, CA 91342	818-365-9661;800-423-5659
§ Wescorp Static Control Products, Mountain View, CA 94041	415-969-7717
§ Westvaco-Static Control, Springfield, MA 01101-1675	413-787-9783
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900
† Zero Plastics, Zero Corp., Monson, MA 01092	413-267-5561

Services, PCB Test Development-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1704**
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
§ Fox Electronics, Ft. Myers, FL 33905	813-693-0099
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
§ GTE Electronic Repair Services, GTE Supply, D/FW Airport, TX 75261	214-615-7590
IDM (International Design Modeling), Bedford, NH 03110	603-472-7068
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Marketech, Inc., Elk River, MN 55330-7034	612-441-8664
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Reliance Plastics & Packaging, Passaic, NJ 07055	201-473-7200
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
Vu-Data Corporation, San Diego, CA 92121	619-452-7670
Wieland Inc., Burgaw, NC 28425	919-259-5050
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Photographic-4100

Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Circuit Images, Inc., Beaverton, OR 97006	503-629-2133
† EMDS, Inc., Gaithersburg, MD 20877	301-840-5710
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
Identatronics, Inc., Elk Grove Village, IL 60007-2082	708-437-2654;1-800-323-5403
† SURON Maagan Michael, D.N. Menashe 37805, ISRAEL	06-394211
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Services, Plastics Fabrication/Molding/Foaming/Finishing-4100

Alden Products Co., Brockton, MA 02403, 508-583-0160	**C•1148,1150**
Cut Craft, Inc., Ft. Worth, TX 76102, 817-332-6151	**C•1662,1684**
† **ECS Composites, Grants Pass, OR 97526, 503-476-8871**	**C•1021**
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181	**C•1026,1028**
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223**	**B•1063**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686	**B•1077**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116	**C•1354**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**C•1759**
† **National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611**	**C•1768,1790**
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400	**C•1062**
† **S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500**	**C•1082-1083,1534**
Serco Products Division:Serco Mold, Inc., Covina, CA 91723, 818-331-0517;800-843-8172(Calif.)	**C•1090-1091**
Simco, Miami, FL 33177, 305-233-9900;800-780-9090	**C•1096**
# **Thrust Industries, Inc., Haubstadt, IN 47639, 800-467-6730;812-768-6730**	**C•1668-1669,1699**
Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
† AME Corporation, Towaco, NJ 07082-0195	201-263-1700
† Amerex, Riverside, CA 92507	909-686-1400
§ American Electronic Components, Elkhart, IN 46514	219-264-1116
Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
† Applied Plastics Technology, Bristol, RI 02809	401-253-0200
APX Technologies Inc., Hicksville, NY 11801	516-433-1313
Arrem Plastics, Inc., Addison, IL 60101	708-628-2450
Autec Power Systems, Simi Valley, CA 93065	805-522-0888
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
Cable Systems, Inc., The HVT Group, Everett, MA 02149	617-389-7080
† Cadillac Plastic & Chem. Co. Div. of M.A. Hanna, Troy, MI 48007-7035	313-583-1200
Cardinal Prods., Inc., Santa Ana, CA 92704	714-546-1224
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8	819-821-4524
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379	508-580-0111
Connector Corp., Chicago, IL 60646	312-539-3108
§ Custom Connector, Cleveland, OH 44114	216-241-1679
D & L Electronics, Langhorne, PA 19047	800-942-3631
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
DEK, Inc., St. Charles, IL 60174	708-377-2575
Delbert Blinn Co., Inc., Pomona, CA 91769	909-629-3900
§ Dimco-Gray, Dayton, OH 45458	513-433-7600
§ Dynacast Inc., Yorktown Heights, NY 10598	914-962-6300
§ E-A-R Specialty Composites, Cabot Safety Corp., Indianapolis, IN 46268	317-692-1111
EBY Company, Philadelphia, PA 19124	215-537-4700
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electronic Components & Materials, GTE Sylvania, Warren, PA 16365	814-726-6500
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
Enerco, Inc., Seattle, WA 98108	206-762-1422
Fastex, Illinois Tool Works, Des Plaines, IL 60016	708-299-2222
Fastex Distributor Business, Illinois Tool Works, Des Plaines, IL 60016	708-350-8200
Ferro Corporation, Filled & Reinforced Plastics Div., Evansville, IN 47711	812-423-5218
Ferro Corporation, Plastic Colorants & Dispersions, Stryker, OH 43557	419-682-3311
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Cable Co., Highland Hts., KY 41076	606-572-8616
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§† Hardigg Cases, Hardigg Industries, South Deerfield, MA 01373	413-665-2163
# The Hirol Company, Ft. Lauderdale, FL 33309	305-974-4900
§ Hobson Bros., Chicago, IL 60630-3884	312-283-3600
§ Hoffman Engineering, Anoka, MN 55303	612-421-2240
§† Injecto Mold Inc., Crellin International, Chicago, IL 60639	312-384-6000
Insulaton Components Associates, Inc., Downey, CA 90241	310-861-7268
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Kam Components, Inc., Nesconset, NY 11767	516-585-0666
§† Keystone Electronics Corp., Astoria, NY 11105-2017	718-956-8900
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
Liberty Polyglas, Inc., West Mifflin, PA 15122	412-466-8611
Manger Electric Company, Inc., Stamford, CT 06902	203-348-7761
§ Mantex Corp., Oxford, MI 48371	313-628-8210
§ McKenzie Technology, Fremont, CA 94538	510-651-2700
§† Meco Precision/Inds. Inc., Bridgeport, CT 06607	203-333-4900
Meritec, Associated Enterprises, Painesville, OH 44077	216-354-3148
† MFG, Parabam Div., Carson, CA 90745	213-549-5044
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
Minnesota Wire & Cable Co., St. Paul, MN 55108-2721	612-642-1800 ; 1-800-258-6922(MWCC)
† Moldtronics, Inc., Downers Grove, IL 60515	708-968-7000
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
MultiNational Resources, Inc., Bedford, NH 03110	603-622-3550
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
† Ny-Glass Plastics Inc., Calnetics Corp., Corona, CA 91720	909-737-9110
Packaging Plus, Inc., Minneapolis, MN 55432	612-574-9909
Parsons Manufacturing, Menlo Park, CA 94025-1476	415-324-4726
The Pedro Companies, St. Paul, MN 55101	612-224-9491
Plasticorp, Harbor City, CA 90710	310-539-9530
§† Plastimatic, Inc., Putnam, CT 06260	203-928-7911
Polestar Plastics, Inc., State College, PA 16801	814-238-2400
Polyflon Company, Crane Co., New Rochelle, NY 10801	914-636-7222
† Polygenex International Inc., Cary, NC 27512-1487	919-380-8100
§† PTS Corporation, Bloomington, IN 47401	812-824-9331
Quantum Scientific Inc., Toronto, ONT M8W 4Y4	416-503-8555;800-268-6000
# Quartzite Processing, Inc., Malden, MA 02148	617-322-3611
RDI Elctrns., Inc., Mamaroneck, NY 10543	914-777-7000
Reliance Plastics & Packaging, Passaic, NJ 07055	201-473-7200
† Resistance Technology Inc., St. Paul, MN 55112	612-636-9770
§ Richco Plastic Co., Chicago, IL 60680	312-539-4060
Rose Enclosures Sys., Inc., Frederick, MD 21701-8353	301-696-9800
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
Sanlar, Inc. T/A, Harbison Industrial Products, Levittown, PA 19057	215-943-9000
Security Plastics, Inc., Miami Lakes, FL 33014	305-823-5440
† Shamrock Plastics & Rubber, Inc., Indianapolis, IN 46218	317-543-3540; 800-382-4635
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
Sjoberg, C., & Son, Inc., Cranston, RI 02910	401-461-8220
† Skydyne Div., AAR Mfg., Port Jervis, NY 12771	914-856-6655;800-428-CASE
H H Smith, NT-T Inc., Meadville, PA 16335	814-724-6440
Steinwall, Inc., Minneapolis, MN 55432	612-571-8202
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Thermoset Plastics Inc., Indianapolis, IN 46220	317-259-4161
Torq Corp., Bedford, OH 44146	216-232-4100
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
United Foam Plastics, Georgetown, MA 01833	508-352-2200
United Technical Products, Fallsington, PA 19054	800-553-5300
† Unit Industries, Fullerton, CA 92631	714-871-4161
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145
# Veetronix, Inc., Lexington, NE 68850	308-324-4600
§ Wescorp Static Control Products, Mountain View, CA 94041	415-969-7717
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900
† Zero Plastics, Zero Corp., Monson, MA 01092	413-267-5561

Services, Plating-4100

Alexandria Metal Finisher, Inc., Lorton, VA 22079	703-643-1636
AMP-AKZO Corporation, Chadds Ford, PA 19317	215-459-2800
† Autoswage Products, Shelton, CT 06484	203-929-1401
Brandywine Abrasives, Spring City, PA 19475	215-948-7028
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Dynacast Inc., Yorktown Heights, NY 10598	914-962-6300
† Electro Miniatures Corp., Moonachie, NJ 07074	201-460-0510
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
† Handy & Harman Elctrn. Matls. Corp., N. Attleboro, MA 02760	508-695-1401
Heritage Metal Finishing Inc., Elizabethtown, PA 17022	717-367-1561
HiTemp Technologies, Inc., San Jose, CA 95131-1101	408-922-0740
† Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065	717-486-3411
Meritec, Associated Enterprises, Painesville, OH 44077	216-354-3148
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153	215-365-8400
Polyflon Company, Crane Co., New Rochelle, NY 10801	914-636-7222

Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
United Technical Products, Fallsington, PA 19054	800-553-5300

Services, Precious Metal Refining-4100

The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
† Technic, Inc., Providence, RI 02940-9650	401-781-6100

Services, Precious Metal Resmelting, Recovery, Recycling-4100

Handy & Harman Precious Metals Refining, S. Windsor, CT 06074	1-800-421-0411; 203-289-4327
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039	401-433-7000
† Technic Inc., Providence, RI 02940-9650	401-781-6100

Services, PC Design/Preparation/Production-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1594**
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500	**A•1700,1702**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1524**
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1704**
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400	**B•1839**
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1842**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004	**A•2020**
Taltronics, Dimetrics, Inc., Davidson, NC 28036, 704-892-8872	**D•1943**
ACC Electronics Company, Echlin Inc., Independence, KS 67301	316-331-1000
Advanced Electronic Packaging, Huntington Beach, CA 92646	714-969-1150
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
Altek Co., Torrington, CT 06790	203-482-7626
AMBIT Associates, Santa Clara, CA 95051-2311	408-241-5767
Andon Elctrns. Corp., Lincoln, RI 02865	401-333-0388
Apollo Magnetics Corp., Los Angeles, CA 90057	213-381-2500
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Baranti Group Inc., Markham, Ont., CAN L3R 2W6	416-479-0148
† Branmag, Inc., N. Tonawanda, NY 14120	716-693-5994
CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Circom Inc., Bensenville, IL 60106	708 595-4460
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
† Da-Tech Corp., Ivyland, PA 18974	215-322-9410
DCI Inc., Olathe, KS 66062	913-782-5672
Deltron, Inc., N. Wales, PA 19454-9990	215-699-9261
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
† Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
† Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
† Electro-Mech Components, Inc., South El Monte, CA 91733-3689	818-442-7180
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
† EOG, INC., OMX, INC., Hunt Valley, MD 21031	410-785-3000
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Flex-Link Products, Inc., San Fernando, CA 91340	818-898-1451
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
GECO, Millheim, PA 16854	814-349-5555
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
General Digital Corp., Enfield, CT 06082	203-741-7171
J. Gordon Electronic Design, Inc., Minneapolis, MN 55432	612-786-2405
HiTech Equipment Corp., San Diego, CA 92126	619-566-1892
Hughes Electronics Products Corp., Livonia, MI 48150	313-427-8310
Hybridyne, Inc., Tucson, AZ 85745	602-629-0001
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
§ Manu-Tronics, Inc., Kenosha, WI 53142-7799	414-947-7700
Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510	708-879-8008
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Micro Industries, Westerville, OH 43081-9486	614-548-7878
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
† Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Quality Research Company, Spokane, WA 99207-9632	509-924-6895
Radix Microelectronics Inc., Colorado Springs, CO 80909	719-597-1975
SMT EAST Corporation, Foxborough, MA 02035	800-888-SMT1
Stratos Product Development Group, Seattle, WA 98121	206-448-1388
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tree Technologies Corporation, Buffalo, NY 14228	716-688-4640
Trionics, Inc., St. Charles, IL 60174	708-365-6570

§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
W.L. Williamson & Assoc., Ltd., Mesa, AZ 85210	602-833-5202

Services, PROM & Array Programming - Also see Services, Microprocessor Development-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# Altron, Inc., Anoka, MN 55303	612-427-7735
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Colt Technology Corp., Lenexa, KS 66219	913-888-1673
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Com-2, Inc., Saline, MI 48176	313-429-9027
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129	218-263-8971
# KelTech Inc., Roanoke, VA 24019	703-362-8466
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Presco, Inc., Woodbridge, CT 06525	203-397-8722
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
† Programmable Devices, Inc., North Reading, MA 01864	508-664-6447
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
§† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
# Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580

Services, Profile Extruders-4100

AAVID Engineering, Inc., Laconia, NH 03247-0400	603-528-3400
† Alexandria Extrusion Co., Alexandria, MN 56308	612-763-6537
† Minor Rubber Co., Inc., Bloomfield, NJ 07003	201-338-6800;800-433-6886
Richco Plastic Co., Chicago, IL 60680	312-539-4060

Services, Qualification Testing — See Services, Environmental Testing (Vol. D)

Services, Reliability-4100

† CDRL Data, Inc., Phoenix, AZ 85027-2823	602-582-8844
Connectronics Corp., Toledo, OH 43607	419-537-0020
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
Green Engineering, Melrose, MA 02176	617-665-8994
§ GTE Testmark Labs, GTE Industry Sls., Irving, TX 75015	214-718-7124
Kentron, Inc., Cedarburg, WI 53012-0142	414-377-3733
MOLEX, Inc., Lisle, IL 60532	708-969-4550
PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Solid State Testing, Inc., Burlington, MA 01803	617-272-0972
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
Teal Electronics Corporation, San Diego, CA 92121	619-558-9000
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
† Ultran Laboratories, Boalsburg, PA 16827	814-466-6200
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Services, Rental, Instruments & Equipment — See Test Equipment, Rental & Lease (Vol. D)

Services, Repair, Maintenance — See Services, Calibration & Repair Instrument (Vol. D)

Services, RFI Measuring — See Services, Electrical Measurement & Test (Vol. D)

Services, Silicon Foundry — See Silicon Foundry Services (Vol. D)

Services, Silk Screening-4100

Buckeye Stamping Co., Columbus, OH 43207, 614-445-8433	**C•1016**
§† Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	**D•2310**
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572	**C•1022**
† JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257	**C•1531**
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	**C•1081**
† S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500	**C•1082-1083**
Simco, Miami, FL 33177, 305-233-9900;800-780-9090	C•1096
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	**C•1081**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
† Apollo Magnetics Corp., Los Angeles, CA 90057	213-381-2500
† Aremco Products, Inc., Ossining, NY 10562	914-762-0685
§# Arkay Engravers, Inc., Ronkonkoma, NY 11779	516-467-7795
† Autoroll Machine Corporation, Middleton, MA 01949	508-777-2160
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
§ Bopla Enclosures, Frederick, MD 21701-8353	301-696-9300
Component General, Inc., Odessa, FL 33556	813-376-6655
The Cutting Edge, Controls Unlimited Inc., Perry, OH 44081	1-800-962-2376
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603

GECO, Millheim, PA 16854	814-349-5555
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
Jayco Interface Technology, Orange, CA 92665	714-974-1701
# KelTech Inc., Roanoke, VA 24019	703-362-8466
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
§† Meco Precision/Inds. Inc., Bridgeport, CT 06607	203-333-4900
§† Miller Dial Corp., El Monte, CA 91731	818-444-4555
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761	508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725	407-574-0208
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153	215-365-8400
Precision Fabrication Technologies, Inc., Monon, IN 47959	1-800-558-7297; 219-253-6666
# Project Pro, Twinsburg, OH 44087	216-425-8888
§† Rose Enclosures Sys., Inc., Frederick, MD 21701-8353	301-696-9800
† Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003	214-231-6663; 214-924-3289;1-800-331-6600
† Virgina Panel Corporation, Waynesboro, VA 22980	703-949-8376
Wontronics, Los Angeles, CA 90039	213-660-6230
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310	801-298-5900

Services, Soldering-4100

International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1705**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
Advanced Interconnections Corp., West Warwick, RI 02893	401-823-5200
§† Alpha Metals, Jersey City, NJ 07304	201-434-6778
Altek Co., Torrington, CT 06790	203-482-7626
†# Altron, Inc., Anoka, MN 55303	612-427-7735
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
† Capewell Components, Cromwell, CT 06416	203-635-4045
Cardinal Control Co., Kensington, CT 06037	203-828-6379
Caribbean Assemblies, Inc., Wintersprings, FL 32708	407-327-0602
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Com-2, Inc., Saline, MI 48176	313-429-9027
Control Laser Corp., Orlando, FL 32809	407-438-2500
† Corlund Electronics Corp., Newbury Park, CA 91320	805-499-6877
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
Devere and Lau Company, Anaheim, CA 92802	310-457-7912
§† Dover Electronics Manufacturing, Binghamton, NY 13902-5212	607-772-7563
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108	203-528-9821
Electronic Connection Corp., Bloomfield, CT 06002	203-243-3356
The Electronics Group, Inc., Charlotte, NC 28208	704-391-9500
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO	613-724-1993
† GSI Corp., Timonium, MD 21093	410-252-1768
Hughes Electronics Products Corp., Livonia, MI 48150	313-427-8310
Indium Corporation of America, Utica, NY 13502	315-853-4900;1-800-4INDIUM
# KelTech Inc., Roanoke, VA 24019	703-362-8466
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
Marc Enterprises, Laguna Niguel, CA 92677	714-249-0302
MicroTek, Inc., Chicopee, MA 01020	413-594-5116
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
† Miller, L.C., Co., Monterey Pk., CA 91754	213-268-3611
Minnesota Wire & Cable Co., St. Paul, MN 55108-2721	612-642-1800 ; 1-800-258-6922(MWCC)
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438	515-923-3751
P C Express, Inc., Hudson, FL 34667	813-863-6114
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
† Qualtronics Corp., Inc., Palm, PA 18070-0468	215-679-0900
Southtronics, Inc., Marietta, GA 30066-6029	404-429-1000
Star-Tron Corporation, Providence, RI 02909	401-274-5090
Technetics Corporation, Indianapolis, IN 46250	317-842-5377;800-467-8324
# Technical Services for Electronics, Inc., Arlington, MN 55307	612-964-2237
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Trionics, Inc., St. Charles, IL 60174	708-365-6570
† Turtle Mountain Corporation, Dunseith, ND 58329	701-244-5242
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173	619-661-6868
Wontronics, Los Angeles, CA 90039	213-660-6230

Services, Technical Writing — See Services, Documentation (Vol. D)

Services, Testing & Measuring — See Services, Electrical Measurement & Test (Vol. D), Services, Environmental Testing

Services, Testing, Environmental — See Services, Environmental Testing (Vol. D)

Services, Training/Education-4100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Dover Electronics Manufacturing, Binghamton, NY 13902-5212, 607-772-7563	**D•2310**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666**	**A•1656**
§ **PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170**	**B•1379**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
AVO International, TBG, Dallas, TX 75237	214-333-3201
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Ballco Atlanta, Conceptual Enterprises Intl. Ltd., Snellville, GA 30278-1078	404-979-5900
† B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
† Basic Measuring Instruments, Foster City, CA 94404	415-570-5355
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
§ Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Electronics Test Centre, Alberta Research Council, Edmonton, AB, CANADA T6N 1E4	403-450-5370
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Instrument Society of America, Research Triangle Park, NC 27709	919-549-8411
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
Learning Group International, Los Angeles, CA 90045-0028	800-421-8166; 310-417-8888
# LG Systems Corp., Lockwood Greene Engineers, Inc., Spartanburg, SC 29304	803-578-2143
Moore Products Co., Spring House, PA 19477	215-646-7400
PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Philips Circuit Assemblies, Tampa, FL 33614-2797	813-933-5113
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Professional Engineering Systems, Erie, PA 16511-1051	814-453-5452
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
† Ultran Laboratories, Boalsburg, PA 16827	814-466-6200

Services, Vibration Surveys-4100

Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Detroit Testing Laboratory, Inc., Warren, MI 48090-0869	313-754-9000
General Vibrations Mfg. Co., Manchester, CT 06040	203-646-0090
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
† Torwico Elctrns. Inc., Lakewood, NJ 08701	908-364-1800

Services, Waveguide Bending & Forming-4100

† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911

Services, Welding & Brazing-4100

† American Aluminum, Mountainside, NJ 07092	908-233-3500
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Burbank Sheet Metal Works Inc., Burbank, CA 91502	818-846-0316
Ceramaseal, New Lebanon, NY 12125	518-794-7800
† Coherent General, Inc., Sturbridge, MA 01566	508-347-2681
Deringer Mfg. Co., Mundelein, IL 60060	708-566-4100
Ewald Instruments Corp., Kent, CT 06757	203-927-3278
GTI/Electronics Div., Hadley, PA 16130-8815	412-253-3161
Jettron Products Inc., E. Hanover, NJ 07936	201-887-0571
Marc Enterprises, Laguna Niguel, CA 92677	714-249-0302
† Miller, L.C., Co., Monterey Pk., CA 91754	213-268-3611
Shamrock Plastics & Rubber, Inc., Indianapolis, IN 46218	317-543-3540; 800-382-4635
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330

Services, Wire Cutting & Stripping - Also see Services, Crimping-4100

§ **ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103**	**C•1707-1708**
§ **Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161**	**C•1700**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**C•1759**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
† **Product Technology, Inc., Irvine, CA 92714, 714-474-8998**	**C•1673**
Acme Model Engineering Co., Ridgefield, NJ 07657	201-943-7650
Altek Co., Torrington, CT 06790	203-482-7626
# Altron, Inc., Anoka, MN 55303	612-427-7735
American Assembly Inc., Florida, NY 10921	914-651-3433
† American Monarch, Minneapolis, MN 55421	612-788-9161
§† American Wire & Electronics, Costa Mesa, CA 92626	714-957-5738
† Apsco, Inc., Mentor, OH 44060	216-352-8961
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
Berg Electronics, Camp Hill, PA 17011	800-237-2374
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744

Services, Wire Cutting & Stripping - Also see-4100

† Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
Caribbean Assemblies, Inc., Altersprings, FL 32708 ... 407-327-0602
† Coherent General, Inc., Sturbridge, MA 01566 ... 508-347-2681
# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 ... 508-580-0111
§ Com-2, Inc., Saline, MI 48176 ... 313-429-9027
§ Control Cable, Inc., Baltimore, MD 21244 ... 410-298-4411
Control Laser Corp., Orlando, FL 32809 ... 407-438-2500
Corlund Electronics Corp., Newbury Park, CA 91320 ... 805-499-6877
§ Custom Computer Cable, Inc., Eden Prairie, MN 55344 .. 612-941-5651;1-800-343-5553
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 ... 201-768-5400
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 ... 617-273-5800
De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089 ... 408-734-2020
§† Dearborn Wire & Cable, L.P., Wheeling, IL 60090 ... 708-459-1000; 800-323-0198
Electronic Coil Corp., Bloomfield, CT 06002 ... 203-243-5233
Electronic Connection Corp., Bloomfield, CT 06002 ... 203-243-3356
† Electro-Prep, Inc., Wareham, MA, MA 02571 ... 508-291-2880
† Electro-Support Systems, Temecula, CA 92590 ... 909-676-2751
† Electroweave, Inc., Worcester, MA 01604 ... 508-752-8932
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 ... 714-669-9473
Eubanks Engineering, Monrovia, CA 91016 ... 818-357-7011
§† Excel Specialty Corp., Chicago, IL 60660 ... 312-262-4781
General Cable Co., Highland Hts., KY 41076 ... 606-572-8616
† GSI Corp., Timonium, MD 21093 ... 410-252-1768
† Hibbing Elctrns. Corp., OECO Corp., Hibbing, MN 55746-0129 ... 218-263-8971
§ Hobson Bros., Chicago, IL 60630-3884 ... 312-283-3600
§† IEC Electronics Corp., Newark, NY 14513 ... 315-331-7742
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
KelTech Inc., Roanoke, VA 24019 ... 703-362-8466
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 ... 416-292-4463
Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
† Line Electric Products, Glastonbury, CT 06033 ... 203-659-3573;1-800-331-1137
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 ... 708-398-5311;800-323-5207
† Manger Electric Company, Inc., Stamford, CT 06902 ... 203-348-7761
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
MicroTek, Inc., Chicopee, MA 01020 ... 413-594-5116
Minnesota Wire & Cable Co., St. Paul, MN 55108-2721 ... 612-642-1800 ; 1-800-258-6922(MWCC)
Mitech ELectronics Corp., Otsego, MI 49078 ... 616-694-9471
Mueller Elec. Co., Cleveland, OH 44114 ... 216-771-5225
† National Telephone & Electronics Inc., Miami, FL 33172 ... 305-592-0551
# North Iowa Electronics, Inc., Winnebago Industries, Inc., Garner, IA 50438 ... 515-923-3751
§ Panduit Corp., Tinley Park, IL 60477-0981 ... 800-777-3300
Quest Controls, Inc., Palmetto, FL 34221 ... 813-729-4799
† Reactel, Inc., Rockville, MD 20850 ... 301-279-5535
Rhino Robots, Inc., Champaign, IL 61824 ... 217-352-8485
§ Storm Products Co., Hinsdale, IL 60521 ... 708-323-9121
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090
† Taurus Electronics, Inc., N. Smithfield, RI 02895 ... 401-769-2625
# Technical Services for Electronics, Inc., Arlington, MN 55307 ... 612-964-2237
†# Techrand Corp. of America, Muskegon, MI 49444 ... 616-798-2930
†# Tratec of California, Inc., Chula Vista, CA 91911 ... 619-476-1155
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 ... 708-964-2330
Trionics, Inc., St. Charles, IL 60174 ... 708-365-6570
† Turtle Mountain Corporation, Dunseith, ND 58329 ... 701-244-5242
† United Wire & Cable Corp., Worcester, MA 01604 ... 508-757-3872
# Unitrek Corporation, Vancouver, WA 98661 ... 206-699-7277
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 ... 310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173 ... 619-661-6868
† Waters Instruments Inc., Rochester, MN 55903 ... 507-252-3700
Weico Wire & Cable, Inc., Edgewood, NY 11717 ... 516-254-2970
† Western Reserve Electronics, Twinsburg, OH 44087 ... 216-425-4951
§† Whitmor Wire & Cable Corp., Valencia, CA 91355 ... 805-257-2400

Services, Wirewrapping/Soldering/Welding/Brazing - Also See Services, Backplane Wiring-4100

Electronic Solutions, Zero Corporation, San Diego, CA 92121, 800-854-7086 ... C•1116,1128
† **E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473 ... C•1672**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
† **Product Technology, Inc., Irvine, CA 92714, 714-474-8998 ... C•1673**
† **Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 ... C•1675**
Altek Co., Torrington, CT 06790 ... 203-482-7626
American Assembly Inc., Florida, NY 10921 ... 914-651-3433
Andon Elctrns. Corp., Lincoln, RI 02865 ... 401-333-0388
† Apsco, Inc., Mentor, OH 44060 ... 216-352-8961
† Assembly Specialists, Chelmsford, MA 01824 ... 508-250-5900
Caribbean Assemblies, Inc., Wintersprings, FL 32708 ... 407-327-0602
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 ... 416-292-4463
§ Com-2, Inc., Saline, MI 48176 ... 313-429-9027
§ Control Cable, Inc., Baltimore, MD 21244 ... 410-298-4411
§† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 ... 617-273-5800
† Datawrap, Inc., Wakefield, MA 01880 ... 617-246-5757
Electronic Connection Corp., Bloomfield, CT 06002 ... 203-243-3356
† Electro-Support Systems, Temecula, CA 92590 ... 909-676-2751
† GSI Corp., Timonium, MD 21093 ... 410-252-1768
HiTemp Technologies, Inc., San Jose, CA 95131-1101 ... 408-922-0740
† Interlogic Industries, Melville, NY 11747-4294 ... 516-420-8111
Jettron Products Inc., E. Hanover, NJ 07936 ... 201-887-0571
KelTech Inc., Roanoke, VA 24019 ... 703-362-8466
Kenmar/TSI, Raleigh, NC 27604 ... 919-876-6049
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 ... 708-398-5311;800-323-5207

† National Telephone & Electronics Inc., Miami, FL 33172 ... 305-592-0551
† Precision Graphics Inc., Raritan, NJ 08869 ... 908-707-8880
RCD Components, Inc., Manchester, NH 03109 ... 603-669-0054
† Reactel, Inc., Rockville, MD 20850 ... 301-279-5535
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
† RMS Techn., Newport News, VA 23606 ... 804-873-0100
† Taurus Electronics, Inc., N. Smithfield, RI 02895 ... 401-769-2625
Technetics Corporation, Indianapolis, IN 46250 ... 317-842-5377;800-467-8324
Trionics, Inc., St. Charles, IL 60174 ... 708-365-6570
† Turtle Mountain Corporation, Dunseith, ND 58329 ... 701-244-5242
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 ... 310-316-9984
† Vertek Intl. Inc., San Diego, CA 92173 ... 619-661-6868
† Western Reserve Electronics, Twinsburg, OH 44087 ... 216-425-4951
Wire Graphics, Inc., Farmingdale, NY 11735 ... 516-293-1525
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 ... 801-298-5900

Servo Systems-4900

BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 ... B•1917
† **BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 ... B•1917**
† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ... D•2315**
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ... B•1250
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ... B•1271
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO ... B•1274**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ... D•2316**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100 ... B•1306
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317 ... 612-474-4500
Advanced Technology Company, Vista, CA 92083 ... 619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238 ... 412-963-7470
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
Applied Controls Co., Inc., Fairfield, NJ 07004 ... 201-227-5454
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ Baldor Electric Company, Fort Smith, AR 72902 ... 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ... 908-819-7070; 908-572-0500
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 ... 619-931-1500
§† Berg, W. M., Inc., East Rockaway, NY 11518 ... 516-599-5010
§ Berkeley Process Control, Inc., Richmond, CA 94804 ... 510-236-3333
Bertsch U.S., Vista, CA 92083 ... 619-727-7420
Caribbean Assemblies, Inc., Wintersprings, FL 32708 ... 407-327-0602
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731 ... 516-261-3300
Data Technology, Inc., Woburn, MA 01811 ... 617-935-8820
† Datron Systems Division, Simi Valley, CA 93065-1650 ... 805-584-1717
§ Design Components, Inc. (DCI), Franklin, MA 02038 ... 508-528-7300;800-341-4811
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 ... 818-882-6333
Electronic Design Engineering, Norco, CA 91760 ... 909-735-1761
§ Galil Motion Control, Inc., Sunnyvale, CA 94086 ... 408 746-2300
† GAP Instrument Corp., Hauppauge, NY 11788 ... 516-273-0909
§ Gettys Corporation, an AEG Company, Racine, WI 53404 ... 414-637-6591
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 ... 918-438-7800
† HH Controls Co., Inc., Arlington, MA 02174 ... 617-646-2626
Indramat, The Rexroth Corp., Wood Dale, IL 60191 ... 708-860-1010
† Industrial Control Co., Rockledge, FL 32955 ... 407-259-7105
§ Industrial Indexing Systems, Inc., Victor, NY 14564 ... 716-924-9181
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 ... 703-639-9045
† Interface Engineering Inc., Holbrook, MA 02343 ... 617-986-2600
§ LJ Technical Systems, Hauppauge, NY 11788 ... 516-234-2100
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 ... 619-662-2235
McFadden Systems, Inc., Santa Fe Springs, CA 90670 ... 310-948-4414
† MFG, Parabam Div., Carson, CA 90745 ... 213-549-5044
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB ... 0264-324155
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 ... 516-567-1100
† Northern Precision Labs., Fairfield, NJ 07006 ... 201-227-4800
Oriel Corp., Stratford, CT 06497-0872 ... 203-377-8282
Ormec Systems Corp., Rochester, NY 14625 ... 716-385-3520
§ Pacific Scientific Co., Rockford, IL 61109 ... 815-226-3100
Parker Hannifin Corporation, Compumotor Division, Rohnert Park, CA 94928 ... 707-584-7558
§† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11042-5416 ... 516-328-3300
† Performance Controls, Inc., Horsham, PA 19044 ... 215-675-6500
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 ... 516-864-1000
† Precision Mechanisms, Westbury, NY 11590 ... 516-ED3-5955
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 ... 516-234-3800
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344 ... 612-942-3600
SCHENCK PEGASUS Corporation, Troy, MI 48083 ... 313-689-9000
§ ServoByte Inc., Millbury, MA 01527 ... 508-865-0225
† Taurus Electronics, Inc., N. Smithfield, RI 02895 ... 401-769-2625
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 ... 215-539-4400
Transmagnetics, Farmingdale, NY 11735 ... 516-293-3100
§ TS Products, Inc., Arleta, CA 91331-3429 ... 818-896-6676
Vasak Inds., Inc., El Segundo, CA 90245 ... 1-800-67-VASAK
Vernitech:Vernitron Corp., Deer Pk., NY 11729 ... 516-586-5100
§† Westamp, Santa Monica, CA 90404 ... 310-393-0401

§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005	314-532-5887

Shaft Encoders, Shaft Position — See Encoders, Shaft Angle (Vol. B)
Shaft Locks — See Locks, Dial & Shaft (Vol. C)
Shafts & Adapters-Also See Couplings, Shaft, Rigid & Flexible-3500 — *See Vol. B*
Shake Tables — See Testers, Vibration (Vol. D)
Shells, Encapsulation — See Cups, Encapsulation (Vol. C)
Shielding, EMI/RFI-4525 — *See Vol. C*
Shielding (MIL), EMI/RFI-2440 — *See Vol. B*
Shielding Beads, Ferrite-4525 — *See Vol. C*
Shields, Cable — See Braid, Cable (Vol. C)
Shields, Cathode-Ray Tube-4525 — *See Vol. C*
Shields, Coil-4525 — *See Vol. C*
Shields, Corona-4525 — *See Vol. C*
Shields, Electrostatic — See Shields, Tube (Vol. C)
Shields, Magnetic-4525 — *See Vol. C*
Shields, Photomultiplier-4525 — *See Vol. C*
Shields, RF-Also See Gaskets, Shielding, RF-4525 — *See Vol. C*
Shields, Transformer-4525 — *See Vol. C*
Shields, Tube-4525 — *See Vol. C*
Shields, Wire — See Braid, Cable (Vol. C)

Shift Registers-2325

§ Centent Co., Santa Ana, CA 92707	714-979-6491
Meissner Industries, Dover, NJ 07801	201-366-1700
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Shifters, Frequency — See Converters, Frequency to Frequency (Vol. D)
Shifters, Phase, Ferrite-3450 — *See Vol. A*
Shifters, Phase, Microwave-3450 — *See Vol. A*
Shifters, Phase, RF-3450 — *See Vol. A*

Shifters, Phase 60/400 Hz-4050

Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
AVO International, TBG, Dallas, TX 75237	214-333-3201
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† Elpaz Instruments, Inc., Murrysville, PA 15668	412-327-8744
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
KGS Electronics, Inc., Arcadia, CA 91006	818-574-1175
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433

Shrinkable Plastics & Elastomers — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C), Tubing, Heat Shrinkable (Vol. C)
Shunts, Connector-2100 — *See Vol. C*

Shunts, Meter-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1153**
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333	**D•1254**
† Empro Manufacturing Company, Inc., Indianapolis, IN 46226, 317-823-4478	**D•1257**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1759**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1278,1280**
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210	**A•1978**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454	**A•1987**
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771	**A•2016**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044	**A•2035**
Amptec Electronics, San Diego, CA 92128	619-578-7816
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
† Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† Deltec Co., Norwalk, CA 90650	310-926-2304
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Holt Instrument, C.P.D. Engineering, Inc., Oconto, WI 54153	414-834-2222
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
Meissner Industries, Dover, NJ 07801	201-366-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Valhalla Scientific, San Diego, CA 92121	619-457-5576
Vishay Resistors, Malvern, PA 19355	215-644-1300
Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550
§ Weston Instruments, Electrical Instrument Service, Inc., Mt. Vernon, NY 10550	914-699-9717

Shutters, Microwave-3450 — *See Vol. A*
SIDACs-4800 — *See Vol. A*

Signal Averagers-2900

Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929

Signal Conditioners & Equipment-1100

Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902	**B•1315**
§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282	**B•1929-1930**
Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1375**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
§ National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1198**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1997,2002**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1101,1199, 1415**
† PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**A•1675, D•1018,1201**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007,2011-2012**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1375**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811	**B•2025**
Acculex Corporation, Taunton, MA 02780	508-880-3660
Acromag Inc., Wixom, MI 48393-7037	313-624-1541
§ Action Instruments, San Diego, CA 92123	619-279-5726
ADAC Corporation, Woburn, MA 01801	617-935-6668
Advanced Process Controls, Woburn, MA 01801	617-932-9262
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Peabody, MA 01960	508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880	508-977-3000
A. P. Circuit, Brooklyn, NY 11237	718-456-2717
# A.P.C.S. America, Grand Rapids, MI 49548	616-247-1453
† Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Avens Signal Equipment, Elmhurst, NY 11373	718-335-1886
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Comptus Inc., New Boston, NH 03070	603-487-5512
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
DGH Corporation, Manchester, NH 03108	603-622-0452
DSP Technology, Fremont, CA 94538-7338	510-657-7555
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311	818-998-8281
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Elcon Instruments, Inc., Whessoe, Plc, Annapolis, MD 21401	410-280-6686
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Frequency Devices, Inc., Haverhill, MA 01830	508-374-0761
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
† Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
HBM, Inc., Marlboro, MA 01752	508-624-4500
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Instrum, Monrovia, CA 91016	818-303-4210
Instruments for Industry, Inc., Ronkonkoma, NY 11779	516-467-8400
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705	602-623-9801
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437	607-272-7640
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
Mathematical Systems Design, Inc., Los Angeles, CA 90064	310-479-7180
Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrum, Denver, CO 80217-5227	303-773-4700
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
MTS Systems, Eden Prairie, MN 55344	612-937-4000
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
Pacific Instruments Inc., Concord, CA 94520	510-827-9010
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
Sensotec, Inc., Columbus, OH 43212	614-486-7723
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
§† Taber Industries, N. Tonawanda, NY 14120	716-694-4000;800-333-5300
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Signal Conditioners & Equipment-1100 (Cont'd)

Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
Tustin Electronics Co., Anaheim, CA 92807	714-777-5800
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

Signal Generators — See Generators, Specific Type (Vol. D)

Signal Systems, Fiber Optic-2325

§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300

Signal Tracers — See Testers, Signal Tracing (Vol. D)
Silica, Fused-2500 — ***See Vol. C***

Silicon Foundry Services-4100

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	**A•2180**
† Holt Inc., Irvine, CA 92718	714-859-8800
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
Lucas Nova Sensor, Lucas Industries, Fremont, CA 94539	510-490-9100
§† Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039	401-433-7000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† VLSI Technology, Inc., San Jose, CA 95131	408-434-3000
Zetex, Inc., Zetex plc., Commack, NY 11725	516-543-7100

Silk Screening Services — See Services, Silk Screening (Vol. D)

Simulation Systems, Electromagnetic Pulse-1100

Cober Electronics, Stamford, CT 06902	203-327-0003
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Velonex, Santa Clara, CA 95050	408-727-7370

Simulators, Data-2900

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Data Environment, Inc., Portland, OR 97291	503-531-0765
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Loral Data Systems, Sarasota, FL 34230	813-371-0811
New Wave Instruments, Provo, UT 84604	801-373-4909
§ Southern Computer Corp., Atlanta, GA 30342	404-252-3340
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Systran Corp., Dayton, OH 45432-3068	1-800-252-5601
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550

Simulators, Digital Satellite-1900

Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1311**
§ Aldec, Inc., Newbury Park, CA 91320	805-499-6867
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010

Simulators, Motion-2550

† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133**	**D•2315**
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100**	**D•1208-1209**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Carco Electronics, Menlo Pk., CA 94025-1106	415-321-8174
§ Centent Co., Santa Ana, CA 92707	714-979-6491
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† McFadden Systems, Inc., Santa Fe Springs, CA 90670	310-948-4414
MTS Systems, Eden Prairie, MN 55344	612-937-4000
PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
§ TS Products, Inc., Arleta, CA 91331-3429	818-896-6676
Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Simulators, Optics-3700 — ***See Vol. B***

Simulators, Power Failure-2900

† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433**	**D•2286-2287**
Bermar Corp., Research Triangle Park, NC 27709	919-489-4316
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
§Φ Powertrend, Inc., Cheyenne, WY 82001	307-635-9221
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
§† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778

Simulators, Powerline Disturbance-2900

California Instruments Corp., San Diego, CA 92123-1509, 619-279-8620;800-4AC-POWER	**D•2251**
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433**	**D•2286-2290**
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
† Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
NF Electronic Instruments, State College, PA 16801	814-237-5580
§Φ Powertrend, Inc., Cheyenne, WY 82001	307-635-9221
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
§† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Techron Div., Crown Intl., Inc., Elkhart, IN 46517	219-294-8300
† Velonex, Santa Clara, CA 95050	408-727-7370

Simulators, Radar-2440 — ***See Vol. B***

Simulators, Resolvers-2900

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300**	**D•1174**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176,1179**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950**	**D•1197**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208-1209**
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
† Magnecomp, Inc., Pickens, SC 29671	803-878-4700
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235

Simulators, Thermocouple-2900

Ectron Corp., San Diego, CA 92111-1980, 619-278-0600	**D•1010**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721	**D•1264**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1887**
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
Xitron Technologies, San Diego, CA 92121	619-458-9852
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725	(415) 326-2151

Simulators (MIL)-2440 — ***See Vol. B***
Sinks, Heat — See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)
Sleeves — See Tubing (Vol. C)
Slides, Cabinet & Chassis-1400 — ***See Vol. C***

Slides, Linear-4900

§† Accuride, Santa Fe Springs, CA 90670	310-903-0200
Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ Del-Tron Precision, Bethel, CT 06801	800-245-5013
§ NMC Fastening Systems, Nylon Molding Corp., Monrovia, CA 91016	818-357-0901
§ Parker Hannifin Corp., Daedal Div., Harrison City PA 15636	412-744-4451
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-3300
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Slip Clutch — See Knobs, Slip Clutch (Vol. C)
Slip Rings & Assemblies-3500 — ***See Vol. B***
Slip Rings & Assemblies (MIL)-2440 — ***See Vol. B***
Slotted Lines, Microwave-3450 — ***See Vol. A***
Socket Adapters-2100 — ***See Vol. C***
Sockets, Array-2100 — ***See Vol. C***
Sockets, Burn-In /Test-2100 — ***See Vol. C***
Sockets, Capacitor-2100 — ***See Vol. C***
Sockets, Chip Carrier, Surface Mount-2100 — ***See Vol. C***
Sockets, CRT-2100 — ***See Vol. C***
Sockets, Crystal-2100 — ***See Vol. C***
Sockets, Diode-2100 — ***See Vol. C***
Sockets, DIP and DIL-2100 — ***See Vol. C***
Sockets, Disposable Carrier-2100 — ***See Vol. C***
Sockets, Integrated Circuit-2100 — ***See Vol. C***
Sockets, International-2100 — ***See Vol. C***
Sockets, Lamp & Lamp Assemblies-2460 — ***See Vol. B***
Sockets, Leadless Carrier-2100 — ***See Vol. C***
Sockets, LIF & ZIF-2100 — ***See Vol. C***
Sockets, Miniature & Subminiature — See Sockets, Diode (Vol. C)
Sockets, Pin Grid Array-2100 — ***See Vol. C***
Sockets, Power (Receptacles)-2100 — ***See Vol. C***
Sockets, Programmable-2100 — ***See Vol. C***
Sockets, Relay-2100 — ***See Vol. C***
Sockets, SIMM-2100 — ***See Vol. C***
Sockets, SIP-2100 — ***See Vol. C***
Sockets, Surface Mount-2100 — ***See Vol. C***
Sockets, Test-2100 — ***See Vol. C***
Sockets, Transistor-2100 — ***See Vol. C***
Sockets, Tube-2100 — ***See Vol. C***
Sockets (MIL)-2440 — ***See Vol. B***

Software, Applications-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100**	**D•1147,1198,1302**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304-1305,1307-1309**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Action Instruments, San Diego, CA 92123	619-279-5726
Alden Computer Systems, Salem, MA 01970	508-744-1314
§# Alligator Technologies, Fountain Valley, CA 92708	714-850-9984
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
§ ATI Technologies Inc., Scarborough, Ont., CANADA M1W 3S2	416-756-0718
Automatix Inc., Billerica, MA 01821	506-667-7900
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
† Aydin Corp., Horsham, PA 19044	215-657-7510
California Automation Inc., San Diego, CA 92121	619-452-1341
§ CMV Software Specialists Inc., Sioux Falls, SD 57102	605-338-6645
# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
Cyberpak Co., Romeoville, IL 60441	708-972-0707
† Datacom, Inc., Ft. Walton Beach, FL 32549	904-244-6121
Dataq Instruments, Inc., Akron, OH 44333	216-668-1444
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Dazix, Intergraph, Huntsville, AL 35894	1-800-239-4111;205-730-2000
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ Elite Software Development, Inc., Bryan, TX 77806	409-846-2340
Enertech Consultants, Campbell, CA 95008	408-866-7266
Eyring, Inc., Provo, UT 84601	801-375-2434
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Forte Technology, Inc., Norwood, MA 02062	617-769-9150
§ GE Fanuc Automation North America Inc., Charlottesville, VA 22906	804-978-5000; 800-648-2001
General Digital Corp., Enfield, CT 06082	203-741-7171
Haverly Systems, Inc., Denville, NJ 07834	201-627-1424
HBM, Inc., Marlboro, MA 01752	508-624-4500
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HyperLogic Corporation, Escondido, CA 92027	619-746-2765
ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
§ Infometrix, Seattle, WA 98121	206-441-4696
Information Retrieval Systems, Inc., New York, NY 10128	212-348-6268
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§Φ Integrated Engineering Software, Winnipeg, Man., CANADA R3B 1Y6	204-942-5636
Intelligent Instrumentation, A Burr-Brown Company, Tucson, AZ 85705	602-623-9801
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Kistler-Morse, Redmond, WA 98073	206-881-8000
Laboratory Technologies Corp., Wilmington, MA 01887	508-657-5400
§ Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
The MathWorks, Inc., Natick, MA 01760	508-653-1415
MicroMath, Inc., Salt Lake City, UT 84121	801-943-0290
§ MicroWay Inc. Research Park, Kingston, MA 02364	508-746-7341
# Mitronics, Rolling Hills, CA 90274	310-377-2022
† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100; 800-441-5758
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
§† Omation Inc., Richardson, TX 75081	214-231-5167;800-553-9119
§ Opto 22, Temecula, CA 92590	714-695-9299
Orion Development Corp., Merrifield, VA 22116-2323	703-698-8126;800-992-8170
§ PERCON, Inc., Eugene, OR 97402-9153	1-800-8-PERCON;503-344-1189
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
# Sheldon Instruments, Provo, UT 84604	801-376-7861
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
Stolzberg Research, Inc., Stony Brook, NY 11790-3305	516-751-4277;800-568-4634
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Sygenex Inc., Redmond, WA 98052	206-881-5500
Systems Data, Inc., Akron, OH 44321	216-666-0085
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
§ Tatum Labs Inc., Ann Arbor, MI 48108	313-663-8810
† Technical Witts, Inc., Glendale, AZ 85308	602-439-1833
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
TSSI, Beaverton, OR 97005	503-643-9281
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818	401-884-4188
§ Wolfram Research, Inc., Champaign, IL 61820-7237	217-398-0700
§ Wonderware, Irvine, CA 92718	714-727-3200

Software, CAD-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ **OrCAD, Hillsboro, OR 97124-7135, 503-690-9881**	**D•1148**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Accel Technologies, Inc., San Diego, CA 92121	619-554-1000
Advanced Micro Computer, Ft. Lauderdale, FL 33309	305-975-9515
§ Applied Information Systems, Inc., Chapel Hill, NC 27514	919-942-7801;800-334-5510
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
CAD Utility CO., Chatsworth, CA 91311	805-527-8630
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Dazix, Intergraph, Huntsville, AL 35894	1-800-239-4111;205-730-2000
§ Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Design Workshop, D.D.O., Que., CANADA H9G 1X5	514-696-4753
Douglas Electronics, Inc., San Leandro, CA 94577	510-483-8770
§ Elite Software Development, Inc., Bryan, TX 77806	409-846-2340
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GraphiCode, Inc., Lynnwood, WA 98036	206-672-1980
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Kepro Circuit Systems, Fenton, MO 63026-2992	314-343-1630
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
§ Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Minc Incorporated, Colorado Springs, CO 80918	719-590-1155
§† Omation Inc., Richardson, TX 75081	214-231-5167;800-553-9119
Optotek Limited, Kanata, Ont., CANADA K2K 2A9	613-591-0336
PADS Software, Inc., Littleton, MA 01460	508-486-9521
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
# Systems Alternatives, Maumee, OH 43537	419-891-1100
§ Tatum Labs Inc., Ann Arbor, MI 48108	313-663-8810
TEAM Visionics Corporation, Santa Clara, CA 95054	408-562-0123
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525

Software, Communications-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ Applied Information Systems, Inc., Chapel Hill, NC 27514	919-942-7801;800-334-5510
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Corp., Horsham, PA 19044	215-657-7510
Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Drumlin, Micro/Sys, Inc., Glendale, CA 91208	818-244-4600
§ GMR Co., Venice, CA 90291-3218	310-399-1490
HDS Inc., Reston, VA 22091	703-620-6200
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Infometrix, Seattle, WA 98121	206-441-4696
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
† Labtronics Inc., Guelph, Ont., CANADA N1G 3B6	519-767-1061
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113	612-638-7777
§ PERCON, Inc., Eugene, OR 97402-9153	1-800-8-PERCON;503-344-1189
PERX,Inc., Corte Madera, CA 94925	415-927-0155
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
Systems Data, Inc., Akron, OH 44321	216-666-0085
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331

Software, Compilers/Languages-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304,1307-1309**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
American Arium, Tustin, CA 92680-7207	714-731-1661
§ Applied Information Systems, Inc., Chapel Hill, NC 27514	919-942-7801;800-334-5510
§ Applied Microsystems Corp., Redmond, WA 98052	206-882-2000
Archelon Inc., Waterloo, Ont., CAN N2K 2J6	519-746-7925
§ Byte Craft Limited, Waterloo, Ont., CAN N2J 4E4	519-888-6911
California Automation Inc., San Diego, CA 92121	619-452-1341
Ecosoft, Inc., Indianapolis, IN 46214	317-271-5551
§ Eyring, Inc., Provo, UT 84601	801-375-2434
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GMR Co., Venice, CA 90291-3218	310-399-1490
Haverly Systems, Inc., Denville, NJ 07834	201-627-1424

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Intermetrics Microsystems Software, Inc., Cambridge, MA 02138	617-661-0072; 800-356-3594
The MathWorks, Inc., Natick, MA 01760	508-653-1415
§ Microtec Research, Inc., Santa Clara, CA 95054	408-980-1300
Microtek International/Dev. Sys. Div., Hillsboro, OR 97124	503-645-7333
§ MicroWay Inc. Research Park, Kingston, MA 02364	508-746-7341
§† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100; 800-441-5758
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Octagon Systems, Westminster, CO 80030	303-430-1500
Parsytec Inc., West Chicago, IL 60185	708-293-9500
PERX,Inc., Corte Madera, CA 94925	415-927-0155
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Wolfram Research, Inc., Champaign, IL 61820-7237	217-398-0700

Software, Computer Performance Measurement-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1285-1286**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304,1307-1309**
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HiLEVEL Technology, Tustin, CA 92680	714-573-1888
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Software, Data Base Management-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089	**A•2149**
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Biosoft, Acropolis Computers Ltd., Ferguson, MO 63135	314-524-8029
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Control Module, Enfield, CT 06082	203-745-2433
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Eyring, Inc., Provo, UT 84601	801-375-2434
§ GMR Co., Venice, CA 90291-3218	310-399-1490
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Information Retrieval Systems, Inc., New York, NY 10128	212-348-6268
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
MicroMath, Inc., Salt Lake City, UT 84121	801-943-0290
# Mitronics, Rolling Hills, CA 90274	310-377-2022
§† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100; 800-441-5758
Northwest Analytical Inc., Portland, OR 97209	503-224-7727
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900

Software, DC Motor Control-2050

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968, D•1164-1165**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
American Control Technology, Inc., Elgin, IL 60123-1203	708-468-6000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Cyberpak Co., Romeoville, IL 60441	708-972-0707
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Keithley MetraByte, Taunton, MA 02780	508-880-3000
Performance Motion Devices, Chelmsford, MA 01824	508-256-1913
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500

Software, Emulation/Simulation-2050

Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304,1307-1309**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
American Arium, Tustin, CA 92680-7207	714-731-1661
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
§ Applied Microsystems Corp., Redmond, WA 98052	206-882-2000
array Microsystems, Colorado Springs, CO 80906	719-540-7999
Biosoft, Acropolis Computers Ltd., Ferguson, MO 63135	314-524-8029
§ Byte Craft Limited, Waterloo, Ont., CAN N2J 4E4	519-888-6911
§ Contec Microelectronics USA, San Jose, CA 95131	408-434-6767;1-800-888-8884
Dazix, Intergraph, Huntsville, AL 35894	1-800-239-4111;205-730-2000
§ Design Automation, Inc., Lexington, MA 02173-3992	617-862-8998
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
§ GW Instruments, Inc., Somerville, MA 02143	617-625-4096
Haverly Systems, Inc., Denville, NJ 07834	201-627-1424
HEI Corporation, Carol Stream, IL 60188	708-665-5500
HiLEVEL Technology, Tustin, CA 92680	714-573-1888
HiTech Equipment Corp., San Diego, CA 92126	619-566-1892
HyperLogic Corporation, Escondido, CA 92027	619-746-2765
Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§Φ Integrated Engineering Software, Winnipeg, Man., CANADA R3B 1Y6	204-942-5636
§ Intermetrics Microsystems Software, Inc., Cambridge, MA 02138	617-661-0072; 800-356-3594
§† LSI Logic Corp., Milpitas, CA 95035	408-433-8000
The MathWorks, Inc., Natick, MA 01760	508-653-1415
§Φ MetaLink Corporation, Chandler, AZ 85244	602-926-0797
Microcompatibles Inc., Silver Springs, MD 20901	301-593-0683
MicroMath, Inc., Salt Lake City, UT 84121	801-943-0290
MicroPlot Systems, Columbus, OH 43229	614-882-4786
Microtek International/Dev. Sys. Div., Hillsboro, OR 97124	503-645-7333
Modular Mining Systems, Inc., Tuscon, AZ 85706	602-746-9127
MTS Systems, Eden Prairie, MN 55344	612-937-4000
§ Omation Inc., Richardson, TX 75081	214-231-5167;800-553-9119
§ Omicron electronic, Hohenems, AUSTRIA A-6845	+ /5576/4010-0
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
SL Corporation, Corte Madera, CA 94925	415-927-1724
Softaid, Inc., Columbia, MD 21046	410-290-7760
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Systems Data, Inc., Akron, OH 44321	216-666-0085
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
§ Tatum Labs Inc., Ann Arbor, MI 48108	313-663-8810
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Software, Graphics-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ AFE Technologies Inc., Charlottesville, VA 22901	804-974-7801
# Alligator Technologies, Fountain Valley, CA 92708	714-850-9984
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ Applied Information Systems, Inc., Chapel Hill, NC 27514	919-942-7801;800-334-5510
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Audre, Inc., San Diego, CA 92127	619-451-2260
† Aydin Corp., Horsham, PA 19044	215-657-7510
Barco Chromatics, Tucker, GA 30084	404-493-7000
Biosoft, Acropolis Computers Ltd., Ferguson, MO 63135	314-524-8029
Cogent Software, Menlo Park, CA 94025-3405	415-324-4360
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Dazix, Intergraph, Huntsville, AL 35894	1-800-239-4111;205-730-2000
Design Workshop, D.D.O., Que., CANADA H9G 1X5	514-696-4753
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
§ GraphiCode, Inc., Lynnwood, WA 98036	206-672-1980
§ IICon Corporation, Morgan Hill, CA 95037	408-779-7466
§ Infometrix, Seattle, WA 98121	206-441-4696
Information Retrieval Systems, Inc., New York, NY 10128	212-348-6268
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
§ International Microsystems, Milpitas, CA 95035	408-942-1001
† Labtronics Inc., Guelph, Ont., CANADA N1G 3B6	519-767-1061
The MathWorks, Inc., Natick, MA 01760	508-653-1415
Microcompatibles Inc., Silver Springs, MD 20901	301-593-0683
MicroMath, Inc., Salt Lake City, UT 84121	801-943-0290
MicroPlot Systems, Columbus, OH 43229	614-882-4786
§ MicroWay Inc. Research Park, Kingston, MA 02364	508-746-7341
Modular Mining Systems, Inc., Tuscon, AZ 85706	602-746-9127
MTS Systems, Eden Prairie, MN 55344	612-937-4000
Northwest Analytical Inc., Portland, OR 97209	503-224-7727
PERX,Inc., Corte Madera, CA 94925	415-927-0155
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
Signum, Inc., Watertown, MA 02172-3356	617-926-3566
SL Corporation, Corte Madera, CA 94925	415-927-1724
3-D Visions, Torrance, CA 90505	310-325-1339
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
TEAM Visionics Corporation, Santa Clara, CA 95054	408-562-0123
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
§# V.I. Corporation, Northampton, MA 01060	413-586-4144
§ Wolfram Research, Inc., Champaign, IL 61820-7237	217-398-0700
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Software, Image Processing-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1147**
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133

§—Product sold through distributors †—Product meets MIL specs Φ—Rentals #—Value Added Reseller

# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Cogent Software, Menlo Park, CA 94025-3405	415-324-4360
Eyring, Inc., Provo, UT 84601	801-375-2434
§ GraphiCode, Inc., Lynnwood, WA 98036	206-672-1980
# Image Graphics, Inc., Shelton, CT 06484	203-926-0100
The MathWorks, Inc., Natick, MA 01760	508-653-1415
# Mitronics, Rolling Hills, CA 90274	310-377-2022
# Recognition Concepts,Inc., Carson City, NV 89706	702-831-0473;1-800-243-8724
§ Regulus Systems, Nevada City, CA 95959	415-593-4197
SL Corporation, Corte Madera, CA 94925	415-927-1724
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
Synoptics, Ltd., Paragon Towers, Newton, MA 02164	617-527-4461
§ Vicom Systems, Inc., Fremont, CA 94538	415-498-3200
Vista Systems, Inc., Peabody, MA 01960	508-532-1971

Software, Information Storage & Retrieval-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1147**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089	**A•2149**
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Audre, Inc., San Diego, CA 92127	619-451-2260
§ Beta Review, Inc., Millwood, VA 22646	703-837-1436
Biosoft, Acropolis Computers Ltd., Ferguson, MO 63135	314-524-8029
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Electronic Controls Design, Milwaukie, OR 97222	503-659-6100
Environmental Telesis & Controls, Austin, TX 78718	512-835-0330
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
Eyring, Inc., Provo, UT 84601	801-375-2434
Haverly Systems, Inc., Denville, NJ 07834	201-627-1424
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
# ICS Electronics Corp., Milpitas, CA 95035-5545	408-263-5500;1-800-952-4499
Information Retrieval Systems, Inc., New York, NY 10128	212-348-6268
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
§ Kistler-Morse, Redmond, WA 98073	206-881-8000
§† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100; 800-441-5758
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
PERX,Inc., Corte Madera, CA 94925	415-927-0155
# Recognition Concepts,Inc., Carson City, NV 89706	702-831-0473;1-800-243-8724
† Samatic Winding Machine, Jenlor Ltd., Fayetteville, NY 13066	315-637-9080
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
# Sheldon Instruments, Provo, UT 84604	801-376-7861
STN International C/O Chemical Abstracts Service, Columbus, OH 43202-1505	614-447-3600
§ Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020
§† ZyLAB Corporation, Buffalo Grove, IL 60089	708-459-8000

Software, Job Scheduling/Accounting-2050

§ CMV Software Specialists Inc., Sioux Falls, SD 57102	605-338-6645
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850,800-937-4688
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Elite Software Development, Inc., Bryan, TX 77806	409-846-2340
§ GMR Co., Venice, CA 90291-3218	310-399-1490
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
# Mitronics, Rolling Hills, CA 90274	310-377-2022
† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100; 800-441-5758
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
§ Stolzberg Research, Inc., Stony Brook, NY 11790-3305	516-751-4277;800-568-4634
Taylor Industrial Software, Edmonton, Alberta, CANADA T5K 2M5	403-482-7547

Software, Label Printing-2050

§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770	**D•1106**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ Brady USA, Inc., Indl. Prods. Div., Milwaukee, WI 53201	1-800-537-8791
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Forte Technology, Inc., Norwood, MA 02062	617-769-9150
§ Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331

Software, Motion Control-2050

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968, D•1164-1165**
§ TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676	**D•2317**
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Cyberpak Co., Romeoville, IL 60441	708-972-0707
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
Performance Motion Devices, Chelmsford, MA 01824	508-256-1913
SL Corporation, Corte Madera, CA 94925	415-927-1724
§ TA Engineering Co., Inc., Moraga, CA 94556	415-376-8500
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
# United Motion Technology, Santa Clara, CA 95054	408-970-9742;1-800-424-STEP

Software, Neural Networks-2050

§ Audre, Inc., San Diego, CA 92127	619-451-2260
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
HyperLogic Corporation, Escondido, CA 92027	619-746-2765
The MathWorks, Inc., Natick, MA 01760	508-653-1415
Neural Systems Inc., Vancouver, BC, CANADA V6N 3H9	604-263-3667
Sygenex Inc., Redmond, WA 98052	206-881-5500

Software, Operating Systems-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304,1307-1309**
§ Tempustech, Inc., Naples, FL 33942, 813-643-2424	**D•1144**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
Acme Electric Corporation, Cuba, NY 14727	716-968-2400
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
California Automation Inc., San Diego, CA 92121	619-452-1341
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Drumlin, Micro/Sys, Inc., Glendale, CA 91208	818-244-4600
§ Eyring, Inc., Provo, UT 84601	801-375-2434
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
Integrated Systems, Inc., Santa Clara, CA 95054	408-980-1500
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
§ NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Parsytec Inc., West Chicago, IL 60185	708-293-9500
§ Point 4 Data Corp., Tustin, CA 92680	714-259-0777
Systems Data, Inc., Akron, OH 44321	216-666-0085
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

Software, Operating Systems Enhancement-2050

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
† Tempustech, Inc., Naples, FL 33942, 813-643-2424	**D•1144**
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
Drumlin, Micro/Sys, Inc., Glendale, CA 91208	818-244-4600
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
Systems Data, Inc., Akron, OH 44321	216-666-0085
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804
Zitel Corporation, Milpitas, CA 95035	408-321-9600;800-622-5020

Software, Programming/Systems Development Aids-2050

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1205**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ National Instruments, Austin, TX 78730-5039, 512-794-0100	**D•1147,1198**
Nohau Corporation, Campbell, CA 95008, 408-866-1820;408-866-4493	**D•1304-1305,1307-1309**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1204-1205**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809	**D•1146**
§ Adatek, Inc., Sandpoint, ID 83864	208-263-1471;800-323-3343
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allen Systems, Columbus, OH 43221	614-488-7122
American Arium, Tustin, CA 92680-7207	714-731-1661
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ Applied Information Systems, Inc., Chapel Hill, NC 27514	919-942-7801;800-334-5510
§ Applied Microsystems Corp., Redmond, WA 98052	206-882-2000
Atlanta Signal Processors, Inc., Atlanta, GA 30308	404-892-7265
§ Byte Craft Limited, Waterloo, Ont., CAN N2J 4E4	519-888-6911
§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323	407-994-3520
California Automation Inc., San Diego, CA 92121	619-452-1341
§ Covox, Inc., Eugene, OR 97402	503-342-1271
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Data Translation, Inc., Marlboro, MA 01752	508-481-3700
Dazix, Intergraph, Huntsville, AL 35894	1-800-239-4111;205-730-2000

Design Workshop, D.D.O., Que., CANADA H9G 1X5	514-696-4753
Drumlin, Micro/Sys, Inc., Glendale, CA 91208	818-244-4600
Dynage/Controls, Inc., Canistota, SD 57012	605-296-3487
Elite Software Development, Inc., Bryan, TX 77806	409-846-2340
† Eyring, Inc., Provo, UT 84601	801-375-2434
General Digital Corp., Enfield, CT 06082	203-741-7171
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
HyperLogic Corporation, Escondido, CA 92027	619-746-2765
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
§ Intermetrics Microsystems Software, Inc., Cambridge, MA 02138	617-661-0072; 800-356-3594
KnowledgeWare, Inc., Atlanta, GA 30326	404-231-8575
The MathWorks, Inc., Natick, MA 01760	508-653-1415
Matrix Corp., Raleigh, NC 27610	919-231-8000
§Φ MetaLink Corporation, Chandler, AZ 85244	602-926-0797
Microtek International/Dev. Sys. Div., Hillsboro, OR 97124	503-645-7333
§ MicroWay Inc. Research Park, Kingston, MA 02364	508-746-7341
§† National Information Systems, Inc., San Jose, CA 95117-1852	408-985-7100: 800-441-5758
§ Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
§ Point 4 Data Corp., Tustin, CA 92680	714-259-0777
Research Inc., Minneapolis, MN 55424	612-941-3300
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
§ Star Semiconductor Corp., Warren, NJ 07059	908-647-9400
§ Star Semiconductor Corp., Warren, NJ 07059	908-647-9400
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
Sygenex Inc., Redmond, WA 98052	206-881-5500
§# Systronix Inc., Salt Lake City, UT 84152-6398	801-534-1017
§ Taylor Industrial Software, Edmonton, Alberta, CANADA T5K 2M5	403-482-7547
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
TL Inds. Inc., Northwood, OH 43619	419-666-8144
§ Touch Technology, Austin, TX 78746	512-328-9284
TSSI, Beaverton, OR 97005	503-643-9281
Versalogic Corp., Eugene, OR 97402	800-824-3163
§ Vertex Industries, Inc., Clifton, NJ 07014	201-472-1331
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Software, Program Translators-2050

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	D•1205
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
CAD Utility CO., Chatsworth, CA 91311	805-527-8630
§ Intermetrics Microsystems Software, Inc., Cambridge, MA 02138	617-661-0072. 800-356-3594
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
TSSI, Beaverton, OR 97005	503-643-9281

Software, Quality Control-2050

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	D•1205
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Electronic Controls Design, Milwaukie, OR 97222	503-659-6100
Forte Technology, Inc., Norwood, MA 02062	617-769-9150
§ GE Fanuc Automation North America Inc., Charlottesville, VA 22906	804-978-5000; 800-648-2001
Heuristics Incorporated, Sacramento, CA 95827	916-369-6606
§ Intec Controls Corp., Walpole, MA 02081	508-660-1221
§ Intellution, Inc., Norwood, MA 02062	617-769-8878
† Labtronics Inc., Guelph, Ont., CANADA N1G 3B6	519-767-1061
The MathWorks, Inc., Natick, MA 01760	508-653-1415
Northwest Analytical Inc., Portland, OR 97209	503-224-7727
Optotek Limited, Kanata, Ont., CANADA K2K 2A9	613-591-0336
Sector Systems Co., Inc., Marblehead, MA 01945	617-639-2625
SL Corporation, Corte Madera, CA 94925	415-927-1724
Sygenex Inc., Redmond, WA 98052	206-881-5500
§ Tele-Denken Resources, Inc., Humble, TX 77346	713-852-5366

Software, Security-2050

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	D•1205
Alpha Omega Computer Systems, Corvallis, OR 97333	503-754-1911
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730-1469	617-275-0850;800-937-4688
DATATRONIC SYSTEMS CORP., Computer Sciences Div., Panorama City, CA 91412-0128	818-988-5290
Eyring, Inc., Provo, UT 84601	801-375-2434

Solar Cells — See Cells, Photovoltaic (Vol. B)

Solder (All Types)-4600 – ***See Vol. C***

Solder Lugs — See Terminals, Lug (All Types) (Vol. C)

Solder Pots & Baths-4600 – ***See Vol. C***

Soldering Accessories-4600 – ***See Vol. C***

Soldering Equipment, Hot Gas-4100

Air-Vac Engrg., Milford, CT 06460	203-874-2541
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§ Contact East, N. Andover, MA 01845	508-682-2000
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hydro-Gen Products Inc., Fort Collins, CO 80522-1517	800-779-0126
Manix Mfg. Inc., Warminster, PA 18974	215-957-6565
Manncorp, Huntingdon Valley, PA 19006	215-364-6100
(MEI) Marpet Enterprises, Inc., Wakefield, MA 01880	617-246-2040
§ Nu-Concept Systems, Colmar, PA 18915	215-822-8400;800-762-4278
§† PACE, Inc., Laurel, MD 20723-1990	301-490-9860
Research Inc., Minneapolis, MN 55424	612-941-3300
Sikama International, Inc., Santa Barbara, CA 93117	805-683-6379

Soldering Equipment, Induction Heating-4100

§† Antex Division, Marblehead, MA 01945	617-631-7100
§ Contact East, N. Andover, MA 01845	508-682-2000
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
† Miller, L.C., Co., Monterey Pk., CA 91754	213-268-3611
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990

Soldering Equipment, Infrared-4100

A.P.E. Corporation, Medford, NY 11763	516-654-1197
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
Electrovert USA Corp., Grand Prairie, TX 75050	214-606-1900
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
§ Eraser Co., Syracuse, NY 13221	315-454-3237
† Manncorp, Huntingdon Valley, PA 19006	215-364-6100
§† Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Research Inc., Minneapolis, MN 55424	612-941-3300
Sikama International, Inc., Santa Barbara, CA 93117	805-683-6379

Soldering Equipment, Printed Circuit-4100

§ ABWJ Systems Corp., Morrisville, NC 27560	919-481-1001
§ ABW Systems, Corporation, Morrisville, NC 27560	919-481-1001
† Air-Vac Engrg., Milford, CT 06460	203-874-2541
§† Analytic Technology Corp., Redmond, WA 98052	206-883-2445;800-428-2808
§† A.P.E. Corporation, Medford, NY 11763	516-654-1197
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
§ Beau Tech, Portland, ME 04101	207-775-6139
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
§† Chemtronics Inc., Hauppauge, NY 11788	516-582-3322:800-645-5244
† Contact East, N. Andover, MA 01845	508-682-2000
Creative Automation Co., Sun Valley, CA 91352	818-767-6220
† Cyclo-Tronics, Inc., Wauconda, IL 60084	708-526-0800
Electronic Controls Design, Milwaukie, OR 97222	503-659-6100
Electrovert USA Corp., Grand Prairie, TX 75050	214-606-1900
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
# EMC Global Technologies Inc., Doylestown, PA 18901	215-340-0650
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
§ ENDECO, Leads Metal Products Inc., Indianapolis, IN 46202-2748	317-631-7200
§ ESICO/TRITON, Triton Industries Inc., Deep River, CT 06417	203-526-5361
Φ# Exselect Engineering Ltd., Concord, Ont., CANADA LK42G2	416-738-4077
§ Hexacon Electric Co., Roselle Park, NJ 07204	908-245-6200
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Hollis Automation, Esterline Corporation, Nashua, NH 03063	603-889-1121
§ Manncorp, Huntingdon Valley, PA 19006	215-364-6100
Nu-Concept Systems, Colmar, PA 18915	215-822-8400:800-762-4278
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
§† PACE, Inc., Laurel, MD 20723-1990	301-490-9860
§† Plato Products, Inc., Industry, CA 91748	818-965-8044:800-423-4510
§ Portasol, Oglesby and Botler Ltd., Charlotte, NC 28226	704-543-6239
Research Inc., Minneapolis, MN 55424	612-941-3300
Sikama International, Inc., Santa Barbara, CA 93117	805-683-6379
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§† Technical Devices, Torrance, CA 90503	310-618-8437
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Ungar, Rubbermaid Office Products Group, Buena Park, CA 90621	714-994-2510
† Unit Design, Orange, CA 92665	714-282-8100
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137	708-469-7473

Soldering Equipment, Resistance-4100

§† Antex Division, Marblehead, MA 01945	617-631-7100
§† A.P.E. Corporation, Medford, NY 11763	516-654-1197
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862	508-667-4111
§† Contact, Inc., Edgecomb, ME 04556	207-882-6116
† Contact East, N. Andover, MA 01845	508-682-2000
§ ESICO/TRITON, Triton Industries Inc., Deep River, CT 06417	203-526-5361
Ewald Instruments Corp., Kent, CT 06757	203-927-3278
# HMC Hub Material Company, Canton, MA 02021	617-821-1870
Hughes Aircraft Co Industrial Products Division, Carlsbad, CA 92009	619-931-3000
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101	617-890-4750
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237	410-574-4960
§† PACE, Inc., Laurel, MD 20723-1990	301-490-9860

Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 ... 800-628-8862
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§ Tech Spray, Inc., Amarillo, TX 79105 ... 806-372-8523
Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762

Soldering Systems, Temperature Controlled-4100

§ ABWJ Systems Corp., Morrisville, NC 27560 ... 919-481-1001
§ ABW Systems, Corporation, Morrisville, NC 27560 ... 919-481-1001
† Air-Vac Engrg., Milford, CT 06460 ... 203-874-2541
§† Analytic Technology Corp., Redmond, WA 98052 ... 206-883-2445;800-428-2808
† Aremco Products, Inc., Ossining, NY 10562 ... 914-762-0685
Automated Production Concepts, Wayne, NJ 07470 ... 201-831-8300
† BTU International, Inc.:BTU Systems Division, N. Billerica, MA 01862 ... 508-667-4111
† Contact East, N. Andover, MA 01845 ... 508-682-2000
§† Cooper Tools, Raleigh, NC 27622 ... 919-781-7200
Creative Automation Co., Sun Valley, CA 91352 ... 818-767-6220
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 ... 914-241-1008
§† ENDECO, Leads Metal Products Inc., Indianapolis, IN 46202-2748 ... 317-631-7200
EPM Corporation, Baltimore, MD 21221 ... 410-686-7800
§ ESICO/TRITON, Triton Industries Inc., Deep River, CT 06417 ... 203-526-5361
Φ# Exselect Engineering Ltd., Concord, Ont., CANADA LK42G2 ... 416-738-4077
§ Hexacon Electric Co., Roselle Park, NJ 07204 ... 908-245-6200
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
§ Hollis Automation, Esterline Corporation, Nashua, NH 03063 ... 603-889-1121
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044 ... 602-968-6241
§ Manncorp, Huntingdon Valley, PA 19006 ... 215-364-6100
§† Metcal, Inc., Menlo Park, CA 94025 ... 800-776-1778
§ Micro Electronic Systems, Inc., Bridgewater, CT 06752 ... 203-350-5004
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 ... 410-574-4960
§† M.M. Newman Corporation, Marblehead, MA 01945 ... 617-631-7100
† Newman, M. M., Corp., Heli-Tube Div., Marblehead, MA 01945 ... 617-631-7100
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904 ... 619-451-1799
§† PACE, Inc., Laurel, MD 20723-1990 ... 301-490-9860
§† Plato Products, Inc., Industry, CA 91748 ... 818-965-8044;800-423-4510
§ Portasol, Oglesby and Botler Ltd., Charlotte, NC 28226 ... 704-543-6239
Research Inc., Minneapolis, MN 55424 ... 612-941-3300
Sikama International, Inc., Santa Barbara, CA 93117 ... 805-683-6379
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 ... 800-628-8862
§† Technical Devices, Torrance, CA 90503 ... 310-618-8437
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§ Ungar, Rubbermaid Office Products Group, Buena Park, CA 90621 ... 714-994-2510
† Unit Design, Orange, CA 92665 ... 714-282-8100
§† Wall Lenk Corporation, Kinston, NC 28502-3349 ... 919-527-4186

Soldering Equipment, Ultrasonic-4100

Sanwa Components USA Inc., Marlboro, MA 01752 ... 508-480-9555
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990

Soldering Equipment, Vapor Phase-4100

Centech Corporation, Minneapolis, MN 55420 ... 612-881-8245
† Manncorp, Huntingdon Valley, PA 19006 ... 215-364-6100
§ Multicore Solders, Inc., Richardson, TX 75081 ... 214-238-1224
Research Inc., Minneapolis, MN 55424 ... 612-941-3300

Soldering Guns, Irons & Desoldering Tools-4600 – *See Vol. C*

Soldering Machines, Laser-4100

† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
† Control Laser Corp., Orlando, FL 32809 ... 407-438-2500
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
Raytheon Co., Laser Products, Quincy, MA 02169 ... 617-479-5300
U. S. Laser Corp., Wyckoff, NJ 07481 ... 201-848-9200

Soldering (MIL)-2440 – *See Vol. B*
Solenoids, Linear-4550 – *See Vol. B*
Solenoids, Proportional-4550 – *See Vol. B*
Solenoids, Rotary-4550 – *See Vol. B*
Solenoids, Stepping-4550 – *See Vol. B*
Solenoids (MIL)-2440 – *See Vol. B*
Solvents – See Cleaners & Solvents (Vol. C)
Sonar Systems-2440 – *See Vol. B*
S100 Bus – See Board Computers & Subassemblies (Vol. D)
Sound Absorbing Materials-2500 – *See Vol. C*
Sound Level Indicators – See Meters, Audio Level (Vol. D)
Sound Recording Equip. – See Microphones (Vol. D), Recorders (Vol. D), etc.
Spacers & Standoffs-2500 – *See Vol. C*
Spaghetti – See Tubing, Spaghetti (Vol. C)
Spark Gaps-4300 – *See Vol. B*

Speakers, Explosion & Flame Proof-1300

JEMA, Wilmette, IL 60091, 708-251-3600 ... D•1046-1047
† **MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 ... D•1052**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ... D•1060
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 ... 516-437-6000
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 ... 314-349-3110
§ Celestion Industries, Inc., Holliston, MA 01746 ... 508-429-6706
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
† Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 ... 505-822-8801
† MTX Oaktron, Monroe, WI 53566 ... 608-328-5560
§ Poly-Planar Inc., Warminster, PA 18974 ... 215-675-7805
§ Quam-Nichols Co., Chicago, IL 60637 ... 312-488-5800
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 ... 818-362-9516

Speakers, Horn-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 ... D•1028
§ **International Components Corp., Melville, NY 11747, 516-293-1500 .. D•1037-1038**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ... D•1041
JEMA, Wilmette, IL 60091, 708-251-3600 ... D•1046-1047
§ **MG Electronics, Hauppauge, NY 11788, 516-582-3400 ... D•1051**
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 ... D•1052
§ **Projects Unlimited, Dayton, OH 45414, 513-890-1918 ... D•1057**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .. D•1065**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... D•1067
AES Corp., Peabody, MA 01960 ... 508-535-7310
§† Aiphone, Bellevue, WA 98005 ... 206-455-0510
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 ... 314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 ... 201-934-8500
§ Celestion Industries, Inc., Holliston, MA 01746 ... 508-429-6706
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 708-584-2300
§ Fourjay Industries, Dayton, OH 45413-0617 ... 513-890-6444
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
§ Harris Corp., Dracon Div., Camarillo, CA 93012 ... 805-987-9511
International Microelectronics, Arlington, TX 76003 ... 817-473-1730
† Kolin Inds., Inc., Pound Ridge, NY 10576 ... 914-764-5775
LZR Electronics, Inc., Gaithersburg, MD 20879 ... 301-921-4600
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 ... 216-442-2286
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 ... 505-822-8801
Mouser Electronics, Santee, CA 92071 ... 800-346-6873
Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
Mouser Electronics, Gilroy, CA 95020 ... 800-346-6873
MultiNational Resources, Inc., Bedford, NH 03110 ... 603-622-3550
§ Paso Sound Products, Pelham, NY 10803 ... 914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386 ... 815-229-7773
§ Pyle Industries, Inc., Huntington, IN 46750 ... 219-356-1200
§ Recoton Corp., Long Island City, NY 11101 ... 718-392-6442
§ Shure Brothers Inc., Evanston, IL 60202-3696 ... 708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ... 516-957-8700;800-645-5516
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 ... 818-362-9516
§ Wheelock, Inc., Long Branch, NJ 07740 ... 908-222-6880

Speakers, Intercom-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 ... D•1028
§ **International Components Corp., Melville, NY 11747, 516-293-1500 .. D•1037-1038**
JEMA, Wilmette, IL 60091, 708-251-3600 ... D•1044,1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ... D•1048
§ **MG Electronics, Hauppauge, NY 11788, 516-582-3400 ... D•1051**
† **MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 ... D•1052**
§ **Quam-Nichols Co., Chicago, IL 60637, 312-488-5800 ... D•1059**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ... D•1060
† **S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500 .. C•1082-1083**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .. D•1065**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... D•1067
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 ... 516-437-6000
§† Aiphone, Bellevue, WA 98005 ... 206-455-0510
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 ... 314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 ... 201-934-8500
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710 ... 510-527-6666
† Marine Electric Systems Inc., Clifton, NJ 07014-1135 ... 201-471-6800
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 708-584-2300
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
§ Harris Corp., Dracon Div., Camarillo, CA 93012 ... 805-987-9511
† Marine Electric Systems, Clifton, NJ 07014-1135 ... 201-471-6800
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 ... 216-442-2286
§† MTX Oaktron, Monroe, WI 53566 ... 608-328-5560
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 ... 708-824-1133
§ Paso Sound Products, Pelham, NY 10803 ... 914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386 ... 815-229-7773
§ Poly-Planar Inc., Warminster, PA 18974 ... 215-675-7805
§ Pyle Industries, Inc., Huntington, IN 46750 ... 219-356-1200
§ Recoton Corp., Long Island City, NY 11101 ... 718-392-6442
§ Shure Brothers Inc., Evanston, IL 60202-3696 ... 708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ... 516-957-8700;800-645-5516
§ Tektone Sound & Signal, Lake Park, FL 33403 ... 407-844-2383
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 ... 818-362-9516
§ Wheelock, Inc., Long Branch, NJ 07740 ... 908-222-6880

Speakers, Midrange-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 ... D•1028
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ... D•1029
§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ... D•1032**

§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037-1038
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1048
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 D•1051
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
§ Quam-Nichols Co., Chicago, IL 60637, 312-488-5800 D•1059
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 D•1067
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Celestion Industries, Inc., Holliston, MA 01746 508-429-6706
CTS Corporation, Elkhart, IN 46514 219-293-7511
§† Hartley Products, Wilmington, NC 28406 919-392-0500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ MTX Oaktron, Monroe, WI 53566 608-328-5560
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
§ Pyle Industries, Inc., Huntington, IN 46750 219-356-1200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 516-957-8700;800-645-5516
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 818-362-9516
§ Wheelock, Inc., Long Branch, NJ 07740 908-222-6880

Speakers, Musical Instrument-1300

§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 D•1067
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Celestion Industries, Inc., Holliston, MA 01746 508-429-6706
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Hartley Products, Wilmington, NC 28406 919-392-0500
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§† MTX Oaktron, Monroe, WI 53566 608-328-5560
§ Pyle Industries, Inc., Huntington, IN 46750 219-356-1200
§ Quam-Nichols Co., Chicago, IL 60637 312-488-5800
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 516-957-8700;800-645-5516

Speakers, Paging — See Speakers, Intercom (Vol. D)

Speakers, Pillow-1300

International Components Corp., Melville, NY 11747, 516-293-1500 D•1037
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 D•1060
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Recoton Corp., Long Island City, NY 11101 718-392-6442
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511;800-626-1511

Speakers, Public Address-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 D•1028
§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037-1038
JEMA, Wilmette, IL 60091, 708-251-3600 D•1044,1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1048
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 D•1051
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
§ Quam-Nichols Co., Chicago, IL 60637, 312-488-5800 D•1059
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 D•1067
§† Aiphone, Bellevue, WA 98005 206-455-0510
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191 800-357-5240
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§ Celestion Industries, Inc., Holliston, MA 01746 508-429-6706
† Marine Electric Systems, Inc., Clifton, NJ 07014-1135 201-471-6800
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ Fourjay Industries, Dayton, OH 45413-0617 513-890-6444
§ Harris Corp., Dracon Div., Camarillo, CA 93012 805-987-9511
† Kolin Inds., Inc., Pound Ridge, NY 10576 914-764-5775
† Marine Electric Systems, Clifton, NJ 07014-1135 201-471-6800
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§† MTX Oaktron, Monroe, WI 53566 608-328-5560
§ Paso Sound Products, Pelham, NY 10803 914-738-4800
§ Perma Power Elctrns., Niles, IL 60714 312-763-0763
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Poly-Planar Inc., Warminster, PA 18974 215-675-7805
§ Precision Electronics, Franklin Park, IL 60131 708-678-5350
§ Pyle Industries, Inc., Huntington, IN 46750 219-356-1200
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 516-957-8700;800-645-5516
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
§ Wheelock, Inc., Long Branch, NJ 07740 908-222-6880

Speakers, Replacement (Incl. Aircraft, Automotive & TV)-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 D•1028
§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1048
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 D•1051
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 D•1067
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§† MTX Oaktron, Monroe, WI 53566 608-328-5560
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Pyle Industries, Inc., Huntington, IN 46750 219-356-1200
§ Quam-Nichols Co., Chicago, IL 60637 312-488-5800
§ Recoton Corp., Long Island City, NY 11101 718-392-6442
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 516-957-8700;800-645-5516

Speakers, Submergence Proof-1300

§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1050
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
§† MTX Oaktron, Monroe, WI 53566 608-328-5560
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 818-362-9516

Speakers, Subminiature-Also See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 D•1028
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 D•1029
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 D•1032
§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037-1038
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 D•1041
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1048-1050
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 D•1051
§ Projects Unlimited, Dayton, OH 45414, 513-890-1918 D•1057
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 D•1060
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 D•1063
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
† Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
MTX Oaktron, Monroe, WI 53566 608-328-5560
MultiNational Resources, Inc., Bedford, NH 03110 603-622-3550
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
§# Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511;800-626-1511
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 516-957-8700;800-645-5516
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512
† Telectro Systems Corp., Corona, NY 11368 718-651-8900

Speakers, Tweeter-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 D•1028
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 D•1029
§ International Components Corp., Melville, NY 11747, 516-293-1500 D•1037-1038
JEMA, Wilmette, IL 60091, 708-251-3600 D•1046-1047
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 D•1048,1050
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 D•1051
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010 D•1052
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 D•1065
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 D•1067
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Celestion Industries, Inc., Holliston, MA 01746 508-429-6706
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§† Hartley Products, Wilmington, NC 28406 919-392-0500
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286

§† MTX Oaktron, Monroe, WI 53566	608-328-5560
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
§ Pyle Industries, Inc., Huntington, IN 46750	219-356-1200
§ Quam-Nichols Co., Chicago, IL 60637	312-488-5800
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516

Speakers, Weatherproof-1300

§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**D•1029**
# **The Hirol Company, Ft. Lauderdale, FL 33309, 305-974-4900**	**B•1072**
§ **International Components Corp., Melville, NY 11747, 516-293-1500**	**D•1037**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1046-1047**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**D•1049-1050**
† **MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010**	**D•1052**
§ **Quam-Nichols Co., Chicago, IL 60637, 312-488-5800**	**D•1059**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**D•1065**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
AES Corp., Peabody, MA 01960	508-535-7310
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191	800-357-5240
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
§ Celestion Industries, Inc., Holliston, MA 01746	508-429-6706
CTS Corporation, Elkhart, IN 46514	219-293-7511
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§ Fourjay Industries, Dayton, OH 45413-0617	513-890-6444
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ Harris Corp., Dracon Div., Camarillo, CA 93012	805-987-9511
§† Hartley Products, Wilmington, NC 28406	919-392-0500
† Kolin Inds., Inc., Pound Ridge, NY 10576	914-764-5775
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297	216-442-2286
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
§† MTX Oaktron, Monroe, WI 53566	608-328-5560
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Poly-Planar Inc., Warminster, PA 18974	215-675-7805
§ Pyle Industries, Inc., Huntington, IN 46750	219-356-1200
§ Recoton Corp., Long Island City, NY 11101	718-392-6442
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516
§ Wheelock, Inc., Long Branch, NJ 07740	908-222-6880

Speakers, Woofer-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**D•1028**
§ **International Components Corp., Melville, NY 11747, 516-293-1500**	**D•1037-1038**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1046-1047**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**D•1050**
§ **MG Electronics, Hauppauge, NY 11788, 516-582-3400**	**D•1051**
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010	**D•1052**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**D•1065**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**D•1067**
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
§ Celestion Industries, Inc., Holliston, MA 01746	508-429-6706
CTS Corporation, Elkhart, IN 46514	219-293-7511
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984	708-584-2300
§† Hartley Products, Wilmington, NC 28406	919-392-0500
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297	216-442-2286
§ MTX Oaktron, Monroe, WI 53566	608-328-5560
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
§ Pyle Industries, Inc., Huntington, IN 46750	219-356-1200
§ Quam-Nichols Co., Chicago, IL 60637	312-488-5800
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516

Speakers (MIL)-2440 — *See Vol. B*

Speaker Systems-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**D•1028**
§ **International Components Corp., Melville, NY 11747, 516-293-1500**	**D•1037-1038**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1046-1047**
MG Electronics, Hauppauge, NY 11788, 516-582-3400	**D•1051**
MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409, 612-825-1010	**D•1052**
§ ArgosSound, Argos Products Co., Inc., Genoa, IL 60135-1191	800-357-5240
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1	416-828-2400
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
§ Celestion Industries, Inc., Holliston, MA 01746	508-429-6706
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710	510-527-6666
§ Paso Sound Products, Pelham, NY 10803	914-738-4800
§ Pyle Industries, Inc., Huntington, IN 46750	219-356-1200
Quam-Nichols Co., Chicago, IL 60637	312-488-5800
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
University Sound, Inc., Mark IV Industries, Sylmar, CA 91342	818-362-9516

Spectrometers-2900

Bomem Inc., Quebec, CANADA G2E-5S5	418-877-2944;1-800-888-FTIR
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076	708-677-4700
Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
Spectron Engineering Inc., Denver, CO 80223	303-733-1060
Spiricon, Inc., Logan, UT 84321	801-753-3729
§† ULVAC North America Corporation, Kennebunk, ME 04043	207-985-2973
§† UTI Instruments Co., San Jose, CA 95131	408-428-9400

Speech Compression & Synthesis Equipment-2325

Ariel Corporation, Highland Pk., NJ 08904	908-249-2900
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Covox, Inc., Eugene, OR 97402	503-342-1271
§ Echo Speech Corp., Carpinteria, CA 93013	805-684-4593
Eletech Electronics, Inc., Anaheim, CA 92805	714-385-1707
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Mimic, Inc., Islington, MA 02090-0705	617-329-9593
§ Rhetorex, Inc., Campbell, CA 95008	408-370-0881
§ Sierra Semiconductor Corp., San Jose, CA 95132	408-263-9300
Spectral Innovations, Santa Clara, CA 95054-1807	408-727-1314
§ Spectrum Signal Proc., Blaine, WA 98231-0025	1-800-663-8986 (US);604-421-5422
§ Voice Connexion, Irvine, CA 92714	714-261-2366

Speed Drives, Motor — See Controls, Motor Speed (Vol. D)
Spiral Wrap — See Tubing, Spiral Wrap (Vol. C)
Splicers, Coaxial Cable-5400 — *See Vol. C*
Splicers, Wire (Incl. Butt & Cap Types)-5400 — *See Vol. C*
Splicers, Wire, Waterproof-5400 — *See Vol. C*
Splices-2100 — *See Vol. C*
Splicing Equipment, Fiber Optic-5400 — *See Vol. C*

Splicing Equipment, Magnetic Tape-1300

§† Benjamin International, Inc., Lake Worth, FL 33461	407-533-0064

Splitters/Combiners, Power — See Dividers, Power (Vol. A)

Spoolers, Printer Buffers-2325

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Advanced Video Products, E-Systems, Westford, MA 01886	508-692-2020
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Digital Products, Inc., Waltham, MA 02154	617-647-1234;800-243-2333
† Eventide, Inc., Little Ferry, NJ 07643	201-641-1200
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Infoprint, Inc., Micro Electronic Business, Inc., Chicago, IL 60641	312-539-6045
Intelligent Interfaces, Inc., Stone Mountain, GA 30086	404-381-9891;1-800-842-0888
§ National Instruments, Austin, TX 78730-5039	512-794-0100
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757

Spoolers, Punched Tape — See Readers, Punched Tape (Vol. D)
Springs (All Types)-2500 — *See Vol. C*
Stabilizers, Current — See Current Sources (Vol. D), Regulators, Current (Vol. D)

Stabilizers, Line Impedance-4050

§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
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† Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
§† JMK, Inc., Amherst, NH 03031	603-886-4100
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800

Stabilizers, Voltage — See Regulators & Stabilizers, Voltage (Vol. D), Transformers, Voltage Regulating (Vol. A), Voltage Sources (Vol. D)
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Stampings, Deep Drawn Metal-2500 — *See Vol. C*
Stampings, Precious Metal — See Preforms, Precious Metal (Vol. C)

Standards, Atomic Beam-2900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1186**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402**
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Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642

Standards, Current-2900

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Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900 .... B•1963
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§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1694,1697-1698
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§ Digital Products, Inc., Waltham, MA 02154 .... 617-647-1234;800-243-2333
§ EDA Instruments, Inc., Toronto, ON, CANADA M4H1H1 416-425-7800
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090 .... 708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
MarLee Switch Co., Upland, CA 91786 714-982-8988
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
Nu Data, Inc., Little Silver, NJ 07739 908-842-5757
OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§# Support Systems Intl. Corp., Richmond, CA 94804 510-234-9090
§ Via West Interface, Inc., Tucson, AZ 85705 .... 602-623-5716;1-800-266-5716

Switches, Decade-5100 – *See Vol. B*
Switches, Diode-3450 – *See Vol. A*
Switches, DIP-5100 – *See Vol. B*
Switches, Fiber Optic-2475 – *See Vol. B*
Switches, Foot Pedal, Mat, Ribbon, etc.-5100 – *See Vol. B*
Switches, Hall Effect-5100 – *See Vol. B*
Switches, High Voltage (Over 250 Volts)-5100 – *See Vol. B*
Switches, Illuminated-5100 – *See Vol. B*
Switches, Intelligent-5100 – *See Vol. B*
Switches, Interlock-5100 – *See Vol. B*
Switches, Keyboard-5150 – *See Vol. B*
Switches, Key Lock-5100 – *See Vol. B*
Switches, Leaf, Single/Multiple-5100 – *See Vol. B*
Switches, Lever/Paddle-5100 – *See Vol. B*
Switches, Limit-5100 – *See Vol. B*
Switches, Liquid Level-5100 – *See Vol. B*
Switches, Lock — See Switches, Key Lock (Vol. B)
Switches, Low Voltage-5100 – *See Vol. B*
Switches, Matrix-5100 – *See Vol. B*
Switches, Membrane-5150 – *See Vol. B*
Switches, Mercury Displacement-5100 – *See Vol. B*
Switches, Microwave — See Switches, Diode (Vol. A)
Switches, Momentary Action-5100 – *See Vol. B*
Switches, Multiposition-5100 – *See Vol. B*
Switches, Optical-3700 – *See Vol. B*
Switches, Paddle Handle — See Switches,Lever/Paddle (Vol. B)
Switches, Photoelectric-3700 – *See Vol. B*
Switches, Power-5100 – *See Vol. B*
Switches, Pressure-5100 – *See Vol. B*
Switches, Program-5100 – *See Vol. B*
Switches, Programmable-5100 – *See Vol. B*
Switches, Proximity-5100 – *See Vol. B*
Switches, Pushbutton-5100 – *See Vol. B*
Switches, Reed-5100 – *See Vol. B*
Switches, RF-5100 – *See Vol. B*
Switches, Rocker-5100 – *See Vol. B*

Switches, Rotary-5100 – *See Vol. B*
Switches, Sealed-5100 – *See Vol. B*
Switches, Shock/Water Proof-5100 – *See Vol. B*
Switches, Slide-5100 – *See Vol. B*
Switches, Snap Action (All Types)-5100 – *See Vol. B*
Switches, Solid State-5100 – *See Vol. B*
Switches, Stepper-5100 – *See Vol. B*
Switches, Tap – See Switches, Rotary (Vol. B)
Switches, Thermally Actuated-5300 – *See Vol. B*
Switches, Thumbwheel-5100 – *See Vol. B*
Switches, Tilt – See Switches, Mercury Displacement (Vol. B)
Switches, Toggle-5100 – *See Vol. B*
Switches, Touch Actuated-5100 – *See Vol. B*
Switches, Vacuum-5100 – *See Vol. B*
Switches (MIL), Non-RF-2440 – *See Vol. B*
Switches (MIL), RF-2440 – *See Vol. B*
Switch Hardware-2500 – *See Vol. C*
Switching Assemblies, PCB Mounted-5150 – *See Vol. B*

Switching Systems, Audio-1300

CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**D•1028**
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1563-1565**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1200**
Signal Switch Company, Corona, CA 91720, 909-736-5404	**B•1479**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
† **Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220**	**D•1074-1075**
360 Systems, Tarzana, CA 91356, 818-342-3127	**D•1072**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
§† Aiphone, Bellevue, WA 98005	206-455-0510
Amber Inds., Inc., Carrollton, TX 75006	214-490-9801
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026	314-349-3110
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446	201-934-8500
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710	510-527-6666
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
L-Com Inc., N. Andover, MA 01845	508-682-6936
MarLee Switch Co., Upland, CA 91786	714-982-8988
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035	708-432-7915
§ ROH, Portland Instrument, Glendale, CA 91201	818-500-0137
† RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504	818-840-6749
† ST Olektron Systems, Signal Technology Corp., Webster, MA 01570	508-943-7440
United Switch Company, Seattle, WA 98199	206-282-8823

Switching Systems, Test & Measurement-2900

CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192-1193**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1538**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1287**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1101,1166,1199**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1200**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
Amber Inds., Inc., Carrollton, TX 75006	214-490-9801
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911	619-575-4011
Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
ITF Corp., Buford, GA 30518	404-945-3844
L-Com Inc., N. Andover, MA 01845	508-682-6936
MarLee Switch Co., Upland, CA 91786	714-982-8988
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
Micronetics, Hudson, NH 03051	603-883-2900
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
Signal Switch Company, Corona, CA 91720	909-736-5404
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054	609-234-7900
United Switch Company, Seattle, WA 98199	206-282-8823
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Switch Seals, Environmental-2500 – *See Vol. C*

Synchronizers, PCM Bit-1900

Loral Data Systems, Sarasota, FL 34230	813-371-0811
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257

Synchronizers (MIL), Antenna-2440 – *See Vol. B*

Synchros-4900

ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600	**D•1190**
Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950	**D•1197**
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100	**D•1312**
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444

Synchros & Resolvers (MIL)-2440 – *See Vol. B*

Synchro Transmitters, Solid State-4900

† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510	D•1176,1178
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600**	**D•1190**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950**	**D•1197**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100**	**D•1208-1209**
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100

Synthesizers, Frequency-2900

† **Continental Microwave Technology Inc., Glen Cove, NY 11542, 516-759-5600**	**A•1357**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500**	**A•1402-1403**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274-2275**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1288**
Programmed Test Sources, Littleton, MA 01460, 508-486-3008	**D•1316**
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411**	**A•1854**
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410	718-441-5207
Anadex Inc., Camarillo, CA 93012	805-987-9660
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
# Communication Solutions, Inc., Baltimore, MD 21237	410-574-4557
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dowty Avionics, Arcadia, CA 91006	818-445-5955
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Fox Electronics, Ft. Myers, FL 33905	813-693-0099
† Greenray Inds., Inc., Mechanicsburg, PA 17055	717-766-0223
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903	714-759-2952
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968	215-666-1900
KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001	916-638-5500
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Luff Research, Inc., Floral Park, NY 11001	516-358-2880
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§† Raytheon-La Jolla, La Jolla, CA 92038	619-457-1000
RF Industries Ltd. (Nuelink), San Diego, CA 92126	619-549-6340;800-233-1728
† SCITEQ Electronics, Inc., San Diego, CA 92123	619-292-0500
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Spectracom Corporation, East Rochester, NY 14445-1484	716-381-4827
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
Tucker Electronics, Dallas, TX 75355-1419	214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000
† Z Communications, Inc., San Diego, CA 92126	619-621-2700

Synthesizers, Speech-2325

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Covox, Inc., Eugene, OR 97402	503-342-1271

Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN	415-288-0390
† Mimic, Inc., Islington, MA 02090-0705	617-329-9593
NAVAN Corporation, Media, PA 19063	215-352-8464
PERX,Inc., Corte Madera, CA 94925	415-927-0155
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
§ Voice Connexion, Irvine, CA 92714	714-261-2366

Synthesizers, Waveform-2900

Continental Microwave Technology Inc., Glen Cove, NY 11542, 516-759-5600	**A•1357**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274-2275**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1288**
Analogic Corp., Peabody, MA 01960	508-977-3000
† Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
NF Electronic Instruments, State College, PA 16801	814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
PERX,Inc., Corte Madera, CA 94925	415-927-0155
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
SCITEQ Electronics, Inc., San Diego, CA 92123	619-292-0500
§ Syntest Corp., Marlboro, MA 01752-9973	508-481-7827
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Systems Integration — See Services, Systems Integration (Vol. D)

Tables, Positioning-4900

† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
ITF Corp., Buford, GA 30518	404-945-3844
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
§† Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Tables, Rotary-4900

† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
Mercotac Inc., Carlsbad, CA 92009	619-431-7723
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
§† Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Tables, X-Y Axis-4900

† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
Microvision Corp., Los Gatos, CA 95008	408-374-3158
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
§† Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Tablets, Digitizing-2000

§ ALTEK Corporation, Silver Springs, MD 20904-7802	301-572-2555
§ Oce Graphics USA, Inc., Mountain View, CA 94039-7169	415-964-7900
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Tachometers, Generator-4900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1295**
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041	**B•1299**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100	**B•1306**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Aetna Engineering, Van Nuys, CA 91409-7749	818-831-0607
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Bertsch U.S., Vista, CA 92083	619-727-7420
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Dixson, Inc., Grand Junction, CO 81503	303-244-1241
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† Electric Tachometer, Philadelphia, PA 19142	215-726-7723
† GIC Thermodynamics, Royal Oak, MI 48073	313-280-1648
§† Globe Motors, Dayton, OH 45404	513-228-3171
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Island Components Group, Bohemia, NY 11716	516-563-4224
§† Kollmorgen Motion Technologies Group, Radford, VA 24141	800-77-SERVO
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
§ Metermaster, Tempe, AZ 85282	602-431-0015
Micronel U.S., Vista, CA 92083	619-727-7400
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Motor-Tronics, Inc., Vista, CA 92083	619-727-7425
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210	704-525-8962
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
Vibrac, Amherst, NH 03031	603-882-6777
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§† WestCon, Marion, OH 43302	614-382-5771

Tachometers, Optical-4900

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875	908-805-1900
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
† Force, Inc., Christiansburg, VA 24073	703-382-0462
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
† Stock Drive-Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844

Tachometers, Pulse-4900

BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600	**B•1917**
† **BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414**	**B•1917**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1391**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Aetna Engineering, Van Nuys, CA 91409-7749	818-831-0607
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Autronics Corp., Arcadia, CA 91006	818-445-5470
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311	818-341-6161
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117	805-968-0782
† BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203	501-851-4000
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Dynapar, Gurnee, IL 60031	312-662-2666
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† Electric Tachometer, Philadelphia, PA 19142	215-726-7723

§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 ... 203-848-9271
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724 ... 908-542-5151;800-932-0489
§† Mansfield & Green Division, A Subsidiary of Ametek Inc., Largo, FL 34643 ... 813-536-7831
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701 ... 813-822-2529
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ... 603-883-3390; 800-999-3390
† Motor Technology, Inc., Dayton, OH 45429 ... 513-294-1041
§ Newport Electronics, Santa Ana, CA 92704-4426 ... 714-540-4914;800-NEWPORT
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
Philips Technologies, Airpax Instruments, Cheshire, CT 06410 ... 203-271-6000
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410 ... 203-271-6000
Portescap U.S., Inc., Hauppauge, NY 11788 ... 516-234-3900
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Teledyne Gurley, Troy, NY 12181 ... 518-272-6300;800-759-1844
Texmate, Inc., Vista, CA 92083-8397 ... 619-598-9899
§ TIF Instruments, Inc., Miami, FL 33150 ... 305-757-8811
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 ... 215-539-4400
Vernitech:Vernitron Corp., Deer Pk., NY 11729 ... 516-586-5100
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 ... 707-938-2121

Tachometers, Stroboscopic-4900

Alpha-M Corp. Dallas, TX 75229 ... 214-406-0424
§ AVO Biddle Instruments, Blue Bell, PA 19422 ... 215-646-9200
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 ... 404-981-6225
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§† Mansfield & Green Division, A Subsidiary of Ametek Inc., Largo, FL 34643 ... 813-536-7831
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ... 603-883-3390; 800-999-3390
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 ... 715-723-1141
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
§ Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
§ SKF Condition Monitoring, San Diego, CA 92123-1841 ... 619-496-3400
§ Sperry, A. W. Instruments, Smithtown, NY 11787 ... 516-231-7050;800-645-5398
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199

Tape and Reel Packaging-4100

MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553 ... C•1764
ADE, Inc., Chicago, IL 60633 ... 312-646-3400
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ... 214-422-1844; 1-800-872-0044
† Dover Electronics Manufacturing, Binghamton, NY 13902-5212 ... 607-772-7563
Eastern Marking Machines, Hempstead, NY 11550 ... 800-835-2393
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
§ Fox Electronics, Ft. Myers, FL 33905 ... 813-693-0099
§ 3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.

Tape Decks — See Recorders, Magnetic Tape (Vol. D), Transports, Tape (Vol. D)
Tape Duplicators — See Duplicators, Magnetic Tape (Vol. D), Perforators,Paper Tape (Vol. D)

Tape Recording Accessories-1300

† International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 ... D•1039
† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410 ... 407-622-3715
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
The Hirol Company, Ft. Lauderdale, FL 33309 ... 305-974-4900
JEMA, Wilmette, IL 60091 ... 708-251-3600
Loral Data Systems, Data Recorders, Sarasota, FL 34230 ... 813-371-0811
§† 3M Audio and Video Markets Division, St. Paul, MN 55144-1000 ... 612-733-7644
† Memtec Corp., Salem, NH 03079 ... 603-893-8080
§ Northeast Innovations, Inc., Concord, NH 03302 ... 603-736-8260
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245 ... 213-322-9370
§ Recoton Corp., Long Island City, NY 11101 ... 718-392-6442
† Reproduction Technologies Inc., Bristol, IN 46507-0790 ... 219-848-5233
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506 ... 818-566-6700
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900

Tape Search Equipment-2000

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ... D•1116,1186-1189
† TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411 ... D•1077,1207
Datachron Inc., Anaheim, CA 92805 ... 714-385-1705
FTS/AUSTRON, Austin, TX 78761-4766 ... 512-251-2341
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900
Voice Identification, Somerville, NJ 08876 ... 908-526-3408

Tape Transport Mechanisms (Audio)-1300

JEMA, Wilmette, IL 60091 ... 708-251-3600

Tape Winders-2000

† Gorman Machine Corp., Brockton, MA 02401 ... 508-588-2900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Infranor, Naugatuck, CT 06770 ... 203-729-8258;800-BE-SERVO
† Telectro Systems Corp., Corona, NY 11368 ... 718-651-8900

Tapes, Electrical Insulation-3100 – *See Vol. C*
Tapes, Films & Foils, Pressure Sensitive-2500 – *See Vol. C*
Tapes, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C)

Tapes, Magnetic, Cartridge-2000

§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
§ Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134 ... 408-432-1300
JEMA, Wilmette, IL 60091 ... 708-251-3600
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000

Tapes, Magnetic, Reel-2000

§ Ampex Corp., Redwood City, CA 94063-3199 ... 415-367-2011
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
JEMA, Wilmette, IL 60091 ... 708-251-3600

Tapes, Magnetic, Digital Cassette-2000

Ampex Corp., Redwood City, CA 94063-3199 ... 415-367-2011
§† Analog & Digital Peripherals, Inc.(ADPI), Troy, OH 45373 ... 513-339-2241
§# Computerware, Inc., Vienna, VA 22182-2266 ... 703-821-8200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
JEMA, Wilmette, IL 60091 ... 708-251-3600

Tapes, Numerical Control-2000

Caristrap Internatonal, Inc., Chomedey, Laval, QUEBEC, CANADA H7SIN8 ... 1-800-361-9466
§ Flexible Technologies, Arlon, E. Providence, RI 02914 ... 401-434-2340

Tapes, Plastic Coated for Cable-2500 – *See Vol. C*
Technical Books-4200 – *See Vol. C*
Tees, Coaxial-3450 – *See Vol. A*
Tees, Waveguide-3450 – *See Vol. A*
Telecommunication Systems & Equipment — See Communications Systems, Telephone (Vol. D)
Telemetering Systems, Electronic — See Communications Systems, Telemetering (Vol. D)
Telephone Cords & Cord Sets — See Cords & Cord Sets, Telephone
Telephone Handsets — See Handsets, etc. (Vol. D)
Telephone Ringing Generators — See Generators. Signal (Vol. D)

Telephone Sets, Exclusion Key-1900

§ Dataprobe, Englewood, NJ 07631 ... 201-569-6464
§ GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837
§ R-Columbia Prods. Co., Inc., Highland Park, IL 60035 ... 708-432-7915

Telephone Systems, Telephones Sound Powered — See Communications Systems, Telephone (Vol. D)

Teleprinters, Auto Send/Receive-1900

Computer Devices, Nutting Lake, MA 01865 ... 508-663-4980
GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837

Teleprinters, Keyboard Send/Receive-1900

Computer Devices, Nutting Lake, MA 01865 ... 508-663-4980
§† Dataproducts New England, Inc., Wallingford, CT 06492 ... 203-265-7151
GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837

Teleprinters, Receive Only-1900

Singer Data Products, Inc., Bensenville, IL 60106, 708-860-6500 ... D•1107
Computer Devices, Nutting Lake, MA 01865 ... 508-663-4980
GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837

Teletypewriters & Equipment-1900

Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844

Television Systems & Equipment, Cable (CATV) & Master Antenna (MATV) — See CATV Systems & Equipment (Vol. D)

Television Systems & Equipment Closed Circuit-1900

§Φ American Laser Systems, Inc., Santa Barbara, CA 93160 ... 805-967-0423
§ Artel Communications Corp., Hudson, MA 01749 ... 508-562-2100
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ ATV Research, Inc., Dakota City, NE 68731 ... 402-987-3771
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123 ... 619-277-6700
† Colorado Video, Inc., Boulder, CO 80306 ... 303-530-9580
Components Corp., Denville, NJ 07834 ... 201-627-0290
§ Dage-MTI, Michigan City, IN 46360 ... 219-872-5514
§ Dotronix, New Brighton, MN 55112 ... 612-633-1742
ElectroPhysics Corp., Fairfield, NJ 07004 ... 201-882-0211
§Φ Gordon Instruments, Inc., Orchard Park, NY 14127 ... 716-662-5353;1-800-333-2672
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN ... 053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821 ... 508-671-5000
HDS Inc., Reston, VA 22091 ... 703-620-6200
† LCT Electronics Corporation, Anaheim, CA 92801 ... 714-991-7317
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 ... 516-226-8950
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 ... 310-828-7496
§† Metron Optics Inc., Solana Beach, CA 92075-0690 ... 619-755-4477

Princeton Electronic Products, North Brunswick, NJ 08902	908-297-4448
†Stenning Instruments, Inc., Camarillo, CA 93010	805-484-4996
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
†Telectro Systems Corp., Corona, NY 11368	718-651-8900
§Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Television Equipment Assocs., So. Salem, NY 10590-0393	914-763-8893
§Video Automation Systems, Pound Ridge, NY 10576	914-764-4613
Volpi-MFG-USA, Auburn, NY 13021-1289	315-255-1737

Temperature Compensators-5300 – *See Vol. B*

Temperature Indicators – See Meters, Temperature (Vol. D), Labels, Temperature Indicating (Vol. B)

Temperature Sensors – See Transducers, Temperature (Vol. B)

Tensile Testers – See Testers, Material (Vol. D)

Terminal Blocks (Incl. Barrier Types)-2100 – *See Vol. C*

Terminal Blocks, DIN Rail Mounted-2100 – *See Vol. C*

Terminal Blocks, Panel Mounting-2100 – *See Vol. C*

Terminal Blocks, PC Board Mounting-2100 – *See Vol. C*

Terminal Boards-2100 – *See Vol. C*

Terminal Boards, Blocks, Strips (MIL)-2440 – *See Vol. B*

Terminal Equipment, Digital-2000

†ADC Telecommunications, Inc., Minneapolis, MN 55435	612-938-8080
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Computerwise, Olathe, KS 66062	913-829-0600
§†Di/An Controls, Inc., Brockton, MA 02401	508-599-8000
Electrocom Industries, S. Bend, IN 46615	219-232-2743
Enterprise Systems Corp., Dover, NH 03820	603-742-7363
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Genicom Corp., Waynesboro, VA 22980	703-949-1471
§GTE Supply, GTE, Irving, TX 75038	800-433-4837
Memodyne, Newton, MA 02164	617-964-6556 (in MA);800-255-1510
†Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
§NEC Technologies, INc., Boxborough, MA 01719	508-264-8000
Ramcom Systems, Torrance, CA 90503	310-214-8601
§SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638	310-802-8425
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§Terminal Data Corp., Rockville, MD 20855	301-921-8282

Terminal Strips (Incl. Barrier Types)-2100 – *See Vol. C*

Terminals, Communications-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
#Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
†Enterprise Systems Corp., Dover, NH 03820	603-742-7363
§GTE Supply, GTE, Irving, TX 75038	800-433-4837
Librascope Corp., Loral Corp., Glendale, CA 91201	818-244-6541
§Penril DataComm Networks, Gaithersburg, MD 20878	301-921-8600

Terminals, Credit Authorization-2000

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Xico, Inc., Chatsworth, CA 91311	818-709-4403

Terminals, Crimp-2100 – *See Vol. C*

Terminals, Data Display (Incl. Alphanumeric & Graphic)-2000

DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
†IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
§Action Instruments, San Diego, CA 92123	619-279-5726
§AFE Technologies Inc., Charlottesville, VA 22901	804-974-7801
§Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Analogic Corp., Peabody, MA 01960	508-977-3000
Apollo Display Technologies, Inc., Holtsville, NY 11742	1-800-LCD-STOC; 516-654-1143
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
†Applied Display Technology, Inc., Newbury Park, CA 91320	805-498-4984
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
Barco Chromatics, Tucker, GA 30084	404-493-7000
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
Chrono-log Corp., Havertown, PA 19083	800-247-6665
§Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§Computer Devices, Nutting Lake, MA 01865	508-663-4980
Computerwise, Olathe, KS 66062	913-829-0600
Control Module, Enfield, CT 06082	203-745-2433
Coreco, Inc., St. Laurent, Que., CANADA H4T 1V8	800-361-4914;514-333-1301
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§†Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
§Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
Endicott Research Group, Endicott, NY 13760	607-754-9187
#Enterprise Systems Corp., Dover, NH 03820	603-742-7363
Excel Technology Intl. Corp., Belle Mead, NJ 08502	908-874-4747
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
General Digital Corp., Enfield, CT 06082	203-741-7171
ΦGenstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§GTE Supply, GTE, Irving, TX 75038	800-433-4837
Honeywell Information Systems, Waltham, MA 02154	617-895-6000
§Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
†Miltope Corp., Melville, NY 11747	516-420-0200
#Mitronics, Rolling Hills, CA 90274	310-377-2022
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
Ramcom Systems, Torrance, CA 90503	310-214-8601
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
†Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tektronix, Inc., Display Products, Beaverton, OR 97077	503-627-5000
§Terminal Data Corp., Rockville, MD 20855	301-921-8282
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
VL Electronics, Inc., Los Angeles, CA 90010-1603	213-738-8700
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Terminals, Data Entry, Multimedia-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
§Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
†Applied Display Technology, Inc., Newbury Park, CA 91320	805-498-4984
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Computerwise, Olathe, KS 66062	913-829-0600
Control Module, Enfield, CT 06082	203-745-2433
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Genicom Corp., Waynesboro, VA 22980	703-949-1471
§GTE Supply, GTE, Irving, TX 75038	800-433-4837
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
§Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
§Xico, Inc., Chatsworth, CA 91311	818-709-4403
§Zebra Technologies Corporation, Vernon Hills, IL 60061-3109	708-634-6700

Terminals, Disconnecting-2100 – *See Vol. C*

Terminals, Display-2000

DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
†Applied Display Technology, Inc., Newbury Park, CA 91320	805-498-4984
Aydin Corp., Horsham, PA 19044	215-657-7510
Barco Chromatics, Tucker, GA 30084	404-493-7000
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
Control Module, Enfield, CT 06082	203-745-2433
§#Craft Data, Inc., Mission Viejo, CA 92691	714-582-8284
§†Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
#Enterprise Systems Corp., Dover, NH 03820	603-742-7363
General Digital Corp., Enfield, CT 06082	203-741-7171
§GTE Supply, GTE, Irving, TX 75038	800-433-4837
§Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
§Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
†Miltope Corp., Melville, NY 11747	516-420-0200
Omnicomp Graphics Corp., Houston, TX 77043	713-464-2990
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
Quantum Electronics, Inc., Lewistown, PA 17044	717-242-1132
†Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Tektronix, Inc., Display Products, Beaverton, OR 97077	503-627-5000
†UCE, Inc., Norwalk, CT 06854	203-838-7509
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§Zebra Technologies Corporation, Vernon Hills, IL 60061-3109	708-634-6700

Terminals, Double Level-2100 – *See Vol. C*

Terminals, Feedthru-2500 – *See Vol. C*

Terminals, Ferrule, Cable-End-2100 – *See Vol. C*

Terminals, Financial-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Computer Devices, Nutting Lake, MA 01865	508-663-4980

Terminals, Fused-2100 – *See Vol. C*

Terminals, Ground-2100 – *See Vol. C*

Terminals, Intelligent/Programmable, Batch-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
§ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§Action Instruments, San Diego, CA 92123	619-279-5726
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Φ#Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
General Digital Corp., Enfield, CT 06082	203-741-7171
§McKenzie Technology, Fremont, CA 94538	510-651-2700

Terminals, Intelligent/Programmable, Interactive-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**

ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Acroloop Motion Control Systems, Inc., Chanhassen, MN 55317	612-474-4500
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Analogic Corp., Peabody, MA 01960	508-977-3000
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
† Applied Display Technology, Inc., Newbury Park, CA 91320	805-498-4984
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§# Craft Data, Inc., Mission Viejo, CA 92691	714-582-8284
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Terminal Data Corp., Rockville, MD 20855	301-921-8282
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Terminals, Intelligent/Programmable, Multiprogramming-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Control Module, Enfield, CT 06082	203-745-2433
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
Miltope Business Products, Miltope Grp., Melville, NY 11747	516-420-0200; 516-756-7650
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Terminals, Intelligent/Programmable, Multiuser-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Aydin Corp., Horsham, PA 19044	215-657-7510
Control Module, Enfield, CT 06082	203-745-2433
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
General Digital Corp., Enfield, CT 06082	203-741-7171
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
LJ Technical Systems, Hauppauge, NY 11788	516-234-2100
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Terminals, Intelligent/Programmable, Real Time-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
QSI Corporation, Salt Lake City, UT 84115, 801-466-8770	**D•1105**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aydin Corp., Horsham, PA 19044	215-657-7510
Control Module, Enfield, CT 06082	203-745-2433
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Editron Systems Inc., Teaneck, NJ 07666	201-837-0051
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
General Digital Corp., Enfield, CT 06082	203-741-7171
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
Xcel Controls, Inc., Mishawaka, IN 46544	219-259-7804

Terminals, Intelligent/Programmable, Transaction Processing-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
Burr-Brown Corp., Tucson, AZ 85734	602-746-1111
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Two Technologies,Inc., Horsham, PA 19044	215-441-5305

Terminals, LED/Lamp Indicators-2100 – *See Vol. C*
Terminals, Lug (All Types)-2100 – *See Vol. C*
Terminals, Miniature & Subminiature-2100 – *See Vol. C*

Terminals, Point-of-Sale-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Autosplice, Inc., San Diego, CA 92121	619-535-0077
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
§† Di/An Controls, Inc., Brockton, MA 02401	508-599-8000
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
General Digital Corp., Enfield, CT 06082	203-741-7171
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
§ Peripheral Resources, Los Angeles, CA 90035	310-552-3888;800-533-2297
Printer Products, Boston, MA 02134	617-254-1200
§ Teledyne Penn-Union, Edinboro, PA 16412	814-734-1631 Ext. 382
Westrex Products, Boston, MA 02134	617-254-1200
§ Xico, Inc., Chatsworth, CA 91311	818-709-4403

Terminals, Printed Circuit Board-2100 – *See Vol. C*
Terminals, Push-on, Quick Disconnect — See Connectors & Terminals, Push-on, Quick Disconnect (Vol. C)
Terminals, Solderless-2100 – *See Vol. C*
Terminals, Standoff-2100 – *See Vol. C*
Terminals, Threaded-2100 – *See Vol. C*
Terminals, Touch — See Touch Terminals (Vol. D)
Terminals, Turret-2100 – *See Vol. C*
Terminals, Wirewrap-2100 – *See Vol. C*
Terminals (MIL), Ground Data-2440 – *See Vol. B*
Terminals & Splices, Solderless, Less Than 30 A, Insul/Uninsul-2100 – *See Vol. C*
Terminals & Splices, Solderless, Greater Than 30 A, Insul/Uninsul-2100 – *See Vol. C*
Terminals & Splices, Solderless, Compression, Insul/Uninsul-2100 – *See Vol. C*
Terminals & Splices, Solderless, Crimp, Insul/Uninsul-2100 – *See Vol. C*
Terminals & Splices, Solderless, Wire Nuts, Insul/Uninsul-2100 – *See Vol. C*
Terminals & Splices, Solderless, Wire Wrap, Insul/Uninsul-2100 – *See Vol. C*
Terminations, Antenna-Also See Dummy Loads-2500 – *See Vol. C*
Terminations, Cable-2100 – *See Vol. C*
Terminations, Fiber Optic-2475 – *See Vol. B*
Terminations, Microwave-3450 – *See Vol. A*

Terminations, VHF, Video, Pulse-1900

† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020	**C•1500-1501,1505**
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Compac, Holbrook, NY 11741	516-585-3400
† Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
† Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
# Manger Electric Company, Inc., Stamford, CT 06902	203-348-7761
† North Hills Signal Processing, Syosset, NY 11791	516-682-7740
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Termination Systems, Wire & Cable-2100 – *See Vol. C*
Test Assemblies (MIL)-2440 – *See Vol. B*
Test Equipment — See Meters, Acceleration, Admittance, etc. (Vol. D)

Test Equipment, Closed Circuit TV-Also See Television Systems & Equipment, Closed-Circuit-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1293**
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
Dotronix, New Brighton, MN 55112	612-633-1742
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
§ Television Equipment Assocs., So. Salem, NY 10590-0393	914-763-8893
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
§ Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109	317-788-9351

Test Equipment, Color TV-2900

§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104	**D•1292-1293**
§† Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Marconi Instruments, Allendale, NJ 07401	201-934-9050
§ Metermaster, Tempe, AZ 85282	602-431-0015
Microvision Corp., Los Gatos, CA 95008	408-374-3158
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100

§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
§ Telemet, Geotel, Inc., Hauppauge, NY 11788	516-436-7260
Television Equipment Assocs., So. Salem, NY 10590-0393	914-763-8893

Test Equipment, Data Communications, Monitors & Recorders-2900

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1145**
Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1311**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1145**
§ ACR Systems Inc., Surrey,B.C., CANADA V3W 4N8	604-591-1128
Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
Analogic Corp., Peabody, MA 01960	508-977-3000
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
†Φ Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
Ballard Technology, Seattle, WA 98117	206-782-8704;1-800-829-1553
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
Computer Devices, Nutting Lake, MA 01865	508-663-4980
§ Contact East, N. Andover, MA 01845	508-682-2000
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
Electro Rent Corp., Van Nuys, CA 91411	800-688-1111
§ Ergotron, Inc., Eagan, MN 55121	612-452-8135
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
International Test Instruments, Tustin, CA 92680	714-573-9000
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
§ Metermaster, Tempe, AZ 85282	602-431-0015
Noetic Technologies, Pompano Beach, FL 33064	305-941-6343;800-780-6343
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054	609-234-7900
Φ Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
Transmagnetics, Farmingdale, NY 11735	516-293-3100
Vektrex Electronic Systems, Inc., San Diego, CA 92126	619-578-6787
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385

Test Equipment, Fiber Optic-2475 – *See Vol. B*

Test Equipment, Mechanical Impedance-2900

Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
† Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811

Test Equipment, Memory Systems, Disk-2900

§ Adaptec, Inc., Milpitas, CA 95035	408-945-8600
Alliance Laboratories, Inc., Redwood City, CA 94063	415-366-8220
† AVA Instrumentation, Inc., Ben Lomond, CA 95005	408-336-2281
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Flexstar Technology, Fremont, CA 94539	510-440-0170
International Test Instruments, Tustin, CA 92680	714-573-9000
Peripherals, Costa Mesa, CA 92626	714-540-4925;800-468-6888
Φ Pioneer Magnetics, Santa Monica, CA 90404	310-829-6751
Pioneer Research, Inc Santa Monica, CA 90404	310-829-6751
Samatic Winding Machine, Jenlor Ltd., Fayetteville, NY 13066	315-637-9080
Simulex Corporation, Tustin, CA 92680	714-730-1500
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Volpi-MFG-USA, Auburn, NY 13021-1289	315-255-1737
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385

Test Equipment, Motor-2900

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2286,2289**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electric Device, Canfield, OH 44406	216-533-1111
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Klein Tools, Inc., Chicago, IL 60659-9033	708-677-9500
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MOTORTEST, Inc., Columbus, OH 43229	614-882-7821
Phenix Technologies, Accident, MD 21520	301-746-8118
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Vibrac, Amherst, NH 03031	603-882-6777

Test Equipment, Rental & Lease - Also See Services, Electrical Measurement & Test-2900

Φ **AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123**	**D•1228-1229,1231-1233**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244**
†Φ **Noise Com Inc., Paramus, NJ 07652, 201-261-8797**	**D•1311**
†Φ **Quantum Data Inc., Elgin, IL 60123, 708-888-0450**	**D•1318**
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566	**D•1322**
† Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730	617-275-0850; 800-937-4688
Elan Systems, Inc., Morgan Hill, CA 95037	800-541-3526
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
Flexstar Technology, Fremont, CA 94539	510-440-0170
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Φ Julie Research Labs., New York, NY 10001	212-633-6625
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
MSD3, Morgan Hill, CA 95037	800-541-3526;408-778-7267
MSD3, Morgan Hill, CA 95037	800-541-3526;408-778-7267
Φ Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
RAG Electronics, Inc., Canoga Park, CA 91304	818-998-6500;800-732-3457
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Step Engineering, Sunnyvale, CA 94088	408-733-7837
Φ Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442	305-570-5580
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010.800-854-8385

Test Equipment, RFI Susceptibility-2900

Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400	**D•1013**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**D•1277**
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010	518-843-2600
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
† LogiMetrics, Plainview, NY 11803	516-349-1700
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
Nearfield Systems, Inc., Carson, CA 90745	310-518-4277
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081	201-379-7778; 800-367-5566
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038	800-952-5302
† Spira Manufacturing Corp., North Hollywood, CA 91605	818-764-8222
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412

Test Equipment (MIL)-2440 – *See Vol. B*

Test Fixtures, ATE-2900

Elastomeric Technologies, Inc., Hatboro, PA 19040, 215-672-0787;215-672-4741	**C•1314**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192**
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Alliance Laboratories, Inc., Redwood City, CA 94063	415-366-8220
AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
† Artronics Corporation, Portsmouth, NH 03802-5070	603-433-3111
# Aspen Test Engrg., Inc., Boulder, CO 80301	303-530-1466
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665	714-998-1961
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1	416-475-2607; 800-667-2518
† Cabletest Products Co., Malden, MA 02148	617-665-2932
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
Elgar Electronics Corporation, San Diego, CA 92121	619-450-0085;800-733-5427
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
§ Emulation Technology, Inc., Santa Clara, CA 95051	408-982-0660
Ergotron, Inc., Eagan, MN 55121	612-452-8135
§ Everett Charles Technologies, Fixture Division, Clifton Park, NY 12065	518-877-7042
Green Engineering, Melrose, MA 02176	617-665-8994

† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
ITF Corp., Buford, GA 30518	404-945-3844
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
LTX Corporation, Westwood, MA 02090	617-461-1000
Marketech, Inc., Elk River, MN 55330-7034	612-441-8664
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
† Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
§† Temptronic Corporation, Newton, MA 02158	617-969-2501
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
# The Test Connection, Inc., Hunt Valley, MD 21030	410-584-2500
† The Test Grp., Inc., San Diego, CA 92121	619-452-4160
Testronics, McKinney, TX 75069	214-542-3111
§ T T I Testron Inc., Woonsocket, RI 02895	401-766-9100
† Virgina Panel Corporation, Waynesboro, VA 22980	703-949-8376
§ "World" Test Systems, Inc., Waynesboro, VA 22980	703-949-6753

Test Methods (MIL)-2440 – *See Vol. B*
Test Points, PCB Mounted-2500 – *See Vol. C*

Test Sets, Communications-1900

Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1311**
† ADC Telecommunications, Inc., Minneapolis, MN 55435	612-938-8080
Amber Electric Design, St. Laurent, PQ,, CANADA H4T 1V8	514-333-8748 800-361-3697
§ Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
† Aydin Corp., Horsham, PA 19044	215-657-7510
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311	818-718-6300
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320	410-584-7400
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ Harris Corp., Dracon Div., Camarillo, CA 93012	805-987-9511
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
§ Leviton Telcom, Leviton Manufacturing, Bothell, WA 98021-4416	206-485-4288; 206-486-2222
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
New Wave Instruments, Provo, UT 84604	801-373-4909
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
Telegenix Grim Corp., Cherry Hill, NJ 08034	609-424-5220
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Test Sets (MIL)-2440 – *See Vol. B*

Test Systems, Automatic DC-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1241**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1287-1288**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289**
† **NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900**	**D•1303**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2286**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
§ Audio Precision, Inc., Beaverton, OR 97075-3070	503-627-0832
Carco Electronics, Menlo Pk., CA 94025-1106	415-321-8174
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Green Engineering, Melrose, MA 02176	617-665-8994
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Hypatia Inc., Hillsboro, OR 97123-9074	503-628-2936
Julie Research Labs., New York, NY 10001	212-633-6625
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810	203-744-0096
LTX Corporation, Westwood, MA 02090	617-461-1000
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
Meissner Industries, Dover, NJ 07801	201-366-1700
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
System General Corporation, Milpitas, CA 95035	408-263-6667
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
§ U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325

Test Systems, Board-2900

AZ-COM, Orinda, CA 94563-2206, 510-254-5400	**D•1235**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659	**C•1680**
Analogic Corp., Peabody, MA 01960	508-977-3000
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
# Aspen Test Engrg., Inc., Boulder, CO 80301	303-530-1466
B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Cabletest Products Co., Malden, MA 02148	617-665-2932
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Digalog Systems, Inc., New Berlin, WI 53151	414-797-8000
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
Flexstar Technology, Fremont, CA 94539	510-440-0170
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
GenRad, Inc., Concord, MA 01742-2174	508-369-4400
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
† Hopper Electronics, Phoenix, AZ 85021-1932	602-870-3093
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
§ McKenzie Technology, Fremont, CA 94538	510-651-2700
Noetic Technologies, Pompano Beach, FL 33064	305-941-6343;800-780-6343
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
§† Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schroff, Inc., Warwick, RI 02886	401-732-3770
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367	1-201-838-2755
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
# The Test Connection, Inc., Hunt Valley, MD 21030	410-584-2500
Testronics, McKinney, TX 75069	214-542-3111
Trio-Tech International, San Fernando, CA 91340	818-365-9200
§ Vu-Data Corporation, San Diego, CA 92121	619-452-7670
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Test Systems, Component-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1241**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1285-1286**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2286**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**C•1438, D•2291**
Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050	**D•1326**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
† Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
Analogic Corp., Peabody, MA 01960	508-977-3000
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Data Environment, Inc., Portland, OR 97291	503-531-0765
Direct Conversion Technique, Inc., Chicago, IL 60641	312-283-1690
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
§ Everett Charles Technologies, Fixture Division, Clifton Park, NY 12065	518-877-7042
Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
ITF Corp., Buford, GA 30518	404-945-3844
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810	203-744-0096
LTX Corporation, Westwood, MA 02090	617-461-1000
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
Maxus Electronic Corp., Boulder, CO 80301	303-447-1226
Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
§ Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064

§† Qualitec Technologies, Inc., Fremont, CA 94538 510-498-1046
§ Sienna Technologies Inc., St. Paul, MN 55120 612-688-6106
§ H H Smith, NT-T Inc., Meadville, PA 16335 814-724-6440
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367 1-201-838-2755
System General Corporation, Milpitas, CA 95035 408-263-6667
Techron Div., Crown Intl., Inc., Elkhart, IN 46517 219-294-8300
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598 510-932-6900
Testronics, McKinney, TX 75069 214-542-3111
Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
† VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
§ Wavetek Corp., San Diego, CA 92123 619-279-2200

Test Systems, Computer Controlled (Automatic)-2900

Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1278
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1286-1287
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1289
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 .... D•1142
MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 .... D•1300
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900 .... D•1303
† **Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2286**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 .... D•1317**
§† **Quantum Data Inc., Elgin, IL 60123, 708-888-0450 .... D•1318**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773 .... D•1325
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
Alliance Laboratories, Inc., Redwood City, CA 94063 415-366-8220
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
Anacom Gen. Corp., Anaheim, CA 92805-6235 714-774-8080
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Artronics Corporation, Portsmouth, NH 03802-5070 603-433-3111
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
A-Systems Inc., Charlottesville, VA 22902 804-295-7200
† Atec, Inc., Houston, TX 77055 713-468-7971
§ Audio Precision, Inc., Beaverton, OR 97075-3070 503-627-0832
# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260 216-784-4456
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1 .... 416-475-2607; 800-667-2518
Carco Electronics, Menlo Pk., CA 94025-1106 415-321-8174
CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 909-394-4410
Clarke-Hess Communications Research Corp., New York, NY 10011 212-255-2940
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
§ Cyber Sys., Inc., Anaheim, CA 92806 714-502-6950
CYTEC Corp., Penfield, NY 14526 .... 716-381-4740;800-346-3117
Data Engineering, Inc., Margate, FL 33063-3206 305-971-0400
Data Environment, Inc., Portland, OR 97291 503-531-0765
Digalog Systems, Inc., New Berlin, WI 53151 414-797-8000
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
Eclypse International Corp., Ontario, CA 91761-9925 909-947-8839
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
Energy Systems, Vancouver, WA 98682 206-896-8310
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
† Graseby Infrared, Graseby PLC, Orlando, FL 32826 407-282-7700
Green Engineering, Melrose, MA 02176 617-665-8994
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
HILEVEL Technology, Tustin, CA 92680 714-573-1888
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 619-931-3000
Impulse Engineering, Goleta, CA 93117-1023 805-685-2030
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
§# Instrumentation Services, Inc., Minneapolis, MN 55427 612-544-8916
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
ITF Corp., Buford, GA 30518 404-945-3844
Keithley MetraByte, Taunton, MA 02780 508-880-3000
Kenmar/TSI, Raleigh, NC 27604 919-876-6049
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
KineticSystems Corp., Lockport, IL 60441 815-838-0005
† LogiMetrics, Plainview, NY 11803 516-349-1700
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810 203-744-0096
LTX Corporation, Westwood, MA 02090 617-461-1000
Matec Instruments, Inc., Hopkinton, MA 01748 508-435-9039
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
Meissner Industries, Dover, NJ 07801 201-366-1700
Microvision Corp., Los Gatos, CA 95008 408-374-3158
†# Microwave Design Svcs., Inc., Ft. Walton Beach, FL 32548 904-664-1234
MTS Systems, Eden Prairie, MN 55344 612-937-4000
§ National Instruments, Austin, TX 78730-5039 512-794-0100
Nearfield Systems, Inc., Carson, CA 90745 310-518-4277
Northeast Innovations, Inc., Concord, NH 03302 603-736-8260
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Ocean Motions Co., Barrington, RI 02806 401-246-1394
† Optimized Devices, Inc., Pleasantville, NY 10570 914-769-6100
Orion Instruments, Inc., Menlo Park, CA 94025 .... 415-327-8800;800-767-4666
Phenix Technologies, Accident, MD 21520 301-746-8118
Probe-Rite, Inc., Santa Clara, CA 95052 408-727-0100
† Production Automation, Inc., San Jose, CA 95131-1026 408-894-9064
§ Pulse Instruments Co., Torrance, CA 90502 310-515-5330
§ Quality Automation, Inc., Anaheim, CA 92805 714-491-8535
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
SCHENCK PEGASUS Corporation, Troy, MI 48083 313-689-9000
Sensor Corp., Scottdale, PA 15683 412-887-4080
†Φ Sheldon Instruments, Provo, UT 84604 801-376-7861
§ Sienna Technologies Inc., St. Paul, MN 55120 612-688-6106
§ Spectrascan, Inc., Colorado Springs, CO 80907 719-599-9254
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
Support Electronics, Inc., Butler, NJ 07405-1367 1-201-838-2755
System General Corporation, Milpitas, CA 95035 408-263-6667
† Technical Witts, Inc., Glendale, AZ 85308 602-439-1833
# Techrand Corp. of America, Muskegon, MI 49444 616-798-2930
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876 301-353-1550
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598 510-932-6900
Testronics, McKinney, TX 75069 214-542-3111
Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Vektrex Electronic Systems, Inc., San Diego, CA 92126 619-578-6787
Vu-Data Corporation, San Diego, CA 92121 619-452-7670
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000
§ "World" Test Systems, Inc., Waynesboro, VA 22980 703-949-6753
§ Ziatech, San Luis Obispo, CA 93401 805-541-0488

Test Systems, Development Engineering — See Services, Assembly & Fabrication (Vol. D)

Test Systems, Functional-2900

† Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
† Artronics Corporation, Portsmouth, NH 03802-5070 603-433-3111
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Aspen Test Engrg., Inc., Boulder, CO 80301 303-530-1466
A-Systems Inc., Charlottesville, VA 22902 804-295-7200
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
Data Environment, Inc., Portland, OR 97291 503-531-0765
Digalog Systems, Inc., New Berlin, WI 53151 414-797-8000
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ Everett Charles Technologies, Fixture Division, Clifton Park, NY 12065 .. 518-877-7042
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
HILEVEL Technology, Tustin, CA 92680 714-573-1888
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300 714-595-6030
Kenmar/TSI, Raleigh, NC 27604 919-876-6049
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
LTX Corporation, Westwood, MA 02090 617-461-1000
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818 219-489-2511
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Probe-Rite, Inc., Santa Clara, CA 95052 408-727-0100
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Reliability Incorporated, Houston, TX 77218 713-492-0550
† Russtech Engineering Company, Inc., Mission Viejo, CA 92691 714-472-0880
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
§ Sienna Technologies Inc., St. Paul, MN 55120 612-688-6106
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
System General Corporation, Milpitas, CA 95035 408-263-6667
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598 510-932-6900
Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
Vu-Data Corporation, San Diego, CA 92121 619-452-7670
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

Test Systems, Hall Effect-2900

GMW Associates, Redwood City, CA 94064, 415-368-4884 .... D•1262-1263
Alliance Laboratories, Inc., Redwood City, CA 94063 415-366-8220
Keithley Instrs., Cleveland, OH 44139 800-552-1115
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818 219-489-2511
Testronics, McKinney, TX 75069 214-542-3111
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

Test Systems, IC-2900

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516 .... D•1251
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1286
Vector Electronic Co., Inc., Sylmar, CA 91342, 818-365-9661;800-423-5659 .... C•1680
Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448

Test Systems, IC-2900 (Cont'd)

Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
LTX Corporation, Westwood, MA 02090	617-461-1000
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
§ Quality Automation, Inc., Anaheim, CA 92805	714-491-8535
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
System General Corporation, Milpitas, CA 95035	408-263-6667
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
Testronics, McKinney, TX 75069	214-542-3111
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

Test Systems, Thermal Stress-2550

Φ **Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004**	**D•1212-1213**
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
Flexstar Technology, Fremont, CA 94539	510-440-0170
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
§† Temptronic Corporation, Newton, MA 02158	617-969-2501
Thermodynamic Engineering Inc., Camarillo, CA 93012	805-484-0472

Test Systems, Ultrasonic, Computer Controlled-2900

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Matec Instruments, Inc., Hopkinton, MA 01748	508-435-9039
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958

Test Systems, VLSI & Memory-2900

† Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
† Artronics Corporation, Portsmouth, NH 03802-5070	603-433-3111
Digalog Systems, Inc., New Berlin, WI 53151	414-797-8000
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
HILEVEL Technology, Tustin, CA 92680	714-573-1888
LTX Corporation, Westwood, MA 02090	617-461-1000
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
System General Corporation. Milpitas, CA 95035	408-263-6667
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900

Testers, Accelerometer — See Calibrators, Accelerometer (Vol. D)

Testers, Armature-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
Phenix Technologies, Accident, MD 21520	301-746-8118
Samatic Winding Machine, Jenlor Ltd., Fayetteville, NY 13066	315-637-9080

Testers, Battery-2900

§ **Alexander Manufacturing Company, Mason City, IA 50402, 800-247-1821;515-423-8955**	**D•1423**
§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666**	**D•1248**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
† American Monarch, Minneapolis, MN 55421	612-788-9161
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
EMICO Inc., Manchester, NH 03109	603-669-5121
Energy Systems, Vancouver, WA 98682	206-896-8310
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Maccor, Inc., Tulsa, OK 74107	918-446-1874
† NCE:National Custom Enterprises, Inc., Burnsville, MN 55337-2559	612-890-1360
NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† Q.V.S., Inc., East Orange, NJ 07017	201-673-3996
§ Schauer Manufacturing, Cincinnati, OH 45242	513-791-3030
§ Shurite Meters, A Prime Technology Co., North Branford, CT 06471	203-481-5721
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

† Xenotronix Inc., Valencia, CA 91355	805-257-4793

Testers, Bit Rate-2900

Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1311**
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
Loral Data Systems, Sarasota, FL 34230	813-371-0811
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
Vektrex Electronic Systems, Inc., San Diego, CA 92126	619-578-6787
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Testers, Burn-in, Aging-2550

AZ-COM, Orinda, CA 94563-2206, 510-254-5400	**D•1235**
Elastomeric Technologies, Inc., Hatboro, PA 19040, 215-672-0787;215-672-4741	**C•1314**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2288,2290**
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
† Artronics Corporation, Portsmouth, NH 03802-5070	603-433-3111
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Cybortronics Inc., Irvine, CA 92718	714-855-2814
§ Delta Design, San Diego, CA 92123-1111	619-292-5000
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
Flexstar Technology, Fremont, CA 94539	510-440-0170
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
ITF Corp., Buford, GA 30518	404-945-3844
Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Milton Ross Co., Warrington, PA 18976	215-491-0600
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
§ Phenix Technologies, Accident, MD 21520	301-746-8118
§ Reliability Incorporated, Houston, TX 77218	713-492-0550
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
§† Temptronic Corporation, Newton, MA 02158	617-969-2501
† Tenney Engineering, Union, NJ 07083	908-686-7870
† Trio-Tech International, San Fernando, CA 91340	818-365-9200

Testers, Cable-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226**
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1240-1241**
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244-1245**
§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666**	**D•1248**
§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
§ **ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305**	**D•1320-1321**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Allen Technology, Sutton, NE 68979	402-773-5285
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
A-Systems Inc., Charlottesville, VA 22902	804-295-7200
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
AVO International, TBG, Dallas, TX 75237	214-333-3201
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Beta Automation, Inc., Newbury Park, CA 91320	805-499-5785
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665	714-998-1961
Cabletest Products Co., Malden, MA 02148	617-665-2932
§ Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
§ Datatran Corp., Denver, CO 80223	303-778-0870
Del Electronics Corp., Valhalla, NY 10595	914-686-3600
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473

Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
† Glenair Inc., Glendale, CA 91201-2497	818-247-6000
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
§ Harris Corp., Dracon Div., Camarillo, CA 93012	805-987-9511
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
§ L-Com Inc., N. Andover, MA 01845	508-682-6936
§ Leviton Telcom, Leviton Manufacturing, Bothell, WA 98021-4416	206-485-4288; 206-486-2222
§ Metermaster, Tempe. AZ 85282	602-431-0015
Noetic Technologies, Pompano Beach, FL 33064	305-941-6343;800-780-6343
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
Phenix Technologies, Accident, MD 21520	301-746-8118
Rutherford Research, Rutherford. NJ 07070	201-933-2091
Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Testronics, McKinney, TX 75069	214-542-3111
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
Torotron Corp., Mt. Vernon, NY 10550	914-664-2050
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549	914-241-1300
Vann Instruments, Albuquerque, NM 87106	505-265-2498
Vitrek Corporation, San Diego, CA 92121	619-586-1695
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Weetech, Inc., Wee GmbH, Sharon, MA 02067	617-784-1208
§ Weidmuller Inc., Paladin Tools, Newbury Park, CA 91320	805-499-0318

Testers, Capacitor-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231	216-349-0370
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ HC Protek, Northvale, NJ 07647	201-767-7242
Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232	813-371-2600
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
§ Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
RE America, Westlake, OH 44145	216-871-7617
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Testronics, McKinney, TX 75069	214-542-3111
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Testers, Circuit — See Testers, Signal Tracing (Vol. D)

Testers, Coil & Transformer-2900

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050	**D•1326**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328**
Voltech, Inc., Ashland, MA 01721, 508-881-7329	**D•1332**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Associated Research, Inc., Lake Bluff, IL 60044	708-295-3312
Atlantic Magnetics, Inc., Pompano Beach, FL 33069	305-979-7920
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
A/Z-Tech, Inc. R&D Lab, Indiana Institute of Technlg., Fort Wayne, IN 46803	219-422-5561
Cambridge Technology, Inc., Watertown, MA 02172	617-923-1181
Clarke-Hess Communications Research Corp., New York, NY 10011	212-255-2940
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050	516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ International Electro Magnetics, Inc., Palatine, IL 60067	708-358-4622
§ Metermaster, Tempe, AZ 85282	602-431-0015
# Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237	410-574-4960
† Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
Rutherford Research, Rutherford, NJ 07070	201-933-2091
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992	219-563-2191
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801	617-938-8390; 1-800-933-9319

Testers, Communication Equipment (Automatic)-2900

FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
§ **Marconi Instruments, Allendale, NJ 07401, 201-934-9050**	**D•1297**
Noise Com Inc., Paramus, NJ 07652, 201-261-8797	**D•1311**
§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Amber Electric Design, St. Laurent, PQ., CANADA H4T 1V8	514-333-8748; 800-361-3697
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1	416-475-2607; 800-667-2518
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Contact East, N. Andover, MA 01845	508-682-2000
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
§ Dataprobe, Englewood, NJ 07631	201-569-6464
† Dataproducts Corporation, Woodland Hills, CA 91367-2499	818-888-4014
Gandalf Data Inc., Gandalf Technologies Inc., Wheeling, IL 60090	708-541-6060; 800-GANDALF
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Impulse Engineering, Goleta, CA 93117-1023	805-685-2030
ITF Corp., Buford, GA 30518	404-945-3844
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
New Wave Instruments, Provo, UT 84604	801-373-4909
Northeast Innovations, Inc., Concord, NH 03302	603-736-8260
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601,1-800-RACAL-55
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
§ Team Systems, Santa Clara, CA 95051	408-720-6877
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp. Germantown, MD 20876	301-353-1550
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Testers, Component Linearity-2900

Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ Contact East, N. Andover, MA 01845	508-682-2000
Direct Conversion Technique, Inc., Chicago, IL 60641	312-283-1690
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
† RE America, Westlake, OH 44145	216-871-7617
Solatron Enterprises, Inglewood, CA 90302	213-678-4981
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Testronics, McKinney, TX 75069	214-542-3111
Φ Venable Industries, Inc., Austin, TX 78758	512-837-2888,800-262-2522

Testers, Corona-2900

§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
§† Ansonics, Inc., Halfway, OR 97834	503-742-7475
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Phenix Technologies, Accident, MD 21520	301-746-8118
Rutherford Research, Rutherford, NJ 07070	201-933-2091
†Φ U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325
Vitrek Corporation, San Diego, CA 92121	619-586-1695

Testers, CRT-2900

Del Electronics Corp., Valhalla, NY 10595, 914-686-3600	**D•1656**
Quantum Data Inc., Elgin, IL 60123, 708-888-0450	**D•1318**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† CELCO, Mahwah, NJ 07430	201-327-1123
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889	908-534-9007
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
Microvision Corp., Los Gatos, CA 95008	408-374-3158
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100

Testers, Diode-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1241**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Bermar Corp., Research Triangle Park, NC 27709	919-489-4316
§ Contact East, N. Andover, MA 01845	508-682-2000
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810	203-744-0096
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
Meissner Industries, Dover, NJ 07801	201-366-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
Renard Manufacturing Company, Inc., Miami, FL 33122-1015	305-592-1500
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Testronics, McKinney, TX 75069	214-542-3111
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

Testers, Electron Beam-2900

Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808

Testers, Electrical Parameter-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964-1965**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**D•1313**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
Direct Conversion Technique, Inc., Chicago, IL 60641	312-283-1690
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
§ Metermaster, Tempe, AZ 85282	602-431-0015
Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
† Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
System General Corporation, Milpitas, CA 95035	408-263-6667

Testers, Electric Power — See Monitors, Power, AC & DC (Vol. D)

Testers, Encoder-2900

† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
Transmagnetics, Farmingdale, NY 11735	516-293-3100

Testers, Fiber Optic-2900

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
Atlantic Scientific Corporation, W. Melbourne, FL 32904	1-800-544-4737
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Laser Precision Corp., Utica, NY 13502	315-797-4449
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
§ Macrodyne Inc., Clifton Pk., NY 12065	518-383-3800
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701	516-226-8950
† 3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
Omega Engineering, Stamford, CT 06907	800-826-6342
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
Rifocs Corp., Camarillo, CA 93012	805-389-9800
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300

Testers, Ground Resistance — See Meters, Ohm (Vol. D)

Testers, Heat, Manual-2550

Associated Research, Inc., Lake Bluff, IL 60044	708-295-3312
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Thermonics, Inc., Santa Clara, CA 95054	408-496-6838
Vitrek Corporation, San Diego, CA 92121	619-586-1695

Testers, Hipot — See Testers, Insulation Breakdown (Vol. D)

Testers, Insulation Breakdown-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1240-1241**
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244-1245**
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248-1249**
Fetco, Sanford, FL 32773, 407-321-3800	**A•2352**
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025	**D•1277**
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289**
† Oram High Voltage, Dayton, TX 77535, 409-258-5553	**D•1853**
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170	**B•1379**
§† Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046	**D•1317**
§ ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305	**D•1321**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
† Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050	**D•1326**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
Allen Technology, Sutton, NE 68979	402-773-5285
Associated Research, Inc., Lake Bluff, IL 60044	708-295-3312
§ Astec High Voltage, Ashland, MA 01721	508-881-8407
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
AVO International, TBG, Dallas, TX 75237	214-333-3201
A/Z-Tech, Inc. R&D Lab, Indiana Institute of Technlg., Fort Wayne, IN 46803	219-422-5561
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665	714-998-1961
Cabletest Products Co., Malden, MA 02148	617-665-2932
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
† Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
Phenix Technologies, Accident, MD 21520	301-746-8118
† Plastic Capacitors, Inc., Chicago, IL 60639	312-469-2229
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
† RE America, Westlake, OH 44145	216-871-7617
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
Weetech, Inc., Wee GmbH., Sharon, MA 02067	617-784-1208

Testers, Insulation Resistance-2900

Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1240-1241**
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244-1245**
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248-1249**
Fetco, Sanford, FL 32773, 407-321-3800	**A•2352**
Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784	**D•1289**
§† Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046	**D•1317**
§ ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305	**D•1320-1321**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
Alliance Laboratories, Inc., Redwood City, CA 94063	415-366-8220
Associated Research, Inc., Lake Bluff, IL 60044	708-295-3312
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665	714-998-1961
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
§ Instek Corporation, City of Industry, CA 91745	818-336-6537
ITF Corp., Buford, GA 30518	404-945-3844
§ Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
§ NGI-Norma Goerz Instruments, Inc., Elk Grove Village, IL 60007	708-437-6444
Oram High Voltage, Dayton, TX 77535	409-258-5553

Phenix Technologies, Accident, MD 21520	301-746-8118
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
Weetech, Inc., Wee GmbH., Sharon, MA 02067	617-784-1208

Testers, Integrated Circuit (Automatic)-2900

Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1285-1286**
§ **MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171**	**D•1300**
System General Corporation, Milpitas, CA 95035, 408-263-6667	**A•1717**
† Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
§ Aristo Computers Inc., Beaverton, OR 97005	503-626-6333;800-327-4786
Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
Reliability Incorporated, Houston, TX 77218	713-492-0550
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
Testronics, McKinney, TX 75069	214-542-3111
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Xitron Technologies, San Diego, CA 92121	619-458-9852

Testers, Integrated Circuit (Manual)-2900

Applied Controls Co., Inc., Fairfield, NJ 07004	201-227-5454
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Contact East, N. Andover, MA 01845	508-682-2000
Data Environment, Inc., Portland, OR 97291	503-531-0765
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
Exatron Automatic Test Equip., San Jose, CA 95111	408-629-7600;800-EXA-TRON
§† E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
GGB Industries, Inc., Picoprobe Division, Naples, FL 33941	813-643-4400
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
Milton Ross Co., Warrington, PA 18976	215-491-0600
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
† Telectro Systems Corp., Corona, NY 11368	718-651-8900
Testronics, McKinney, TX 75069	214-542-3111
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
Xitron Technologies, San Diego, CA 92121	619-458-9852

Testers, Interface-2900

§ **National Instruments, Austin, TX 78730-5039, 512-794-0100**	**D•1147**
§ Anacom Gen. Corp., Anaheim, CA 92805-6235	714-774-8080
Cablescan, Inc., Subsidiary of Eubanks Engrg. Co., Orange, CA 92665	714-998-1961
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Datatran Corp., Denver, CO 80223	303-778-0870
§ Electrodata, Inc., Bedford Heights, OH 44128	216-663-3333
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
L-Com Inc., N. Andover, MA 01845	508-682-6936
§ Multi-Tech Systems, Inc., Mounds View, MN 55112	612-785-3500;800-328-9717
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
Simulex Corporation, Tustin, CA 92680	714-730-1500
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550

Testers, LED & LED Arrays-2900

EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
ITF Corp., Buford, GA 30518	404-945-3844
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
Microvision Corp., Los Gatos, CA 95008	408-374-3158
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
Testronics, McKinney, TX 75069	214-542-3111
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811

Testers, Life, Component-2550

Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
ITF Corp., Buford, GA 30518	404-945-3844
KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
RE America, Westlake, OH 44145	216-871-7617

Rutherford Research, Rutherford, NJ 07070	201-933-2091
Solatron Enterprises, Inglewood, CA 90302	213-678-4981
† Tenney Engineering, Union, NJ 07083	908-686-7870

Testers, Logic Card-2900

§† Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Data Environment, Inc., Portland, OR 97291	503-531-0765
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900

Testers, Loopback-2900

† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550

Testers, Magnetic Core-2900

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826	**D•2256**
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102	**D•1295**
Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638**	**D•1334**
LDJ Electronics, Troy, MI 48099-0219	313-528-2202
Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100

Testers, Magnetic Head Media-2900

§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Alliance Laboratories, Inc., Redwood City, CA 94063	415-366-8220
Flexstar Technology, Fremont, CA 94539	510-440-0170
International Test Instruments, Tustin, CA 92680	714-573-9000

Testers, Magnetic Medium-2900

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1236**
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102	**D•1295**
§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638**	**D•1334**
International Test Instruments, Tustin, CA 92680	714-573-9000
§ MBD International, Dallas, TX 75287-0577	214-788-5277
Q-Card, Inc., Owings Mills, MD 21117-1634	410-581-0112

Testers, Magnetron-2900

Cober Electronics, Stamford, CT 06902	203-327-0003
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808

Testers, Material-2550

Magnos, Hudson, MA 01749, 508-562-1173	**D•1296**
§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638**	**D•1334**
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
LDJ Electronics, Troy, MI 48099-0219	313-528-2202
MTS Systems, Eden Prairie, MN 55344	612-937-4000
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
Panametrics, Waltham, MA 02154-3497	617-899-2719
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000

Testers, Memory Board-2900

Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Digalog Systems, Inc., New Berlin, WI 53151	414-797-8000
HILEVEL Technology, Tustin, CA 92680	714-573-1888
Reliability Incorporated, Houston, TX 77218	713-492-0550
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926

Testers, Meter-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700	**D•2269**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328-1329**
AVO International, TBG, Dallas, TX 75237	214-333-3201
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
† EG & G Flow Technology, Inc., Phoenix, AZ 85072	602-437-1315
Electronic Development Corp., EDC, Boston, MA 02127-4198	617-268-9696
Elgar Electronics Corporation, San Diego, CA 92121	619-450-0085;800-733-5427
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Gralex Industries, Norwood, NJ 07648	800-486-4499
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Julie Research Labs., New York, NY 10001	212-633-6625
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
Rotek Instrument Corp., Waltham, MA 02254	617-899-4611
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260

§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

Testers, Microwave-2900

§ Marconi Instruments, Allendale, NJ 07401, 201-934-9050 .... D•1297
Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Carco Electronics, Menlo Pk., CA 94025-1106 415-321-8174
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Giga-tronics, Inc., Sunnyvale, CA 94089 408-734-5780
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 .... 514-694-6666; 800-724-3911
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 516-273-9800
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
† Telecommunications Techniques Corp., Germantown, MD 20876 301-353-1550
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Testers, Modem-2900

Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Electrodata, Inc., Bedford Heights, OH 44128 216-663-3333
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Northeast Innovations, Inc., Concord, NH 03302 603-736-8260
† Phoenix Microsystems, Huntsville, AL 35806 205-922-1200
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813 516-791-1175
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
† Telecommunications Techniques Corp., Germantown, MD 20876 301-353-1550

Testers, Motor-2900

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2275
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2289
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773 .... D•1325
Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050 .... D•1326
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
Amptec Electronics, San Diego, CA 92128 619-578-7816
Associated Research, Inc., Lake Bluff, IL 60044 708-295-3312
§ AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§ Klein Tools, Inc., Chicago, IL 60659-9033 708-677-9500
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
MOTORTEST, Inc., Columbus, OH 43229 614-882-7821
Optimized Devices, Inc., Pleasantville, NY 10570 914-769-6100
Phenix Technologies, Accident, MD 21520 301-746-8118
§ Qualitec Technologies, Inc., Fremont, CA 94538 510-498-1046
§† Staco Energy Products Co, Dayton, OH 45403 513-253-1191
Vibrac, Amherst, NH 03031 603-882-6777

Testers, Phase Noise-2900

§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

Testers, PIND-2900

† Pind Testers Inc., Irvine, CA 92718 714-457-1090

Testers, Potentiometer-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1266,1273
Julie Research Labs., New York, NY 10001 212-633-6625
Omega Engineering, Stamford, CT 06907 800-826-6342
† Production Automation, Inc., San Jose, CA 95131-1026 408-894-9064
§ Qualitec Technologies, Inc., Fremont, CA 94538 510-498-1046
Solatron Enterprises, Inglewood, CA 90302 213-678-4981

Testers, Power Supply-2900

Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660 .... D•2245-2247
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 .... D•1684-1685,2257
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2275
† Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784 .... D•1289
§ MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 .... D•1300,2283
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900 .... D•1303
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2286-2290
§ Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 .... D•1317
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858 .... D•1909,1911
Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 .... D•1322
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
Astec Standard Power, Oceanside, CA 92054 619-757-1880
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Bermar Corp., Research Triangle Park, NC 27709 919-489-4316
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Electronic Development Corp., EDC, Boston, MA 02127-4198 617-268-9696
Energy Systems, Vancouver, WA 98682 206-896-8310
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE .... (0256) 810808
Green Engineering, Melrose, MA 02176 617-665-8994
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Julie Research Labs., New York, NY 10001 212-633-6625
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
NH Research, Irvine, CA 92714 714-474-3900
Optimized Devices, Inc., Pleasantville, NY 10570 914-769-6100
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Power/Mate Corporation, San Diego, CA 92110 .... 800-843-8544;619-299-3800
Prodigit Electronics, Simi Valley, CA 93065 805-527-0888
† Production Automation, Inc., San Jose, CA 95131-1026 408-894-9064
Reliability Incorporated, Houston, TX 77218 713-492-0550
§† Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§† Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
† Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
Valhalla Scientific, San Diego, CA 92121 619-457-5576
Φ Venable Industries, Inc., Austin, TX 78758 512-837-2888,800-262-2522
§ Xantrex Technology Inc., Bellingham, WA 98227-9754 206-671-2966
Xitron Technologies, San Diego, CA 92121 619-458-9852

Testers, Pulse Jitter-2900

† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
International Test Instruments, Tustin, CA 92680 714-573-9000
† Phoenix Microsystems, Huntsville, AL 35806 205-922-1200
† Telecommunications Techniques Corp., Germantown, MD 20876 301-353-1550
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 919-460-3300

Testers, RAM-2900

MiNT Systems Corporation, Milpitas, CA 95035-6262, 408-262-7171 .... D•1301

Testers, Relay-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226-1227
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518 .... D•1241
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 .... D•2256
§ Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666 .... D•1248
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 .... D•2269
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2275
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
AVO International, TBG, Dallas, TX 75237 214-333-3201
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
Eclypse International Corp., Ontario, CA 91761-9925 909-947-8839
† Haefely, Inc., Woodbridge, VA 22192 703-494-1900
ITF Corp., Buford, GA 30518 404-945-3844
§ Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
† Optimized Devices, Inc., Pleasantville, NY 10570 914-769-6100
† Production Automation, Inc., San Jose, CA 95131-1026 408-894-9064
§ Qualitec Technologies, Inc., Fremont, CA 94538 510-498-1046
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
Solatron Enterprises, Inglewood, CA 90302 213-678-4981
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Testronics, McKinney, TX 75069 214-542-3111
Wilmar Electronics, Inc., Torrance, CA 90505 310-326-6668

Testers, Resistivity-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 .... D•1226-1227
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200 .... D•1243
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910 .... D•1244-1245
Fetco, Sanford, FL 32773, 407-321-3800 .... A•2352
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 .... D•1273
† PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 .... D•1315
Shalltronix Corp., Selma, NC 27576, 919-965-6346 .... D•1324

† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328,1330**
Vitrek Corporation, San Diego, CA 92121, 619-586-1695	**D•1333**
Alpha Metals, Jersey City, NJ 07304	201-434-6778
Andeen-Hagerling, Inc., Cleveland, OH 44139-2231	216-349-0370
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Cambridge Technology, Inc., Watertown, MA 02172	617-923-1181
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Julie Research Labs., New York, NY 10001	212-633-6625
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
§ NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072	716-773-7634
Omega Engineering, Stamford, CT 06907	800-826-6342
Plastic Systems Inc., Marlboro, MA 01752-3004	508-485-7390
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§ Spectrascan, Inc., Colorado Springs, CO 80907	719-599-9254
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300

Testers, Resistor-2900

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Julie Research Labs., New York, NY 10001, 212-633-6625	**D•1280**
Shalltronix Corp., Selma, NC 27576, 919-965-6346	**D•1324**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
† **Valhalla Scientific, San Diego, CA 92121, 619-457-5576**	**D•1328**
Automated Production Concepts, Wayne, NJ 07470	201-831-8300
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Cambridge Technology, Inc., Watertown, MA 02172	617-923-1181
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229	503-641-4141
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Hypatia Inc., Hillsboro, OR 97123-9074	503-628-2936
Integrated Technologies Solutions Inc., Farmingdale, NY 11735	516-420-9401
Meissner Industries, Dover, NJ 07801	201-366-1700
§ Metermaster, Tempe, AZ 85282	602-431-0015
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
§ Monroe Electronics, Inc., Lyndonville, NY 14098	716-765-2254
† Optimized Devices, Inc., Pleasantville, NY 10570	914-769-6100
† PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
§ Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
RE America, Westlake, OH 44145	216-871-7617
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Vitrek Corporation, San Diego, CA 92121	619-586-1695

Testers, ROM Devices-2900

§ Contact East, N. Andover, MA 01845	508-682-2000
HILEVEL Technology, Tustin, CA 92680	714-573-1888
§ Prologic Systems, Broomfield, CO 80020	303-460-0103
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
System General Corporation, Milpitas, CA 95035	408-263-6667

Testers, Servo — See Analyzers, Servo (Vol. D)

Testers, Shock-2550

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
§ CVC Products, Inc., Rochester, NY 14603	716-458-2550
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
Media Recovery Inc., Graham, TX 76450	800-527-9497;817-549-5462 (Texas)
MTS Systems, Eden Prairie, MN 55344	612-937-4000
† Pind Testers Inc., Irvine, CA 92718	714-457-1090
R. C. Electronics Inc., Goleta, CA 93117	805-685-7770

Testers, Short Turn — See Testers, Coil (Vol. D)

Testers, Signal Tracing-2900

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
§† **Projects Unlimited, Dayton, OH 45414, 513-890-1918**	**D•1057**
Singer Data Products, Inc., Bensenville, IL 60106, 708-860-6500	**D•1107**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
AlphaTest Corp., Mesa, AZ 85204-6597	602-545-5518
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Eclypse International Corp., Ontario, CA 91761-9925	909-947-8839
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
L-Com Inc., N. Andover, MA 01845	508-682-6936
§ MBD International, Dallas, TX 75287-0577	214-788-5277
Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
Probe-Rite, Inc., Santa Clara, CA 95052	408-727-0100
§ PTS Corporation, Bloomington, IN 47401	812-824-9331
§ Shattuck Industries, Santa Cruz, CA 95060	408-427-3122
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Systems Testing, Inc., Santa Clara, CA 95052	408-727-0100
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
† Virgina Panel Corporation, Waynesboro, VA 22980	703-949-8376

Testers, Solderability-4100

MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
† Caig Laboratories, Rancho Bernardo, CA 92127-1904	619-451-1799
† Express Test Corp., Sunnyvale, CA 94088-3419	408-737-3555
Hexacon Electric Co., Roselle Park, NJ 07204	908-245-6200
§ Hollis Automation, Esterline Corporation, Nashua, NH 03063	603-889-1121
§† Kester Solder Div., Litton Sys., Inc., Des Plaines, IL 60018	708-297-1600

Testers, Synchro/Resolver-2900

† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176,1181**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600**	**D•1190**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950**	**D•1197**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100**	**D•1312**
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Transmagnetics, Farmingdale, NY 11735	516-293-3100

Testers, Thickness (all types)-2900

§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
† Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057	216-428-7505
§† Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
† Ocean Motions Co., Barrington, RI 02806	401-246-1394
Panametrics, Waltham, MA 02154-3497	617-899-2719
§ Sloan Technology, Santa Barbara, CA 93103	805-963-4431
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
TEGAM, Inc., Madison, OH 44057	800-666-1010

Testers, Thyristor-2900

Darrah Electric Company, Cleveland, OH 44102	216-631-0912
LEM U.S.A., Inc., Milwaukee, WI 53218	414-353-0711
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810	203-744-0096
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Testronics, McKinney, TX 75069	214-542-3111

Testers, Tracking & Erosion Resistance (Insulation)-2900

§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§† Guildline Instruments, Lake Mary, FL 32746	407-333-3327
Hipotronics Inc., Brewster, NY 10509	914-279-8091
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
†Φ U. E. Systems, Inc., Elmsford, NY 10523	914-592-1220;800-223-1325

Testers, Transistor-2900

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bermar Corp., Research Triangle Park, NC 27709	919-489-4316
§ Contact East, N. Andover, MA 01845	508-682-2000
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Lorlin Test Systems, Axiam, Inc., Danbury, CT 06810	203-744-0096
LTX Corporation, Westwood, MA 02090	617-461-1000
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810	203-744-0096
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
QUAN-TECH, Stansbury Industries Inc., Flanders, NJ 07836	201-927-1766
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Testronics, McKinney, TX 75069	214-542-3111
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wavetek Corp., San Diego, CA 92123	619-279-2200

Testers, Transmission & Delay-2900

Amber Electric Design, St. Laurent, PQ,, CANADA H4T 1V8	514-333-8748; 800-361-3697
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Marconi Instruments, Allendale, NJ 07401	201-934-9050
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
S Squared Electronics, formerly ComTech Systems, Inc., Valley Stream, NY 11581-2813	516-791-1175
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550

Testers, Tube-2900

§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668

Testers, Vibration-Also See Services, Environmental Test-2900

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
§ **Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-U-SENS-IT**	**B•2024**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
American Hofmann Corp., Lynchburg, VA 24506	804-522-0300
APS Dynamics, Inc., Carlsbad, CA 92008	619-438-4848
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
§ Cyber Sys., Inc., Anaheim, CA 92806	714-502-6950
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
§ Epic, Inc., New York, NY 10038	212-349-2470
GenRad, Inc., Concord, MA 01742-2174	508-369-4400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
† MB Dynamics Inc., Cleveland, OH 44146-1483	216-292-5850
Metrix Instrument Co., Houston, TX 77043	713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MTS Systems, Eden Prairie, MN 55344	612-937-4000
Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
† Pind Testers Inc., Irvine, CA 92718	714-457-1090
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
TEGAM, Inc., Madison, OH 44057	800-666-1010
TEKTRONIX-Signal Analysis Unit, Santa Clara, CA 95052-8086	408-496-0960
† Thermotron Inds., Holland, MI 49423	616-392-1491
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811

Testers, Voltage-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226-1227**
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1241**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244-1245**
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666	**D•1248-1249**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1273**
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401	**D•2274**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**D•1277**
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**D•1319**
Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050	**D•1326**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635	312-889-1448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Calibron Instruments, Burton-Rogers Co., Waltham, MA 02154	617-894-6440
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
§ Contact East, N. Andover, MA 01845	508-682-2000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
†Φ Electro-Tech Systems, Inc., Glenside, PA 19038	215-887-2196
§ EMCO, Components Specialties Inc., Lindenhurst, NY 11757	516-957-8700
EMICO Inc., Manchester, NH 03109	603-669-5121
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109	815-397-7070
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ Ideal Industries, Inc., Sycamore, IL 60178	815-895-5181
Julie Research Labs., New York, NY 10001	212-633-6625
KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
§ Klein Tools, Inc., Chicago, IL 60659-9033	708-677-9500
Lark Electronics, Inc., New York, NY 10040	212-569-0430
LTX Corporation, Westwood, MA 02090	617-461-1000
§ MBD International, Dallas, TX 75287-0577	214-788-5277
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
§ Phenix Technologies, Accident, MD 21520	301-746-8118
§† Qualitec Technologies, Inc., Fremont, CA 94538	510-498-1046
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402	805-528-5858
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§ Sperry, A. W. Instruments, Smithtown, NY 11787	516-231-7050;800-645-5398
§ Square D Co., Palatine, IL 60067	708-397-2600
§ Steinel America, Inc., Minnetonka, MN 55345	800-852-4343
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
§ TIF Instruments, Inc., Miami, FL 33150	305-757-8811
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607	415-452-1936

Testers, Voltage Breakdown-2900

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312	**D•1226-1227**
Cabletest International Inc., Markham, Ont., CANADA L3R 4C1, 416-475-2607;800-667-2518	**D•1240-1241**
Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910	**D•1244-1245**
§ **Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8, 416-299-6666**	**D•1248-1249**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**D•1277**
† **Kikusui International Corp., Signal Hill, CA 90804-1203, 310-986-1677;800-545-8784**	**D•1289**
Oram High Voltage, Dayton, TX 77535, 409-258-5553	**D•1853**
§ **PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170**	**B•1379**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
§ **ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305**	**D•1320-1321**
Slaughter Co, R.E. Phelon Co., Ardmore, OK 73401, 405-223-4773	**D•1325**
† **Torotron Corp., Mt. Vernon, NY 10550, 914-664-2050**	**D•1326**
Valhalla Scientific, San Diego, CA 92121, 619-457-5576	**D•1330**
Allen Technology, Sutton, NE 68979	402-773-5285
Alliance Laboratories, Inc., Redwood City, CA 94063	415-366-8220
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Cabletest Products Co., Malden, MA 02148	617-665-2932
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Electrical Instrument Service, Mt. Vernon, NY 10550	914-699-9717
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
Glassman Europe Limited, Basingstoke, Hampshire RG24 0NE	(0256) 810808
Haefely, Inc., Woodbridge, VA 22192	703-494-1900
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
† Joslyn Electronic Systems Corp., Goleta, CA 93116	800-752-8068; 805-968-3551
Keithley Instrs., Cleveland, OH 44139	800-552-1115
KeyTek Instrument Corp., Wilmington, MA 01887	508-658-0880
§ Klein Tools, Inc., Chicago, IL 60659-9033	708-677-9500
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Micro Instrument Company, Escondido, CA 92029	619-746-2010
Phenix Technologies, Accident, MD 21520	301-746-8118
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
Rosemount Analytical Inc., Cedar Grove, NJ 07009	800-222-2600 ext. 400
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Rutherford Research, Rutherford, NJ 07070	201-933-2091
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
§ Sienna Technologies Inc., St. Paul, MN 55120	612-688-6106
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
Vitrek Corporation, San Diego, CA 92121	619-586-1695

Testers, (MIL)-2440 — ***See Vol. B***
Testing, Environmental — See Services, Environmental Testing (Vol. D)
Thermal Converters — See Converters, Thermal (Vol. B)
Thermal Imagers — See Imagers, Thermal (Vol. D)

Thermal Platforms-2900

† **AAVID Engineering, Inc., Laconia, NH 03247-0400, 603-528-3400**	**C•1561**
EG & G Wakefield Engineering, Wakefield, MA 01880, 617-245-5900	**C•1580,1582-1583**
Sigma Systems Corp., San Diego, CA 92116, 619-283-3193	**D•1211**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1213**
TECA, ThermoElectric Cooling America Corp., Chicago, IL 60639, 312-342-4900	**C•1644-1645**
Environmental Stress Systems, Inc., Sonora, CA 95370	209-928-4900
ESS, Inc., Sonora, CA 95370	209-928-4900
† FTS Systems, Inc., Stone Ridge, NY 12484	914-687-0071
Fujipoly, America Corp., Cranford, NJ 07016	908-272-3850
† Langley:Fleet Aerospace, Inc., San Diego, CA 92112	619-264-3181
† Lytron Incorporated, Woburn, MA 01801	617-933-7300

† Noren Products Inc., Menlo Pk., CA 94025	415-322-9500
Power Devices Inc., Laguna Hills, CA 92653	714-552-6712
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Thermacore Inc., Lancaster, PA 17601	717-569-6551
VA-Tran Systems Inc., Chula Vista, CA 91911	619-423-4555

Thermistors-5300 – ***See Vol. B***
Thermistors (MIL)-2440 – ***See Vol. B***
Thermocouple Devices & Materials — See Cooling/Heating Modules, Thermoelectric (Vol. B)

Thermocouple Interfaces for Personal Computers-2000

Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215, 800-368-2516	**D•1251**
§ **National Instruments, Austin, TX 78730-5039, 512-794-0100**	**D•1198,1302**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2005, D•1101,1199,1415**
Action Instruments, San Diego, CA 92123	619-279-5726
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Columbus Instruments, Columbus, OH 43204	614-276-0861
Dianachart Inc., Rockaway, NJ 07866	201-625-2299
§ duTec, Inc., Jackson, MI 49204-0964	800-248-1632
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Keithley MetraByte, Taunton, MA 02780	508-880-3000
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309	305-739-7004
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Weschler Instruments, Hughes Corp., Cleveland, OH 44136	216-238-2550

Thermocouples, Elements & Accessories-5300 – ***See Vol. B***
Thermoelectric, Modules — See Cooling/Heating Modules, Thermolectric (Vol. B)

Thermographs-2900

B-G Instruments, Inc., Mead, WA 99021, 206-567-5000	**D•1083**
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§† Onset Computer Corp., Pocasset, MA 02559-3450	508-563-9000
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134

Thermometers, Electronic (All Types) — See Meters, Temperature (Vol. D)

Thermometers, Microscopic, Infrared-2900

Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
§Φ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007	215-781-0700; 800-523-8989
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Raytek, Inc., Santa Cruz, CA 95060-1820	408-458-1110
Swan Associates, New Haven, CT 06534	203-387-3917

Thermometers, Resistance-2900

Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541	**B•1858**
Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000	**B•1875**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721	**D•1264**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266,1268**
† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210**	**A•1975**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**B•1978, D•1359**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1362-1363**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389,1391**
§ **Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974**	**B•1909**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
ARi Industries, Inc., Addison, IL 60101	708-953-9100;800-237-6725
§ Atkins Technical Inc., Cainesville, FL 32608	904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Bayley Instrument Company, Kenwood, CA 95452	707-833-6014
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080	
† Digitec, Marion, OH 43302	614-387-3444
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
† GIC Thermodynamics, Royal Oak, MI 48073	313-280-1648
Gossen/Texmate, Vista, CA 92083-8397	619-598-9899;1-800-394-8344
§ Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
Instrulab, Dayton, OH 45404	513-223-2241
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
Keystone Carbon, Thermistor Div., St. Marys, PA 15857	814-781-1591
† Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Meissner Industries, Dover, NJ 07801	201-366-1700
Micro Technical Industries, San Clemente, CA 92672	714-366-1752
† Minco Products, Minneapolis, MN 55432	612-571-3121
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
PYCO, Inc., Penndel, PA 19047	215-757-3704
Pyrocom Co., Seattle, WA 98133	206-365-3535
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
† Relco Products, Denver, CO 80237	303-756-1143
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796	617-527-4385
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
Texmate, Inc., Vista, CA 92083-8397	619-598-9899
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695	908-287-2870
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300	512-244-1956

Thermostats-Also See Switches, Thermally Actuated; Controls, Temperature-5300 – ***See Vol. B***
Thermowells-5300 – ***See Vol. B***
Thin-Film Memory Systems, Planar — See Memory Systems (Vol. D)
Thyristors and SCRs, Surface Mount-4800 – ***See Vol. A***
Thyristors (Incl. Silicon Controlled Rectifiers) - Also see DIACs; TRIACs, SIDACs-4800 – ***See Vol. A***
Thyristors (MIL)-2440 – ***See Vol. B***
Ties, Wire & Cable — See Wire & Cable Ties (Vol. C)

Time Delays, Precision-2900

† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500	**B•1608**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197	408-738-4266
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
§ Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
§ Nolatron, Harrisburg, PA 17111	717-564-3398
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831	510-471-9717;800-221-7060
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Timeco, Inc., Huntington, WV 25705	304-523-5149
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220

Time Dispenser, Microprocessor based-2200

Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1524**
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341

Time Management Systems-2200

FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341	**A•1405**
TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411	**D•1077.1207**
Chrono-log Corp., Havertown, PA 19083	800-247-6665
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336

Timers, Counting-2200

§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665**	**D•1151**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1457**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
† **Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740**	**D•1159**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437**	**D•1345**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000**	**D•1160**
§ **Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200**	**B•1524-1525**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**D•1360**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1364**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390-1391**
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092

Timers, Counting-2200 (Cont'd)

§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
# Canyon Elctrns., Inc., Phoenix, AZ 85021	602-944-4421
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
ENM Company, Chicago, IL 60646	312-775-8400
§ ESE, El Segundo, CA 90245	310-322-2136
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
Hecon Corp., Eatontown, NJ 07724	908-542-9200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Industrial Timer Co., Centerbrook, CT 06705	203-767-7130
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441	815-838-0005
§ Lab-Line Instruments, Melrose Park, IL 60160	708-450-2600
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Red Lion Controls, York, PA 17402	717-767-6511
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
§ Square D Co., Palatine, IL 60067	708-397-2600
† Statek Corp., Orange, CA 92668	714-639-7810
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
§ Trumeter Company, Inc., New York, NY 10001	212-564-0666;800-537-2261
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Timers, Cycle & Reset-2200

§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1457**
§ Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1524-1525**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1364**
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000	**B•1587-1588**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1390-1391**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Amperite Co., Inc., Union City, NJ 07087	201-864-9503
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
# Canyon Elctrns., Inc., Phoenix, AZ 85021	602-944-4421
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
Dantronics, Inc., St. Paul, MN 55126	612-484-2108
§ Deltrol Controls, Milwaukee, WI 53215	414-671-6800
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
ENM Company, Chicago, IL 60646	312-775-8400
§ ESE, El Segundo, CA 90245	310-322-2136
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ Industrial Timer Co., Centerbrook, CT 06705	203-767-7130
§ Intermatic, Spring Grove, IL 60081	815-675-2321
§ International Microtronics, Tucson, AZ 85714	602-748-7900
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Metermaster, Tempe, AZ 85282	602-431-0015
Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
Northwest Microcircuits, Inc., Philomath, OR 97370	503-929-6424
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560	615-483-8405
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
§ Red Lion Controls, York, PA 17402	717-767-6511
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
§ Square D Co., Palatine, IL 60067	708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
† Statek Corp., Orange, CA 92668	714-639-7810
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Techniques, Inc., Englewood, NJ 07631	201-569-5900
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
Timeco, Inc., Huntington, WV 25705	304-523-5149
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
V R Industries, Inc., Warwick, RI 02886	401-732-6800
Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Timers, Delay-2200

§† Amperite Co., Inc., Union City, NJ 07087, 201-864-9503	**B•1417**
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1456-1457**
Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299	**A•1536**
§ Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1524-1525**
Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000	**B•1587**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500	**B•1612,1614**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
AES Corp., Peabody, MA 01960	508-535-7310
§ Air-O-Tronics, Pelco Electronics, Cazenovia, NY 13035	315-655-2387
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911	619-575-4011
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Bel Fuse, Jersey City, NJ 07302	201-432-0463
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Corby Industries, Inc., Allentown, PA 18103	215-433-1412
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215	800-368-2516
§ Deltrol Controls, Milwaukee, WI 53215	414-671-6800
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
ENM Company, Chicago, IL 60646	312-775-8400
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§ Furnas Elec., Batavia, IL 60510	708-879-6000
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
§ IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
§ Industrial Timer Co., Centerbrook, CT 06705	203-767-7130
† International Sensor Systems, Inc., Aurora, NE 68818	402-694-6111
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830	908-283-4925
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900

§ Paragon Electric Co., Inc., Two Rivers, WI 54241 ... 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 ... 818-885-8223
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Regent Controls, Inc., Shelton, CT 06484-0767 ... 203-924-2924
† Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 ... 516-273-9800
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161 ... 414-421-4380;1-800-803-0444
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 ... 315-638-1300
† Statek Corp., Orange, CA 92668 ... 714-639-7810
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
† Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151 ... 414-782-3800
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 ... 419-525-8450
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149
§ Time Mark Corp., Tulsa, OK 74116 ... 918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656 ... 612-553-9224;1-800-328-0580
§ V R Industries, Inc., Warwick, RI 02886 ... 401-732-6800

Timers, Electrolytic Cell-2200

† The Fredericks Company, Huntingdon Valley, PA 19006 ... 215-947-2500
Master Electronic Controls, Los Angeles, CA 90025 ... 310-452-1336

Timers, Interval-2200

§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665 ... D•1151**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1457**
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ... D•1116,1186-1189
DCI Inc., Olathe, KS 66062, 913-782-5672 ... D•1344
† **Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740 ... D•1159**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 ... B•1043
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345**
§ **Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... B•1524-1525**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ... D•1360**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ... D•1364**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ... B•1587-1588**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ... B•1612,1614**
† Abrams Instrument Corp., Lansing, MI 48910-3688 ... 517-882-7211
§ Air-O-Tronics, Pelco Electronics, Cazenovia, NY 13035 ... 315-655-2387
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 ... 203-399-6253
§† Amperite Co., Inc., Union City, NJ 07087 ... 201-864-9503
§† Antex Electronics Corp., Gardena, CA 90248-2617 ... 310-532-3092
§ Artisan Controls Corp., Parsippany, NJ 07054 ... 201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 ... 614-387-8827
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514 ... 216-758-8299
# Canyon Elctrns., Inc., Phoenix, AZ 85021 ... 602-944-4421
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
§† Cramer Co., Old Saybrook, CT 06475-1261 ... 800-247-6784
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
† DARE Electronics, Inc., Troy, OH 45373 ... 513-335-0031
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
§ Deltrol Controls, Milwaukee, WI 53215 ... 414-671-6800
† Digitec, Marion, OH 43302 ... 614-387-3444
§ Dimco-Gray, Dayton, OH 45458 ... 513-433-7600
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 ... 201-941-4455
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 ... 812-426-2806
DSP Technology, Fremont, CA 94538-7338 ... 510-657-7555
Dynapar, Gurnee, IL 60031 ... 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
† Electro Physics Co., Inc., Waukegan, IL 60085 ... 708-249-5801
ENM Company, Chicago, IL 60646 ... 312-775-8400
§ ESE, El Segundo, CA 90245 ... 310-322-2136
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 ... 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 ... 815-758-7000
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 ... 415-753-5814
§ I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ... 602-748-7900
§ Industrial Timer Co., Centerbrook, CT 06705 ... 203-767-7130
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
† International Sensor Systems, Inc., Aurora, NE 68818 ... 402-694-6111
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
§ Lektra Laboratories Inc., Bronx, NY 10451 ... 718-292-8243
† Logitek, Inc., Ronkonkoma, NY 11779 ... 516-467-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 ... 414-228-5500
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 ... 908-283-4925
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 ... 317-328-4010
Master Electronic Controls, Los Angeles, CA 90025 ... 310-452-1336
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
# Meylan Corporation, Upper Montclair, NJ 07043-1844 ... 201-744-6400
Microavionics Corp., Costa Mesa, CA 92626 ... 714-957-6904
§ Midtex Relays, Inc., El Paso, TX 79906 ... 915-772-1061;1-800-MIDTEX1
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ... 603-883-3390; 800-999-3390
§ National Controls Corp., W. Chicago, IL 60185 ... 708-231-5900
§ Non-Linear Systems, San Diego, CA 92121 ... 619-535-2161
Northwest Microcircuits, Inc., Philomath, OR 97370 ... 503-929-6424
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 ... 414-793-1161
PPM, Inc., Cleveland, OH 44122 ... 1-800-899-4776
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 ... 516-234-3800
§ Red Lion Controls, York, PA 17402 ... 717-767-6511
§ Regent Controls, Inc., Shelton, CT 06484-0767 ... 203-924-2924
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 ... 516-273-9800
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161 ... 414-421-4380;1-800-803-0444
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 ... 315-638-1300
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
§ Technic, Inc., Providence, RI 02940-9650 ... 401-781-6100
Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151 ... 414-782-3800
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149
§ Time Mark Corp., Tulsa, OK 74116 ... 918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656 ... 612-553-9224;1-800-328-0580
§ Verdure Industries Inc., Omaha, NE 68124 ... 402-691-8300

Timers, Programmed-2200

§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665 ... D•1151**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1457, C•1577**
§ **Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 ... D•1345**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... B•1524-1525
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1142
Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 ... A•1712
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ... D•1364**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390
Acculex Corporation, Taunton, MA 02780 ... 508-880-3660
AES Corp., Peabody, MA 01960 ... 508-535-7310
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 ... 203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248-2617 ... 310-532-3092
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 ... 908-464-3550
§ Artisan Controls Corp., Parsippany, NJ 07054 ... 201-428-1770
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 ... 614-387-8827
† Autronics Corp., Arcadia, CA 91006 ... 818-445-5470
# Canyon Elctrns., Inc., Phoenix, AZ 85021 ... 602-944-4421
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
§ Centent Co., Santa Ana, CA 92707 ... 714-979-6491
Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
Colorado Data Systems, Tektronix, Englewood, CO 80110 ... 303-762-1640; 800-237-2831
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
§ Cramer Co., Old Saybrook, CT 06475-1261 ... 800-247-6784
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
Dantronics, Inc., St. Paul, MN 55126 ... 612-484-2108
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 ... 800-368-2516
† Digitec, Marion, OH 43302 ... 614-387-3444
Dimco-Gray, Dayton, OH 45458 ... 513-433-7600
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 ... 201-941-4455
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 ... 812-426-2806
Dynapar, Gurnee, IL 60031 ... 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
§ Eliwell Inc., Baldwinsville, NY 13027 ... 315-638-9598
ENM Company, Chicago, IL 60646 ... 312-775-8400
§ ESE, El Segundo, CA 90245 ... 310-322-2136
§ Extech Instruments Corp., Waltham, MA 02154 ... 617-890-7440
§ John Fluke Mfg. Co., Inc., Everett, WA 98203 ... 206-347-6100
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458 ... 201-825-9696
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ Industrial Timer Co., Centerbrook, CT 06705 ... 203-767-7130
§ Intermatic, Spring Grove, IL 60081 ... 815-675-2321
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
† International Sensor Systems, Inc., Aurora, NE 68818 ... 402-694-6111
§ IVO Industries, Inc., Eatontown, NJ 07724 ... 908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005

§ Lab-Line Instruments, Melrose Park, IL 60160 ... 708-450-2600
† Logitek, Inc., Ronkonkoma, NY 11779 ... 516-467-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 ... 414-228-5500
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 ... 317-328-4010
Master Electronic Controls, Los Angeles, CA 90025 ... 310-452-1336
§ Maxmar Controls Inc., Pleasantville, NY 10570 ... 914-747-3540
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Microavionics Corp., Costa Mesa, CA 92626 ... 714-957-6904
§ Monroe Electronics, Inc., Lyndonville, NY 14098 ... 716-765-2254
§ National Controls Corp., W. Chicago, IL 60185 ... 708-231-5900
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 ... 414-793-1161
Pass & Seymour Canada, Inc., Legrand, Concord, ONT L4K 3M9 ... 416-738-9195
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 ... 812-386-1000
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 ... 516-234-3800
Scanning Devices, Inc., Waltham, MA 02154 ... 617-891-8991
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161 ... 414-421-4380;1-800-803-0444
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 ... 609-589-7500
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
Techniques, Inc., Englewood, NJ 07631 ... 201-569-5900
Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151 ... 414-782-3800
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149
§ Trumeter Company, Inc., New York, NY 10001 ... 212-564-0666;800-537-2261

Timers, Sequence-2200

§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1457, C•1577**
† **Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740 ... D•1159**
§ **Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... B•1524-1525**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 ... D•1364**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305 ... D•1320-1321
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390
† Abrams Instrument Corp., Lansing, MI 48910-3688 ... 517-882-7211
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 ... 203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248-2617 ... 310-532-3092
§ Artisan Controls Corp., Parsippany, NJ 07054 ... 201-428-1770
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 ... 614-387-8827
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514 ... 216-758-8299
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
§ Cramer Co., Old Saybrook, CT 06475-1261 ... 800-247-6784
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
† DARE Electronics, Inc., Troy, OH 45373 ... 513-335-0031
Dynapar, Gurnee, IL 60031 ... 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
ENM Company, Chicago, IL 60646 ... 312-775-8400
§ ESE, El Segundo, CA 90245 ... 310-322-2136
§ Furnas Elec., Batavia, IL 60510 ... 708-879-6000
§ Industrial Timer Co., Centerbrook, CT 06705 ... 203-767-7130
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
† Logitek, Inc., Ronkonkoma, NY 11779 ... 516-467-4200
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 ... 908-283-4925
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 ... 317-328-4010
Master Electronic Controls, Los Angeles, CA 90025 ... 310-452-1336
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Microavionics Corp., Costa Mesa, CA 92626 ... 714-957-6904
§ Midtex Relays, Inc., El Paso, TX 79906 ... 915-772-1061;1-800-MIDTEX1
§ National Controls Corp., W. Chicago, IL 60185 ... 708-231-5900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
Paragon Electric Co., Inc., Two Rivers, WI 54241 ... 414-793-1161
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 ... 315-638-1300
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 ... 609-589-7500
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151 ... 414-782-3800
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149

Timers, Solid State-2200

§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1457**
§† **Curtis Instruments, Inc., Mt. Kisco, NY 10549, 914-666-2971 ... D•1158**
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ... D•1186
DCI Inc., Olathe, KS 66062, 913-782-5672 ... D•1344
Gralex Industries, Norwood, NJ 07648, 800-486-4499 ... D•1353
§ **Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200 ... B•1524**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 ... B•1558,1561
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ... D•1315
† Abrams Instrument Corp., Lansing, MI 48910-3688 ... 517-882-7211
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 ... 408-720-8737
AES Corp., Peabody, MA 01960 ... 508-535-7310
§ Air-O-Tronics, Pelco Electronics, Cazenovia, NY 13035 ... 315-655-2387
† Alarm Controls Corporation, Deer Park, NY 11729 ... 516-586-4220
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 ... 203-399-6253
§ Amperite Co., Inc., Union City, NJ 07087 ... 201-864-9503
Analog Systems, Tucson, AZ 85731-7389 ... 602-290-1818
§† Antex Electronics Corp., Gardena, CA 90248-2617 ... 310-532-3092
§ Artisan Controls Corp., Parsippany, NJ 07054 ... 201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 ... 614-387-8827
† Autronics Corp., Arcadia, CA 91006 ... 818-445-5470
AVO International, TBG, Dallas, TX 75237 ... 214-333-3201
§ Brentek International, Inc., York, PA 17406 ... 717-755-8000
Brill Electronics, Los Angeles, CA 90025 ... 310-452-8002
§ Amerace Electronic Components, Punta Gorda, FL 33950 ... 813-575-8400
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514 ... 216-758-8299
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
§ Centent Co., Santa Ana, CA 92707 ... 714-979-6491
§ Cramer Co., Old Saybrook, CT 06475-1261 ... 800-247-6784
C-Tek Inc., Wakefield, MA 01880 ... 617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282 ... 708-662-2666
Dantronics, Inc., St. Paul, MN 55126 ... 612-484-2108
† DARE Electronics, Inc., Troy, OH 45373 ... 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 ... 812-426-2806
Douglas Randall, Pawcatuck, CT 06379 ... 203-599-2075
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 ... 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
† Electro Physics Co., Inc., Waukegan, IL 60085 ... 708-249-5801
ENM Company, Chicago, IL 60646 ... 312-775-8400
§ ESE, El Segundo, CA 90245 ... 310-322-2136
§ Exar Corp., San Jose, CA 95161-9007 ... 408-434-6400
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
§ Furnas Elec., Batavia, IL 60510 ... 708-879-6000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458 ... 201-825-9696
† Holt Inc., Irvine, CA 92718 ... 714-859-8800
§ IDEC Corporation, Sunnyvale, CA 94089-2211 ... 408-747-0550
§ International Microtronics, Tucson, AZ 85714 ... 602-748-7900
† International Sensor Systems, Inc., Aurora, NE 68818 ... 402-694-6111
§ IVO Industries, Inc., Eatontown, NJ 07724 ... 908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
§ Klockner Moeller, Franklin, MA 02038 ... 508-520-7080
§ Lektra Laboratories Inc., Bronx, NY 10451 ... 718-292-8243
† Logitek, Inc., Ronkonkoma, NY 11779 ... 516-467-4200
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209 ... 414-228-5500
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 ... 908-283-4925
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 ... 317-328-4010
§ Maxmar Controls Inc., Pleasantville, NY 10570 ... 914-747-3540
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Microavionics Corp., Costa Mesa, CA 92626 ... 714-957-6904
§ MKC Electronics Corp., Overland Park, KS 66215 ... 913-894-9711
§ National Controls Corp., W. Chicago, IL 60185 ... 708-231-5900
NEC Electronics, Inc., Mountain View, CA 94039-7241 ... 1-800-366-9782
§ Non-Linear Systems, San Diego, CA 92121 ... 619-535-2161
Northwest Microcircuits, Inc., Philomath, OR 97370 ... 503-929-6424
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
§ OTTOTEK, IMC, Tucson, AZ 85714 ... 602-748-7900
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 ... 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
Phi Technologies, Inc., Oklahoma City, OK 73105 ... 405-521-9000
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 ... 812-386-1000
# Project Pro, Twinsburg, OH 44087 ... 216-425-8888
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 ... 516-234-3800
§ Regent Controls, Inc., Shelton, CT 06484-0767 ... 203-924-2924
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161 ... 414-421-4380;1-800-803-0444
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 ... 315-638-1300
† Statek Corp., Orange, CA 92668 ... 714-639-7810
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 ... 609-589-7500
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
§† Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151 ... 414-782-3800
Timeco, Inc., Huntington, WV 25705 ... 304-523-5149
§ TURCK Inc., Minneapolis, MN 55441-2656 ... 612-553-9224;1-800-328-0580
§ Verdure Industries Inc., Omaha, NE 68124 ... 402-691-8300

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Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437 .... D•1345
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1379
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1379
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389
Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
§ Bristol Babcock Inc., Watertown, CT 06795 .... 203-575-3000;800-395-5497
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235 614-889-6152
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
§ Hecon Corp., Eatontown, NJ 07724 908-542-9200
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
§ Kistler-Morse, Redmond, WA 98073 206-881-8000
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
§ Newport Electronics, Santa Ana, CA 92704-4426 .... 714-540-4914;800-NEWPORT
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
Philips Technologies, Airpax Instruments, Cheshire, CT 06410 203-271-6000
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

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CTI Electronics, Stratford, CT 06497, 203-386-9779 .... D•1086
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
§† Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 .... D•1097
Transparent Devices, Inc., Newbury Park, CA 91320, 805-499-5000 .... B•1126
Apollo Display Technologies, Inc., Holtsville, NY 11742 .... 1-800-LCD-STOC; 516-654-1143
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Aydin Corp., Horsham, PA 19044 215-657-7510
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
† Carroll Touch, Inc., AMP, Inc., Round Rock, TX 78680 512-244-3500
§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
§# Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
Electro Mechanical Systems, Inc., Champaign, IL 61820 217-359-7125
Elographics Inc., Oak Ridge, TN 37830 615-482-4100
General Digital Corp., Enfield, CT 06082 203-741-7171
†# Greenspring Computers, Inc., Menlo Park, CA 94025 415-327-1200
HMW Enterprises, Inc., Waynesboro, PA 17268 717-765-4690
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
IlCon Corporation, Morgan Hill, CA 95037 408-779-7466
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
MicroTouch Systems, Inc., Methuen, MA 01844 508-659-9000
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
§ Touch Technology, Austin, TX 78746 512-328-9284
Wells-Gardner Elctrns. Corp., Chicago, IL 60639 312-252-8220
§# XKD Corporation, Dynatech, Los Gatos, CA 95030 408-395-3700

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Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1026
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 .... B•1836-1837
§† Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 .... D•1097
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 .... B•1840-1841
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1099
# Thrust Industries, Inc., Haubstadt, IN 47639, 800-467-6730;812-768-6730 .... C•1668
Transparent Devices, Inc., Newbury Park, CA 91320, 805-499-5000 .... B•1126
Apollo Display Technologies, Inc., Holtsville, NY 11742 .... 1-800-LCD-STOC; 516-654-1143
Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
† Carroll Touch, Inc., AMP, Inc., Round Rock, TX 78680 512-244-3500
Computer Dynamics Sales, Greer, SC 29650 803-877-8700
Computer Keyboard Systems, Santa Monica, CA 90401 310-395-4639
§# Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
† Electro Mechanical Systems, Inc., Champaign, IL 61820 217-359-7125
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
Elographics Inc., Oak Ridge, TN 37830 615-482-4100
General Digital Corp., Enfield, CT 06082 203-741-7171
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-9063
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
§ Mantex Corp., Oxford, MI 48371 313-628-8210
MicroTouch Systems, Inc., Methuen, MA 01844 508-659-9000
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§ Pactec Corp., LaFrance Corp., Philadelphia, PA 19153 215-365-8400
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 .... 214-231-6663; 214-924-3289;1-800-331-6600
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Topflight, York, PA 17404 .... 717-843-9901;800-233-9386
§† Touch Technology, Austin, TX 78746 512-328-9284
2M Sales Company, Burnsville, MN 55337 612-890-7774
Wells-Gardner Elctrns. Corp., Chicago, IL 60639 312-252-8220
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Touch Terminals-2000

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1124
§† Interaction Systems Inc., Watertown, MA 02172, 617-923-6001 .... D•1097
Transparent Devices, Inc., Newbury Park, CA 91320, 805-499-5000 .... B•1126
Apollo Display Technologies, Inc., Holtsville, NY 11742 .... 1-800-LCD-STOC; 516-654-1143
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
† Carroll Touch, Inc., AMP, Inc., Round Rock, TX 78680 512-244-3500
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
Electro Mechanical Systems, Inc., Champaign, IL 61820 217-359-7125
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
General Digital Corp., Enfield, CT 06082 203-741-7171
HMW Enterprises, Inc., Waynesboro, PA 17268 717-765-4690
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
§ MicroTouch Systems, Inc., Methuen, MA 01844 508-659-9000
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
§† Touch Technology, Austin, TX 78746 512-328-9284
Vetra Systems Corp., Plainview, NY 11803 516-454-6469

Tracers, Curve-2900

Hameg Instruments, Oceanside, CA 92056, 619-630-4080;800-247-1241 .... D•1404
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 .... 516-231-6900; 1-800-645-5104
RAG Electronics, Inc., Canoga Park, CA 91304 .... 818-998-6500;800-732-3457
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
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Trackballs, XY Positioning-2200

BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 .... B•1917
CTI Electronics, Stratford, CT 06497, 203-386-9779 .... D•1086
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 .... B•1829
† Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590 .... D•1163
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 .... B•1849, D•1167
† Amkey, Methuen, MA 01844 508-975-5445
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
Computer Keyboard Systems, Santa Monica, CA 90401 310-395-4639
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
Tracking Systems (MIL)-2440 – *See Vol. B*
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International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1705
Ocean Motions Co., Barrington, RI 02806, 401-246-1394 .... B•1980
Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Amphenol Interconnect Products, LPL Technologies, Endicott, NY 13760 607-754-4444
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Aydin Corp., Horsham, PA 19044 215-657-7510
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
§ Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 .... 1-800-888-LAN1;919-481-5100
General Electronic Materials Technology, Los Alamitos, CA 90720 714-761-5684
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§† Holt Inc., Irvine, CA 92718 714-859-8800
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Phi Technologies, Inc., Oklahoma City, OK 73105 405-521-9000
§ Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
SEEQ Technology, San Jose, CA 95131 .... 408-432-7400;1-800-333-7706
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§ Ten-Tec, Inc., Sevierville, TN 37862 615-453-7172

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Translators, Data-2325

Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... D•1200-1202
§† Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ...... B•1309
TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411 .... D•1077,1207
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1394,1396
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Design Workshop, D.D.O., Que., CANADA H9G 1X5 514-696-4753
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
Keithley MetraByte, Taunton, MA 02780 508-880-3000
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
§† Sipex Corp., Billerica, MA 01821 508-667-8700

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Translators, Time Code-2000

§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665 .... D•1151
† Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1116,1186-1189
† TRAK Systems, Div. TRAK Microwave Corp., Tampa, FL 33634-6391, 813-884-1411 .... D•1077,1207
Datachron Inc., Anaheim, CA 92805 714-385-1705
§ ESE, El Segundo, CA 90245 310-322-2136

FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341

Transmission Line, Data — See Cable, Data Transmission (Vol. C)
Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. C)
Transmission Lines (MIL), RF-2440 — ***See Vol. B***

Transmission Systems, Data-2000

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1187-1189**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121**	**B•1223-1227**
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
† Alden Electronics, Inc., Westboro, MA 01581	508-366-8851
§Φ American Laser Systems, Inc., Santa Barbara, CA 93160	805-967-0423
§ Artel Communications Corp., Hudson, MA 01749	508-562-2100
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
§ Coastcom, Concord, CA 94520	510-825-7500
§ Comspec Digital Products Inc., Houston, TX 77043	713-461-4487
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Dowty Avionics, Arcadia, CA 91006	818-445-5955
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359	617-826-0099
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
† Phoenix Microsystems, Huntsville, AL 35806	205-922-1200
† Potter Instrument, (PSI-Peripheral Support), El Segundo, CA 90245	213-322-9370
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Transmagnetics, Farmingdale, NY 11735	516-293-3100

Transmitters, Fiber Optic-2475 — ***See Vol. B***

Transmitters, Fixed Frequency-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1187-1189**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† AEROCOM, Miami, FL 33133	305-448-6503
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
ARS Inc., Orlando, FL 32809	1-800-950-5633
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Electrocom Industries, S. Bend, IN 46615	219-232-2743
† EVI, Inc., Columbia, MD 21046	410-290-1919
Glatzer Industries Corp., New Rochelle, NY 10801	914-576-2700
HDS Inc., Reston, VA 22091	703-620-6200
§ International Microtronics, Tucson, AZ 85714	602-748-7900
LF Engineering Company Inc., East Haven, CT 06512	203-467-3590
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
§ OTTOTEK, IMC, Tucson, AZ 85714	602-748-7900
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
§† Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300

Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000

Transmitters, Laser-3700 — ***See Vol. B***

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§ Action Instruments, San Diego, CA 92123	619-279-5726
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964	818-884-6860
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
§ Data Instruments, Inc., Acton, MA 01720	800-332-3282
Dynamation Transducers Corporation, Holliston, MA 01746	508-429-8440
MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Metrix Instrument Co., Houston, TX 77043	713-461-2131
Ocean Motions Co., Barrington, RI 02806	401-246-1394
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
Transmagnetics, Farmingdale, NY 11735	516-293-3100
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Transmitters, Process Control (Temperature, Pressure, Flow. etc.)-5500 — ***See Vol. B***
Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1187-1189**
AES Corp., Peabody, MA 01960	508-535-7310
ARS Inc., Orlando, FL 32809	1-800-950-5633
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
Dantel, Fresno, CA 93727	209-292-1111
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
HBM, Inc., Marlboro, MA 01752	508-624-4500
HDS Inc., Reston, VA 22091	703-620-6200
§ Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
§† Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Uniplex Corp., St. Paul, MN 55117	612-490-1936
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300
VIZ Meteorological Instruments, Philadelphia, PA 19144-5782	215-844-2626

Transmitters, Tone-1900

§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Dantel, Fresno, CA 93727	209-292-1111
Dowty Avionics, Arcadia, CA 91006	818-445-5955
Electrocom Industries, S. Bend, IN 46615	219-232-2743
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
§† Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
§ Verdure Industries Inc., Omaha, NE 68124	402-691-8300

Transmitters (MIL)-2440 — ***See Vol. B***
Transmitters (MIL), Fiber Optic-2440 — ***See Vol. B***

Transponders-1900

† AEROCOM, Miami, FL 33133	305-448-6503
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950	201-539-5500
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999	410-583-4000
† A.R.F. Prods., Boulder, CO 80307-3128	303-499-2946
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Computer Instruments Div., Westbury, NY 11590	516-876-8400
Data Delay Devices, Clifton, NJ 07013-1915	201-773-2299
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
§† Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
Tracer Electronics, Inc., Bloomfield, NJ 07003	201-338-1234
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Transports, Tape (all kinds)-2000

International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622	**D•1039**
Amilon Corp., Woodside, NY 11377	718-274-1794
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
Blackhole Technology, Winchester, MA 01890	617-721-7690
Cipher Data Products, Inc., an Archive Co., San Diego, CA 92131	619-578-9100
Fujitsu America, Inc., Computer Products Group, San Jose, CA 95134	408-432-1300
† Memtec Corp., Salem, NH 03079	603-893-8080
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Reproduction Technologies Inc., Bristol, IN 46507-0790	219-848-5233
§ Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500

TRIACs-4800 — ***See Vol. A***
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Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)
Trimmers, Potentiometer — See Potentiometers, Trimmer (Vol. A)
Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Counting-2200

§ International Components Corp., Melville, NY 11747	516-293-1500
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586

Tubes, Flash-3700 — ***See Vol. B***

Tubes, Ignitron-2200

† EEV Inc., Elmsford, NY 10523	914-592-6050
§ International Components Corp., Melville, NY 11747	516-293-1500
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213

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Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. B)
Tubes, TV Camera Pickup-3700 — ***See Vol. B***

Tubes, Transmitting-1900

† EEV Inc., Elmsford, NY 10523	914-592-6050
§ International Components Corp., Melville, NY 11747	516-293-1500
† Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000
† Varian Associates, Electron Device Business. Palo Alto, CA 94304	415-493-4000; 800-544-4636

Tubes, X-ray-2200

§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900

† EEV Inc., Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
† Penta Laboratories, Inc., Chatsworth, CA 91311 .... 818-882-3872;800-421-4213
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 .... 415-493-4000; 800-544-4636

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Tubes (MIL), Microwave-2440 – *See Vol. B*
Tubes (MIL), Power & Gas, Planar-2440 – *See Vol. B*
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Tubing, Expandable-6000 – *See Vol. C*
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Tubing, Glass-2500 – *See Vol. C*
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Tubing, Waveguide-3450 – *See Vol. A*
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Tuners, AM/FM-1300

EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 .... D•1073
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... D•1067
§† Aiphone, Bellevue, WA 98005 206-455-0510
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§ Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 708-584-2300
§ Paso Sound Products, Pelham, NY 10803 914-738-4800
§ Precision Electronics, Franklin Park, IL 60131 708-678-5350
§† PTS Corporation, Bloomington, IN 47401 812-824-9331
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
§ University Sound, Inc., Mark IV Industries, Sylmar, CA 91342 818-362-9516
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Tuning Circuits, Surface Mount-3130 – *See Vol. A*
Tuning Forks-2300 – *See Vol. A*
Tweezers, Manual & Vacuum-5400 – *See Vol. C*
Ultrasonic Transceivers, High Resolution, Narrow Beam-5500 – *See Vol. B*

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100

American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Clean Room Products, Inc., Ronkonkoma, NY 11779-6528 516-588-7000
§ Contact East, N. Andover, MA 01845 508-682-2000
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Electronic Controls Design, Milwaukie, OR 97222 503-659-6100
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§† Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888
† Stenning Instruments, Inc., Camarillo, CA 93010 805-484-4996
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
† Tech Spray, Inc., Amarillo, TX 79105 806-372-8523
§ UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788

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Urea Formaldehyde — See Plastic Raw Materials (Vol. C)
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Valve Positioners & Actuators-3500 – *See Vol. B*
Valves, Solenoid-4550 – *See Vol. B*

Valves, Vacuum-4100

Aerodyne Controls Corporation, Ronkonkoma, NY 11779 516-737-1900
§† Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
† Bemco, Simi Valley, CA 93065 805-583-4970
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514 216-758-8299
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854 203-853-9500
§ Crouzet Corporation, Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
§ CVC Products, Inc., Rochester, NY 14603 716-458-2550
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887 .... 508-658-5410;800-848-9800
§ Hoke Incorporated, Cresskill, NJ 07626 201-568-9100
§ Makk-O Industries, Yonkers, NY 10703 .... 914-376-0160; 914-376-0161
§† MKS Instruments, Inc., Andover, MA 01810 .... 508-975-2350;800-227-8766
§† ULVAC North America Corporation, Kennebunk, ME 04043 207-985-2973
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300

Varactors — See Diodes, Varactor (Vol. A)
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Vibrators-4050

Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 .... B•2025
Alpha-M Corp., Dallas, TX 75229 214-406-0424
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675 714-493-8181
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† MB Dynamics Inc., Cleveland, OH 44146-1483 216-292-5850
† Thermotron Inds., Holland, MI 49423 616-392-1491
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929

Video Components & Equipment — See Specific Component: Amplifiers (Vol. D), Cameras (Vol. D), Networks (Vol. D), etc.
Video/Audio Links, Fiber Optic-2475 – *See Vol. B*
Viewers (MIL)-2440 – *See Vol. B*

Viewing Hoods, Cathode Ray Tube-2975

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433

Vinyl Compounds — See Plastic Raw Materials (Vol. C)
Vises-5400 – *See Vol. C*

Visual Micro Inspection Systems-2900

† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277 603-882-1447
§ Advanced Video Products, E-Systems, Westford, MA 01886 508-692-2020
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028 212-228-0900
† D. O. Industries, Rochester, NY 14623 716-359-4000
† Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
Vista Systems, Inc., Peabody, MA 01960 508-532-1971
Volpi-MFG-USA, Auburn, NY 13021-1289 315-255-1737

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Voice Recognition Equipment — See Recognition Equipment, Speech (Vol. D)
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Voltage Sources-4000

Φ Electronic Development Corp., EDC, Boston, MA 02127-4198, 617-268-9696 .... D•1253
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1272
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 .... D•2268
Integrated Technologies Solutions Inc., Farmingdale, NY 11735, 516-420-9401 .... D•2274
Julie Research Labs., New York, NY 10001, 212-633-6625 .... D•1279
Keithley Instrs., Cleveland, OH 44139, 800-552-1115 .... D•1284-1285
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 .... D•1967
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1328
† Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
§ Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
California Instruments Corp., San Diego, CA 92123-1509 .... 619-279-8620; 800-4AC-POWER
Clarke-Hess Communications Research Corp., New York, NY 10011 ... 212-255-2940
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
Endicott Research Group, Endicott, NY 13760 607-754-9187
John Fluke Mfg. Co., Inc., Everett, WA 98203 206-347-6100
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§ Keithley MetraByte, Taunton, MA 02780 508-880-3000
Kikusui International Corp., Signal Hill, CA 90804-1203 ... 310-986-1677;800-545-8784
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Power Designs, Inc., Westbury, NY 11590 516-333-6200
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
Techron Div., Crown Intl., Inc., Elkhart, IN 46517 219-294-8300
Tucker Electronics, Dallas, TX 75355-1419 .... 214-348-8800;800-527-4642
Xitron Technologies, San Diego, CA 92121 619-458-9852
ZI-TECH Instrument Corp., Palo Alto, CA 94303-0725 .... (415) 326-2151

Voltmeter, Electrostatic-2900

† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .. D•1277
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8 416-299-6666
Davis Instrument Mfg. Co., Inc., Baltimore, MD 21215 800-368-2516
§ Monroe Electronics, Inc., Lyndonville, NY 14098 716-765-2254
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Trek, Incorporated, Medina, NY 14103-0728 716-798-3140
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 707-938-2121

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VXIbus Modular Test Systems-2900

CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 .... D•1250

† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714, 714-474-3900 ... D•1849
Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ... D•1311
Tracewell Enclosures, Inc., Westerville, OH 43081, 614-846-6175;800-848-4525 ... C•1106,1108-1110
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478 ... 716-265-1600
Advanced Power Designs Inc., Irvine, CA 92714 ... 714-263-8605
AMASCO, Torrance, CA 90501 ... 310-781-9494
Analogic Corp., Peabody, MA 01960 ... 508-977-3000
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 ... 404-981-6225
Colorado Data Systems, Tektronix, Englewood, CO 80110 ... 303-762-1640; 800-237-2831
Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 ... 415-753-5814
KineticSystems Corp., Lockport, IL 60441 ... 815-838-0005
§ National Instruments, Austin, TX 78730-5039 ... 512-794-0100
† North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 ... 516-567-1100
Precision Filters, Inc., Ithaca, NY 14850 ... 607-277-3550
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
Schlumberger Instruments, Schlumberger Technlgs., Billerica, MA 01821 ... 508-671-9700;1-800-225-5765
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
Transmagnetics, Farmingdale, NY 11735 ... 516-293-3100
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228 ... 919-460-3300

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Welding Equipment & Accessories (Excl. Equipment for Semiconductor Devices)-5400 – *See Vol. C*

Welding Machines, Laser-4100

§ BEA electro-optics, inc., Des Plaines, IL 60016 ... 708-298-1420
† Coherent General, Inc., Sturbridge, MA 01566 ... 508-347-2681
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
† Control Laser Corp., Orlando, FL 32809 ... 407-438-2500
U. S. Laser Corp., Wyckoff, NJ 07481 ... 201-848-9200

Welding Machines, Ultrasonic, Metals & Plastics-4100

Pamran Inc., Racine, WI 53404 ... 414-637-7999
Φ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382 ... 610-696-4710;800-323-1269

White Noise Generator Modules — See Generators, White Noise (Vol.), Diodes, Noise
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Wire, Antenna (All Types)-6000 – *See Vol. C*
Wire, Bare, Copper-6000 – *See Vol. C*
Wire, Bare, Nickel-6000 – *See Vol. C*
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Wire Strippers, Automatic-4100

Berg Electronics, Camp Hill, PA 17011 ... 800-237-2374
Burndy Corporation, An FCI Company, Norwalk,, CT 06856 ... 203-838-4444
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
§ Contact East, N. Andover, MA 01845 ... 508-682-2000
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 ... 914-241-1008
§ Eraser Co., Syracuse, NY 13221 ... 315-454-3237
Eubanks Engineering, Monrovia, CA 91016 ... 818-357-7011
Φ Ewald Instruments Corp., Kent, CT 06757 ... 203-927-3278
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
§† General Laser, Inc., Scottsdale, AZ 85260 ... 602-991-0674
§ Harris Corp., Dracon Div., Camarillo, CA 93012 ... 805-987-9511
# HMC/Hub Material Company, Canton, MA 02021 ... 617-821-1870
§ Ideal Industries, Inc., Sycamore, IL 60178 ... 815-895-5181
§ ITT Cannon, Santa Ana, CA 92705-5684 ... 714-557-4700
§ Klein Tools, Inc., Chicago, IL 60659-9033 ... 708-677-9500
Quantum Chromodynamics, Inc., Torrance, CA 90501 ... 310-320-5717
§Φ Schleuniger, Inc., Manchester, NH 03101 ... 603-668-8117

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Work Stations, Computer-2000

Flexible Furniture Division, Metal Components, Inc., Plainwell, MI 49080, 616-685-6831;800-875-6836 ... C•1044
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 ... 716-292-6050
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
§ Advanced Video Products, E-Systems, Westford, MA 01886 ... 508-692-2020
Alpha Wire Corp., Elizabeth, NJ 07207-0711 ... 908-925-8000
Alusett U.S.A., Inc., Peekskill, NY 10566 ... 914-737-0120
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
† Aydin Corp., Horsham, PA 19044 ... 215-657-7510
Barco Chromatics, Tucker, GA 30084 ... 404-493-7000
§ Cincinnati Electrosystems, Milford, OH 45150 ... 513-831-6800
† Codar Technology, Inc., Longmont, CO 80503 ... 303-776-0472
Electro Rent Corp., Van Nuys, CA 91411 ... 800-688-1111
Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Enterprise Systems Corp., Dover, NH 03820 ... 603-742-7363
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 ... 617-267-8600
† E-Systems, Melpar Div., Falls Church, VA 22046 ... 703-560-5000
Φ Genstar Rentals, Inc., Calabasas, CA 91302 ... 800-422-3300
HMW Enterprises, Inc., Waynesboro, PA 17268 ... 717-765-4690
IBI Systems Inc., Ft. Lauderdale, FL 33309 ... 305-978-9225
Image Graphics, Inc., Shelton, CT 06484 ... 203-926-0100
Kewaunee Scientific Corp., Technical Workstation Div., Lockhart, TX 78644 ... 512-398-5292
Omnicomp Graphics Corp., Houston, TX 77043 ... 713-464-2990
Parsytec Inc., West Chicago, IL 60185 ... 708-293-9500
Ragen Systems, Inc., Ragen Corp., Warren, NJ 07059 ... 908-561-4200
§# Support Systems Intl. Corp., Richmond, CA 94804 ... 510-234-9090
§ Vicom Systems, Inc., Fremont, CA 94538 ... 415-498-3200
Xcel Controls, Inc., Mishawaka, IN 46544 ... 219-259-7804
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

Work Stations, Laminar Flow-4100

§ Forma Scientific, Inc., Marietta, OH 45750 ... 614-373-4763
§† Gruenberg Oven Co., Williamsport, PA 17701 ... 717-326-1755
§ Hodge Manufacturing Co., Inc., Springfield, MA 01107 ... 413-781-6800
Kewaunee Scientific Corp., Technical Workstation Div., Lockhart, TX 78644 ... 512-398-5292
§† Stackbin Corp., Lincoln, RI 02865 ... 401-333-1600;800-333-1603

Work Stations, 3-D Video Microscope-4100

Alusett U.S.A., Inc., Peekskill, NY 10566 ... 914-737-0120
Metron Optics Inc., Solana Beach, CA 92075-0690 ... 619-755-4477

Work Stations/Decks, Data Entry-1400 – *See Vol. C*
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X-ray Detector Arrays (For Industrial Inspections)-4100

† Advanced Photonix, Inc., Camarillo, CA 93012 ... 805-484-2884
† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260 ... 216-784-4456
§ Capintec Instruments, Ramsey, NJ 07446 ... 201-825-9500
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 ... 908-231-0960
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
§ Lixi, Inc., Downers Grove, IL 60515 ... 708-620-4646
§ Solid State Relays, Oak Brook, IL 60521 ... 708-932-1660

X-ray Imaging System-4100

† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-784-4456

X-ray Inspection Equipment-4100

Aristo Grid Lamp Prods., Roslyn, NY 11576	516-484-6141
† Ball Corporation, Industrial Systems Division, Mogadore, OH 44260	216-784-4456
# Biomation Instruments, Almonte, Ont., CANADA K0A1A0	613-256-2821
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Lixi, Inc., Downers Grove, IL 60515	708-620-4646
§ Nicolet Instrument Corp., Measurement Instruments, Madison, WI 53711	608-271-3333
Nuclear Research Corp., Warrington, PA 18976	215-343-5900
Panametrics, Waltham, MA 02154-3497	617-899-2719

X-Y Axis Tables — See Tables, X-Y (Vol. D)

X-Y-Z Systems, Programmable-2550

Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
§ Glenmarc Manufacturing Inc., Vernon Hills, IL 60061	708-634-6080;800-323-5350
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
§ TS Products, Inc., Arleta, CA 91331-3429	818-896-6676
§† Velmex, Inc., East Bloomfield, NY 14443	716-657-6151;800-642-6446

Yokes, Deflection, CRT-1800 — ***See Vol. A***

Zener Diodes — See Diodes, Zener (Vol. A)

Zone Boxes, Thermocouple — See Thermocouples, Elements & Accessories (Vol. B)

93
94 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in **boldface**

Many manufacturers also show FAX, TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

AAA CIRCUITS, INC., 827 Black Oak Ridge Road, Wayne, NJ 07470, Tel: 201-835-2765, FAX: 201-835-2768; FSC No.: 5998; Empl.: 18; *Sls. Mgr.:* F. J. La Manna; *Dist. Mgr.:* f. J. La Manna

AAK CORP, 747 River St, Haverhill, MA 01832, Tel: 508-373-3769, 800-886-2225, TELEX: 04 26 3109-1, FAX: 508-373-8881; FSC No.: 04 26 3109-1; Empl.: 20; *Sls. Mgr.:* Marie Credit .... **D•2052-2055**

Local Sales Offices & Reps

CA	Los Angeles, Power Partners	213-215-0800
OH	Cleveland, Tiby Co.	216-371-5335

AALPHA PRECISION, Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, 800-835-3355, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt

A & D ELEC. INSTRS., 73-07 88th St, Glendale, NY 11385, Tel: 718-275-6516, FAX: 718-275-6516; FSC No.: 01914; Empl.: 7

A & J MANUFACTURING CO., 14131 Franklin Ave., Tustin, CA 92680, Tel: 714-544-9570, FAX: 714-544-4215; FSC No.: 08060; Empl.: 70; *Sls. Mgr.:* B. M. Evers

AAVID™

FAX: 603-528-1478

AAVID ENGINEERING, INC., One Kool Path, P.O. Box 400, Laconia, NH 03247-0400, Tel: 603-528-3400, TWX: 510-298-1127; FSC No.: 30161; Empl.: 450; *Sls. Mgr.:* Charles Nelson; *Dist. Mgr.:* Patrick SandeFur ... **C•1561**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540, FAX:205-830-1542
AZ	Phoenix, Gregory & Assocs.	602-870-8797, FAX:602-870-8796
CA	Brea, Masco Elctrns.	714-990-6991, FAX:714-990-2053
CA	Julian, Sontronics	619-765-3294, FAX:619-765-0868
CA	Santa Clara, WestRep	408-988-8833, FAX:408-988-3186
CO	Broomfield, SummitWest Mktg.	303-460-9600, FAX:303-460-9074
FL	Apopka, Cartwright & Bean, Inc.	407-889-9100, FAX:407-889-2168
FL	Deerfield Bch., Cartwright & Bean, Inc.	305-429-3400,FAX:305-429-3402
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160, FAX:404-368-0125
IL	Itasca, Beta Technlg. Sls., Inc.	708-250-9586, FAX:708-250-9592
IN	Carmel, Kahsar Sls. Inc.	317-844-9353, FAX:317-844-9353
IA	Des Moines, S P S Assocs.	515-225-0607, FAX:515-225-8713
KS	Olathe, S P S Assocs.	913-764-4460, FAX:913-764-6161
LA	Covington, Cartwright & Bean, Inc.	504-892-2326, FAX:504-892-2326
MD	Sykesville, Eastern Technlg.	410-442-2952, FAX:410-489-7780
MA	Milford, Selmark Assocs., Inc.	508-478-9088, FAX:508-478-5145
MI	Muskegon, Kahsar Sls. Inc.	616-798-4451, FAX:616-798-4451
MI	Sterling Heights, Kahsar Sls., Inc.	313-795-3530, FAX:313-795-4181
MN	Edina, Foster (Mel) Tech. Sls.	612-941-9790, FAX:612-944-0634
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170, FAX:601-981-1171
MO	Earth City, S P S Assocs.	314-291-0520, FAX:314-291-7138
NJ	Berkeley Hgts., Cambridge-Allen & Assocs.	908-464-0203,FAX:908-468-9090
NJ	Medford, McCoy Group	609-953-0770, FAX:609-953-1238
NM	Albuquerque, Ron-Tek, Inc.	505-299-3771, FAX:505-299-3771
NY	Endwell, Reagan/Compar	607-754-2171, FAX:607-754-4270
NY	Rochester, Reagan/Compar Rochester	716-271-2230,FAX:607-754-4270
NY	Syracuse, Reagan/Compar Syracuse	315-432-8232,FAX:607-754-4270
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303, FAX:704-536-0313
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130, FAX:919-876-4130
OH	Cincinnati, Kahsar Sls. Inc.	513-598-1484, FAX:513-598-6870
OH	Columbus, Kahsar Sls. Inc.	614-252-4009, FAX:614-252-4009
OH	Elyria, Kahsar Sls., Inc.	216-365-5219, FAX:216-365-5219
OH	Parma, Kahsar Sls. Inc.	216-845-0103, FAX:216-845-0103
OR	Lake Oswego, S P S Elctrns.	503-697-7768, FAX:503-697-7764
PA	Exton, McCoy Group	215-363-0350
PA	Pittsburgh, Kahsar Sls., Inc.	412-734-8797, FAX:412-734-8797
TN	Germantown, Cartwright & Bean, Inc.	901-758-8113,FAX:901-758-8068
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450, FAX:615-539-6885
TX	Austin, MIL-REP Assocs., Inc.	512-346-6331, FAX:512-346-1975
TX	Houston, MIL-REP Assocs., Inc.	713-444-2557, FAX:713-444-2751
TX	Richardson, MIL-REP Assocs., Inc.	214-644-6731, FAX:214-644-8161
UT	Bountiful, TQ (Butterworth) Mktg.	801-298-8388, FAX:801-298-8840
WA	Mt. Lake Terrace, S P S Elctrns.	206-323-4140, FAX:206-323-4140
WI	Milwaukee, Beta Technlg. Sls., Inc.	414-543-6609, FAX:414-543-9288
PR	Guaynabo, ISLA Caribe Electro Sls.	809-720-4430, FAX:809-720-1097
Can	Calgary, Alb., Intelatech	403-230-3190, FAX:403-230-3183
Can	Mississauga, Ont., Intelatech	416-629-0082, FAX:416-629-1795
Can	Nepean, Ont., Intelatech	613-769-5618, FAX:613-596-2442
Can	Pointe Claire, Que., Intelatech	514-630-6041, FAX:514-630-5612

Local Distributors

AL	Huntsville, Century Fasteners Corp.	205-883-5344
AL	Huntsville, Hammond Elctrns. Inc.	205-830-4764
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Aero-Space Southwest Inc.	602-582-2779
AZ	Phoenix, Future Elctrns. Inc.	602-968-7140
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates Co. Inc.	501-562-9100
AR	Springdale, Carlton-Bates Co. Inc.	501-756-5012
CA	Chatsworth, Future Elctrns. Inc.	818-772-6240
CA	Chatsworth, Time Elctrns.	508-532-6200
CA	Compton, Time Elctrns.	213-979-5090
CA	Culver City, Time Elctrns.	314-391-6444
CA	Culver City, Time Elctrns.	508-532-6200
CA	Fountain Valley, Comps. Ctr. Inc.	714-979-0437

CA	Fremont, Acacia/Deanco	415-623-7500
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Irvine, Future Elctrns. Inc.	714-260-4141
CA	Los Angeles, Bell Inds. Inc	213-826-6778
CA	Los Angeles, Bell Inds. Inc.	213-826-6778
CA	Los Angeles, Bell Inds. Inc.	310-826-2355
CA	Milpitas, Kent Elctrns./PYR	408-262-5300
CA	Mtn. View, Energy Sls. Inc.	415-969-0800
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Future Elctrns. Inc.	619-625-2800
CA	San Diego, Kent Elctrns./PYA	619-271-5404
CA	San Diego, Kent Elctrns./SHE	619-453-7133
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Future Elctrns. Inc.	408-435-9100
CA	San Jose, Time Elctrns.	408-943-9490
CA	Santa Ana, B D S Elctrns. Inc.	714-662-1050
CA	Santa Ana, Bell Inds. Inc.	714-835-1464
CA	Santa Clara, Comps. Cen.	408-988-3751
CA	Santa Fe Springs, Bell Inds. Inc.	213-826-6778
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Kent Elctrns./PYR	213-691-0561
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Added Value Elctrn.	714-258-9501
CA	Tustin, Added Value Elctrn.	714-259-8258
CA	Tustin, Time Elctrns.	714-669-0100
CO	Broomfield, Future Elctrns.	303-421-0123
CO	Englewood, Kent Elctrns.	303-762-0670
CO	Englewood, N E P Elctrns. Inc.	303-799-9898
CO	Englewood, Time Elctrns.	303-721-8882
CO	Littleton, Indelco Inc.	303-795-3431
CO	Wheat Ridge, Added Value Elctrn. Inc.	303-422-1701
CO	Wheatridge, Acacia/Deanco Inc.	303-421-7004
CO	Wheatridge, Bell Inds. Inc.	303-431-8732
CT	Berlin, Kent Elctrns. Inc.	203-829-2100
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Allied Elctrns.	1-800-433-5700
CT	Oxford, Tower Fasteners Comp.	203-264-3000
CT	South Winds, Car-Lac Elctrns.	203-282-0631
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, Arnold Indl.	203-215-7168
CT	Wallingford, Cronin Elctrns., Inc.	800-982-4449, 203-265-3134
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Altamonte Springs, Bell Inds.	813-541-4434
FL	Altamonte Springs, Future Elctrns.	407-767-8414
FL	Ft. Lauderdale, Hammond Elctrns. Inc.	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Largo, Elctrn./Precepts	813-544-3636
FL	Largo, Future Elctrns.	813-530-1222
FL	Largo, Kent Elctrns.	813-545-0057
FL	Miami, All American	305-621-8282
FL	Orlando, Hammond Elctrns. Inc.	407-849-6060
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Allied Elctrns.	305-486-0500
FL	Tampa, Century Fasteners Co.	813-886-5770
FL	Tampa, Century Fasteners Corp.	813-886-5770
FL	Winter Park, Servtronics	407-677-8191
GA	Duluth, All American	404-476-0194
GA	Lawrenceville, Century Fasteners	404-516-1620
GA	Norcross, Atlanta Hardware Special	404-449-3000
GA	Norcross, Future Elctrns. Inc.	404-441-7675, 404-441-7676
GA	Norcross, Hammond Elctrns. Inc.	404-449-1996
GA	Norcross, Time Elctrns.	404-368-0969
IL	Elk Grove, Bell Inds.	708-640-1910
IL	Elk Grove, Kent Elctrns.	708-364-1300
IL	Gurnee, N E P Elctrns. Inc.	708-662-0185
IL	Hoffman Estates, Future Elctrns. Inc.	312-882-1255
IL	Lisle, Comps. Inc.	708-852-7707
IL	Rosemont, Advent Elctrns. Inc.	708-297-6200
IL	Schaumburg, Time Elctrns.	708-303-3037
IL	Wood Dale, Allied Elctrns.	312-697-8200
IL	Wood Dale, N E P Elctrns. Inc.	708-595-8500
IN	Ft. Wayne, Bell Inds. Inc.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Mar Elctrns. Inc.	317-633-6699
IN	Indianapolis, P E I Genesis Elctrn.	219-287-2911
IN	Indianapolis, R M Elctrns.	317-291-7110
IN	South Bend, P E I Genesis Elctrn.	219-287-2911
IA	Cedar Rapids, Advent Elctrns. Inc.	319-363-0221
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
KS	Wichita, R S C Elctrns.	316-267-5213
MD	Columbia, Future Elctrns. Inc.	301-995-1222
MD	Columbia, Kent Elctrns.	301-621-8100
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko Sls. Inc.	301-470-3300
MA	Bolton, Future Elctrns. Inc.	508-366-2400
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Chelsea, Future Elctrns.	617-889-9440
MA	Marlborough, Hardware Specialty Co. Inc.	508-481-8622
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Peabody, Time Elctrns.	508-532-6200
MA	Wilmington, North Star Elctrn.	508-657-5155
MI	Ann Arbor, Bell Inds. Inc.	313-971-9093
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns. Inc.	313-477-1650
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Livonia, Future Elctrns.	313-261-5270
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Bergquist Co.	612-835-2322
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	St. Paul, Kent Elctrns.	612-642-2828
MN	Thief River, Digi-Key Corp.	218-681-6674
MO	Hazelwood, Kent Elctrns.	314-895-1515
MO	Independence, Kent Elctrns.	816-254-3410
MO	Manchester, Time Elctrns.	314-391-6444
MO	Springfield, Carlton-Bates Co. Inc.	501-562-9100
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MO	St. Louis, Ric-Tronics	314-997-4707
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Manchester, Cronin Elctrns., Inc.	800-982-7777
NJ	Blackwood, Hardware Specialty	609-228-6800
NJ	Cherry Hill, Hardware Specialities	609-663-0034
NJ	Fairfield, Bell Inds. Inc.	201-227-6060
NJ	Fairfield, Future Elctrns.	201-299-0400
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Mountainside, Route Elctrns.	908-654-8283
NJ	Parsippany, Future Elctrns.	609-778-7600
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Alexandria Bay, Carsten Elctrns.	416-477-9898
NY	Amherst, Rush Elctrns.	800-343-5247
NY	Baldwin, Accessories for Elec.	516-546-1751
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Buffalo, Irwin Indl.	416-889-9100
NY	Buffalo, Summit Distrs. inc.	716-887-2800
NY	Champlain, Prelco Elctrns.	514-389-8051
NY	Elmhurst, Century Fasteners Co.	718-446-5222
NY	Elmhurst, Century Fasteners Corp.	718-446-5000
NY	Fairport, Allied Elctrns.	1-800-433-5700
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Holtsville, Tower Fasteners	516-289-8800
NY	Long Island City, Hardware Specialties	718-361-9393
NY	Mineola, Hardware Sepc.	516-741-7100
NY	Mt. Sinai, Kent Elctrns.	516-447-2000
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Masline Elctrns. Inc.	716-546-5373
NY	Syracuse, Future Elctrns.	315-451-2371
NY	Syracuse, Hardware Specialty	315-434-9093
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Charlotte, Century Fasteners Corp.	704-554-0444
NC	Charlotte, Future Elctrns.	704-455-9030
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns. Inc.	919-275-6391
NC	Raleigh, Allied Elctrns.	1-800-433-5700
NC	Raleigh, Century Elctrn. Comps.	919-782-2116
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Century Fasteners Corp.	919-787-1800
NC	Raleigh, Dixie/Resource Elctrns.	919-724-5961
NC	Raleigh, Time Elctrns.	919-847-9650
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Cleveland, Darrah Elec.	216-631-0912
OH	Columbus, Time Elctrns.	614-794-3301
OH	Columbus, Wedemeyer	614-436-9600
OH	Dayton, Bell Inds. Inc.	513-435-8660
OH	Hooven, Bell Inds. Inc.	513-353-2355
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, R S C Elctrns.	405-631-7729
OK	Tulsa, Carlton-Bates Co. Inc.	918-250-1626
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Comp. Resources	503-641-8488
OR	Beaverton, Future Elctrns. Inc.	503-626-2977
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Erie, REM Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Huntingdon, REM Elctrns.	412-864-7423
PA	Norristown, Century Elctrn. Comp.	215-631-5400, 215-631-5404
PA	Philadelphia, P E I-Genesis	215-673-0400
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Columbia, Dixie Elctrns.	704-377-5413
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Hammond Elctrns. Inc.	803-233-4121
SC	W. Columbia, Century Fasteners Corp.	803-791-1800
TN	Memphis, Carlton-Bates Co. Inc.	901-365-3539
TN	Nashville, Carlton-Bates Co. Inc.	615-885-3232
TN	Oakridge, Dixie Elctrns.	615-481-3393
TX	Austin, Added Value Elctrns.	512-346-6331
TX	Austin, Carlton-Bates Co., Inc.	512-837-9098
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Time Elctrns.	512-346-7346
TX	Austin, Wofford Elctrns., Inc.	512-339-1131
TX	Dallas, Added Value Elctrn.	214-404-1144
TX	Dallas, Allied Elctrns.	1-800-433-5700
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Carlton-Bates Co. Inc.	817-831-0395
TX	Houston, Carlton-Bates Co. Inc.	817-831-0395
TX	Houston, Carlton-Bates Co., Inc.	817-831-0395
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Kent Elctrns.	713-978-5849
TX	Irving, Time Elctrns.	214-621-0500
TX	Lorado, REM	216-373-1300
TX	Richardson, All American	800-541-1435
TX	Richardson, Kent Elctrns.	713-780-7770
TX	Richardson, R S C Elctrns.	214-644-3444
TX	Richardson, Time Elctrns.	214-644-4644
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Future Elctrn. Inc.	801-972-8489
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
UT	West Lake City, Added Value Elctrn.	801-975-9500
UT	West Valley City, Time Elctrns.	801-973-8494
VA	Ashland, Century Fasteners Corp.	804-550-2058
WA	Kent, Comps. Resources	206-340-1646
WA	Kirland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia/Deanco Inc.	206-881-5566
WA	Redmond, Energy Sls. Inc.	206-883-2342
WA	Redmond, Future Elctrns. Inc.	206-881-8199
WA	Redmond, Kent Elctrns./PYR	206-883-7200
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Milwaukee, Progressive Image Inc.	414-321-4722
WI	New Berlin, N E P Elctrns. Inc.	414-785-9100
WI	New Berlin, Rekco	414-784-3430
WI	W. Allis, Advent Elctrns.	414-475-6860
WI	Waukesha, Future Elctrns.	414-700-1004
Can	Edward, Future Elctrns. Inc.	204-786-7711
Can	Galgary, Future Elctrns. Inc.	403-250-5550
Can	Markham, Ont., Carsten Elctrns.	416-477-7705
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Ottawa, Ont., Carsten Elctrns.	416-495-7705
Can	Pointe Claire, Que., Future Elctrns. Inc.	514-694-7710
Can	Port Royal, Prelco Elctrns.	514-389-8051
Can	Richmond Hill, Ont., Irwin Indl.	416-889-9100
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Vancouver, BC, Future Elctrns. Inc.	604-294-1166
Can	Victoria, BC, Queale Elctrns. Ltd.	604-388-6111

FAX: 908-526-6866

ABACUS CONTROLS INC., 80 Readington Rd., Somerville, NJ 08876, Tel: 908-526-6010; FSC No.: 54241; Empl.: 30; *Sls. Mgr.:* R.J. Swinger .... **D•2223-2225**

Local Sales Offices & Reps

AL	Gurly, Saber Assocs., Inc.	205-776-9481
CA	Jamul, Power Partners	619-560-0099
CA	Los Angeles, Power Partners	310-215-0800
CA	Sunnyvale, N-S Westronics	408-745-1102
CA	Ventura, Power Partners	805-659-5356
CT	New London, Elctrn. Sls. of New England	203-443-2646
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Tampa, Saber Assocs., Inc.	813-961-0689
GA	Dacula, Saber Assocs., Inc.	404-962-8740
IN	Fishers, Carter, McCormic & Peirce, Inc.	317-842-9277
MA	N. Dartmouth, Elctrn. Sls. of New England	508-997-8016
MI	Farmington Hills, Carter, McCormic & Peirce, Inc.	313-477-7700
NC	Clayton, Saber Assocs., Inc.	919-553-5009
OH	Englewood, Carter, McCormic & Peirce, Inc.	513-836-0951
OH	Parma, Carter, McCormic & Peirce, Inc.	216-398-0400
PA	Pittsburgh, Carter, McCormic & Peirce, Inc.	412-826-3800
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 718-589-5682, 1-800-888-ABALON, FAX: 718-589-0300; Empl.: 25

ABATRON, INC., 33 Center Dr., Gilberts, IL 60136, Tel: 708-426-2200, 800-445-1754, FAX: 708-426-5966

ABB KENT-TAYLOR INC, Asea Brown Boveri, P.O. Box 20550, Rochester, NY 14602-0550, Tel: 716-292-6050, FAX: 716-273-6207; Empl.: 350; *Dist. Mgr.:* Jim Wicker

ABB SEMICONDUCTOR, See IXYS Corporation

abbott

FAX: 310-836-1027

ABBOTT ELECTRONICS, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 310-202-8820; FSC No.: 6130, 5999, 15755; Empl.: 120; *Sls. Mgr.:* William G. Standen .... **D•1491-1511, 2226-2227**

Local Sales Offices & Reps

MA	Whitinsville, Power Factor & Assoc. ...	508-234-6415
NJ	Ft. Lee, Abbott Elctrns.	201-461-4411
TX	Richardson, Abbott Elctrns.	214-437-0697
Can	Ottawa, Subtec Ltd.	613-738-1470

Abbott
TECHNOLOGIES INC
The Powerhouse of Quality

FAX: 818-768-0395/7

ABBOTT TECHNOLOGIES, INC., 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, 1-800-367-8200; FSC No.: 58910; Empl.: 62; *Sls. Mgr.:* Suresh Soni, Sls. Mgr. ...... **A•2234-2253; D•1512-1515, 2228-2229**

Local Sales Offices & Reps

CA	Sun Valley, Abbott Technlgs., Inc.	818-504-0644
NJ	Palisades Pk., Abbott Technlgs., Inc. ..	201-461-4005

ABBOTT TRANSISTOR LABS, Power Supplies, See Abbott Electronics, Power Supplies

AB CONTROLS & TECHNOLOGY INC., 1700 Rockville Pike, Rockville, MD 20852, Tel: 301-984-6020, FAX: 301-981-3270; *Sls. Mgr.:* Andrew Kassman

A.B. CONTROLS & TECHNOLOGY, INC., 255 Pennbright, Ste. 200, Houston, TX 77090, Tel: 713-876-3728, 301-984-6020, FAX: 713-876-4853; Empl.: 15; *Sls. Mgr.:* Andrew Kassman; *Dist. Mgr.:* Andrew Kassman

ABL ELECTRONICS SUPPLY, INC., 11 S. Broad St., Peekskill, NY 10566, Tel: 914-736-1010, 1-800-431-2103, FAX: 914-736-1899; Empl.: 18; *Sls. Mgr.:* George Wiesel .... **C•1287, 1706-1709**

ABLESTIK ELECTRONIC MATERIALS & ADHESIVES-EMCA-REMEX PRODUCTS, 160 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-855-1000, TWX: 710-566-1128, FAX: 215-855-8202; Empl.: 50; *Sls. Mgr.:* Jeff Gausepohl

ABLESTIK LABORATORIES, 20021 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-764-4600, FAX: 310-764-2545; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* J. Gausepohl

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, FAX: 408-436-0969; FSC No.: 8Z441; *Sls. Mgr.:* V. Lumba

ABRACON CORPORATION, 1010 Calle Cordillera Bldg. 103, San Clemente, CA 92673, Tel: 714-498-4505, FAX: 714-498-1714; *Sls. Mgr.:* Jeff Trusiak; *Dist. Mgr.:* Dean Nessen .... **A•1180, 1330-1331**

ABRAMS INSTRUMENT CORP., 1322 Rensen St., Lansing, MI 48910-3688, Tel: 517-882-7211, FAX: 517-882-3136; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ABSOLUTE FILTER CO., P.O. Box 594, Ambler, PA 19002, Tel: 215-886-9176, FAX: 215-886-9179; Empl.: 2; *Sls. Mgr.:* Ed Borzelleca

ABSOPULSE ELECTRONICS LTD., 110 Walgreen Rd., Carp, Ont., Can K0A 1L0, Tel: 613-836-3511, FAX: 613-836-7488; Empl.: 31; *Sls. Mgr.:* Tony Plangger; *Dist. Mgr.:* Nanno Habets

ABWJ SYSTEMS CORP., 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti/Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ABW SYSTEMS, CORPORATION, 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti / Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St., Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* Ron Ruby

ACCEL TECHNOLOGIES, INC., 6825 Flanders Dr., San Diego, CA 92121, Tel: 619-554-1000, FAX: 619-554-1019; Empl.: 33; *Sls. Mgr.:* Earl Therrien

ACCESSORIES FOR ELECTRONICS, INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516-867-1922; FSC No.: 54355; Empl.: 27; *Sls. Mgr.:* Bill Harris

ACC RELAYS, Echlin Inc., 1300 West Oak St., Independence, KS 67301-0778, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 900; *Sls. Mgr.:* Neil Heisler; *Dist. Mgr.:* Gary Ledbetter

ACCULEX CORPORATION, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3660, TELEX: 503989, FAX: 508-880-0179; *Sls. Mgr.:* Richard A. Mullen

ACCULIN, INC., 209 W. Central St., Natick, MA 01760, Tel: 508-650-1012, FAX: 508-650-1457; Empl.: 5; *Sls. Mgr.:* Barry Hilton

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

ACCU-NOISE LAB, Marek Technology Inc., 23 Padanaram Rd., Ste. 5, Danbury, CT 06811, Tel: 203-743-3633; *Sls. Mgr.:* R. L. Longo; *Dist. Mgr.:* Robert L. Longo

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 508-745-7878, FAX: 508-745-7922; Empl.: 15; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS CORP., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, 1-800-334-5904, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* Roger M. Mahoney

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 310-903-0200, TWX: 910-586-1632, FAX: 310-903-0208

ACCUSONIC DIVISION, O.R.E. International Inc., Box 709, Falmouth, MA 02541, Tel: 508-548-5800, TELEX: 6817399 OREFAL UW, FAX: 508-540-3835; Empl.: 100; *Sls. Mgr.:* Robert Beede

ACCUSONIC PRODUCTS, Global Market Development, 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-437-6000, FAX: 516-358-2307; FSC No.: 11-3044326; Empl.: 11; *Sls. Mgr.:* Anthony W. Mazzeo; *Dist. Mgr.:* Anthony W. Mazzeo

ACCUTECH, Adaptive Instrs. Corp., 15 Bunazzoli Ave., Riverside Indl. Park, Hudson, MA 01749, Tel: 508-568-0500, FAX: 508-568-9085; *Sls. Mgr.:* Cliff Lewis

ACCUTECH BENCHMARK SERVICES, P.O. Box 252, Brick, NJ 08723, Tel: 1-908-206-0026, FAX: 908-206-0280

ACCU-TECH CORPORATION, 200 Hembree Park Dr., Roswell, GA 30076-3890, Tel: 404-751-9473, 800-221-4767, FAX: 404-475-4659; Empl.: 52; *Sls. Mgr.:* Randy Guhl; *Dist. Mgr.:* Dale Yarber

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

ACCU-TRONICS MFG., INC., 4255 White Bear Pkwy., St. Paul, MN 55110, Tel: 612-653-1961, FAX: 612-653-1041; Empl.: 35; *Sls. Mgr.:* Jeffrey H. Zappa

ACDC ELECTRONICS, DIV. OF ASTEC AMERICA, See Astec America

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, FAX: 313-984-1446; Empl.: 200

ACI COMPONENTS, INC., 23422 Peralta, Ste. D, Laguna Hills, CA 92653, Tel: 714-588-9611, FAX: 714-588-1855; FSC No.: 5930; Empl.: 5; *Sls. Mgr.:* Christian Dwyer

ACL INC., 1960 E. Devon Ave., Elk Grove Village, IL 60007, Tel: 708-981-9212, 1-800-782-8420, TELEX: 4330251, ESYLNK: 708-981-9212; Empl.: 12

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400, FAX: 716-968-3948; *Sls. Mgr.:* Dale Guilford

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650, FAX: 201-943-0516; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, 4815 West 5th St., Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* George Mergel

ACME-URDC, INC., 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Al Haag

ACON, INC., 22 Bristol Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 15; *Sls. Mgr.:* Frank Gurley .... **D•2058-2066**

Local Sales Offices & Reps

CA	Carlsbad, Zerimar Sls.	619-436-3379
CA	San Jose, Silicon Valley Sls.	408-432-1967
FL	Oldsmar, Suncoast Elctrn. Sls.	813-787-9221
IN	Columbus, High Tech Assocs.	812-378-4835
MA	Tyngsboro, AMS Mktg.	508-263-9712
MI	Rochester Hills, Geotronix	313-373-4334
MN	Minneapolis, Electro-Serv Co.	612-338-3475
OH	Richfield, Geotronix	216-659-6100
OK	Tulsa, Advance Tech Sls.	918-664-0482
PA	Drexel Hill, DNE Sls.	215-789-6822
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
Can	Don Mills, Ont., Canadian Source Corp.	416-445-0211

ACOPIAN TECHNICAL COMPANY, Box 638, Easton, PA 18044, Tel: 215-258-5441, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal .... **D•1517-1548**

Local Sales Offices & Reps

FL	Melbourne, Acopian	407-727-1172

ACRODYNE CONTROLS, See Accudyne Corp.

ACROLOOP MOTION CONTROL SYSTEMS, INC., 7801 Park Dr., Chanhassen, MN 55317, Tel: 612-474-4500, FAX: 612-474-7674; Empl.: 13; *Sls. Mgr.:* Mike Wagner; *Dist. Mgr.:* Mike Wagner

ACROMAG INC., 30765 Wixom Rd., P.O. Box 437, Wixom, MI 48393-7037, Tel: 313-624-1541, FAX: 313-624-9234; Empl.: 75; *Sls. Mgr.:* L. Anderson

ACR SYSTEMS INC., 8561-132nd St., Surrey,B.C., Canada V3W 4N8, Tel: 604-591-1128, FAX: 604-591-2252; Empl.: 5; *Sls. Mgr.:* Rick Schellenberg; *Dist. Mgr.:* Rick Schellenberg

ACTEL CORPORATION, 955 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-1010, FAX: 408-739-1540; Empl.: 86; *Sls. Mgr.:* Bob Duyn

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, FAX: 619-279-6290; Empl.: 230; *Sls. Mgr.:* Frank Williams, Sls. VP

ACTION USA, 6 Brightwater Cir., St. Petersburg, FL 33704, Tel: 813-821-5000, 800-821-5001, FAX: 813-822-8800

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 .... **D•1149**

ACTIVE ELECTRONICS, Future Electronics, 237 Hymus Blvd., Pointe-Claire, Que., Canada H9R 5C7, Tel: 514-694-7710, 1-800-677-8899, FAX: 514-697-8112; Empl.: 1700; *Dist. Mgr.:* Mike Zuppa (USA), Doug Kisway (CAN)

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman; *Dist. Mgr.:* Bill Karmell

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574, FAX: 201-589-3155; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Conslt.

ADAC CORPORATION, 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, FAX: 617-938-6553; Empl.: 40

ADALET-PLM/DIV. OF SCOTT & FETZER CO., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349, FAX: 216-267-1681; FSC No.: 73389; Empl.: 177

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TELEX: 62262290, FAX: 818-500-7239; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAM TECHNOLOGIES INC., 211 Clay Ave. W., Roselle Park, NJ 07204, Tel: 908-245-4000, FAX: 908-245-4455; Empl.: 152; *Sls. Mgr.:* Brett Hammerschmidt

ADAPTEC, INC., 691 South Milpitas Blvd., Milpitas, CA 95035, Tel: 408-945-8600, TELEX: 910-338-0060, FAX: 408-262-2533; Empl.: 6000; *Sls. Mgr.:* Wayne Gartin; *Dist. Mgr.:* Roy Safire

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Sumin Tchen

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 18; *Sls. Mgr.:* William Chambers; *Dist. Mgr.:* Carolyn Pennington/Lynn LaDuca

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 16; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-938-8080, TELEX: 290321, FAX: 612-946-3292; Empl.: 2000; *Sls. Mgr.:* Larry Asten

ADDACON GREENSBORO, 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYSTEMS CORP., Photographic Sciences Corp., 770 Basket Rd., Webster, NY 14580-0478, Tel: 716-265-1600, FAX: 716-872-6142; FSC No.: 23389; Empl.: 11; *Sls. Mgr.:* J. Cessna, J. Butters; *Dist. Mgr.:* Jack Petz

Local Sales Offices & Reps

CA	Torrance, AMASCO-South	213-781-9494
FL	Melbourne, Saber Assocs.	800-327-0853
MD	Landover, Sel-Tronics	301-341-2700
MA	Hopkinson, Eastern Sys.	508-435-2151
MN	Minneapolis, Engineering Prods. Assoc.	612-835-9022
NJ	Newark, Rical Assocs.	201-643-0880
NM	Albuquerque, Trembly Assocs.	505-266-8616
OH	Westlake, TMS, Inc.	216-327-3527
PA	N. Wales, Scientific Devs.	215-699-7707
TX	Richardson, Scientific Devs. (SW)	214-231-8106
WA	Woodinville, Test & Measurement, Inc.	206-485-1111
EXP	Leport Marly, France, Euromeasure, SA	33 160 131110
Intl	Ramat-Gan, Isreal, IES	972 37526333
Intl	Warwickshire, England, Fozmula Ltd.	926 335411
Can	Quebec, Interfax Sys.	514-336-0392

ADE, INC., 1430 E. 130th St., Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 160 Hamlet Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 650; *Sls. Mgr.:* Julian Caduto

AP
ADTECH POWER

FAX: 714-634-0802

ADTECH POWER INC., 2220 S. Dupont Dr., Anaheim, CA 92806, Tel: 714-634-9211; FSC No.: 56410; Empl.: 55; *Sls. Mgr.:* Bernie Smilak; *Dist. Mgr.:* Bernie Smilak .... **D•1549-1551**

Local Sales Offices & Reps

NY	New York, Morgan Elctrn. Sls.	516-549-5180

Local Distributors

AL	Birmingham, Industrial Elec. Supp.	205-956-8504
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	San Francisco, Zack Elctrns.	415-626-1444
LA	Lafayette, Ralph's of Lafayette	318-233-0105
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Woburn, Mac Bearing	617-933-2110
PA	Philadelphia, Philadelphia Elctrns.	215-673-0400
TX	Ft. Worth, Allied Elctrns.	1-800-433-5700

ADTRON CORPORATION, 3050 S. Country Club Dr., # 24, Mesa, AZ 85210, Tel: 602-926-9324, FAX: 602-926-9359; Empl.: 10; *Sls. Mgr.:* Tony Giallella

ADTRON INSTRUMENTS, 13801 N. 7th St., Ste. 201, Phoenix, AZ 85022, Tel: 602-863-2250, FAX: 602-863-0914; Empl.: 2; *Sls. Mgr.:* H. Painter

ADVACOM, INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774

ADVANCE CONVERSION DEVICES CO.UNIT OF TRANSITOR DVCS., INC., 85 Horsehill Rd., Cedar Knolls, NJ 07927, Tel: 201-267-1900, FAX: 201-267-2047; FSC No.: 52298; Empl.: 100; *Sls. Mgr.:* Ron Zeman .... **D•2230-2231**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	205-539-1485
AZ	Scottsdale, Dave Menegay & Assocs.	602-994-9519
AR	El Dorado, Kemp Instrs. Co., Inc.	501-862-5869
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Canoga Park, FLW, Inc.	818-719-0037
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW Inc.	714-751-7513
CA	Costa Mesa, FLW, Inc.	714-751-7512
CO	Denver, Elcom, Inc.	303-337-2300
CT	Watertown, May Technlg.	203-274-3777
FL	Ft. Lauderdale, Reynolds & Assocs., Inc.	305-344-4536
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
FL	Tampa, Reynolds & Assocs., Inc.	818-372-8369
GA	Duluth, Reynolds & Assocs.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	708-520-1200
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Kansas City, MTS	913-888-5100
MD	Hunt Valley, Elctrn. Resources, Inc.	301-584-8157
MA	Lexington, E.F. Delfino,Inc.	617-862-1118
MI	Ann Arbor, Ashby Assocs., Inc.	313-995-4082
MN	St. Louis Pk., Elctrn. Innovation, Inc.	612-922-2945
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NY	Endicott, Advanced Comp. Corp.	607-785-3191
NY	Kingston, Advanced Comp. Corp.	914-339-1730
NY	N. Syracuse, Advance Comps.	315-699-2671
NY	Rochester, Advanced Comps. Corp.	716-544-7017
NY	Scottsville, Advanced Comps. Corp.	716-889-1429
NC	Raleigh, Reynolds & Assocs., Inc.	919-876-0282
OH	Arcanum, Ashby Assocs., Inc.	513-692-8713
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OK	Tulsa, Kemp Instrs.,Inc.	918-663-4501
PA	Pittsburgh, Ashby Assocs., Inc.	412-343-5105
PA	Southampton, Campbell Assocs.	215-322-6630
PA	West Chester, Elctrn. Resources, Inc.	215-431-0198
SC	Greenville, Reynolds & Assocs., Inc.	803-288-8701
TX	Lewisville, J. Hughes Co.	214-221-1536, 214-221-1538
UT	Murray, Elcom	801-262-2400,801-262-2472
VA	Alexandria, Dyna-Rep Co.	703-354-1222
VA	Harrisburg, Elctrn. Resources, Inc.	703-289-5571
VA	Norfolk, Elctrn. Resources, Inc.	804-583-4859
EXP	NY/New York, Roburn Agencies, Inc.	914-968-1016
Can	Weston, Ont., Duncan Instrs., Canada Ltd.	416-742-4448
CA	La Jolla, Keller-Simonsen Assocs.	619-453-5720, FAX:619-453-1695
CA	Manhattan Bch., Pacific Edge	310-546-9009, FAX:310-546-3005
CA	Sunnyvale, Pass Assocs.	408-735-9040, FAX:408-735-0882
FL	Coral Springs, CBC Elctrns.	305-755-1111, FAX:305-341-8379
FL	Longwood, CBC Elctrns.	407-831-5380, FAX:407-831-0965
FL	Tampa, CBC Elctrns.	813-969-1901, FAX:813-264-2744
GA	Lilburn, Adams Elctrns. Inc.	404-925-9115, FAX:404-925-4116
IL	Berkeley, ESA Tech. Mktg.	708-544-0120, FAX:708-544-0266
IN	Indianapolis, CC Electro Sls.	317-921-5000, FAX:317-921-5005
IA	Cedar Rapids, Delltron	319-393-0075, FAX:319-393-0058
KS	Wichita, Miller Aerospace	316-689-8292, FAX:316-689-8247
MD	Randallstown, Beacon North	703-478-2480
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Madison Hgts., Pine Sls.	313-589-0350, FAX:313-589-3420
MN	Eden Prairie, Electro Mark	612-944-5850, FAX:612-944-5855
MO	St. Louis, Acorn	314-421-1751,FAX:314-421-1752
NH	Nashua, Bell Controls	603-882-6984, FAX:603-882-9049
NJ	Elberon, Compar	908-229-3666, FAX:908-229-3687
NJ	Wood-Ridge, Compar	201-460-3569
NY	Bellmore, Compar New York	516-221-7300, FAX:516-221-7600
NC	Sanford, Adams Elctrns. Inc.	919-774-8816
OH	Beachwood, Thompson & Assocs., Inc.	216-831-6277,FAX:216-831-2553
OH	Dayton, Thompson & Assocs., Inc.	513-435-7733, FAX:513-435-1898
OH	Orient, Thompson & Assocs., Inc.	614-877-4304, FAX:614-877-0872
OR	Beaverton, Micro Sls.	503-645-2841, FAX:503-645-3754
PA	Carnegie, Del Steffen & Assocs.	412-276-7366, FAX:412-276-4616
TX	Dallas, Converter Elctrns.	214-333-2028, FAX:214-333-2028
UT	Ogden, Taylor Mktg.	801-546-9570, FAX:801-546-9590
VA	Sterling, Beacon North	703-478-2480, FAX:703-435-7115
WA	Bellevue, Micro Sls.	206-451-0568, FAX:206-453-0092

Advanced Analog
a division of Intech

FAX: 408-988-2702

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930; FSC No.: 52467; Empl.: 200; *Sls. Mgr.:* Michael Sullivan .... **D•2067**

Local Sales Offices & Reps

AL	Huntsville, Sides Assocs.	205-859-9395, FAX:205-851-8785
AZ	Tempe, Thor Engrg.	602-438-8494, FAX:602-438-6879

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 130; *Sls. Mgr.:* David Bouley, V.P. of Sls.

ADVANCED
COMPONENTS
INDUSTRIES,
INC.

FAX: 310-328-0062

ADVANCED COMPONENTS INDS., INC., Div of Kaschke, 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060; *Sls. Mgr.:* Irma Spreitzer .... **A•1318, 2254-2255; B•1403**

Local Sales Offices & Reps

CT	Hopkinton, Berkshire Elctrns.	508-435-9356
IL	Schaumburg, Terry McNulty & Assocs.	708-780-9868
MA	Hopkinton, Berkshire Elctrns.	508-435-9356

ADVANCED CONNECTOR TECHNOLOGY, 2368 Eastman Ave., # 5, Ventura, CA 93003, Tel: 805-644-9990, FAX: 805-644-9664; Empl.: 5; *Sls. Mgr.:* Karin Kalli

ADVANCED CONTROL SYS., 10 Old Mine Rock Way, Hingham, MA 02043, Tel: 617-740-0223, FAX: 617-740-4227; Empl.: 13; *Sls. Mgr.:* Leopold Bric .... **D•1150**

ADVANCED CONTROL SYSTEMS, 1117 Baker St., Ste. C, Costa Mesa, CA 92626-4114, Tel: 714-540-9010, FAX: 714-540-5313; Empl.: 7; *Sls. Mgr.:* Gary Rasmussen

ADVANCED CONVERSION TECH., 2001 Fulling Mill Rd. P.O.B. 70, Middletown, PA 17057, Tel: 717-939-2300, FAX: 717-939-7170; FSC No.: 60642; Empl.: 100; *Sls. Mgr.:* L.M. Reis

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150, FAX: 714-536-0936; Empl.: 8; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HARDWARE ARCHITECTURES, INC., P. O. Box 9669, Moscow, ID 83843, Tel: 208-883-8000, FAX: 208-883-8001; Empl.: 50; *Sls. Mgr.:* Jack Maynard

ADVANCED HARDWARE MANUFACTURING, INC., 925 Horan Drive, Fenton, MO 63026, Tel: 314-343-3850, FAX: 314-343-3937; Empl.: 16

ADVANCED HIGH VOLTAGE COMPANY, P.O. Box 32408, Tucson, AZ 85751, Tel: 602-721-2424, 818-997-7222, FAX: 602-721-2322; *Sls. Mgr.:* John Richardson .... **D•1553**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, 800-444-5923, FAX: 208-772-7613; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Jeff Petkevicius .... **B•1819**

ADVANCED INTERCONNECTIONS CORP., P.O. Box 1019, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, FAX: 408-720-8297; Empl.: 10

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED METALLURGY, 1003 Corporate Dr., Murray Corp. Park, Export, PA 15632, Tel: 412-733-8332, FAX: 412-733-2880

ADVANCED MICRO COMPUTER, 1321 NW 65th Pl., Ft. Lauderdale, FL 33309, Tel: 305-975-9515, FAX: 305-975-9698; Empl.: 20; *Sls. Mgr.:* Lee Maxey

ADVANCED MICRO DEVICES, INC., 901 Thompson Place, Sunnyvale, CA 94088, Tel: 408-732-2400, TELEX: 34-6306

ADVANCED MICRO SYSTEMS, INC., 2 Townsend West, Nashua, NH 03063-1277, Tel: 603-882-1447, FAX: 603-881-7600; Empl.: 50

ADVANCED MOTION CONTROLS, INC., 518 W. Water St., P.O. Box 64, Princeton, WI 54968, Tel: 414-295-3500, FAX: 414-295-3504

ADVANCED PHOTONIX, INC., 1240 Avenida Acaso, Camarillo, CA 93012, Tel: 805-484-2884, FAX: 805-484-9935; Empl.: 90; *Sls. Mgr.:* D. Tingley, W. Bandel, R. Dahl

ADVANCED POWER DESIGNS INC., 17744 Skypark Circle No. 250, Irvine, CA 92714, Tel: 714-263-8605, FAX: 714-263-8607; Empl.: 23

ADVANCED POWER PRODUCTS, 32249 Murrieta Rd., Menifee, CA 92584, Tel: 714-672-7704; Empl.: 2

APS ADVANCED POWER SOLUTIONS

FAX: 510-460-5498

ADVANCED POWER SOLUTIONS, M & L Enterprises, 5994 W. Las Positas Blvd., Ste. 117, Pleasanton, CA 94588, Tel: 510-734-3060; Empl.: 15; *Sls. Mgr.:* Bill Smith; *Dist. Mgr.:* Bill Smith .... **D•1554-1556**

Local Sales Offices & Reps

CA	West Lake Village, MPL Assoc.	805-379-9251
FL	Del Ray Beach, Phelps Assoc.	407-276-7591
MA	Bellingham, OEM Mktg.	508-528-4983
MO	Bridgeton, Dytronix	314-291-4777
NH	Salem, OEM Mktg.	603-893-0009
NY	Hauppauge, Sticom	516-366-4221
PA	Pittsburgh, Catalyst Sls.	412-826-3434
UT	Layton, Taylor Mktg.	801-546-9570
VA	Vienna, The Walters Grp.	703-660-3799

ADVANCED POWER TECHNOLOGY, 405 S.W. Columbia Street, Bend, OR 97702, Tel: 503-382-8028, FAX: 503-388-0364; Empl.: 106; *Sls. Mgr.:* Tom Loder; *Dist. Mgr.:* Tom Loder

ADVANCED PROCESS CONTROLS, 500 West Cummings Park, Woburn, MA 01801, Tel: 617-932-9262, FAX: 617-932-0939; *Sls. Mgr.:* Richard Smith

ARC ADVANCED RUBBER CONCEPTS, INC.
P. O. BOX 489 - HWY. 77 SOUTH
PAULS VALLEY, OKLA. 73075

FAX: 405-238-3029

ADVANCED RUBBER CONCEPTS, Formerly Glolite Sales Ltd., Hwy 77 South, Pauls Valley, OK 73075, Tel: 405-238-5541, 800-654-3662; Empl.: 10 .... **B•1820**

Local Sales Offices & Reps

AZ	Peoria, Sem of Arizona	602-486-1191
CA	Mission Viejo, Champa Assocs.	714-581-3459
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
MD	Baltimore, Chesapeak Ind. Mktg.	410-653-0476
NY	Hauppauge, Aurora-Schmitt	516-434-1313

ADVANCED TECHNICAL MATERIALS, INC., 20 River Ave., Patchogue, NY 11772, Tel: 516-363-9018, 516-289-0363, FAX: 516-363-8002; FSC No.: OR8N4; *Sls. Mgr.:* Mike Geraci

FAX: 619-727-4436

ADVANCED TECHNOLOGY COMPANY, 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7430; Empl.: 10; *Sls. Mgr.:* Bill Linko .... **C•1562-1573**

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-834-1541, FAX: 814-834-1556; Empl.: 22; *Sls. Mgr.:* John M. Sidoni .... **B•1858-1859**

Local Sales Offices & Reps

GA	Atlanta, DHR Mktg.	404-564-0529
MA	Andover, Crawford & Assoc.	508-470-2122
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-829-1970
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157
Can	Dundas, Ontario, D.J. Hyslop & Co.	416-628-0266

ADVANCED THERMISTOR DIV.
U.S. SENSOR

FAX: 714-639-1220

ADVANCED THERMISTOR DIV., U.S. Sensor Corp., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000; Empl.: 25 .... **B•1860-1862**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls. Inc.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls. Inc.	602-577-0580
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Englewood, Compass Mktg. & Sls., Inc.	303-721-9663
FL	Orlando, Richmar Elctms. Corp.	407-352-3755
IL	Downers Grove, Richmar Elctms. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctms. Corp.	317-577-9950
IA	Iowa City, Richmar Elctms. Corp.	319-354-8894
MA	Canton, John Ferrari Co.	617-821-4599
MI	Brighton, AP Assocs., Inc.	313-229-6550
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990
NY	North Syracuse, Entec Grp.	315-458-7936
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Downington, Grasso Tech. Sls.	215-458-8967
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Plano, Richmar Elctms. Corp.	214-424-8388
TX	Round Rock, Richmar Elctms. Corp.	512-255-2551
WI	Butler, Richmar Elctms. Corp.	414-781-1730

ADVANCED VIDEO PRODUCTS, E-Systems, 2 Robbins Rd., Westford, MA 01886, Tel: 508-692-2020, FAX: 508-692-2140; Empl.: 65; *Sls. Mgr.:* Christopher Mohen

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, FAX: 219-223-2524; FSC No.: 50788; Empl.: 31; *Sls. Mgr.:* Kay Nixon .... **C•1682**

Local Sales Offices & Reps

CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Solvang, ATronix Technlg.	805-686-4366
CO	Arvada, Arrowhead	303-423-5556
FL	Davie, DAN-Tech Sls., Inc.	305-581-2884
IL	Elk Grove, W. G. Brouillette & Assoc.	708-290-1313
KY	Frankfort, Fred A. Dorsey Assoc.	502-695-2250
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
OR	Lake Oswego, Caruso & Assocs., Inc.	503-635-5282
PA	W. Conshohocken, Eastern Comps.	215-825-8610
MD	Baltimore, Eastern Comps. Sls. Corp.	301-788-7050
TX	Dallas, Materials Technlgy. Co.	214-484-4677
UT	Ogden, Arrowhead	801-479-7151
Can	Nepean, Ont., Subtec Ltd.	613-723-7720
WA	Bellevue, Caruso & Assocs.	206-455-8811

ADVANCE POWER SUPPLIES, INC., See Farnell Advance Power, Inc.

ADVANCE WIRE & CABLE ASSEMBLY, Electrical Insulation Suppliers, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

ADVANTEST AMERICA, INC., 1100 Busch Parkway, Buffalo Grove, IL 60089-4503, Tel: 800-441-0852, FAX: 708-634-2610; Empl.: 233; *Sls. Mgr.:* Atlee Jacobson

Instruments

ADVANTEST CORPORATION, NS Bldg. 2-4-1, Nishi-Shinjuku, Tokyo 163, Japan, Tel: 03-3342-7500, TELEX: 232-4914 ADVAN, FAX: J:03-3342-7510; Empl.: 1827; *Sls. Mgr.:* Shinpei Takeshita

ADVIN SYSTEMS INC., 1050-L East Duane Ave., Sunnyvale, CA 94086, Tel: 408-243-7000, FAX: 408-736-2503; *Sls. Mgr.:* Wing Hui

ADVOTECH, INC., 422 North Main St., Butler, PA 16001, Tel: 412-283-4497, FAX: 412-283-8830

A E G CORPORATION, Mt. Airy Corners III, 180 Mt. Airy Rd., Basking Ridge, NJ 07920, Tel: 908-204-8900, FAX: 908-231-8353; Empl.: 200; *Dist. Mgr.:* Don Walsh

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL DEFENSE CORP., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929, FAX: 215-822-9165; FSC No.: 93346; Empl.: 1,600; *Sls. Mgr.:* Denis Ritchie

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, FAX: 617-423-2952; *Sls. Mgr.:* George Wood; *Dist. Mgr.:* Daniel Wiswell .... **D•1223**

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Wladimir Dorta

AERODYNE CONTROLS CORPORATION, 30 Haynes Court, Ronkonkoma, NY 11779, Tel: 516-737-1900, FAX: 516-737-1912; FSC No.: 14923; Empl.: 80; *Sls. Mgr.:* Anthony R. Pipitone

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417, FAX: 516-694-6771; FSC No.: 88379; Empl.: 490

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, FAX: 817-654-3405; Empl.: 60; *Sls. Mgr.:* Ben L. Fryrear

AEROSPACE PRODUCTS DIV, A Subsidiary of Ametek, Inc., 50 Fordham Rd., Wilmington, MA 01887, Tel: 508-988-4947, FAX: 508-988-4944

AEROSPACE SYSTEMS, Communication Cable Inc., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, FAX: 507-235-6088; FSC No.: 24600; Empl.: 170; *Sls. Mgr.:* Robert L. Johnson

AEROSPACE WIRE & CABLE INC., 129-09 18 Ave., College Point, NY 11356, Tel: 718-358-2345, 1-800-395-0200, FAX: 718-358-2522; Empl.: 15

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* K. Wyman; *Dist. Mgr.:* K. Ross

AEROVOX INC., 370 Faunce Corner Rd., North Dartmouth, MA 02747-1217, Tel: 508-995-8000, FAX: 508-995-3000; FSC No.: 4K459; Empl.: 1500 Worldwide; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Jack Chmura .... **A•1008-1009, 1585**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Pheonix, Interstate Mktg.	602-263-8044
CA	Santa Clara, Ross Mktg.	408-988-8111
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Englewood, Elcom, Inc.	303-792-3330
CT	Wallingford, J.E. Boeing Co.	203-265-1318
DE	Greenville, H. Anderson	302-655-2917
FL	Margate, E.P.M. Corp.	305-977-0331
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Chicago, Rowe Mktg.	312-664-3744
IL	Elk Grove Vl., Carlson Elctrns. Sls.	708-956-8240
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, F.J. Campisano Co.	317-577-0319
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
KS	Overland Park, Beneke & McCaul Inc.	913-765-2298
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MA	Marion, R.F. Swoish Co.	508-748-2536
MI	Farmington Hills, Carrier & Gable, Inc.	313-477-8700
MN	Minneapolis, Comstrand Inc.	612-574-9480
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Columbus, F.J. Campisano Co.	614-538-1176
OH	Mentor, F.J. Campisano Co.	216-975-9300
OK	Tulsa, Ammon & Rizos Co.	918-749-6116
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Leechburg, F.J. Campisano Co.	412-845-2577
TN	Knoxville, 20th Century Mktg.	615-539-0676
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	El Paso, Ammon & Rizos Co.	915-534-7533
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
TX	San Antonio, Welaire	210-666-1800
WA	Bellevue, Luscombe Engrg. Co.	206-223-1541
WI	Milwaukee, Carlson Elec. Sls.	414-476-2790
Can	Mississauga, Ont., Longman Sls.	416-670-8100

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Milpitas, California Cap.	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Riverside, Elctrn. Supply Co.	714-683-7300
CA	Sacramento, IEC Sacremento	916-363-6030
CA	San Diego, Elctrn. Supply Co.	619-693-8222
CA	San Diego, Projections Unltd.	619-453-8444
CA	San Jose, Elctrn. Supply Co.	408-453-3770
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Tustin, Projections Unltd.	714-544-2700
CA	Westlake Vlge., Jaco Elctrns.	805-495-9998
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, IEC Headquarters	303-292-5537
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Hoffman Estates, IEC Chicago	708-843-2040
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IN	Indianapolis, R.S. Elctrns.	800-488-9065
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Pk., R.S. Elctrns.	800-251-0067
MD	Columbia, Jaco Elctrns.	301-995-6620
MA	Andover, Bell Inds.	508-474-8880
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MI	Grand Rapids, R.S. Elctrns.	800-776-1155
MI	Livonia, R.S. Elctrns.	800-366-7750
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Jaco Elctrns.	919-876-7767
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	800-962-0191
OH	Maumee, R.S. Elctrns.	800-472-3231
OR	Beaverton, IEC Portland	503-641-1690
PA	McKean, Advacom	814-4[illegible]-7774
TX	Austin, Jaco Elctrns.	512-835-0200
UT	W. Valley City, Salt Lake Beta Wintronics	801-966-0236
WA	Bellevue, IEC Seattle	206-455-2727
WI	Milwaukee, Marsh Elctrns.	414-475-6000

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AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Brian Rockett

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-831-0607, FAX: 818-363-6292; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFE TECHNOLOGIES INC., 3046A Berkmar Dr., Charlottesville, VA 22901, Tel: 804-974-7801, FAX: 804-974-7803; Empl.: 7(USA) 75(UK); *Sls. Mgr.:* Rob Brooks; *Dist. Mgr.:* Rob Brooks

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AFP ISOREG, AFP Transformers, Inc., 234 Taylor St., P.O. Box 486, Littleton, MA 01460, Tel: 508-486-9483, FAX: 508-486-3539; FSC No.: 7Y052; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

AHAMTOR INC., 999 Inc., 27901 Front St., Temecula, CA 92589-9019, Tel: 714-676-4151, FAX: 714-676-3031; *Sls. Mgr.:* John Markley

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 1700; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 5707 Airport Way So., Seattle, WA 98108, Tel: 206-762-8014, 800-426-0244, TWX: 910-444-1333, FAX: 206-762-8394; FSC No.: 3D536; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* Clyde Pfifer

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200; FSC No.: 10400;Multiple; Empl.: 313; *Sls. Mgr.:* Win Clark; *Dist. Mgr.:* Win Clark .... **C•1147**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Downey, Buffa Co., Inc.	310-923-4618
CA	Sunnyvale, Advanced Tech. Sls.	510-847-2060
CO	Aurora, Piper Sls.	303-340-1300
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
NH	Nashua, Solla - Tronics	603-882-7146
NY	Glen Cove, Dynorep	516-676-1598
NJ	Sommerville, Dynorep	908-874-4670
NY	Port Jefferson Sta., Dynorep	516-928-5135
OH	Kettering, Electro-Com	513-299-0864
OR	Tigard, Eltech, Inc.	503-684-3458
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Powhatan, Eagle Sls.	804-492-9027
WA	Bellevue, Eltech Inc.	206-643-4330
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
Can	Montreal, Source Elctrns. Ltd.	514-388-8979

Local Distributors

MD	Timonium, D.C. Elctrns.	410-252-6576
NY	Elmsford, Gemini Elect	914-592-5252
TX	Dallas, Hall Mark Elctrns.	214-343-5000
CA	Monrovia, Erik-A-Elect	818-574-1020
AZ	Scottsdale, Spirit Elctrns.	602-998-1533

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794, FAX: 818-988-4746

AIR FILTRATION PRODUCTS, INC., 707 No. Main Ave., Tuscon, AZ 85705, Tel: 602-624-2272, FAX: 602-624-2279; Empl.: 10; *Sls. Mgr.:* Ike Campos .... **C•1612**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Brett Hoffman

airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret .... **B•1234-1239**

Local Sales Offices & Reps

CA	Mountain View, Thorson-West	415-964-9300
CA	Signal Hill, Thorson Co.	310-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
FL	Naples, Techtron Sls. Corp.	813-566-3800
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
MN	St. Paul, Motion Technlg., Inc.	612-481-8691
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, Milton C. Matthews Co.	716-271-1910
PA	Downingtown, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIRMAR TECHNOLOGY, 69 Meadowbrook Dr., Milford, NH 03055, Tel: 603-673-9570, FAX: 603-673-4624; Empl.: 75; *Sls. Mgr.:* Cindy Russell

AIR-O-TRONICS, Pelco Electronics, 2747 Rt 20 E., P.O. Box 326, Cazenovia, NY 13035, Tel: 315-655-2387, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15; *Sls. Mgr.:* Randy Page, Dave Dice

AIRPAX-CAMBRIDGE DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-CHESHIRE DIV., See Philips Technologies, Automotive Elctrns. Grp.

AIRPAX-FREDERICK DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-INTERNATIONAL DIV., See Philips Technologies, Airpax Mechatronics Grp.

AIRPAX SENSOR DIV., See Philips Technologies, Sensor Prods.

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44483, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500; *Sls. Mgr.:* Dan Gagliano V.P. Sls.

AJ'S POWER SOURCE, INC.

FAX: 813-996-5037

A.J.'S POWER SOURCE, INC., 4105 Cox Dr., Land-O-Lakes, FL 34639, Tel: 800-933-7725; Empl.: 10; *Sls. Mgr.:* Allen L. Johnson Jr. **D•1557-1559**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Mission Viejo, Champa Assocs.	714-581-3459
CA	San Diego, Power Assocs.	619-275-0641
FL	Land O'Lakes, AJ's Power Source	813-996-2583
KS	Lenexa, The Beams Co.	913-541-9197
NH	Salem, OEM Mktg.	603-893-1197
NY	Pittsford, Franklin Sls.	716-248-8251
TX	Richmond, Jim D. Gray & Assoc., Inc.	713-342-1710
VA	Sterling, Beacon North, Inc.	703-478-2480

AKG ACOUSTICS, INC., 1525 Alvarado St., San Leandro, CA 94577, Tel: 510-351-3500, FAX: 510-351-0500; Empl.: 120; *Sls. Mgr.:* David Angress

AKRO-MILS, Myers Industries, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47202, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave. #7, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50 **A•1181, 2256; D•1560**

Local Sales Offices & Reps

OR	Portland, Halbar RTS	503-244-4123
PA	Newtown, Indl. Sls. Assocs.	215-860-2076
WA	Redmond, Halboar RTS	206-882-0990

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441, FAX: 517-629-9501; *Sls. Mgr.:* Dale A. Bash

ALCATEL CANADA WIRE INC., 10376 Battleview Parkway, Manassas, VA 22024, Tel: 703-369-0440, FAX: 703-369-4087; Empl.: 5,000; *Sls. Mgr.:* John Murphy

ALCATEL CHESTER CABLE CORP., 15 Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, FAX: 914-469-9935

ALCOMET, INC., 110 Mary Ann Rd., Beaver Dam, WI 53916, Tel: 414-885-9200, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

ALDEC, INC., 3525 Old Conejo Rd., , Newbury Park, CA 91320, Tel: 805-499-6867, TELEX: 239-447, FAX: 805-498-7945; Empl.: 57; *Sls. Mgr.:* Harry Tosado

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 508-898-2427; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN PRODUCTS CO., P.O. Box 510, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, FAX: 508-583-0164; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul **C•1148-1151**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 1411 Military Rd., Buffalo, NY 14217, Tel: 716-875-6240, FAX: 716-875-2404; Empl.: 25

ALEPH INTERNATIONAL®

FAX: 818-365-7274

ALEPH INTERNATIONAL CORP., 1026 Griswold Ave., San Fernando, CA 91340, Tel: 818-365-9856, 800-423-5622; Empl.: 15; *Sls. Mgr.:* Frank Mastrolonardo; *Dist. Mgr.:* Janis Dingman **B•1404-1405, 1662**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Mesa, Sys. Sls. of Arizona	602-464-9989
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Englewood, Omega Ltd.	303-762-1921
FL	Longwood, Beacon Elctrns.	407-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Meca Sls.	312-334-4020
IA	Marian, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Randallstown, Beacon North	703-478-2480
MA	Taunton, Focus Sls.	508-824-2480
MI	Lathrup Village, RC Nordstrom & Co.	313-559-7373
MN	Minneapolis, Intl. Elctrns.	612-571-0000
MO	St. Louis, MSB Assocs.	314-946-5577
NM	Albuquerque, Sys. Sls. of Arizona	505-889-2901
NY	Fairport, TAC Sls.	716-223-7610
NY	Glencove, Dynorep	516-676-1598
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Centerville, Engrg. Mktg. Assoc.	513-433-2800
SC	Greenville, Beacon Elctrns.	803-297-7830
TN	Knoxville, Beacon Elctrns.	615-691-0062
TX	Irving, Aid Elctrns.	214-790-4761
VA	Sterling, Beacon North	703-478-2480
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

AZ	Tempe, Acacia Sls.	602-894-2874
CA	Fremont (North), Acacia Sls.	510-623-7500
CA	Los Angeles, Bell Inds.	310-826-2355
CA	San Jose, Spectra Elctrns.	408-955-7800
CA	Santa Monica (South), Master Distrs.	310-452-1229
CO	Englewood, Comp. Distrs.	303-770-6214
CO	Wheatridge, Acacia Sls.	303-421-7004
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Clearwater, Comp. Distrs.	813-796-0466
FL	Lakeland, Wes-Garde Comps.	813-644-7564
IL	Chicago, Leeds Electro Comps.	312-625-3800
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Woburn, Control Design	317-932-9404
MI	Grand Rapids, SF Elctrns.	616-459-0216
MN	Plymouth, Leeds Electro Comps.	612-557-1277
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
PA	Malvern, Control Design	215-296-0150
TX	Dallas, Off the Shelf	214-247-0052
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Acacia Sls.	206-881-5566

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, FAX: 617-235-6588; Empl.: 60; *Sls. Mgr.:* Tom Conklin/John Boyd; *Dist. Mgr.:* Tom Conklin/John Boyd

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92198, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 390; *Sls. Mgr.:* Dave Zeman **D•1423**

Local Sales Offices & Reps

CA	San Diego, Alexander Batteries;New Prod./OEM Div.	619-480-4445,,,619-480-1351

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50402, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 350 **D•1423**

ALEXANDRIA EXTRUSION CO., P.O. Box 847 Cty. Rd. 22 North, Alexandria, MN 56308, Tel: 612-763-6537, FAX: 612-763-6530; Empl.: 175; *Sls. Mgr.:* Brian L. Bloedorn

ALEXANDRIA METAL FINISHER, INC., 9418 Gunston Cove Rd., Lorton, VA 22079, Tel: 703-643-1636, FAX: 703-690-6731; Empl.: 75; *Sls. Mgr.:* Larry Capoccia

ALFA ELECTRONICS, INC., P. O. Box 8089, Princeton, NJ 08543-8089, Tel: 609-275-0220, FAX: 609-275-9536; Empl.: 9; *Sls. Mgr.:* Jeff Kao

ALFCO, Div. of Air Maze, 1000 Cindy Lane, Carpinteria, CA 93013, Tel: 805-684-7651, FAX: 805-684-3654; FSC No.: 17504; Empl.: 100; *Sls. Mgr.:* Barbara McIntyre

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, FAX: 203-874-5063; Empl.: 255

ALLEGRO MICROSYSTEMS, INC., formerly Sprague Semiconductor Grp., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, FAX: 508-792-9024; FSC No.: OCVK3; Empl.: 2000; *Sls. Mgr.:* D. Ax; *Dist. Mgr.:* K. Gutkowski

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-6724; Empl.: 300; *Sls. Mgr.:* Jeffrey Buchman **A•1514, 1619**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
MA	Scituate, D&M Tech. Sls.	617-545-9369
MI	Ann Arbor, Tech. Sls. Assocs.	313-995-4082
OH	Cleveland, Tech. Sls. Assocs.	216-461-0826
OH	Dayton, Tech. Sls. Assocs.	513-298-2062
NC	Raleigh, Reynolds Assocs.	407-259-7000
PA	W. Conshohocken, Eastern Comp. Sls. Inc.	215-270-9530
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN- BRADLEY CO., Div. of Industrial Control Grp., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016, FAX: 414-382-4444; Empl.: 1600; *Dist. Mgr.:* Dick Zajork

FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-827-7422; Empl.: 35; *Sls. Mgr.:* Brad Hammarquist **A•1010-1013, 1860-1863**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-565-4019
AR	Little Rock, Design Mktg.	501-336-8122
CA	Cupertino, Prism Technical Sls., Inc.	408-435-7377, fx:408-257-8847
CA	Irvine, Gravley & Assocs., Inc.	714-852-9339
CT	Windsor, Janeco	203-688-4513
GA	Atlanta, JWL Assocs.	404-518-8500
IL	Chicago, Rendell Sls.	312-967-1513
IN	Indianapolis, Century Tech. Sls.	513-677-5088
MI	Warren, Burcaw Co.	313-573-4605
NJ	Cooper-Simon	201-428-0600
NY	Franklin Square, Cooper-Simon	516-489-0404
NC	JWL Assocs.	919-414-8887
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Century Tech. Sls.	513-677-5088
OK	Oklahoma, Design Mktg.	405-789-5911
MN	Oakdale, Complete Sls.	612-731-2923
TX	Austin, Design Mktg.	512-263-9151
TX	Houston, Design Mktg.	713-469-7949
WA	Redmond, Interstate Elctrns.	206-885-5257
WA	Seattle, Interstate Elctrns.	206-885-5257
EXP	Dublin, Ireland, Standard Comps. Ltd.	375-25025

Local Distributors

CA	Costa Mesa, Orange Ctny. Comps.	714-979-3597
CA	Oakland, Brill Elctrns.	405-834-5888
CA	San Diego, Mock III	619-560-0515
CA	San Jose, Spectra	408-955-7800
CA	Santa Clara, Bravo	408-980-8500
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Itasca, Voyager Elctrns. Corp.	312-773-4900

MN	Hibbing, Minntech Elctrns.	218-262-5227
NJ	Garfield, B & R Elctrns.	201-470-0700
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLEN SYSTEMS, 2346 Brandon Rd., Columbus, OH 43221, Tel: 614-488-7122; Empl.: 10

ALLEN TECHNOLOGY, PO Box 575, Sutton, NE 68979, Tel: 402-773-5285

ALLIANCE ELECTRONICS CORP., 8560 SW Salish Lane, Wilsonville, OR 97070-0503, Tel: 503-682-4976, FAX: 503-682-0390; Empl.: 21; *Sls. Mgr.:* Nate Olson

ALLIANCE LABORATORIES, INC., 555 Price Ave., Redwood City, CA 94063, Tel: 415-366-8220, FAX: 415-366-0634; Empl.: 10; *Sls. Mgr.:* Michael Munroe

ALLIED CONTROLS INCORPORATED, 562 Captain Neville Dr., Waterbury, CT 06705-3827, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 5945; *Sls. Mgr.:* John T. Kryjak, VP Sls. & Mktg.; *Dist. Mgr.:* J. Kronenberger

ALLIED ELCTRNS., Subsidiary of Hall-Mark, 7410 Pebble, Fort Worth, TX 76118, Tel: 800-433-5700, FAX: 817-595-6470; Empl.: 250; *Sls. Mgr.:* Ed Bridges

ALLIEDSIGNAL AEROSPACE, Aerospace Systems & Equipment, 118 Hwy. 35, Eatontown, NJ 07724, Tel: 908-389-7761, TELEX: 132-444, FAX: 908-389-7301; FSC No.: 83298;Multiple; Empl.: 1,000; *Sls. Mgr.:* R. Freeman

ALLIEDSIGNAL INC., Communications Systems, 1300 E. Joppa Rd., Towson, MD 21286-5999, Tel: 410-583-4000, TWX: 710-232-1823, FAX: 410-337-7485; FSC No.: 06845; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

ALLIGATOR TECHNOLOGIES, 17150 Newhope St., Ste. 114, Fountain Valley, CA 92708, Tel: 714-850-9984, FAX: 714-850-9987; Empl.: 10; *Sls. Mgr.:* Bertil Wanner

A-L-L MAGNETICS INC./THE MAGNET SOURCE, 930 S. Placentia Ave., Placentia, CA 92670, Tel: 800-262-4638, 800-525-3536, FAX: 714-632-1754,714-632-1757; FSC No.: 5999; Empl.: 43; *Sls. Mgr.:* Tim Pollett; *Dist. Mgr.:* Steve Alexander .... **A•1319**

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525, TELEX: 317027, FAX: 312-728-6410; FSC No.: 26863

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALPHA COMPONENTS, 1106 E Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, FAX: 717-697-8608; FSC No.: 52748; *Sls. Mgr.:* Jerry Buckwalter

ALPHA-CORE INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-335-6805, FAX: 203-384-8120; Empl.: 20; *Sls. Mgr.:* Sandu Pescaru

ALPHA DIST. CORP., 3554 Brecksville Rd., Richfield, OH 44286, Tel: 216-659-7100, 1-800-628-0841, FAX: 216-659-3459

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(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
alpha
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

ALPHA INDUSTRIES, INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, TELEX: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1400; *Sls. Mgr.:* David Barker

ALPHA-M CORP., 11518 Reeder Rd S.W., 115, Dallas, TX 75229, Tel: 214-406-0424, FAX: 214-241-6778; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, FAX: 201-434-7508; Empl.: 350; *Sls. Mgr.:* Dave Zerfoss, VP Assembly Prods.

ALPHA OMEGA COMPUTER SYSTEMS, 33815 Eastgate Circle, Corvallis, OR 97333, Tel: 503-754-1911, FAX: 503-754-1913; Empl.: 8; *Sls. Mgr.:* Gary Oliver; *Dist. Mgr.:* Gary Oliver

ALPHA PRODUCTS, INC., 5740 Corsa Ave. #104, Westlake Village, CA 91362, Tel: 818-889-9304, TELEX: 215-305, FAX: 818-706-8986

ALPHA-TECH INC., P.O. Box 209, Riverdale, NJ 07457, Tel: 201-838-1188, FAX: 201-838-1188; FSC No.: 1X300; Empl.: 8; *Sls. Mgr.:* M. Rice

ALPHATEST CORP., 557 E. Juanita Ave., # 6, Mesa, AZ 85204-6597, Tel: 602-545-5518, FAX: 602-545-5521; FSC No.: 07-411732-F; Empl.: 6; *Sls. Mgr.:* Dan Rodgers; *Dist. Mgr.:* Dan Rodgers

ALPHA THERMISTOR, INC., 7181 Construction Ct., San Diego, CA 92121, Tel: 619-549-4660, 800-235-5445, FAX: 619-549-4791; Empl.: 30; *Sls. Mgr.:* David Pyle

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711, Tel: 908-925-8000, TELEX: 6853017, TWX: 710-996-5895, FAX: 908-925-7938; Empl.: 376; *Sls. Mgr.:* Linda Smith

ALTAIR EXCHANGE CORPORATION, 24907 Avenue Tibbetts Unit-C, Valencia, CA 91355, Tel: 805-257-6964, FAX: 805-257-6490

ALTECH CORP., 35 Royal Rd., Flemington, NJ 08822-6000, Tel: 908-806-9400, FAX: 908-806-9490; Empl.: 35; *Sls. Mgr.:* Steve Stahovic, VP Sls.; *Dist. Mgr.:* Mort Gelfand, VP Opers. ... **B•1342; C•1006-1007, 1138, 1152-1159**

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626, FAX: 203-496-7113; FSC No.: 53939; Empl.: 65; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORPORATION, 12210 Plum Orchard Dr., Silver Springs, MD 20904-7802, Tel: 301-572-2555, TWX: 710-825-0422, FAX: 301-572-2510; FSC No.: 7D336; Empl.: 46; *Sls. Mgr.:* Frank D. Augustino; *Dist. Mgr.:* Frank D. Augustino

ALTERA CORPORATION, 2610 Orchard Parkway, San Jose, CA 95134-2020, Tel: 408-894-7000, TELEX: 888496, FAX: 408-248-7097

ALTERNATIVE MANUFACTURING, INC., 8 Summer St., P.O. Box 200, Winthrop, ME 04364-200, Tel: 207-377-9377, FAX: 207-377-9379; Empl.: 20

altran
ALTRAN CORP

FAX: 815-455-3171

ALTRAN CORPORATION, 6101 Factory Rd., Crystal Lake, IL 60014, Tel: 815-455-5650 .... **A•2257-2259**

ALTRON, INC., 6700 Industry Ave., N.W., Anoka, MN 55303, Tel: 612-427-7735, FAX: 612-427-3980; Empl.: 185; *Sls. Mgr.:* Jim Ruid

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ALUMAPAK, Electronic Precepts of Florida, 11651 87th St., N., Largo, FL 34643, Tel: 800-775-6077; Empl.: 7; *Sls. Mgr.:* Roy Bloomquist .... **C•1009**

Local Distributors

FL	Largo, Elctrn. Precepts of Fl.	800-367-4649

ALUSETT U.S.A., INC., 200 N. Water St., Peekskill, NY 10566, Tel: 914-737-0120, FAX: 914-737-8697; Empl.: 35

AMADOR, 1775 Old Highway 8, New Brighton, MN 55112-1891, Tel: 612-631-2487, TELEX: 5106007012, ESYLNK: 62911738, FAX: 612-631-3515; Empl.: 44; *Sls. Mgr.:* Gene A. Panger

AMASCO, 370 Amapola, Torrance, CA 90501, Tel: 310-781-9494, FAX: 310-781-9059; Empl.: 20; *Sls. Mgr.:* William Barten

AMATOM ELECTRONIC HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, TELEX: 963-419, FAX: 203-387-4101; FSC No.: 06540; Empl.: 125; *Sls. Mgr.:* James Marshall

AMBER ELECTRIC DESIGN, 6969 Trans-Canada Hwy., St. Laurent, PQ., Canada H4T 1V8, Tel: 514-333-8748, 800-361-3697, TELEX: 514-333-1388; FSC No.: 38047; Empl.: 40; *Sls. Mgr.:* Wayne Jones

AMBER INDS., INC., 3312 Wiley Post Rd., Carrollton, TX 75006, Tel: 214-490-9801, FAX: 214-980-0329; *Sls. Mgr.:* Paul Russell .... **B•1343**

Local Sales Offices & Reps

CO	Englewood, Dynatech	303-773-2830
IL	Park Ridge, G. McL. Cole Co.	708-827-6040
TX	Dallas, Seaton Corp.	214-980-9860
TX	Houston, Seaton Corp.	713-731-2649

AMBIT ASSOCIATES, 2038 San Rafael Ct., Santa Clara, CA 95051-2311, Tel: 408-241-5767, FAX: 408-241-4051

AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504, FAX: 201-666-0597; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

AMBROID CO., P.O. Box 38, Springfield, VT 05156, Tel: 802-885-9244, FAX: 802-885-9223; Empl.: 5; *Sls. Mgr.:* Manuel F. Usle

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AMCO ENGINEERING, 3801 N. Rose St., Schiller Pk., IL 60176, Tel: 708-671-6670, 800-833-3156; Empl.: 350; *Sls. Mgr.:* Tom Ligman .... **C•1010-1013, 1574**

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, C. T. Carlberg	602-468-0750
CA	Los Angeles, Knight Co.	310-670-2833
CA	Orange County, Knight Co.	714-833-8250
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CA	Temecula, The Knight Co.	714-699-2495
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Bethel, Instr. Dynamics	203-743-5045
FL	Tampa, Temco Sls. Inc.	813-855-7566, 800-282-6815
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Bensenville, Electronic Solutions, Inc.	708-766-3667
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
IA	Cedar Rapids, Dy-Tronix Inc.	319-377-8275
KS	Leawood, Dy-Tronix Inc.	913-339-6333
KS	Wichita, Dy-Tronix Inc.	316-838-0884
LA	Lafayette, Kemp Instruments	318-269-9452
MD	Columbia, L. G. White & Co.	410-290-8880
MA	Wakefield, Instr. Dynamics	617-245-5100
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MI	Portage, Electro Sls. Assocs.	616-323-2416
MN	St. Paul, Heyda/Hanks Assoc.	612-484-8531
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777
NM	Albuquerque, C. T. Carlberg Assocs.	505-899-2155
NY	Endwell, Reagan/Compar Albany	607-754-2171
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Reagan/Compar, Albany	716-271-2230
NY	Syracuse, Reagan Campar, Albany	315-432-8232
NC	Cary, L. G. White & Co.	919-380-8084
NC	Winston Salem, L. G. White & Co.	919-765-1665
OH	Chesterland, Electro Sls. Assocs.	216-729-0190
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, Kemp Engr.	918-663-4501
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Edgemont, White/Whiddett Co.	215-353-6343
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
SC	Greenville, L. G. White & Co.	803-271-0630
TX	Addison, Kemp Instrs.	214-931-7100

TX	Houston, Kemp Instrs.	713-466-1465
TX	Marble Falls, Kemp Instrs.	512-598-6115
VA	Ashland, L. G. White & Co.	804-752-7055
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EXP	NJ, Mahwah, Intl. Sls. Div.	201-825-0473

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AME CORPORATION, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195, Tel: 201-263-1700, FAX: 201-263-8199; Empl.: 20; *Sls. Mgr.:* Edward Dimitry .... **B•1663**

Local Sales Offices & Reps

CT	Woodbridge, White Indl. Assoc.	203-387-7037
FL	Longwood, EAB,Inc.	407-339-4986
MD	Jamesburg, Decco Sls. Co.	908-521-0323
NJ	Wyckoff, Chanco	201-891-7866
TX	Dallas, Control Comps. Corp.	214-458-8877
Can	Scarborough, Ont., Leecraft Inds.	416-292-4463

Local Distributors

Can	Scarborough, Ont., Leecraft Inds.	416-439-6320

AMERACE ELECTRONIC COMPONENTS, 7474 Utilities Road, Punta Gorda, FL 33950, Tel: 813-575-8400, FAX: 813-575-8484; Empl.: 300

AMEREX, 888 Marlborough Ave., Riverside, CA 92507, Tel: 909-686-1400, FAX: 909-683-4221; *Sls. Mgr.:* Dan R. Prillwitz

AMERICAN ADVANTECH CORP., 1310 Tully Rd., Ste. 115, San Jose, CA 95122, Tel: 408-293-6786, FAX: 408-293-4697; Empl.: 72; *Sls. Mgr.:* Thomas Chen

AMERICAN AEROSPACE CONTROLS, 570 Smith St., Farmingdale, NY 11735, Tel: 516-694-5100, FAX: 516-694-6739; Empl.: 48; *Sls. Mgr.:* Gregory D'Abramo .... **B•1914-1915**

AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 908-233-3500, FAX: 908-233-3241; Empl.: 125; *Sls. Mgr.:* Ronald R. King

AMERICAN ASSEMBLY INC., P.O. Box 515, 7 Industrial Dr., Florida, NY 10921, Tel: 914-651-3433, FAX: 914-651-2055; FSC No.: 74795; Empl.: 5

AMERICAN ARIUM, 14281 Chambers Rd., Tustin, CA 92680-7207, Tel: 714-731-1661, FAX: 714-731-6344; Empl.: 39; *Sls. Mgr.:* Jeff Acampora

AMERICAN CAPACITOR CORPORATION, 5367 Third St., Irwindale, CA 91706, Tel: 818-814-4444, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 59366; Empl.: 65; *Sls. Mgr.:* Joseph Latourelle; *Dist. Mgr.:* Joseph Latourelle

AMERICAN CHEMICAL ETCHING, See American Etching & Mfg.

AMERICAN CHEMICAL, INC., 2630 S. Irving Ave., Minneapolis, MN 55408-1047, Tel: 612-374-1767, FAX: 612-377-3590; *Sls. Mgr.:* Dennis Werneke; *Dist. Mgr.:* Karl Westerman

AMERICAN CONTROL PRODUCTS, Div. of Precision Timer Co., Inc., 47 Westbrook Ind'l Pk., Westbrook, CT 06498, Tel: 203-399-6253, FAX: 203-399-5619; Empl.: 35; *Sls. Mgr.:* R.D. Florin; *Dist. Mgr.:* R.D. Florin

AMERICAN CONTROL TECHNOLOGY, INC., 1447 Holmes Rd., Elgin, IL 60123-1203, Tel: 708-468-6000, FAX: 708-468-8959; *Sls. Mgr.:* Al Shrock .... **B•1665**

AMERICAN CYANAMID CO., Metal Coated Fibers Dept., South Cherry St., Wallingford, CT 06492, Tel: 203-284-4217

AMERICAN ELECTRONIC COMPONENTS, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, FAX: 219-264-4681; Empl.: 400; *Sls. Mgr.:* J. J. Wills, East/S. Kalin, West; *Dist. Mgr.:* Lonnie Haley .... **B•1711**

Local Sales Offices & Reps

AL	Birmingham, Tenn Tech, Inc.	205-879-0676
AL	Decatur, Tenn Tech, Inc.	205-350-5548
AL	Huntsville, World Distrs.	205-539-0441
AZ	Tempe, H-D Assocs., Inc.	602-784-2944
CA	Canoga Parkk, C & W Comp. Sls.	818-700-2684
CA	Sunnyvale, Pass Assocs.	408-735-9040
CT	Waterbury, Cannon Assocs., Inc.	203-597-0240
FL	Clearwater, J. J. Galleher Co.	813-461-7706
GA	Marietta, Tenn Tech, Inc.	404-971-1419
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
KS	Lenexa, Richard Greene Co.	913-492-6886
MI	Kentwood, Miltimore	616-554-9292
MI	Novi, Miltimore Sls.	313-349-0260
MI	St. Clair Shores, American Elctrns.	313-778-8440
MN	Minneapolis, Volco Co.	612-933-6631
MO	St. Louis, R. Greene Co.	314-994-0222
NE	Omaha, Volco Co.	402-330-6700
NH	Nashua, Cannon Assocs., Inc.	603-598-4766
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Phoenix, Adcon	315-695-3124
NY	Wantagh, DONY Tech. Sls.	516-826-5550
NY	Willamsville, CEF Tech. Sls.	716-633-7324
NC	Garner, Tenn Tech, Inc.	919-779-3309
OH	Cleveland, Orr Assocs.	216-871-1800,800-837-2700
PA	Erie, Orr Assocs.	814-456-2404
RI	Barrington, Cannon Assocs.	401-245-0850
TN	Brentwood, Tenn Tech, Inc.	615-373-4970
TX	Dallas, Dawson & Assocs., Inc.	214-241-3843
UT	Salt Lake City, Western Controls	801-292-5900
WA	Bothell, Temco N.W.	206-481-6150
WA	Spokane, Temco Northwest	509-534-8635
Can	Oakville, Ont., Davis Controls, Ltd.	416-829-2000

Local Distributors

AZ	Tempe, H-D Assocs., Inc.	602-784-2944
CA	Canoga Pk., Acort	818-700-2001
CA	San Carlos, Campbell & George	415-594-1994
FL	Clearwater, J.J. Galleher Co.	813-461-7706
GA	Smyrna, Tech Controls, Inc.	404-333-9883
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
KS	Lenexa, Richard Greene Co.	913-492-6886
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Grand Rapids, North Coast Comps., Inc.	616-452-0800,800-944-0325
MS	Corinth, World Distrs.	601-287-2915
MO	St.Louis, Richard Greene Co.	314-994-0222
NE	Omaha, Volco Co.	402-330-6700
NJ	Lawrenceville, Riverside Comp. Supp. Co.	609-896-1611
NY	Buffalo, Niagara Elec. Sls.	716-825-3100
NY	E. Syracuse, Niagara Elec. Sls.	315-437-1656
NY	Phoenix, Adcon	315-695-3124
NY	Rochester, Niagara Elec. Sls.	716-272-9150
NY	Wantagh, Dony Tech. Sls.	516-826-5550
NC	Charlotte, Mel Sls.	704-541-5750
OH	Cleveland, Orr Assocs.	216-871-1800,800-837-2700
PA	Erie, Orr Assocs.	814-456-2404
TX	Dallas, Dawson & Assocs.	214-241-3843
TX	Dallas, Dawson & Assocs., Inc.	214-241-3843
UT	N. Salt Lake City, Western Controls Co.	801-292-5900
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AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima,, CA 91331-2796, Tel: 818-896-1187, FAX: 818-896-0095; Empl.: 49

AMERICAN HOFMANN CORP., P.O. Box 10369, 3700 Cohen Pl., Lynchburg, VA 24506, Tel: 804-522-0300, ESYLNK: 5106000480, FAX: 804-846-1340; Empl.: 180; *Sls. Mgr.:* C. DeVuyst

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150, FAX: 401-723-1420; Empl.: 1300; *Sls. Mgr.:* Gabe Stephen

AMERICAN LASER SYSTEMS, INC., P.O. Box 6944, Santa Barbara, CA 93160, Tel: 805-967-0423, FAX: 805-683-4382; FSC No.: 5850; Empl.: 4

AMERICAN MAGNETICS CORPORATION, Group 4, 740 Watsoncenter Rd., Carson, CA 90745, Tel: 213-775-8651, TWX: 910-345-6258; Empl.: 300; *Sls. Mgr.:* Jane Magee, OEM Sls. Mgr.

AMERICAN MAGNETICS, P.O. Box 49, Carterville, IL 62918, Tel: 618-985-4838, FAX: 618-985-4106; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, TELEX: 557-592, FAX: 615-482-5472; Empl.: 35; *Sls. Mgr.:* Scott T. Smith

AMERICAN METAL WASH, 360 Euclid Ave, Canonsburg, PA 15317, Tel: 412-746-4203, FAX: 412-746-5738; Empl.: 15; *Sls. Mgr.:* Steven M. Nourie

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, FAX: 201-377-3078; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson

AMERICAN MICROSYSTEMS, INC., Nikko Kyodo, Ltd., 2300 Buckskin Road, Pocatello, ID 83201, Tel: 208-233-4690, FAX: 208-234-6795; Empl.: 1700; *Sls. Mgr.:* Harold Blomquist; *Dist. Mgr.:* Harold Blomquist

AMERICAN MICROWAVE TECHNOLOGY, INC., 3080 Enterprise Street, Suite A, Brea, CA 92621, Tel: 714-993-0802, FAX: 714-993-1619; Empl.: 34; *Sls. Mgr.:* Lowell A. Beezley

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421, Tel: 612-788-9161, FAX: 612-788-2057; FSC No.: 11146; Empl.: 120; *Sls. Mgr.:* Kathleen Varga

AMERICAN NEURALOGIX, INC., 411 Central Pk. Drive, Sanford, FL 32771, Tel: 407-322-5608, FAX: 407-322-5609; Empl.: 14; *Sls. Mgr.:* Richard T. English; *Dist. Mgr.:* Richard T. English

AMERICAN PRECISION INDUSTRIES
Electronic Components Group

FAX: 716-652-4814

AMERICAN PRECISION IND.,DELEVAN/SMD DIVISIONS, 270 Quaker RD., E. Aurora, NY 14052, Tel: 716-652-3600; FSC No.: 5950; Empl.: 250; *Sls. Mgr.:* Denis C. Kohlhagen .... **A•1186-1189**

Local Sales Offices & Reps

CA	West Lake Vlg., First Rep of Southern Calif.	805-373-0887
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FL	Orlando, Comp. Design Mktg.	407-240-3903
IN	Ft. Wayne, Johnson Grp., Inc.	219-471-7100
IA	Cedar Rapids, C. Horn & Assocs.	319-393-8703
KS	Parker, S.W. Assocs.	913-898-6552
MD	Lutherville, J.A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps. Inc.	508-422-3327
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Morristown, T.A.I.	609-778-5353
NJ	Ridgewood, Ballou Inc.	201-444-6990
NY	Mendon, Tech-Mark	716-624-2314
NC	Charlotte, JWL	704-541-5750
OH	Troy, S-Tek	513-339-5974
TX	Irving, Kite Elctrn. Sls.	214-986-0321
Can	Dorval, Que., J.G. Weiss Co.	514-685-6644

Local Distributors

CA	Irvine, ITT Multicomponents	714-727-4001
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Brothers Elctrns. of FL	800-342-6700
MA	Sterling, Compatible Comps. Inc.	508-422-7641
NH	Nashua, Brevan Elcttrns.	603-889-7230
NJ	E. Brunswick, Brothers Elctrns., Inc.	908-238-2200
NY	Plainview, ACI Elctrns. Corp.	516-293-6630
SC	Darlington, Aerco, Inc.	803-395-6575
TX	Ft. Worth, Patco	817-429-8596
Can	Willowdale, Ont., Electrosonic	416-494-1555

AMERICAN RADIONIC CO. INC., 32 Hargrove Grade, Palm Coast, FL 32137, Tel: 904-445-6000, FAX: 904-445-6871; Empl.: 200

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FAX: 310-944-0590

AMERICAN RELAYS, INC., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, Tel: 310-944-0447; FSC No.: 1HY41; Empl.: 45; *Sls. Mgr.:* Richard Lenning .... **B•1407-1411**

Local Sales Offices & Reps

AL	Madison, Benchmark Technical Sales	205-464-0033
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	St. Petersburg, Bolton Assocs.	813-864-2294
GA	Norcross, Benchmark Technical Sales	404-446-1711
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NY	Jericho, J-Square Mktg., Inc.	516-935-3200
NC	Raleigh, Benchmark Tech. Sls., Inc.	919-850-0633
OH	Cleveland, Components, Inc.	216-243-9200
OH	Dayton, Components, Inc.	513-372-7411

Local Distributors

AZ	Phoenix, Keystone Electro Sls.	602-995-3005
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
MN	Minneapolis, The Bergquist Co.	612-835-2322
NJ	East Brunswick, Brothers Elctrns.	201-238-2200

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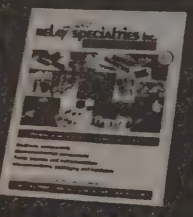

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CA	Santa Ana, Amtek Elctrn. Co.	714-751-6181

AMERICAN SWITCH CORP., See Mors Components, Inc.

AMERICAN TECHNICAL CERAMICS CORPORATION, 1 Norden La., Huntington Sta., NY 11746-2102, Tel: 516-547-5700, FAX: 516-547-5748; FSC No.: 29990;11272-868-73; Empl.: 497; *Sls. Mgr.:* Ralph Wood, Global Sls. Mgr.

AMERICAN TIME PRODS. DIV., See Frequency Control Prods., Inc.

AMERICAN TRANS-COIL CORPORATION, 124-06 101 Ave., P.O.Box 357, Richmond Hill, NY 11419-1410, Tel: 718-441-5207, FAX: 718-441-4930; FSC No.: 18212; Empl.: 45; *Sls. Mgr.:* Walter T. Clancy

AMERICAN ULTRAVIOLET, 562 Central Avenue, Murray Hill, NJ 07974, Tel: 908-665-2211, TELEX: 13-9266, FAX: 908-665-9523; Empl.: 26; *Sls. Mgr.:* Patrick M. Higgins; *Dist. Mgr.:* Patrick M. Higgins

AMERICAN WIRE & ELECTRONICS, 3198K Airport Loop Drive, Costa Mesa, CA 92626, Tel: 714-957-5738, FAX: 714-957-1614; Empl.: 5; *Sls. Mgr.:* Greg Corzine; *Dist. Mgr.:* Ray Forbes

FAX: 714-831-8642

AMERICAN ZETTLER, 75 Columbia, Aliso Viejo, CA 92656, Tel: 714-831-5000; Empl.: 200; *Sls. Mgr.:* Fred Harmon .... **B•1412-1415**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
CA	Canyon Country, Interconn	805-298-3199
CA	Newbury Park, Interconn	805-499-4024
CA	San Diego, Cetinske Sls. Co.	619-487-3335
CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CA	Trabuco Canyon, Interconn	714-589-4655
CO	Longmont, Luscombe Engrg. Co.	303-772-3342
CT	Madison, Focus Elctrn. Sls., Inc.	203-245-4314
IA	Cedar Rapids, J.R. Sls. Engrg. Inc.	319-393-2232
FL	Melbourne, Synergistic Technlgs., Inc.	407-242-9661
FL	Odessa, Synergistic Technlgs., Inc.	813-920-5814
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Arlington Hgts., KMA Sls. Co.	708-398-5300
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Pk., AME Sls.	913-492-3971
MD	Gaithersburg, Naudain Assocs. So. Inc.	301-258-5040
MA	Taunton, Focus Elctrn. Sls., Inc.	508-824-3840
MI	Brighton, AP Assocs., Inc.	313-229-6550
MN	Minneapolis, R.W. Marshall Co.	612-929-0457
MO	St. Charles, AME Sls.	314-928-2599
NJ	Edison, R. E. Breuer Co., Inc.	908-561-6161
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NY	Jericho, R. E. Breuer Co. Inc.	516-935-3330
NY	Rochester, Union Mktg. Grp.	716-546-7820
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Cincinnati, Makin & Assocs.	513-871-2424
OH	Dublin, Makin & Assocs.	614-793-9545
OH	Solon, Makin & Assocs.	216-248-7370
OR	Portland, Thorson Co. N.W.	503-293-9001
TX	Irving, AID Elctrns.	214-790-4761
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Burlington, Ont., Alternate Source Comps. Ltd.	416-335-6385
Can	Port Coquitlam, B.C., Macom Agencies Ltd.	604-942-1292

Local Distributors

AL	Huntsville, Electro-Wise	205-721-0773
AZ	Tempe, Acacia Elctrns.	602-894-2874
AZ	Tempe, Cypress Elctnrs.	602-966-2256
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura, Cypress Elctrns.	818-597-9491
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, C.O. Supply Co.	818-998-5841
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Fremont, Acacia Elctrns.	510-623-7500
CA	Irvine, Acacia Elctrns.	714-660-0834
CA	Irvine, Kensington Elctrns.	714-588-0575
CA	Oakland, Master Distrs.	510-835-1500, FAX:510-835-0398
CA	San Diego, Acacia Elctrns.	619-597-0577
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Spectra Elctrns.	408-955-7800
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Monica, Master Distrs.	310-452-1229, FAX:310-399-8600
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Time Elctrns.	303-721-8882
CO	Wheatridge, Acacia Elctrns.	303-421-7004
CT	Milford, Fleet Elctrns., Inc.	203-877-2577
CT	Southbury, Time Elctrns.	203-271-3200
FL	Boca Raton, Zelcon, Inc.	407-451-1600
FL	Orlando, Time Elctrns.	407-841-6565
GA	Norcross, Time Elctrns.	404-368-0969
IL	Lisle, Comps., Inc.	708-852-7707
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko Sls., Inc.	301-470-3300
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Boston, Freedom Ind. Grp., Inc.	800-888-8005
MA	Peabody, Time Elctrns./New Eng.	508-532-6200
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Edina, Time Elctrns.	612-943-2433
MN	New Brighton, Chris Elctrns. Distrs.	612-631-2647
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Spec.	201-337-1000
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Resco/Raleigh	919-781-5700
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Columbus, Time Elctrns.	614-794-3301
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, RSC Elctrns.	214-644-3444
TX	Richardson, Time Elctrns.	214-644-4644
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	West Valley, Time Elctrns.	801-973-8494
WA	Bothel, Cypress Elctrns.	206-483-1144
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia Elctrns.	206-881-5566
WI	Milwaukee, Progressive Image	414-321-4722
Can	Burnaby, Intek Elctrns.	604-294-8100
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CA	Del Mar, K L Mktg.	619-755-0669
CO	Englewood, Cain Technlg.	303-220-8118
CT	Litch Field, Intrade, Inc.	203-567-5901
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Palm Bay, JBM Assoc.	407-725-2823
MA	Hudson, Compak, Inc.	508-568-0331
MA	Stoneham, ECM	617-279-0900
PA	Pittsburgh, MarkeTech Intl.	412-561-0644
VA	Fairfax, Schibley Assoc.	703-591-3008

Local Distributors

CA	Santa Clara, Semi-Dice, Inc.	408-980-9777
MA	S. Easton, Semi Dice, Inc.	508-238-8344
MA	Stoneham, East Coast Microwave	617-279-0900
NY	Central Islip, Semi-Dice, Inc.	516-234-7676

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AL	Huntsville, Hamilton/Avnet	205-837-7211
AL	Huntsville, Hammond Elctrns. Inc.	205-830-4764
AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Powell Elctrns.	205-837-5300
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
AZ	Chandler, Hamilton/Avnet Elctrns.	602-961-1211
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2626
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling Elctrns. Corp.	602-437-5565
AZ	Scottsdale, Kent Elctrns. Corp.	602-998-0399
AZ	Tempe, Time Elctrns.	602-731-6752
AR	Little Rock, Carlton-Bates Co.	501-562-9100
AR	Little Rock, Electro Entprs.	501-661-0575
CA	Calabasas, Marshall Inds.	818-878-7000
CA	Carlsbad, Hardware Spec. Co.	619-431-8622
CA	Chatsworth, Alatec Prods.	818-727-9636
CA	Chatsworth, Kent Elctrns. Corp.	818-998-3333
CA	Costa Mesa, Cypress Elctrns., Inc.	714-549-2424
CA	Costa Mesa, Hamilton/Avnet	714-641-4100
CA	Culver City, Hamilton/Avent Elctrns.	310-217-6888
CA	El Monte, Marshall Inds.	818-307-6000
CA	El Segundo, Force Elctrns.	213-772-1324
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CA	Milpitas, Marshall Inds.	408-942-4600
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CA	Rancho Cordova, Marshall Inds.	916-635-9700
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CA	Sacramento, IEC	916-363-6030
CA	San Diego, Cypress Elctrns, Inc.	619-535-0011
CA	San Diego, Hamilton Avnet Elctrns.	619-571-1900
CA	San Diego, Kent Elctrns. Corp.	619-453-7133
CA	San Diego, Marshall	619-627-4140
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Comps. Ctr, Inc.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	St. Petersburg, Marshall Inds.	813-573-1399
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3300
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Tustin, Time Elctrns.	714-669-0216
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Colorado Springs, Hamilton/Avnet Elctrns.	719-637-0055
CO	Denver, CSID, Inc.	303-292-9594
CO	Denver, Hardware Spec. Co.	303-371-8553
CO	Englewood, Hamilton Avnet Elctrns.	303-799-7800
CO	Englewood, Kent Elctrns. Corp.	303-792-9100
CO	Englewood, Time Elctrns.	303-721-8883
CO	Thornton, Marshall Inds.	303-451-8383
CT	Berlin, Kent Elctrns. Corp.	203-829-2100
CT	Danbury, Hamilton/Avnet	203-743-6077
CT	Southbury, Heilind Elctrns., Inc.	203-262-1700
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Alatec Prods.	407-834-5552
FL	Altamonte Springs, Marshall Inds.	305-767-8585
FL	Clearwater, Hamilton/Avent Elctrns.	813-530-0644
FL	Ft. Lauderdale, Hamilton/Avnet	305-733-6300
FL	Ft. Lauderdale, Hammond Elctrns., Inc.	305-973-7103
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Largo, Kent Elctrns. Corp.	813-545-0057
FL	Orlando, EMSCO	407-872-0826
FL	Orlando, Hammond Elctrns.	407-841-1010
FL	Orlando, Time Elctrns.	407-841-6566
FL	San Diego, Cypress	407-657-3300
FL	Winter Pk., Hamilton/Avnet	407-657-3300
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Duluth, Hamilton/Avent Elctrns.	404-623-5475
GA	Norcross, Atlanta Hardware Spec. Co.	404-449-3000
GA	Norcross, Hammond	404-449-1996
GA	Norcross, Marshall	404-923-5750
GA	Norcross, Time Elctrns.	404-448-4448
GA	Norcross, TTI, Inc.	404-662-0911
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Bensenville, Hamilton Avnet Elctrns.	708-860-7700
IL	Elk Grove Vl., Kent Elctrns. Corp.	708-364-1300
FL	Orlando, TTI, Inc.	407-859-1000
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Schaumburg, Marshall	708-490-0155
IL	Schaumburg, Sterling Elec.	708-303-9900
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Carmel, Hamilton/Avnet	317-844-9533
IN	Indianapolis, Marshall	317-297-0483
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
IA	Cedar Rapids, Kent Elctrns. Corp.	319-373-0525
KS	Lenexa, Hamilton Avnet Elctrns.	913-888-8900
KS	Lenexa, Marshall	913-492-3121
KS	Overland Park, Kent Elctrns. Corp.	913-338-4300
KY	Lexington, Hamilton/Avnet Elctrns. Strategic	606-259-1475
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Annapolis Jct., Powell	301-880-3255
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3560
MD	Columbia, Kent Elctrns. Corp.	410-720-6200
MD	Columbia, Time Elctrns.	410-964-3091
MD	Columbia, TTI, Inc.	301-995-1331
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Hunt Valley, Alatec Prods.	301-667-0063
MD	Ijamsville, Hardware Spec. Co.	301-831-1212
MD	Silver Springs, Marshall Inds.	301-622-1118
MA	Chelmsford, Kent Elctrns. Corp.	508-250-9666
MA	Marlborough, Hardware Spec. Co.	508-481-8622
MA	Methuen, Aved Elctrns.	508-688-3800
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Peabody, Hamilton/Avnet Elctrns.	508-531-7430
MA	Peabody, Time Elctrns.	508-532-9777
MA	Westborough, In Stock Prods.	508-870-5750
MA	Westborough, Powell Elec.	508-366-6100
MA	Wilmington, Heiland Elctrns.	508-657-4870
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Woburn, Alatec Prods.	617-935-4530
MI	Livonia, Marshall	313-525-5850
MI	Livonia, RS Elctrns.	313-525-1155
MI	Novi, Hamilton Avnet Elctrns.	313-347-4270
MN	Edina, Time Elctrns.	612-931-2131
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Hamilton/Avnet	612-932-0678
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	Plymouth, Marshall	612-559-2211
MN	St. Paul, Gopher Elctrns. Co., Inc.	612-490-4900
MN	St. Paul, Kent Elctrns. Corp.	612-642-2828
MO	Bridgeton, Alatec Prods.	314-298-0010
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Chesterfield, Hamilton Avnet Elctrns.	314-537-1600
MO	Earth City, Lectronix	314-344-1166
MO	Hillsboro, Kent Elctrns. Corp.	314-895-1515
MO	Manchester, Time Elctrns.	314-230-7500
MO	Maryland Hgts., RS/Olive Elctrns.	314-997-7709
NJ	Blackwood, Hardware Spec. Co.	609-228-6800
NY	Buffalo, Summit Distrs.	716-887-2800
NJ	Camden, G.R.S. Elctrns., Inc.	609-964-8560
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Denville, Kent Elctrns. Corp.	201-625-5500
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Marlton, Time Elctrns.	609-596-1286
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Old Bridge, BTC, Inc.	908-679-9300
NJ	Parsippany, Hamilton/Avent Elctrns.	201-515-5300
NJ	Wayne, Time Elctrns.	201-882-4611
NM	Albuquerque, Hamilton Avnet Elctrns.	505-828-1058
NY	Bohemia, March Elctrns., Inc.	516-563-6000
NY	East Syracuse, Time Elctrns.	315-434-9837
NY	Endicott, Marshall Inds.	607-785-2345
NY	Hauppage, Marshall Inds.	516-273-2424
NY	Hauppauge, Hamilton/Avnet	516-434-7420
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Long Island City, Hardware SPec. Co.	718-361-9393
NY	Lynbrook, Peerless Elctrns.	516-593-2121
NY	Mineola, Hardware Spec. Co.	516-741-7100
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Syracuse, Hardware Spec. Co.	315-434-9093
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Hamilton/Avent Elctrns.	704-527-2485
NC	Greensboro, Hammond Elctrns., Inc.	919-275-6391
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Raleigh, Hamilton Avnet Elctrns.	919-878-0819
NC	Raleigh, Marshall	919-878-9882
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Thompson Elctrns.	614-228-6191
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Hamilton/Avnet	513-439-6721
OH	Dayton, Marshall	513-898-4480
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Independence. Hamilton/Avent Elctrns.	216-573-1380
OH	Independence, T T I Inc.	216-328-9755
OH	Solon, Marshall Inds.	216-248-1788
OH	Solon, Repco Elctrns.	216-248-8900
OH	Twinsburg, Schuster Elctrns., Inc.	216-425-8134
OK	Oklahoma City, Electro Ent.	405-427-6591
OK	Tulsa, Carlton-Bates	918-250-1626
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Hamilton/Avnet	503-526-6200
OR	Beaverton, IEC	503-641-1690
OR	Beaverton, Kent Elctrns. Corp.	503-626-8300
OR	Beaverton, Marshall	503-644-5050
OR	Beaverton, Time Elctrns.	206-820-1525
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Clifton Heights, Tri-Com, Inc.	215-259-7400
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PA	Wayne, Peak Elctrns., Corp.	215-293-9000
SC	Greenville, EMSCO	803-233-4121
TN	Memphis, Carlton-Bates	901-365-3539
TN	Nashville, Carlton-Bates	615-885-3232
TX	Austin, Hamilton/Avnet	512-832-4306
TX	Austin, Kent Elctrns. Corp.	512-834-1900
TX	Austin, Marshall	512-837-1991
TX	Austin, Time Elctrns.	512-339-3051
TX	Carrolton, Sterling Elctrns.	713-243-1600
TX	Dallas, Hamilton/Avnet	214-308-8111
TX	Dallas, Wallace Elctrns., Inc.	214-340-0400
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TX	Grand Prairie, Alatec Prods.	214-606-1744
TX	Houston, Hamilton/Avent Elctrns.	713-861-8517
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Marshall	713-467-1666
TX	Houston, Sterling Elctrns Corp.	713-625-9800
TX	Richardson, Kent Elctrns. Corp.	214-669-2600
TX	Richardson, Marshall Inds.	214-705-0600
TX	Richardson, Time Elctrns.	214-480-5000
UT	Salt Lake City, Hamilton Avnet Elctrns.	801-266-2022
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Marshall	801-973-2288
UT	W. Valley City, IEC	801-977-9750
UT	West Valley City, Time Elctrns.	801-973-0208
VA	Richmond, Sterling Elctrns. Corp.	804-323-5510
WA	Bellevue, IEC	206-455-2727
WA	Bothell, Marshall Inds.	206-486-5747
WA	Kirkland, Time Elctrns.	206-820-1525

WA	Redmond, Hamilton Avnet Elctrns.	206-881-6697
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Oshkosh, Electronic Inds.	414-235-8930
WI	Waukesha, Hamilton/Avnet Elctrns.	414-784-4511
WI	Waukesha, Marshall Inds.	414-797-8400
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OK	Stilwell, Cherokee Nation Distrs.	800-259-7772
TX	Dallas, Elctrn. Parts Inventory Corp.	800-458-4777
TX	El Paso, Ideal Inds. Elctrn. Supp.	915-779-6647
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Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Framingham, Gallagher Assocs.	508-626-2346
MO	St. Louis, Acorn Elctrns.	314-421-1751

Local Distributors

CA	Santa Monica, Master Distrs.	310-452-1229
IL	Chicago, Newark Elctrns.	312-784-5100

AMPEX CORP., 401 Broadway, Redwood City, CA 94063-3199, Tel: 415-367-2011, TELEX: 348464, FAX: 415-367-2769; Empl.: 6000; *Sls. Mgr.:* Rollin Stanford

AMPHENOL CORPORATION, Corporate Headquarters, 358 Hall Ave., Wallingford, CT 06492, Tel: 203-265-8910, FAX: 203-265-8516; Empl.: 3200(USA)

AMPHENOL, Bendix Connector Operations, 40-60 Delaware St, Sidney, NY 13838, Tel: 607-563-5011, TELEX: 932456, FAX: 607-563-5157; FSC No.: 77820; Empl.: 1500; *Sls. Mgr.:* Chas. Morse; *Dist. Mgr.:* Lew Lafornara

AMPHENOL CANADA CORP., 20 Melford Dr., Scarborough, Ontario, Canada M1B 2X6, Tel: 416-291-4401, TELEX: 065-25210, FAX: 416-292-0647; FSC No.: 5935; Empl.: 180; *Sls. Mgr.:* Andy Toffelmire/Debbi Tippett; *Dist. Mgr.:* Tom Whitley

AMPHENOL INTERCONNECT PRODUCTS, LPL Technologies, 20 Valley St, Endicott, NY 13760, Tel: 607-754-4444, FAX: 607-786-4311; FSC No.: 13509; Empl.: 450; *Sls. Mgr.:* David Hubbell; *Dist. Mgr.:* Jerry Potochnik

AMPHENOL RF OPERATIONS, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810, Tel: 203-743-9272, 800-627-7100, FAX: 203-796-2032; FSC No.: 74868; Empl.: 600; *Sls. Mgr.:* T. R. Burton; *Dist. Mgr.:* K. V. Keefe

AMPHENOL SPECTRA-STRIP/ITD, 720 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-3200, FAX: 203-281-5872; Empl.: 119

AMPLIFIER RESEARCH

FAX: 215-723-5688

AMPLIFIER RESEARCH, 160 School House Rd., Souderton, PA 18964-9990, Tel: 215-723-8181; FSC No.: 30639; Empl.: 75; *Sls. Mgr.:* L. Pokorny .... **D•1002-1003, 1022-1023, 1224-1225**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-830-9224
AZ	Heber, Mar Tech Assocs.	602-535-4961
CA	N. Hollywood, O'Halloran Assoc.	213-877-0173
CA	San Jose, O'Halloran Assoc.	408-243-1600
CO	Boulder, H. Bass. Assoc.	303-530-7509
FL	Melbourne, W.A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W.A. Brown Instrs., Inc.	407-648-9662
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
IN	Indianapolis, Elctrn. Instr. Assocs.	317-252-5811
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
LA	Lockport, Airep Elctrns.	504-693-3666
MD	Severna Park, Round Bay Eng.	410-647-8007
MA	Lexington, R. J. Sickles Assoc.	617-862-5100
MN	Minnetonka, Elctrn. Instr. Assocs.	612-933-7793
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Ridgefield Pk., Scientific Dvcs.	201-440-3430
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Rochester, Eastern Sys. of NY	716-292-1460
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Dublin, Micro Sls.	614-792-9117
OK	Tulsa, Airep Elctrns.	918-592-7711
PA	Philadelphia, R. Meyers Assoc.	215-224-1663
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
UT	Bountiful, Herb Bass Assoc.	801-295-7100
WA	Seattle, J. J. Assocs., Inc.	206-246-6619
Can	Ottawa, Rohde & Schwarz Canada	613-592-8000

AMPLIFONIX, INC., 2707 Black Lake Place, Philadelphia, PA 19154, Tel: 215-464-4000, FAX: 215-464-4001; FSC No.: 60979; Empl.: 75; *Sls. Mgr.:* Michael Sonstein; *Dist. Mgr.:* Michael Sonstein

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.

AMPRO COMPUTERS,INC., 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-522-2100, FAX: 408-720-1305; Empl.: 51; *Sls. Mgr.:* Victor Maccharoli/Brian McConnell

AMPTEC ELECTRONICS, 12650 Sabre Springs Pky., Ste. 207, San Diego, CA 92128, Tel: 619-578-7816, FAX: 619-578-7816; Empl.: 18

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 17

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St, Fort Smith, AR 72903-7097, Tel: 501-452-3987, FAX: 501-452-7752; FSC No.: 55943; Empl.: 5; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

A M SENSORS, INC., 26 Keewaydin Dr., Unit B, Salem, NH 03079-2839, Tel: 603-898-1543, FAX: 603-898-1638; Empl.: 10; *Sls. Mgr.:* Rocco Ciesce

AMSTAT INDUSTRIES, INC., 3012 N. Lake Terrace, Glenview, IL 60025, Tel: 708-998-6210, FAX: 708-998-6218

AMUNEAL MANUFACTORING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin .... **C•1683**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-581-0884, FAX:602-581-3522
CA	Banning, C.E.M., Inc.	714-845-1216
CA	Fremont, Edward Blake Assocs., Inc.	510-770-9058,FAX:510-770-9698
CA	San Diego, C.E.M., Inc.	619-583-8571, FAX:619-583-2718
CA	Santa Ana, C.E.M., Inc.	714-835-2702, FAX:714-835-0851
CT	Meriden, MPS Elctrns., Inc.	203-235-1414
MA	Norwood, MPS Elctrns.	617-769-8700, FAX:617-769-7703
NY	Yonkers, Sonkin Assocs.	914-968-8282, FAX:914-968-9187
OH	Kettering, F.L. Ohmer & Assocs.	513-434-1454, FAX:513-434-2067
OR	Tigard, Rep-West, Inc.	503-639-0325, FAX:503-684-9040
TX	Austin, Eatman Engrg.	512-795-0920
TX	Austin, Eatman Engrg., Co.	512-795-0920, FAX:512-795-0960
TX	Rockwell, Eatman Engrg.	214-771-1903, FAX:214-722-3501
WA	Seattle, Rep-West	206-283-8351, FAX:206-283-8699
Intl	Israel, Ramat Hasharon, Star-Gal Engrg., Ltd.	011-972-3-5490226
Can	Toronto, Ontario, Norgay Entrprs. Ltd.	416-234-8966,FAX:416-234-8970

ANACOM GEN. CORP., 1335 S. Claudina St, Anaheim, CA 92805-6235, Tel: 714-774-8080, FAX: 714-774-7388; Empl.: 95; *Sls. Mgr.:* Sye Keene; *Dist. Mgr.:* Sye Keene

ANADEX INC., 1080 Avenida Acaso, Camarillo, CA 93012, Tel: 805-987-9660, FAX: 805-388-0133; Empl.: 15

ANADYNE POWER SUPPLY DIVISION, 14005 Stage Road, Santa Fe Springs, CA 90670-5216, Tel: 213-921-9364, FAX: 213-921-8163; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair La., Anaheim, CA 92801, Tel: 714-992-6990, FAX: 714-992-0471; Empl.: 35

ANALOG & DIGITAL PERIPHERALS, INC.(ADPI), P.O. Box 499, Troy, OH 45373, Tel: 513-339-2241, FAX: 513-339-0070; FSC No.: 31-0949-745; Empl.: 28; *Sls. Mgr.:* W. Rych Haynes; *Dist. Mgr.:* Lyle Ellicott

ANALOG DEVICES, INC., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, Tel: 617-329-4700, TWX: 710-394-6577, ESYLNK: 62896514, FAX: 617-326-8703; FSC No.: 24355; Empl.: 5200; *Sls. Mgr.:* Joe Reichbach; *Dist. Mgr.:* Ed Renola

ANALOG EQUIPMENT CORPORATION, 3780-9 Burns Rd., Palm Bch. Gardens, FL 33410, Tel: 407-622-3715; FSC No.: 67584; *Sls. Mgr.:* V. Ratner

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01960, Tel: 508-977-3000, FAX: 508-531-7356; Empl.: 1200; *Sls. Mgr.:* Martyn Culverhouse .... **D•1170**

Local Sales Offices & Reps

CA	San Diego, Analogic Corp.	619-484-7661
OH	Parma, Analogic Corp.	216-884-4420
PA	Chalfont, Analogic Corp.	215-997-1808

ANALOGIC CORP., Data Conversion Prods. Grp., 360 Audubon Rd., Wakefield, MA 01880, Tel: 508-977-3000, FAX: 617-245-1274; Empl.: 1200; *Sls. Mgr.:* D. Travers .... **D•1170**

ANALOG MODULES INC.

FAX: 407-834-3806

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750-3426, Tel: 407-339-4355; FSC No.: 61651; Empl.: 48; *Sls. Mgr.:* W.C. Hudson, Exec. VP; *Dist. Mgr.:* Mark Roberts .... **B•1210; D•1005, 1573**

Local Sales Offices & Reps

NJ	Madison, DJ Assocs.	201-822-0002

ANALOG SYSTEMS, P.O. Box 17389, Tucson, AZ 85731-7389, Tel: 602-290-1818, FAX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Sharon Raban

ANALYTIC TECHNOLOGY CORP., 15233 N.E. 90th, Redmond, WA 98052, Tel: 206-883-2445, 800-428-2808, FAX: 206-882-2138; Empl.: 10; *Sls. Mgr.:* Jim Dooley

ANAREN MICROWAVE, INC., P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8930, FAX: 315-432-9121; FSC No.: 31597; Empl.: 300

ANATECH ELECTRONICS, INC., 94 Jewell St., Garfield, NJ 07026, Tel: 201-772-4242, FAX: 201-772-4646; Empl.: 10

ANCO ELECTRONICS, INC., 9477 Archibald Avenue, Rancho Cucamonga, CA 91730, Tel: 1-800-545-ANCO, FAX: 714-989-9935

ANCOT, 115 Constitution Drive, Menlo Park, CA 94025, Tel: 415-322-5322, FAX: 415-322-0455; Empl.: 10; *Sls. Mgr.:* Chris Lynch

AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-9916, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (PURDY UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

ANDEEN-HAGERLING, INC., 31200 Bainbridge Rd., Cleveland, OH 44139-2231, Tel: 216-349-0370, TELEX: 4931432, FAX: 216-349-0359; Empl.: 9; *Sls. Mgr.:* Eric Whitman

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FAX: 814-696-0403

ANDERSON ELECTRONICS, P. O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428; Empl.: 60; *Sls. Mgr.:* Mike Martin .... **A•1333**

Local Sales Offices & Reps

CA	Sunnyvale, Logan Sls	408-732-6020
GA	Lawrenceville, B. T. Funderburk, Inc.	404-963-9495
IL	South Elgin, R.K. Elctrn.	708-695-8552
KS	Westwood, E.P.I. Inc	913-432-1792
MA	Woburn, Microwave Comp. Mktg., Inc.	617-273-3106
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MO	St. Louis, E.P.I. Inc.	314-962-1411
NC	Raleigh, B. T. Funderburk, Inc.	919-846-2373
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Souderton, Intek, Inc.	215-723-0433
TX	Plano, GW Prods.	214-422-1746
WA	Seattle, Harry Levinson Co.	206-382-1300
Can	Hamilton, Ont., Cartwright Southall Assocs.	416-528-0294

ANDERSON POWER PRODUCTS, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, TELEX: 940453, FAX: 617-254-9217; Empl.: 110; *Sls. Mgr.:* Tom Fielding

AEC

FAX: 401-333-0287

ANDON ELCTRNS. CORP., 4 Court Dr., Lincoln, RI 02865, Tel: 401-333-0388; FSC No.: OEBT2; Empl.: 55; *Sls. Mgr.:* Jack Galinev; *Dist. Mgr.:* Peter Gallotello, Mktg. Mgr. .... **C•1256-1259**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-539-1405
AL	Huntsville, SACS	205-533-4229
CA	Los Angeles, TNT & Assocs.	714-830-6096
CA	San Jose, Integrated Tech. Sls.	408-727-3406
CO	Littleton, Con-Tek Mktg., Inc.	303-973-8490
CT	N. Bradford, Todino Engrg. Sls.	203-488-2896
FL	Boca Raton, SACS	407-391-1034
GA	Norcross, SAC	404-447-6154
IL	Arlington Heights, Greenslade Sls., Inc.	708-593-3450
MD	Baltimore, Baguol/Grimm Assocs.	410-719-0770
MN	Minneapolis, D.A. Case Assocs., Inc.	612-831-6777
NJ	Venture Quest, Inc.	201-377-4922
NY	Fairport, L-Mar Assocs., Inc.	715-425-9100
NC	Raleigh, SACS	919-859-9970
OH	Dayton, Dirckson & Assoc. Inc.	513-294-3657
OH	Richfield, Geotronix Inc.	216-659-6100
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	McMinnville, Electro-Design	503-472-0481
PA	Ft. Washington, SMC	215-628-3394
RI	Smithfield, Todino Sls.	401-232-5656
TX	Dallas, Advance Tech. Sls.	214-340-1300
Can	Concord, Ont., Votron Elctrns., Inc.	416-699-9870

Local Distributors

CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Santa Clara, Trinity Elctrns.	408-980-9011
MD	Gaithersbury, Axis Elctrns., Inc.	301-840-9640
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Syracuse, Lead Elctrns.	315-454-4544
OH	Columbus, Spectra Elctrns.	614-265-2250
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Woodbridge, Ont., Ryantronics Sls. & Importing	416-856-2992

ANDOVER, INC., 310 North Earl Avenue, Lafayette, IN 47904, Tel: 317-447-1157, FAX: 317-447-1150; Empl.: 120; *Sls. Mgr.:* Harry O. Minns

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 800-255-1479, TELEX: 25-3897, FAX: 708-349-5943; *Sls. Mgr.:* Henry Duvalsaint

ANDREW CORPORATION, 4301 Westbank Dr., Ste. A-100, Austin, TX 78746, Tel: 800-331-4144, 512-314-3000, FAX: 512-314-3193; Empl.: 350; *Sls. Mgr.:* John Chvatal, Dir of Sls.

ANDUFET DIGITAL CORP., 545 W. Allen Ave., San Dimas, CA 91773, Tel: 909-394-0171, FAX: 909-394-9931; Empl.: 3

ANGO ELECTRONICS CORP., 29 Ewing Ave., North Arlington, NJ 07031, Tel: 201-955-0800, FAX: 201-955-2332; *Sls. Mgr.:* John Ngo .... **C•1014**

ANGSTROHM PRECISION, INC., Dale Electronics, 18400 Precision Place, Hagerstown, MD 21742, Tel: 301-739-8722, FAX: 301-797-6852; Empl.: 500; *Sls. Mgr.:* Don Hutzell .... **A•1923**

ANGUS ELECTRONICS CO., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, FAX: 317-247-4749; FSC No.: 72264; Empl.: 2000; *Sls. Mgr.:* Thomas W. Pilcher

ANNULUS TECHNICAL INDUSTRIES, INC., P.O. Box 1390, 101 Nelson St., Port Dover, Ont., CAN NOA 1NO, Tel: 519-583-3440, FAX: 519-583-3460; Empl.: 21; *Sls. Mgr.:* Don MacAdam

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, FAX: 516-435-1612; Empl.: 280; *Sls. Mgr.:* Amir Chitayat, VP Sls.

ANRITSU WILTRON SALES CO., 685 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-776-8300, FAX: 408-776-1744; Empl.: 100; *Sls. Mgr.:* Bill Wiedemann

ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475, FAX: 503-742-2991; Empl.: 6

ANTENNA RESEARCH ASSOCIATES, 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, FAX: 301-937-2796; FSC No.: 23360; Empl.: 30; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139, Tel: 216-349-8400, TELEX: 4332133 (AS INTL CLV), FAX: 216-349-8407; Empl.: 1000; *Dist. Mgr.:* Patty Fritz, Natl. Distr. Sls. Mgr.

ANTEX DIVISION, 24 Tioga Way, P.O.Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St., Gardena, CA 90248-2617, Tel: 310-532-3092, FAX: 310-532-8509; Empl.: 53; *Sls. Mgr.:* Richard Gross; *Dist. Mgr.:* Richard Gross

ANTONA CORP., 1643 1/2 Westwood Blvd., Los Angeles, CA 90024-5603, Tel: 310-473-8995, FAX: 310-473-7112; Empl.: 3; *Sls. Mgr.:* Katherine Capanna

ANVIL CASES, Subsidiary of Zero Corporation, 15650 Salt Lake Ave., City of Industry, CA 91745, Tel: 818-968-4100; FSC No.: 59288; Empl.: 109; *Sls. Mgr.:* Whitt Adams

AOFR, INC., 800 E. Campbell, Suite 108, Richardson, TX 75081, Tel: 214-644-1394, FAX: 214-480-9278; *Sls. Mgr.:* Dwain Lawhon

AOT ELECTRONICS, INC., 4000 Mac Arthur Blvd, Newport Beach, CA 92660, Tel: 714-852-9999, FAX: 714-261-9999; Empl.: 27; *Sls. Mgr.:* Jon Stevenson

A. P. CIRCUIT, 397 Linden St., Brooklyn, NY 11237, Tel: 718-456-2717, TELEX: 428759, FAX: 718-456-2717

A.P.C.S. AMERICA, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1453; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

A.P.E. CORPORATION, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; Empl.: 25; *Sls. Mgr.:* Arthur Ayala

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APEX MICROTECHNOLOGY CORP., 5980 N. Shannon Rd., Tucson, AZ 85741, Tel: 602-690-8600, TELEX: 170631; FSC No.: 60024; Empl.: 120; *Sls. Mgr.:* Greg L. Brennan .... **D•1006-1009, 2068-2069**

Local Sales Offices & Reps

AZ	Tucson, Apex Microtechnology	602-690-8602
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Manhattan Beach, Com-Star	310-318-9803
CA	Rancho Cucamonga, Com-Star	909-944-5744
CT	Lebanon, Signal Sls. Engrg.	203-889-4050
FL	Seminole, Q Rep	813-397-8431
IL	Palatine, Vine Sls., Inc.	708-934-5476
MD	Ellicott, Nelson Elctrns.	410-747-7887
MA	Woburn, Signal Sls. Engrg.	617-938-7872
MN	Bloomington, Industrial Rep.	612-854-8027
NH	Newton, Signal Sls. Eng.	603-382-3669
NJ	Allendale, Eastec Assocs.	201-934-7135
WI	Appleton, Vine Sls., Inc.	414-731-9873

Local Distributors

AZ	Tuscon, Apex	602-742-8600
Can	Kanata, J-Squared Technlgs.	613-592-9540

Can	Point-Claire, J-Squared Technlgs.	514-694-8330
Can	Rexdale, J-Squared Technlgs.	416-674-0927

A.P.M. HEXSEAL CORPORATION, 44 Honeck St, Englewood, NJ 07631, Tel: 201-569-5700, TELEX: 13-3403, FAX: 201-569-4106; FSC No.: 97539; Empl.: 29; *Sls. Mgr.:* Riva Solins; *Dist. Mgr.:* Riva Solins .... **B•1669**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
AR	Hot Springs, ASI	501-624-4608
CA	Belmont, Edward B. Hoin Assoc.	415-592-6401
CA	Chatsworth, Porter Co.	818-700-0808
CO	Englewood, Delltron Co.	303-741-2122
CT	Meriden, Gerber Sls. Corp.	203-630-3477
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Atlanta, L & D Inc.	404-395-7079
IL	Lombard, FF/Hill Gray	708-832-4101
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Silver Spring, N.K.A. Inc.	301-585-6141
MA	Burlington, Gerber Sls.	617-229-1150
MI	Troy, C.B. Jensen Co.	313-643-0506
MN	Bloomington, Murnco	612-854-4161
NJ	Hackensack, CBA/METRO	201-440-4114
NY	Syracuse, Rep Tech.	315-437-2845
NC	Raleigh, L & D Inc.	919-876-5301
OH	Powell, Val Skol Sls.	614-889-0174
PA	Paoli, Tyler Griffin	215-647-1550
WA	Edmonds, Evergreen Mktg. Grp.	206-485-8063
Can	Ontario, Deskin Inc.	416-475-1412

Local Distributors

CA	Garden Grove, Richey Impact Elec.	714-895-0060
CO	Littleton, Indelco	303-795-3431
CT	New London, Jan Elctrns.	203-442-4386
FL	Miami, Elctrn. Equip.	305-526-6000
IL	Chicago, Newark Elctrns.	312-784-5100
IN	South Bend, Pei-Genesis	219-287-2911
KS	Wichta, Midwest Fasteners	316-267-3318
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elctrl. Sply.	617-749-6700
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MN	Minneapolis, Aero-Space Computer	612-884-4725
MO	Maryland Heights, LCOMP, Inc.	314-291-6200
NY	Lynbrook, Peerless Radio	516-593-2121
OH	Cincinnati, Hughes Peters	513-351-2000
PA	Philadelphia, Sanson & Rowland	215-329-9264
WI	Milwaukee, Indst. Elctrns.	414-276-1212

APOLLO DISPLAY TECHNOLOGIES, INC., 194-22 Morris Ave., Holtsville, NY 11742, Tel: 1-800-LCD-STOC, 516-654-1143, FAX: 516-654-1496; *Sls. Mgr.:* Richard Eicher .... **B•1019**

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07004, Tel: 201-227-5454, FAX: 201-882-1422; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA SYSTEMS, INC., 409A East Preston St., Baltimore, MD 21202, Tel: 800-541-2003, 410-576-0335, FAX: 410-576-0338; Empl.: 6; *Sls. Mgr.:* Robert Kondner

APPLIED DESIGN COMPANY, 2010 E. Hennepin Ave., Minneapolis, MN 55413, Tel: 612-378-0094, FAX: 612-378-0733

APPLIED DISPLAY & CONTROL, 415 W. Golf Rd., Ste. 10, Arlington Heights, IL 60005, Tel: 708-228-9690, FAX: 708-228-9698 .... **B•1020**

APPLIED DISPLAY TECHNOLOGY, INC., 2150 Anchor Court, Newbury Park, CA 91320, Tel: 805-498-4984, FAX: 805-376-2011; FSC No.: OM3A8; Empl.: 15; *Sls. Mgr.:* John Becker

APPLIED ELECTRO TECHNLG., INTL., See Scientific Technologies Inc.

APPLIED ENGINEERING PRODUCTS, P.O. Box 510, New Haven, CT 06513, Tel: 203-756-1669, FAX: 203-776-2813; FSC No.: 19505; Empl.: 105; *Sls. Mgr.:* Jeff Buccitti; *Dist. Mgr.:* Jeff Buccitti

APPLIED FIBEROPTICS, INC., East Main St., Southbridge, MA 01550, Tel: 508-765-9121, 800-225-7486, FAX: 508-764-3639; Empl.: 35; *Sls. Mgr.:* Charles P. Kiritsy

APPLIED INFORMATION SYSTEMS, INC., 100 Europa Dr., Ste. 555, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, FAX: 919-493-7563; *Sls. Mgr.:* Dawn Edgerton

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, FAX: 805-967-8227; FSC No.: 11935; Empl.: 8,000; *Sls. Mgr.:* Steven E. Beal

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, FAX: 619-450-9885; FSC No.: 367 4112; Empl.: 250; *Sls. Mgr.:* Greg Barnhart; *Dist. Mgr.:* Greg Barnhart, V.P. Worldwide Sls.

APPLIED MICROSYSTEMS CORP., 5020 148th Ave NE, Redmond, WA 98052, Tel: 206-882-2000, TELEX: 185196, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200, FAX: 401-253-0474; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre III

APPLIED
POWER
CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70 .... **D•1574-1578, 2056-2057**

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AL	Huntsville, BCI	205-539-4411,FAX:205-539-4412
AK	Contact The Factory Direct	
CA	Contact The Factory Direct	
CA	San Diego, Cirolia Elect. Sls.	619-743-3015, FAX:619-743-3804
CA	Santa Clara, W.J. Elect. Sls.	408-982-9222, FAX:408-982-9224
CO	Contact The Factory Direct	
FL	Clearwater, Tech-Rep Assoc.	813-872-9900, FAX:813-573-9370
FL	Ft. Lauderdale, Tech-Rep. Assoc.	305-791-2708, FAX:813-573-9370
GA	Lawrenceville, BCI	404-962-6826, FAX:404-962-6338
HI	Contact The Factory Direct	
ID	Contact The Factory Direct	
IL	Contact The Factory Direct	
IL	Arlington Heights, Greenslade Sls.	708-593-3450, FAX:708-593-3468
IN	Contact The Factory Direct	
IA	Contact The Factory Direct	
KS	Contact The Factory Direct	
KY	Contact The Factory Direct	
MD	Columbia, Delta III Assoc.	410-730-4700, FAX:410-730-0790
MA	Topsfield, Whitehead Assoc.	508-887-8050, FAX:508-887-5434
MI	Contact The Factory Direct	
MN	Minneapolis, Tec Team Sls.	612-854-6616, FAX:612-854-8031
MO	Contact The Factory Direct	
MT	Contact The Factory Direct	
NE	Contact The Factory Direct	
NV	Contact The Factory Direct	
NJ	Bergenfield, Technology Dynamics Inc.	201-385-0500,FAX:201-385-0702
NM	Albuquerque, IMEC	505-275-0936, FAX:505-294-1121
NY	Elmont, Crane & Egert	516-872-0800, FAX:516-872-9074
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881, FAX:315-446-3047
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SC	Contact The Factory Direct	
SD	Contact The Factory Direct	
TX	Dallas, Tesco Elctrn. Sls.	214-553-1200, FAX:214-553-1299
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APPROVED PURIFICATION CORP., 1088 R. Hope St., P.O. Box 4186, Stamford, CT 06907, Tel: 203-357-0141, FAX: 203-356-1697 .... **B•1916**

APROTEK, 9323 W. Evans Cr Rd., Rogue River, OR 97537, Tel: 503-582-2120, FAX: 503-582-2149; Empl.: 6; *Sls. Mgr.:* K. Conley

APSCO, INC., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-352-8961, TELEX: 284580, FAX: 216-354-7306; Empl.: 200; *Sls. Mgr.:* Ian Davey-Turner

APS DYNAMICS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

APTEK TECHNOLOGIES, INC., DBA Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, FAX: 305-421-8044; FSC No.: 36741; Empl.: 50; *Sls. Mgr.:* Dwain Jenkins; *Dist. Mgr.:* Dwain Jenkins

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 14

apx TECHNOLOGIES INC.

FAX: 516-433-1457

APX TECHNOLOGIES INC., 264 Duffy Ave., Hicksville, NY 11801, Tel: 516-433-1313; Empl.: 300; *Sls. Mgr.:* David Baum .... **A•2266-2267; D•1580-1583**

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CA	Pasadena, Electro Mech. Inst.	818-795-7193
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MD	Manchester, Imagitron Sls. Co.	410-374-5600
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MI	Wyoming, N. Coast Comps.	616-249-8910
MN	Plymouth, Highland Elctrn.	612-557-7022
NH	Hudson, Bob Mirabella	508-877-0884
NM	Albuquerque, Syntech	505-266-7951
NY	Fulton, Jones/Sudders	315-598-6942
MO	Independence, Hitec Central	816-796-6684
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
Can	Concord, Ont., Astec Comps. Ltd.	416-669-4022

AQUALARM, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 91911, Tel: 619-575-4011, FAX: 619-575-4012; FSC No.: 2V373; Empl.: 8; *Sls. Mgr.:* John L Hooper

ARCHELON INC., 460 Forestlawn Rd., Waterloo, Ont., CAN N2K 2J6, Tel: 519-746-7925, FAX: 519-746-7925; Empl.: 3; *Sls. Mgr.:* Preston Gurd

ARCO ELECTRONICS, 9822 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8707, FAX: 818-882-6513; FSC No.: 84171; Empl.: 10; *Sls. Mgr.:* Randy Ryan

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933, FAX: 818-700-9541; *Sls. Mgr.:* Carrie Donze; *Dist. Mgr.:* Carrie Donze .... **B•1132-1133, 1670-1672**

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CA	Los Angeles, Electric Switches	800-252-4640, 800-421-8855
CA	Tustin, Western Switches	213-627-6126
CA	Van Nuys, Wesgarde Comp.	818-786-3724
CT	Hartford, Wesgarde Comp.	203-527-7705
IL	Carol Stream, Wesgarde Comp.	708-653-1460
KS	Overland Park, Wesgarde Comp.	913-262-2718
MD	W. Springfield, T. F. Cushing	413-788-7341
MI	Benton Harbor, Benton Elec. Sply.	616-925-0060
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MO	St. Louis, Wesgarde Comp.	314-567-7776
NH	Nashua, Wesgarde Comp.	603-880-1971
NJ	Denville, Lashen Elctrns.	201-627-3783
NJ	Mt. Laurel, Wesgarde Comp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Westerville, Wesgarde Comp.	614-885-0319
OR	Eugene, Larsco	503-484-7491
SC	Darlington, AERCO, Inc.	803-395-6575
TX	Dallas, Wesgarde Comp.	214-357-1768

ARC SYSTEMS, INC., 2090 Joshuas Path, Hauppauge, NY 11788-4764, Tel: 516-582-8020, FAX: 516-582-8038; FSC No.: 67245; *Sls. Mgr.:* Robert Miller

AREMCO PRODUCTS, INC., Box 429, Ossining, NY 10562, Tel: 914-762-0685, FAX: 914-762-1663; Empl.: 30; *Sls. Mgr.:* Peter Schwartz

A.R.F. PRODS., P.O. Box 3128, Boulder, CO 80307-3128, Tel: 303-499-2946, FAX: 303-499-2946; FSC No.: 4G971; Empl.: 3

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314, FAX: 818-799-9407; FSC No.: 50290; Empl.: 25; *Sls. Mgr.:* Linda Galman

ARGOSSOUND, Argos Products Co., Inc., 600 S. Sycamore St., Genoa, IL 60135-1191, Tel: 800-357-5240, FAX: 815-784-5110; Empl.: 25; *Sls. Mgr.:* Dick Neville; *Dist. Mgr.:* Ron Evers

ARGO TRANSDATA CORP., 1 Heritage Pk., Clinton, CT 06413-0554, Tel: 203-669-2233, FAX: 203-669-4316; Empl.: 25

ARIEL CORPORATION, 433 River Rd., Highland Pk., NJ 08904, Tel: 908-249-2900, FAX: 908-249-2123; *Sls. Mgr.:* Bob Yarrow

ARIES ELECTRONICS, INC.

FAX: 908-996-3891

ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 908-996-6841; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee .... **A•1689-1691; B•1673; C•1260-1268**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, C.T. Carlsberg Assocs.	602-468-0750
CA	San Mateo, Larsen Assoc.	415-358-9559
CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, West Inc.	303-477-8180
FL	Melbourne, The R-Rep Co.	407-722-1900
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
WI	Hartland, Selective Sls.	414-367-1133
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MD	W. Friendship, Consolidated Techlgs., Co.	301-442-5827
MA	Harvard, Enterprise Tech.	508-772-6003
MI	Novi, Innovative Sls. & Mktg.	313-344-8860
MN	Bloomington, Horizon Technlgs.	612-884-6515
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Ho-Ho-Kus, DJ Fisher Co.	201-652-0080
NM	Albuquerque, C.T. Carlberg Assocs.	505-899-2155
NY	Rochester, Harmon & Sullivan Assoc. Inc.	716-647-6037
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Willoughby Hills, Versatron	216-944-0082
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
PA	Harrisburg, All-Tech Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Burleson, Bounty Elctrns.	817-447-9775
WA	Redmond, Doran Sls. Assocs.	206-885-1885

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
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CA	Gardena, Cal, Switch & Signal	213-770-2330
CO	Englewood, Indelco	303-694-9444
FL	Ft. Lauderdale, KSM	305-971-5900
FL	Palm Bay, CDI	407-724-9910
IL	Northbrook, Classic	312-272-9650
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MD	Baltimore, Resco	410-529-0500
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MI	Southfield, Michigan Lectrols	313-353-1350
MN	Minneapolis, Bergquist Elect.	612-835-2322
NM	Albuquerque, Harrison	505-343-1011
NY	Lynbrook, Peerless Radio	516-593-2121
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PA	Philadelphia, Powell Elctrns.	215-365-1900
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TX	Richardson, Altair Co.	214-231-5155
UT	Salt Lake City, Kimball	801-328-2075
WI	Milwaukee, Progressive	414-321-4722
Can	Toronto, SEMAD	416-475-8500

ARI INDUSTRIES, INC., 381 ARi Court, Addison, IL 60101, Tel: 708-953-9100, 800-237-6725, FAX: 708-953-0590; FSC No.: 04849; Empl.: 56; *Sls. Mgr.:* D. J. MacKenzie; *Dist. Mgr.:* D. J. MacKenzie

ARISTO COMPUTERS INC., 6700 SW 105th Avenue, Ste. 307, Beaverton, OR 97005, Tel: 503-626-6333, 800-327-4786, FAX: 503-626-6492; *Sls. Mgr.:* Linda Fish, Ntl. Sls. Coord.

ARISTO COMPUTERS INC., 6700 SW 105th Avenue, Ste. 307, Beaverton, OR 97005, Tel: 503-626-6333, 800-327-4786, FAX: 503-626-6492; *Sls. Mgr.:* Linda Fish (Natl. Sls. Coord.)

ARISTO GRID LAMP PRODS., 35 Lumber Road, Roslyn, NY 11576, Tel: 516-484-6141, FAX: 516-484-6992; Empl.: 21

ARKAY ENGRAVERS, INC., 10-3 Drew Court, Ronkonkoma, NY 11779, Tel: 516-467-7795, FAX: 516-467-8310; FSC No.: 6Z099; Empl.: 9; *Sls. Mgr.:* Kenneth Kaplan

ARK-LES CORP, P.O.BOX 14466, Raleigh, NC 27620, Tel: 919-231-2000, FAX: 919-231-9825; Empl.: 350

ARMBAR INDUSTRIES INCORPORATED

FAX: 908-679-3222

ARMBAR INDUSTRIES, INC., 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 908-679-3377; FSC No.: 2R610; Empl.: 11; *Sls. Mgr.:* Stephen Gregg .... **A•1015**

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MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase	814-763-3640

ARMEL ELECTRONICS, 1601 75th St., N. Bergen, NJ 07047, Tel: 201-869-4201, FAX: 201-869-4304; FSC No.: 91663; Empl.: 55; *Sls. Mgr.:* V. A. Pasqualino

ARNOLD ENGINEERING COMPANY, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152, Tel: 815-568-2000, FAX: 815-568-2228; Empl.: 650; *Sls. Mgr.:* E. F. Migely, V.P. Mktg./Sls.

ARNOLD MAGNETICS

FAX: 805-484-4113

ARNOLD MAGNETICS, 4000 Via Pescador, Camarillo, CA 93012, Tel: 805-484-4221; FSC No.: 04879; Empl.: 100; *Sls. Mgr.:* Glen Underwood .... **D•1585-1591**

Local Sales Offices & Reps

AL	Huntsville, Arnold Magnetics Corp.	800-421-8181
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AROMAT CORP., Matsushita Electrical Works Ltd., 629 Central Avenue, New Providence, NJ 07974, Tel: 908-464-3550, TELEX: 4754170; Empl.: 360; *Sls. Mgr.:* Bob Zegarski; *Dist. Mgr.:* Jeff Burger .... **B•1418-1434, 1674**

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CT	Plainville, Northeast Reps.	203-866-6030
FL	Maitland, EIR, Inc.	407-660-9600
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IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
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CA	San Diego, Bell Inds.	619-268-1277
CA	San Jose, Pioneer Technlgs.	408-954-9100
CA	San Jose, Sierra West	408-435-7477
CA	Santa Monica, Brill Elctrns.	310-452-8002
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-691-9010
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Indelco	303-694-9444
CO	Lakewood, Acacia/Deanco	303-232-2882
CO	Wheat Ridge, Acacia/Deanco	303-421-7004
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager	203-265-4600
CT	Yalesville, Glynn Elctrns.	203-265-2498
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Pioneer Technlgs.	407-834-9090
FL	Clearwater, Pioneer Technlgs.	813-536-0445
FL	Deerfield Bch., Pioneer Technlgs.	305-428-8877
FL	Orlando, Sager	407-240-3114
GA	Concord, Dixie Elctrns.	800-277-5916
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Pioneer Technlgs.	404-448-1711
GA	Norcross, RS Elctrns.	404-242-0520
GA	Norcross, Sager Elctrcl.	404-446-0085
IL	Bensenville, Goold Elctrncs.	708-860-7171
IL	Elk Grove Vl., Bell Inds.	708-640-1910
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Control Design Supp.	317-788-4614
IN	Indianapolis, Newark Elctrns.	317-259-0085
IN	Indianapolis, RS Elctrns.	317-253-9065
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
KS	Kansas City, L Comp.	816-241-0111
LA	Metarie, Newark Elctrns.	504-838-9771
MA	Andover, Bell Industries	508-474-8880
MD	Colombia, DK Elctrns.	301-995-1950
MD	Columbia, Sager	301-995-6580
MA	Canton, Richey Imapact Elect.	617-821-1500
MA	Hingham, Sager Elctrns. Supp. Co.	617-749-6700
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Winchester, Bell Inds.	617-729-5800
MI	Ann Arbor, Bell Inds.	313-971-9093
MI	Flint, RS Elctrns.	313-742-5000
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Control Design Supp. Inc.	612-721-6555
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Gopher Elctrns.	612-490-4900
MO	Maryland Heights, L Comp	314-426-3150
MO	Maryland Heights, Olive Elctrns.	314-997-7709
MO	Maryland Hgts., L-Comp	314-291-6200
NH	Salem, Sager	603-898-1348
NJ	Mountainside, Mars Elctrns.	201-233-0044
NJ	Oakland, Relay Specialties	201-337-1000
NM	Albuquerque, Bell Inds.	505-292-2700
NC	Durham, Pioneer Technlgs.	919-544-5400
NY	Farmingdale, Bell Inds.	516-752-9303
NY	Hauppauge, Sager	516-348-1300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, 718-523-3456
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Charlotte, Pioneer Technlgs.	704-527-8188
NC	Raleigh, Sager	919-850-9550
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Columbus, Elctrns. Mktg. Corp. (EMC)	614-299-4161
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Bell Inds.	513-435-8660
OH	Highland Heights, Elctrns. Mktg. Corp. (EMC)	216-442-3441
OH	Kettering, Elctrns. Mktg. Corp. (EMC)	513-439-4711
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Oklahoma City, Newark Elctrns.	405-495-5000
OK	Tulsa, Newark Elctrns.	918-832-7004
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Lake Oswego, Bell Inds.	503-635-6500
OR	Portland, P&R Inds.	503-292-8682
PA	Horsham, Pioneer/Del. Vall.	215-674-4000
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Sager	215-464-4336
PA	Pittsburgh, Sager	412-772-2233
PA	Wayne, Peak Elctrns.	215-293-9000
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Dixie Elctrns.	803-297-1437
TN	Gray, Dixie Elctrns.	615-477-2131
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Newark Elctrns.	512-338-0287
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Corpus Christie, Douglas Elctrns.	512-883-5103
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Newark Elctrns.	214-340-3585
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Southwest Elctrns.	214-234-3050
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
TX	Houston, Newark Elctrns.	713-827-0630
TX	Houston, Newark Elctrns.	713-827-7040
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Newark Elctrns.	214-256-6585
TX	Richardson, Bell Inds.	214-690-0466
TX	San Antonio, Newark Elctrns.	512-349-2641
TX	Stafford, Southwest Elctrns.	713-240-4000
UT	Midvale, Bell Inds.	801-255-9611
VA	Roanoke, Mexitronics Corp.	703-342-4444
WA	Redmond, Bell Inds.	206-885-9963
WI	Mequon, Taylor Elec.	414-241-4321
WI	Waukesha, Bell Inds.	414-547-8879
Can	Calgary, Alberta, Zentronics	403-272-1021
Can	Edmonton, Alberta, Deskin Sls. Corp.	403-466-2106
Can	Markham, Ont., Deskin Sls. Corp.	416-496-2511
Can	Mississauga, Ont., Zentronics	416-564-9600
Can	Montreal, Que., Ferrotronics	514-341-3450
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Richmond, BC, Zentronics	604-273-5575
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	St. Laurent, Que., Zentronics	514-737-9700
Can	Vancouver, B.C., Deskin Sls. Corp.	604-324-8343

AROW COMPONENTS & FASTENERS, INC., 31012 Huntwood Ave., Hayward, CA 94544, Tel: 510-487-2100, FAX: 510-471-7018; FSC No.: 46467; Empl.: 52; *Sls. Mgr.:* James Sings, VP/Sls.

ARRAY CONNECTOR CORPORATION, 7400 N.W. 52nd St., Miami, FL 33166-5598, Tel: 305-591-7530, FAX: 305-592-2428; FSC No.: 5935; Empl.: 60; *Sls. Mgr.:* Roger Johnson

ARRAY MICROSYSTEMS, 1420 Quail Lake Loop, Colorado Springs, CO 80906, Tel: 719-540-7999, FAX: 719-540-7950; Empl.: 24; *Sls. Mgr.:* Douglas Mitchell; *Dist. Mgr.:* Douglas Mitchell

ARREM PLASTICS, INC., 502 Vista Ave., Addison, IL 60101, Tel: 708-628-2450, FAX: 708-628-1855; Empl.: 70; *Sls. Mgr.:* Jack Schrieffer

ARROW FASTENER, 271 Mayhill St., Saddlebrook, NJ 07662, Tel: 201-843-6900, FAX: 201-843-3911; Empl.: 600; *Sls. Mgr.:* Robert Hand

ARROW HART CONTROLS, Products Unlimited Corp., P.O. Box 413, Sterling, IL 61081, Tel: 815-626-0300, FAX: 815-626-8637; Empl.: 1000; *Sls. Mgr.:* Paul Schnackenberg; *Dist. Mgr.:* Paul Schnackenberg

ARS INC., 2400 Sand Lake Rd., Orlando, FL 32809, Tel: 1-800-950-5633, FAX: 407-856-1960; Empl.: 100; *Sls. Mgr.:* Jim Layne

ARSTAN PRODUCTS INTL., See APX Arstan Products

ARTEL COMMUNICATIONS CORP., 22 Kane Industrial Dr., Hudson, MA 01749, Tel: 508-562-2100, FAX: 508-562-6942; Empl.: 60; *Sls. Mgr.:* Edmund Govoni

ARTISAN CONTROLS CORP., P.O. Box 233, 5 Eastmans Rd., Ste.100, Parsippany, NJ 07054, Tel: 201-428-1770, FAX: 201-428-1426; Empl.: 100

ARTRONICS CORPORATION, 124 Heritage Dr., P.O. Box 5070, Portsmouth, NH 03802-5070, Tel: 603-433-3111, FAX: 603-433-4684; Empl.: 10; *Sls. Mgr.:* Anthony Santomango

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Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5110
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-996-0635
AZ	Scottsdale, Compass Mktg. & Sls.	602-585-0202
AZ	Tucson, Compass Mktg. & Sls., Inc.	602-293-1220
CA	Chatsworth, WCV-Raltech, Inc.	818-700-0933
CA	San Jose, Kottmeier Assocs.	408-371-8700
CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Norcross, R. O. Whitesell & Assocs.	404-449-9190
IL	Itasca, Janus, Inc.	708-250-9650
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Hammond, Design Mktg. & Assocs.	504-542-1115
MD	Annapolis, EES, Inc.	301-269-4234
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-888-0800
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Scotch Plains, Mil Comp.	908-322-7898
NJ	Marlton, BGR Assocs.	609-983-1020
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Elctrn. Sources	503-627-0838
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-936-6161
TN	Knoxville, R. O. Whitesell & Assocs.	615-694-9476
TN	Nashville, R.O. Whitesell & Assoc.	615-352-4760
TX	Austin, Design Mktg. & Assocs.	512-263-9151
TX	Dallas, Design Mktg. & Assocs.	214-480-8151
TX	Houston, Design Mktg. & Assocs.	713-550-3318
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Midlothian, EES, Inc.	804-794-8939
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tucson, Hall-Mark	602-742-0515
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Chatsworth, Hall-Mark	818-713-4500
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Chula Vista, Inter Elctrns.	619-476-0577 (US)
CA	Cypress, Bell	805-499-6821
CA	Irvine, Hall-Mark	714-727-6000
CA	Rocklin, Bell Inds.	916-652-0414
CA	Rocklin, Hall-Mark	916-624-9781
CA	San Diego, Bell	619-268-1277
CA	San Diego, Hall-Mark	619-268-1201
CA	San Jose, Hall-Mark	408-432-4000
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Fe Spg., Bell JIT/JDE	213-921-3611
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-424-1985
CO	Englewood, Hall-Mark	303-790-1662
CT	Cheshire, Hall-Mark	203-271-2844
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Spgs., Bell Inds.	407-339-0078
FL	Casselberry, Hall-Mark	407-830-5855
FL	Ft. Lauderdale, Bell Inds.	305-421-1997
FL	Largo, Hall-Mark	813-541-7440
FL	Melbourne, New Yorker Elect.	407-727-0955
FL	Pompano, Hall-Mark	305-971-9280
FL	Pompano Bch., Peerless	305-973-4141
FL	Tampa, Bell Inds.	813-541-4434
GA	Duluth, Hall-Mark	404-623-4400
GA	Norcross, Bell Inds.	404-662-0923
IL	Elk Grove Vlg., Bell Inds.	708-640-1910
IL	Urbana, Bell	217-328-1077
IL	Wood Dale, Hall-Mark	312-860-3800
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-875-8200
IN	Indianapolis, Bell Inds. JIT	317-876-3740
IN	Indianapolis, Hall-Mark	317-872-8875
IN	Indianapolis, PEI/Genesis	317-879-0700
IN	South Bend, PEI/Genesis	219-287-2911
KS	Lenexa, Hall-Mark	913-888-4747
MD	Columbia, Hall-Mark	301-988-9800
MD	Columbia, Peerless Radio Corp.	301-997-1717
MD	Jessup, Bell Inds.	301-953-2566
MA	Andover, Bell Inds.	508-474-8880
MA	Billerica, Hall-Mark	617-935-9777
MA	Middleboro, Glynn Elctrns.	800-225-8684
MA	Middleboro, Glynn Elctrns.	800-427-4262
MI	Livonia, Hall-Mark	313-462-1205
MN	Bloomington, Hall-Mark	612-941-2600
MO	Earth City, Hall-Mark	314-291-5350
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Moorestown, Hall-Mark	609-235-1900
NJ	Parsippany, Hall-Mark	201-515-3000
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Fairport, Hall-Mark	716-425-3300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mamaroneck, New York Elctrn.	914-698-7600
NY	Penn Yann, Advacom Technlgs.	315-536-2221
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Charlotte, EMC	704-394-6195
NC	Raleigh, Hall-Mark	919-872-0712
OH	Centerville, EMC	513-439-4711
OH	Cleveland, EMC	216-442-3441
OH	Columbus, EMC	614-299-4161
OH	Columbus, Hall-Mark	614-888-3313
OH	Dayton, Advacom Tech.	513-274-5900
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Hall-Mark	216-349-4632
OH	Worthington, Hall-Mark	614-888-3313
OH	Worthington, Hall-Mark	800-767-0392
OK	Tulsa, Hall-Mark	918-251-6110
OR	Lake Oswego, Bell Inds.	503-635-6500
PA	Bristol, Bell Inds.	215-788-5000
PA	McKean, Advacom Tech.	814-476-7774
PA	Philadelphia, Hall-Mark	215-355-7300
PA	Philadelphia, PEI-Genesis	215-673-0400
PA	Trevose, Bell Inds.	215-953-2800
TN	Jackson, Carlton-Bates	901-664-2714
TN	Nashville, Carlton-Bates	615-885-3232
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Hall-Mark (Corp.)	214-343-5000
TX	Houston, Hall-Mark	713-781-6100
TX	Richardson, Bell Inds.	214-690-0466
UT	Salt Lake City, Bell Inds.	801-255-9611
VT	Charlotte, Kelner Elctrns.	800-323-0460
WA	Redmond, Priebe Elctrns.	206-881-2363
WA	Seattle, Bell Inds.	206-867-5410
WA	Seattle, Hall-Mark	206-547-0415
WI	New Berlin, Hall-Mark	414-797-7844
WI	Waukesha, Bell	414-547-8879

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ASCENT POWER TECHNOLOGY, 146 Adesso Dr., Concord, Ont., Canada L4K3C3, Tel: 905-660-9819; Empl.: 125; *Sls. Mgr.:* Howard Gang .... **D•1592-1594**

Local Sales Offices & Reps

CA	Santa Clara, Computer Modules	408-496-1881
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Prospect, Keibler & Assocs.	502-228-7283
MD	Towson, Arbotek Assocs. Inc.	410-825-0775
MA	Burlington, New England Tech. Sls.	617-229-6387
NJ	Mahwah, North East Comps.	201-825-0233
NJ	Tintan Falls, McAdam Assocs.	908-870-8685
NY	E. Rochester, Empire Tech. Assoc.	716-381-8500
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
Can	Ontario, B.C., Current Mktg. Inc.	416-426-3413

ASC SYSTEMS, Box 566, St. Clair Shores, MI 48080, Tel: 313-882-1133; Empl.: 15; *Sls. Mgr.:* R. Martin; *Dist. Mgr.:* D. Leader

ASELCO, INC., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877, Tel: 301-863-1937, FAX: 301-840-1382; Empl.: 7; *Sls. Mgr.:* Yoon Kim

ASHLAND ELEC. PRODS., INC., 10 Industrial Way, POB 1380, Rochester, NH 03867, Tel: 603-335-1100, FAX: 603-335-1120; FSC No.: 04810; Empl.: 30; *Sls. Mgr.:* T.G. Dolan, Jr.; *Dist. Mgr.:* Roxanne Ramsey

ASI INSTRUMENTS, INC., 8570 Katy Freeway, Suite 116, Houston, TX 77024, Tel: 800-245-7056, FAX: 713-461-7348; Empl.: 15; *Sls. Mgr.:* Bill Walker

A.S.I. MICROSYSTEMS, INC., (Formerly Andrich Systems, Inc.), 1531 Smithtown Ave., Bohemia, NY 11716, Tel: 516-589-5656, FAX: 516-589-6094; *Sls. Mgr.:* Robert G. Andrews

ASLAN COMPUTER CORPORATION, 10922 Klingerman Ave., Bldg.4, S. El Monte, CA 91733, Tel: 818-575-5271, FAX: 818-575-0394; Empl.: 20; *Sls. Mgr.:* Chris Witham

ASPECT ELECTRONICS INC., 12740 Earhart Ave., Auburn, CA 95602, Tel: 916-887-1008, FAX: 916-887-1108; Empl.: 42; *Sls. Mgr.:* Donald Roelands

ASPEN IMAGING, International, Inc., 555 Aspen Ridge Dr., Lafayette, CO 80026-9300, Tel: 303-666-5750, 1-800-955-5555, TELEX: 45-0055; FSC No.: 84-0724829; Empl.: 380; *Sls. Mgr.:* Elizabeth Ema

ASPEN SEMICONDUCTOR CORP., 4001 North First Street, San Jose, CA 95134, Tel: 408-456-1800

ASPEN TEST ENGRG., INC., 4665 Nautilus Ct., Boulder, CO 80301, Tel: 303-530-1466, FAX: 303-530-9383; Empl.: 25; *Sls. Mgr.:* Mark L. Buchheister

ASSEMBLED ELECTRONIC ENCLOSURES, 666-668 Tower Rd., Mundelein, IL 60060, Tel: 708-566-2030, FAX: 708-566-4712

ASSEMBLY SPECIALISTS, 14 Alpha Rd., Chelmsford, MA 01824, Tel: 508-250-5900, FAX: 508-250-5902; Empl.: 15

ASSMANN ELECTRONICS, INC., Assmann Electronics GMBH, 1849 W. Drake Dr. Ste. 101, Tempe, AZ 85283, Tel: 602-897-7001, FAX: 602-897-7255; Empl.: 22; *Sls. Mgr.:* Mitch Simpson

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Local Sales Offices & Reps

CA	Chatsworth, Techlgs. West	818-700-6426
CA	Pleasanton, MMI	510-846-0377
CO	Morrison, Energy Equip. Sls.	303-697-0662
IN	Nobelsville, Loren Green Assocs. South	317-776-9473
NH	Nashua, Intersell	603-880-6500
TX	Richardson, J. Wisdom & Assocs., Inc.	214-470-9093
VA	Fairfax, Sci. Assocs., Inc.	703-385-0600

ASSOCIATED SPRING, BARNES GRP., 10 Main St., Bristol, CT 06010, Tel: 203-583-1331, FAX: 203-584-0727; Empl.: 1920; *Sls. Mgr.:* D.G. Ammerman

ASSURANCE TECHNOLOGIES, INC., 495 Wegner Dr., West Chicago, IL 60185, Tel: 708-231-4800, FAX: 708-231-8844; Empl.: 25; *Dist. Mgr.:* Brian K. Bagan

ASTEC HIGH VOLTAGE, C/O 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-8407, FAX: 508-879-8669; *Sls. Mgr.:* Jim Stedman .... **D•1596-1597**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Scottsdale, Power-Up Elctrns.	602-955-1105
CA	Dana Point, Electro Venture	714-496-5225
FL	Palm Bch. Gdns., Graham Assocs., Inc.	407-622-4049
IL	Arlington Heights, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Olathe, Tech. Sls. Assocs	913-829-2800
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Plymouth, EQS Sys.	313-455-7920
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NH	Intersell	603-880-6500
NY	Wantagh, Bytec	516-781-7400
NC	Winston-Salem, Murcota	919-722-9445
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
WI	Brookfield, McMahon Sls., Inc.	414-782-3335

Local Distributors

MA	Ashland, Intl. Power Sources	508-881-7434
OH	Chesterland, EQS Sys.	216-729-2222

ASTEC

FAX: 619-439-4243

ASTEC STANDARD POWER, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880; Empl.: 600; *Sls. Mgr.:* Tom Szabo, Dir. of Sls.; *Dist. Mgr.:* Robert Claborne .... **D•1598-1603, 2071-2073**

Local Sales Offices & Reps

AZ	Tempe, Techni-Source Corp.	602-497-0711, FAX:602-497-1077
CA	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
CA	Los Gatos, Luscombe Engrg.	408-370-2020, FAX:408-374-8663
CO	Colorado Springs, Omega Ltd.	719-598-6845, FAX:719-528-5729
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120, FAX:305-977-4752
FL	St. Petersburg, QXI	813-894-4556, FAX:813-894-3989
IL	Itasca, LTD Technlgs., Inc.	708-773-2900, FAX:708-773-0358
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075, FAX:319-393-0058
MD	Pasadena, Electronic Engrg. & Sls.	410-255-9686, FAX:410-255-9688
MA	Needham, Com-Sls., Inc.	617-444-8071, FAX:617-449-8047
MN	Edina, Ohms Technlg., Inc.	612-932-2920, FAX:612-932-2918
MO	Florissant, Delltron Co. Inc.	314-839-0033, FAX:314-839-4290
MO	Kansas City, Delltron Co., Inc.	816-436-6445, FAX:816-436-9982
NJ	Moorestown, T.A.I. Corp.	609-778-5353, FAX:609-778-7828
NM	Albuquerque, Techni-Source Corp.	505-268-4232, FAX:505-268-0451
NY	Clarence Ctr., Leonard D. Allen	716-634-5403, FAX:716-634-5404
NY	Melville, Parallax	516-351-1000, FAX:516-351-1606
NY	Pittsford, Leonard D. Allen	716-377-3530
NY	Syracuse, Leonard D. Allen	315-437-8387, FAX:315-437-3710
NC	Raleigh, R.W. Mitscher Co., Inc.	919-848-0941, FAX:919-848-9156
OH	Englewood, Carter, McCormic & Peirce	513-836-0951,FAX:513-836-2358
OR	Portland, ES/Chase Co., Inc.	503-292-8840, FAX:503-292-8827
TX	Austin, Milco Mktg., Inc.	512-343-1275, FAX:512-343-0980
TX	Missouri City, Milco Mktg., Inc	713-261-7843, FAX:713-469-5156
TX	Plano, Milco Mktg., Inc.	214-578-8827, FAX:214-578-7026
WA	Kirkland, ES/Chase Co., Inc.	206-823-9535, FAX:206-821-7257
WI	Milwaukee, LTD Technlgs., Inc.	414-774-1000, FAX:414-774-0593
Can	Brampton,Ont., Cantec Reps.	416-791-5922, FAX:416-791-7940
Can	Ottawa, Ont., Cantec Reps.	613-725-3704, FAX:613-725-0490
Can	St. Eustache, Que., Cantec Reps.	514-623-5496, FAX:514-623-5482

Local Distributors

AL	Birmingham, Newark	205-979-7003
AL	Huntsville, Future	205-830-2322
AL	Huntsville, Newark	205-837-9091
AL	Huntsville, Reptron	205-722-9500
AL	Mobile, Newark	205-471-6500
AL	Montgomery, Newark	205-270-8074
AK	Newark	800-321-8984
AZ	Phoenix, Future	602-968-7140
AZ	Phoenix, Newark	602-742-9905
AZ	Tempe, RicheyCypress	602-966-8856
AR	Little Rock, Newark	501-225-8130
CA	Camarillo, Milgray	805-484-4055
CA	Chatsworth, Future	818-772-6240
CA	Citrus Hgts., Newark	916-721-1633
CA	Corona, Compumech	714-278-4761
CA	Dublin, Newark	415-572-8300
CA	Garden Grove, RicheyCypress	714-895-0060
CA	Garden Grove, RicheyCypress	714-898-8288
CA	Irvine, Future	714-250-4141
CA	Irvine, Milgray	714-753-1282
CA	Los Angeles, Newark	213-664-5252
CA	Los Angeles, Newark	818-242-1900
CA	Milpitas, Compumech	408-945-9100
CA	Orange, Newark	714-634-8224
CA	San Diego, Future	619-625-2800
CA	San Diego, Newark	619-453-8211
CA	San Diego, RicheyCypress	619-271-4511
CA	San Jose, Future	408-434-1122
CA	San Jose, Milgray	408-456-0900
CA	San Jose, Newark	408-559-6900
CA	San Jose, RicheyCypress	408-956-8010
CA	Sun Valley, RicheyCypress	818-768-0403
CA	Thousand Oaks, Compumech	805-492-6299
CA	Ventura, Newark	805-644-2265
CO	Colorado Springs, Newark	719-576-2644
CO	Denver, Newark	303-757-3351
CO	Englewood, RicheyCypress	303-792-5829
CO	Lakewood, Future	303-232-2008
CT	Bethel, Future	203-743-9594
CT	Bloomfield, Newark	203-243-1731
CT	E. Hartford, Newark	203-289-1416
CT	Meriden, Newark	203-630-2239
CT	Milford, Milgray	203-878-5538
CT	Newton, Target	203-426-4403
CT	Seymore, Target	203-888-1480
FL	Altamonte Springs, Future	407-767-8414
FL	Boca Raton, Newark	407-241-0605
FL	Bradenton, Newark	813-755-7910
FL	Clearwater, Newark	813-443-0661
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Ft. Meyers, Newark	813-275-6310
FL	Jacksonville, Newark	904-399-5041
FL	Lake Mary, Milgray	407-321-2555
FL	Largo, Future	813-530-1222
FL	Melbourne, Newark	407-727-7308
FL	Miami, Newark	305-593-2686
FL	Orlando, Newark	407-896-8350
FL	Plantation, Newark	305-424-1566
FL	Tampa, Newark	813-287-1578
FL	Tampa, Reptron	813-854-2000
FL	Tampa, Reptron	813-854-2351
FL	Tampa, Reptron	813-855-4650
GA	Atlanta, Newark	404-448-8500
GA	Atlanta, Newark	404-761-9902
GA	Atlanta, Newark	404-951-2363
GA	Macon, Newark	912-743-2446
GA	Norcross, Future	404-441-7676
GA	Norcross, Milgray	404-446-9777
GA	Norcross, Newark	404-448-1300
GA	Norcross, Reptron	404-446-1300
HI	Aiea, Newark	806-487-8951
ID	Boise, Newark	208-342-4311
IL	Addison, Newark	708-495-7740
IL	Arlington Hgts., Newark	708-392-9009
IL	Aurora, Newark	708-820-2411
IL	Chicago, Hallmark	708-860-3800
IL	Chicago, Newark	312-792-8233
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Decatur, Newark	217-875-4411
IL	Glenview, Compumech	708-998-8264
IL	Hoffman Estates, Future	708-882-1255
IL	Libertyville, Newark	708-362-2248
IL	Palatine, Milgray	708-202-1900
IL	Palos Hills, Newark	708-430-0690
IL	Peoria, Newark	309-693-3771
IL	Rockford, Newark	815-229-0225
IL	Schaumburg, Newark	708-310-8980
IL	Schaumburg, Newark	708-843-0700
IL	Schaumburg, Reptron	708-882-1700
IL	Springfield, Newark	217-787-9972
IN	Evansville, Newark	812-423-2552
IN	Ft. Wayne, Newark	219-484-0766
IN	Indianapolis, Custom Svc. Elec.	317-879-9119
IN	Indianapolis, Newark	317-884-0047
IN	Merriville, Newark	219-738-2787
IA	Bettendor, Newark	319-359-3711
IA	Cedar Rapids, Newark	319-393-3800
IA	Des Moines, Newark	515-278-0670
KS	Overland Park, Newark	913-677-0727
KS	Overland Pk., Milgray	913-236-8800
KS	Wichita, Newark	316-267-8755
KY	Lexington, Newark	605-266-6446
KY	Louisville, Newark	502-423-0280
LA	Metairie, Newark	504-838-9771
MD	Beltsville, Newark	301-604-1700
MD	College Pk., Newark	301-982-9711
MD	Columbia, Future	410-290-0600
MD	Columbia, Milgray	410-995-6169
MD	Columbia, Newark	301-964-4482
MD	Hanover, Newark	410-712-6922
MD	Timonium, Newark	410-560-2886
MD	Wheaton, Newark	301-949-9665
MA	Bolton, Future	508-779-3000
MA	Braintree, Target	617-848-9330
MA	Gardner, Computech	508-630-2909
MA	Methuen, Newark	508-683-0913
MA	Methuen, Newark	508-688-1837
MA	W. Springfield, Newark	413-785-5851
MA	Walpole, Newark	508-660-1071
MA	Walpole, RicheyCypress	508-668-8200
MA	Waltham, Newark	617-894-8050
MA	Westwood, Target	617-329-2700
MA	Wilmington, Milgray	508-657-5900
MA	Woburn, Newark	617-932-9040
MA	Woburn, Newark	617-935-8350
MA	Worcester, Newark	508-757-4515
MI	Detroit, Newark	313-967-0600
MI	Farmington Hills, Newark	313-737-5150
MI	Flint, Royalite	313-238-4641
MI	Gaylord, Reptron/K-Byte	517-732-6244
MI	Grand Rapids, Future	616-249-3200
MI	Grand Rapids, Newark	616-455-9190
MI	Livonia, Future	313-261-5270
MI	Livonia, Reptron	313-525-2700
MI	Oak Park, Newark	313-967-0600
MI	Saginaw, Newark	517-799-0480
MI	Traverse City, Newark	616-929-2313
MI	Troy, Newark	313-680-9110
MN	Burnsville, Newark	612-890-0584
MN	Crystal Bay, Newark	612-535-4280
MN	Duluth, Newark	218-727-4776
MN	Eden Prairie, Future	612-944-2200
MN	Eden Prairie, Richeycypress	612-934-2104
MN	Minneapolis, Newark	612-331-6350
MN	Minnetonka, Reptron	612-938-0000
MN	St. Paul, Newark	612-631-2683
MN	Vadnais Hgts., Reptron	612-481-0756
MS	Jackson, Newark	601-956-3834

MS	Tupelo, Newark	601-840-0305
MO	Crestwood, Newark	314-821-7466
MO	Independence, Newark	816-478-0561
MO	Springfield, Newark	417-886-0092
MO	St. Louis, Future	314-469-6805
MO	St. Louis, Newark	314-296-2505
MT	Helena, Newark	406-443-6192
NE	Omaha, Newark	402-592-2423
NV	Las Vegas, Newark	702-597-0330
NV	Reno, Newark	702-322-6090
NH	Derry, Target	603-434-8440
NH	Nashua, Newark	603-888-5790
NH	Salem, Diamond	603-894-4420
NH	Salem, Sager	603-894-4420
NJ	Bordentown, Newark	609-298-4450
NJ	Clark, Newark	908-381-1343
NJ	E. Brunswick, Newark	908-937-6600
NJ	Fairfield, Newark	201-882-0300
NJ	Marlton, Future	609-596-4080
NJ	Marlton, Milgray	609-983-5010
NJ	Parsippany, Future	201-299-0400
NJ	Parsippany, Milgray	201-335-1766
NJ	Pennsauken, Newark	609-663-9490
NJ	Springfield, Newark	212-964-2556
NJ	Union, Newark	908-851-2290
NM	Albuquerque, Newark	505-828-1878
NY	Binghampton, Newark	607-771-8795
NY	Buffalo, Newark	716-862-9700
NY	Commack, Newark	516-499-1216
NY	Farmingdale, Milgray	516-391-3000
NY	Farmingdale, Milgray	516-420-9800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Fishkill, Newark	914-896-4190
NY	Hauppauge, Future	516-234-4000
NY	Latham, Newark	518-783-0083
NY	Long Island, Sager Elctrns.	516-348-1300
NY	Pittsford, Milgray	716-381-9700
NY	Pittsford, Newark	716-381-4244
NY	Rochester, Future	716-272-1120
NY	Syracuse, Future	315-451-2371
NY	Syracuse, Newark	315-437-6611
NC	Charlotte, Newark	704-535-5650
NC	Concord, Future	704-455-9030
NC	Greensboro, Newark	919-292-7240
NC	Greensboro, Newark	919-294-2142
NC	High Point, Newark	919-884-8881
NC	Raleigh, Future	919-790-7111
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Newark	919-781-7677
NC	Raleigh, Reptron	919-870-5189
NC	Wilmington, Newark	919-791-9393
OH	Akron, Newark	216-374-9987
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cincinnati, Hughes Peters	800-899-8228
OH	Cincinnati, Newark	513-771-9700
OH	Cincinnati, Newark	513-772-8181
OH	Cleveland, Milgray	216-447-1520
OH	Cleveland, Newark	216-391-9330
OH	Columbus, Hughes Peters	614-294-5351
OH	Columbus, Newark	614-431-0809
OH	Columbus, Newark	614-481-8141
OH	Dayton, Newark	513-294-8980
OH	Mayfield Hgts., Future	216-449-6996
OH	Parma Hgts., Newark	216-886-0505
OH	Solon, Reptron	216-349-1415
OH	Toledo, Newark	419-886-0404
OH	Valley View, Newark	216-447-8860
OH	Warrensville, Newark	216-587-1700
OH	Worthington, Reptron	614-436-6675
OH	Youngstown, Newark	216-793-6134
OH	Zanesville, Newark	614-454-6704
OK	Oklahoma City, Newark	405-495-5000
OK	Tulsa, Newark	918-252-5070
OR	Beaverton, Future	503-645-9454
OR	Portland, Newark	503-257-0741
PA	Allentown, Newark	609-434-7171
PA	Freeport, Newark	412-295-4400
PA	King of Prussia, Newark	215-265-0933
PA	Malvern, Newark	215-296-5522
PA	Philadelphia, Newark	215-245-7300
PA	Pittsburgh, Newark	412-367-2790
PA	Pittsburgh, Newark	412-788-4790
PA	Pittsburgh, Newark	412-823-5150
SC	Columbia, Newark	803-798-0198
SC	Greenville, Newark	803-288-9610
SC	N. Charleston, Newark	803-764-3091
TN	Brentwood, Newark	615-371-1341
TN	Chattanooga, Newark	615-899-0056
TN	Jackson, Newark	901-664-6076
TN	Knoxville, Newark	615-588-6493
TN	Memphis, Newark	901-365-8060
TX	Austin, Future	512-502-0991
TX	Austin, Newark	512-338-0287
TX	Dallas, Hall-Mark Elctrns.	214-553-4300
TX	Dallas, Milgray	214-248-1603
TX	El Paso, Newark	915-778-5322
TX	Ft. Worth, Newark	817-589-1295
TX	Houston, Future	713-556-8696
TX	Houston, Newark	713-270-4800
TX	Irving, RicheyCypress	214-255-0065
TX	Richardson, Future	214-437-2437
TX	Stafford, Milgray	713-240-5360
UT	Murray, Milgray	801-261-2999
UT	Salt Lake City, Future	801-972-8489
UT	Salt Lake City, Newark	801-261-5660
VT	Burlington, Newark	802-282-5671
VT	Burlington, Newark	802-860-1856
VA	Arlington, Newark	703-522-7552
VA	Chantilly, Newark	703-471-7447
VA	Richmond, Newark	802-282-5671
VA	Roanoke, Newark	703-345-7001
VA	Virginia Bch., Newark	804-499-0719
WA	Bellvue, Newark	206-641-9800
WA	Bothell, Future	206-489-3400
WA	Seattle, RicheyCypress	206-575-1910
WA	Spokane, Newark	509-327-1935
WV	Dunbar, Newark	304-768-6872
WI	Brookfield, Newark	414-783-6566
WI	Green Bay, Newark	414-494-1400
WI	Madison, Newark	608-221-4738
WI	Milwaukee, Newark	414-453-9100
WI	Waukesha, Future	414-786-1884
Can	Calgary, Alb., Future	403-250-5550
Can	Edmonton, Alb., Future	403-438-2858
Can	Laval, Que., Newark	514-681-6476
Can	London, Ont., Newark	519-685-4280
Can	Markham, Ont., Carsten	416-477-7705
Can	Mississauga, Ont., Future	416-612-9200
Can	Mississauga, Ont., Milgray	416-678-0958
Can	Mississauga, Ont., Newark	416-670-2888
Can	Mississauga, Ont., Newark	416-670-7799
Can	Montreal, Que., Newark	514-738-4488
Can	Nepean, Ont., Carsten	613-564-0622
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-426-5900
Can	Pointe Claire, Que., Future	514-694-7710
Can	Quebec, que., Future	418-877-6666
Can	St. Laurent, Que., Carsten	514-334-8321
Can	Vancouver, BC, Future	604-294-1166
Can	Westminster, BC, Newark	604-520-5721
Can	Winnipeg, Man., Future	204-786-7711

ASTER, a Porta Systems Company, 86 South Street, Hopkinton, MA 01748, Tel: 508-435-0101; *Sls. Mgr.:* Lou Maiolo

ASTRO DYNAMICS, INC., 2 Gill St., Woburn, MA 01801, Tel: 617-935-4944, FAX: 617-935-4982; Empl.: 50; *Sls. Mgr.:* Leo Donahue

ASTRO-GEO-MARINE, INC., 2186 Knoll Dr. B, Ventura, CA 93003, Tel: 805-654-8300, FAX: 805-654-8314; FSC No.: 51473; Empl.: 12

ASTRO INSTRUMENT CORP., 450 Goolsby Blvd., Deerfield, FL 33442-3019, Tel: 305-698-6000, FAX: 305-698-6011; FSC No.: 51761; *Sls. Mgr.:* Peter J. Sinatra, Jr.

ASTRO INTERNATIONAL CORP., 100 Park Ave., League City, TX 77573, Tel: 713-332-2484, FAX: 713-554-6795; Empl.: 50; *Sls. Mgr.:* Curt Nicholls

ASTROMEC, INC., 2950 Arrowhead Dr., Carson City, NV 89706, Tel: 702-883-9226, FAX: 702-883-9228; Empl.: 40; *Sls. Mgr.:* Ken Irvin

Ai

FAX: 401-822-2430

ASTRO-MED, INC., 600 East Greenwich Avenue, W. Warwick, RI 02893, Tel: 401-828-4000, TWX: 710-382-6409; FSC No.: 6625; Empl.: 225; *Sls. Mgr.:* Everett V. Pizzuti .... **D•1410-1412**

ASTROSYSTEMS, INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600, FAX: 516-328-1658; *Sls. Mgr.:* Howard Lazarus; *Dist. Mgr.:* Roy Hartmann, Sls. Mgr. .... **D•2244-2249**

ASTRO TOOL CORP., 21615 Southwest Tualatin Valley Hwy., Beaverton, OR 97006, Tel: 503-642-9853, FAX: 503-591-7766

A-SYSTEMS INC., 1500 Avon St. Extd., Charlottesville, VA 22902, Tel: 804-295-7200, FAX: 804-295-7201; Empl.: 45; *Sls. Mgr.:* F. M. Artrip

AT&T
Capital Corporation

FAX: 214-456-4002

AT&T CAPITAL CORPORATION, 1830 West Airfield Dr., DFW Airport, TX 75261-9260, Tel: 800-874-7123; Empl.: 220 .... **D•1228-1233**

AT&T
Microelectronics

FAX: 215-778-4106

AT&T MICROELECTRONICS, 555 Union Blvd., 500404000, Allentown, PA 18103, Tel: 1-800-372-2447, In Can.:1-800-553-2448 .... **A•1334-1335, 2268-2271; D•1604-1607**

Local Sales Offices & Reps

AZ	Phoenix, AT&T Microelectronics	602-844-6529
CA	Cypress, AT&T Microelectronics	714-220-6223
CA	Santa Clara, AT&T Microelectronics	408-980-3700
CO	Denver, AT&T Microelectronics	303-290-3708
GA	Norcross, AT&T Microelectronics	404-446-4700
IL	Itasca, AT&T Microelectronics	708-290-3335
MA	Framingham, AT&T Microelectronics	508-626-2161
MN	Bloomington, AT&T Microelectronics	612-885-4300
NY	Poughkeepsie, AT&T Microelectronics	914-485-7744
NC	Raleigh, AT&T Microelectronics	919-881-8023
OR	Portland, AT&T Microelectronics	503-244-3883
PA	Allentown, AT&T Microelectronics	215-770-3343
TX	Irving, AT&T Microelectronics	214-869-2040

Local Distributors

AL	Huntsville, Arrow/Schweber	205-837-6955
AZ	Tempe, Anthem	602-966-6600
AZ	Tempe, Arrow/Schweber	602-431-0030
CA	Calabasas, Arrow/Schweber	818-880-9686
CA	Chatsworth, Anthem	818-775-1333
CA	Irvine, Anthem	714-768-4444
CA	Rocklin, Anthem	916-624-9744
CA	San Diego, Anthem	619-453-9005
CA	San Diego, Arrow/Schweber	619-565-4800
CA	San Jose, Anthem	408-452-2219
CA	San Jose, Arrow/Schweber	408-441-9700
CA	San Jose, Capstone	408-453-9804
CA	San Jose, Merit	408-434-0800
CA	Tustin, Arrow/Schweber	714-587-0404
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone	303-375-1300
CO	Englewood, Anthem	303-790-4500
CO	Englewood, Arrow/Schweber	303-799-0258
CT	Wallingford, Arrow/Schweber	203-265-7741
CT	Waterbury, Anthem	203-575-1575
FL	Deerfield Beach, Arrow/Schweber	305-429-8200
FL	Lake Mary, Arrow/Schweber	407-333-9300
GA	Duluth, Arrow/Schweber	404-497-1300
IL	Itasca, Arrow/Schweber	708-250-0500
IL	Itasca, Capstone	708-250-0300
IL	Schaumburg, Anthem	708-884-0200
IN	Indianapolis, Arrow/Schweber	317-299-2071
IA	Cedar Rapids, Arrow/Schweber	319-395-7230
KS	Lenexa, Arrow/Schweber	913-541-9542
MD	Columbia, Anthem	301-995-6640
MD	Columbia, Arrow/Schweber	301-596-7800
MA	Wilmington, Anthem	508-657-5170
MA	Wilmington, Arrow/Schweber	508-658-0900
MA	Wilmington, Capstone	508-657-5874
MI	Livonia, Arrow/Schweber	313-462-2290
MN	Eden Prairie, Anthem	612-944-5454
MN	Eden Prairie, Arrow/Schweber	612-941-5280
NJ	Holmdel, Arrow/Schweber	908-949-4700
NJ	Marlton, Arrow/Schweber	609-596-8000
NJ	Marlton, Capstone	609-596-7500
NJ	Pine Brook, Anthem	201-227-7960
NJ	Pine Brook, Arrow/Schweber	201-227-7889
NY	Commack, Anthem	516-493-6600
NY	Hauppauge, Arrow/Schweber	516-231-1000
NY	Melville, Arrow/Schweber	516-391-1300
NY	Rochester, Arrow/Schweber	716-427-0300
NC	Raleigh, Arrow/Schweber	919-876-3132
NC	Raleigh, Capstone	919-954-0600
OH	Centerville, Arrow/Schweber	513-435-5563
OH	Solon, Arrow/Schweber	216-248-3990
OK	Tulsa, Arrow/Schweber	918-252-7537
OR	Beaverton, Anthem	503-643-1114

OR	Beaverton, Arrow/Schweber	503-629-8090
PA	Horsham, Anthem	215-443-5150
PA	Pittsburgh, Arrow/Schweber	412-963-6807
TX	Austin, Arrow/Schweber	512-835-4180
TX	Carrollton, Arrow/Schweber	214-380-6464
TX	Carrollton, Capstone	214-380-9049
TX	Houston, Arrow/Schweber	713-530-4700
TX	Richardson, Anthem	214-238-7100
UT	Salt Lake City, Anthem	801-973-8555
UT	Salt Lake City, Arrow/Schweber	801-973-6913
WA	Bellevue, Almac	206-643-9992
WI	Brookfield, Arrow/Schweber	414-792-0150
Can	Dorval, Que., Arrow/Schweber	514-421-7411
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., Arrow/Schweber	416-670-7769

AT&T NETWORK SYSTEMS,NETWORK CABLE SYS. DIV., 111 Madison Ave., Morristown, NJ 07962, Tel: 1-800-344-0223, Ext. 1027

ATC-FROST MAGNETICS INC., 1130-Eighth Line, Oakville,Ont., Canada L6H 2R4, Tel: 416-844-6681, FAX: 416-844-6895; Empl.: 180; *Sls. Mgr.:* C.M. Webb

ATC POWER SYSTEMS, INC., 45 Depot St., Merrimack, NH 03054, Tel: 603-429-0391, FAX: 603-429-0795; FSC No.: 61814; Empl.: 40; *Sls. Mgr.:* Robert L. Grant, Jr. Sls. Mgr.

ATEC, INC., 8219 Kempwood Dr., Houston, TX 77055, Tel: 713-468-7971, FAX: 713-468-6585; FSC No.: 09552; Empl.: 70; *Sls. Mgr.:* R.L. Rainwater

ATE SUPER TECHS, 4031 NE 17 Terr., Pompano Beach, FL 33064, Tel: 800-780-6343, 305-941-6343, 305-973-0996, FAX: 305-941-9413; *Sls. Mgr.:* Desmond James

ATHENA CONTROLS, INC., 5145 Campus Dr., Whitemarsh Ind. Campus, Plymouth Meeting, PA 19462, Tel: 215-828-2490, FAX: 215-828-7084; Empl.: 70; *Sls. Mgr.:* Douglas Crowell

ATI (AHAM TOR INC.), 999 Company, P.O. Box 9019, Temecula, CA 92390-0739, Tel: 714-676-4151, FAX: 714-676-3031

ATI TECHNOLOGIES INC., 3761 Victoria Park Ave., Scarborough, Ont., Canada M1W 3S2, Tel: 416-756-0718, FAX: 416-756-0720; Empl.: 430; *Sls. Mgr.:* Jon Turner, VP-OEM Sls.

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ATKINS TECHNICAL INC., 3401 S.W. 40th Blvd., Gainesville, FL 32608, Tel: 904-378-5555, FAX: 904-335-6736; Empl.: 45; *Sls. Mgr.:* Robert M. Atkins; *Dist. Mgr.:* Kenneth A. Robinson

ATLANTA SIGNAL PROCESSORS, INC., 770 Spring Street N.W., Atlanta, GA 30308, Tel: 404-892-7265, FAX: 404-892-2512; Empl.: 20; *Sls. Mgr.:* William E. Jouris

ATLANTIC MAGNETICS, INC., 1441 S.W. 30th Ave., Pompano Beach, FL 33069, Tel: 305-979-7920, FAX: 305-978-3788; Empl.: 37; *Sls. Mgr.:* Edward Cammarata; *Dist. Mgr.:* Scott Thompson

ATLANTIC OPTICAL MOULDING, Ellis St., P.O. Box 309, Webster, MA 01570, Tel: 508-943-1746; Empl.: 6

ATLANTIC SCIENTIFIC CORPORATION, 4300 Fortune Pl., Ste. A, W. Melbourne, FL 32904, Tel: 1-800-544-4737, FAX: 407-727-0736; Empl.: 50; *Sls. Mgr.:* Bill Purcell, V.P.

ATLAS ENERGY SYSTEMS, INC., 713 W. Duarte Rd., Bldg. G299, Arcadia, CA 91007, Tel: 818-575-0755, FAX: 818-575-0665; Empl.: 30; *Sls. Mgr.:* James LoGudice; *Dist. Mgr.:* James LoGudice

ATLAS ENGINEERING CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100, FAX: 617-445-4942; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Levi Fears

ATLAS/SOUNDOLIER, COMMERCIAL SOUND DIV., Atapco Security & Communications Group, 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Bud Waters, Natl. Sls. Mgr.

ATLAS/SOUNDOLIER, INDUSTRIAL CABINET DIV., Atapco Security & Communications Grp., 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Gary Shamel, Indl. Cabinet Div./ Sls. Mgr.

ATLEE INC., 10 Bayfield Dr., North Andover, MA 01845, Tel: 508-681-1003, TELEX: 928252, FAX: 508-686-2934; FSC No.: 99378; Empl.: 20; *Sls. Mgr.:* Tom Fiocco; *Dist. Mgr.:* Tom Fiocco .... **C•1015, 1671**

Local Sales Offices & Reps

MA	Sharon, Cummings Assocs.	617-784-5600
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Arlington, Rem-Air Corp.	214-234-1069

Local Distributors

CA	Anaheim, Bisco Inds.	714-635-0380
CA	San Jose, Bisco Inds.	408-946-8980
IL	Franklin Pk., Bisco Inds.	312-451-1230
MA	Marlboro, Hardware Specialties	617-481-8622
MA	N. Andover, Atlee, Direct	508-681-1003
MA	Winchester, Webb	617-729-5800
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Paramus, N.Y. Fastener	201-265-8770
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, G & B Fasteners	516-694-0990

ATMEL CORPORATION, 2125 O'Nel Drive, San Jose, CA 95131, Tel: 408-441-0311, FAX: 408-436-4200; Empl.: 875; *Dist. Mgr.:* Dave Walton

ATOMERGIC CHEMETALS CORP., 222 Sherwood Ave., Farmingdale, NY 11735-1718, Tel: 516-694-9000, TWX: 6852289, FAX: 516-694-9177; Empl.: 30; *Sls. Mgr.:* A. Pensiero

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

THE AUBURN MANUFACTURING COMPANY, 29 Stack Street/P.O. Box 251, Middletown, CT 06457-0251, Tel: 203-346-6677, FAX: 203-346-1334; Empl.: 45; *Sls. Mgr.:* Gary L. Mittelman, VP

AUDIO PRECISION, INC., PO Box 2209, Beaverton, OR 97075-3070, Tel: 503-627-0832, TELEX: 283957 AUDIO UR, FAX: 503-641-8906; Empl.: 33; *Sls. Mgr.:* Thomas Mintner

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305, 800-533-7863, FAX: 607-652-3653; FSC No.: 97101; Empl.: 120; *Sls. Mgr.:* Fred Rosscoe

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, TELEX: 69-1241; Empl.: 14; *Sls. Mgr.:* Gordon Anderson

AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 50

AUGAT ALCOSWITCH, Augat Inc., 452 John Dietsch Blvd., Attleboro Falls, MA 02763, Tel: 508-699-9800, FAX: 508-699-6717; FSC No.: 95146; Empl.: 150; *Sls. Mgr.:* Gillis Mellen

AUGAT, INC., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703, Tel: 508-222-2202, TWX: 710-391-0644, FAX: 508-222-0693; *Sls. Mgr.:* Gillis Mellen; *Dist. Mgr.:* Dick Thorpe

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 708-682-4100, FAX: 708-682-4562; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* Jim Steranko, Prod. Mgr.; *Dist. Mgr.:* Jim Steranko, Prod. Mgr.

AULT

FAX: 612-493-1911

AULT, INCORPORATED, 7300 Boone Ave. N, Minneapolis, MN 55428, Tel: 612-493-1900; Empl.: 300; *Sls. Mgr.:* Greg Harris .... **D•1608-1609**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Santa Clara, Magna Sls.	408-727-8753
CT	Wallingford, Marathon Sls., LTD	203-663-2734
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, MSI	708-285-1000
IA	Des Moines, Spectrum Sls.	913-648-6811
MA	Framingham, Marathon Sls., LTD	508-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Fairfield, T.A.M.	201-575-4130
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Jas. J. Backer Co.	503-627-0775
PA	Philadelphia, All-Tech Mktg.	717-540-1204
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

CA	Huntington Bch., House of Batteries	800-432-3385
Can	Markham, Deskin Sls.	416-475-1412
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Natl. Electro Sls. Corp.	800-423-2664
MA	Wilmington, North Star Elctrns.	508-657-5155
NJ	Clifton, Vantage Comps.	201-777-4100
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Columbus, Promark/EMC	614-299-4161
TX	Fort Worth, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
WA	Seattle, Radar Elec.	206-282-2511

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 60; *Sls. Mgr.:* Michael Aleksinas

AUSTRIA MIKRO SYSTEME INTERNATIONAL, Schloss Premstaetten, Unterpremstaetten, Austria A-8141, Tel: (03136) 500, TELEX: 312547 AMS A, FAX: (03136)52501,53650; Empl.: 600; *Sls. Mgr.:* Mr. Wilfried Beie

AUSTRON, INC., See FTS Austron

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FAX: 805-522-8777

AUTEC POWER SYSTEMS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-522-0888; Empl.: 100; *Sls. Mgr.:* Bill Glynn; *Dist. Mgr.:* Jeanne Hirsch .... **D•1610-1615**

Local Sales Offices & Reps

CA	Bonsall, Power Specialists	619-726-4799
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Mountain View, Straube Assocs., Inc.	415-969-6060
CA	Simi Valley, Power Specialists	805-581-4785

OH	Dayton, The Lyons Corp.	513-278-0714
OH	Richfield, The Lyons Corp.	216-659-9224
OH	Westerville, The Lyons Corp.	614-895-1447
OR	Beaverton, Blair-Hirsh Co.	503-641-1875
WA	Lynnwood, Blair-Hirsh Co.	206-774-8151
Can	Kanata, Ont., CMT Renmark, Inc.	613-591-9555
Can	Mississauga, Ont., CMT Renmark, Inc.	416-612-0900
Can	Pointe Claire, Que., CMT Renmark, Inc.	514-694-6088

Local Distributors

CA	Corona, Compumech Elctrns.	714-278-4761
CA	Milpitas, Compumech Elctrns.	408-945-9100
CA	Thousand Oaks, Compumech Elctrns.	805-495-6299
IL	Glennview, Compumech Elctrns.	708-998-8264
MA	Gardner, Compumech Elctrns.	508-630-2909

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, FAX: 201-633-7755; Empl.: 4

AUTOMATIC COIL CORP., 3545 N.W. 71st Street, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245; *Sls. Mgr.:* Joseph Keith, VP, Sls. Mgr.

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC TIMING AND CONTROLS, Sycon Corp., 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-8827; Empl.: 300; *Sls. Mgr.:* J.M. Tornetta

AUTOMATION COMPONENT TECHNOLOGY, 41305 Albrae At., Fremont, CA 94538, Tel: 510-226-0900, 510-490-3587 (Sales), FAX: 510-226-0769; Empl.: 28; *Sls. Mgr.:* George Holman, Sls. Mgr.

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 21

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl., Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATIX INC., 755 Middlesex Turnpike, Billerica, MA 01821, Tel: 506-667-7900, FAX: 508-663-5482; Empl.: 65; *Sls. Mgr.:* Peter Mayek, Dir. of Sls.

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 25; *Sls. Mgr.:* David E. Drenning .... **B•1240**

Local Sales Offices & Reps

CA	Valencia, Blair Randle & Assoc.	805-259-3326
CA	Watsonville, Techrep North	408-761-2244
CT	Newtown, Sturdy Corp.	203-426-4403
CT	Seymour, Sturdy Corp.	203-888-1480
IL	St. Charles, Arrowhead Automation	708-584-0058
MA	Braintree, Sturdy Corp.	617-848-9330
MA	Westwood, Sturdy Corp.	617-326-8300
MN	Little Canada, Assured Sls.	612-482-1309
NH	Derry, Sturdy Corp.	603-434-8440
NY	Sidney, Charles Co.	607-563-8064
OR	Portland, D.A. Sullivan Co.	503-292-2448

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 10121 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-535-0077, FAX: 619-535-0130; Empl.: 197; *Sls. Mgr.:* Ken Krone

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, FAX: 203-929-6187; *Sls. Mgr.:* Arthur DiFabbio

AUTRONICS CORP., 325 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5470, FAX: 818-446-0014; FSC No.: 03972; Empl.: 100; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, FAX: 215-259-8379; Empl.: 100

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, FAX: 408-336-5049; FSC No.: 61933; Empl.: 4; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC, A Subsidiary of Hewlett-Packard, 3175 Bowers Ave., Santa Clara, CA 95054, Tel: 408-727-0700, FAX: 408-970-6070; Empl.: 7600

AVANTI CIRCUITS, INC., 17650 N. 25th Ave., Phoenix, AZ 85023, Tel: 1-800-234-1556, FAX: 1-602-375-1909; Empl.: 65; *Sls. Mgr.:* Steve Tappan

AVASEM CORPORATION, 1271 Parkmoor Ave., San Jose, CA 95126, Tel: 408-297-1201, FAX: 408-925-9460; Empl.: 42; *Sls. Mgr.:* Richard Konrad

AVELEM, La Billardiere, Gargilesse, France 36190, Tel: 33-54478672, FAX: 33-54477799; Empl.: 12

AVEL TRANSFORMERS INC., 47 South End Plaza, New Milford, CT 06776, Tel: 203-355-4711, FAX: 203-354-8597; Empl.: 225; *Sls. Mgr.:* Melanie B. Roman .... **A•2272-2275; D•1616**

AVENS SIGNAL EQUIPMENT, 85-08 Queens Blvd., Elmhurst, NY 11373, Tel: 718-335-1886, FAX: 718-429-5785; Empl.: 15; *Sls. Mgr.:* Peter Eng .... **A•1620-1622**

AVERY DENNISON, 1 Clarks Hill, Framingham, MA 01701, Tel: 508-879-0511, FAX: 508-879-5009; Empl.: 8000; *Sls. Mgr.:* George Curtis

AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Dona Logan; *Dist. Mgr.:* Michael S. Batley VP/GM .... **D•1424-1425**

Local Sales Offices & Reps

CO	Denver, Tessco	303-778-1119
IL	Cary, Bob Burns Assoc.	708-516-3322
IN	Carmel, New Era	317-844-4530
NM	Albuquerque, Genl. Mktg.	505-892-3426
PA	Philadelphia, Allpower Tech.	215-289-6025
TX	Rowlett, Campion Sls.	800-877-7623

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd, P.O. Box 391, Burbank, CA 91503-0391, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 485; *Sls. Mgr.:* D. Ladin

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FAX: 908-382-4996

AVIONIC INSTRUMENTS, REA International Inc., 1414 Randolph Ave., Avenel, NJ 07001, Tel: 908-388-3500; FSC No.: 10933 (FSCM); Empl.: 150; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba .... **D•2232-2239**

Local Distributors

NJ	Avenel, REA Intl. Ltd.	908-382-7100

AVO BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

AVO INTERNATIONAL, TBG, 4651 S. Westmoreland, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Hermann Michaeli

AVTECH

FAX: 613-226-2802

AVTECH ELECTROSYSTEMS LTD., P.O. Box 5120, Stn. F, Ottawa, Ontario, Canada K2C 3H4, Tel: 613-226-5772; Empl.: 8 .... **D•1234**

Local Sales Offices & Reps

MA	Westford, ICS Assocs, Inc.	508-692-3545
NM	Albuquerque, Tech. Mktg. Specialists	505-291-1363
NY	Ogdensburg, Avtech Electrosystems Ltd.	315-472-5270
Can	Ottawa, Ont., Avtech Electrosystems Ltd.	613-226-5772

AVTEL/UNITRON, 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* Fred Cullum .... **D•2241-2243**

Local Sales Offices & Reps

CA	Sunland, JVC Assocs. (Jim Crevier)	818-352-7348
NC	Charlotte, Bruster Lawing & Assocs.	803-831-1205
VA	Midlothian, Bruster Lawing & Assocs.	804-794-3879

AVX
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FAX: 803-626-2442

AVX CORPORATION, A Kyocera Group Company, 801 17th Ave. South, Myrtle Beach, SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; *Dist. Mgr.:* Mike Craven .... **A•1024-1028, 1336-1337, 1866-1867**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Interstate Mktg.	602-263-8044/8241
CA	Mountain View, Peninsula Tech Sls.	415-965-3636
CA	San Diego, Interstate Mktg.	619-693-3220
CA	San Jose, Quadrep Inc.	408-432-3300
CA	Woodland Hills, Interstate Mktg. Assocs.	818-883-7606
CO	Englewood, Thorson Rocky Mt. Inc.	303-773-6300
CT	Wallingford, J.E. Boeing	203-265-1318
FL	Belleair Bch., Beacon Elctrns.	813-593-2267
FL	Casselbury, Dyne-A-Mark	407-831-2822
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6508
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IL	Itasca, Janus, Inc.	708-250-9650
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, Frank J. Campisano	317-577-0319
IN	Kokomo, M. Gottlieb Assocs.	317-455-0444
IA	Cedar Rapids, R.F. Welch	319-362-6824
KS	Overland Park, Beneke & McCaul	816-765-2998
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MI	Flint, M. Gottlieb Assocs.	313-732-3922
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	Minneapolis, Comstrand Inc.	612-574-9480
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NY	Ithica, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Greensboro, Beacon Elctrns.	919-674-0348
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Beaverton, Western Tech Sls.	503-644-8860
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Columbus, Frank J. Campisano	614-538-1176
OH	Mentor, Frank J. Campisano	216-975-9300
OK	Tulsa, Ammon & Rizos	918-749-6116
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
PA	Leechburg, Frank J. Campisano	412-845-2577
SC	Greenville, Beacon Elctrns.	803-297-7830
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	El Paso, Ammon & Rizos	915-534-7533
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Salt Lake City, Thorson Rocky Mt. Inc.	801-942-1683

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610 E. 10th. St., Oakland, CA 94606
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INSTRUMENTS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

WA	Bellevue, Western Tech Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Delafield, Janus, Inc.	414-646-5420
PR	Rio Piedras, J.E. Boeing	809-753-9805
Can	Calgary, Alb., Tech-Trek	403-241-1719
Can	Kanata, Ont., Tech-Trek	613-599-8787
Can	Mississauga, Ont., Tech-Trek	416-238-0366
Can	Richmond, BC, Tech-Trek	604-276-8735
Can	St. Laurent, Que., Tech-Trek	514-337-7540

Local Distributors

AL	Huntsville, Future Elctrns. Corp.	205-830-2322
AL	Huntsville, Hallmark Elctrns.	205-830-2565
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Future Elctrns. Corp.	602-968-7140
AZ	Phoenix, Hallmark Elctrns.	602-437-1200
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Phoenix, Wyle Elctrns.	602-437-2088
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Scottsdale, Spirit Elctrns.	602-998-1533
AZ	Tucson, Hallmark Elctrns.	602-742-0515
CA	Calabasas, Kent Elctrns.	818-876-1800
CA	Calabasas, Marshall Inds.	818-878-7000
CA	Calabasas, Wyle Elctrns.	818-880-9000
CA	Camarillo, Milgray Elctrns.	800-635-7812
CA	Chatsworth, Future Elctrns. Corp.	818-772-6240
CA	Chatsworth, Hallmark Elctrns.	818-773-4500
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Capstone Elctrns.	714-587-0638
CA	Irvine, Future Elctrns. Corp.	714-250-4141
CA	Irvine, Hallmark Elctrns.	714-727-6000
CA	Irvine, Integrated Elctrns. Corp.	714-753-0127
CA	Irvine, Marshall Inds.	714-458-5301
CA	Irvine, Milgray Elctrns.	800-468-9277
CA	Irvine, Wyle Elctrns.	714-863-9953
CA	Milpitas, California Capacitor	408-262-6000
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Rancho Cordova, Wyle Elctrns.	916-638-5282
CA	Rocklin, Hallmark Elctrns.	916-624-9781
CA	Sacramento, Integrated Elctrns. Corp.	916-363-6030
CA	San Diego, Future Elctrns. Corp.	619-625-2800
CA	San Diego, Hallmark Elctrns.	619-268-1201
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Diego, Marshall Inds.	619-627-4140
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Wyle Elctrns.	619-565-9171
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Future Elctrns. Corp.	408-434-1122
CA	San Jose, Hallmark Elctrns.	408-432-4000
CA	San Jose, Jaco Elctrns.	408-432-9290
CA	San Jose, Milgray Elctrns.	408-456-0900
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Wyle Elctrns.	408-727-2500
CA	Torrance, Kent Elctrns.	310-320-2700
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Tustin, Projections Unltd.	714-544-2700
CA	Yorba Linda, Corona	714-283-8185
CO	Aurora, Capstone Elctrns.	303-375-2613
CO	Denver, Integrated Elctrns. Corp.	303-292-6121
CO	Denver, Integrated Elctrns. Corp.	303-292-9594
CO	Englewood, Hallmark Elctrns.	303-790-1662
CO	Englewood, Kent Elctrns.	303-792-9100
CO	Thornton, Marshall Inds.	303-451-8383
CO	Thornton, Wyle Elctrns.	303-457-9953
CT	Berlin, Kent Elctrns.	203-829-2100
CT	Bethel, Future Elctrns. Corp.	203-743-9594
CT	Chesire, Hallmark Elctrns.	203-272-1704
CT	Milford, Milgray Elctrns.	800-922-6911
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, GRS Elctrns.	203-265-2077
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Future Elctrns. Corp.	407-767-8414
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Ft. Lauderdale, Hallmark Elctrns.	305-484-4740
FL	Ft. Lauderdale, Marshall Inds.	407-767-8585
FL	Lake Mary, Milgray Elctrns.	800-367-0780
FL	Largo, Future Elctrns. Corp.	813-530-1222
FL	Largo, Hallmark Elctrns.	813-544-4394
FL	Largo, Kent Elctrns.	813-545-0057
FL	Melbourne, Dove Elctrns.	407-242-6916
FL	Melbourne, GRS Elctrns.	407-768-6966
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Duluth, Hallmark Elctrns.	404-476-8206
GA	Norcross, Future Elctrns. Corp.	404-441-7676
GA	Norcross, Marshall Inds.	404-923-5750
GA	Norcross, Milgray Elctrns.	800-241-5523
IL	Elk Grove Vlg., Kent Elctrns.	708-364-1300
IL	Gurnee, NEP Elctrns.	708-662-0185
IL	Hoffman Estates, Future Elctrns. Corp.	708-882-1255
IL	Hoffman Estates, Integrated Elctrns. Corp.	708-843-2040
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Lisle, Components, Inc.	708-852-7707
IL	Palatine, Milgray Elctrns.	800-322-6271
IL	Schaumburg, Marshall Inds.	708-490-0155
IL	Wood Dale, Hallmark Elctrns.	703-860-0239
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Hallmark Elctrns.	317-876-7165
IN	Indianapolis, Marshall Inds.	317-297-0483
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
KS	Lenexa, Hallmark Elctrns.	913-888-0523
KS	Lenexa, Marshall Inds.	913-291-4650
KS	Overland Park, Milgray Elctrns.	800-255-6576
MD	Baltimore, Resco Baltimore	301-931-8200
MD	Beltsville, Resco Baltimore	301-937-9100
MD	Columbia, Future Elctrns. Corp.	410-290-0600
MD	Columbia, GRS Elctrns.	410-995-6744
MD	Columbia, Hallmark Elctrns.	410-381-2036
MD	Columbia, Jaco Elctrns.	410-995-6620
MD	Columbia, Kent Elctrns.	410-720-6200
MD	Columbia, Milgray Elctrns.	800-638-6658
MD	Gaithersburg, M.S. Elctrns.	301-921-0200
MD	Silver Spring, Marshall Inds.	301-622-1118
MA	Billerica, Hallmark Elctrns.	508-667-0902
MA	Bolton, Future Elctrns. Corp.	508-779-3000
MA	Burlington, Wyle Elctrns.	617-272-7300
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Springfield, C&D Elctrns.	413-781-1776
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Wilmington, Milgray Elctrns.	800-648-3595
MI	Farmington hills, Key Elctrns.	313-489-5455
MI	Livonia, Future Elctrns. Corp.	313-261-5270
MI	Livonia, Marshall Inds.	313-525-5850
MI	Plymouth, Hallmark Elctrns.	313-416-5811
MN	Bloomington, Hallmark Elctrns.	612-881-9461
MN	Eden Prairie, Future Elctrns. Corp.	612-944-2200
MN	Plymouth, Marshall Inds.	612-559-2211
MN	St. Paul, Kent Elctrns.	612-642-2828
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Earth City, Hallmark Elctrns.	913-888-0523
MO	St. Louis, Future Elctrns. Corp.	314-469-6805
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	Denville, Kent Elctrns.	201-625-5500
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Fairfield, Tri-Start Elctrns.	201-227-3500
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Future Elctrns. Corp.	609-596-4080
NJ	Marlton, Milgray Elctrns.	800-257-7111
NJ	Moorestown, Hallmark Elctrns.	609-235-1900
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Future Elctrns. Corp.	201-299-0400
NJ	Parsippany, Hallmark Elctrns.	201-515-4475
NJ	Parsippany, Milgray Elctrns.	800-622-0291
NJ	Teterboro, EAC Corp.	201-288-4477
NM	Albuquerque, Hallmark Elctrns.	505-344-2454
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Endicott, Marshall Inds.	607-785-2345
NY	Fairport, Hallmark Elctrns.	716-425-7195
NY	Farmingdale, Milgray Elctrns.	800-622-0291
NY	Fayetteville, Tri-Start Elctrns.	315-637-1312
NY	Hauppauge, Future Elctrns. Corp.	516-234-4000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Marshall Inds.	516-273-2695
NY	Hauppauge, Vargas Elctrns.	516-273-1111
NY	Penn Yan, Advacom, Inc.	315-536-2221
NY	Pittsford, Milgray Elctrns.	716-381-9700
NY	Rochester, Future Elctrns. Corp.	716-272-1120
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns.	800-366-7663
NY	Ronkonkoma, Hallmark Elctrns.	516-737-0838
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NY	Williamsville, Rome Elctrns.	800-366-0118
NC	Concord, Future Elctrns. Corp.	704-455-9030
NC	Pleasant Garden, Tri-Start Elctrns.	919-674-5515
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Future Elctrns. Corp.	919-790-7111
NC	Raleigh, Hallmark Elctrns.	919-878-8729
NC	Raleigh, Jaco Elctrns.	919-876-7767
NC	Raleigh, Marshall Inds.	919-878-9882
NC	Raleigh, Milgray Elctrns.	800-562-3118
OH	Cleveland, Milgray Elctrns.	800-321-0008
OH	Dayton, Advacom, Inc.	513-274-5900
OH	Dayton, Marshall Inds.	513-898-4480
OH	Mayfield Heights, Future Elctrns. Corp.	216-449-6996
OH	Middleburg, Advacom, Inc.	216-826-3300
OH	Solon, Hallmark Elctrns.	216-248-4803
OH	Solon, Marshall Inds.	216-248-1788
OH	Worthington, Hallmark Elctrns.	614-888-0767
OK	Tulsa, Hallmark Elctrns.	918-254-6207
OR	Beaverton, integrated Elctrns. Corp.	503-641-1690
OR	Beaverton, Almac/Cap Elctrns.	503-629-8090
OR	Beaverton, Future Elctrns. Corp.	503-645-9454
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Beaverton, Wyle Elctrns.	503-643-7900
PA	Export, Advacom, Inc.	412-325-7551
PA	McKean, Advacom, Inc.	814-476-7774
PA	Warrington, Tri-Start Elctrns.	215-343-8384
TX	Austin, Hallmark Elctrns.	512-258-3777
TX	Austin, Jaco Elctrns.	512-835-0220
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Wyle Elctrns.	512-345-8853
TX	Carrollton, Capstone Elctrns.	800-388-CAPS
TX	Dallas, Hallmark Elctrns.	214-553-4295
TX	Dallas, Milgray Elctrns.	800-637-7227
TX	Houston, Future Elctrns. Corp.	713-556-8696
TX	Houston, Hallmark Elctrns.	713-781-6100
TX	Houston, Jaco Elctrns.	713-780-7770
TX	Houston, Marshall Inds.	713-467-1666
TX	Houston, Wyle Elctrns.	713-879-9953
TX	Richardson, Future Elctrns. Corp.	214-437-2437
TX	Richardson, Jaco Elctrns.	214-234-5565
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Richardson, Marshall Inds.	214-705-0600
TX	Richardson, Wyle Elctrns.	214-235-9953
TX	Stafford, Milgray Elctrns.	800-952-1849
UT	Murray, Milgray Elctrns.	800-537-9739
UT	Salt Lake City, Future Elctrns. Corp.	801-972-8489
UT	Salt Lake City, Hallmark Elctrns.	801-269-0416
UT	Salt Lake City, Marshall Inds.	801-973-2288
UT	W. Valley City, Integrated Elctrns. Corp.	801-977-9750
UT	W. Valley City, Wyle Elctrns.	801-974-9953
VA	Vienna, Dove Elctrns.	703-893-1821
WA	Bellevue, Almac/Cap Elctrns.	206-643-9992
WA	Bellevue, Integrated Elctrns. Corp.	206-455-2727
WA	Bothell, Future Elctrns. Corp.	206-489-3400
WA	Bothell, Marshall Inds.	206-486-5747
WA	Everett, Hallmark Elctrns.	206-290-5324
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Redmond, Wyle Elctrns.	206-881-1150
WI	New Berlin, Hallmark Elctrns.	414-797-9259
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Waukesha, Future Elctrns. Corp.	414-786-1884
WI	Waukesha, GRS Elctrns.	414-544-3193
WI	Waukesha, Marshall Inds.	414-797-8400
PR	Canovanas, Milgray Elctrns.	809-876-8200
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	Calgary, Alb., Future Elctrns. Inc.	403-250-5550
Can	Edmonton, Alb., Future Elctrns. Corp.	403-438-2858
Can	Mississauga, Ont., Capstone Elctrns.	416-670-2010
Can	Mississauga, Ont., Future Elctrns. Corp.	416-612-9200
Can	Mississauga, Ont., Milgray Elctrns.	416-678-0958
Can	Ottawa, Ont., Future Elctrns. Inc.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns. Corp.	514-694-7710
Can	Pointe Claire, Que., Marshall Inds.	514-694-8142
Can	Pointe Claire, Que., Milgray Elctrns.	514-426-5836
Can	Quebec, Que., Future Elctrns. Inc.	418-877-6666
Can	Vancouver, BC, Future Elctrns. Inc.	604-294-1166
Can	Winnipeg, Man., Future Elctrns. Inc.	204-786-7711
KS	Overland Park, Kent Elctrns.	913-338-4300
MD	Baltimore, Micro-Comp	301-644-5700
CA	Westlake Vlg., Jaco/Distel	805-495-9998
VA	Lynchburg, Micro-Comp	804-239-2626

AVX FILTERS CORP., 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 160; *Sls. Mgr.:* Terry Cantine, Prod. Mktg. Mgr.

AXEL ELECTRONICS, INC., Subsidiary of FPBSM Industries Inc., 19060 Dominquez Hills Dr., Rancho Dominquez, CA 90220, Tel: 718-291-3900, FAX: 718-526-0248; FSC No.: 13058; Empl.: 160; *Sls. Mgr.:* H. Mordkoff

NORMAN N. AXELROD ASSOCS.:ELECTRO-OPTICAL, LASER, & MACHINE VISION DIV., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 805-527-0900, FAX: 805-527-4968; *Sls. Mgr.:* K. G. Kroll

AXIOHM, INC., 1775 Hwy. 8, Ste. 107, New Brighton, MN 55112, Tel: 612-638-9856, FAX: 612-638-0758; Empl.: 130; *Sls. Mgr.:* Kieth Jentoff .... **D•1078-1081**

AYA-INSTRUMENTS, INC., 5001 Baum Blvd., Pittsburgh, PA 15213, Tel: 412-622-5500, FAX: 412-681-3773; *Sls. Mgr.:* A. Anouchi

AYDIN CORP., 700 Dresher Rd., Horsham, PA 19044, Tel: 215-657-7510, TELEX: 685-1211, FAX: 215-657-3830; Empl.: 1400; *Sls. Mgr.:* John Politis

AYDIN CORPORATION (WEST), 30 Great Oaks Boulevard, San Jose, CA 95119-1371, Tel: 408-629-1100, TWX: 910-373-1238, FAX: 408-224-4625; FSC No.: ZV23-1686808; *Sls. Mgr.:* George Whitehill; *Dist. Mgr.:* Clarence Ruckriegel

AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, FAX: 215-968-3214; FSC No.: 13923; Empl.: 300

AZCO CORP., 385 Falmouth Ave., Elmwood Park, NJ 07407, Tel: 201-791-1428, FAX: 201-791-8420; Empl.: 15

AZ-COM, 12 Rose Lane, Ste. 104, Orinda, CA 94563-2206, Tel: 510-254-5400, FAX: 510-254-5400; FSC No.: 68-0283683; Empl.: 5; *Sls. Mgr.:* A. Hadas ..... **D•1235**

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

A/Z-TECH, INC. R&D LAB, Indiana Institute of Technlg., 1600 East Washington Blvd., Fort Wayne, IN 46803, Tel: 219-422-5561, FAX: 219-422-7696; Empl.: 25

aztec INDUSTRIES

FAX: 602-844-9625

AZTEC INDUSTRIES, INC., 333 S. Nina Drive, Mesa, AZ 85210, Tel: 602-833-3131, 800-729-3132; Empl.: 40; *Sls. Mgr.:* Dan Harper ..... **B•1821**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540, FAX:205-830-1542
FL	Dearfield Beach, Cartwright & Bean, Inc.	305-429-3400,FAX:305-429-3402
FL	Orlando, Cartwright & Bean, Inc.	407-889-9100, FAX:407-889-2168
GA	Atlanta, Cartwright & Bean, Inc.	404-368-0160, FAX:404-368-0125
KS	Shawnee Mission, Marc E. Nelson Assoc.	913-268-9099
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170, FAX:601-981-1171
NE	Omaha, Label Concepts	402-496-3997, FAX:402-496-3855
NE	Omaha, Label Concepts	402-592-5080, FAX:402-592-5088
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303, FAX:704-536-0313
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130, FAX:919-876-4132
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, Kay Todd Assocs.	214-458-8833, FAX:214-458-8837

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, FAX: 714-538-9740; FSC No.: 56623; Empl.: 165; *Sls. Mgr.:* Bosie White; *Dist. Mgr.:* Bosie White ..... **B•1021**

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-667-7826

BABCOCK

DISPLAY PRODUCTS, INC.

FAX: 714-490-1368

BABCOCK DISPLAY PRODUCTS, INC., A Subsidiary of Babcock, Inc., 1051 S. East St, Anaheim, CA 92805, Tel: 714-491-5100; Empl.: 150 ..... **B•1021**

Local Sales Offices & Reps

AZ	Tempe, ETS	602-921-7122
CA	Cupertino, Costar Inc.	408-446-9339
CO	Denver, AKI Entprs.	303-756-0700
CT	Wallingford, Alpha Omega Sls. Corp.	203-949-0388
FL	N. Palm Beach, Universal Mktg. & Sls.	407-842-1440
GA	Norcross, Elctrns. Sls. Inc. (ESI)	404-448-6554
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MD	Baltimore, Eastern Comps. Sls.	410-788-7050
MA	North Reading, Alpha Omega Sls. Corp.	508-664-1118
MI	Farmington Hills, Rathsburg Assoc., Inc.	313-489-1500
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Glen Rock, WD Sls., Inc.	201-447-8821
NM	Rio Rancho, Elctrn. Tech. Sls. Inc. (ETS)	602-921-7122
NY	Eastchester, WD Sls., Inc.	914-779-8738
NY	N. Syracuse, Entec Grp., Inc.	315-458-7936
NC	Cary, Elctrn. Sls. Inc. (ESI)	919-467-8486
OH	Columbus, Rathsburg Assoc., Inc.	614-457-2242
OR	Hillsboro, Temco Northwest	503-465-4030
PA	Norristown, Eastern Comps. Sls.	215-270-9530
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
WA	Bothell, Temco Northwest	206-481-6150
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

BACHI, INC., 1201 Ardmore, Itasca, IL 60143, Tel: 708-773-5600, FAX: 708-773-5621; Empl.: 95

BACON INDUSTRIES, INC., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518, FAX: 617-926-2022; FSC No.: 99098; Empl.: 25; *Sls. Mgr.:* R. S. Cass

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 1-800-992-2537; Empl.: 150

BAKNOR INDUSTRIES INC., 2209 Dunwin Drive, Mississauga, Ont., Canada L5L 1X1, Tel: 416-828-2400, FAX: 416-828-5500; Empl.: 25; *Sls. Mgr.:* M. E. Sawicki

BALDOR ELECTRIC COMPANY, P.O. Box 2400, Fort Smith, AR 72902, Tel: 501-646-4711, FAX: 501-648-5792; Empl.: 2900; *Sls. Mgr.:* John McFarland V.P. Sls.

BALLANTINE LABORATORIES, 9 Saddle Rd., Cedar Knolls, NJ 07927, Tel: 201-984-1900, FAX: 201-984-1479; FSC No.: 50423; Empl.: 30

BALLARD TECHNOLOGY, 1216 NW 75th Street, Seattle, WA 98117, Tel: 206-782-8704, 1-800-829-1553, FAX: 206-782-8174; Empl.: 7; *Sls. Mgr.:* Kevin S. Christian

BALLCO ATLANTA, Conceptual Enterprises Intl. Ltd., P.O. Box 1078, Snellville, GA 30278-1078, Tel: 404-979-5900, FAX: 404-979-5900; Empl.: 49; *Sls. Mgr.:* W. Kann

BALL CORP., EFRATOM DIVISION, 3 Parker, Irvine, CA 92718-1605, Tel: 714-770-5000, TELEX: 68-5635, FAX: 714-770-2463; Empl.: 225 ..... **A•1339**

Local Sales Offices & Reps

CA	Dana Point, Geil Mktg.	714-489-7644
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Parker, W. Howard Assoc.	303-841-5755
FL	Melbourne, Bass Assocs.	407-259-1866
GA	Norcross, Beacon Microwave	404-449-8464
IN	Fort Wayne, TX Sls. Indiana	219-489-4447
MD	Baltimore, Stemler Assoc., Inc.	410-944-8262
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Huntington, CDB Entprs.	516-692-5200
TX	Dallas, Beacon Microwave	214-437-1505
CA	Huntington Bch., Scientific Dvcs.- West	714-840-3501
VA	Lynchburg, Incandescent Tech.	804-846-7391
WA	Bellevue, Syntek	206-462-7700

BALL CORPORATION, Industrial Systems Division, 3400 Gilchrist Rd., Mogadore, OH 44260, Tel: 216-784-4456, TELEX: 98-6327-PVI-AKR, FAX: 216-784-9854; Empl.: 130; *Sls. Mgr.:* George Gugliotta

BALL SCREWS & ACTUATORS CO., 3616 Snell Ave., San Jose, CA 95136-1305, Tel: 408-629-1132, FAX: 408-629-2620; Empl.: 63; *Sls. Mgr.:* Steve Trumbauer

BALSTON, 260 Neck Rd., Box 8223, Haverhill, MA 01835-0723, Tel: 508-374-7400, FAX: 508-374-7070; Empl.: 200; *Sls. Mgr.:* Scott Feenan

BAMBECK SYSTEMS INC., 1921 E. Carnegie Ave., Santa Ana, CA 92705, Tel: 714-250-3100, 800 334-3101, FAX: 714-757-1610; Empl.: 25; *Sls. Mgr.:* Robert Bambeck

B & B MOTOR & CONTROL CORP., B & B Long Island City, 1967 State Hwy 27 Ste. 32, Edison, NJ 08817, Tel: 908-819-7070, 908-572-0500, FAX: 908-819-7010; Empl.: 90; *Sls. Mgr.:* Thomas Miceli

BAND-IT - IDEX, INC., 4799 Dahlia Street, Denver, CO 80216, Tel: 303-320-4555, TELEX: 45-0009, FAX: 303-333-6549; *Sls. Mgr.:* Terry L. Joles; *Dist. Mgr.:* Ron Isherwood

B & K PRECISION, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, FAX: 312-794-9740; FSC No.: 08098, 18110, 48560, 30678; Empl.: 200; *Sls. Mgr.:* Richard Polak

BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3631; *Sls. Mgr.:* Floyd Schneider

BARADINE PRODUCTS LTD., P.O. Box 86757, North Vancouver, B.C., Canada V7L 4L3, Tel: 604-988-9853, FAX: 604-988-9899; Empl.: 3; *Sls. Mgr.:* Garry J. Anderson; *Dist. Mgr.:* Garry J. Anderson

BARANTI GROUP INC., 2650 John St, Unit 22, Markham, Ont., Can L3R 2W6, Tel: 416-479-0148, FAX: 416-479-0149; *Sls. Mgr.:* Barry Papoff

BARBER COLMAN COMPANY

a Siebe company

FAX: 815-877-8844

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132-2940, Tel: 815-637-3000, TELEX: 4330175 BC11; Empl.: 300; *Sls. Mgr.:* David Boxall ..... **B•1241**

Local Sales Offices & Reps

AZ	Tucson, Kachina Controls	602-886-4984
AK	Anchorage, Control Contractors	907-561-3044
CA	Anaheim, Instrument Lab.	714-236-7900
CA	San Jose, Instr. Lab.	408-434-0160.
CA	Santa Clara, Johnson Assocs.	408-984-4626
CO	Denver, Tessco	303-778-1119
FL	Clearwater, J. J. Galleher Co.	813-461-7706
GA	Norcross, McGoff Pyrotech, Inc.	404-840-9811
GA	Roswell, Cascade Controls	404-664-9000
HI	Rockford, Barber-Colman	815-637-3000
IL	Arlington Hgts., Carlin Automation	708-981-0800
IL	Rock Island, Carlin Automation	309-788-1275
IN	Noblesville, Triangle Sls.	317-773-5480
KS	Goddard, Parker & Foster	316-794-2686
LA	Baton Rouge, Hahn/Enstocko, Inc.	504-926-9310
MI	Allendale, Applied Instr. Co.	616-895-9600
MI	Farmington, Applied Instrs.	313-476-9060
MN	Minneapolis, Temp-Tec	612-784-3306
MO	St. Louis, Temtron	314-968-5242
NV	Las Vegas, Kachina Controls	702-791-5666
NJ	Hackensack, AP Tech. Sls.	201-487-6222
NM	Albuquerque, Kachina Controls	505-260-1741
NY	Victor, Sanwal Technlgs.	716-924-1950
NC	Matthews, Carotek, Inc.	704-847-4406
OH	Cincinnati, Heat Equip. & Technlgs.	513-591-3000
PA	Frazer, Weiss Instrs. Inc.	215-647-4650
PA	Pittsburgh, Weiss Instr., Inc.	412-344-1500
RI	Providence, N.E.T.S.	401-454-2777
TN	Memphis, Industrial Process Controls	901-795-4200
TX	Fort Worth, ASKCO Instr. Corp.	817-568-0003
TX	Houston, ASKCO Instr. Co.	713-645-9898
WA	Redmond, Sales & Engrg. Assocs.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assocs.	206-573-5161
WI	Appleton, Pyro-Matic	414-739-4247
WI	Wauwatosa, Pyro-Matic	414-453-1171

BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 7040, Rockford, IL 61125-7040, Tel: 815-397-7400, FAX: 815-398-3885; Empl.: 350; *Sls. Mgr.:* Jeff Wagner; *Dist. Mgr.:* John Locamo ..... **B•1241**

Local Sales Offices & Reps

AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Corona Del Mar, Motion Control of So.CA.	714-675-0211
CA	Mission Viejo, PJS Assocs.	714-472-0856
CA	San Jose, O'Donnell Assoc. North	408-456-2856
CO	Denver, Motion Technlg.	303-757-3003
IL	Hinsdale, Patton Sls. Co.	708-325-2170
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
MI	Grand Rapids, Russell Sls.	616-956-9111
MN	Minneapolis, Josco Melius, Inc.	612-861-3343
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NH	Salem, Sales Engrg.	603-893-5521
NJ	W. Caldwell, Grimm-Siegel Assoc.	201-575-9300
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
PA	Pittsford, Franklin Sls.	716-248-8251

WI	Brookfield, Heartland Tech. Mktg.	414-792-0920
Can	Vancouver, B.C., Madison Indl. Equip., Ltd.	604-872-8155

Local Distributors

CA	Anaheim, Minarik Elec. Co.	714-994-2251
AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Fresno, Minarik Elec. Co.	209-255-8087
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Ontario, Minarik Elec. Co.	714-391-0064
CA	San Diego, Minarik Elec.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
MI	Troy, B & B Motor & Control Corp.	313-583-7450
FL	Winter Springs, B & B Motor & Control Corp.	407-696-4511
CO	Commerce City, Minarik Elec. Co.	303-289-5800
NJ	Edison, B & B Motor & Control Corp.	201-572-0500
IL	Elk Grove Vlg., Genl. Controls	708-595-2152
NY	Long Island City, B & B Motor & Control Corp.	718-784-1313
IL	Schaumburg, Minarik Elec. Co.	708-885-9337
IN	Indianapolis, B & B Motor & Control Corp.	317-248-0396
MD	Silver Spring, B & B Motor & Control Corp.	301-685-5834
MA	Somerville, Electro-Sls. Co., Inc.	617-666-0500
MN	Eagan, N.W. Power Prods. Inc.	612-452-6467
NJ	Edison, B & B Motor & Control Corp.	908-572-0500
NY	Rochester, B & B Motor & Control Corp.	716-424-7040
NC	Greensboro, B & B Motor & Control Corp.	919-379-8966
OR	Portland, Minarik Elec. Co.	503-253-3402
OH	Cincinnati, Cincinnati Belting & Transmission Co.	513-621-9050
OH	Dayton, Cincinnati Belting & Transmission Co.	513-223-0653
TX	Houston, Minarik Elec. Co.	713-748-0808
TX	Irving, Minarik Elec. Co.	214-402-8188
TX	San Antonio, Minarik Elec. Co.	512-822-7097
SC	Taylors, B & B Motor & Control Corp.	803-268-5702
WA	Redmond, Minarik Elec. Co.	206-885-0832

BARCO CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, FAX: 404-493-1314; FSC No.: FSCM 59992; Empl.: 103; *Sls. Mgr.:* James Spencer

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL INC

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[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725

(800) CAL-SWCH

BARKSDALE CONTROLS DIV., Imo Industries Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 234; *Sls. Mgr.:* J. Douglas Holland

BARNES ENGINEERING, West Coast Sls. & Mktg., 3601 W. Macarthur Blvd., 904, Santa Ana, CA 92704, Tel: 714-533-7530, FAX: 714-533-4755; FSC No.: 53823, SIC 3400; Empl.: 47; *Sls. Mgr.:* Gordon Mackenzie

BARNES ENGINEERING DIV., EDO Corporation, 88 Long Hill Cross Rds., Shelton, CT 06484, Tel: 203-926-1777, TELEX: 6819115, FAX: 203-926-9285; Empl.: 250; *Sls. Mgr.:* M. L. Marusic

BARNES ENGINEERING COMPANY, 2715 Delta Pl., Colorado Springs, CO 80910, Tel: 719-390-6500, FAX: 719-390-6700; Empl.: 57

BARR ASSOCIATES, INC., 2 Lyberty Way, Westford, MA 01886, Tel: 508-692-7513, FAX: 508-692-7443; FSC No.: 65807; Empl.: 95

BARRINGTON PLASTICS, 3838 Church Road, Mt. Laurel, NJ 08054, Tel: 609-235-5151, FAX: 609-778-9032; Empl.: 120; *Sls. Mgr.:* Gary Brown

BARSOM INC., See IR Scientific

BARTH ELECTRONICS, INC., 1300 Wyoming St., Boulder City, NV 89005, Tel: 702-293-1576, FAX: 702-293-7024; Empl.: 9; *Sls. Mgr.:* Sue Smith

BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 10; *Sls. Mgr.:* David P. Bartlett

BAS BLEU INDL. CO., LTD., Rm. 815, No.110, Han-Kow ST., Sec.1, Taipei, Taiwan 10008, Tel: (02)331-6519, TELEX: 23015 HJIC, FAX: 886-2-381-6812; Empl.: 20; *Sls. Mgr.:* Athena W.R. Lo, VP

BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 50; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

BASIC MEASURING INSTRUMENTS, 335 Lakeside Dr., Foster City, CA 94404, Tel: 415-570-5355, TWX: 910-374-3059, FAX: 415-574-2176; Empl.: 90; *Sls. Mgr.:* Craig Waterman

BASICON, INC., 14273 NW Science Park Drive, Portland, OR 97229, Tel: 503-626-1012, FAX: 503-643-4686

BASISTA/NIEC, 3401 Brecksville Rd 110, Richfield, OH 44286, Tel: 216-659-9287, FAX: 216-659-3580; Empl.: (NIEC-Japan) 1200 230M Sales

Basler Electric
Electronic Product Group

FAX: 618-654-2351

BASLER ELEC., Electronic Product Group, Rte. 143, Highland, IL 62249, Tel: 618-654-2341, 800-645-2074; Empl.: 1401; *Sls. Mgr.:* Dennis Faires .... **D•1617**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg. Co.	205-880-0592
AZ	Tempe, Trembly Assoc., Inc.	602-431-9417
CA	Newport Beach, S.P.A. Inc.	714-863-1193
CA	Santa Clara, Sourcetronics, Inc.	408-988-8801
CA	Torrance, Printed Circuit Board Specialists	213-320-3022
CO	Golden, Trembly Assocs., Inc.	303-421-8900
FL	Clearwater, Sunland Assoc.	813-536-2955
FL	Lauderhill, Sunland Assoc.	305-748-1303
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Norcross, Electro Mech Sls. Engrg. Co.	404-447-6478
IL	Chicago, G. McI. Cole Co.	708-827-6040
IA	Cedar Rapids, Thomas L. Dowell & Assoc., Inc.	313-393-7920
KS	Overland Park, Thomas L. Dowell & Assocs., Inc.	913-722-4242
MD	Baltimore, C.W. Bass & Assocs.	410-744-4611
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
MA	Monson, R. F. Duffy Assocs.	413-267-9884
MA	Whitinsville, Power Factor & Assocs.	508-234-6415
MN	Apple Valley, Arkco Sls.	612-432-6593
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, Thomas L. Dowell & Assoc., Inc.	314-849-4234
NJ	Scotch Plains, Mil-Com Sls. Assocs.	908-322-7898
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
NY	Smithtown, T & K Sls.	516-724-3456
NC	Raleigh, Electro Mech. Sls. Engrg. Co.	919-790-9300
OH	Hillsboro, J. P. Woods & Assocs.	513-393-9582
OH	Maineville, J. P. Woods & Assocs.	513-677-2120
PA	Pittsburgh, Gormley Farrington	412-795-8010
TX	Dallas, Weisler & Assoc., Inc.	214-437-2386
TX	Houston, Weisler & Assoc., Inc.	713-467-1847
UT	N. Salt Lake City, Trembly Assocs.	801-295-4703
VA	Ashland, Glasscock & Assoc.	804-798-2125
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	206-944-0761
PR	Rio Piedras, Klamco Elctrns.	809-748-5214

BASLER ELECTRICS, Magnetics Product Grp., Rt 143, Box 269, Highland, IL 62249, Tel: 618-654-2341, FAX: 618-654-2351; Empl.: 1500; *Sls. Mgr.:* Don Ginther .... **D•1617**

FAX: 617-361-1835

BATTERY ENGINEERING, INC., 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555; FSC No.: 60289; Empl.: 50; *Sls. Mgr.:* R. Fay .... **D•1426**

BATTERY SPECIALTIES

FAX: 714-755-0889

BATTERY SPECIALTIES, 3530 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-755-0888, 1-800-352-3706 (Toll free in CA); Empl.: 30; *Sls. Mgr.:* Guy K. Hudson; *Dist. Mgr.:* Guy K. Hudson .... **D•1427-1429**

BAXTER-INDUSTRIAL DIVISION, 27200 N. Tourney Rd., Valencia, CA 91355, Tel: 805-253-7466, FAX: 805-253-7634; Empl.: 50; *Sls. Mgr.:* Jeff Blair

BAY COMPONENTS, INC., 418 3rd St., Annapolis, MD 21403, Tel: 410-268-0122, FAX: 410-268-7909; Empl.: 1; *Sls. Mgr.:* Barbara Bunting

BAYLEY INSTRUMENT COMPANY, Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BAYSTAT, 3575 Haven Ave., Menlo Park, CA 94025, Tel: 415-364-3205, FAX: 415-363-8079; Empl.: 100; *Sls. Mgr.:* James V. Travis

BAY TECHNICAL ASSOCIATES, INC., 200 N. 2nd St., Bay St. Louis, MS 39520, Tel: 800-523-2702, 601-467-8231, FAX: 601-467-4551; FSC No.: 64-0588860; Empl.: 100; *Sls. Mgr.:* Jackie La Fontaine

B C SYSTEMS, INC., 200 Terminal Road, Setauket, NY 11733, Tel: 516-751-9370, FAX: 516-751-9378; Empl.: 50; *Sls. Mgr.:* Joseph Small

BEAD INDUSTRIES, 110 Mountain Grove St., P.O. Box K, Dept. 100, Bridgeport, CT 06605-0571, Tel: 203-334-4124, FAX: 203-367-9957; Empl.: 175; *Sls. Mgr.:* Keith Lebo

BEA ELECTRO-OPTICS, INC., 640 Pearson, Ste. 200, Des Plaines, IL 60016, Tel: 708-298-1420, FAX: 708-298-1423; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 310-944-6251, FAX: 310-946-9670; Empl.: 43

Beau Products
DIVISION OF VERNITRON CORPORATION

FAX: 603-524-1627

BEAU INTERCONNECT SYSTEMS, Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5102; FSC No.: 13150; Empl.: 150; *Sls. Mgr.:* Wayne Eshelman; *Dist. Mgr.:* Larry Murphy .... **C•1269-1273**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-880-0592
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Garden Grove, Elsco Elect. Inc.	714-891-4621
GA	Norcross, Electro-Mech Sls. Engrg.	404-447-6478
IL	Lisle, W-G Controls	708-963-5954
IN	Carmel, Green-Wissler Sls., Inc.	317-843-5785
IA	Cedar Rapids, KKB and Co.	319-373-1730
MN	Bloomington, PSI	612-944-8545
MO	St. Louis, KKB & Co.	314-647-2400
NH	Amherst, D.A.Crowley & Assoc.	603-673-7050
NJ	Lawrenceville, DVS Co.	609-896-1112
NJ	W. Caldwell, Grimm Siegel & Assoc.	201-575-9300
NY	Syracuse, Pi'tronics, Inc.	315-455-7346
NC	Raleigh, Electro-Mech Sls. Engrg.	919-790-9300
OH	Beechwood, Electronic Salesmasters Inc.	216-831-9555
OR	Beaverton, Pacific Mktg. Specialist,	503-641-9373
TX	Irving, Comtech Sls. Inc.	214-751-1181
WA	Redmond, Pacific Mktg. Specialists,	206-882-3144
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121
Can	West Vancouver, BC, Leister Blake Entprs. Ltd.	604-926-6127

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau, FAX: 207-775-7710; Empl.: 6; *Sls. Mgr.:* Barbara Pike, Credit Mgr.; *Dist. Mgr.:* Barbara Pike

BEAVER LABS, P. O. Box 202, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

BEC INC./CERTIFIED CALIBRATION LABS, 945 Horsham Rd., Horsham, PA 19044, Tel: 800-523-3808, FAX: 215-675-0966,800-523-3808; Empl.: 8; *Sls. Mgr.:* David Hines

BECKMAN INDUSTRIAL CORP., Affiliate of Emerson Electric Co., 4200 Bonita Pl., Fullerton, CA 92635, Tel: 714-447-2300, TELEX: 7607569, FAX: 714-447-2400; Empl.: 1900; *Sls. Mgr.:* Ron Sullivan, Sls. & Mktg. V.P. .... **A•1868, 2056-2057**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls., Inc.	205-533-1735
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Escondido, Clint Bradley Sls.	619-743-0138
CA	Newport Beach, Jones & McGeoy Sls.	714-724-8080
CA	Santa Clara, Criterion Sls.	408-988-6300
CO	Littleton, Simpson Assocs.	303-794-8381
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	St. Petersburgh, QXI, Inc.	813-894-4556
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
ID	Boise, Emerging Technlg. Sls., Inc.	208-378-4680
IL	Elk Grove Village, Carlson Elctrn. Sls. Co.	708-956-8240
IN	Indianapolis, Precision Elec. Comp.	317-842-3740
IA	Cedar Rapids, Carlson Elctrns.	319-378-1450
KS	Overland Park, Electri-Rep, Inc.	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Farmingham, Gallagher Assoc.	508-626-2346
MI	Brighton, A.P. Assoc.	313-229-6550
MN	Minneapolis, Comstrand, Inc.	612-574-9480
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Fairfield, Tech. Applications & Mktg., Inc.	201-575-4130
NY	Manlius, LamTec Sls. Corp.	315-682-4780
NC	Cary, Electronic Sls., Inc.	919-467-8486
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Cleveland, Omega Sls., Inc.	216-360-9400
OR	Portland, Venture Elctrns., Inc.	503-624-0617
PA	Trevose, Omega Sls.	215-244-4000
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
Can	Kanata, Ont., Electro Source, Inc.	613-592-3214
Can	Pointe Claire, Que., Electro Source, Inc.	514-630-7486
Can	Rexdale, Ont., Electro Source, Inc.	416-675-4490
Can	Richmond, B.C., Blakewood Elctrn. Sys., Inc.	604-444-3344

BECK SYSTEMS INC., Beck Technology, 2354 Ave. C North, Saskatoon, SK, CAN S7L 5X5, Tel: 306-975-1080, FAX: 306-975-3993; Empl.: 7; *Sls. Mgr.:* Shane Simpson

BEEDE ELECTRICAL INSTRUMENT CO., INC., 175 South Main St., Penacook, NH 03303, Tel: 603-753-6362, FAX: 603-753-6201; FSC No.: 06555; Empl.: 350; *Sls. Mgr.:* Jeffrey L. Schindler; *Dist. Mgr.:* Diane Aldrich .... **D•1339**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, F L W, Inc.	714-751-7512
CA	Fremont, FLW, Inc.	510-651-6511
CA	Oxnard, FLW, Inc.	805-984-0167
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Des Plaines, Saffro & Assocs.	708-299-7680
IN	Carmel, Frank Kahsar Sls.	317-844-9353
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MA	Canton, N.E.S. Elctrn. Rep. Co.	617-828-4835
MI	Muskegon, Frank Kahsar Sls.	616-798-4451
MI	Sterling Hghts., Frank Kahsar Sls.	313-795-3530
MO	Independence, Gribble Sls. Engrg. Co.	816-796-4333
NJ	Kenilworth, Shortess-Rawson & Assocs.	908-276-2525
NY	Buffalo, NRM Mktg.	716-634-4300
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Spencerport, NRM Mktg. Grp.	716-352-9166
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Cincinnati, Frank Kahsar Sls.	513-598-1484
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Elyria, Frank Kahsar Sls.	216-365-5219
OH	Palma, Frank Kahsar Sls.	216-845-0103
PA	Kulpsville, The James Dell Co.	215-584-4925
PA	Pittsburg, Frank Kahsar Sls.	412-734-8797
TX	Dallas, Southwest Elctrn. Industries	214-690-9881
TX	Vidor, Southwest Elec. Ind.	409-786-1028
Can	Brampton, Ont., Mod-Tronics, Ltd.	416-457-6322

Local Distributors

CA	El Cajon, Meter Craft	619-258-8990
CA	Hayward, Dynametron	510-786-9459
CA	Los Angeles, EIL	213-685-7020
CA	Sunnyvale, EIL	408-744-0271
CO	Aurora, R & R Instrmn.	303-364-8325
CO	Denver, EIL	303-534-4160
CO	Denver, Process Meas.	303-937-7226
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Edgewater, Southern Instrs.	904-427-3963
FL	Hialeah, Kimball Elec.	305-822-5792
FL	Palm Bay, EIL	407-725-8300
IL	Bridge View, EIL	708-430-2292
IL	Countryside, Inotek/Pacific Indicator	708-352-3500
IL	Franklin Pk., Alca, Inc.	708-451-6644
KS	Overland Pk., Brooks Elctrns.	913-648-3131
KY	Louisville, E.I.L. Instrs.	502-454-3420
MD	Hunt Valley, E.I.L. Instrs.	410-584-7400
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Waltham, Calibron	617-894-6440
MI	Ferndale, Ram Meter, Inc.	313-398-6767
NJ	Pennsauken, EIL	609-488-0474
NJ	Pompton Lakes, Instrument Masters	201-839-2876
NY	Clarence, EIL	716-634-8500
NY	Mastic Beach, Alternate Solution	516-399-7701
NC	Charlotte, E.I.L. Instrs.	704-376-2237
OH	Cleveland, Weschler Instr.	216-238-2550
OH	Dayton, EIL	513-435-2134
OH	Madison, Madison Elec.	216-428-6464
OH	Middlefield, Bentronix	216-632-0606
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
TN	Knoxville, Brownell Elec.	615-966-3441
TX	Beaumont, Straughn Elec.	409-838-4563
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, E.I.L. Instrs.	214-357-0297
TX	Houston, American Analog	713-941-7265
TX	Houston, E.I.L. Instrs.	713-271-3100
VA	Norfolk, EIL	804-855-9553
VA	Richmond, Meter Metrics	804-275-1431
WA	Redmond, E.I.L. Instrs.	206-882-3222
WI	Milwaukee, E-M Instrs.	414-272-7799
Can	Ontario, Modtronics	416-457-6322
Can	Quebec, Brunelle	819-563-9096
Can	Toronto, EIL	416-624-6660

BEHLMAN

An Astrosystems Company

FAX: 516-328-1658

BEHLMAN ELECTRONICS INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600 ... **D•2244-2249**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs., Inc.	602-431-9417
CA	Chatsworth (Southern), Technlgs. West	818-700-6426
CA	San Francisco (Northern), RDX Corp.	510-568-5606
CA	Ventura, Behlman Elctrns.	805-642-0660
CO	Golden, Trembly Assocs., Inc.	303-279-3019
IL	Wheeling, Ed Joyner & Co.	708-520-1200
KS	Overland Park, Markline Technlgs.	913-681-8880
MD	Hampstead, Tech. Instr. Sls.	301-239-4452
MI	St. Claire Shores, Agren-Asher Co.	313-773-2220
MN	Eden Prairie, Professional Mktg.	612-934-5939
MO	Lake St. Louis, Markline Technlgs.	314-625-6222
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, Trembly Assocs., Inc.	505-266-8616
NY	Lake Success, Behlman Elctrns.	516-328-1600
OK	Tulsa, Acudata Inc.	918-743-1875
PA	Lansdale (Eastern), Tech. Inst. Sls.	215-361-7850
PA	Pittsburgh (Western), Instrmn. Sys.	412-823-7005
TX	Houston, Acudata Inc.	713-580-2451
UT	N. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
WA	Seattle, Datacom Assocs.	206-285-2525

BEHLMAN ELECTRONICS, INC., Astrosystems, 2021 Sperry Ave.,No. 18, Ventura, CA 93003, Tel: 805-642-0660, FAX: 805-642-0790; FSC No.: 53636 .... **D•2244-2249**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assocs.	205-539-1485
AZ	Tempe, Trembly Assocs. Inc.	602-431-9417
CA	Chatsworth, Technlgs. West	818-700-6426
CA	San Francisco, RDX Corp.	510-568-5606
CA	Ventura, Behlman	805-642-0660
CO	Golden, Trembly Assocs. Inc.	303-279-3019
FL	Melbourne, Reynolds & Assocs.	407-259-7000
GA	Duluth, Reynolds Assocs.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	708-520-1200
KS	Overland Park, Markline Technlgs.	913-681-8880
MD	Hampstead, Tech. Inst. Sls.	301-239-4452
MN	Eden Prairie, Professional Mktg. Svcs. Inc.	612-934-5939
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, Trembly Assocs. Inc.	505-266-8616
NY	Fayettsville, Martin P. Andrews	315-637-5291
OK	Tulsa, Acudata Inc.	918-743-1875
PA	Lansdale, Tech. Inst. Sls.	215-361-7850
PA	Pittsburgh, Instrmn. Sys. Inc.	412-823-7005
TX	Houston, Acudata Inc.	713-580-2451
TX	Plano, Acudata, Inc.	214-424-3567
UT	N. Salt Lake City, Trembly Assocs. Inc.	801-295-4703
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Mississauga, Ont., Altus Technologies	416-670-0783

BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS COMPANY, Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500; Empl.: 25 .... **B•1917**

Local Sales Offices & Reps

CA	Garden Grove, BEI Motion Sys. Co.	714-534-5830
CA	San Rafael, BEI Motion Sys. Co.	415-492-2840
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
GA	Snellville, BEI Motions Sys. Co.	404-978-6301
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Norwell, BEI Motion Sys. Co.	617-878-9820
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
NJ	Morristown, BEI Motion Sys. Co.	201-984-5600
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
PA	Lancaster, BEI Motion Sys. Co.	717-299-6243
TX	Cleburne, BEI Motion Sys. Co.	817-556-2211
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Willowdale, Willer Engrg., Ltd.	416-499-4421

BEI MOTION SYSTEMS COMPANY, Chatsworth Encoder Div., 9223 Deering Avenue, Chatsworth, CA 91311, Tel: 818-341-6161, FAX: 818-882-4553; Empl.: 120; *Sls. Mgr.:* Robert Kemp .... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, FAX: 619-471-2675; Empl.: 30; *Sls. Mgr.:* Hank Robinson, Sls. Mgr. .... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off. Carlsbad, CA for sales off. info.

BEI MOTION SYSTEMS COMPANY, DIGITAL PRODS. DIV., See BEI Motion Systems Company,Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, FAX: 805-968-3154; Empl.: 60; *Sls. Mgr.:* Glenn Avolio .... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, ITEK ENCODER DIV., See BEI Motion Systems Company, Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, FAX: 619-744-8815; Empl.: 60; *Sls. Mgr.:* Mike Lopez .... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, 178 A Street, Needham Hgts., MA 02194, Tel: 617-455-1414, FAX: 617-455-6514; *Sls. Mgr.:* Marvin Kansky .... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, FAX: 501-851-5476; Empl.: 80; *Sls. Mgr.:* Marvin Kansky, Sls. Mgr. ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BELDEN WIRE AND CABLE COOPER INDS., See Cooper Industries/ Belden Div.

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* Dennis Ackerman .... **A•1512, 1515-1523, 1692, 2276-2293; B•1340, 1344-1349; D•2074-2075**

Local Sales Offices & Reps

AL	Huntsville, INTEREP	205-881-1096
AZ	Phoenix, U.S. Sls.	602-451-1155
CA	Los Angeles, C & N Assocs.	805-254-5844
CA	San Jose, Meridian Tech Sls.	408-262-5474
CO	Boulder, Talisman Assoc.	303-444-7300
FL	Sanford, D Assocs.	407-321-9594
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, LTD Tech.	708-773-2900
IN	Indianapolis, Insul Reps	317-469-1994
MN	St. Paul, Rockmore Sls.	612-941-1390
MO	Bridgeton, Dy-Tronix	314-291-4777
NJ	East Brunswick, Winch Sls.	908-613-1515
NM	Albuquerque, Syntech	602-264-7971
NY	Rochester, Tri-Tech	716-385-6500
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Columbus, A. Baier Co.	614-764-1144
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Salt Lake City, Western Mktg.	801-268-9768
WI	Milwaukee, LTD Tech.	414-774-1006
Can	Toronto, Cantronics	416-297-8668
GA	Atlanta, Beacon Elect.	404-256-9640
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
KS	Leawood, Dy-Tronix	913-339-6333
MN	St. Paul, Rockmore Sls.	612-941-1390
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
PA	Hatboro, AQS	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

FL	Longwood, D-Assocs., Inc.	407-830-8976
IL	Chicago, LTD	708-773-2900
GA	Atlanta, Beacon Elect.	404-256-9640
KS	Leawood, Dy-Tronix	913-339-6333
MN	S. St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
NJ	E. Brunswick, Winch Sls. Assoc.	201-613-1515
MO	St. Louis, Dy-Tronix	314-291-4777
OH	Cleveland, Arthur Baier Co.	216-461-6161
NY	E. Rochester, Tri-Tech Elec.	716-385-6500
PA	Hatsboro, AQS	215-674-3562
NC	Raleigh, Beacon Elect.	919-787-0330
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

CT	Wallingford, Sager	203-265-4600
FL	Boca Raton, D & R	407-977-8751
FL	Orlando, Sager	407-240-3114
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, Sager	919-850-9550
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Philadelphia, Sager	215-464-4336
AL	Huntsville, CDI	205-883-7501
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CT	Wallingford, Sager	203-265-4600
FL	Ft. Lauderdale, CDI	305-971-4950
FL	Orlando, Sager	407-240-3114
GA	Norcrosss, CDI	404-441-3320
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, Bell Inds.	603-882-1133
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Bohemia, Key Comps.	516-567-7500
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, CDI	919-787-7311
NC	Raleigh, Sager	919-850-9550
OR	Beaverton, Comp. Resources	503-641-8488
PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Philadelphia, Sager	215-464-4336
VA	Falls Church, CDI	703-241-8227

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
COOPER INDUSTRIES
BELDEN
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

BEL HYBRIDS & MAGNETICS, Bel Fuse Inc., 5362 W. 78TH St., Indianapolis, IN 46268, Tel: 317-876-0044, FAX: 317-876-0092; Empl.: 23; *Sls. Mgr.:* Warren Mitch .... **A•1692**

Local Sales Offices & Reps

AL	Huntsville, Interep	205-881-1096
CA	Milpitas, Meridian	408-262-5474
FL	Longwood, D-Assocs.	407-830-8976
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Indianapolis, Insul-Reps, Inc.	317-251-1994
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix Inc.	316-838-0884
MN	Eden Praire, Rockmore	612-941-1390
MO	Raytown, Dy-Tronix	913-229-6333
MO	St. Louis, Dy-Tronix	314-291-4777
NY	Hauppauge, CCI	516-273-5050
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cleveland, Arthur H. Baier, Inc.	216-461-6161
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Austin, Oeler & Menelaides, Inc.	512-453-0275
VA	Charlottesville, DVS	804-973-0303
WI	Milwaukee, LTD Technlgs.	414-774-1000

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain .... **D•1026-1027**

Local Sales Offices & Reps

IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
MD	Columbia, Tyler Griffin Co.	301-995-1215
PA	Paoli, Tyler Griffin Co.	215-647-1550

F.W. BELL

FAX: 407-677-5765

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900; FSC No.: 18479; Empl.: 70; *Sls. Mgr.:* Stephen L. Dakel; *Dist. Mgr.:* Stephen L. Dakel .... **B•1918; D•1152-1153, 1236-1237**

Local Sales Offices & Reps

AL	Birmingham, Southrep	205-304-8225
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Arcadia, Southwest Instr.	818-574-0049
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CO	Denver, Trembly Assoc.	303-279-3019
FL	Winter Springs, T Squared Mktg.	407-699-9992
GA	Newnan, South Rep	404-304-8225
IL	Palatine, Golbeck Milota Assoc.	708-705-0602
MD	Hampstead, Technical Instr. Sls.	301-239-4452
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, Trembly Assoc.	505-266-8616
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Beachwood, Electronic Salesmaster	216-831-9555
OR	Beaverton, NW Test & Measurement	503-645-9000
PA	Lansdale, Technical Instr. Sls.	215-361-7850
WA	Bellevue, NW Test & Measurement	206-881-8857
WI	Madison, Golbeck Milota Assoc.	608-222-7037
Can	Dorval, Que., Weiss Co.	514-685-6644

Local Distributors

AZ	Tempe, Trembly Assoc.	602-431-9417
ID	Boise, Radar Elec. Co. Inc.	208-336-2227
CA	Irwindale, Shafer Eng.	818-960-5402
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CA	Norco, Empire Instr.	714-279-6364
CA	Pomona, Inspection Tech.	714-626-2600
CA	San Marcos, Mitchell Instr.	619-744-2690
FL	Orlando, Brownell Electro	407-843-6776
OR	Portland, Radar Elec. Co.	503-232-3404
GA	Atlanta, P & R Instrs.	404-391-9117
GA	Forest Park, Brownell Electro	404-362-9009
GA	Marietta, Peach State Instr.	404-424-0447
IL	Crystal Lake, Right Distributors	815-459-0645
KY	Louisville, United Utility Supp.	502-451-2430
MD	Baltimore, Davis Instr.	410-358-3900
MD	Hunt Valley, E.I.L. Instrs.	410-584-7400
MA	N. Andover, Contact East	508-682-9844
MA	Sharon, Adcour	617-784-8123
MO	St. Louis, Indsl. Srv. Lab.	314-423-3141
NY	Rochester, Transcat	800-828-1470
NY	Whitestone, Power Electro Supply	718-767-1447
OH	Cleveland, Meter Master	216-351-1234
OH	Dayton, Electro Sls. Assoc.	513-426-5551
TX	Dallas, Seaton Elctrns.	214-980-9860
PA	McKeesport, Barno Radio Co.	412-751-5966
PA	Reading, Barbey Elctrns.	215-376-7451
SC	Charleston, Cameron Barkley Co.	803-745-2837
TN	Chattanooga, Edwin Bohr	615-877-8207
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
TX	Mesquite, Inspection Prods.	214-686-4275
VA	Richmond, Fidus	804-275-2302
WA	Seattle, Radar Elec. Co.	206-282-2511
Can	Mississauga, Ont., BCS Elctrns. Ltd.	416-602-8550
Can	Montreal, Que., Pro Jean	514-273-8331

J.W.MILLER

FAX: 310-515-1962

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 310-515-1720; FSC No.: 76493; Empl.: 30; *Sls. Mgr.:* Jeff Johnson .... **A•1190-1195**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve, Inc.	602-844-8289
CA	J.W. Miller	310-515-1720
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
GA	Buckhead, MFRS. Sls. & Mktg. Svcs.	404-342-3503
IL	Skokie, Specialized Mktg.	708-674-1111
IN	Carmel, Current Elctrn. Mktg., Inc.	317-844-1770
MD	Sykesville, DJC Elctrn. Sls., Inc.	410-795-7020
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582

MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MS	Hattiesburg, Mfgs. Sls. & Mktg. Svcs.	601-264-4755
MO	St. Louis, Lowell/Kangas Assocs.	314-821-4050
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NY	Marcellus, J.G. Welch Sales	315-673-1009
NY	Rochester, J.G. Welch Sales	716-244-1100
NY	Yonkers, Roburn Agencies, Inc.	914-968-1016
NC	Raleigh, South Tech Sls.	919-571-1313
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Portland, Caruso-Camelleri Assoc.	503-246-5439
TN	Memphis, MFRS. Sls. & Mktg. Svcs.	901-767-0801
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Bellevue, Caruso-Camelleri Assoc.	206-455-8811
EXP	N.Y., Yonkers, Roburn Agencies, Inc.	914-968-1016
Can	Calgary, Alberta, Cana Rep Grp., Inc.	403-255-0294
Can	Montreal, Que., Cana-Rep. Grp., Inc.	514-276-4477
Can	Surrey, B.C., Cana Rep Grp., Inc.	604-599-1232

Local Distributors

CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
IL	Chicago, Newark Elctrns.	708-784-5100
IN	Indianapolis, Custom Svc. Elctrn.	
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
NJ	E. Brunswick, Brothers Elctrns.	908-238-2200
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Willowdale, Ont., Electro Sonic, Inc.	416-494-1666

BELLOFRAM CORPORATION, State Route 2, Box 305, Newell, WV 26050, Tel: 304-387-1200, 1-800-733-2356, FAX: 304-387-1212; Empl.: 300; *Sls. Mgr.:* David Lewis; *Dist. Mgr.:* David Lewis

BELMONT INSTRUMENT CORP., Pinehurst Pk., 8 Cook St., Billerica, MA 01821, Tel: 508-663-0212, FAX: 508-663-0214

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 908-272-8591, TELEX: 229854, FAX: 908-272-3825; Empl.: 125; *Sls. Mgr.:* Joseph Abramczyk

BEMCO, 2255 Union Place, Simi Valley, CA 93065, Tel: 805-583-4970, FAX: 805-583-5033; Empl.: 43; *Sls. Mgr.:* Glenn Elliott

BENCHMARQ MICROELECTRONICS, INC., 2611 Westgrove 109, Carrollton, TX 75006, Tel: 214-407-0011, FAX: 214-407-9845; Empl.: 120; *Sls. Mgr.:* Jim Vernon

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENJAMIN INTERNATIONAL, INC., 3677 23rd Ave. South, Lake Worth, FL 33461, Tel: 407-533-0064, FAX: 407-547-2844

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 800-227-5514, 702-782-3611, TELEX: 354437, FAX: 702-782-9253; FSC No.: 1561105

BERG
ELECTRONICS

FAX: 302-892-1274,5

BERG ELECTRONICS, 150 Corporate Center Dr., Ste. 201, Camp Hill, PA 17011, Tel: 800-237-2374; *Dist. Mgr.:* Phil Raudensky, Dir. Natl. Distbn.

Local Sales Offices & Reps

PA	Camp Hill, Berg Elctrns.	800-237-2374

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Aerospace Computer SW	602-582-2779
AZ	Phoenix, Bell Ind.	602-966-7800
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Deanco/Acacia Div.	602-894-2874
AZ	Tempe, TTI	602-431-1191
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fremont, Deanco/Acacia Div.	510-623-7500
CA	Hawthorne, Bell Inds.	213-757-8381
CA	Irvine, Deanco/Acacia Div.	714-660-0834
CA	Los Angeles, TTI	818-891-8885
CA	LosAngeles, Bell Ind.	310-826-2355
CA	Orange County, Bell Inds.	714-895-7801
CA	Orange County, Capstone Elctrns.	714-730-0349
CA	Orange County, TTI	714-641-9393
CA	Sacramento, Bell Ind.	916-652-0414
CA	San Carlos, LoDan West	415-592-4600
CA	San Diego, Bell Ind.	619-268-1277
CA	San Diego, Deanco/Acacia Div.	619-597-0577
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, TTI	619-748-2025
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, TTI	408-946-5577
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Santa Fe Springs, Bell/Cable & Components	213-921-3611
CA	Sante Fe Springs, Bell/Corp. Warehouse	213-921-3611
CA	Sante Fe Springs, Bell/Just-In-Time	213-921-3611
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Ventura, Bell Inds.	818-879-9494
CO	Denver, Bell Inds.	303-424-1985
CO	Denver, Capstone Elctrns.	303-375-1300
CO	Denver, TTI	303-429-6806
CO	Lakewood, Deanco/Acacia Div.	303-375-1300
CT	Danbury, Bell Inds.	203-269-6801
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Wallingford, TTI	203-284-7474
CT	Yalesville, Deanco/Schaal Div.	203-265-4600
DC	Washington, Resco/Washington	301-937-9100
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Largo, LoDan Elctrns.	813-538-2600
FL	Orlando, Bell Inds.	407-339-0078
FL	Orlando, Deanco Inc.	407-671-5100
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, TTI	407-859-1000
GA	Atlanta, Bell Inds.	404-446-7167
GA	Atlanta, Deanco Inc.	404-429-0126
GA	Norcross, Hammond Elctrns.	800-241-5437
GA	Norcross, TTI	404-662-0911
IL	Addison, Belford Elctrns. Inc.	708-691-1100
IL	Chicago, Bell Inds.	708-640-1910
IL	Chicago, Capstone Elctrns.	708-250-0300
IL	Chicago, LoDan Elctrns.	708-398-5311
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, TTI	708-884-6500
IL	Chicago, Waldom Elec.	312-585-1212
IL	Wheaton, Deanco/Mega Div.	708-665-6214
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Bell/Just-In-Time	317-876-3740
IN	Indianapolis, Meunier Elctrn. Supply	317-635-3511
MD	Baltimore, Bell Inds.	410-290-5100
MD	Baltimore, Resco/Baltimore	410-931-8200
MD	Columbia, Sager Elctrns.	301-995-4900
MD	Columbia, TTI	410-995-1331
MD	Gaithersburg, Deanco, Inc.	301-948-5444
MA	Boston, Bell Inds.	508-474-8880
MA	Boston, Capstone Elctrns.	800-388-2277
MA	Burlington, Deanco/Schaal Div.	617-272-7940
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Tewksbury, TTI	508-851-2000
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minnetonka, TTI	612-933-8555
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Fairfield, Deanco Inc.	201-575-7960
NJ	Mt. Laurel, TTI	609-234-6400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Ithaca, Deanco, Inc.	607-257-4444
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NY	Ronkonkoma, TTI	516-737-2000
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Deanco, Inc.	919-851-2065
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
OK	Tulsa, Norvell Elctrns.	918-628-1916
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Almac/Arrow	503-629-8090
OR	Beaverton, Component Resources Inc.	503-641-8488
OR	Portland, Bell Inds.	503-635-6500
OR	Tigard, TTi, Inc.	503-684-3707
PA	Bristol, Bell/Wire & Cable	215-788-5000
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Bell Inds.	215-953-2899
PA	Philadelphia, Capstone Elctrns.	609-596-7500
PA	Philadelphia, Sager Elctrns.	215-464-4336
PA	Trevose, Bell/Cable & Components	215-990-9183
SC	Greenville, Hammond/Emsco	803-233-4121
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Dallas, Bell Inds.	214-690-0466
TX	Dallas, Capstone Elctrns.	214-380-9049
TX	Dallas, Force Elctrns.	214-247-9955
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Fort Worth, Allied	817-595-3500
TX	Fort Worth, TTI	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Ft. Worth, TTI, Inc. (Connector Div.)	817-834-2202
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Norvell Elctrns.	713-462-1666
UT	Salt Lake City, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184
WA	Bellevue, Almac/Arrow	206-643-9992
WA	Kent, Components Resources	206-454-8666
WA	Redmond, Deanco/Acacia Div.	206-881-5566
WA	Redmond, TTI	206-882-0291
WI	Milwaukee, Bell Inds.	414-547-8879
Intl	Ft. Worth, TX, TTI, Inc.	817-847-6666
Can	Ottawa, Wackid Radio	613-728-1821

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Carol McDevitt

THE
BERGQUIST
COMPANY

FAX: 612-835-4156

THE BERGQUIST CO., 5300 Edina Ind'l., Minneapolis, MN 55439, Tel: 800-347-4572; FSC No.: 55285; Empl.: 275; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey .... **B•1822-1823; C•1654-1657, 1710-1711**

Local Sales Offices & Reps

CA	Canyon Country, Bergquist Co.	805-252-9930
CA	San Mateo, Larson Assoc.	415-358-9559
CO	Westminister, Glennmar, Inc.	303-423-1572
DE	Newark, Bergquist Co.	302-738-5080
GA	Atlanta, Bergquist Co.	404-816-7113
MI	Minneapolis, Bergquist	612-835-2322
MA	Brookline, Harman Assocs.	617-232-6687
MN	Eden Prairie, Hanna-Lind	612-942-8554
NY	No. Syracuse, Leonard D. Allen	315-458-7470
OH	Cleveland, Staff Co.	216-331-5100
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
TX	Lewisville, Bergquist	214-317-1502
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

AL	Huntsville, Component Dist., Inc.	205-883-7501
CA	Fountain Valley, Components Center	213-582-0667
CA	Mtn. View, Energy Sls.	415-969-0800
CO	Aurora, JET Elctrns.	303-364-1000
FL	Ft. Lauderdale, Components Dist. Inc.	305-973-6915
GA	Norcross, Components Dist. Inc.	404-441-3320
IL	Chicago, NEP Elctrns.	312-625-8400
NC	Raleigh, Components Dist. Inc.	919-834-9465
TX	Dallas, Components Dist. Inc.	214-694-0373
WA	Redwood, Murphy Elctrns.	206-881-1234

BNC DIGITAL DELAY AND LIGHT PULSE GENERATORS

FAX: 510-236-3105

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 510-234-1100; Empl.: 30; *Sls. Mgr.:* E. J. Buchs .... **D•1239**

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BERKELEY PROCESS CONTROL, INC., 1001 West Cutting Blvd., Richmond, CA 94804, Tel: 510-236-3333, FAX: 510-236-1186; Empl.: 50; *Sls. Mgr.:* Ken Shane; *Dist. Mgr.:* Ken Shane

BERKSHIRE TRANSFORMER CORP., 3 Segar Mtn. Rd., P O Box 129, Kent, CT 06757, Tel: 203-927-3541, FAX: 203-927-4583; FSC No.: 89870; Empl.: 45; *Sls. Mgr.:* George Kraemer

BERK-TEK INC., 132 White Oak Road, New Holland, PA 17557-9722, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* John Osborn, Sls. Mgr.; *Dist. Mgr.:* Allan Schoonover, V.P. Dist. Sls.

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316, FAX: 919-419-1394; *Sls. Mgr.:* M. Conland

BERTAN

THE HIGH VOLTAGE PEOPLE

FAX: 516-935-1766

BERTAN HIGH VOLTAGE, 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Paul Oranges ...... **D•1618-1623**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Encino, King-Way Assoc.	818-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
GA	Norcross, Currie, Peak, Frazier	404-449-7662
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
KS	Lenexa, Midtec Assoc.	913-541-0505
MD	Randallstown, Beacon North	703-591-1300
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, Geotronix, Inc.	216-659-6100
MN	Minneapolis, Electronic Instrs.	612-374-5628
MO	St. Louis, Midtec Assoc.	314-275-8666
NM	Albuquerque, Thorson/Desert States Co.	505-293-8555
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Hicksville, Bertan Assocs., Inc.	516-433-3110
NY	Liverpool, Northern Tech. Sls. Co.	315-451-1091
OH	Cleveland, Geotronix	216-659-6100
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Cain-White & Co., Inc.	206-462-2118
WI	Milwaukee, Coombs Assocs.	414-351-6123

BERTSCH U.S.

FAX: 619-727-4436

BERTSCH U.S., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; *Sls. Mgr.:* B. Linko .... **B•1242-1243**

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934, FAX: 608-565-2221; Empl.: 600ò; *Sls. Mgr.:* Donald Soe

BESTECHNOLOGY

FAX: 206-382-0186

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300; Empl.: 8 .... **B•1863**

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785, FAX: 805-499-9071; Empl.: 8

BETA PHASE, 1200 Chrysler Dr., Menlo Park, CA 94025, Tel: 415-494-8410, FAX: 415-853-8228

BETA REVIEW, INC., PO Box 38, Millwood, VA 22646, Tel: 703-837-1436, FAX: 703-837-3063; Empl.: 2; *Sls. Mgr.:* Norman M. Fine

βT

FAX: 508-842-0748

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 508-842-0516; Empl.: 80 .... **B•1864-1869**

BETA TRANSFORMER TECH. CORP., ILC Data Device Corp., 40 Orville Drive, Bohmia, NY 11716, Tel: 516-244-7393, FAX: 516-244-8893; FSC No.: 64948; Empl.: 80; *Sls. Mgr.:* Carol Sauer, V.P.

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000, FAX: 201-694-7975; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. .... **A•2295**

BG ELECTRONICS, EPC Corp., 519 South 5th Avenue, Mt. Vernon, NY 10550-4430, Tel: 914-664-5591, FAX: 914-664-4729; FSC No.: 33791; Empl.: 6; *Sls. Mgr.:* Don Edwards

B-G INSTRUMENTS, INC., Route 1, Box 258, Mead, WA 99021, Tel: 206-567-5000, FAX: 509-238-4920; *Sls. Mgr.:* John Baum .... **D•1083**

Local Sales Offices & Reps

WA	Spokane, B-G Instrs., Inc.	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 70

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590, FAX: 612-894-9380; FSC No.: 08450; Empl.: 300; *Sls. Mgr.:* Fred LaMarche .... **A•1196-1197, 2296-2297**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Denver, Electro Comp. Sys.	303-762-9576
IL	Wheaton, EMTronics	708-665-6222
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Southfield, Chapman Tech. Assocs. ...	313-352-1645
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Montville, Astrum Sls.	201-263-8438
NC	Raleigh, Tingen Tech. Sls.	919-870-6670
OH	Worthington, R J Mktg.	614-888-7638
TX	Dallas, Precision Sls.	214-701-9031
WA	Redmond, Halbar PNW, Inc.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

BIBCO, INC., 326 East Main, Benton Harbor, MI 49022, Tel: 616-925-8445, 800-851-5701, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* Phil Wilcox

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, 1-800-242-2863, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* Richard Milne

BICRON ELECTRONICS, 50 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125, FAX: 203-824-1137; FSC No.: 10617; Empl.: 120; *Sls. Mgr.:* Frank Pierzga .... **A•2299-2301; B•1627, 1919**

Local Sales Offices & Reps

AL	Madison, Southern Elec. Rep.	205-461-8925
CA	San Clemente, ATA Assocs.	714-661-9700
CO	Denver, Omega, Ltd.	303-762-1921
NH	Bow, George T. Molleur	603-228-0557
NY	Pittsford, W.A. Franklin Sls.	716-248-8251
PA	Pittsburgh, S.K.A. Co.	203-582-5897
UT	Salt Lake City, Omega, Ltd.	303-762-1921
WI	Milwaukee, KMA Sls. Co.	414-259-1771

BIKOR, Microsemi Corporation, 1504 W. 228th St., Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 70; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 61009, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINICATOR P THY, FAX:; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Ayers

BIOMATION INSTRUMENTS, 335 Perth St., PO Box 156, Almonte, Ont., Canada K0A1A0, Tel: 613-256-2821, FAX: 613-256-5872; FSC No.: OAG53; Empl.: 3; *Sls. Mgr.:* Andy Guest

BIOMATION, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 408-988-6800, FAX: 408-988-1647; *Sls. Mgr.:* John Adam; *Dist. Mgr.:* Walt Klees

BIOMEDICAL TECHNOLOGY, Triangle Biomedical Sciences, Inc., 2604G Carver St., Durham, NC 27705, Tel: 919-471-2237, FAX: 919-477-5883; Empl.: 8

BIOSOFT, Acropolis Computers Ltd., P.O. Box 10938, Ferguson, MO 63135, Tel: 314-524-8029, FAX: 314-524-8129

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD, FAX: 216-248-5426; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* William Yochum, VP of Sls. & Mktg.; *Dist. Mgr.:* Greg Johns, Sls. Mgr.

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 310-695-0446, 310-692-9391, FAX: 310-692-4008

BIT 3 COMPUTER CORPORATION, 8120 Penn Avenue S., Minneapolis, MN 55431-1393, Tel: 612-881-6955, FAX: 612-881-9674; FSC No.: 7Y590; *Sls. Mgr.:* Merle Lonnon

Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 20; *Sls. Mgr.:* Thomas Silber; *Dist. Mgr.:* Thomas Silber .... **C•1537**

Local Sales Offices & Reps

AZ	Phoenix, Jarko Assocs.	602-596-8533
AZ	Tempe, Jarko Assocs.	602-596-8533
CA	Chatsworth, Alatec	818-727-7800
CA	Cupertino, Prism Tech. Sls.	408-366-6766
CO	Englewood, Delltron Co.	303-741-2122
GA	Norcross, Electro-Mech Sls.	205-447-6478
IL	Downers Grove, Richmar Elec. Corp.	708-968-0118
IN	Indianapolis, Richmar Elec. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MA	Norwood, The MacInnis Co.	617-762-8090
NY	Fairport, Senntec Sls.	716-425-3954
NC	Raleigh, Electro-Mech Sls.	919-790-9300
OH	Cleveland, Marlow Assocs.	216-831-8232
NY	Glen Cove, Dyno Rep, Inc.	516-676-1598
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Plano, Richmar Elec. Corp.	214-424-8388
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WI	Butler, Richmar Elec. Corp.	414-781-1730
Can	Markham, Ont., Avotronics, LTD.	416-475-2024

Local Distributors

AL	Huntsville, All American	206-837-1555
AL	Huntsville, Century Fasteners	205-883-5344
AZ	Phoenix, Aero-Space SW.	602-582-2779
AZ	Phoenix, EKO Sales	602-437-4646
AZ	Tucson, PSN Distbn., Inc.	602-623-9800
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Chatsworth, Jacon Fasteners	818-700-2901
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Fremont, Alatec	415-657-7701
CA	Fremont, Vic/Tal Sls.	415-651-6420
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	Milpitas, MS Inserts	408-946-6565
CA	Mission Hills, Coast Air Inc.	818-898-2288
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
CA	Monrovia, Erik-A-Elctrn. Distb.	818-574-1020

CA	North Hollywood, Elctrn. Hardware Ltd.	818-982-6100
CA	Oxnard, R. C. Dudek	805-988-4882
CA	San Diego, Western Fasteners	619-292-5115
CA	San Jose, R. C. Dudek	408-321-9011
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Torrance, MS Inserts	213-539-1530
CO	Littleton, Indelco	303-795-3431
CO	Wheatridge, Colorado Elctrn. Hdwr.	303-431-4334
CT	Milford, Plastic & Metal Comps. Co.	203-877-2723
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Apopka, Tropic Fasteners	407-880-4777
FL	Delray Beach, Fastbolt Corp.	407-272-3100
FL	Largo, Elctrn. Precepts of FL.	813-544-3636
FL	Pompano Bch., Peerless Radio	305-973-4141
FL	Winter Park, Servtronics	407-677-8191
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
GA	Peachtree City, Engineered Comps.	404-487-7600
IL	Chicago, EMF	312-889-8323
IL	Downers Grove, S.W. Anderson Co.	708-964-2600
IL	Elmhurst, Miltex Sls.	708-941-7100
IL	Lisle, Comps. Inc.	312-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, MAR Elctrns.	317-633-6699
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Capital Fasteners	301-948-9310
MA	Ashland, Quality Comps.	508-881-6504
MA	Billerica, MS Inserts	508-670-5600
MA	Marlborough, Hardware Spec. Co.	508-481-8622
MA	Waltham, Electronic Fasteners	617-890-7780
MA	Winchester, Webb Distbn.	617-729-5800
MI	Livonia, Tri-West Prods.	313-422-7900
MN	Bloomington, Aero-Space Computor Supp.	612-884-4725
MN	Eden Prairie, S. W. Anderson Co.	612-934-2700
MN	Hibbing, Minn-Tech Elctrns.	218-267-5228
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Peters, Heartland Elctrns.	314-928-6010
NH	Manchester, Crown Comps.	603-626-1717
NJ	So. Hackensack, Fastbolt Corp.	201-440-9100
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Dists.	716-887-2800
NY	Elmhurst, Century Fasteners	718-446-5000
NY	Holtsville, Tower Fastener Co.	516-289-8800
NY	Long Island City, Hardware Specialty Co.	718-361-9393
NY	Mt. Vernon, All American	914-699-2224
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrn. Comps.	919-782-2116
NC	Raleigh, Century Fasteners	919-787-1800
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Englewood, ADS	513-836-8636
OH	Solon, Repco	216-248-8900
OR	Beaverton, Component Resources	503-641-8488
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Harrisburg, Ad-Tech Elctrns.	717-561-9905
PA	Huntingdon Valley, Plastic & Metal Prods.	215-322-2000
PA	Norristown, Century Elctrns.	215-631-5400
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	West Columbia, Century Fasteners	803-791-1800
TX	Dallas, Global Fasteners	214-340-6068
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Seattle, Component Resources	206-454-8666
WA	Seattle, Radar Elec. Co. Inc.	206-282-2511
EXP	CA/Bakersfield, Gray-Weatherhead Equip.	805-397-4281
Can	Mississauga, Ont., Gould Fasteners	416-677-8253
Can	Ontario, Rush Elctrns. Ltd.	416-677-7280
Can	Richmond Hill, Ont., Irwin Indl.	416-889-9100
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Laurent, Quebec, Carsten Elctrns.	514-334-8321
Can	Ste-Foy, Que., Crobel L.T.E.	418-687-1171
Can	Surry, British Columbia, Memco	604-590-1553

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 508-520-1200, FAX: 508-541-8951; Empl.: 230; *Sls. Mgr.:* S. Adams

BKC SEMICONDUCTORS INCORPORATED., 6 Lake Street, Lawrence, MA 01841, Tel: 508-681-0392, FAX: 508-681-9135; FSC No.: 66891; Empl.: 110; *Sls. Mgr.:* Elizabeth J. Pucci; *Dist. Mgr.:* Patricia Sullivan .... **A•2131-2133**

Local Sales Offices & Reps

AL	Huntsville, Giesting	205-830-4554
AZ	Scottsdale, BKC Western Sls. Off.	602-951-8010
CA	Chatsworth, Wes-K Raltech	818-700-0933
CA	San Jose, Loroco Sls.	408-436-8770
CO	Englewood, Comp Sls.	303-779-8060
FL	Altamonte Spr., Kinetic	407-339-3855
FL	Deerfield Bch., Kinetic	305-480-6040
FL	Palm Harbor, Kinetic	813-934-3768
GA	Duluth, Giesting	404-476-0025
ID	Meridan, Comp Sls.	208-888-3554
IL	Elk Grove Vl., Oasis	708-640-1850
IN	Carmel, Giesting	317-844-5222
IA	Cedar Rapids, Oasis	319-377-8738
KY	Versailles, Giesting	606-873-2330
MD	Baltimore, Tai	410-732-5353
MA	Salem, Diamond Ltd.	508-744-2050
MA	Westborough, Anchor	508-898-2724
MI	Coloma, Giesting	616-468-4200
MI	Comstock Pk., Giesting	616-784-9437
MI	Livonia, Giesting	313-478-8106
MN	Burnsville, 2M Sls.	612-890-7774
NJ	Moorestown, Tai	609-778-5353
NY	N. Syracuse, Entec Grp.	315-458-7936
OH	Cincinnati, Giesting	513-385-1105
OH	Cleveland, Giesting	216-261-9705
OH	Columbus, Giesting	614-459-4800
OR	Tigard, Vantage	503-620-3280
PA	Pittsburgh, Giesting	412-828-3553
TX	Austin, Mrep	512-250-0820
TX	Dallas, Mrep	214-484-5711
UT	Midvale, Comp Sls.	801-561-5099
VA	Charlottesville, Tai	804-971-7840
WA	Bellevue, Vantage	206-455-3460
WI	Brookfield, Oasis	414-782-6660
Can	Kanata, Indigo	613-591-1053
Can	Mississauga, Indigo	416-670-0284
Can	Quebec, Indigo	514-696-6104

Local Distributors

AL	Huntsville, Nu Horizons	205-722-9330
CA	Agoura Hills, Zeus	818-889-3838
CA	Costa Mesa, Hamilton/Avnet	714-641-4199
CA	San Diego, Zeus	619-277-9681
CA	San Jose, All American	408-943-1200
CA	San Jose, Zeus	408-629-4789
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Torrance, All American	310-320-0240
CA	Walnut, ACI	714-594-1731
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CA	Yorba Linda, Zeus	714-921-9000
CT	Killingworth, ACI	203-663-3311
CT	Monroe, Nu Horizons	203-265-0162
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Miami, All American	305-621-8282
FL	Oviedo, Zeus	407-365-3000
FL	Sunrise, All American	305-572-7999
FL	Winter Park, Hamilton/Avnet	407-657-3300
GA	Norcross, Nu Horizons	404-416-8666
IL	Bensenville, Hamilton/Avnet	708-860-7780
MD	Columbia, Nu Horizons	410-995-6330
MD	Columbia, Zeus	301-997-1118
MA	Peabody, Hamilton/Avnet	617-532-3701
MA	Wakefield, All American	617-246-2300
MA	Wakefield, Nu Horizons	617-246-4442
MA	Wakefield, Zeus	617-246-8200
MA	Woburn, ACI	617-935-7230
MN	Eden Prairie, All American	612-944-2151
NJ	Cherry Hill, Hamilton/Avnet	609-424-0110
NJ	Mt. Laurel, Nu Horizons	609-231-0900
NJ	Pine Brook, Nu Horizons	201-882-8300
NJ	Totowa, ACI	201-812-0507
NY	Amityville, Nu Horizons	516-226-6000
NY	Plainview, ACI	516-293-6630
NY	Port Chester, Zeus	914-937-7400
NY	Rochester, Nu Horizons	716-292-0777
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Zeus	516-737-4500
OH	Dayton, Hamilton/Avnet	513-439-6730
OH	Dayton, Zeus	513-293-6162
TX	Addison, Hamilton/Avnet	214-308-8140
TX	Richardson, All American	214-231-5300
TX	Richardson, Zeus	214-783-7010
Can	Ontario, Hamilton/Avnet	416-564-6060

BKL, 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 40 .... **B•1134**

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

BLACKHOLE TECHNOLOGY, 225 East St, Winchester, MA 01890, Tel: 617-721-7690, FAX: 617-721-7260; Empl.: 5; *Sls. Mgr.:* John W. McDonough, Jr.

BLATEK, INC., 2820 E. College Ave., Ste. F, State College, PA 16801, Tel: 814-231-2085, 814-231-2086, FAX: 814-231-2087; Empl.: 20

BLH ELECTRONICS, INC., 75 Shawmut Road, Canton, MA 02021-9111, Tel: 617-821-2000, FAX: 617-828-1451; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* Ron Burke

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 140 .... **A•1340-1345**

Local Sales Offices & Reps

AL	Madison, R.W. Mitscher Co., Inc.	205-464-0745
CA	Chatsworth, Cygnus Sls. Engrg.	818-727-0312
CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CO	Boulder, Alfred A. Steinberg Rep Co.	303-442-6018
CT	Plainfield, R. W. Mitscher Co., Inc.	203-564-1691
FL	Lutz, R. W. Mitscher Co., Inc.	813-948-2351
FL	Tequesta, R.W. Mitscher Co., Inc.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co., Inc.	404-923-3239
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
NJ	Collingswood, R. W. Mitscher Co., Inc.	609-858-6440
NM	Albuquerque, Border States Tech. Assocs.	505-884-9100
NY	Binghamton, R. W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NY	Pittsford, R. W. Mitscher Co., Inc.	716-586-4012
NC	Davidson, R.W. Mitscher Co., Inc.	704-896-7434
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Alpha, Poliquin & Co., Inc.	513-426-8055
OR	Portland, Temper Tech. Mktg.	503-292-8201
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Austin, Electra Reps, Inc.	512-339-1163
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Richmond, R. W. Mitscher Co., Inc.	804-320-7350
EXP	CT, Stamford, Dage Corp.	203-324-3123

BLUE M, A GENERAL SIGNAL COMPANY, 2218 W. 138th St., Blue Island, IL 60406, Tel: 708-385-9000, FAX: 708-331-2515; Empl.: 300; *Sls. Mgr.:* Gary Carlin

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, FAX: 312-478-3232; *Sls. Mgr.:* James C. Stormont

BOGEN COMMUNICATIONS, INC. MPD PRODS., See Memory Protection Devices, Inc.

BOGEN COMMUNICATIONS, INC., Sound Prods., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, FAX: 201-934-9832; *Sls. Mgr.:* David A. Chambers; *Dist. Mgr.:* Christopher Wildfoerster

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL COMPANY, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 908-356-7787, 800-526-3935, FAX: 1-908-356-7362; Empl.: 40; *Sls. Mgr.:* Beth Shapiro, OEM Sls. Mgr. .... **A•1346**

Local Distributors

NY	E. Setauket, Dove Elctrn. Comps.	800-232-9825
TX	Ft. Worth, Allied Elctrns.	1-800-433-5700

BOMAR INTERCONNECT PRODUCTS, 1850 Route 46, Ledgewood, NJ 07852, Tel: 201-347-4040, FAX: 201-347-2111; Empl.: 12; *Sls. Mgr.:* Don Cornelius; *Dist. Mgr.:* Don Cornelius

BOMCO, See MuShield Co.

BOMEM INC., 450 Ave. St-Jean Baptiste, Quebec, Canada G2E-5S5, Tel: 418-877-2944, 1-800-888-FTIR, TELEX: 051-31543, FAX: 418-877-2834; Empl.: 120; *Sls. Mgr.:* Henry Buijs

BONAR-KARD-O-LITE, See BKL (formerly Bonar-Kard-O-Lite)

BONDHUS CORPORATION, 1400 E. Broadway, Monticello, MN 55362, Tel: 612-295-2162, FAX: 612-295-4440; Empl.: 100; *Sls. Mgr.:* Hans Wegner

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, FAX: 201-584-3037; FSC No.: 04901; Empl.: 74; *Sls. Mgr.:* Rich Anlas

BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH

FAX: 708-865-5301

BOSCH, ROBERT, CORP. 2800 S. 25th Ave., Broadview, IL 60153, Tel: 708-865-5301; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson .... **B•1435**

Local Sales Offices & Reps

CA	Montrose, Luscombe Engrg.	818-249-9000
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IA	Davenport, QIPS	319-388-0189
MN	Minneapolis, H.M.R., Inc.	612-888-2122
OH	Richfield, Geotronix Inc.	216-659-6100
PA	Nomstown, Brandon Assocs.	215-278-0500
TX	The Colony, Juliana Co.	214-625-1075

Local Distributors

AL	Huntsville, World Distrs.	205-539-0441
CA	Carson, Accele Elctrns.	213-637-3533
CA	Cerritos, David Levy Co.	800-421-3536
CA	N. Hollywood, Mobile Sound	213-668-1699
CA	Santa Monica, Distr. Specialties	213-452-3445
FL	Naranja, LES, Distrs.	305-248-6701
GA	Norcross, Whitehead Elctrns.	404-923-6667
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IL	N. Chicago, Sound Quest/Delta	708-473-1200
IL	Waukegan, Vanco	708-689-0210
MI	Livonia, Delta Supp. Co.	313-525-5858
MI	Troy, Terminal Supp. Co.	313-362-0790
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Wes Garde Comp.	314-567-7776
NY	Elmsford, Kin-Tronics, Inc.	914-968-7736
PA	Norristown, Brandon Assocs.	215-278-0500
TX	The Colony, The Juliana Co.	214-625-1075

BRILL ELECTRONICS
(510) 834-5888
810 E. 10th St., Oakland, CA 94606
BOURNS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL INC
THE SOURCE FOR
BOURNS INC
Ultra-Miniature Switches
[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
(800) CAL-SWCH

BOSCHERT, INC., See Computer Products, Inc.

BOSTON GEAR, IMO Industries Inc., 14 Hayward St, Quincy, MA 02171, Tel: 617-328-3300, 1-800-225-5280, FAX: 617-479-6238; Empl.: 402

BOURNS, INC., Electronic Components Sls., 1200 Columbia Ave., Riverside, CA 92507-2114, Tel: 909-781-5500, 801-750-7200, FAX: 909-781-5273; Empl.: 4000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Patricia Moorman .. **A•1869-1874, 2052, 2058-2067; B•1656, 1675-1680, 1920-1923**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Auburn, QuadRep Inc.	916-269-2701
CA	Irvine, QuadRep Southern	714-727-4222
CA	San Diego, QuadRep Southern	619-755-1188
CA	San Jose, QuadRep Inc.	408-432-3300
CO	Parker, Parker Webster Co.	303-841-4888
CT	Wallingford, John E. Boeing Co., Inc. ..	203-265-1318
FL	Casselberry, Dyne-A-Mark	407-831-2822
FL	Palm Bay, Dyne-A-Mark	407-725-7470
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Meridian, Intermountain Tech. Mktg., Inc.	208-888-6071
IL	Elk Grove Village, Oasis Sls. Corp.	708-640-1850
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IN	Kokomo, Technlg. Mktg. Corp.	317-459-5152
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-245-7411
MD	Baltimore, Micro-Comp, Inc.	410-644-5700
MA	Chelmsford, John E. Boeing Co., Inc. ..	508-256-5800
MI	Farmington Hills, Rathburg Assocs., Inc.	313-489-1500
MI	Troy, Epsco, Inc.	313-528-0983
MN	Edina, Mel Foster Tech. Sls. Inc.	612-941-9790
MO	Bridgeton, Centech, Inc.	314-291-4230
MO	Raytown, Centech, Inc.	816-358-8100
NJ	Moorestown, Thomas Assocs., Inc.	609-778-5353
NY	Hicksville, J-Square Mktg. Inc.	516-935-3200
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Indian Trail, CSR Elctrns.	704-882-3995
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OK	Tulsa, Ammon & Rizos	918-749-6116
OR	Beaverton, J.J. Backer Co.	503-627-0775
PA	Allison Park, Bear Mktg., Inc.	412-492-1150
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Murray, Parker Webster Co.	801-266-9939
VA	Lynchburg, Micro-Comp, Inc.	804-239-2626
WA	Seattle, J. J. Backer Co.	206-285-1300
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
PR	Rio Piedras, P.C. Elctrns., Inc.	809-753-9805
Can	Burnaby, B.C., Davetek Mktg. Inc.	604-430-3680
Can	Dorval, Quebec, John G. Weiss Co., Ltd.	514-685-6644
Can	Mississauga, Ont., John G. Weiss Co., Ltd.	416-673-0011
Can	Nepean, Ont., John G. Weiss Co., Ltd. ..	613-225-1810

Local Distributors

CA	Los Angeles, Bell Inds.	213-826-6778
CA	Culver City, Hamilton/Avnet	213-558-2071
CA	El Monte, Marshall Ind.	818-307-6186
CA	Gardena, California Switch & Signal ..	310-538-9830
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Riverside, Elctrn. Supp. Corp.	909-683-7300
CA	San Diego, Time/Harper	619-674-2800
CA	Santa Ana, Teknopak	714-558-8840
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	312-359-5500
MD	White Marsh, Radio Elec. Svc. Co.	410-931-8200
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, RS Elctrns.	313-525-1155
MN	Thief River Falls, Digi-key Corp.	218-681-6674, 800-344-4539
NJ	Camden, General Radio Supply	609-964-8560
NJ	Teterboro, EAC Corp.	201-288-4477
NY	Rome, Rome Elctrns.	315-337-5400
NY	Binghamton, Pioneer Std.	607-722-9300
NY	Buffalo, Summit Distrs. Inc.	716-887-2800
NY	Ronkonkoma, Mast Distbtrs.	516-471-4422
NY	Woodbury, Seymour Elctrns.	516-496-7474
OH	Cleveland, Pioneer Std.	216-587-3600
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	Fort Worth, TTI, Inc.	817-429-4600
TX	Stafford, Harrison Equip. Co.	713-879-2600
WA	Bellevue, Almac Elctrns.	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Concord, Ont., ITT Multicomponents ..	416-736-1144
Can	Willowdale, Ont., Electro Sonic	416-494-1666

BOURNS INSTRUMENTS INC., 1200 Columbia, Riverside, CA 92507, Tel: 714-781-5148, FAX: 714-781-5178; FSC No.: 80294; Empl.: 220; *Sls. Mgr.:* Al Lara

BOWMAR/ALI, See Weschler Instruments, Hughes Corp.

BOWMAR INSTRUMENT CORP., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809, Tel: 219-747-3121, FAX: 219-747-9601; FSC No.: 99479; Empl.: 170; *Sls. Mgr.:* Gary McClintick, V.P. Mktg.

BRADFORD ELECTRONICS, INC., See Dale Electronics, Columbus Div.

BRADY USA, INC., Indl. Prods. Div., P.O. Box 2131, Milwaukee, WI 53201, Tel: 1-800-537-8791, TELEX: 26-677, TWX: 910-262-3151, FAX: 1-800-292-2229; *Sls. Mgr.:* Brian P. Connolly; *Dist. Mgr.:* Brian P. Connolly

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, TELEX: 26-677, TWX: 910-262-3151, FAX: 414-354-0453; FSC No.: 85480; *Sls. Mgr.:* R.F. Faustich

BRAILSFORD & CO., INC., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820, FAX: 914-967-1836; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321, FAX: 203-423-4406; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRAND-REX COMPANY, BICC Cables Corporation, 1600 W. Main St., Willimantic, CT 06226-1128, Tel: 203-456-8000, TELEX: 99-4444, TWX: 710-440-2248, FAX: 203-423-8128; FSC No.: 71124; Empl.: 800

BRANDT ELECTRONICS, INC., 815 E. Middlefield Road, Mountain View, CA 94043, Tel: 415-967-4944, FAX: 415-967-9105; FSC No.: 57837; Empl.: 30; *Sls. Mgr.:* Fred Kuttner

BRANDYWINE ABRASIVES, 501 South Main St., Spring City, PA 19475, Tel: 215-948-7028, FAX: 215-948-8151; Empl.: 10

BRANMAG, INC., 908 Niagara Falls Blvd., N. Tonawanda, NY 14120, Tel: 716-693-5994, FAX: 716-693-5848; FSC No.: 9V968; Empl.: 6; *Sls. Mgr.:* B. Veljkovic

BRAXTON MFG., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795, Tel: 203-274-6781, FAX: 203-274-9195; Empl.: 115; *Sls. Mgr.:* Richard Rosa

BREEZE-ILLINOIS, See Transtechnology Electronics

BRENTEK INTERNATIONAL, INC., 150 W. Beaver St., York, PA 17406, Tel: 717-755-8000, FAX: 717-840-0988; *Sls. Mgr.:* Roberta Breneman

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-499-5504; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

BRILL ELECTRONICS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 310-452-8002, FAX: 310-392-9585; *Sls. Mgr.:* Sam Nizam; *Dist. Mgr.:* Kelly Garcia .... **B•1390, 1454, 1591, 1692, 1874, 1934; C•1648, 1724, 1752; D•1258**

BRIM ELECTRONICS, P.O. Box 336 E, Fair Lawn, NJ 07410, Tel: 201-796-2886, FAX: 201-778-2792; FSC No.: 57834 .... **C•1712-1721**

Local Sales Offices & Reps

AZ	Phoenix, Mactronix	602-951-3437
MA	Stow, GH Assocs.	508-897-3534
TN	Industrial Elctrns., Inc.	615-573-7135
EXP	NY, N.Y.C., Roburn Agencies	914-968-1016

Local Distributors

AL	Dothan, Carmichael Whls. Supp.	205-793-7066
CA	Canoga Park, Tim-Co. Sls.	818-992-5040
CA	San Diego, Shanks & Wright	619-239-0176
CT	Manchester, IMS	203-649-4415
CT	Waterbury, Century Elec.	203-755-0405
FL	Lake Mary, Electronic Fasteners	305-321-4000
KS	Topeka, Acme Radio Supp. Co.	913-235-1363
LA	New Orleans, Radio Parts	504-581-5959
MA	Billerica, Eastern Video Sys.	617-667-0009
MA	Lexington, Wholesale Elect. Supp.	617-862-3590
MA	Springfield, Electro-Term	413-734-6469
MA	Waltham, Linear Elect.	617-894-7300
NH	Dover, American Radio Corp.	603-742-6800
NJ	Hackensack, Milcor	201-489-1313
NY	LIC, H.L. Dalis	212-361-1100
NY	N.Y.C., Center Indl.	718-458-6363
OK	Oklahoma City, Huhzicker Bros., Inc.	405-275-2121
OK	Tulsa, Radio, Inc.	918-587-9123
RI	Newport, J & S Elctrn. Distb.	401-847-2977
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TX	Denison, Denison Elctrns.	214-465-0341
TX	Texarkana, McCulloch Elctrns.	214-792-6923
VT	Cavendish, C S Svc. & Supp. Co.	802-226-7582
VA	Norfolk, Todd Elec.	804-855-3111
WA	Seattle, Amateur Radio Supp.	206-767-3222
MN	Minneapolis, Boerger & Assoc.	612-636-4339

BRINKMANN INSTRUMENTS, INC., One Cantiague Road, P.O. Box 1019, Westbury, NY 11590-0207, Tel: 516-334-7500, TELEX: WUI 6852174, FAX: 516-334-7506

BRISTOL BABCOCK INC., 1100 Buckingham St., Watertown, CT 06795, Tel: 203-575-3000, 800-395-5497, TELEX: 962417, FAX: 203-754-1477; FSC No.: 08664; Empl.: 500; *Sls. Mgr.:* Fred Merrill

BROOKS ELECTRONICS, 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433, FAX: 215-227-7687; Empl.: 100; *Sls. Mgr.:* Gary J. Brooks; *Dist. Mgr.:* Gary J. Brooks

BROOKS INSTRUMENT DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, TELEX: 4975082, FAX: 215-362-3745; Empl.: 500; *Sls. Mgr.:* Harry Lund

BROOKS POWER SYSTEMS, 1400 Adams Rd. Unit E, Bensalem, PA 19020, Tel: 215-244-0264, 1-800-523-1551, FAX: 215-244-0160; Empl.: 90; *Sls. Mgr.:* Grace Rogers

BROOKTREE CORPORATION, 9950 Barnes Canyon Road, San Diego, CA 92121, Tel: 619-535-3494, TELEX: 383596, FAX: 619-597-0673

BROWN APPLIED TECHNOLOGY INC., 31 Progress Ave., Scarborough, Ont., Canada M1P 4S6, Tel: 416-298-0560, FAX: 416-298-0806; Empl.: 135; *Sls. Mgr.:* Sam Lagis; *Dist. Mgr.:* Nick Markoff

Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds., Inc.	602-439-0134
CA	Los Angeles, Brown Applied Technlg. Intl.	310-541-4751
CA	Santa Clara, Brown Applied Technlg. Intl.	408-727-8551
CO	Monument, Sunbird Inds., Inc.	719-481-2900
IL	Inverness, Heartland Tech.	708-358-6622
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
NH	Salem, OEM Mktg. Sls.	603-893-0009
OR	Portland, Power Resources	503-452-1859

B.R.T.B. INC., 80 Citizen CRT 7, Markham, Ont., Canada L6G 1A7, Tel: 416-475-8903, FAX: 416-475-0157; Empl.: 12

BRUEL & KJAER INSTRS. INC., 2364 Park Central Blvd., Decatur, GA 30035, Tel: 404-981-6225, FAX: 404-981-8370; Empl.: 80

BRUSH INDUSTRIES INC., 3rd & Reagan Sts., P.O. Box 638, Sunbury, PA 17801-0638, Tel: 717-286-5611, 800-233-0362, FAX: 717-286-2649; FSC No.: 19418; Empl.: 100

BT & D TECHNOLOGIES, 500 N. Walnut St., Kennett Square, PA 19348, Tel: 215-444-6888, 800-545-4306, FAX: 215-444-6868; Empl.: 350; *Sls. Mgr.:* Paul V. O'Donnell

BTC ELECTRONIC COMPONENTS, 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 908-679-9300, FAX: 908-679-9311; FSC No.: 63365; Empl.: 50; *Sls. Mgr.:* Jim Messina

BTU INTERNATIONAL, INC.:BTU SYSTEMS DIVISION, 23 Esquire Rd., N. Billerica, MA 01862, Tel: 508-667-4111, TELEX: 94-7489, FAX: 508-667-9068; Empl.: 300; *Sls. Mgr.:* James Griffin

BUBBL-TEC, 6805 Sierra Ct., Dublin, CA 94568, Tel: 510-829-8705, FAX: 510-829-9796; Empl.: 19; *Sls. Mgr.:* Bob Nelson

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FAX: 614-445-8224

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AZ	Phoenix, Moss Mktg.	602-433-9349, FAX:602-249-4767
CA	San Diego, Vale Elctrns, Assocs.	619-693-0113
CA	Santa Clara, Engrg. Assocs.	408-988-5001, FAX:408-727-1860
CO	Aurora, Moss Mktg.	303-340-8535, FAX:303-341-7930
FL	Indian Rock Bch., PAR Assocs., Inc.	813-596-8841, FAX:813-595-8523
GA	Atlanta, Par Assoc.	404-391-9117, FAX:404-395-6346
IL	Long Grove, Robert Adams Sls.	708-634-3384, FAX:708-634-3585
KS	Lenexa, Midtec Assoc.	913-541-0505, FAX:913-541-1729
MD	Columbia, Tyler Griffin Co.	301-995-1215, FAX:301-995-0344
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680, FAX:617-484-8693
MI	Beachwood, Elctrn. Sls. Masters, Inc.	216-831-9555,FAX:216-831-8647
MN	Minneapolis, A. J. Warner Co.	612-823-8272
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Ocean, P. Saftler Assocs.	908-922-3014, FAX:908-922-8198
NM	Albuquerque, Moss Mktg.	505-292-7505, FAX:602-249-4767
NY	Fulton, P. Saftler Assocs.	315-592-7184, FAX:315-592-4152
NY	Lynbrook, P. Saftler Assoc.	516-593-7880, FAX:516-593-7637
NC	Charlotte, PAR Assocs., Inc.	704-535-9858, FAX:704-535-5347
OH	Columbus, McFadden Sls.	614-761-3177, FAX:614-761-2487
OR	Hillsboro, Doran Sls. Assocs., Inc.	503-640-4500, FAX:503-640-4555
PA	Paoli, T. Griffin Co.	215-647-1550, FAX:215-640-4652
TX	Dallas, REM Comps.	214-234-1069, FAX:214-234-1082
UT	Salt Lake City, Moss Mktg.	801-363-5875, FAX:801-328-8236
WA	Bothel, Doran Sls. Assocs., Inc.	206-488-1200, FAX:206-488-1217

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2626, FAX:602-275-0578
CA	Los Angeles, Elect. Switches	213-664-1141, FAX:213-660-5130
CO	Littleton, Display Plus	303-730-7333, FAX:303-795-8298
GA	Marietta, Peach State Instrs.	404-971-5050
ID	Boise, Radar Elec.	208-336-2227, FAX:208-336-2322
MA	Waltham, Linear Elctrns.	617-894-7300
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611, FAX:313-665-5896
NJ	Dover, Electrospec	201-361-6300, FAX:201-361-7868
NM	Albuquerque, Bestech	505-298-0034, FAX:505-296-3422
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
NC	Charlotte, Lakeland Engrg. & Equip.	704-597-0044, FAX:704-597-7957
OR	Portland, Radar Elec.	503-232-3404
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
WA	Richland, Radar Elec.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Elec.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Elec.	509-747-3053, FAX:509-456-8069

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, FAX: 216-951-4015; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* Bill DeRoche

BUEHLER PRODUCTS, INC., P. O. Box 33400, Raleigh, NC 27636, Tel: 919-469-8522, TWX: 510-924-2474; Empl.: 400; *Sls. Mgr.:* D. Frank Slighton

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Local Sales Offices & Reps

CA	Hollywood, Bulbtronics, Inc.(Western Region)	800-245-BULB,213-461-6262

BULOVA WATCH CO., See Frequency Control Prods., Inc., American Time Prods. Div.

BUMPER SPECIALTIES, INC., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, FAX: 609-261-7300; *Sls. Mgr.:* Charles T. Holliday

BUNTING MAGNETICS CO., 500 So. Spencer Rd., Newton, KS 67114, Tel: 316-284-2020, 800-835-2526, FAX: 316-283-4975; Empl.: 120; *Sls. Mgr.:* Robert J. Bunting

BURBANK SHEET METAL WORKS INC., 156 W. Verdugo Ave., Burbank, CA 91502, Tel: 818-846-0316, FAX: 818-846-0359; Empl.: 12

BURGESS-SAIA, INC., 1335 Barclay Blvd., Buffalo Grove, IL 60089, Tel: 708-215-9600, FAX: 708-215-9606; FSC No.: 6U850; Empl.: 13; *Sls. Mgr.:* Richard Maxwell; *Dist. Mgr.:* Richard Maxwell **B•1244-1245, 1681-1683**

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CA	Mountain View, Westech Sls.	415-961-1422
CA	Tustin, Sierra Pacific Engrg.	714-731-3411
CA	Van Nuys, Halbar	818-906-3941
CO	Littleton, Harthun Assoc.	303-795-5545
FL	Ft. Lauderdale, Synergistic Technlgs.	305-791-8255
FL	Melbourne, Synergistic Technlgs.	407-242-9661
FL	Odessa, Synergistic Technlgs.	813-920-5814
FL	Orlando, Motion Prods. Inc.	407-381-8480
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FL	Palm Harbor, Synergistic Technlgs.	813-785-7238
FL	Pompano,Bch., Motion Prods. Inc.	305-783-9003
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Addison, Vikeland Sls.	708-832-8425
IL	Glen Ellyn, Lincoln Hodges Inc.	708-469-6750
KS	Overland Pk., Singer Indl. Sls.	913-381-3684
KS	Overland Pk., Singer Indl. Sls.	913-897-2008
KS	Shawnee Mission, Mertens Co.	913-432-9323
MD	Glenarm, Hodgins Assocs.	301-592-7047
MA	Braintree, R.F. Duffy Assocs.	617-848-3550
MA	Monson, R.F. Duffy Assoc. Inc.	413-267-9884
MI	Royal Oak, Elctrl. Sys. Co.	313-542-1747
MN	St. Paul, Kencotronics	612-645-7717
MN	St. Paul, Vikeland Sls. Inc.	612-645-4647
MO	St. Louis, Mertens Co.	314-993-6600
NH	Manchester, Peak Sls.	603-625-2250
NJ	Hackensack, A.P. Tech. GCF Inc.	201-487-6222
NJ	Sussex, Carbone Assocs.	201-875-1882
NY	E. Syracuse, Applications Specialists	315-437-2814
NY	Rochester, Application Specialists	716-586-6226
OH	Cincinnati, Anderson-Bolds, Inc.	513-528-5680
OH	Cleveland, Anderson-Bolds, Inc.	216-360-9800
OH	Dayton, Electrical Sys. Co.	513-434-9822
OH	Orrville, Electrical Sys. Co.	216-682-5530
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
OR	Tigard, Halbar-RTS	503-624-5741
PA	Philadelphia, Kenneth B. Erdman, Co.	215-233-0172
PA	Wayne, Hodgins Assocs.	215-688-9056
TN	Knoxville, Hughes Assocs.	615-558-0283
WA	Bothel, Doran Sls. Assocs.	206-488-1200
WA	Redmond, Halbar-RTS	206-882-0990
WI	St. Francis, Vikeland Sls.	414-744-7253
Can	Ottawa, Ont., Graham Dewar Assoc.	613-744-8463
Can	Pickering, Ont., Graham Dewar Assoc.	416-839-9955
Can	Scarborough, Ont., Burgess Switch Co.	416-299-0852

Local Distributors

AL	Muscle Shoals, Jones Elctrns., Inc.	205-383-1241
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Fresno, Control Elec.	209-268-4411
CA	Long Beach, Elctrl. Power & Controls	213-498-6699
CA	Redwood City, HdB Elec.	415-368-1388
FL	Boca Raton, Zelcon Inc.	407-451-1600
FL	Miami, B & R Elctrns. Supp. Inc.	305-255-4510
FL	W. Palm Bch., Atlantic Elec. Inc.	407-686-8553
IL	Chicago, Leeds Electro Comp.	312-625-3800
IL	Harvey, George Elctrns.	708-331-1983
MA	Fall River, Broadway Elec. Sls.	508-673-3339
MA	Holyoke, Falcetti & Clark Elec.	413-532-9402
MA	Medford, Empire Elec.	617-395-5000
NJ	Rockaway, NASCO	201-625-7777
MI	Grand Rapids, S & F Elctrns. Supp.	616-459-0216
MI	St. Clair Shores, Spemco	313-771-2700
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NH	Bedford, Cohen Machinery Co. Inc.	603-624-4324
NJ	Oakland, Relay Specialties	201-337-1000
NJ	South Hackensack, NASSOR	201-641-3737
NY	Bronx, Equiptex Ind. Prod.	212-324-1190
NY	Roosevelt, Automated Equip. Co.	516-538-7417
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Triangle Elec. Motor	919-596-1333
NC	Gastonia, JMT Elctrns. & Control	704-867-4401
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Lansdale, County Elec.	215-368-1960
RI	Providence, J & H Elec. Co., Inc.	401-421-7840
SC	Greenville, Sawyer Elctrns. Corp.	803-235-0438
TX	San Antonio, Sherman Elec. Supp. Inc.	512-224-1004
VA	Charlottsville, Virginia Elect. Comp.	804-296-4184
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BURLEIGH INSTRUMENTS, Burleigh Park, P.O. Box E, Fishers, NY 14453-0755, Tel: 716-924-9355, TELEX: 978379, FAX: 716-924-9072; Empl.: 65; *Sls. Mgr.:* Dr. Brian Samoriski

BURLING INSTRUMENTS, INC., P.O. Box 298, Chatham, NJ 07928-0298, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 20; *Sls. Mgr.:* Michael Wetterer

Local Sales Offices & Reps

CA	Costa Mesa, Robinson Tech. Assoc.	714-557-1622
CA	Mountain View, Claypool Controls Co.	415-968-7488
CT	Stratford, M. A. Selmon Co.	203-377-3525
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
IL	Lisle, WG Controls	708-963-5954
MI	Dearborn Hgts., CVA	313-274-4959
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4374
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
OK	Tulsa, Ernie Graves Co.	918-584-4707
PA	Edgemont, White/Whiddett Co.	215-353-6343
TN	Chattanooga, Eclipse Thermal Sys.	615-266-4831
Can	Concord, Ont., Baker Instrs. Ltd.	416-738-4780
Can	Vancouver, B.C., John Sherman Agcs. Ltd.	604-254-9622

BURNDY CORPORATION, An FCI Company, 51 Richards Ave., Norwalk,, CT 06856, Tel: 203-838-4444, FAX: 203-852-6227; Empl.: 3500; *Sls. Mgr.:* Frank Zavattaro

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CA	Santa Ana, Burr-Brown Corp.	714-835-0712
CA	Santa Clara, I2, Inc.	408-988-3400
CO	Denver, Burr-Brown Corp.	303-452-3545
GA	Atlanta, Rep Inc.	404-938-4358
IL	Arlington Hgts., Burr-Brown Corp.	708-437-2877
IA	Cedar Rapids, Rep Assoc. Corp.	319-373-0152
MD	Rockville, Marktron Inc.	301-251-8990
MA	N. Billerica, Burr-Brown Corp.	508-670-9800
MI	Farmington, Burr-Brown Corp.	313-474-6533
MN	Bloomington, Electronic Sls. Agency	612-884-8291
MO	Bridgeton, BC Elctrn Sls., Inc.	314-739-6683
NM	Albuquerque, Morrison & Fern, Inc.	505-271-8433
NY	Buffalo, Advanced Comp. Corp.	716-832-6791
NY	Endicott, Advanced Comps. Corp.	607-785-3191
NY	Syracuse, Advanced Comps. Corp.	315-699-2671
NY	Yonkers, Burr-Brown Corp.	914-964-5252
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Aurora, Meta Tech. Sls. Inc.	216-562-8772
OH	Cincinnati, Burr-Brown Corp.	513-891-4711
OH	Cleveland, K-T/Depco Mktg.	216-442-6200
PA	Pittsburgh, K-T/Depco Mktg.	412-367-1011
PA	Spring House, QED Elctrns.	215-643-9200
TN	Jefferson City, Rep Inc.	615-475-4105
TX	Dallas, Burr-Brown Corp.	214-783-4555
TX	Houston, Acudata Inc.	713-580-2451
TX	Houston, Burr-Brown Corp.	713-988-6546
TX	Plano, Acudata Inc.	214-424-3567
UT	Salt Lake City, Aspen Sls., Inc.	801-467-2401
WA	Kent, Burr-Brown Corp.	206-859-9220

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BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 310-322-6580, FAX: 310-322-8130; FSC No.: 29593; Empl.: 43

BUSSMANN DIVISION, Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* Scott Robinson; *Dist. Mgr.:* Scott Robinson

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BYTEK CORP., Instrument Systems Div., 543 NW 77th St., Boca Raton, FL 33487-1323, Tel: 407-994-3520, TELEX: 4998369 BYTEK, FAX: 407-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 4 Technology Dr., Westborough, MA 01581, Tel: 508-366-8000, FAX: 508-366-0244; Empl.: 273; *Sls. Mgr.:* Stephen Nesbit, VP Sls.; *Dist. Mgr.:* Robert Welch, VP Indirect Channels

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CABLEC CONTINENTAL CABLES CO., BICC Cables Corp., 2555 Kingston Rd., York, PA 17402-9950, Tel: 717-757-6600, FAX: 717-755-4717; Empl.: 750; *Sls. Mgr.:* John Turcich, Sls. V.P.; *Dist. Mgr.:* Dennis Myers

CABLEFORM INC., Zion Cross Roads, Troy, VA 22974, Tel: 804-589-8224, TELEX: 822434, FAX: 804-589-3803; *Sls. Mgr.:* Richard L. Shannon .... **A•1875**

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, FAX: 714-921-2493; *Sls. Mgr.:* Richard Heintz

CABLESTAR, INCORPORATED, 310 S. Franklin St., Glasgow, KY 42141, Tel: 800-338-8223, FAX: 502-651-2973; Empl.: 25; *Sls. Mgr.:* Larry Hollon

CABLE SYSTEMS, INC., The HVT Group, 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, FAX: 617-389-4758; FSC No.: 33426; Empl.: 70; *Sls. Mgr.:* James R. Collmer

CABLETEST INTERNATIONAL INC., 400 Alden Rd., Markham, Ont., Canada L3R 4C1, Tel: 416-475-2607, 800-667-2518, FAX: 416-475-2609; Empl.: 50 .... **D•1240-1241**

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CABLETRON SYSTEMS, INC., 35 Industrial Way, Rochester, NH 03867, Tel: 603-332-9400, FAX: 603-332-4616; Empl.: 1500; *Sls. Mgr.:* Jack Branowski

CABLE USA, INC., 2584 So. Horseshoe Dr., Naples, FL 33942-3560, Tel: 813-643-6400, FAX: 813-643-4230; FSC No.: 67050; Empl.: 55; *Sls. Mgr.:* Joe Giordano

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KS	Wichita, Buckman & Assocs.	316-267-2052
MN	St. Paul, Countryman Assocs.	612-645-9151

MO	St. Charles, Buckman & Assocs.	314-947-4727
NC	Kings, Phillip Matthews Corp.	919-983-9790,

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310, FAX: 516-742-2416; FSC No.: 04213; Empl.: 30 .... **A•1198-1212**

CADDELL COIL CORP., P.O. Box 1232, South St., Middletown Springs, VT 05757, Tel: 802-235-2019, FAX: 802-235-2019; Empl.: 6; *Sls. Mgr.:* James Caddell .... **A•1213**

Local Sales Offices & Reps

FL	Vero Bch., R.B. Caddell	305-562-4496

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OH	Cleveland, Arthur H. Baier Co.	216-292-7500
OH	Dayton, Arthur H. Baier Co.	513-233-0087
OR	Beaverton, Elctrn. Sources	503-627-0838
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CAD ENGRG. & ASSEMBLY INC., 8663 Tyler Blvd., Mentor, OH 44060, Tel: 216-255-7744, FAX: 216-255-5900; Empl.: 28

CADILLAC PLASTIC & CHEM. CO. DIV. OF M.A. HANNA, P.O. Box 7035, Troy, MI 48007-7035, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAD UTILITY CO., 21115 Devonshire St., Ste.318, Chatsworth, CA 91311, Tel: 805-527-8630, FAX: 805-526-5093; Empl.: 6; *Sls. Mgr.:* Stan Chambers

CAIG LABORATORIES, 16744 West Bernardo Dr., Rancho Bernardo, CA 92127-1904, Tel: 619-451-1799, FAX: 619-451-2799; Empl.: 15; *Sls. Mgr.:* Mark Lohkemper; *Dist. Mgr.:* Laurie Skultety

CAL-AV LABS, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-369-1000, FAX: 408-371-0672; Empl.: 5

CAL-CHIP ELECTRONICS, 69 Steam Whistle Dr., Ivyland, PA 18974, Tel: 215-953-9770

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Audrey Zarrow; *Dist. Mgr.:* Audrey Zarrow

CALEX MFG. CO., INC., 2401 Stanwell Drive, Concord, CA 94520, Tel: 510-687-4411, FAX: 510-687-3333; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Linda Hearne .... **D•1624, 2083-2089**

Local Distributors

OH	Richfield, Alpha Distr.	216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 10; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CALIFORNIA EASTERN LABS. INC., 4590 Patrick Henry Dr., Santa Clara, CA 95056-0964, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 118

California
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CALIFORNIA INSTRUMENTS CORP., 9025 Balboa Ave., San Diego, CA 92123-1509, Tel: 619-279-8620, 800-4AC-POWER; FSC No.: 16067; Empl.: 70; *Sls. Mgr.:* D.R. Chilcoat, G.R. Holland, G. Gartman .... **D•2250-2252**

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CA	Santa Clara, Tritek Solutions	408-554-0455
CO	Louisville, SDW Mountain States Reps	303-665-8089
FL	Clearwater, Beacon Microwave & Inst.	813-796-2378
GA	Norcross, Beacon Microwave & Inst.	404-449-8464
IL	Arlington Hts., Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assoc.	317-844-0114
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MD	Mt. Airy, Electronic Resources, Inc.	301-865-3771
MN	Minneapolis, Berndt Assoc.	612-546-2021
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Ridgefield Park, Sci. Dvcs., Inc.	201-440-3430
NM	Albuquerque, SDW Mountain States Reps	505-883-3668
NY	Rochester, Tae-Rep, Inc.	512-388-9961
NY	Whitney Pt., Tae-Rep, Inc.	607-692-3705
OH	Cincinnati, Dietrich & Assocs., Inc.	513-984-8924
OH	Cleveland, Dietrich & Assocs.,Inc.	216-642-7965
OR	Beaverton, Northwest Test & Meas.	503-645-9000
PA	Horsham, Sci. Dvcs., Inc.	215-956-0700
PA	Pittsburgh, Dietrich & Assocs., Inc.	412-892-2992
PA	West Chester, Electronic Resources, Inc.	215-431-0198
RI	Narragansett, PAT Assocs.	401-783-9598
TX	Austin, Sci. Dvcs. SW	512-338-9961
TX	Richardson, Sci. Dvcs. SW	214-231-8106
VA	Harrisonburg, Electronic Resources, Inc.	703-289-5571
WA	Bellevue, N.W. Test & Measurement	206-881-8857
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400
Can	Downsview, Ont., Testforce Sys., Inc.	416-398-1375
Can	N. Vancouver, B.C., Jerome & Francis Co., Ltd.	604-986-1286
Can	St. Laurent, Que., TestForce Sys., Inc.	514-856-0970

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214, FAX: 408-263-7846; FSC No.: 56427; Empl.: 180; *Sls. Mgr.:* Ted Beloin; *Dist. Mgr.:* Ashok Chalaka

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CO	Monument, Pinnacle Sls.	719-488-9097
FL	Boca Raton, Tech. Sls. Specs.	407-391-3718
GA	Lawrenceville, WLA & Assocs.	404-339-9443
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Indianapolis, CC Electro Sls.	317-921-5000
IN	Minneapolis, Intl. Elec.	612-571-0000
MD	Columbia, Delta III	410-730-4700
MA	Hudson, Compak, Inc.	508-568-0331
MI	Detroit, CC Electro Sls.	313-455-0000
NM	Albuquerque, Techni-Source Corp.	505-268-4232
NY	Hicksville, J-Square Mktg.	516-935-3200
NC	Raleigh, WLA & Assocs.	919-231-9939
OH	Cleveland, CC Electro Sls.	216-228-4338
OR	Beaverton, Elctrn. Sources	503-627-0838
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Dallas, Innovative Tech. Sls.	214-699-3485
UT	Salt Lake City, Pinnacle Sls.	801-264-8366
VA	Midlothian, Delta III	804-379-1816
WA	Belleview, Elctrn. Sources	206-451-3500

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AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep. Tech. Sls.	619-941-0558
CA	San Gabriel, Calmark Corp.	818-287-0451
CA	Sunnyvale, Calmark Corp.	408-737-0123
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Woodbridge, Golten Assoc.	708-985-5100
IA	Blue Grass, Rothkopf & Assoc.	319-381-4396
KS	Olathe, Rothkopf & Assoc.	913-829-8897
MD	Towson, Dalbrook Corp.	410-296-3165
MA	Norwood, Tom Maguire Assoc.	617-551-0500
MI	Brighton, W.R.Hummon	313-486-5333
MN	St. Paul, Innovate Sls.	612-225-9772
MO	St. Louis, Rothkopf & Assoc.	314-961-4485
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elect.	516-349-1600
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Miamisburg, Electronics Comps., Inc.	513-866-3340
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Lansdale, Dalbrook Corp.	215-362-8033
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Richardson, Zonk Assocs.	214-238-7651
VA	Fredericksburg, Dalbrook Corp.	703-786-0335
WA	Snohomish, Unicomp, Inc.	206-568-0511
EXP	Ireland/Cappoquin, Calmark Ireland, Ltd.	353-58-54205
EXP	San Gabriel, CA, Calmark Corp.	818-287-0451
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

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CA	Fremont, Connex Elctrns.	510-656-7722
CA	San Jose, Rose Elctrns.	408-263-9700
CO	Denver, Solder Tec.	303-623-5000
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MD	Beltsville, Petricko, Inc.	301-937-4960
MA	Haverhill, Webb Distbn.	508-374-0100
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Nutley, Nationwide Circuit Prod.	201-667-1333
NM	Albuquerque, Betatron	505-821-1122
NY	Elmsford, Multimetrics Co.	914-347-3667
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TX	Richardson, Zec Sls.	214-669-0895
UT	Salt Lake City, Standard Supply	801-486-3371
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

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CAL-SCOPE, Exceltron Inc., 473-707 Macara Ave., Sunnyvale, CA 94086, Tel: 408-730-4573, 1-800-828-3547, FAX: 408-730-9537; Empl.: 4; *Sls. Mgr.:* Michi A. Kawaguchi

CAL-TEK ENGINEERING, 36 Riverside Drive, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

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CAMBRIDGE TECHNOLOGY, INC., 23 Elm Street, Watertown, MA 02172, Tel: 617-923-1181, FAX: 617-924-8378; Empl.: 33; *Sls. Mgr.:* Jack Kelley

C.A.M. GRAPHICS CO., INC., 15 Ranick Dr. W., Amityville, NY 11701, Tel: 516-842-3400, FAX: 516-842-1005; FSC No.: 63203; Empl.: 50; *Sls. Mgr.:* Karen Henderson

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CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
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CA	San Diego, Luscombe Eng.	619-689-0018
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Hartford, D.A. Crowley & Assoc.	203-727-9007
FL	Altamonte Springs, DHR Mktg., Inc.	407-331-1199
FL	Lauderhill, DHR Mktg., Inc.	305-742-7555
FL	Tampa, DHR Mktg., Inc.	813-987-2950
GA	Duluth, DHR Mktg., Inc.	407-331-1199
IL	Elk Grove Vlg., Control Sls.	708-595-2110
IA	Cedar Rapids, Rep Assoc. Corp.	319-373-0152
KY	Louisville, Bromberg & Assoc.	502-456-1498
MN	Eden Prairie, Electro Mark	612-944-5850
MS	Pascagoula, DHR Mktg., Inc.	601-769-1122
MO	Bridgeton, Cen Tech, Inc.	314-291-4230
MO	Raytown, Cen Tech, Inc.	816-358-8100
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NM	Albuquerque, Reptronix	505-292-1718
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NY	Syracuse, L.D. Allen, Inc.	315-437-8387
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NC	Statesville, DHR Mktg., Inc.	704-872-0242
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PA	Wayne, Quality Comps.	215-687-3553
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-690-0870
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Austin, R. F. Kimball Co., Inc.	512-443-5284
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
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CAPACITOR TECHNOLOGY PRODUCTS, INC., 5015 Speedway Dr., Ft. Wayne, IN 46825, Tel: 219-484-9054, FAX: 219-484-8275; *Sls. Mgr.:* Kevin Kurtz

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CAPEWELL COMPONENTS, 46 Nooks Hill Rd., Cromwell, CT 06416, Tel: 203-635-4045, FAX: 203-635-3631; Empl.: 55; *Sls. Mgr.:* Chris Haelsen

CAPINTEC INSTRUMENTS, 6 Arrow Rd., Ramsey, NJ 07446, Tel: 201-825-9500, TELEX: 642375, FAX: 201-825-1336; FSC No.: 6666;6685; Empl.: 150; *Sls. Mgr.:* Eric Weis; *Dist. Mgr.:* Robert Kanzler

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PA	Southampton, Campbell Assoc.	215-322-6630

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CARDON CORP., 222 Berkeley St., Boston, MA 02116, Tel: 617-267-1760, FAX: 617-267-4621; Empl.: 10

CAREY ELECTRONICS ENGINEERING CO., 1880 Clifton Ave., Springfield, OH 45505, Tel: 513-323-6300; Empl.: 10-25

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CARISTRAP INTERNATONAL, INC., 1760 Fortin Blvd., Chomedey, Laval, Quebec, Canada H7SIN8, Tel: 1-800-361-9466, TELEX: 05-24463; FSC No.: 05-24463;;;514-663-1520; Empl.: 50; *Sls. Mgr.:* Audrey Karass; *Dist. Mgr.:* Audrey Karass

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MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MN	Crystal, Technical Comp.	612-561-5556
MN	Farmington Hills, R.C. Merchant	313-476-4600
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NJ	Burlington, VDE Elctrns.	609-387-9331
NJ	Eatontown, Pacent Engrg.	908-264-2202
NY	Great Neck, Pacent Engrg.	516-482-4678
NY	Rochester, Application Specialists	716-586-6226
NC	Siler City, Crossroads Elctrns. Assoc.	919-742-2372
OH	Columbus, Gerry Bryant	614-870-7338
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CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Carlos, Campbell & George	415-594-1994
CA	San Diego, Cal Switch	619-231-6740
CA	San Diego, Control Design	619-457-9822
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CT	Hartford, Wes-Garde Comps.	203-527-7705
CT	Wallingford, Sager Elec. Supp.	203-265-4600
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Orlando, Sager Elec. Supp.	407-240-3114
ID	Boise, Radar Elec.	208-336-2227
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
IL	Chicago, Leeds-Electro Comp.	312-625-3800
IL	Chicago, Newark Elctrns.	800-367-3573
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Davenport, Industrial Eng. Supp.	319-323-9721
KS	Overland Park, Wes-Garde Comps.	913-266-2718
LA	Shreveport, Carlton Bates Co.	318-636-9975
MD	Columbia, Sager Elec. Supp.	410-995-4900
MD	Jessup, Treeko Sls., Inc.	1-800-638-0582
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Stark Elctrns.	612-332-1325
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MO	St. Louis, Wes-Garde Comp.	314-567-7776
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NH	Salem, Sager Elec. Supp.	603-898-1348
NJ	Oakland, Relay Specialties	201-337-1000
NY	Hauppauge, Sager Elec. Supp.	516-348-1300
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Woodside, Switches Unltd.	718-478-5000
NC	Raleigh, Sager Elec. Supp.	919-850-9550
OH	Cincinnati, Schuster	513-489-1400
OH	Twinsburg, Schuster	216-425-8134
OH	Westerville, Wes-Garde Comps.	614-885-0319
OK	Oklahoma City, Carlton Bates Co.	405-681-4446
OK	Tulsa, Carlton Bates Co.	918-250-1626
OR	Portland, Radar Elec. Co.	503-232-3404
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
PA	Mars, Sager Elec. Supp.	412-772-2233
PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, Sager Elec.	215-464-4336
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comps.	214-357-1768
TX	Ft. Worth, Allied Elctrns.	817-595-3500
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WA	Seattle, Radar Elec.	206-282-2511
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PA	Emmaus, Castall	215-965-2911
TX	Spring, Castall	713-320-2445

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CO	Palisade, Jay-Max Sls.	303-464-5880
FL	Longwood, Merit Fasteners Corp.	407-331-4815
GA	Conyers, Gateway Indl. Supp.	412-745-7900
GA	Norcross, Georgia Indl. Fasteners	404-448-6375
IL	Alsip, M & E Comps.	708-396-0700
IL	Crystal Lake, Sub-Sem Inc.	815-459-4139
IN	Ft. Wayne, Wayne Fasteners Inc.	219-484-0393
MD	Baltimore, Whitney Distrs., Inc.	301-944-8080
MI	Kentwood, Select Fasteners Fast, Inc.	616-698-1000
MN	Minneapolis, Patton Indl. Prods., Inc.	612-944-9120
MS	Jackson, Sunbelt Bolt & Screw Co., Inc.	601-354-4215
OH	Solon, Fasteners Tool & Supp.	216-248-2710
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OR	Beaverton, Oregon Connector Co.	503-628-1600
PA	Huntingdon Valley, Plastic & Metal Prods. Corp.	215-322-2000
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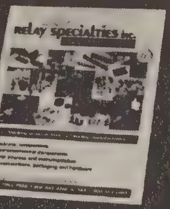

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NJ	Teaneck, DC Assocs.	201-692-7924

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CA	Los Angeles, Peripheral Resources	310-552-3888
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IN	Indianapolis, Metropolitan Sls.	800-262-9994
NY	Hewlett, Metropolitan Sls.	516-599-7900
TX	Dallas, Omini-Pro Elctrns.	214-713-9000
TX	Dallas, R Squared Elctrns.	214-406-1117
TX	Houston, R. Squared	713-820-3210
Can	Concord, CBC	416-660-1616
Can	Ottawa, Prime Peripherals	613-723-3111
Can	Ottawa, Ont, Prime Peripherals	613-782-2430
Can	St. Laurent, Que, Prime Peripherals	514-956-7553
Can	Toronto, TLS	416-479-1911

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FAX: 516-582-4922

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FAX: 215-363-8719

CELL-CON, INC., 305 Commerce Dr., Exton, PA 19341, Tel: 215-363-8552; Empl.: 14; *Sls. Mgr.:* Gene Kiley Jr. .... **D•1431-1433**

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Local Distributors

PA	Bensalem, Scott's Emergency Lighting	215-639-1777

CENTECH CORPORATION, 200 W. 88th St., Minneapolis, MN 55420, Tel: 612-881-8245, TWX: 431-0015-L8M, FAX: 612-881-4137

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 14; *Sls. Mgr.:* A. Freimanis

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CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, FAX: 217-359-6904; Empl.: 50; *Sls. Mgr.:* Earl D. Jacobsen; *Dist. Mgr.:* Avon Morgan

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CA	Newbury Pk., Centronic, Inc., E-O Comps. Div.	805-499-5902

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CA	San Jose, Exxus	408-249-3526
CO	Golden, J. F. Hurlbut Co.	303-279-7796
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KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, Wafer, Spindler & Assoc.	410-744-1133
MA	Plymouth, DC Assoc.	617-585-5085
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Teaneck, DC Assocs.	201-692-7924
NY	E. Syracuse, R.M. Scanlon Assoc.	315-463-7682
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PA	Willow Grove, Tech. Sls. Assoc.	215-784-0170

TX	Dallas, THT Sls.	214-783-1501
WA	Seattle, J.J. Assocs.	206-246-6619

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CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 919-342-2381, TELEX: 574493, FAX: 919-342-4012; Empl.: 200; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 4201 Business Center Dr., Fremont, CA 94538, Tel: 510-683-8554, FAX: 510-683-3848; *Sls. Mgr.:* John Levin

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CA	San Jose, Kottmeier Assocs.	408-371-8700
FL	Orlando, Comp. Design Mkt.	407-240-3903
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Glen Ellyn, Lincoln Hodges	708-469-6750
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MN	Bloomington, Horizon	612-884-6515
CO	Littleton, Contec Mktg., Inc.	303-973-8490
NY	Great Neck, Trionic Assoc.	516-466-2300
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, Sunbelt Comps.	214-248-8000
Can	Brampton, Ont., Cantec Reps. Inc.	416-791-5922
WA	Redmond, Electronic Mktg. Grp.	206-882-0962
IL	Franklin Pk., Champion Technlgs.	708-451-1000

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CA	Reseda, Jan Dvcs.	818-708-1100
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IL	Palatine, OHM Elctrns.	708-359-5500
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CHATSWORTH DATA CORPORATION, 20710 Lassen St, Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 80; *Sls. Mgr.:* Hank Boehm .... **D•1243**

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CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

FAX: 714-838-4742

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IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
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NJ	Lawrenceville, DVS Co.	609-896-1112
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OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
OR	Beaverton, R-Tron	503-645-4323
PA	Allison Pk., Geotronix, Inc.	412-487-1770
TX	Dallas, Richmar Elctrns.	214-424-8388
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CA	San Jose, O'Donnell Assocs. N., Inc.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Orlando, So. Atlantic Comp. Sls.	407-857-3650
GA	Norcross, So. Atlantic Comp. Sls.	404-447-6154
IL	Schaumburg, Martan, Inc.	708-303-5660
IL	Waukegan, Cherry Elctrl. Prods.	708-662-9200
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, Cherry Elctrl. Prods., Automotive	313-477-4477
MI	Kentwood, Miltimore Sls., Inc.	616-554-9292
MI	Novi, Miltimore Sls., Inc.	313-349-0260
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NC	Raleigh, So. Atlantic Comp. Sls.	919-859-9970
OK	Catoosa, Comptech Sls., Inc.	918-266-1966
OR	Portland, Venture Elctrns.	503-624-0617
TX	Austin, Comptech Sls., Inc.	512-343-0300
TX	Houston, Comptech Sls., Inc.	713-492-0005
TX	Irving, Comptech Sls., Inc.	214-751-1181
VA	Chantilly, Colrud Corp.	703-904-0240
WA	Bellevue, Venture Elctrns.	206-454-4594
Can	Calgary, Alberta, r.n. Longman Sls., Inc.	403-295-6324
Can	Kirkland, Que., r.n. Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., r.n. Longman Sls., Inc.	416-670-8100
Can	Neapean, Ont., r.n. Longman Sls., Inc.	613-564-0100

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Time Elctrns.	205-721-1134
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	San Jose, Powell Elctrns.	408-943-9020
AZ	Tempe, L Comp, Inc.	800-325-1393
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Gardena, Cal Switch	310-770-2330
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Sacramento, Integrated Elec.	916-363-6030
CA	San Diego, Time Elctrns.	619-674-2800
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Colorado Springs, Avnet/Ampex Store	719-637-0055
CO	Denver, Integrated Elec.	303-292-6121
CO	Denver, Newark Elctrns.	303-757-8531
CO	Englewood, Time Elctrns.	303-721-8882
CT	Hartford, Wes-Garde Comps. Grp.	203-527-7705
CT	Wallingford, G.R.S. Midan Elec. Inc.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Reptron Elctrns.	305-979-8227
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Lakeland, Wes-Garde Comps. Grp.	813-644-7564
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, Time Elctrns.	407-841-6565
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Sager Elctrns.	404-446-0085
GA	Norcross, Time Elctrns.	404-368-0969
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Bell Inds./Graham	317-875-8200
IN	Indianapolis, PEI Genesis Elec.	317-328-0700
IN	South Bend, PEI Genesis Elect.	219-287-2911
IA	Cedar Rapids, Advent Elec., Inc.	319-363-0221
GA	Norcross, Reptron Elctrns.	404-446-1300
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Columbia, Sager Elctrns. Inc.	301-995-4900
MD	Columbia, Time Elctrns.	301-964-3090
MD	Savage, Pyttronic Inds., Inc.	301-792-0780
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Peabody, Time Elctrns.	508-532-6200
MI	Livonia, Reptron Elect., Inc.	313-525-2700
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Kansas City, L Comp, Inc.	816-241-0111
MO	Manchester, Time Elctrns.	314-391-6444
MO	Maryland Hgts., L Comp, Inc.	314-291-6200
MO	St.Louis, Wes-Garde Comps. Grp.	314-567-7776
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Little Falls, Powell Elctrns., Inc.	201-890-0010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Specs.	800-526-5376
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Buffalo, Summit Dists.	716-887-2800
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hauppauge, Time Elctrns.	516-434-3344
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Summit Dists.	716-334-8110
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Cary, Powell Elctrns.	919-467-1212
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Raleigh, Time Elctrns.	919-847-9650
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Akron, Aesco Elctrns. Comps.	216-762-8818
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Bell Inds.	513-435-5922
OH	Dayton, Stotts Friedman	513-298-5555
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Integrated Elec.	503-641-1690
OR	Portland, Radar Elec.	503-232-3404
OR	Portland, Tek-Elec.	503-246-5451
OR	Portland, Time Elctrns.	503-626-2979
PA	Mars, Sager Elctrns.	412-772-2233
PA	Montgomeryville, Pyttronics Inds., Inc.	215-643-2850
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, PEI Genesis Elect.	800-523-0727, 800-222-1772
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Wes-Garde Comps.	214-357-1768
TX	Ft. Worth, Allied Elctrns., Inc.	817-595-6477
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Newark Elctrns.	713-270-4800
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Southwest Elec., Inc.	713-240-4000
UT	Salt Lake City, Stand. Supp. Co.	801-486-3371
UT	W. Valley City, Integrated Elctrns.	801-977-9750
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Bellevue, Integrated Elctrns., Inc.	206-455-2727
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Waukesha, Hawk Elctrns.	414-547-4457
Can	Burnaby, B.C., ITT/Rae Ind. Elect.	604-291-8866
Can	Calgary,Alberta, ITT/Rae Ind. Elect.	403-273-2780
Can	Concord, Ont., ITT/RAE Ind. Elect.	416-798-4884
Can	Don Mills, Ont., Saynor Varah, Inc.	416-445-0723
Can	London, Ont., Saynor Varah Inc.	519-649-1414

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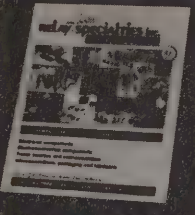

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CHESSELL EUROTHERM, EUROTHERM, INTL., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, FAX: 215-968-0662; Empl.: 82; *Sls. Mgr.:* Howard Sherer; *Dist. Mgr.:* Howard Sherer

CHESTEC CORPORATION, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700, FAX: 516-883-7155; Empl.: 3; *Sls. Mgr.:* J.P. Schindler

CHESTERFIELD PRODUCTS, INC., Microwave Filter Co., Inc., 6743 Kinne St, East Syracuse, NY 13057, Tel: 800-666-9655, 315-463-2309, FAX: 315-463-1467; *Sls. Mgr.:* Marian Frair .... **A•1655**

Local Sales Offices & Reps

CA	Carlsbad, MTM Intl., Inc.	619-729-6338
IL	Chicago, Tech. Sls.	312-237-7210
MD	Baltimore, Advanced Tech. Sls.	301-323-3140
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
NJ	Elmwood Park, L & M Assoc., Inc.	201-797-0441
NY	Syracuse, Microwave Filter Co., Inc.	315-437-3953

CHICAGO BLOWER CORP., 1675 Glen Ellyn Rd., Glendale Heights, IL 60139, Tel: 708-858-2600, ESYLNK: 62912209, FAX: 708-858-7172; Empl.: 250; *Sls. Mgr.:* R.W. Wessel

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070, FAX: 312-227-6646; FSC No.: 5910; *Sls. Mgr.:* Joan Looi ..... **A•1029**

CHICAGO LASER SYSTEMS, INC., 1798 Sherwin, Des Plaines, IL 60018, Tel: 708-827-9620, TELEX: 6505123515MCI UW, FAX: 708-827-9710; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, TELEX: ITT 4994023, FAX: 312-282-8199; Empl.: 300; *Sls. Mgr.:* William R. Shinn

CHIPS AND TECHNOLOGIES, INCORPORATED, 3050 Zanker Road, San Jose, CA 95134, Tel: 408-434-0600, TWX: 272929 CHIPS UR

CHIU TECHNICAL CORP., 252 Indian Head Rd., Kings Park, NY 11754, Tel: 516-544-0606, FAX: 516-544-0809; FSC No.: 38-32, 38-41; Empl.: 25; *Sls. Mgr.:* Frank A. Denny, V.P. Mktg.

CHLORIDE ELECTRO NETWORKS, Chloride Power Electronics, Inc., 1 Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; Empl.: 350; *Sls. Mgr.:* Gary Balfour

CHLORIDE EL PASO, Chloride Power Elctrns., 9-B Founders Blvd., El Paso, TX 79906, Tel: 915-592-9985, FAX: 915-595-1664; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Robin Lee

CHLORIDE POWER ELECTRONICS, One Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; FSC No.: 3698; Empl.: 300; *Sls. Mgr.:* Steve Olson

CHOMERICS, INC.:W.R. GRACE & CO., 77 Dragon Ct., Woburn, MA 01888, Tel: 617-935-4850, FAX: 617-933-4318; Empl.: 650; *Sls. Mgr.:* William Lionetta; *Dist. Mgr.:* William Flanders .... **C•1659-1661**

Local Sales Offices & Reps

AZ	Mesa, Chomerics	602-964-0771
CA	Carson, Chomerics	310-518-6921
CT	Trumbull, Chomerics	203-452-0253
FL	Longwood, Chomerics	407-876-5800
GA	Kennesaw, Chomerics	404-928-4243
IL	Chicago, Chomerics	708-458-0649
MA	Woburn, Chomerics	617-935-4850
NY	Bohemia, Chomerics	516-567-6186
NC	Greensboro, Chomerics	919-674-3144
OH	Beavercreek, Chomerics	513-427-0002
TX	Dallas, Chomerics	214-960-7236
WA	Seattle, Chomerics	206-624-3763
Can	Trenton, Ont., Chomerics	613-965-6161

Local Distributors

AZ	Phoenix, Cupps Indl. Supp.	602-869-0600
CA	Santa Clara, K.R. Anderson, Co.	408-727-2959
CO	Denver, R.S.I.	303-373-1812
CT	Bloomfield, E.I.S.	203-243-9440
FL	Orlando, E.I.S.	407-855-7100
GA	Atlanta, United Seal & Rubber	404-454-9912
IL	Hillside, E.I.S.	708-547-5400
MD	Baltimore, Sosco Corp.	301-574-7555
MA	N. Andover, Mktg. East	508-689-9565
MI	Mt. Clemens, E.I.S.	313-791-8510
MN	Mounds View, Indl. Gasket	612-785-2266
MO	Kansas City, E.I.S.	816-471-5966
NJ	Branchburg, Robert McKeown	201-218-9000
NY	Lancaster, Sealing Dvcs.	714-684-7600
OH	Chargin Falls, Electrolock	216-543-6626
OR	Portland, E.I.S.	503-227-3601
PA	Essington, Tri-Com, Inc.	215-521-3080
SC	Greenville, Electrolock	803-297-9830
TN	Memphis, E.I.S.	901-947-4176
TX	Dallas, Oriental Gasket	214-956-9100
UT	Salt Lake City, E.I.S.	801-483-1226
VA	Bluefield, E.I.S.	703-322-5424
WA	Tukwilla, E.I.S.	206-241-1010
WI	Mequon, Fabrico	414-241-5300
Can	Markham, Ont., Matrix Technlg.	416-477-4442

CHR, Furon, 407 East St., P.O. Box 1911, New Haven, CT 06509, Tel: 203-777-3631, FAX: 203-787-1725; Empl.: 116; *Sls. Mgr.:* James Drisoll, Natl. Sls. Mgr.; *Dist. Mgr.:* James Drisoll, Natl. Sls. Mgr.

CHRISTIANA INDUSTRIES CORP., 6500 North Clark, Chicago, IL 60626-4094, Tel: 312-465-6330, FAX: 312-465-6271; Empl.: 250; *Sls. Mgr.:* Mitchell J. Waters; *Dist. Mgr.:* Mitchell J. Waters

CHRISTIE ELECTRIC CORP., 18120 S. Broadway, Gardena, CA 90248, Tel: 310-715-1402, FAX: 310-618-8368; FSC No.: 02294; Empl.: 35; *Sls. Mgr.:* Scott Marvel

CHROMALOX INSTRS. & CONTROLS, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, TELEX: 55-5129, FAX: 615-793-3563; Empl.: 110; *Sls. Mgr.:* John Guthrie

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 800-247-6665, FAX: 215-853-3972; Empl.: 20; *Sls. Mgr.:* Kathy Jacobs .... **D•1151**

CHURCHILL CORP., 344 Franklin St., Box G, Melrose, MA 02176, Tel: 617-665-4700, FAX: 617-662-5291; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIC COMPONENTS INDS. CO., LTD., 4FL No. 5 Lane 130, Min-Chung Rd., Hsin Tien City, Taiwan R.O.C., Tel: 886-2-9174302, TELEX: 35261 MEISCO, FAX: 886-2-9124480; Empl.: 30; *Sls. Mgr.:* James Huang

CICOIL CORP., 24960 Ave. Tibbitts, Valencia, CA 91355-3428, Tel: 805-295-1295, FAX: 805-295-0813; Empl.: 75; *Sls. Mgr.:* James Alderson

CIDTEC (CID TECHNOLOGIES INC.), 101 Commerce Blvd., Liverpool, NY 13088, Tel: 315-451-9410, FAX: 315-451-9421

CIMCO WIRE & CABLE, INC., See Specialty Cable Corp.

CINCH CONNECTOR DIVISION, Labinal Components & Systems Inc., 1501 Morse Ave., Elk Grove Village, IL 60007, Tel: 708-981-6000, FAX: 708-981-1718; *Sls. Mgr.:* Bill Kysiak; *Dist. Mgr.:* Wes Walker

CINCH CYLINDRICAL DIVISION, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428, Tel: 612-537-1010, FAX: 612-537-9614; *Sls. Mgr.:* Jim Simmons; *Dist. Mgr.:* Scott Campbell

CINCINNATI ELECTROSYSTEMS, 502 Techne Center Dr., Milford, OH 45150, Tel: 513-831-6800, FAX: 513-831-4866; Empl.: 110; *Sls. Mgr.:* Brian Doherty

CINCINNATI SUB-ZERO PRODS., 12011 Mosteller Rd., Cincinnati, OH 45241, Tel: 513-772-8810, TELEX: 214390 SUBZERO CIN, FAX: 513-772-9119; Empl.: 117; *Sls. Mgr.:* Harold Zeilman

CIPHER DATA PRODUCTS, INC., an Archive Co., 10101 Old Grove Rd., San Diego, CA 92131, Tel: 619-578-9100, FAX: 619-693-4435; Empl.: 1500; *Sls. Mgr.:* Wes Bankston, VP Sls.

CIPRICO INC., 2800 Campus Drive, Plymouth, MN 55441, Tel: 612-551-4000, FAX: 612-551-4002; Empl.: 79; *Sls. Mgr.:* Stu Reille

CIRCOM INC., 505 W. Main St., Bensenville, IL 60106, Tel: 708-595-4460, FAX: 708-595-4615; Empl.: 38; *Sls. Mgr.:* R. Alan Rosenberg

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Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
AZ	Scottsdale, Avtec Earl & Assoc.	602-994-3813
CA	Irvine, Circuit Assembly	714-855-7887
CA	Santa Clara, Westrep	408-988-8833
CO	Englewood, ELCOM Inc.	303-792-3330
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
FL	Ft. Lauderdale, Tech-Rep Assoc., Inc.	305-791-2708
FL	Merritt Island, Tech-Rep Assoc., Inc.	407-453-3313
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IN	Carmel, Frank E. Kahsar Sls.	317-844-9353
MD	Baltimore, Eastern Comp. Sls.	410-788-7050
MA	Canton, The TMR Grp.	617-828-1848
MI	Muskegon, Frank E. Kahsar Sls.	616-798-4451
MI	Sterling Hts., Frank E. Kahsar Sls.	313-795-3530
MN	Osseo, Gaffney Sls., Inc.	612-425-5484
MO	Grandview, Harris Hanson Co.	816-763-6200
MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Berkeley Hgts., Cambridge Allen & Assoc.	201-464-0203
NM	Albuquerque, SynTech	505-266-7951
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, L & D, Inc.	919-876-5301
NC	Wilmington, L & D, Inc.	919-256-8110
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OH	Columbus, Frank E. Kahsar Sls.	614-252-4009
OH	Elyria, Frank E. Kahsar Sls.	216-365-5219
OR	Portland, General Elctrns.	503-297-8500
PA	Pittsburgh, Frank E. Kahsar Sls.	412-734-8797
TN	Bristol, L & D, Inc.	615-878-2266
TX	Plano, Connector Specialists	214-517-1207
WI	Milwaukee, LTD Technlgs., Inc.	414-774-1000

Local Distributors

AL	Birmingham, Newark Elctrns.	205-942-7003
AL	Huntsville, Component Distrs.	205-851-7800
AL	Huntsville, Newark Elctrns.	205-837-9091
AL	Huntsville, Powell Elctrns.	205-837-5300
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Newark Elctrns.	602-864-9905
AZ	Phoenix, Tri Tek	602-371-0860
AZ	Tucson, Newark Elctrns.	602-881-9001
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Irvine, Mann Southwest	714-380-4170
CA	Irvine, Powell Elctrns.	714-263-9363
CA	Los Angeles, All American	213-320-0240
CA	Milpitas, Newark Elctrns.	408-262-0121
CA	Orange, Newark Elctrns.	714-634-8224
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CO	Colorado Springs, Newark Elctrns.	719-576-2644
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FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
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FL	Miami, Electronic Equip.	305-526-6000
FL	Palm Bay, Component Distrs.	407-724-9910
FL	Plantation, Newark Elctrns.	305-424-4400
FL	Pompano Bch., Electronic Equip.	305-960-1200
FL	Tampa, Electronic Equip.	813-988-0810
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IA	Des Moines, Newark Elctrns.	515-222-0700
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FL	Altamonte Springs, Sls. Engrg. Concepts	407-830-8444
FL	Brooksville, C.P. Clare Corp.	904-596-5886
FL	Deerfield Beach, Sls. Engrg. Concepts	305-426-4601
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IL	Chicago, Indl. Reps., Inc.	708-967-8430
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
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MA	Tewksbury, Procomp Assoc.	508-858-0100
MI	Bloomfield, Schank Elctrn. Mktg.	313-644-8224
MI	Holland, Schank Elctrn. Mktg.	616-393-8924
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MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NJ	Ft. Lee, Nexus Technlg. Sls.	201-947-0151
NY	Rochester, Electra Sls. Corp.	716-427-7860
NY	Syracuse, Electra Sls. Corp.	315-463-1248
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CO	Englewood, Purdy Co. Assocs.	303-790-2211
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
GA	Shellville, South Tech.	404-978-3669
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, Needler Sls.	317-255-8056
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MA	Norwell, Norris & Assocs.	617-659-7988
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NH	Peterborough, Joe Phillips	603-924-3822
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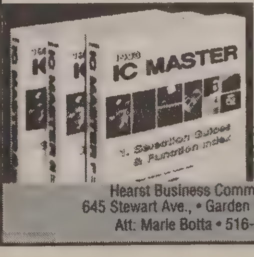

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KS	Overland Park, M.I.N.K. Assocs. Inc.	913-341-8309
MN	Plymouth, R.C.O.M., Inc.	612-557-2801
MO	Bridgeton, M.I.N.K. Assocs., Inc.	314-291-5454
IN	Frankfort, C-S Elctrn. Sls., Inc.	317-659-1874
NH	Nashua, Collmer Semiconductor, Inc.	603-880-7568
NY	Franklin Square, Cooper-Simon Emtec	516-489-0404
NC	Cary, Maxfield Engrd. Prods.	919-467-6444
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Greensburg, Collmer Semiconductor, Inc.	412-832-0166
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
WI	Waukesha, Collmer Semiconductor, Inc.	414-547-0185
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Mobile, Allied Elctrns.	205-476-1875
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Fremont, Allied Elctrns.	510-505-0220
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Rocklin, Allied Elctrns.	916-632-3104
CA	S. San Francisco, Allied Elctrns.	415-952-9599
CA	San Diego, Allied Elctrns.	619-279-2550
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CO	Littleton, Indelco	303-795-3431
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Jacksonville, Allied Elctrns.	904-739-5920
FL	Largo, Allied Elctrns.	813-541-4660
FL	Miami Lakes, Allied Elctrns.	305-558-2511
FL	Pompano Bch., Allied Elctrns.	305-978-3008
GA	Atlanta, Allied Elctrns.	404-612-9360
GA	Duluth, Allied Elctrns.	404-497-9544
IL	Libertyville, Allied Elctrns.	708-918-0250
IL	Oak Forest, Allied Elctrns.	708-535-0038
IL	Schaumberg, Marsh Elctrns.	708-240-9290
IL	Wood Dale, Allied Elctrns.	708-860-0007
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Carmel, Altex Elctrns., Inc.	317-848-1323
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MA	Norwood, Allied Elctrns.	617-255-0361
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Plymouth, Allied Elctrns.	313-416-9300
MN	Bloomington, Allied Elctrns.	612-881-0838
MN	Minneapolis, AEI Elctrns.	612-338-4754
MN	Minneapolis, Marsh Elctrns.	612-831-4840
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-697-0038
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Edison, Allied Elctrns.	908-572-9600
NJ	Moorestown, Allied Elctrns.	609-234-7769
NJ	Parsippany, Allied Elctrns.	201-428-3350
NY	Fairport, Allied Elctrns.	716-425-3850
NY	La Grangeville, Allied Elctrns.	914-452-1470
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Syracuse, Allied Elctrns.	315-463-2955
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Cincinnati, Allied Elctrns.	513-771-6990
OH	Solon, Allied Elctrns.	216-248-4200
OH	Worthington, Allied Elctrns.	614-785-1270
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Allied Elctrns.	503-252-0335
PA	Camp Hill, Allied Elctrns.	717-975-3570
PA	Pittsburgh, Allied Elctrns.	412-367-4124
SC	Greenville, Allied Elctrns.	803-288-8835
TN	Knoxville, Industrial Elctrns.	615-573-7135
TN	Memphis, Allied Elctrns.	901-367-2895
TX	Austin, Allied Elctrns.	512-219-7171
TX	Dallas, Allied Elctrns.	214-553-4370
TX	El Paso, Allied Elctrns.	915-779-6294
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Allied Elctrns.	713-455-3993
TX	Humble, Allied Elctrns.	713-446-8005
UT	Salt Lake City, Allied Elctrns.	801-261-5244
VA	Springfield, Allied Elctrns.	703-644-9515
VA	Virginia Bch., Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Tacoma, Allied Elctrns.	206-572-7745
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	New Berlin, Nep Elctrns.	414-785-9100

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Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg. Assocs.	415-948-2635
IA	Cedar Rapids, Wes Tech Assocs.	319-393-9790
KS	Overland Park, Omni Tech. Sls.	913-469-9688
MD	Kensington, Koebert Assocs. Inc.	301-493-8924
MA	Farmingham, Bengal Assocs.	508-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
MO	Lees Summit, Omni Tech Sls.	816-578-4221
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Smithtown, Koebert Assocs.	516-979-6683
OH	Dayton, Cel-Tronics	513-848-3282
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
VA	Alexandria, Koebert Assocs., Inc.	703-461-3655
WA	Snohomish, Unicomp, Inc.	206-568-0511

COLORADO DATA SYSTEMS, Tektronix, 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, 800-237-2831, TWX: 910-933-0193, FAX: 303-781-0253; Empl.: 80; *Sls. Mgr.:* Dave Fink

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-530-9580, FAX: 303-530-9569; *Sls. Mgr.:* Kirk Fowler

COLORGRAPHIC COMMUNICATIONS CORP., 5388 New Peachtree Road., Atlanta, GA 30341, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 25; *Sls. Mgr.:* Elyse Mintz

COLT ELECTRONICS CO., INC., 15301 West 109th St., Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; *Sls. Mgr.:* Michael S. Lynn

COLT TECHNOLOGY CORP., 15301 West 109th St., Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; Empl.: 95; *Sls. Mgr.:* Jeffrey S. Lynn

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., 1925 MacDade Blvd, Woodlyn, PA 19094, Tel: 215-872-3900, FAX: 215-872-3882; FSC No.: 07571; Empl.: 75; *Sls. Mgr.:* Robert R. Reymos

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-276-0861, TELEX: 246514, FAX: 614-276-0529; *Sls. Mgr.:* Jan Czekajewski

COMAIR ROTRON, A KLI Company, 2675 Customhouse Ct., San Ysidro, CA 92173, Tel: 619-661-6688, FAX: 619-661-1757; FSC No.: 5Y921; Empl.: 800; *Dist. Mgr.:* Ralph R. Stevens

COMATEL USA, INC., 22 Eagle Rd., Commerce Pk., Danbury, CT 06810, Tel: 203-797-9445, TELEX: 643-011, FAX: 203-790-9298; Empl.: 10; *Sls. Mgr.:* Tim Papp

COMCLOK, INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Audrey Zarrow; *Dist. Mgr.:* Audrey Zarrow .... **A•1349**

Local Sales Offices & Reps

CA	Arcadia, HMC	818-447-0958
CA	San Jose, Blue Elctrns. Sls.	408-248-4399

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 708-470-9600

COMLINEAR CORP., 4800 Wheaton Drive, Fort Collins, CO 80525, Tel: 303-226-0500, FAX: 303-226-0564; FSC No.: 62839; Empl.: 160; *Sls. Mgr.:* John Perzow; *Dist. Mgr.:* John Perzow

COMM CON CONNECTORS INC., 1848 Evergreen St., Duarte, CA 91010, Tel: 818-301-4200, FAX: 818-301-4212; Empl.: 13; *Sls. Mgr.:* Robert Farnum; *Dist. Mgr.:* James Orr .... **C•1289**

Local Sales Offices & Reps

AL	Huntsville, Effective Mktg. Force	205-233-2947
AZ	Scottsdale, Spectrum Mktg.	602-890-9000
AZ	Tempe, Elctrn. Tech. Sls.	602-921-7122
CA	Montrose, Signal Entprs.	818-957-0640
CA	Napa, Stewart/Fullerton Assoc.	707-258-1160
CO	Denver, Spectrum Mktg.	303-480-9991
CT	New Fairfield, Sales Engrg.	203-746-6905
GA	Atlanta, Effective Mktg. Force	404-948-6023
IL	Rockford, Rockford Controls	708-960-2447
NH	Salem, Sales Engrg.	603-893-5521
NC	Raleigh, Effective Mktg. Force	919-867-6221
OR	Portland, J.J. Backer Co.	206-285-1300
PA	Souderton, Intek Inc.	215-723-0433
TX	Plano, Aticus	214-964-0663
Can	Markham, Matrix Technlg. Ltd.	416-477-4442

Local Distributors

AZ	Phoenix, Be-Switched	602-275-4805
CA	Gardena, Cal Switch	213-538-9830
CA	Riverside, Elctrn Supp.	714-781-0453
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CT	Danbury, Heilind Elctrns	203-797-8600
GA	Norcross, Century Elctrns.	404-449-3424
IL	Chicago, Leeds Electro Comps.	312-625-3800
MA	Marlborough, NOW Elctrns.	508-460-0187
MA	Wilmington, Heilind Elctrns.	508-657-4870
MN	Plymouth, Leeds Electro Comps.	612-557-1277
NC	Raleigh, Century Elctrns.	919-782-2116
OK	Tusla, Radio Inc.	918-587-9123
PA	Norristown, Century Elctrns.	215-631-5400
WA	Lynwood, Oman & Assocs.	
WA	Vancouver, Interconnect Sls.	206-256-4085
WI	Milwaukee, Progressive Image	414-321-4722

COMMODORE SEMICONDUCTOR GROUP, 950 Rittenhouse Road, Norristown, PA 19403, Tel: 215-666-7950, FAX: 215-647-0791

COMMONWEALTH SPRAGUE CAPACITOR, INC., 11 Brown St., N. Adams, MA 01247, Tel: 413-664-4556, FAX: 413-663-9132

COMM/SCOPE, INC., Network Cable Div., P.O. Box 879, Claremont, NC 28610, Tel: 704-324-2200, 800-982-1708, TELEX: 802-166, FAX: 704-459-5099; *Sls. Mgr.:* Nita Hunsucker

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COMMUNICATION COIL INC., 2839 N. Narragansett Ave., Chicago, IL 60634, Tel: 312-637-1333; FSC No.: 81815; Empl.: 75; *Sls. Mgr.:* E. Goldman .... **A•1224, 1623, 2305**

Local Sales Offices & Reps

AZ	Peoria, SEM of Arizona	602-486-1191
CO	Denver, Lindberg & Co.	303-758-9033
FL	Melbourne, M.E.T. Assocs.	407-255-3733
IL	Chicago, CCI	312-637-1333
IL	Northbrook, H. Benjamin Assocs.	708-272-2900
IN	Ft. Wayne, Corrao-Marsh & Assoc.	219-482-2725
IA	Cedar Rapids, Wes-Tech Assoc.	319-393-9790
MA	Brookline, TPG Inc.	617-731-0858
OH	Dayton, Ashbacher & Assocs.	513-252-7785
UT	Salt Lake City, Lindberg & Co.	801-277-2643

COMMUNICATION DEVICES, INC., 1-130 McLevin Ave., Scarborough, Ont., CAN M1B3R6, Tel: 416-292-4463, TELEX: 065-25428, FAX: 416-292-4295; Empl.: 70

COMMUNICATIONS & ENERGY CORP., 7395 Taft Park Dr., E. Syracuse, NY 13057, Tel: 315-452-0709, FAX: 315-452-0732; Empl.: 16; *Sls. Mgr.:* Emily Bostick; *Dist. Mgr.:* Emily Bostick .... **A•1625**

For All U.S. Call: Communications & Energy Corp., 315-452-0709;FAX:315-452-0732

COMMUNICATIONS INSTRUMENTS, INC., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, Tel: 704-628-1711, FAX: 704-628-1439; FSC No.: 58614; Empl.: 385; *Sls. Mgr.:* R. McClinton; *Dist. Mgr.:* K. Jackson .... **B•1438-1448, 1628-1629**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AZ	Phoenix, Westrep	602-820-9962
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Denver, Con-Tek Mktg.	303-973-8490
CT	Torrington, Phoenix Sls.	203-496-7709
FL	Oviedo, Conley & Assocs.	407-365-3283
IL	Arlington Hts., MB Sls.	708-392-9499
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Cedar Rapids, C. H. Horn & Assocs. ..	319-393-8703
KS	Wichita, Baka	316-682-2166
MA	Needham, Component Technlg., Inc. ..	617-449-8490
MI	Grosse Pointe Park, Greiner Assocs., Inc.	313-499-0188
MN	North Mankato, El Sls.	507-345-5786
NY	Babylon, ASTROREP	516-422-2500
NY	Syracuse, M. M. Hare Co.	315-457-6859
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Vandalia, Stegman Blaine	513-890-7975
PA	Philadelphia, Tech. Sls. Assoc.	215-784-0170
TX	Dallas, Electra Reps	214-248-3852
WA	Seattle, Eclipse Mktg.	206-885-6991
Can	Don Mills, Ont., RD Assocs.	416-441-9667

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	San Diego, Time Elctrns.	619-578-2500
CA	Santa Ana, Norstan Elctrns.	213-924-7651
CA	Santa Monica, Master Elctrns.	213-452-1229
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-721-8882
CT	Enfield, Gemcap	203-745-3410
FL	Orlando, T & T Prods., Inc.	407-857-2282
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Peerless Radio	305-973-4141
GA	Norcross, Time Elctrns.	404-448-4448
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Schaumburg, Time Elctrns.	708-303-3000
KS	Wichita, Airtechnics	316-267-2849
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko	301-792-0112
MA	Peabody, Time Elctrns.	508-532-9900
MO	Manchester, Time	314-391-6444
MO	Maryland Heights, L Comp	314-291-6200
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Specialties	201-337-1000
NY	Centereach, Gemcap Comps.	516-331-0069
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Lynbrook, Peerless Radio	516-593-2121
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COMMUNICATIONS SYS. TECHNOLOGY, INC., 2018 Rhodes Street, Hermosa Beach, CA 90254, Tel: 213-374-3849; Empl.: 4; *Sls. Mgr.:* A.L. Perry

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Local Sales Offices & Reps

AL	Huntsville, EMA Inc.	205-837-7363
CA	Campbell, Senah	408-374-1031
CA	Westlake Village, CAL-Rep.	818-991-1940
GA	Atlanta, EMA Inc.	404-448-1215
MA	Haverill, L-K Assoc.	617-373-1313
MO	St. Louis, Abrams & Assocs.	314-569-0447
NC	Raliegh, EMA Inc.	919-847-8800
SC	Greenville, EMA Inc.	803-233-4637
TX	Dallas, Talo Products	214-644-6010
VA	Fairfax, Schibley Assocs.	703-591-3008

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg .... **D•2256**

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, FAX: 416-475-4158; Empl.: 36; *Sls. Mgr.:* Rick Lewis

COMPAS, 100 Chimney Point Dr., Ogdensburg, NY 13669, Tel: 315-393-3573, FAX: 315-393-7638; Empl.: 350; *Sls. Mgr.:* James L. Clare

COMPENSATED DEVICES INCORPORATED, 166 Tremont Street, Melrose, MA 02176, Tel: 617-665-1071, FAX: 617-665-7379; FSC No.: 55801; Empl.: 65; *Sls. Mgr.:* Tom Briand

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

COMPIX, INC., 15824 SW Upper Boones Ferry Rd., Lake Oswego, OR 97035-4066, Tel: 503-639-8496; Empl.: 14; *Sls. Mgr.:* James G. Walcutt-VP Sls. Mktg.

COMPONENT GENERAL, INC., 2445 Success Dr., Odessa, FL 33556, Tel: 813-376-6655, FAX: 813-372-9096; FSC No.: 61732; Empl.: 30; *Sls. Mgr.:* Thomas Floridio

Local Sales Offices & Reps

CA	Los Angeles, L & M Engrg. South	310-417-3044
CA	Mountain View, Bridge Mktg.	415-965-8045
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Merrimack, DBM Tech. Sls., Inc.	603-424-5700
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NY	Rye Brook, Tekmar Sls.	914-632-7464
TX	Dallas, Rep-Tec, Inc.	214-956-8700
EXP	Odessa, FL, Comp. Gen. Inc.	813-376-6655

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Wayne Douglas; *Dist. Mgr.:* Wayne Douglas

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 310-829-3615, FAX: 310-829-9584; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman .... **A•1030-1057**

Local Sales Offices & Reps

SC	Greenville, Walter Lamphier	803-232-4687

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* Fred Bielenberg

COMPONENTS ELECTRONICS CORP., 629A Lowther Rd., Lewisberry, PA 17339, Tel: 717-938-4151, FAX: 717-938-5910; Empl.: 45; *Sls. Mgr.:* J.Galli; *Dist. Mgr.:* J.Galli

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPTUS INC., 342 Lyndeboro Rd., New Boston, NH 03070, Tel: 603-487-5512, FAX: 603-487-5513; Empl.: 5; *Sls. Mgr.:* Leander Nichols; *Dist. Mgr.:* Leander Nichols

COMPUCART, Versa Tec, P.O. Box 2095, Tampa, FL 33601-2095, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPUCRAFT FABRICATORS INC., 669 Mary St., Warminster, PA 18974, Tel: 215-443-7107, FAX: 215-443-7195; FSC No.: 76977; Empl.: 18; *Sls. Mgr.:* Stephen Dalton

COMPUMOTOR DIVISION, Parker Hannifin Corp., 5500 Business Park Dr., Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015; Empl.: 150; *Sls. Mgr.:* A. Statz; *Dist. Mgr.:* A. Statz

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COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard .... **D•1172-1175**

Local Sales Offices & Reps

MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Neewport, Industrial Sensors Inc.	313-383-8300
NY	Moravia, Electrotech Sys.	315-497-1598
NC	Charlotte, Motion Technology	704-525-9855
OH	Cincinnati, Rilco	513-271-0630
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Bedford, Automated Dynamics	817-267-5716
UT	Salt Lake City, Protronix	804-265-9105
Can	Downsview, Electromate Ind. Sls.	416-665-0221

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, FAX: 508-667-8561; Empl.: 13; *Sls. Mgr.:* Sandra R. Clark

COMPUTER DOCTORS, 9204-B Baltimore Blvd., College Park, MD 20740, Tel: 1-800-RAM-STAR, 301-474-3095, FAX: 301-474-0805

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29650, Tel: 803-877-8700, FAX: 803-879-2030

COMPUTER INSTRUMENTS CORP., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 40

COMPUTER INSTRUMENTS DIV., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 42; *Sls. Mgr.:* Brian Peskin

COMPUTER KEYBOARD SYSTEMS, 1640 Fifth Street, Ste. 224, Santa Monica, CA 90401, Tel: 310-395-4639, FAX: 310-393-6040; Empl.: 25; *Sls. Mgr.:* Trevor Bray; *Dist. Mgr.:* Trevor Bray

COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 908-638-8000, 800-526-5088, FAX: 908-638-4931; FSC No.: 3643; Empl.: 170; *Sls. Mgr.:* Leslie P. Listwa; *Dist. Mgr.:* Todd Smith

CPS

FAX: 503-684-8164

COMPUTER POWER SUPPLIES (CPS), 15800 Upper Boones Ferry Rd., #150, Lake Oswego, OR 97035, Tel: 503-684-8026; *Sls. Mgr.:* Clifford Gaw

COMPUTER PRODUCTS, INC, Process Automation, 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, FAX: 305-979-7371; Empl.: 150; *Sls. Mgr.:* Jack Sloan, VP Sls.

COMPUTER PRODUCTS

POWER CONVERSION

FAX: 617-464-6612

COMPUTER PRODUCTS/POWER CONVERSION AMERICA, 7 Elkins Street, So. Boston, MA 02127, Tel: 800-733-9288, 617-464-6600; FSC No.: 62125; Empl.: 1050; *Dist. Mgr.:* Jim O'Sullivan, VP Distbn. & Sls. .... **D•1486, 1631-1635, 2048, 2090-2095**

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg	602-488-0750
CA	Encinitas, Jones & McGeoy Sls.	619-753-6784
CA	San Diego, Jones & McGeoy Sls.	714-756-6269
CA	Santa Ana, Jones & McGeoy Sls.	714-547-6466
CA	Santa Clara, Criterion Sls.	408-988-6300
CO	Aurora, Electrodyne	303-695-8903
FL	Altamonte Springs, Electra Mark	407-830-0844
FL	Plantation, Electra Mark	305-452-2872
FL	Tampa, Electramark	813-962-1882
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Itasca, Janus, Inc.	708-250-9650
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-tronix, Inc.	913-339-6333
KS	Wichita, Dy-tronix, Inc.	316-838-0884
MD	Columbia, Third Wave Solutions, Inc.	410-290-5990
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MA	North Reading, Alpha Omega Sls.	508-664-1118
MN	Edina, Mel Foster	612-944-3456
MO	Bridgeton, Dy-tronix, Inc.	314-291-4777
NJ	Cherry Hill, Tritek	609-667-0200
NM	Albuquerque, C.T. Carlberg	505-899-2155
NY	Rochester, Empire Tech	719-381-8500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Skanealeles, Empire Tech	315-685-5703
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433
OH	Cleveland, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, Ammon & Rizos	918-749-6116
OR	Beaverton, Micro Sls., Inc.	503-645-2841
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Bellevue, Micro Sls., Inc.	206-451-0568
WI	Delafield, Janus, Inc.	414-646-5420
Can	Montreal, Electro Source	514-630-7486
Can	Ottawa, Ont., Electro Source	613-592-3214
Can	Toronto, Electro Source	416-675-4490

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Marshall Inds.	602-496-0290
CA	Calabasas, Marshall Inds.	818-878-7000
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Capstone	714-587-0638
CA	Irvine, Marshall Inds.	714-458-5380
CA	Irvine, Milgray	800-466-9277
CA	Milpitas, Marshall Inds.	408-943-4600
CA	N. Hollywood, B. J. Wolfe Entprs.	213-877-5518
CA	Sacramento, Marshall Inds.	916-635-9700
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, B.J. Wolfe Entprs.	408-371-3443
CA	San Jose, Capstone Elctrns.	408-453-9804
CO	Denver, Capstone Elctrns.	303-451-8383
CO	Denver, Marshall Inds.	303-451-8383
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Atlanta, Marshall Inds.	404-923-5750
GA	Atlanta, Milgray	800-241-5523
IL	Chicago, Capstone Elctrns.	708-250-0300
IL	Chicago, Marshall Inds.	708-490-0155
IL	Chicago, Milgray	800-322-6271
IN	Indianapolis, Marshall Inds.	317-297-0483
KS	Kansas City, Marshall Inds.	913-492-3121
KS	Kansas City, Milgray	800-255-6576
MD	Columbia, Capstone	609-596-7500
MD	Columbia, Milgray	800-638-6656
MD	Silver Springs, Marshall Inds.	301-622-1118
MD	Spencerville, United States Elctrns.	301-384-3300
MD	Spencerville, US Elctrns.	301-384-3300
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Winchester, Webb Distbn.	617-729-6839
MI	Detroit, LWC Distrs.	313-464-7700
MI	Detroit, Marshall Inds.	313-525-5850
MN	Minneapolis, Capstone	612-250-0300
MN	Minneapolis, Marshall Inds.	612-559-2211
MO	St. Louis, Marshall Inds.	314-291-4650
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Milgray	800-257-7111
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Milgray	800-622-0291
NY	Farmingdale, Milgray	800-645-4729
NY	Rochester, Marshall Inds.	716-235-7620
NY	Syracuse, Marshall Inds.	607-785-2345
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Cleveland, Electronic Mktg. Corp. (EMC)	800-366-3625
OH	Cleveland, Marshall Inds.	216-248-1788
OH	Columbus, Elctr. Mktg. (EMC)	800-366-3621
OH	Dayton, Marshall Inds.	513-898-4480
OH	Westerville, Marshall Inds.	614-891-7581
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Philadelphia, Century Elctrn. Comps.	215-631-5400
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Dallas, Marshall Inds.	214-233-5200
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Marshall Inds.	713-467-1666
TX	Houston, Milgray	800-962-1849
TX	Houston, Norvell Elctrns.	713-777-1666
UT	Salt Lake City, Marshall Inds.	801-485-1551
UT	Salt Lake City, Milgray	800-537-9739
WA	Seattle, Almac Elctrns.	206-643-9992
WA	Seattle, Marshall Inds.	206-486-5747
WA	Spokane, Almac Elctrns.	509-924-9500
WI	Milwaukee, Marshall Inds.	414-797-8400
Can	Brampton,Ont., Marshall Inds.	416-458-8046
Can	Calgary, Alb., Zentronics	403-295-8838
Can	Mississauga, Ont., Capstone Elctrns.	416-670-2010
Can	Mississauga, Ont., Zentronics	416-451-9600
Can	Montreal, Que., Zentronics	514-737-9700
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Pointe Claire, Que, Marshall Inds.	514-694-8142
Can	Richmond, B.C., Zentronics	604-273-5575

COMPUTER PRODUCTS/POWER CONVERSION, See Power Conversion America, Computer Prods.Inc.

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 90; *Sls. Mgr.:* Mick Maher; *Dist. Mgr.:* Mick Maher

COMPUTER SYSTEMS TECHNICAL SUPPORT, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; FSC No.: 9J740; Empl.: 13; *Sls. Mgr.:* Reuven Arad

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22182-2266, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, FAX: 913-829-0810; Empl.: 27; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTRON DISPLAY SYSTEMS, Excel Corporation, 835 Bonnie Lane, Elk Grove Village, IL 60007, Tel: 708-952-8800, FAX: 708-952-0232; Empl.: 100; *Sls. Mgr.:* W. Miller .... **B•1035**

Local Sales Offices & Reps

CA	Ontario, Xcel Corp.	909-391-4321
CA	San Diego, El-Com	619-578-0900
CO	Littleton, Romulus	303-770-4888
FL	Margate, EPM Corp.	305-977-0331
IL	Palatine, Technlg. Sls.	708-991-6600
MI	Troy, C.B. Jensen & Assoc.	313-643-0506
NJ	Hasbrouk Hgts., Comp-Tech	201-288-7400
NJ	Hasbrouk Hgts., Tory Sls.	201-288-5656
NJ	Toms River, Xcel Corp.	908-830-7525
NY	Rochester, Apex	716-272-7040
OH	Cleveland, Xcel Corp.	216-239-4998
OR	Beaverton, J.J. Backer	503-627-0775
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Richardson, Pro-Comp	214-669-1500
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Jose, Powell Elctrns	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Elctrns./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
MD	Columbia, Powell Elctrns.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	W. Borough, Powell Elctrns.	617-336-6100
MI	St. Clair Shores, Specialties Mktg.	313-771-2700
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Comp. Distrs,	919-834-9465

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy N.S. 141, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 3; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

COMSTRON A DIV. OF AEROFLEX, 35 S. Service Road, Plainview, NY 11803, Tel: 516-752-2351, TWX: 310-497-3525, FAX: 516-694-6771; Empl.: 120; *Sls. Mgr.:* William J. Meditz

COMTECH MICROWAVE CORP, Comtech Telecommunications Corp., 105 Baylis Rd., Melville, NY 11747, Tel: 516-777-8900, FAX: 516-777-8877; FSC No.: 31196; *Sls. Mgr.:* B. Diers

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Robert Green

COMUS INTERNATIONAL, 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-667-6200, 1-800-35-COMUS, FAX: 201-667-6837; *Sls. Mgr.:* Gene Moran .... **B•1449, 1700**

Local Sales Offices & Reps

MA	Sharon, Adcour	617-784-8123

Local Distributors

MA	Sharon, Adcour	617-784-8123,FAX:617-784-5563

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, FAX: 716-372-1594; Empl.: 135

CONAX BUFFALO CORPORATION, 2300 Walden Ave., Buffalo, NY 14225, Tel: 716-684-4500, FAX: 716-684-7433; FSC No.: 03688; Empl.: 190; *Sls. Mgr.:* R.C. Paluch

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: MFR 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton .... **C•1290-1291, 1540**

Local Distributors

AL	Huntsville, Century Fasteners	205-883-5344
AZ	Tucson, PSN Distrbn.	602-623-9800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Mission Hills, Coast Air	818-898-2288
CA	San Jose, Bisco	408-996-8420
CO	Denver, CSID/Integrated	303-292-5538
CT	Danbury, Heilind	208-797-8600
DE	New Castle, Electronics Exchange	302-322-5401
FL	Sanford, Electronic Fasteners	407-321-4000
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
HI	AIEA, Newark Elctrns.	808-487-8951
ID	Coeurd' Alene, A-I Consolidated	208-765-3280
IL	Franklin Park, Bisco	312-451-1230
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Wichita, RSC Elex	216-267-5213
KY	Bowling Green, Crescent Elctrns.	502-842-2444
LA	New Orleans, Radio Pts.	504-581-5959
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Billerica, MS Inserts	508-670-5600
MI	Farmington Hills, Advent Elctrns.	313-477-1650

MN	New Brighton, Chris ELctrns.	612-631-2647
MS	Jackson, Newark Elctrns.	601-956-3834
MO	St. Charles, Finnegan Elctrns.	314-946-6201
NE	Omaha, Omaha Elctrns.	402-341-3440
NV	Reno, Richco	702-323-4939
NH	Nashua, Brevan	603-889-7230
NJ	Kenilworth, Federated Purchasers	201-272-0505
NM	Albuquerque, Electronic Pts.	505-293-6161
NY	Bohemia, Car-Lac	516-567-4200
NC	Raleigh, Century Elec. Comp.	919-782-2116
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Comp. Resources	503-641-8488
PA	Philadelphia, PEI Genesis	215-673-0400
RI	Pawtucket, Major Edwards	401-725-7400
SC	Charleston, Wholesale Indl. Elex	803-577-6388
TN	Knoxville, Industrial Elect	615-573-7135
TX	Richardson, Aero Glen	214-234-0984
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Colchester, Hooker Elctrns.	802-864-0885
VA	Springfield, Southern Fasteners	703-922-8048
WA	Redmond, Olander	206-881-3488
WV	Beckley, State Elec.	304-256-2219
WI	Grafton, Lakeview Elex	414-377-8250
EXP	Taipei, Taiwan, Gold-Tek Elec. Co.	20-717-2302
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280

Condenser Products

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; FSC No.: 16727; Empl.: 22; *Sls. Mgr.:* Terry Baker .... **A•1058-1060**

Local Sales Offices & Reps

TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772

CONDOR

D.C. POWER SUPPLIES, INC.

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,; Empl.: 250; *Sls. Mgr.:* Michael F. Kirkowski, Exec. VP Mktg.; *Dist. Mgr.:* Mary Shaw .... **D•1636-1645**

Local Sales Offices & Reps

AL	Huntsville, Adams Elctrns.	205-882-2988
AZ	Phoenix, Howe & Howe	602-264-7971
CA	San Dimas, AF Sls.	909-599-4412
CA	Sunnyvale, Tritiny Technlg.	408-733-9000
CO	Denver, AKI Entprs.	303-388-4488
CT	Madison, Focus Elctrns. Sls.	203-245-4314
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Lilburn, Adams Elctrns.	404-925-9115
IL	Elk Grove Vlg., Tristar	708-593-0200
IN	Carmel, Current Elctrns. Mktg.	317-844-1770
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Park, Lorenz Sls., Inc.	913-469-1312
MD	Columbia, Delta III Assocs.	410-730-7400
MA	Taunton, Focus Elctrns. Sls., Inc.	508-824-3840
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Minneapolis, ECS	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Pittsford, C W Beach Co.	716-586-3200
NY	Yonkers, Sonkin Assocs.	914-968-8282
OH	Dayton, Thompson & Assocs.	513-435-7733
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
TX	Austin, M Rep	512-205-0828
TX	Dallas, M Rep	214-484-5711
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
Can	Mississauga, GMA, Inc.	416-671-6111

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Huntsville, Future Elctrns.	205-830-2322
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Allied Elctrns.	602-437-9080
AZ	Phoenix, Future Elctrns.	602-968-7140
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Tempe, Cypress Elctrns.	602-966-2256
AZ	Tucson, SWS Elctrns.	602-628-1613
CA	Camarillo, Milgray	805-484-4055
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Chatsworth, Future	818-772-6240
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Costa Mesa, FLW	714-751-7512
CA	Fremont, Allied Elctrns.	510-505-0220
CA	Fremont, FLW	415-651-6511
CA	Irvine, Milgray	714-753-1282
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Future	619-625-2800
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Jose, Future Elctrns.	408-434-1122
CA	San Jose, Milgray	408-456-0900
CA	Santa Ana, Foresight	714-833-2134
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Foresight	408-980-9700
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Broomfield, Future Elctrns.	303-421-0123
CO	Englewood, Allied Elc.	303-790-1664
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Kent Elctrns.	303-762-0670
CT	Berlin, Kent Elctrns.	203-829-2100
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Allied Elctrns.	203-272-7730
CT	Milford, Milgray	203-878-5538
FL	Altamonte Springs, Future	407-767-8414
FL	Casselberry, Allied	800-433-5700
FL	Deerfield Beach, Vantage Comp.	305-729-1001
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lake Mary, Milgray	800-367-0780
FL	Largo, Future	813-530-1222
FL	Largo, Kent Elctrns.	813-545-0057
FL	Orlando, Hammomd Elctrns.	407-841-1010
GA	Duluth, Allied Elctrns.	800-433-5700
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Milgray	404-446-9777
IL	Chicago, Dalec Distrs.	312-283-0300
IL	Elk Grove, Kent Elctrns.	708-364-1300
IL	Hoffman Estate, Future Elctrns.	708-882-1255
IL	Palatine, Milgray	708-202-1900
IL	Schaumberg, Bortech Sls.	708-882-7640
IL	Wood Dale, Allied Elctrns.	800-433-5700
IN	Indianapolis, Allied Elctrns.	800-433-5700
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
IA	Des Moines, Allied Elctrns.	800-433-5700
KS	Lenexa, Allied Elctrns.	800-433-5700
KS	Overland Park, Kent Elctrns.	913-338-4300
KS	Overland Pk., Milgray	913-236-8800
KS	Shawnee Mssn, Aerospace Comp.	913-432-8508
KY	Louisville, Allied Elctrns.	800-433-5700
LA	Metairie, Allied Elctrns.	800-433-5700
MD	Columbia, Allied Elctrns.	800-433-5700
MD	Columbia, Future Elctrns.	301-290-0600
MD	Columbia, Kent Elctrns.	301-720-6200
MD	Columbia, Milgray	301-621-8169
MD	Columbia, Vantage	410-720-5100
MD	Gaitherburg, MS Elctrns.	301-921-0200
MA	Andover, Vantage Comp	508-687-3900
MA	Billerica, Allied Elctrns.	800-433-5700
MA	Billerica, Mayor Elctrns.	617-229-2255
MA	Boston, Future Elctrns.	508-779-3000
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Wilmington, Milgray	508-657-5900
MI	Ann Arbor, McNaughton-McKay	313-995-9515
MI	Livonia, Future Elctrns.	313-261-5270
MI	Madison Heights, McNaughton-McKay	313-399-7500
MI	Plymouth, Allied Elctrns.	800-433-5700
MN	Bloomington, Allied Elctrns.	800-433-5700
MN	Eden Prairie, Cypress	612-934-2104
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Bortech Sls.	612-835-9005
MN	Minneapolis, Aerospace Comp. Prod.	612-884-4725
MN	St. Paul, Kent Elctrns.	612-642-2828
MO	Earth City, Allied	800-433-5700
MO	Hazelwood, Kent Elctrns.	314-895-1515
NE	Omaha, Allied Elctrns.	800-433-5700
NH	Nashua, Allied Elctrns.	800-433-5700
NJ	Clifton, Vantage Comp.	201-777-4100
NJ	Marlton, Future Elctrns.	609-596-4080
NJ	Marlton, Milgray	609-983-5010
NJ	Parsippany, Allied Elctrns.	800-433-5700
NJ	Parsippany, Milgray	201-335-1766
NY	All Cities, Allied Elctrns.	800-433-5700
NY	Farmingdale, Milgray	516-391-3000
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Mt. Sinai, Kent Elctrns.	516-447-2000
NY	Pittsford, Milgray	716-381-9700
NY	Rochester, Future Elctrns.	716-272-1120
NY	Smithtown, Vantage Comp.	516-543-2000
NY	Yonkers, Kintronics	914-347-2530
NC	Concord, Future Elctrns.	704-455-9030
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Allied	800-433-5700
NC	Raleigh, Century Elctrns. Comp.	919-596-2220
NC	Raleigh, Future Elctrns.	919-790-7111
NC	Raleigh, Milgray	919-790-8094
OH	All Cities, Allied Elec	800-433-5700
OH	Cleveland, Milgray	216-447-1520
OH	Mayfield Hts., Future Elec	216-449-6996
OK	Tulsa, Allied Elctrns.	800-433-5700
OK	Tulsa, Norvell Elec.	918-628-1916
OR	Beaverton, EOFF	503-645-9454
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Bend, EOFF	503-388-1544
OR	Eugene, EOFF	503-342-1277
OR	Salem, Eoff	503-363-9251
PA	All Cities, Allied Elctrns.	800-433-5700
PA	Norristown, Century Elctrns. Comp.	215-631-5400
RI	Pawtucket, Major Edwards	401-725-7400
SC	Greenville, Allied Elctrns.	800-433-5700
TN	Memphis, Allied Elctrns.	800-433-5700
TX	All Cities, Allied Elctrns.	800-433-5700
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Norvell Elctrns.	214-233-0020
TX	Dallas, Milgray	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Future Elctrns.	713-556-8696
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Norvell Elctrns.	713-462-1666
TX	Irvine, Cypress Elctrns.	214-255-0065
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Stafford, Milgray	713-240-5360
UT	Salt Lake City, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Milgray	801-261-2999
VA	All Cities, Allied Elctrns.	800-433-5700
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Redmond, Future Elctrns.	206-881-8199
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Seattle, Allied	800-433-5700
WA	Vancouver, Eoff	206-694-7504
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Waukesha, Future Elctrns.	414-786-1884
Can	Calgary, Alb., Future Elctrns.	403-250-5550
Can	Edmonton, Alb., Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Future Elctrns.	416-612-9200
Can	Mississauga, Ont., Milgray	416-678-0955
Can	Montreal, Que., Elctrn. Wholeslrs.	514-769-8851
Can	Ottawa, Ont., Elctrn. Wholeslrs.	613-746-4413
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pt. Claire, Que., Ferrotronic Comp.	514-426-0300
Can	Pt. Claire, Que., Future Elctrns.	514-694-7710
Can	Pt. Claire, Que., Milgray	514-426-5900
Can	Quebec, Que., Future Elctrns.	418-877-6666
Can	Toronto, Ont., Duncan Inst. Ltd.	416-742-4448
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 110

CONDOR SYSTEMS, INC., 2133 Samaritan Dr., San Jose, CA 95124, Tel: 408-371-9580, FAX: 408-371-9589; FSC No.: 62065; Empl.: 318; *Sls. Mgr.:* Dave Klingler

CONDUCTIVE RUBBER TECHNOLOGY, INC., 22125 17th Ave. S.E. Ste. 117, Bothell, WA 98021, Tel: 206-486-8559, FAX: 206-487-0945; Empl.: 30; *Sls. Mgr.:* K. Grant

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; Empl.: 25; *Sls. Mgr.:* Walter G. Bruce

CONDUCTUS, INC., 969 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-737-6700, FAX: 408-737-6699; Empl.: 40

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777, FAX: 419-729-3779; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 120; *Sls. Mgr.:* Steve A. Muise, VP Sls.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 10 B Trackside Business Park, Cheshire,, CT 06410, Tel: 203-250-9678, FAX: 203-250-9688; FSC No.: 50974; Empl.: 15; *Sls. Mgr.:* Joseph W. Raines

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059, FAX: 312-539-3825; *Sls. Mgr.:* Michael Gits .... **C•1292**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 10340 Julian Dr., Cincinnati, OH 45215, Tel: 513-772-3680; FSC No.: 32076; Empl.: 60; *Sls. Mgr.:* Bob Cain

Connectronics Corp.

FAX: 419-537-0007

CONNECTRONICS CORP., 2745 Avondale Ave., Toledo, OH 43607, Tel: 419-537-0020; FSC No.: 0LE36; Empl.: 15; *Sls. Mgr.:* Bruce A. Begitschke ...... **C•1293**

Local Sales Offices & Reps

AZ	Tucson, Blackhart Assocs.	602-579-0399
CA	Morgan Hill, Power Connection, Inc.	408-779-8888
CO	Silt, Blackhart Assocs.	303-876-5605
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Stillwater, Prof. Elctrn. Reps	612-436-1950
NJ	Summit, Intl. Cable Corp.	908-273-4470
NY	Victor, Kirby Mktg.	716-248-8750
OH	Toledo, Connectronics	419-537-0020

FAX: 708-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 708-851-4722; FSC No.: 5955; Empl.: 45; *Sls. Mgr.:* Tom Grabowski ..... **A•1350-1355**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, Spectrum Mktg. Assoc.	602-890-9000
CA	Campbell, Shur Sls.	408-374-5577
CA	San Diego, A.T.A. Assoc.	619-792-6079
CA	Westlake Village, First Rep	805-373-0887
CO	Denver, Spectrum Mktg. Assoc.	303-480-9991
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Boca Raton, APM Assoc.	407-395-7308
FL	Tampa, APM Assoc.	813-886-2457
FL	Winter Park, APM Assoc.	407-678-2777
ID	Boise, Q.R. Crown	208-344-9588
IN	Ft. Wayne, R.O. Whitesell	219-489-0588
IN	Indianapolis, R.O. Whitesell	317-876-9000
IN	Kokomo, R.O. Whitesell	317-457-9127
KY	Versailles, R.O. Whitesell	606-873-1182
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Lexington, Kanan Technlgs.	617-861-7300
MI	Grand Blanc, R.O. Whitesell	313-695-0770
MI	Grand Rapids, R.O. Whitesell	616-942-5420
MI	Southfield, R.O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell	616-983-7337
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, R.O. Whitesell	513-528-5644
OH	Cleveland, R.O.Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R.O.Whitesell	513–298-9546
OR	Portland, Q.R. Crown	503-620-8320
PA	Glenside, Koebert Assocs.	215-887-2310
PA	Pittsburgh, R.O. Whitesell	412-963-6161
TX	Austin, Synergistic Sls.	512-346-2122
TX	Houston, Synergistic Sls.	713-937-1990
TX	Richardson, Synergistic Sls.	214-644-3500
WA	Bellevue, Q.R. Crown	206-453-5100
WI	Mequon, Artmor Ltd.	414-242-4127
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Kanata, Ont., J-Squared Tech., Inc.	613-592-9540

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2317

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 96; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

Consolidated
electronic wire & cable

FAX: 708-455-8979

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 708-455-8830; FSC No.: 73612; Empl.: 97; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ... **C•1294-1298, 1726-1739**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
AR	N. Little Rock, Leo Baker Co.	501-834-2537
CA	Irvine, Vale Elctrns. Assoc.	714-551-4004
CA	San Diego, Vale Elctrns. Assocs.	619-487-7025
CA	San Jose, Westron Assoc.	408-264-4070
CO	Denver, Diversified Mktg. Grp.	303-231-6039
CT	Consolidated Elctrn. Wire	708-455-8830
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Newnan, New Age Elctrns.	404-476-0079
IL	Mt. Prospect, The Dombrow Co.	708-253-3326
IN	Carmel, Frank Kahsar Sls.	317-844-9353
IA	Cedar Rapids, R.W. Kunz	319-396-5386
IA	Des Moines, Jerry Bunch Elec. Sls.	515-287-7057
KS	Prairie Village, R.W. Kunz	913-648-3535
MI	Sterling Heights, Frank Kahsar Sls.	313-795-3530
MN	Minneapolis, Tecteam Sls., Inc.	612-854-6616
MO	St. Louis, R.W. Kunz	314-966-4977
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Woodside, Greater Metro Sls.	718-424-1911
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cincinnati, Frank Kahsar Sls., Inc.	513-598-1484
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Elyria, Frank Kahsar Sls.	216-365-5219
OH	Mentor, Frank Kahsar Sls.	216-257-1166
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Wexford, Frank Kahsar Sls.	412-935-8561
SC	Walhallia, Overton Assoc.	803-638-7101
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Plano, B&R Elctrn. Sls. Corp.	214-985-0028
VA	Merchanicsville, R.B. Marsland Assocs.	804-746-5770
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
WI	Mequon, E.A. Dickinson	414-241-9140
Can	Con. Elctrn. Wire & Cable	800-621-4278

CONTACT, INC., Rte. 27 Box 2230, Edgecomb, ME 04556, Tel: 207-882-6116, FAX: 207-882-6122; FSC No.: MO7015; Empl.: 11; *Sls. Mgr.:* R.Reid; *Dist. Mgr.:* R.Reid

CONTACT EAST, 335 Willow St. S., N. Andover, MA 01845, Tel: 508-682-2000, FAX: 508-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTAQ TECHNOLOGIES CORP., 15 Main St., Bristol, VT 05443, Tel: 802-453-3332, FAX: 802-453-4250; FSC No.: 6680

CONTEC MICROELECTRONICS USA, 2188 Bering Drive, San Jose, CA 95131, Tel: 408-434-6767, 1-800-888-8884, FAX: 408-434-6884; Empl.: 50; *Sls. Mgr.:* Nayan Pradhan

CONTINENTAL DEVICE INDIA LIMITED, C-120 Naraina Industrial Area, New Delhi, India 110028, Tel: 536150-53 (4 lines), TELEX: 031-76209, TWX: 031-76230; FSC No.: I.J.; Empl.: 1100; *Sls. Mgr.:* P. Gulati, Gen. Mgr. & VP Mfg.

CONTINENTAL ELECTRONICS CORPORATION, P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398, FAX: 214-381-4949; FSC No.: 52151; Empl.: 270

CONTINENTAL MICROWAVE TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* Robert Herrmann, Gen. Mgr. .... **A•1357**

Local Sales Offices & Reps

CA	Palo Alto, Microwave Mktg. Assoc.	415-326-4143
CA	Westlake Vl., Westtech Microwave, Inc.	805-373-0033
FL	Melbourne Beach, EDSI Sls.	407-952-1240
MD	Laurel, CSDS, Inc.	301-953-7884
NY	Melville, R.F. Elctrn. Sls.	516-420-8890
MA	Wayland, High Tech Sls.	508-653-3838
TX	Richardson, SW Microwave Elctrns. Corp.	214-669-1195
Can	Montreal, Que., Solid State Engrg. Co.	514-481-3313

CONTINENTAL RESOURCES, Computer & Peripherals Div., 175 Middlesex Tpke., Bedford, MA 01730-1469, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-6563; Empl.: 250; *Sls. Mgr.:* Mark Berling

CONTINENTAL RESOURCES, INC, Test Instruments Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-2046; Empl.: 250

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21244, Tel: 410-298-4411, FAX: 410-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Bill Cook; *Dist. Mgr.:* Bill Cook

CONTROL COMPONENTS & SYSTEMS, INC., 557 Long Road, Pittsburgh, PA 15235, Tel: 412-371-1111, FAX: 412-371-1112

CONTROL CONCEPTS CORP., Liebert Corp., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, FAX: 607-722-8713; Empl.: 85; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Jim Harrison

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 25; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Sandy Walthers

CONTROL ENGRG., INC., 190 Doty Circle, West Springfield, MA 01089, Tel: 413-781-1330, FAX: 413-732-3367; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 407-438-2500, TELEX: 514215; Empl.: 70; *Sls. Mgr.:* Steven Graham, Sls. Mgr.

CONTROLLED ENVIRONMENT EQUIPMENT CORP., 29 Sanford Dr., Gorham, ME 04038, Tel: 207-854-9126, TELEX: 62903721, FAX: 207-854-4357; FSC No.: 25254; Empl.: 10; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy, Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Timothy Tazzia; *Dist. Mgr.:* Ken Krause .... **D•2253-2255**

Local Sales Offices & Reps

AL	Controlled Power Co.	1-800-521-4792
AK	Anchorage, Alaska Computer Environment	907-248-7168
AZ	Phoenix, Controlled Power Co.	1-800-521-4792
CA	Foster City, Controlled Power Co.	1-800-521-4792
CO	Denver, Computer Facility Components	303-778-8488
DC	Quality Power Sys. (GSA)	1-800-521-4792
FL	Orlando, KO Power	1-800-229-4250
GA	Atlanta, Gallagher Electric	1-800-521-4792
IL	Controlled Power Co.	1-800-521-4792
IN	Indianapolis, C.M. Buck	317-293-5704
KS	Shawnee Mission, Maxima Elec. Sls.	913-722-1591
KY	Corydon, C.M. Buck	812-738-4373
LA	Metaire, Rapco Assocs.	1-800-521-4792
MD	Baltimore, Controlled Power Co.	1-800-521-4792
MI	Troy, Controlled Power Co.	1-800-521-4792
MN	Minnetonka, Automated Process Sys.	612-935-4766
MO	St. Louis, Controlled Power Co.	1-800-521-4792
NE	Omaha, Computer Protection	402-571-2322
NH	Bedford, Innovative Technologies, Inc.	603-624-4163
NJ	Nutley, Controlled Power Co.	1-800-521-4792
NM	Albuquerque, D.E.S.I.	505-292-1022
NY	Bay Shore, Controlled Power Co.	1-800-521-4792
NY	Buffalo, Controlled Power Co.	1-800-521-4792
NC	Charlottte, Glen & Larson Co.	704-847-7418
OH	Westerville, Power Com Systems	614-890-1124
OK	Oklahoma City, Controlled Power Co.	1-800-521-4792
OK	Tulsa, Controlled Power Co.	1-800-521-4792
OR	Portland, NRG	503-242-2506
PA	Philadelphia, Controlled Power Co.	1-800-521-4792
PA	Pittsburgh, Controlled Power Co.	1-800-521-4792
SC	Charleston, Glenn & Larson Co.	803-763-8640
TN	Memphis, Total Environmental Sys.	901-743-7154
TN	Memphis/Nashville, Controlled Power Co.	1-800-521-4792

TX	Dallas, Controlled Power Co.	1-800-521-4792
TX	Elpaso, Controlled Power Co.	1-800-521-4792
TX	Houston, Controlled Power Co.	1-800-521-4792
UT	Salt Lake City, Controlled Power Co.	1-800-521-4792
VA	Sterling, Quality Power Sys. (GSA)	703-709-2224, 1-800-521-4792
WA	Seattle, Tech Source	206-292-1656
WI	Wisconsin Rapids, Controlled Power Co.	1-800-521-4792
EXP	Various Offices, Controlled Power Co.	1-800-521-4792
PR	San Juan, RFF	809-755-5679
Can	Various Offices, Controlled Power Co.	1-800-521-4792

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167, FAX: 203-741-6064; Empl.: 160; *Sls. Mgr.:* James W. Bianco

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* H.M. Stuhler; *Dist. Mgr.:* H.M. Stuhler

CONTROL RESOURCES INC., 325 Ayer, Harvard, MA 01451, Tel: 508-772-4043, FAX: 508-772-4142; Empl.: 10; *Sls. Mgr.:* James Quirk .... **C•1575**

CSI CONTROL SCIENCES INCORPORATED

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510; FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman .... **D•1176-1181**

Local Sales Offices & Reps

CA	Luguna Niguel, Aktron Sls.	714-496-5057
FL	Oldsmar, Suncoast Elctrn. Sls.	813-787-9221

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL, INC.
THE SOURCE FOR
COOPER
Belden
[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
(800) CAL-SWCH

IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MD	Annapolis, Homersmith, Inc.	410-269-6493
MA	Salem, Forbes Engrg.	508-744-1693
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Williamstown, Homersmith, Inc.	609-567-7464
NC	Jamestown, Homersmith, Inc.	919-883-3999
PA	Springfield, Homersmith Inc.	215-543-2434
TX	Richardson, Beacon Microwave	214-437-1505
TX	Roundrock, Beacon Microwave	512-244-6675
VA	Shawsville, Homersmith Inc.	703-268-9720
WI	Cedarburg, Hi-Tech Dvcs. Corp.	414-375-9595

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 45; *Sls. Mgr.:* Paul Adams

CTC

FAX: Fax 718-361-6386

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ... **D•2314-2315**

Local Sales Offices & Reps

Can	Montreal, Que., Control Tech. Elctrns. CTC Canada	514-733-3279,FAX:514-733-2132

CONTROL TECHNOLOGY, INC., 7608 N. Hudson, Oklahoma City, OK 73116, Tel: 405-840-3163, FAX: 405-848-0489; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONTROLTEK, INC., 14201 NW Science Park Dr., Portland, OR 97229, Tel: 503-641-0876, FAX: 503-641-7349; Empl.: 16; *Sls. Mgr.:* Kevin Caswell

cdi CONVERSION DEVICES, INC.
EXCELLENCE IN POWER CONVERSION TECHNOLOGY

FAX: 508-559-9288

CONVERSION DEVICES, INC., 15 Jonathan Drive, Brockton, MA 02401, Tel: 508-559-0880; Empl.: 70; *Sls. Mgr.:* Wayne Carlson .... **D•2096-2097**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AZ	Phoenix, Howe & Howe, Sls.	602-264-7971
CA	Camarillo, The Tricamo Co.	805-388-0039
CA	Mountain View, L.S. Engrg.	415-967-5880
CA	San Diego, The Tricamo Co.	619-689-1000
CO	Englewood, Odyssey 1	303-773-8176
CT	Fairfield, Bossaco	203-255-2326
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Oviedo, Conley & Assocs.	407-365-3283
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
IA	Cedar Rapids, M.I.N.K. Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs.	919-341-8309
MD	Ellicott City, VPI	410-461-2525
MA	Brockton, Conversion Dvcs., Inc.	508-559-0880
MA	Scituate, N.E.A.R.	617-545-6327
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
MO	Bridgeton, M.I.N.K. Assocs.	315-291-5454
NJ	Paramus, Eltech Sls., Inc.	201-967-1309
NM	Albuquerque, H.E.R. Elctrns.	505-265-8609
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Raleigh, South Tech. Sls.	919-571-1313
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Broken Arrow, D. J. Sls.	918-258-1445
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
PA	Plymouth Meeting, CMS Sls. & Mktg.	215-834-6840
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
UT	Salt Lake City, Odyssey 1	801-485-4728
WA	Mountlake Ter., SPS Elctrns.	206-323-4140
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Mississauga, Ont., Andy Baumen Assocs. Ltd.	416-828-2600

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Local Sales Offices & Reps

CA	San Jose, Vernexx & Assocs.	408-972-9072
FL	Clearwater, Dan-Tech Sls.	813-441-2609
FL	Davie, Dan-Tech Sls.	305-581-2884
MD	Kensington, Koebert Assocs.	301-439-8924
MA	Arlington, Interstate Sls. Assocs.	617-646-3914
MA	Chelmsford, Interstate Sls. Assocs.	508-256-2287
NY	Rochester, KLM Garner	716-385-2103
NY	Smithtown, Koebert Assocs.	516-979-6683
PA	Glenside, Koebert Assoc.	215-887-2310
RI	Warren, Interstate Sls. Assocs.	401-245-8364
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Alexandria, Koebert Assocs.	703-461-3655
Can	Rexdale, Valtrie Mktg.	416-851-0335
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

Local Distributors

AL	Huntsville, Comp. Distrs., Inc.	205-851-7800
CA	Santa Anna, Foresight Elctrns.	714-833-2134
CA	Santa Clara, Foresight	408-980-9700
CO	Englewood, Comp. Distrs.,Inc.	303-770-6214
FL	Clearwater, Comp. Distrs., Inc.	813-796-0466
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Comp. Distrs., Inc.	404-441-3320
IL	Roselle, Foresight Elctrns.	708-980-9890
PA	Glenside, Mark Elctrns.	215-887-2317
TX	Dallas, Comp. Distrs., Inc.	214-644-0373
Can	Markham, Ont., Wm. Saynor & Assocs.	416-415-1044
Can	Rexdale, Valtrie Mktg.	416-798-2555

CONVERTER POWER, INC., Locust Rd., Ipswich, MA 01938, Tel: 508-356-2558, FAX: 508-356-5729; *Sls. Mgr.:* Barry Essig

COOKE VACUUM PRODS., INC., 13 Merritt St., S. Norwalk, CT 06854, Tel: 203-853-9500, FAX: 203-838-9553; Empl.: 45; *Sls. Mgr.:* Louis W. Genuario

THE COOL-AMP CONDUCTO-LUBE CO., 15834 Upper Boones Ferry Rd., Lake Oswego, OR 97035, Tel: 503-624-6426, FAX: 503-624-6436; FSC No.: 31628; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COOL CORPORATION, 14170 23rd Ave. N., Minneapolis, MN 55447, Tel: 1-612-559-3117, FAX: 1-612-559-9679; Empl.: 5; *Sls. Mgr.:* Will Mielenz

COONER WIRE CO., 9265 Owensmouth Ave., Chatsworth, CA 91311, Tel: 818-882-8311, FAX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER INDUSTRIES/BELDEN DIV., P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393, FAX: 317-983-5294; Empl.: 3500; *Sls. Mgr.:* Dan Trotta, Mgr. OEM Sls.; *Dist. Mgr.:* Rick Schneldewind, Mgr. Dist. Sls.

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, FAX: 919-783-2067

COORS CERAMICS CO., Electronics, 17750 W. 32nd Ave., Golden, CO 80401, Tel: 303-277-4591, FAX: 303-277-4779; Empl.: 1700

COORS ELECTRONIC PACKAGE CO., 511 Manufacturers Rd., Chattanooga, TN 37405, Tel: 615-755-5452, FAX: 615-755-5438; Empl.: 200; *Sls. Mgr.:* Jim F. Wade

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Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell Assocs.	205-883-5110
AZ	Tempe, Westrep	602-820-9932
CA	Montrose, Luscombe	818-249-9000
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Norcross, Robert O. Whitesell	404-449-9190
ID	Boise, Jas J. Backer Co.	208-343-9831
IL	Itasca, Beta Technlg. Sls. Inc.	708-250-9586
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-876-9000
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, Robert O. Whitesell	606-873-1182
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-352-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	Englewood, MOS Mktg.	201-569-2071
NM	Albuquerque, Rontek, Inc.	505-299-4124
NY	Great Neck, MOS Mktg.	516-487-3966
NY	Skaneateles, Empire Tech Sls.	315-685-5703
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-6609
Can	Ontario, R.N. Longman	416-670-8100

CORECO, INC., 6969 Trans-Canada Hwy, Ste. 113, St. Laurent, Que., Canada H4T 1V8, Tel: 800-361-4914, 514-333-1301, FAX: 514-333-1388; Empl.: 32

CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 100; *Sls. Mgr.:* Bruce MacDonald

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Local Sales Offices & Reps

CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI Inc.	813-894-4556
KS	Overland Park, Electri-Rep	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Heights, Pine Sales, Inc.	313-589-0350
MN	Eden Praire, PWC Incorporated	612-934-1409
MO	St. Louis, Electra-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Beaverton, Elctrn. Sources, Inc.	503-620-0441
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comp. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, P.R., E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projections Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon ELctrns.	612-642-2828
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	No. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Elctrns.	214-553-4300
TX	Fort Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL-DUBILIER ELCTRNS. (CORPORATE HEADQUARTERS), 1700 Route 23 North, Wayne, NJ 07470, Tel: 201-694-8600; Empl.: 500ò; *Sls. Mgr.:* A. Cavuto .... **A•1062-1065**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI, Inc.	813-894-4556
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
KS	Overland Park, Electri-Rep.	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Hgts., Pine Sls., Inc.	313-589-0350
MN	Eden Prairie, PWC Inc.	612-934-1409
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NY	Syracuse, L.D. Allen	315-437-8387
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Tigard, Earl & Brown Co., Inc.	503-639-2100
PA	Erdenheim, Omni Sls.	215-233-4600
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comps. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830
Can	N. Vancouver, B.C., Arwin Tech. Sls.	604-980-4557

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projection Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, Greene-Shaw, Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
NY	Hauppauge, Jaco Elctrns., Inc.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Electronics	214-553-4300
TX	Ft. Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur; *Dist. Mgr.:* Lou Schnur

CORNING INCORPORATED, Advanced Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-7920, TELEX: 932498, FAX: 607-974-7618; *Sls. Mgr.:* Paul Marx; *Dist. Mgr.:* Brian Gray

CORNING INCORPORATED, Opto-Electronics Group, MP-RO-03, Corning, NY 14831, Tel: 1-800-525-2524, FAX: 607-974-7522; Empl.: 26,000

CORONA MAGNETICS, INC., 201 Corporate Terrace, Corona, CA 91719, Tel: 909-735-7558, FAX: 909-735-6753; Empl.: 60; *Sls. Mgr.:* Uwe Paasch

CORTEC, INC., 15672 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

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Local Distributors

CA	Santa Clara, Foresight	408-980-9700,714-833-2134
CO	Englewood, CDI	303-770-6214
FL	Ft. Lauderdale, CDI	1-800-558-2351
GA	Duluth, Stelmack Power	404-441-7927
GA	Norcross, Applied Power	1-800-445-8316
IL	Schaumberg, Mar Lyn	708-924-9111
IA	W. Des Moines, Allied	1-800-433-5700
KS	Lenexa, Allied	1-800-433-5700
LA	Metairie, Allied	1-800-433-5700
MA	Lowell, Total Power	508-453-7272
MI	Brighton, Applied Power	1-800-624-5496
MI	Holland, Indl. Control	800-878-6722
MN	Bloomington, Allied	1-800-433-5700

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MO	Earth City, Allied	1-800-433-5700
NE	Omaha, Allied	1-800-433-5700
NJ	Lodi, TRC	201-779-8282
OH	Cincinatti, Schuster	513-489-1400
PA	McKean, Advacom	814-476-7774
TX	Dallas, Allied	1-800-433-5700
UT	Salt Lake City, CDI	801-261-5244

COSMO CORPORATION, 3239 W. 14th St, Cleveland, OH 44109, Tel: 216-861-5594, FAX: 216-861-0416; Empl.: 350; *Sls. Mgr.:* B. Gordon

COSMOS PLASTIC CO., 3239 W. 14th St, Cleveland, OH 44109, Tel: 216-861-5594

COTO WABASH, A Kearney National Company, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, FAX: 401-942-0920; Empl.: 300; *Sls. Mgr.:* J. Lynch(East); *Dist. Mgr.:* Chris Cardin ..... **B•1451-1453**

Local Sales Offices & Reps

AL	Owens Cross Rds., cmrCross Assocs.	205-883-5991
AZ	Phoenix, Spectrum Mktg. Assocs., Inc.	602-890-9000
CA	Newport Bch., Forbes Pacific Inc.	714-722-6174
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-480-9991
FL	Orlando, Standard Mktg.	407-856-4140
FL	Sunrise, Standard Mktg.	305-749-5557
FL	Tampa, Standard Mktg.	813-933-5833
IL	Arlington Hgts., M.J. Petersen & Assocs.	708-577-8200
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Midwest Tech. Sls. Inc.	319-393-5115
KS	Goddard, Midwest Tech. Sls. Inc.	316-794-8565
KS	Lenexa, Midwest Tech. Sls. Inc.	913-888-5100
MD	Columbia, Delta III Assoc., Inc.	301-730-4700
MA	Andover, Crawford Assocs.	508-470-2122
MN	Roseville, TLC	612-483-2226
MO	Earth City, Midwest Tech. Sls. Inc.	314-298-8787
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Cortland, Net Sls.	607-756-6592
NY	Great Neck, MOS Mktg. Assocs.	516-487-3966
NY	Victor, Net Sls.	716-924-1844
NC	Charlotte, Godwin Assocs.	704-549-8500
NC	Raleigh, Godwin & Assoc.	919-878-8000
OR	Oregon City, Halbar Pacific	503-656-3714
PA	Trevose, Omega Elctrn. Sls.	215-244-4000
TX	Plano, Richmar Elctrns.	214-424-8388
TX	Round Rock, Richmar Elctrns.	512-255-2551
UT	Ogden, Spectrum Mktg. Assocs. Inc.	801-972-8552
WA	Redmond, Halbar Pacific	206-882-0990
Can	Pickering, Ont., Current Mktg.	416-428-3413
Can	Pointe Claire, Que., A. R. Gray Assocs.	514-694-6378

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Saratoga, Testco Inc.	408-253-1900
CA	Sunnyvale, Spirox	408-739-3334
CO	Denver, Spectrum Distrbn.	303-480-9991
FL	W. Melbourne, Astro Mktg.	407-727-8817
IL	Bedsville, Voyager Elect. Corp.	708-860-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove Village, Nu-Way Elect. Dist., Inc.	708-437-7120
MA	Methuen, Aved Elect. Inc.	508-688-3800
MN	Fridley, Voyager Elect. Corp.	612-571-7766
NJ	Oakland, Relay Specialties	201-337-1000
NY	Rochester, Masline Elect., Inc.	716-546-5373
PA	Philadelphia, SHAP Elect. Co.	215-969-3300
TX	Ft. Worth, Allied Elec.	817-595-3500
TX	Austin, Altair Co.	512-837-4970
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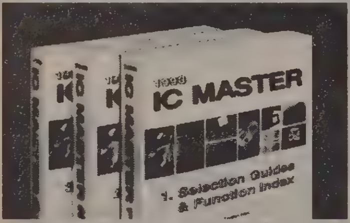

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COVID, INC., 1725 W. 17th St, Tempe, AZ 85281, Tel: 602-966-2221, FAX: 602-966-6728; Empl.: 40; *Sls. Mgr.:* Suzanne Jones

COVOX, INC., 675 Conger St, Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 30; *Sls. Mgr.:* Kevin Corson; *Dist. Mgr.:* Donna Corson

CPS, 15800 Upper Boones Ferry Rd., # 150, Lake Oswego, OR 97035, Tel: 503-684-8026, FAX: 503-684-8164; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069, FAX: 408-986-8278; Empl.: 6

CRAFT DATA, INC., 27022 Cordero Lane, Mission Viejo, CA 92691, Tel: 714-582-8284, FAX: 714-248-2390; Empl.: 4

CRAIG SYSTEMS CORP., Eastern Technologies, Ltd., 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 508-388-5662, TWX: 710-347-0590, FAX: 508-388-0845; FSC No.: 81902; Empl.: 150; *Sls. Mgr.:* Roger Chouinard

CRAMCO INC., 80 Sinnott Rd., Scarborough, Ont., Can M1L 4M7, Tel: 416-757-2876, FAX: 416-757-5530; Empl.: 40; *Sls. Mgr.:* Leo Logiacco

Cramer

FAX: 414-377-4028

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-268-2150, 414-375-5700; Empl.: 118; *Sls. Mgr.:* William G. Pickart ..... **A•2306-2308**

Local Sales Offices & Reps

IL	Chicago, Cramer Coil & Transformer Co., Inc.	312-907-0184
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
MI	Madison Hgts., D.E.M. Sls.	313-583-1500
MN	Minnetonka, Hanna Lind Ltd.	612-931-1242
MO	St. Charles, Buckman & Assocs.	314-947-4727
NC	Kernersville, Wallace Elctrns. Sls.	800-334-3518
OH	Centerville, Mid-Star Technlgs.	513-439-5700
WI	Saukville, Cramer Coil & Transformer Co., Inc.	414-375-5700
Can	Neapean, Ont., Ellam Assocs.	613-727-3892

CRAMER CO., 139 Mill Rock Road East, Old Saybrook, CT 06475-1261, Tel: 800-247-6784, FAX: 203-388-9831; Empl.: 210; *Dist. Mgr.:* E. Latourette

CRANE ELECTRONICS, INC., 4700 Smith Rd., Cincinnati, OH 45212, Tel: 800-676-7644, FAX: 513-631-5700; FSC No.: OAKZ5; Empl.: 25

CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, FAX: 603-643-4657; FSC No.: 8A287; Empl.: 100

CREATIVE AUTOMATION CO., 11641 Pendleton St., Sun Valley, CA 91352, Tel: 818-767-6220, FAX: 818-767-0123; Empl.: 25; *Sls. Mgr.:* Royal Bush

CRITERION

FAX: 416-299-8398

CRITERION INSTRS., LTD., 30 Progress Ave., Scarborough, Ont., CAN M1P4W8, Tel: 416-299-6666; Empl.: 16 ..... **D•1248-1249, 1651**

Local Sales Offices & Reps

IL	Chicago, Rock Sls. Inc.	708-351-9903
MI	Troy, Satullo Assocs. Inc.	313-585-4811
NC	Selma, Shalltronix Corp.	919-965-6346
OH	Cleveland, ABITEC Inc.	216-531-9122
TX	Lewisville, E.P.R.	214-436-4772
WI	Rock Sls. Inc.	708-351-9903
Can	Calgary, AL, Landel Controls	403-254-8900
Can	Montreal, Que., Projean Inst.	514-273-8331
Can	Richmond, B.C., John McMillan	604-273-1747
Can	Saskatchewan, Landel Controls	306-522-3399

CRL COMPONENTS, INC., Roxboro Group, Highway 20 West, Fort Dodge, IA 50501, Tel: 515-573-1300, FAX: 515-573-1342; FSC No.: 71590; Empl.: 500; *Dist. Mgr.:* Jim Wood

CR MAGNETICS, INC. (FORMERLY CURRENT RING CO., INC.), 308 Axminister Dr., Fenton, MO 63026, Tel: 314-343-8518, FAX: 314-343-5119; Empl.: 5 ..... **A•2309; B•1455, 1927**

Local Sales Offices & Reps

MO	Fenton, CR Magnetics, Inc.	314-343-8518

CROMPTON MODUTEC, 920 Candia Rd., Manchester, NH 03109, Tel: 603-669-5121, 800-METERS-1, FAX: 603-622-2690,603-641-2620; FSC No.: 53498; Empl.: 450

CROSS ELECTRONICS, 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591, FAX: 412-776-1596; Empl.: 35; *Sls. Mgr.:* L. R. Craig

CROSSPOINT
THE PROGRAMMING PRODUCTS DIVISION OF
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FAX: 201-941-4919

CROSSPOINT, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli ..... **B•1701**

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CROUZET CORPORATION, 3237 Commander Dr., Carrollton, TX 75006-2506, Tel: 214-250-1647, 1-800-677-5311; Empl.: 80; *Sls. Mgr.:* Jack Wolbrink .. **B•1246-1247, 1456-1457, 1702-1703; C•1576-1577**

Local Sales Offices & Reps

AZ	Scottsdale, Jeff Miller	602-948-0751
CA	San Ramon, C. F. M. Sls.	510-735-3601
CT	Westbrook, John Brewer	203-399-7311
FL	New Port Richey, Kirk Sls.	813-846-8558
GA	Atlanta, Levine Lectronics	404-565-1556
IL	Schaumburg, Eric Pfister	708-885-5696
IA	W. Des Moines, HDI Ltd.	515-225-3777
MA	Burlington, Anacon Sls. Assoc.	617-272-9080
MN	St. Paul, Johnson Co.	612-429-2544
MS	Jackson, Doby Assocs.	501-981-1138
NY	Fairport, Tac Sls.	716-223-7610
NY	Nyack, S & Y Assocs.	914-358-9484
OH	Centerville, Omega Sls.	513-434-5507
OH	Gahanna, Jack Matthews	614-476-6441
OR	Portland, Control Dvcs. NW	503-659-3216
PA	Valley Forge, Providence Mktg.	215-935-3300
TX	Dallas, John Hill	214-250-1647
WA	Bellevue, Control Dvcs. NW	206-451-8552

Local Distributors

AZ	Phoenix, Southwestern Automation	602-276-7022
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Santa Monica, Master Distrs.	310-452-1229
FL	Orlando, Louis Pryor	407-295-3762
GA	Tucker, CID, Inc	404-491-3143
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, PEI Genesis	317-879-0700
MA	Norwell, Controls Plus	617-871-0078
MN	Minneapolis, Lakeland Engrg.	612-544-0321
MN	St. Paul, Powermation	612-645-0781
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Genessee Indl. Elec.	716-873-9661
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
OH	Cincinnati, Aetna Elec.	513-871-8338
OR	Milwaukee, 04 Controls	503-659-7891
PA	Willow Grove, C.A. Briggs Co.	215-784-9250
SC	Columbia, Resource Elctrns.	803-779-5332
TX	Ft. Worth, Swieco.	817-281-1811
TX	Nacogdoches, Elliott Elec.	409-569-7941
WA	Kent, Motors & Controls Corp.	206-872-8010
WI	Waukesha, Powermation	414-523-0600

CROVEN CRYSTALS, 500 Beech St., Whitby, ON, Canada L1N 5S5, Tel: 416-668-3324, FAX: 416-668-5003; FSC No.: 00809; Empl.: 150; *Sls. Mgr.:* R. McCormick .... **A•1412-1417**

Local Sales Offices & Reps

CA	San Mateo, Melvin Sls.	415-349-7445
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Ovieda, Conley & Assocs.	407-365-3283
MD	Towson, Dickison Sls. Co.	410-823-0923
MA	Norwood, Naton Assocs.	617-762-3224
MN	Minneapolis, Dunlop Consultants	612-559-9693
NY	New Rochelle, Ascor Elctrns.	914-235-8838
OR	Tigard, Eltech Inc.	503-684-3458
PA	Ft. Washington, Beta Sls.	215-643-6650
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
VA	Charlottesville, PDQ Sls.	804-979-7085
WA	Bellevue, Eltech, Inc.	206-643-4330

CROZIER METRLOGY LABS. INC., 529 N. Wolf Rd., Wheeling, IL 60090, Tel: 708-520-9085, FAX: 708-520-9150: Empl.: 5; *Sls. Mgr.:* Richard D. Crozier

CRYDOM COMPANY

FAX: 310-865-3318

CRYDOM COMPANY, 6015 Obispo Ave., Long Beach, CA 90805, Tel: 310-865-3536, TWX: 910-250-5756; Empl.: 365; *Sls. Mgr.:* James L. Jensen; *Dist. Mgr.:* James L. Jensen .... **A•2136-2142; B•1464-1472**

Local Sales Offices & Reps

CA	Pleasanton, Sierra Sls. Engrg.	510-484-2250
MA	Duxbury, Crydom Co.	617-837-9722
NJ	Red Bank, Crydom Co.	908-576-1576
TX	Carrollton, Seaton Corp.	214-980-9860
WA	Redmond, Components West	206-885-5880
Can	Port Coquitlam, BC, Macom Agencies	604-942-1292

CRYOMAGNETICS, INC., 1006 Alvin Weinberg Dr., Oak Ridge, TN 37830, Tel: 615-482-9551, FAX: 615-483-1253; *Sls. Mgr.:* D. Michael Coffey

CRYSTAL COMPONENTS USA, P.O. Box 1410, Cyrstal Lake, IL 60039-1410, Tel: 815-477-2052, FAX: 815-477-2052; Empl.: 5; *Sls. Mgr.:* Robert Kemp

CRYSTAL ENGINEERING CORP., 1119 Los Olivos, Los Osos, CA 93402, Tel: 805-528-2155, 800-444-1850, FAX: 805-528-3113; Empl.: 10; *Sls. Mgr.:* Wayne Hamari; *Dist. Mgr.:* Wayne Hamari

CRYSTAL SEMICONDUCTOR CORP., 4210 S. Industrial Dr., Austin, TX 78744, Tel: 512-445-7222, FAX: 512-445-7581

CRYSTALOID ELECTRONICS, 5282 Hudson Dr., Hudson, OH 44236, Tel: 216-655-2429, FAX: 216-655-2176; Empl.: 125

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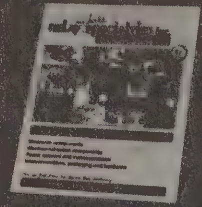

CSB BATTERY OF AMERICA CORPORATION, 3201 Alta Mere, Ft. Worth, TX 76116, Tel: 817-732-2258, FAX: 817-732-2019; *Sls. Mgr.:* Gregg Hubbard .... **D•1434**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
CA	Arcadia, Van Gott & Assocs.	818-445-9728
FL	Margate, EPM Corp.	305-977-0331
FL	Melbourne, EPM Corp.	407-255-3733
FL	Orlando, EPM Corp.	407-425-6149
GA	Norcross, Electro Mech	404-447-6478
IL	Palatine, Technlg. Sls., Inc.	708-991-6600
IA	Cedar Rapids, Lowell-Kangas & Assoc.	319-362-9290
KS	Shawnee, Lowell-Kangas & Assoc.	913-631-3515
MA	Seekonk, Rudolph Mktg. Assocs.	508-399-6270
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NY	Franklin Sq., Cooper-Simon & Co., Inc.	516-489-0404
NC	Raleigh, Electro Mech	919-790-9300
OH	Dayton, North Central Mktg.	513-845-3575
OH	Lexington, North Central Mktg.	419-884-9804
OH	Lyndhurst, North Central Mktg.	216-442-2717
TX	Dallas, Exel Technlgs., Inc.	214-239-3935
WI	Milwaukee, Technlg. Sls., Inc.	414-964-5015

Local Distributors

FL	Largo, D & D Battery	813-587-9900
FL	Tampa, Micro Precision	813-854-2061
GA	Doraville, Lighting Plastic Suppliers	404-448-9373
IL	Barrington, Alexander Tech. Sls., Inc.	708-381-7222
MA	Methuen, Generation Elctrns., Inc.	508-683-1177
TX	San Antonio, Altex Elctrns.	512-655-8882
TX	Spring, Jabro Southwest	713-367-9393

CSD INDUSTRIES, INC., dba C Enterprises, 310-110 Via Vera Cruz, San Marcos, CA 92069, Tel: 619-744-8182, 800-334-3815, FAX: 619-744-1659; Empl.: 28; *Dist. Mgr.:* Steve Yamasaki

C-S ELECTRONIC SALES, INC., 259 E. Walnut St., Frankfort, IN 46041, Tel: 317-659-1874, FAX: 317-659-4185; Empl.: 4

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CSI CAPACITORS, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069-3009, Tel: 619-747-4000, TELEX: 697832; FSC No.: 10026; Empl.: 25 .... **A•1066**

Local Sales Offices & Reps

AL	Huntsville, Comp. Mktg. Svc.	205-881-6699
AZ	Paradise Valley, Techrep Arizona	602-991-6646
CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, SAM Rep., Inc.	407-869-9565
IL	Des Plaines, Esco Assocs.	312-298-5310
MD	Middletown, ST/Woolard	301-371-4500
MA	Canton, New England Elctrn. Sls.	617-828-4835
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Cazenovia, S. T. Woolard	315-655-8145
OH	Dayton, K. W. Elctrn. Sls.	513-890-2150
OR	Beaverton, Components West	503-642-9110
PA	Pittsburgh, KW Elctrn. Sls.	412-366-9396
SC	Six Mile, S.T. Woolard	803-868-4226
TX	Carrollton, Seaton Corp.	214-980-9860
WA	Redmond, Components West	206-885-5880
Can	Port Coquitlam, BC, Macom Agencies	604-942-1292

CSTS, 4015 E. Leaverton Ct., Anaheim, CA 92807-1610, Tel: 714-632-1300, FAX: 714-632-1937; Empl.: 14

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, FAX: 617-246-2905; Empl.: 15

CTI ELECTRONICS, 110 Old South Ave., Stratford, CT 06497, Tel: 203-386-9779, FAX: 203-378-4986 .... **D•1086**

Local Sales Offices & Reps

CT	Stratford, CTI Elctrns.	203-386-9779
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Local Sales Offices & Reps

AL	Huntsville, R.O. Whitesell & Associates	205-883-5110,FAX:205-882-9626
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-996-0635, FAX:602-996-0586
AR	Hot Springs Vlg., Southern States Mktg., Inc.	501-922-0807,FAX:501-922-0807
CA	Auburn, Ewing-Foley, Inc.	916-885-6591, FAX:916-885-6594
CA	Calabasas, Centaur Corp.	818-591-1655, FAX:818-591-7479
CA	Irvine, Centaur Corp.	714-261-2123, FAX:714-261-2905
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525, FAX:415-941-5109
CA	San Diego, Centaur Corp.	619-278-4950, FAX:619-278-0649
CA	South Pasadena, CTS Corp.	213-682-1137, FAX:818-441-3058
CO	Denver, ELCOM, Inc.	303-337-2300, FAX:303-745-0462
CT	Brookfield, CTS Corp.	203-740-9755, FAX:203-740-9747
CT	Hamden, CompRep Assocs., Inc.	203-932-4403, FAX:203-932-4551
CT	Stamford, Unesco/Genex, Inc.	203-322-9308, FAX:203-329-8924
FL	Boca Raton, R.O. Whitesell & Assocs.	407-393-6139,FAX:407-393-6072
FL	Longwood, R.O. Whitesell & Assocs.	407-682-6662,FAX:407-682-7038
FL	Palm Harbor, R.O. Whitesell & Assocs.	813-787-0898,FAX:813-787-0987
GA	Norcross, R.O. Whitesell & Associates	404-449-9190,FAX:404-449-9197
IL	Northbrook, Dolin Sls. Co., Inc.	708-498-6770, FAX:708-498-4885
IN	Huntington, Elctrn. Reps., Inc.	219-356-3513, FAX:219-356-0337
IN	Indianapolis, Elctrn. Reps., Inc.	317-894-1414, FAX:317-894-1216
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127, FAX:317-456-1234
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660, FAX:319-364-7906
KS	Olathe, Advanced Tech. Sls., Inc.	913-782-8702, FAX:913-782-8641
MD	Lutherville, DGR, Inc.	301-583-1360, FAX:301-825-5579
MA	Waltham, Unesco/Genex, Inc.	617-890-1535, FAX:617-890-7931
MA	Westwood, CompRep Assocs., Inc.	617-329-3454:FAX:617-329-6395
MI	Farmington Hills, J. L. Montgomery Assocs., Inc.	313-489-0099,FAX:313-489-0189
MN	Minneapolis, Robert W. Marshall Co., Inc.	612-929-0457,FAX:612-929-8307
MN	Minneapolis, S & R Comp. Sls., Inc.	612-559-3090, FAX:612-559-3153
MO	Bridgeton, Advanced Tech. Sls., Inc.	314-291-5003, FAX:314-291-7958
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990,FAX:505-345-4848
NY	E. Syracuse, Nycom, Inc.	315-437-8343, FAX:315-437-1208
NY	Rockville Centre, S-J Assocs., Inc	516-536-4242, FAX:516-536-9638
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433, FAX:919-782-8476
OH	Dayton, Baehr, Greenleaf & Assocs., Inc.	513-439-0724,FAX:513-439-0387
OH	Westlake, Baehr, Greenleaf & Assocs., Inc.	216-892-1770,FAX:216-892-1771
OR	Tigard, Vantage Corp.	503-620-3280, FAX:503-684-0676
PA	Trevose, P.S.A. Inc.	215-245-0513, FAX:215-245-4817
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088,FAX:412-934-3990
TN	Knoxville, R.O. Whitesell & Associates	615-694-9476,FAX:615-691-9693
TX	Austin, Southern States Mktg., Inc.	512-835-5822, FAX:512-835-1404
TX	Houston, Southern States Mktg., Inc.	713-789-2426:FAX:713-789-3202
TX	Irving, CTS Corp.	214-444-2570, FAX:214-401-4091
TX	Richardson, Southern States Mktg., Inc.	214-238-7500,FAX:214-231-7662
UT	Murray, ELCOM, Inc.	801-262-2400, FAX:801-262-2583
WA	Bellevue, Vantage Corp.	206-455-3460, FAX:206-455-9419
WI	Glendale, Dolin Sls. Co., Inc.	414-482-1111, FAX:414-351-4142
PR	Caguas, CompRep Assocs., Inc.	809-746-6550, FAX:809-746-4800
Can	Calgary, Alb., r.n.Longman Sls., Inc.	403-228-8719, FAX:403-295-6324
Can	Kirkland, Que., r.n.Longman Sls., Inc.	514-694-3911, FAX:514-695-4414
Can	Mississauga. Ont., r.n.Longman Sls., Inc.	416-670-8100,FAX:416-670-1384
Can	Nepean, Ont., r.n.Longman Sls., Inc.	613-564-0100, FAX:613-596-9019

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AL	Huntsville, Marshall Inds.	205-881-9235, FAX:205-881-1490
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200, FAX:602-437-2348
AZ	Phoenix, Marshall Inds.	602-496-0290, FAX:602-893-9029
AZ	Tempe, Bell Inds.	602-966-3600, FAX:602-967-6584
CA	Agoura Hills, Bell Inds.	818-879-9494, FAX:818-991-7696
CA	Calabasas, Marshall Inds.	818-878-7000, FAX:818-880-6846
CA	Chatsworth, Hall-Mark Elctrns.	818-773-4500, FAX:818-773-4555
CA	Cypress, Bell Inds.	714-895-7801, FAX:714-891-4570
CA	Irvine, Capstone Elctrns.	714-283-8185, FAX:714-283-8191
CA	Irvine, Hall-Mark Elctrns.	714-727-6000, FAX:714-727-6066
CA	Irvine, Integrated Elctrns.	714-753-0127, FAX:714-753-0831
CA	Irvine, Marshall Inds.	714-660-0951, FAX:714-581-5255
CA	Milpitas, Marshall Inds.	408-942-4600, FAX:408-262-1224
CA	Rancho Cordova, Marshall Inds.	916-635-9700, FAX:916-635-6044
CA	Rocklin, Bell Inds.	916-652-0418, FAX:916-652-0403
CA	Rocklin, Hall-Mark Elctrns.	916-624-9781, FAX:916-961-0922
CA	Sacramento, Integrated Elctrns.	916-363-6030, FAX:916-362-6926
CA	San Diego, Bell Inds.	619-268-1277, FAX:619-492-9826
CA	San Diego, Hall-Mark Elctrns.	619-268-1201, FAX:619-268-0209
CA	San Diego, Marshall Inds.	619-627-4158, FAX:619-627-4163
CA	San Jose, Capstone Elctrns.	408-453-9804, FAX:408-453-9819
CA	San Jose, Hall-Mark Elctrns.	408-432-4000, FAX:408-432-4044
CA	San Jose, Rose Elctrns.	408-943-0200, FAX:408-943-0360
CA	Sunnyvale, Bell Inds.	408-734-8570, FAX:408-734-8875
CA	Sunnyvale, PSC Elctrns.	408-737-1333, FAX:408-737-0502
CA	Yorba Linda, Corona Elctrns.	714-283-8185, FAX:714-283-8191
CO	Denver, Bell Inds.	303-691-2460, FAX:303-691-9036
CO	Denver, Integrated Elctrns.	303-292-6121, FAX:303-297-2053
CO	Englewood, Hall-Mark Elctrns.	303-790-1662, FAX:303-790-4991
CO	Littleton, Indelco Elctrns.	303-795-3431, FAX:303-795-8298
CO	Thornton, Marshall Inds.	303-451-8444, FAX:303-457-2899
CT	Cheshire, Hall-Mark Elctrns.	203-271-2844, FAX:203-269-1704
CT	Wallingford, Bell Inds.	203-269-6801, FAX:203-269-6527
CT	Wallingford, Greene-Shaw Elctrns.	203-265-3333, FAX:203-265-3583
CT	Wallingford, Marshall Inds.	203-265-3822, FAX:203-284-9285
FL	Altamonte Springs, Bell Inds.	407-339-0078, FAX:407-339-0139
FL	Altamonte Springs, Marshall Inds.	800-226-4486, FAX:407-767-8676
FL	Altamonte Springs, Vantage Comps.	407-682-1199,FAX:407-682-1286
FL	Deerfield, Vantage Comps.	305-429-1001, FAX:305-481-3586
FL	Ft. Lauderdale, Component Assocs., Inc.	305-733-4100,FAX:305-733-0384
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880, FAX:305-977-4887

FL	Largo, Hall-Mark Elctrns.	813-541-7440,	FAX:813-544-4394
FL	Pompano Bch., Hall-Mark Elctrns.	305-971-9280,	FAX:305-971-9339
FL	St. Petersburg, Marshall Inds.	813-573-1399,	FAX:813-573-0069
FL	Woodale, Hall-Mark Elctrns.	708-860-3800,	FAX:708-860-0239
GA	Duluth, Hall-Mark Elctrns.	404-623-4400,	FAX:404-476-8806
GA	Norcross, Bell Inds.	800-525-6666,	FAX:407-339-0139
GA	Norcross, Marshall Inds.	404-923-5750,	FAX:404-923-2743
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300,	FAX:708-860-1573
IL	Elk Grove Vlg., Bell Inds.	708-640-1910,	FAX:708-640-0474
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040,	FAX:312-843-2320
IL	Itasca, Capstone Elctrns.	708-250-0300,	FAX:708-250-0183
IL	Schaumburg, Marshall Inds.	312-490-0155,	FAX:312-490-0569
IN	Indianapolis, Bell Inds.	317-875-8200,	FAX:317-875-8219
IN	Indianapolis, Hall-Mark Elctrns.	317-872-8875,	FAX:317-872-7165
IN	Indianapolis, Marshall Inds.	317-297-0483,	FAX:317-297-2787
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747,	FAX:913-888-0523
KS	Lenexa, Marshall Inds.	913-492-3121,	FAX:913-492-6205
MD	Burtonville, United States Elctrns., Inc.	301-384-3300,	FAX:301-384-1537
MD	Columbia, Hall-Mark Elctrns.	410-290-5100,	FAX:410-290-8006
MD	Columbia, Hall-Mark Elctrns.	410-988-9800,	FAX:410-381-2036
MD	Columbia, Vantage Comps., Inc.	410-720-5100,	FAX:410-381-2172
MD	Silver Springs, Marshall Inds.	301-622-1118,	FAX:301-622-0451
MA	Andover, Bell Inds.	508-474-8880,	FAX:508-474-8902
MA	Andover, Vantage Comps.	508-687-3900,	FAX:508-687-4116
MA	Billerica, Hall-Mark Elctrns.	508-667-0902,	FAX:508-667-4129
MA	Newton, Green-Shaw Elctrns.	617-969-8900,	FAX:617-969-4712
MA	Tewksbury, Armor Elctrns.	508-640-1499,	FAX:508-640-1570
MA	Wilmington, Capstone Elctrns.	508-657-5874,	FAX:508-988-9282
MA	Wilmington, Marshall Inds.	508-658-0810,	FAX:508-658-7608
MI	Livonia, Marshall Inds.	313-525-5850,	FAX:313-525-5855
MI	Plymouth, Hall-Mark Elctrns.	313-416-5800,	FAX:313-416-5811
MN	Bell Inds. (Nationwide)	800-289-2355	
MN	Capstone Elctrns. (Nationwide)	800-388-2277	
MN	Bloomington, Hall-Mark Elctrns.	612-881-2600,	FAX:612-881-9461
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766,	FAX:612-571-9519
MN	Plymouth, Marshall Inds.	612-559-2211,	FAX:612-559-8321
MN	Thief River Falls, Digi-Key Corp. (Nationwide)	800-344-4539	
MO	Bridgeton, Marshall Inds.	314-291-4650,	FAX:314-291-5391
MO	Earth City, Hall-Mark Elctrns.	314-291-5350,	FAX:314-291-0362
NJ	Clifton, Vantage Comps., Inc.	201-777-4100,	FAX:201-777-6194
NJ	Fairfield, Bell Inds.	201-227-6060,	FAX:201-227-2626
NJ	Fairfield, Marshall Inds.	201-882-0320,	FAX:201-882-0095
NJ	Marlton, Capstone Elctrns.	609-569-7500,	FAX:609-988-1684
NJ	Moorestown, Hall-Mark Elctrns.	609-235-1900,	FAX:609-235-3381
NJ	Mt. Laurel, Marshall Inds.	609-234-9100,	FAX:609-778-1819
NJ	Parsippany, Hall-Mark ELctms.	201-515-3000,	FAX:201-515-4475
NM	Albuquerque, Bell Inds.	505-292-2700,	FAX:505-275-2819
NY	Buffalo, Summit Distrs.	716-887-2800,	FAX:716-887-2866
NY	Endicott, Marshall Inds.	607-785-2345,	FAX:607-785-5546
NY	Fairport, Hall-Mark Elctrns.	716-425-3300,	FAX:716-425-7195
NY	Rochester, Marshall Inds.	716-235-7620,	FAX:716-235-0052
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600,	FAX:516-737-0838
NY	Smithtown, Vantage Comps., Inc.	516-543-2000,	FAX:516-543-2030
NC	Raleigh, Capstone Elctrns.	919-954-0600,	FAX:919-954-9445
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712,	FAX:919-878-8729
NC	Raleigh, Marshall Inds.	919-878-9882,	FAX:919-872-2431
OH	Columbus, Hall-Mark Elctrns.	614-888-3313,	FAX:614-888-0767
OH	Dayton, Bell Inds.	513-434-8231,	FAX:513-434-8103
OH	Dayton, Bell Inds.	513-435-5922,	FAX:513-435-3122
OH	Dayton, Marshall Inds.	513-898-4480,	FAX:513-898-9363
OH	Solon, Hall-Mark Elctrns.	216-498-1100,	FAX:216-248-4801
OH	Solon, Marshall Inds.	216-248-1788,	FAX:216-248-2312
OK	Tulsa, Hall-Mark Elctrns.	918-254-6110	
OR	Beaverton, ALMAC/Arrow	503-629-8090,	FAX:503-645-0611
OR	Beaverton, Bell Inds.	800-525-6666,	FAX:503-520-1948
OR	Beaverton, Integrated Elctrns.	503-641-1690,	FAX:503-646-3737
OR	Beaverton, Marshall Inds.	503-644-5050,	FAX:503-646-8256
PA	Philadelphia, PEI/Genesis	215-673-0400,	FAX:215-553-8022

416-624-5572

CTS CORP., AUTOMOTIVE PRODUCTS, 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-3580 .... **B•1705**

CTS CORP., CONNECTOR PRODUCTS, 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, FAX: 612-533-3037; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

CTS CORP., ELECTROCOMPONENTS, 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-3580; Empl.: 110 ...... **B•1704-1705; D•1028**

Refer to CTS Corp., Elkhart, IN for sales offices and representative listing.

CTS CORP., FREQUENCY CONTROLS, 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860, FAX: 815-786-9743; Empl.: 450 .... **A•1358-1377**

Refer to CTS Corp., Elkhart, IN, for sales offices & representative listings.

CTS CORP, Microelectronics, 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882, FAX: 317-497-5399; Empl.: 505; *Sls. Mgr.:* Dick Kramer

CTS CORP., RESISTOR NETWORKS, 406 Parr Rd., Berne, IN 46711, Tel: 219-589-3111, FAX: 219-589-3243; Empl.: 650; *Sls. Mgr.:* Jim Kolkowski; *Dist. Mgr.:* Cliff Stults .... **A•1908-1909**

CTS OF CANADA, LTD., 80 Thomas St., Streetsville, Ontario, Can. L5M 1Y9, Tel: 416-826-1141, FAX: 416-858-9058; Empl.: 220

CUBIT, Div. of Proteus Industries. Inc., 340 Pioneer Way, Mountain View, CA 94041, Tel: 415-962-8237, FAX: 415-965-9355; FSC No.: 62443; Empl.: 37; *Sls. Mgr.:* Jon Heiner

CUESTA SYSTEMS CORPORATION, 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160, 800-332-3440, TELEX: 4949381 CUESTA, FAX: 805-546-0834; *Sls. Mgr.:* Dee Kruger

CUI STACK INC., 9640 S.W. Sunshine Ct., Beaverton, OR 97005, Tel: 503-643-4899, FAX: 503-643-6129; Empl.: 11; *Sls. Mgr.:* Jim Seiler; *Dist. Mgr.:* T. Dougan/W. Glessner .... **B•1248, 1706; C•1303; D•1029, 1653**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
CO	Franktown, MRC, Inc.	303-660-8750
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
NJ	Flanders, Guido Assocs.	201-347-4643
NJ	Moorestown, Tai Corp.	609-778-5353
NC	Raleigh, B.T. Funderburk	919-846-2373
OH	Lexington, North Central Mktg.	419-884-9804
TX	Richardson, J.D. Gram & Assoc.	214-699-9976

Local Distributors

CA	Canoga Park, RAG Elctrns.	818-998-6500
CA	Milpitas, R & D Elctrn. Parts	408-262-7144
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Great Neck, The Instr. Mart	516-487-7430
OR	Beaverton, Norvac Elctrns.	503-644-1052

CUNO, INC., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541; Empl.: 700; *Sls. Mgr.:* Alan Ponchick

CURRENT COMPONENTS, INC., 8600 Myersville Rd., Middleton, MD 21769, Tel: 301-473-5333, FAX: 301-371-7353; *Sls. Mgr.:* John Hackler

CURRENT TECHNOLOGY, INC., 101 W. Buckingham Rd., Richardson, TX 75081-4802, Tel: 214-238-5300, FAX: 214-238-0911; *Sls. Mgr.:* Steve Larson, VP Sls. & Mktg.

CURTIS INDUSTRIES, PO Box 343925, Milwaukee, WI 53234-3925, Tel: 414-649-4200, FAX: 414-649-4279; FSC No.: 73631; Empl.: 110; *Sls. Mgr.:* Al Hungsberg; *Dist. Mgr.:* Al Hungsberg

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CURTIS INSTRUMENTS, INC., 200 Kisco Ave., Mt. Kisco, NY 10549, Tel: 914-666-2971, TWX: 710-571-2163; FSC No.: 18530; Empl.: 400; *Sls. Mgr.:* Michael Miller .... **D•1158**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, TecRep Mktg.	602-991-6646
CA	Santa Clara, NorCal RepCo	408-988-1643
CA	Seal Beach, Texel Engrg.	310-596-9411
CO	Golden, J.F. Hurlbut Co.	303-279-7796
FL	Longwood, NSL Assocs.	407-629-5226
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Chicago, Bierhaus Sls.	312-751-8088
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Baltimore, Advanced Tech. Sls.	410-323-3140
MA	Brookline, Harman Assocs.	617-232-6687
MA	E. Longmeadow, Harman Assoc.	413-733-1425
MI	Ann Arbor, T.E. Murphy Co.	313-995-4082
MN	Edina, S.J. Collins & Assoc.	612-933-7661
MO	St. Louis, Acorn Elctrns.	314-421-1751
NH	Hudson, Harman Assoc.	603-882-0025
NY	Manhasset, WinCor Elctrn. Sls. Corp.	516-627-9474
NY	Manlius, Smith Tech. Sls.	315-682-1777
NC	Raleigh, L & D Inc.	919-876-5301
OH	Arcanum, T.E. Murphy Co.	513-692-8713
OH	Piqua, T.E. Murphy Co.	513-778-0247
OR	Portland, Evergreen Mktg.	503-598-7667
PA	Newtown Square, W. Reeves Assocs.	215-356-7500
TX	Carrollton, Lektron	214-416-4585
WA	Edmonds, Evergreen Mktg.	206-485-8063
WI	Milwaukee, Bierhaus Sls.	414-963-0318
Can	Mississauga, Patlon Aircraft	416-624-5572

CUSTOM BOBBIN WINDINGS, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369, Tel: 614-452-6973, FAX: 614-452-4156; Empl.: 16

CUSTOM CABLE CORP., 242 Butler St., Westbury, NY 11590, Tel: 516-334-3600, TELEX: 269301, FAX: 516-334-3989; Empl.: 20; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COILS INC., P.O. Box 348, Alcester, SD 57001-0348, Tel: 605-934-2460, FAX: 605-934-2440; FSC No.: 34808; Empl.: 75; *Sls. Mgr.:* Randy Larson ..... **A•2311**

Local Sales Offices & Reps

CA	Irvine, CalRep, Inc.	714-509-7707
CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Arvada, Krebill Comp. Sls.	303-940-7420
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
IN	Indianapolis, T.P.S. Assocs.	317-841-3046
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Kansas City, Lorenz Sales, Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MI	Holland, T.P.S. Assocs.	616-399-4665
MN	Edina, M F I	612-832-9017

MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660

CUSTOM COMPUTER CABLE, INC., 7171 Shady Oak Rd., Eden Prairie, MN 55344, Tel: 612-941-5651, 1-800-343-5553, FAX: 612-941-2865; Empl.: 40; *Sls. Mgr.:* Sam McDonald

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679, FAX: 216-241-1734; Empl.: 24; *Sls. Mgr.:* Larry Weider

CUSTOM CONTROL SENSORS, INC., 21111 Plummer Street, Chatsworth, CA 91313-2516, Tel: 818-341-4610, FAX: 818-709-0426; Empl.: 350; *Sls. Mgr.:* Larry Lewis

CUSTOM ELECTRONICS, Browne St., Oneonta, NY 13820, Tel: 607-432-3880, FAX: 607-432-3913; FSC No.: 23280; Empl.: 90; *Sls. Mgr.:* D. Hathaway

CUSTOM LINEAR INC., 617-E. Arques Ave., Sunnyvale, CA 94086-3832, Tel: 408-749-9933, FAX: 408-736-4720; Empl.: 15; *Sls. Mgr.:* Earl Wentworth

CUSTOM LOGIC, P.O. Box 3940, Crestline, CA 92325, Tel: 909-338-4059, FAX: 909-338-4450

CUSTOM MICRO SYSTEMS, INC., P. O. Box 9472, Livonia, MI 48151, Tel: 313-559-5397

Custom Power Systems

FAX: 516-467-5066

CUSTOM POWER SYSTEMS, 33 Comac Loop, Ronkonkoma, NY 11779-9998, Tel: 516-467-5328; Empl.: 30 .... **D•2082**

Local Sales Offices & Reps

CA	Agoura Hills, Powerdyne	818-991-0632
CA	San Jose, NES	408-293-2600
FL	Oviedo, Lighthouse Mktg.	407-366-0073
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
NJ	Clementon, Systech Assocs.	609-784-8300
NY	Smithtown, J L Sls.	516-864-1701
TX	Dallas, Eatman Engrg.	214-771-1903

CUSTOM SCI. INSTRS., Atlas Electric Devices Co., 13 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-538-8500, FAX: 201-984-6793; Empl.: 35; *Sls. Mgr.:* Henry Piekarski

CUSTOM SERVO MOTORS, P.O. Box 443, New Ulm, MN 56073, Tel: 507-354-1616, FAX: 507-354-1611; *Sls. Mgr.:* Pat McLaughlin, Blake Benson

CUT CRAFT, INC., 1501 Northpark Drive, Ft. Worth, TX 76102, Tel: 817-332-6151, FAX: 817-332-3304; Empl.: 90; *Sls. Mgr.:* Fred A. Antonini .... **C•1662, 1684**

CUTLER-HAMMER, INC., SHALLCROSS RESISTOR PRODS., See RCL Shallcross, Inc.

THE CUTTING EDGE, Controls Unlimited Inc., 4823 North Ridge Rd., Perry, OH 44081, Tel: 1-800-962-2376, FAX: 216-259-5015; Empl.: 4; *Sls. Mgr.:* Paul Adams

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Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871
AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
AR	Little Rock, Erickson Sls.	501-455-0618
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	Napa, Stewart-Fullerton	707-258-1160
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Guilford, Tynik, Inc.	203-453-1613
FL	Oviedo, Conley & Assocs.	407-365-3283
FL	Tampa, Standard Mktg.	813-933-5833
GA	Norcross, Lamons Sls.	404-242-2610
IL	Des Plaines, G. McL Cole Co.	708-827-6040
IN	Greenfield, France Entprs.	317-462-6098
IN	Greenwood, Liberty Sls.	317-888-8396
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Taunton, Focus Elctrn. Sls.	508-824-3840
MI	Holland, Mackinaw Sls, Inc.	616-399-4665
MN	Minneapolis, Robt. Marshall Co.	612-929-0457
MO	Kansas City, Ruffolo & Assocs.	816-471-5701
NJ	Middletown, Elctrn. Mktg. Assoc.	908-615-9484
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Akron, Augnat Assocs.	216-666-2819
OR	Tigard, Eltech Inc.	503-684-3458
PA	Hatboro, A Q S	215-674-3562
TN	Greeneville, Lamons Sls. Co.	615-639-8711
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Eltech	206-643-4330
Can	Etobicoke, True North Tech. Ltd.	416-744-2233
Can	Mississauga, Ont., True North Tech., Ltd.	416-677-9788

Local Distributors

CA	Canoga Park, Acort Inds., Inc.	818-700-2991
CA	Fountain Valley, Components Ctr.	714-979-0437
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050
CA	Santa Ana, El-Com/Cabletek	714-432-6630
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, Bell Inds.	408-745-0400
CO	Arvada, Denver Wintronics	303-431-7161
DE	Wilimington, Wholesale Elctrns., Inc.	302-652-3222
FL	Stuart, Microwave Comps., Inc.	407-286-4455
IL	Crystal Lake, Sub-Sem Inc.	815-459-4139
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, Bell Inds.	317-875-8202
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Norwood, Emtel Elctrns.	617-769-9500
MI	St. Clair Shores, Spemco	313-771-2700
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	Thief River Falls, Digi-Key Corp.	800-346-5144
NJ	Roselle, Lectron Inds.	201-245-5858
NJ	Union, Lectron Inds.	908-687-2626
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Bohemia, Car-Lac Elctrns.	800-645-1192
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Bristol, AIM Elctrns.	215-785-3500
PA	Levittown, Aim Elctrns.	215-946-3900

CYBERPAK CO., 1413 Sherman Rd., Unit 110, Romeoville, IL 60441, Tel: 708-972-0707, FAX: 708-972-0713; Empl.: 5; *Sls. Mgr.:* R. Weinbrenner

CYBER SYS., INC., 2031 E. Cerritos Ave., Anaheim, CA 92806, Tel: 714-502-6950, FAX: 714-563-7527; Empl.: 15

CYBORTRONICS INC., 17 Hammond, Ste. 409, Irvine, CA 92718, Tel: 714-855-2814, FAX: 714-855-0278; *Sls. Mgr.:* Eric Luebben

CYBRID INCORPORATED, 10 Woodcrest Drive, Woodcliff Lake, NJ 07675, Tel: 201-307-0426, FAX: 201-391-7112; Empl.: 9

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-0800, FAX: 708-526-0803; Empl.: 10

THE CYLIX CORPORATION, 2637 Townsgate Rd., Ste. 200, Westlake Vl., CA 91361, Tel: 805-379-3155, FAX: 805-379-4551; FSC No.: 59; Empl.: 15; *Sls. Mgr.:* Peter Norman; *Dist. Mgr.:* Peter Norman

CYPRESS MAGNETICS, INC., 8753 Industrial Lane, Rancho Cucamonga, CA 91730, Tel: 909-987-3570, FAX: 909-980-2009; FSC No.: 59791; Empl.: 15; *Sls. Mgr.:* Robert C. Greenwood

CYPRESS SEMICONDUCTOR CORP., 3901 North First Street, San Jose, CA 95134, Tel: 408-943-2600, TELEX: 821032 CYPRESS SNJ UD, TWX: 910-997-0753, FAX: 408-943-2741

CYTEC CORP.

FAX: 716-381-0475

CYTEC CORP., 2555 Baird Road, Penfield, NY 14526, Tel: 716-381-4740, 800-346-3117; Empl.: 20; *Sls. Mgr.:* Harry Turner .... **D•1250**

DABURN ELECTRONICS & CABLE CORP., 225 Pegasus Ave., Northvale, NJ 07647, Tel: 201-768-5400, FAX: 201-768-9642; FSC No.: 25706 ..... **C•1740-1746**

Local Sales Offices & Reps

AZ	Chandler, Harco	602-838-7186
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Newport Beach, SPA Elctrns.	714-863-1193
CO	Denver, Mountain Reps	303-333-7745
FL	Tampa, SRT Mktg.	813-884-4805
IN	Carmel, STB & Assocs.	317-844-9227
MD	Bel Air, Freedman Malta Assocs.	301-879-3848
MA	No. Scituate, W. A. Hendrickson	617-545-0652
MN	Minneapolis, R. K. Sls.	612-571-1001
NY	E. Syracuse, Liberty Elec.	315-437-8100
NY	Plainview, Robt. Smith Assocs.	516-681-3155
NC	Concord, Muncy Sls. Assocs.	800-762-1271
PA	King of Prussia, Freedman-Malta	215-337-9211
PA	Pittsburgh, Catalyst Sls.	412-826-3434
WA	Edmonds, ACDC	206-745-5445
WI	Menomonee Falls, Voss-Dent Assocs.	414-781-0555
EXP	Rehovot, Isreal, M.G.R.	972-8411719
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Diego, Shanks & Wright	619-239-0176
CT	Danbury, Pilgram	203-792-7271
CT	West Hartford, Signal Ctr.	203-233-8551
FL	Altamonte, Royce	305-869-4700
FL	Miami, Small Parts	305-751-0856
GA	Atlanta, ACK Radio Supp.	404-351-6340
IA	Marion, Brenneman & Assoc.	319-377-6394
LA	Harahan, Elctrn. Parts & Supp.	504-734-0641
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Carlisle, Davis Assoc.	617-434-6121
MA	Needham, YDI Electronics	617-449-1005
MA	Woburn, Pacer	617-935-8330
MN	New Brighton, Chris	612-631-2647
NJ	Bayville, Berkley Indl.	908-341-9366
NJ	Cranford, GSI Elctrns.	908-272-6400
NJ	Kenilworth, Federated Purchaser	908-272-0505
NY	Albany, E. E. Taylor	518-438-7811
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Hauppauge, Broadline	516-231-4100
NY	Rochester, Simcona	716-328-3230
PA	Philadelphia, AC Radio	215-462-9379
RI	Westerly, Ocean State EL.	401-596-3080
WA	Seattle, Westlake Elctrns.	206-622-6600
Can	Markham, Ont., Arma	416-475-2024

DADEN ASSOCIATES, 1001 Calle Amanecer, San Clemente, CA 92673, Tel: 714-366-1522, FAX: 714-366-9600; FSC No.: 57032; Empl.: 49; *Sls. Mgr.:* Mark Fournier

DAGE-MTI, 701-N. Roeske Ave., Michigan City, IN 46360, Tel: 219-872-5514, FAX: 219-872-5559; Empl.: 51; *Sls. Mgr.:* Paul Thomas

DAGE PRECISION INDUSTRIES, INC., 46701 Fremont Blvd., Fremont, CA 94538, Tel: 510-683-3930, FAX: 510-683-3935; Empl.: 7; *Sls. Mgr.:* Bonnie Nichols

DAICO INDUSTRIES, INC., 2453 East Del Amo Blvd., Rancho Dominguez, CA 90220, Tel: 310-631-1143, FAX: 310-631-8078; FSC No.: 28983; Empl.: 130; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Diane Felando

DAIDO PRECISION ENGINEERED PRODUCTS/, Sumtak Electronics, 615 Pierce St., Somerset, NJ 08875, Tel: 908-805-1900, FAX: 908-805-0122; *Sls. Mgr.:* Phillip Giannini, Nat. Sls. Mgr.

DAITRON, INC., 7150 S.W. Hampton, Suite 130, Tigard, OR 97223, Tel: 503-620-2879, TELEX: 910-240-4863, FAX: 503-620-2942; Empl.: 13; *Sls. Mgr.:* Harry Iino; *Dist. Mgr.:* Karen Sempert

DALE ELECTRONICS, INC., Columbus Div., 1122 23rd Street, Columbus, NE 68601-3647, Tel: 402-563-6506, FAX: 402-563-6418; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Greg Mefford; *Dist. Mgr.:* Jon Trabert ..... **A•1225-1233, 1379-1381, 1910-1931, 2072-2077, 2312-2313; B•1024-1026, 1870-1871; C•1306-1308**

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Mike Burns; *Dist. Mgr.:* Jon Trabert ...... **A•1910-1915, 1917-1924**

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jon Trabert .... **A•1379-1381, 2072-2077**

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* Mike Husman; *Dist. Mgr.:* Jon Trabert .. **A•1225-1230, 1232-1233, 2312-2313; C•1306-1308**

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DALLAS SEMICONDUCTOR, 4401 South Beltwood Pkwy., Dallas, TX 75244, Tel: 214-450-0400, FAX: 214-450-0470; Empl.: 700; *Sls. Mgr.:* Jack Mattis .... **A•1525-1527**

Local Sales Offices & Reps

AL	Huntsville, Glen White & Assocs.	205-882-6751
AZ	Scottsdale, Haas & Assocs.	602-488-3662
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Santa Clara, Phase II	408-980-0414
CA	Thousand Oaks, S.C. Cubed	805-461-4675
CA	Tustin, S.C. Cubed	714-731-9206
CO	Wheat Ridge, Waugaman Assoc.	303-423-1020
CT	Wallingford, Technology Sls. Inc.	203-269-8853
FL	Altamonte Springs, Semitronic Assoc.	407-831-8233
FL	Clearwater, Semitronic Assoc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Norcross, Glen White & Assocs.	404-441-1447
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Eng.	317-849-4260
IA	Cedar Rapids, Cahill, Schmitz & Howe	319-377-8219
KS	Overland Park, Gibb Technlg. Sls.	913-451-6785
MA	Woburn, Mill-Bern Assocs.	617-932-3311
MI	Livonia, Geisting & Assocs.	313-478-8106
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Chesterfield, Gibb Technlg. Sls.	314-530-0495
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NY	Fairport, Technlg. Sls.	716-223-7500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NC	Huntersville, Glen & White Assoc.	704-875-3777
NC	Raleigh, H & A Sls.	919-848-1931
OH	Cincinnati, Geisting & Assocs.	513-385-1105
OH	Cleveland, Geisting & Assoc.	216-261-9705
OH	Columbus, Geisting & Assoc.	614-459-4800
OK	Tulsa, West Assocs.	918-665-3465
OK	Tusla, West Assocs.	918-665-3465
OR	Beaverton, Western Tech. Sls.	503-644-8860
PA	Pittsburgh, Geisting & Assoc.	412-828-3553
TN	Gray, Glen White & Assoc.	615-477-8850
TX	Austin, West Assoc.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Salt Lake City, Waugaman Assocs. ...	801-261-0802
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Sumer, Inc.	414-784-6641
EXP	Hato Rey, PR, Semitronic Assoc.	809-766-0700
Can	Burnaby, B.C., Davetek Mktg.	604-430-3680
Can	Ottowa, Dynasty	613-596-9800
Can	Pointe Claire, Dynasty	514-695-7353

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Irvine, Insight Elctrns.	714-727-2111
CO	Wheat Ridge, Added Value Elect. Dist.	303-422-1701
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Lake Mary, Milgray-Elctrns.	407-321-2555
GA	Duluth, Hall-Mark Elctrns.	404-623-4400
IL	Palatine, Milgray Elctrns.	708-202-1900
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
MA	Wilmington, Milgray Elctrns.	508-657-5900
MI	Livonia, Hall-Mark Elctrns.	313-462-1205
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OK	Tusla, Sterling Elctrns.	918-663-2410
OR	Beaverton, Anthem Elctrns.	503-643-1114
TX	Richardson, Anthem Elctrns.	214-238-7100
UT	Salt Lake City, Anthem Elctrns.	801-973-8555
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
Can	Ville St. Laurent, Que., ITT Multicomponents	514-335-7697

DALSA INC., 605 McMurray Road, Waterloo, Ont., Canada N2V 2E9, Tel: 519-886-6000, FAX: 519-886-8023; *Sls. Mgr.:* Ralph Beier

DAMAC PRODUCTS, INC., 10410-1 Pioneer Blvd., Santa Fe Springs, CA 90670, Tel: 310-946-0881, FAX: 310-946-2631; Empl.: 30; *Sls. Mgr.:* Melodie Eberhart

DANAHER CONTROLS, 1675 N. Delany Rd., Gurnee, IL 60031-1282, Tel: 708-662-2666; Empl.: 300; *Sls. Mgr.:* R. Lowry; *Dist. Mgr.:* S. Rosenthal

DANCER COMMUNICATIONS, INC., 649 South Ave., Bldg. 8, Secane, PA 19018, Tel: 215-543-8066, FAX: 215-543-2151; *Sls. Mgr.:* Joanne Gilligan

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Dan Hall .... **D•1654-1655**

Local Sales Offices & Reps

CA	Pasadena, Electro Mecha. Instrs.	818-795-7193

D & L ELECTRONICS, Box 1236 540 Valley View Rd., Langhorne, PA 19047, Tel: 800-942-3631, FAX: 215-757-7391

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-2380; Empl.: 7; *Sls. Mgr.:* Eugene Rane

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 526 Thorpe Rd., Orlando, FL 32824, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Gary Moore; *Dist. Mgr.:* Don Malinovsky .... **C•1700**

Local Sales Offices & Reps

CA	El Toro, DMC Western Reg.	407-855-6161

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 11952 Challenger Court, Moorpark, CA 93021, Tel: 1-805-529-3788, FAX: 805-529-3837; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Bob Long

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DA/PRO RUBBER, INC., 601 N. Poplar, Broken Arrow, OK 74012, Tel: 918-258-9386, FAX: 918-258-3286; Empl.: 260; *Sls. Mgr.:* Walter F. Sanders; *Dist. Mgr.:* Walter F. Sanders

DARE ELECTRONICS, INC., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

DARRAH ELECTRIC COMPANY, 5914 Merrill Ave., Cleveland, OH 44102, Tel: 216-631-0912, FAX: 216-631-0440; Empl.: 24; *Sls. Mgr.:* David J. Darrah; *Dist. Mgr.:* David J. Darrah

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 40; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, FAX: 904-244-6344; FSC No.: 32365; Empl.: 50

DATACON, INC., Interconnect Sub-Systems, 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 170; *Dist. Mgr.:* Lonise M. Silva

DATACUBE, INC., 300 Rosewood Drive, Danvers, MA 01923, Tel: 508-777-4200, FAX: 508-777-3117; Empl.: 130; *Sls. Mgr.:* David Lerner

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ...... **A•1528-1544**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Tech Sls., Inc.	602-246-1614
AR	R-Squared	713-820-3210
CA	Mountain View, Weseloh/Swanson & Assocs.	415-961-0565
CA	Yorba Linda, Target Elctrns.	714-692-1630
DE	Jack McCoy Assocs.	215-363-0350
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IN	Electro Mktg.	513-890-8322
KY	Electro Mktg.	513-890-8322
LA	R-Squared	713-820-3210
ME	Dynamic Sls., Inc.	617-272-5676
MA	Burlington, Dynamic Sls., Inc.	617-272-5676
MI	Livonia, Electro Mktg.	313-421-7590
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
NH	Dynamic Sls., Inc.	617-272-5676
NJ	Medford, Jack McCoy Assocs.	609-953-0770
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NC	Raleigh, Hughes Assocs., Inc.	919-467-7029
OH	Dayton, Electro Mktg.	513-890-8322
OK	R-Squared	713-820-3210
PA	Downingtown, Jack McCoy, Inc.	215-363-0350
PA	Pittsburgh, Electro Mktg.	412-492-0688
RI	Dynamic Sls., Inc.	617-272-5676
SC	Hughes Assocs., Inc.	919-467-7029
TN	Morristown, Hughes Assocs., Inc.	615-587-2433
TX	Houston, R-Squared	713-820-3210
VT	Dynamic Sls., Inc.	617-272-5676
Can	Ont., Source Elctrns.	416-676-0830

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
TX	Carrollton, Omni Pro	214-713-9000

DATA DEVICE CORP., See ILC Data Device Corp.

Data Display Products

FAX: 310-640-7639

DATA DISPLAY PRODUCTS, 445 So. Douglas St., El Segundo, CA 90245-4630, Tel: 310-640-0442, 800-421-6815; FSC No.: 15513; Empl.: 40; *Sls. Mgr.:* Anthony Toniolo; *Dist. Mgr.:* Anthony Toniolo ..... **B•1136-1139**

Local Sales Offices & Reps

AL	Madison, Southern Elctrn. Reps.	205-461-8925
CA	Arcadia, HMC	818-447-0958
CA	Cupertino, Codella Mktg.	408-248-3890
CO	Broomfield, Summitwest Mktg.	303-460-9600
IL	Lemont, Trend-Tronics	708-972-1166
MA	Randolf, Hatch Assocs.	617-963-3306
MN	Minneapolis, Amtek Mktg.	612-561-5371
NJ	Flanders, K & R Engrg.	201-584-5235
OR	Beaverton, WJ Sls.	503-626-3759
PA	Allison Park, KW Elect. Sls	412-492-0777
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Freeport, Marathon Assoc.	409-233-7026

Local Distributors

CA	Arcadia, Parco	818-447-0958,800-423-4892
CA	Santa Clara, Bell Elctrn. Supp.	408-727-2355
CO	Denver, Hardware Specialty	303-371-8553
IL	Lemont, Trend-Tronics	708-972-1166, 800-323-1697
MD	Burtonsville, U.S. Elctrns.	301-384-3300
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Methuen, Aved Elctrns.	508-688-3800
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Flanders, VKR Svcs.	201-584-5393,800-631-9362
NJ	Rockaway, Tonar Inds.	201-586-9000,800-654-6246
NY	Hauppauge, Vargas	516-273-1111,800-645-1402
NC	Charlotte, EMC	704-394-6195
OH	Cleveland, EMC	216-442-3441
OH	Columbus, EMC	614-299-4161
OH	Dayton, EMC	513-439-4711
OH	Englewood, Argent Inds.	513-836-8633
PA	Philadelphia, Shap Elctrns.	215-969-3300, 800-441-0375
PA	York, ECI	717-846-5334
Can	Burnaby, B.C., Intek Elctrns.	604-294-8100, FAX:604-294-6335
Can	Calgary, Alb., Cardinal Ind. Elctrns.	403-259-6817, FAX:403-259-8699
Can	Edmonton, Alb., Cardinal Ind. Elctrns.	403-483-6266,FAX:403-484-8926
Can	Markham, Ont., Carsten Elctrns.	416-477-9898, FAX:416-477-7474
Can	Pt. Claire, Que., Coba Elctrns.	514-694-1335, FAX:514-694-1337
Can	Rexdale, Ont., Valtrie Mktg.	416-798-2555, FAX:416-798-2560

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063-3206, Tel: 305-971-0400; *Sls. Mgr.:* Mario M. Martinez

DATA ENVIRONMENT, INC., Box 91511, Portland, OR 97291, Tel: 503-531-0765

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 800-332-3282, TELEX: 200081, FAX: 508-263-0630; Empl.: 300; *Sls. Mgr.:* Ernest C. Lutfy .... **B•1928-1930**

Local Sales Offices & Reps

AL	Fairhope, FLW Southeast	205-990-8989
AL	Huntsville, FLW Southeast, Inc.	205-536-6207
AZ	Phoenix, Trembly	602-431-9417
CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Santa Clara, Johnson Assoc.	408-984-4626
CO	Highlands Ranch, Valcomp Elctrns., Inc.	303-791-0330
FL	Orlando, FLW Southeast, Inc.	407-894-9671
GA	Marietta, FLW Southeast, Inc.	404-424-1731
IL	Bridgeview, Finn & Conway, Inc.	708-599-0103
IN	Indianapolis, C.M. Buck & Assoc. Inc.	317-293-5704
IA	Cedar Rapids, Delltron Co.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	410-730-4700
MA	Acton, Data Instrs., Inc.	617-264-9550
MI	Rochester Hills, Geotronix, Inc.	313-373-4334
MN	Minnetonka, Finn & Conway Inc.	612-593-1273
MO	Kansas City, Delltron Co.	816-436-6445
MO	Manchester, Midwest Control Prods.	314-394-8040
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Albany, Expert Indl. Sys., Inc.	518-869-3355
NY	N. Tonawanda, Expert Indl. Sys., Inc.	716-694-3935
NY	Rochester, Expert Indl. Sys., Inc.	716-323-1305
NY	Syracuse, Expert Indl. Sys., Inc.	315-455-2469
NC	Charlotte, Emco, Inc.	704-372-8281
OH	Richfield, Geotronix, Inc.	216-659-6100
OH	Trotwood, Geotronix Inc.	513-854-5939
OK	Oklahoma City, Bauman Instr. Corp.	405-631-8080
OK	Tulsa, Bauman Instr. Corp.	918-492-8086
PA	Allison Park, Geotronix, Inc.	412-487-1770
PA	Richboro, Technical Dvcs. Inc.	215-953-1595
TX	Grand Prairie, Collinsystems, Corp.	214-647-3569
TX	Houston, Collinsystems, Corp.	713-464-9460
WA	Redmond, S.E.A. Sls.	206-883-4999
WA	Vancouver, S.E.A. Sls.	206-573-5161
WI	Brookfield, Finn & Conway Inc.	414-784-3300
Can	Richmond, BC, Maxwell Morton Assocs.	604-273-1337
Can	Woodbridge, Ont., Technel Engrg. Inc.	416-851-4244

Local Distributors

CA	Glendale, A. Biederman, Inc.	818-246-8431
CA	Milpitas, A. Biederman, Inc.	408-435-0209
CO	Lafayette, Big Horn Instrmn.	303-665-4054
CT	Meriden, Meriden Cooper	203-237-8448
GA	Norcross, AA Elec. Inc.	404-449-8670
IN	Indianapolis, C & E Sls., Inc.	317-844-9799
MA	Billerica, Tanyx Meas. Inc.	508-671-0183
MI	Taylor, North Cen. Engrg., Inc.	313-942-0900
MN	Minneapolis, Process Measurement Co.	612-544-4035
MN	St. Paul, Power/mation	612-645-0781
MO	St. Louis, ISL Corp.	314-423-3141
NJ	Newark, Norman Bragar Co., Inc.	201-344-1100
NY	Amherst, KOM Lamb Inc.	716-691-6400
NC	Charlotte, EMCO	704-372-8281
OH	Cincinnati, C & E Sls. Inc.	513-241-1069
OH	Twinsburg, The Stanley M. Proctor Co.	216-425-7814
OR	Portland, Branom Instr.	503-283-2555
PA	Bensalem, Airline Hydraulics	215-638-4700
TX	Dallas, Butler and Land	214-343-8800
TX	Sugar Land, Alpha Process Sls.	713-240-4505
UT	Salt Lake City, Rust Automation Equip.	801-486-9865
WA	Seattle, Branom Instr.	206-762-6050
WI	Waukesha, Power/mation	414-542-2868
Can	Don Mills, Ont., Intertechnology, Inc.	416-445-5500

DATAK CORP., An LKG Company, 2240 15th St., Rockford, IL 61104, Tel: 815-229-7773, 1-800-645-2262, FAX: 815-229-7785; *Sls. Mgr.:* Wayne Timpe ... **C•1677**

Local Sales Offices & Reps

AL	Alabaster, Rohr-Wanger-Roberts	205-879-7361
AZ	Mesa, Yocum Mktg.	602-834-3334
CA	Gardena, Bidwell-Schwartz Assoc.	213-770-0300
CA	Irvine, English Damco Sls.	714-753-1950
CA	So. San Francisco, Carelli-Ema, Inc.	415-873-2524
CT	Lebanon, Adams McGregor Sales	203-537-5737
FL	Altamonte Springs, DHR Mktg.	407-331-1199
FL	Pompano Bch., DHR Mktg.	305-972-9157
GA	Norcross, Rohr-Wanger-Roberts	404-463-9349
IL	Addison, Elctrn. Specs.	708-250-9080
IA	Cedar Rapids, Mink Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Associates	913-341-8309
MD	Silver Spring, Mid-Atlantic Sls.	301-593-7749
MN	Minneapolis, Kodo Assocs., Inc.	612-881-1255
MO	Bridgeton, M.I.N.K. Assocs.	314-291-5454
OH	Akron, Buckeye Mktg. Grp.	216-836-7875
OR	Portland, Jos. V. Belusko	503-222-4279
PA	Philadelphia, Instrmn. Specialties	215-742-0898
PA	Pittsburgh, Buckeye Mktg. Grp.	412-655-1519
RI	Coventry, Adams McGregor	401-726-1300
SC	Rock Hill, Rohr-Wanger-Roberts	803-324-5111
TX	Rowlett, Campion Sls. Co., Inc.	214-475-8313
VA	Charlottesville, Mid Atlantic Sales	804-973-8099
WI	Waterford, Elctrn. Specs.	414-662-2859
Can	Montreal, Cantronics Ltd./Cantronics Intl. Ltd.	514-848-7132
Can	Scarborough, Ont., Cantronics Ltd./Cantronics Intl. Ltd.	416-297-8668,FAX:416-297-0107

Local Distributors

AL	Birmingham, ACK Radio Supply Co.	205-322-0588
AZ	Phoenix, Dalis Elctrns.	602-275-2885
AZ	Phoenix, Tri-Tek, Inc.	602-371-0860
AZ	Scottsdale, D.C. Elctrns.	602-945-7736
CA	Belmont, Jameco	415-592-6718
CA	Berkeley, Al Lasher's Elctrns.	510-843-5915
CA	Canoga Pk., Sandys Elctrns.	818-346-8353
CA	Concord, Pacific Valley Elctrns.	510-682-4700
CA	Costa Mesa, Marvac-Dow Elctrns.	714-650-2001
CA	Fremont, Easy Tech.	510-770-2300
CA	Fresno, Sparky Elctrns.	209-227-2986
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Hollywood, Pacific Radio Exchg.	213-462-1393
CA	Manhattan Bch., Fry's Elctrns.	310-364-3789
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Mountain View, Haltek Elctrns.	415-969-0510
CA	No. Hollywood, Sandy's Elctrns.	818-983-2550
CA	Redwood City, HDB Elctrns.	415-368-1388
CA	San Diego, Gateway Elctrns.	619-279-6802
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CA	Thousand Oaks, Pace Elctrns.	805-497-7515
CA	Van Nuys, All Elctrns.	818-333-8009
CO	Colorado Springs, Centennial Elctrns.	719-633-4666
CT	Greenwich, Wise Comps.	203-531-4880
DE	New Castle, Electronics Exch.	302-322-5401
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Atlanta, Ack Radio Supply	404-351-6340
GA	Macon, Fouraker Elctrns.	912-746-4325
GA	Norcross, Austin Elctrns.	404-449-8697
ID	Boise, Kimball Elctrns.	208-232-2201
IL	Berwyn, B-B & W, Inc.	312-749-1710
IL	Mt. Prospect, Tri-State Elec.	312-255-0600
IL	Niles, Joseph Elec.	312-297-4200
IL	Peoria, Klaus Radio	309-691-4840
IL	S. Holland, Union Elctrns.	708-333-4100
IN	Ft. Wayne, Warren Radio	219-426-5344
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KY	Louisville, Peerless Elec.	502-637-7674
LA	Lafayette, Ralph's	318-233-0105
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, Capitol Radio Whlsrs.	301-881-2270
MA	Lynn, Land Elctrns. Supp.	617-592-2220
MA	Needham, You-Do-It Elctrns.	617-449-1005
MA	Norwood, Gerber Elec.	617-769-6000
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, Norwest Elctrns.	313-261-4551
MN	Minneapolis, AEI/Acme Elctrn Parts.	612-338-4754
MO	Kansas City, Elctrn. Supp.	816-931-0250
MO	St. Louis, Gateway Elec.	314-427-6116
MO	St. Louis, Van Sickle	314-621-5000
MT	Bozeman, Elctrn. Svc. & Distr.	406-587-4466
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NV	Las Vegas, Sandy's Elctrns.	702-383-8353
NV	Reno, Elect. Distr. Co.	702-323-2766
NJ	Denville, Lashen Elctrns.	201-627-3783
NJ	Greenbrook, Greenbrook Elctrns.	201-968-3500
NJ	Kenilworth, Federated Purchasers, Inc.	201-272-0505
NM	La Cruces, Elctrn. Parts Co.	505-523-4578
NY	Buffalo, Summit Distr.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Plainview, Kelvin Elctrns.	516-349-7620
NY	Rochester, Summit Elec.	716-334-8110
NC	Greensboro, Guilford Elctrns. Supp.	919-275-1385
OH	Warren, REM Elctrns. Supply	216-373-1300
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Portland, Radar Elec.	503-232-3404
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Pawtucket, Jabbour Electronic Supply	401-728-4600
RI	Providence, W. Dandreta & Co.	401-861-2800
RI	Westerly, Ocean State Elctrns.	401-596-3080
SC	Charleston, Wholesale Inds. Elctrns.	803-722-2634
TN	Memphis, W & W Distbg.	901-527-4627
TX	Houston, Elctrn. Parts Outlet	713-784-0140
TX	Richardson, Off The Shelf Comps.	214-238-0808
TX	Stafford, C.E.C. Elctrn. Parts	713-498-5573
UT	Salt Lake City, Kimball Elec.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-256-4610
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	Wausau, Electronics Inc.	715-845-4671
NH	Newton, Adams-McGregor	603-382-3669

DATAKEY, INC., 407 W. Travelers Trail, Burnsville, MN 55337, Tel: 612-890-6850, FAX: 612-890-2726; FSC No.: 7025; Empl.: 50; *Sls. Mgr.:* Jerry Cox

DATALUX CORP., 155 Aviation Dr., Winchester, VA 22602, Tel: 703-662-1500, FAX: 703-662-1682; Empl.: 25; *Sls. Mgr.:* R.H. Twyford

DATA MEGA INC., Mega Data, 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6501, FAX: 708-860-3672

DATA POWER, See Beaver Labs

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464; Empl.: 35; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91367-2499, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 3500; *Sls. Mgr.:* Paul Depa; *Dist. Mgr.:* John Thorse

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-7801; FSC No.: 96238; Empl.: 200; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 150 Springside Dr., Ste. B220, Akron, OH 44333, Tel: 216-668-1444, TELEX: 6502817028, FAX: 216-666-5434

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 150; *Sls. Mgr.:* Carl Anderson, Sls. V.P.

DATA RAY

FAX: 303-451-1143

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234, Tel: 1-800-926-5556, 303-451-1300; Empl.: 100; *Sls. Mgr.:* A. Woodley .... **B•1028-1031**

Local Sales Offices & Reps

CA	Seal Bch., Texel	213-596-9411

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, 800-344-9684, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 55; *Sls. Mgr.:* L. Rizzo .... **B•1931**

Local Sales Offices & Reps

AK	El Dorado, Indl. Controls Assoc.	501-862-5978
CA	Anaheim, Direct Drives & Controls	714-993-3412
CO	Denver, Motion Tek	303-333-6050
IL	Geneva, The Fromm Co.	708-208-6100
MI	Troy, Kinetic Technlgs.	313-828-9700
NJ	Maywood, Concept 250 Inc.	201-488-7343
NY	Sidney, A.J.S. Controls	607-563-8978
OH	Cincinnatti, G.R. Fehr Co., Inc.	513-772-5700
PA	Wexford, Intek Sys.	412-935-4717
UT	Salt Lake City, Motion Tek, Inc.	801-268-9815

Local Distributors

NY	Sidney, AJS Controls	607-563-8978

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* Pam Nelson; *Dist. Mgr.:* Lori Dustin

FAX: 909-928-7701

DATATRONICS, INC., 28151 Highway 74, Romoland, CA 92585, Tel: 909-928-7700; FSC No.: 0F5M2 .... **A•2314**

For all states not listed, please contact factory in Romoland, CA 909-928-7700.

Local Sales Offices & Reps

AL	Huntsville, Bolton Assoc.	205-880-1164
CA	Riverside, Dalbeck-Vought, Inc.	909-243-1170
CA	San Jose, Fischer Assoc.	408-733-7350
CO	Denver, Megatronix	303-730-6262
FL	St. Petersburg, Bolton Assocs.	813-864-2294
GA	Dunwoody, Bolton Assoc.	404-671-9827
IL	Elgin, Selective Sls.	708-697-3757
IL	Park Ridge, Synmark Sls.,Inc.	312-390-9696
IN	Ft. Wayne, Gen.II Mktg.,Inc.	219-436-4485
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Dy-Tronix	913-339-6333
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Woburn, Radian Assocs.,Inc.	617-933-7386
MI	Kalamazoo, Midwestern Sls.	616-372-6133
MI	Troy, C.B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Tech. Solutions	612-785-9303
MO	Bridgeton, Dy-Tronix	314-291-3861
NJ	Kenilworth, Ventronics, Inc.	908-272-9262
OH	Columbus, N. Central Mktg.	419-884-9804
OR	Lake Oswego, Abacus Sls.	503-777-8111
SC	Greenwood, Bolton Assoc.	803-223-4018
TX	Plano, Vielock Assoc.	214-881-1940
UT	Bountiful, Anderson Assoc.	801-292-8991
WI	East, Selective Sls.	414-367-1133
Can	Quebec, Componetics	514-331-9930

Local Distributors

OH	N. Central Mktg.	419-884-9804
WI	Selective Sls.	414-367-1133

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATAWARE ELECTRONICS INC., 8227 44th Ave. West H, Mukilteo, WA 98275, Tel: 206-742-5000, FAX: 206-742-8900; Empl.: 50-100; *Sls. Mgr.:* William Bovermann

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410, FAX: 215-322-9730; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL®

INNOVATION and EXCELLENCE

FAX: 508-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048-1194, Tel: 508-339-3000; Empl.: 550; *Sls. Mgr.:* L. Jacobsen .... **D•1184-1185, 1340-1343, 2099-2103**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	San Diego, Bestronics of San Diego	619-693-1111
CA	Santa Clara, W. J. Electrns.	408-982-9222
CO	Denver, Elcom, Inc.	303-337-2300
CA	La Mirada, Select Elctrns.	213-921-5159
FL	Largo, Q-Rep	813-397-8431
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Inverness, Carvel Engrg. & Sls.	708-934-9600
IN	Indianapolis, Wilson Tech. Sales	317-872-2513
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonsville, Chesapeake Technlg., Inc.	301-236-0530
MI	W. Bloomfield, Infinity, Inc.	313-932-1179
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Haddenfield, G. L. Williams Assocs.	609-428-6060
NM	Albuquerque, Delta Elctrn. Sls.	505-271-3276
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Elmont, Crane & Egert	516-872-0800
NC	Cary, Hughes Assocs., Inc.	919-467-7029
TN	Knoxville, Hughes Assocs, Inc.	615-558-0283
TX	Arlington, ION Assocs.	817-695-8000
TX	Austin, ION Assocs.	512-794-9006
TX	Houston, ION Assocs.	713-537-7717
UT	Murray, Elcom, Inc.	801-262-2400
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	206-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
WI	New Berlin, Carvel Engrg. & Sls.	414-784-7007
Can	Mississauga, Ont., Tracan Elctrns.	416-625-7752
Can	Montreal, Que., Tracan Elctrns.	514-955-8096
Can	Nepean, Ont., Tracan Elctrns.	613-596-9760
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0522

DATRICON, Scientific Technologies, Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 42

DATRON SYSTEMS DIVISION, 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.: 119; *Sls. Mgr.:* John Ricardi

DATUM TIMING, Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, ESYLNK: 714-533-6345; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann .... **D•1116, 1186-1189**

Divisions of Datum Inc. Divisions of Datum Inc.

Local Sales Offices & Reps

CA	BANCOMM	408-578-4161
AL	Huntsville, Southern Mktg. Assoss. Ltd.	205-534-6020
AK	Anchorage, Dryden Instrmn	907-344-4995
CA	Anaheim, Datum	714-533-6333
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Littleton, Vic Meyers Assocs. Inc.	303-730-7313
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Alpharetta, Southern Mktg. Assocs. Ltd.	404-664-9797
IL	Des Plaines, Marsland Assocs.	708-298-2620
IN	Brownsburg, Marsland Assocs.	317-852-8688
IA	Marion, Marsland	319-373-0566
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Columbia, Creative Mktg. Assocs.	301-880-4161
MA	Waltham, Scientific Devices-New England	617-890-2252
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	908-964-6200
NM	Albuquerque, Vic Meyers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
OH	Dublin, Micro Sls. Corp.	614-792-9117
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-579-2995
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WA	Seattle, Comptronics	206-784-9713
WI	New Berlin, Marsland Assocs.	414-786-6611

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; Empl.: 6; *Sls. Mgr.:* Dean Davidge

DAVIES MOLDING CO., 350 E. Kehoe Blvd., Carol Stream, IL 60188, Tel: 708-510-8188, FAX: 708-510-9944; FSC No.: 72512; Empl.: 130; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

Davis

INSTRUMENTS

FAX: 410-358-0252

DAVIS INSTRUMENT MFG. CO., INC., 4701 Mt. Hope Drive, Baltimore, MD 21215, Tel: 800-368-2516 .... **D•1251**

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5926, TELEX: 288219, TWX: 810-459-1822; Empl.: 6000

DAYTRONIC CORP., BTR Grp., 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, FAX: 513-866-3327; Empl.: 125; *Sls. Mgr.:* Ronald J. Toke

DAZIX, Intergraph, One Madison Industrial Park, Huntsville, AL 35894, Tel: 1-800-239-4111, 205-730-2000, FAX: 205-730-8344

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 407-727-0660; Empl.: 337

DCI

FAX: 913-782-5766

DCI INC., 14812 W. 117th Street, Olathe, KS 66062, Tel: 913-782-5672; FSC No.: 58677; Empl.: 40; *Sls. Mgr.:* Larry Shelton .... **B•1032; D•1344**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Lomita, Techrep Comps.	310-539-9070
CA	San Diego, Techrep - San Diego	714-361-7727
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
FL	Sarasota, REP USA	813-923-2897
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Deerfield, Jebco Sls. Ltd.	708-945-2102
IN	Ft. Wayne, M/S Sls. & Assoc.	219-463-3023
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix	316-838-0884
MA	Pembroke, R.G. Assocs., Inc.	617-293-5233
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Dy-Tronix	314-291-4777
MA	Lowell, R.G. Assocs., Inc.	508-458-9802
NY	Pittsford, L-Tron	716-383-0050
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303

NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, H H & Assocs.	214-247-8308
TX	Houston, Talon Tech. Sls.	713-999-8588
VA	Alexandria, Dandelion-sk	703-722-4316
WA	Seattle, Brett Assocs., Inc.	206-328-6900
WA	Roy, Accu-Tec	206-843-9143

Panel Meters

AZ	Phoenix, J.Smith & Assoc.	602-267-0981
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
CT	Tolland, R.G. Assoc.	203-875-4201
FL	Sarasota, REP USA	813-923-2897
MO	Raytown, Vertec Assocs., Inc.	816-737-0377
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
MN	Minneapolis, Instrmn. Resources	612-537-2434
NJ	Manchester, Vertec	314-394-6242
NV	Las Vegas, Jim Smith & Assocs., Inc.	702-798-5053
NM	Albuquerque, Jim Smith & Assocs., Inc.	505-345-6501
NC	Charlotte, Zelco Assocs., Inc.	704-541-6122
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
Can	Montreal, Que., Morrison & Force Dvcs.	514-737-0072
FL	Longwood, CBC Elctrns.	407-831-5380
IL	Elmhurst, Utronix Sls. Inc.	312-834-1100
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
NJ	Cherry Hill, Analectro, Inc.	800-247-3581
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
RI	Warwick, Ertronics, Inc.	401-732-3567
TX	Dallas, Kay Todd Assocs.	214-458-8833
Can	St.Laurent, Que., Componetics	514-331-9930

DCT INSTRUMENTS, 1165 Chambers Road, Columbus, OH 43212, Tel: 1-800-328-1028, FAX: 614-481-7701; *Sls. Mgr.:* Joe Snell

DDI INC., 5 Dodge St., Ste. 310, Beverly, MA 01915-1703, Tel: 508-927-7976, FAX: 508-921-6388; Empl.: 4; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

DDK ELECTRONICS, INC., 401 Bentley Street, Markham, Ont., Canada L3R 9T2, Tel: 416-470-1346, FAX: 416-470-1479; Empl.: 25; *Sls. Mgr.:* Bill Anderson

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. SVCS. INC., 1271 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, L.P., 250 W. Carpenter, Wheeling, IL 60090, Tel: 708-459-1000, 800-323-0198, FAX: 708-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Scott Gauger

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 1-310-397-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, TELEX: 4754247, FAX: 908-757-8561; FSC No.: 630673043; *Sls. Mgr.:* Ron Fichter

DEI, 230 N. Market Pl., Escondido, CA 92029, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

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Local Distributors

AL	Huntsville, Century Fastener	205-883-5344
AZ	Tempe, Ziptape ID Sys.	602-967-8888
CA	Huntington, HW Eckhardt Corp.	714-375-4926
CA	Riverside, Elctrn. Supply	714-683-7300
CA	San Fernando, Aleph Intl.	818-365-9856
CA	Santa Clare, The Wachtel Co.	408-982-0962
CO	Denver, Hardware Specs.	303-371-8553
CT	Milford, Plastic & Metal Comp.	203-877-2723
DE	Wilmington, Wholesale Elctrns.	302-652-3222
FL	Tampa, Century Fastener	813-886-5770
GA	Lawrenceville, Century Fastener	404-513-1620
GA	Suwanne, Arden Fastener	404-945-3105
IL	Addison, L-Comp	708-628-1400
IL	Bensenville, Vertex Computer Cable	708-766-7979
IL	Hillside, Zellerbach	708-448-8200
IN	Bloomington, Stansifer Radio Co., Inc.	812-336-6339
IN	Indianapolis, Wire Supplies, Inc.	317-786-4485
ME	Bangor, ICC North	207-942-2600
MD	Hanover, Vertex Computer Cable	301-796-5000
MA	Marlborough, Hardware Specs.	508-481-8622
MA	Woburn, Pacer Elctrns.	617-935-8330
MI	Muskegon, All Phase Elec.	616-733-3171
MN	Faribault, KGP Telecomm.	507-334-2269
MN	St. Paul, Arden Fasteners	612-483-6681
MO	St. Louis, L-Comp	314-291-6200
NV	Las Vegas, Kiesub	702-733-3888
NJ	Kenilworth, Federated Purch.	201-272-0505
NJ	Northvale, Glasgal Comm.	201-768-8082
NY	Farmingdale, Vertex Computer Cable	516-293-9880
NY	Holtsville, Tower Fastener Co.	516-289-8800
NY	Long Island City, Hardware Specs.	718-361-9393
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Century Fastener	704-554-0444
NC	Charlotte, Texas Intl.	704-588-0004
NC	Raleigh, Century Fastener	919-787-1800
ND	Fargo, Border Sls.	701-239-2379
OH	Brookpark, Calvert Wire & Cable	216-433-7600
OH	Dayton, Vertex Wire & Cable	513-223-5333
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	W. Columbia, Century Fastener	803-791-1800
TN	La Vergne, Arden Fastener	615-641-6661
TX	Dallas, Texas Intl.	512-366-3648
TX	Dallas, Wolford Elctrns.	713-331-2255
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Seattle, Radar Elctrn. Co., Inc.	206-282-2511
WI	New Berlin, Cable Comps., Inc.	414-785-1060
Can	Toronto, Cords Canada Ltd.	416-787-1114

DELBERT BLINN CO., INC., Box 2007, Pomona, CA 91769, Tel: 909-629-3900, FAX: 909-622-6218; Empl.: 6

DEL

FAX: 914-699-4005

DEL ELECTRONICS CORP., One Commerce Park, Valhalla, NY 10595, Tel: 914-686-3600; FSC No.: 01378; Empl.: 95 **A•1157-1158, 1601, 1676, 2315, 2532; D•1656-1659**

Local Sales Offices & Reps

CA	Alambra (So. CA), James Gerry Co.	213-283-7694
CA	Gilroy, Armstrong & Assocs.	408-848-3221
CT	Redding, PCS	203-938-7013
MD	Kensington, Koebert Assoc.	301-493-8924
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
NM	Albuquerque, Quality Technlg.	505-899-4565
PA	Glenside, Koebert Assoc.	215-887-2310

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052-0449, Tel: 716-652-3600, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen **A•1186-1189**

Local Sales Offices & Reps

AL	Decatur, El Tech	205-353-7899
AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Chatsworth, First Rep. of S. CA	818-718-6155
CA	Milpitas, Advanced Technlg. Sls.	408-946-4111
CO	Parker, TMA	303-841-3435
FL	Orlando, CDM	407-240-3903
GA	Roswell, JWL Assoc.	404-518-8500
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Liberty Sls.	317-888-8396
IN	New Albany, Liberty Sls.	317-888-8396
IA	Cedar Rapids, C. Horn & Asst.	319-393-8703
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps.	508-422-3327
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Morrestown, TAI	609-778-5353
NJ	Ridgewood, Ballou	201-444-6990
NY	Manhassett, Ballou, Inc.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Charlotte, JWL Assoc.	704-541-5750
OH	Mason, S-Tek	513-398-5843
TX	Irving, Kite Elctrn. Sls. Co.	214-986-0321
Can	Mississauga, J. G. Weiss Co. Ltd.	416-673-0011
Can	Nepean, J. G. Weiss Co. Ltd.	613-825-0545
Can	St. Laurent, J. G. Weiss Co. Ltd.	514-337-5022
Can	Vancouver, J. G. Weiss Co. Ltd.	604-873-1112
Can	Winnipeg, J. G. Weiss Co. Ltd.	204-783-4387

Local Distributors

CA	Fountain Valley, Ecliptek	714-963-4009
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Irvine, ITT Multicomponents	714-727-4001
CA	San Diego, Neumann	619-695-3005
CA	Santa Clara, Trinity Elctrns.	408-980-9014
CA	Stanton, Inductive Comps.	716-828-3420
FL	Ft. Lauderdale, Bros. Elec. of FL	800-342-6700
MD	Savage, Pyttronics Ind.	301-792-0708
MA	Sterling, Compatible Comps.	617-422-6762
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray/New York	800-645-4729
NY	Plainview, ACI Elctrns.	516-293-6630
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby, B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ont., Saynor Varah Elctrns.	416-445-2347
Can	Montreal, Que., Prelco Elctrns. Ltd.	514-389-8051
Can	Pointe-Claire, Future Elctrn.	514-694-7710
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

DELTA CONTROLS CORP., 585 Fortson St., Shreveport, LA 71107, Tel: 318-424-8471, TELEX: 784554, FAX: 318-425-2421; Empl.: 32; *Sls. Mgr.:* Steve Croom, VP Sls.

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, FAX: 619-277-7884; Empl.: 227; *Sls. Mgr.:* Bob Williams

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 508-927-1060, FAX: 508-922-6430; FSC No.: 00795; Empl.: 108; *Sls. Mgr.:* James Gillen; *Dist. Mgr.:* James Gillen

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569, FAX: 615-483-1142; Empl.: 12

DELTA PRODUCTS CORPORATION, 3225 Laurelview Court, Fremont, CA 94538, Tel: 510-770-0660, FAX: 510-770-0122; Empl.: 5000; *Dist. Mgr.:* J.F. Amend

DELTA PRODUCTS CORPROATION(EAST COAST OFFICE), 2000 Aerial Center Pkwy., Morrisville, NC 27560, Tel: 919-380-8883, FAX: 919-380-8383

DELTA WIRE & CABLE CO., 2550 Commonwealth Ave., P.O. Box 833, North Chicago, IL 60064, Tel: 708-473-4990, FAX: 708-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTEC CO., 13065 Tom White Way, Unit G, Norwalk, CA 90650, Tel: 310-926-2304, FAX: 310-926-8536; Empl.: 7; *Sls. Mgr.:* Dennis Orman

DELTEC ELCTRNS. CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241, FAX: 619-296-8039; FSC No.: 52297; Empl.: 150; *Sls. Mgr.:* Jeff Frank; *Dist. Mgr.:* Rod Pullen

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DELTONA TRANSFORMER CORP., 801 U.S. Hwy. 92, East, DeLand, FL 32724, Tel: 904-736-7900, FAX: 904-736-0379; Empl.: 140; *Sls. Mgr.:* Michael L. Prelec

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DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800; Empl.: 180; *Sls. Mgr.:* Bill Wiberg; *Dist. Mgr.:* Frank Stadler **B•1480-1481, 1630**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tucson, Earl Clemick & Assocs.	602-749-4003
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CA	Santa Clarita, T&C Engrg.	805-254-8778
CT	Waterbury, Cannon Assocs., Inc.	203-597-0240
FL	Tampa, Florida Comp. Sls.	813-873-3622
GA	Roswell, JWL Assoc.	404-518-8500
IL	Elk Grove Village, Tristar Group	708-593-0200
IN	Ft. Wayne, Nationwide Comps.	219-423-9535
MN	St. Paul, Kencotronics, Inc.	612-645-7717
MO	Chesterfield, Weisler & Assocs.	314-537-0010
NY	Pt. Washington, Ashtec Inc.	516-767-0336
NY	Rochester, Omni Sls.	716-248-0340
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Willoughby, Nationwide Comps.	216-946-3226
PA	Valley Forge, Providence Mktg.	215-935-3300
RI	Barrington, Cannon Assoc.	401-245-0850
TX	Houston, Weisler & Assocs.	713-467-1862
Can	Pointe Claire, Nobel-Teck Inc.	514-695-7498

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Montgomery, Southern Controls	205-277-5030
AZ	Tempe, Control Design	602-829-7981
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Anaheim, Control Design	714-821-1516
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	San Jose, Consolidated Parts	408-435-1200
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps.	213-873-4802
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Waterbury, All-Phase Elec. Supply	203-755-0405
FL	Altamonte Springs, Control Des.	407-788-3220
FL	Ft. Lauderdale, SE Elctrns.	305-563-4131
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Orlando, EMSCO	407-849-6362
GA	Stone Mountain, Control Des.	404-979-3500
IL	Bensenville, Gould Elctrns.	708-860-7171
IN	Indianapolis, Control Design	317-788-4559
IA	Davenport, Warren Radio	319-322-5301
IA	Marion, Control Des.	319-373-2923
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Kornfield Thorp Elec.	913-321-7070
KS	Wichita, Kriz-Davis Co.	316-267-4354
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Brighton, Interstate Elctrns. Equip.	617-782-9000
MA	Westborough, In Stock Prods.	508-870-5750
MI	Jackson, Fulton Radio Supp.	517-784-6107
MI	Madison Hgts., Galco Indl. Elctrns.	313-542-9090
MN	Minneapolis, Control Design	612-721-6555
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Keene, Tradesmen Elctrl. Supp.	603-352-1205
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Raritan, Masters Elctrn.	201-725-3533
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Vestal, Wholesale Elec. Supp.	607-729-1526
ND	Fargo, WESCO	701-232-4446
ND	Minot, J.I. Company	801-852-4466
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Ardmore, Ardmore Elec. Supp.	405-223-3571
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Dunn Elec.	503-285-0214
PA	Erie, Rem Elctrns.	814-453-5626
PA	Malvern, Control Design	215-296-0150
PA	Philadelphia, Lindley Elec.	215-329-7005
TX	Dallas, Control Design	214-358-1441
TX	Lubbock, R & R Elec. Co.	806-765-7727
TX	San Antonio, Blackburn Drives Controls	512-349-2621
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Glen Allen, Hermitage Distrs.	804-550-3030
VA	Staunton, Southern Elec.	703-886-6218
WI	Manitowoc, Englewood Elec.	414-684-6653
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Control Design	414-784-1015

DELTRON, INC., 290 Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, FAX: 215-699-2310; Empl.: 120

DEL-TRON PRECISION, 5 Trowbridge Drive, Bethel, CT 06801, Tel: 800-245-5013, FAX: 203-778-2721; Empl.: 50; *Sls. Mgr.:* Emil Melvin

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, FAX: 714-897-1772; FSC No.: 66847; Empl.: 50; *Sls. Mgr.:* Al Kile, VP Sls.

DENSITRON CORPORATION, Densitron International, 3425 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-530-3530, TWX: 910-349-6200, FAX: 310-534-8419; FSC No.: 62483; Empl.: 42; *Sls. Mgr.:* Richard Driscoll VP Sls./Mktg.; *Dist. Mgr.:* Richard Driscoll VP Sls./Mktg. .... **B•1033**

Local Sales Offices & Reps

AZ	Tempe, Techni-Source	602-730-8093
CA	Irvine, Comp. Mktg. Assocs.	714-727-0688
CA	Milpitas, Telesis Sls.	408-946-7300
CO	Englewood, Comp. Sls.	303-779-8060
CT	W. Hartford, M-R Tech. Sls.	203-521-2101
FL	Margate, EPM Corp.	305-977-0331
GA	Acworth, E.A.B., Inc.	404-975-3660
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Ft. Wayne, R.L. Bontempo Assocs.	219-478-1057
KS	Overland Pk., Markline Technlgs.	913-681-8880
MA	Wellesley Hills, Sturdy Corp/Nova Assocs.	617-235-2330
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, Midtech Assocs.	314-275-8666
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, C-Tech Sls.	919-782-8100
OH	Centerville, Engrg. Mktg. Assocs.	513-433-2800
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Wasatch/Prorep Mktg.	801-268-3434
VA	Sterling, Beacon-North	703-478-2480
WA	Seattle, J. J. Assocs.	206-246-6619
Can	Mississauga, Ont., IntelaTech	416-629-0082

DEPAC CORP., 201 Mill St., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 708-566-4100, TWX: 910-685-4231; *Sls. Mgr.:* W. Johnston

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, FAX: 617-862-3769; FSC No.: 4D417; Empl.: 5

DESIGN COMPONENTS, INC. (DCI), 1 Kenwood Circle, Franklin, MA 02038, Tel: 508-528-7300, 800-341-4811, FAX: 508-520-1424; Empl.: 50

DESIGN TECHNOLOGY, 11489 Woodside Ave., Santee, CA 92071, Tel: 619-448-2888, FAX: 619-448-3044; FSC No.: 619-440-8048; Empl.: 50; *Sls. Mgr.:* Jeff Jonas; *Dist. Mgr.:* Sherry Golden

DESIGN WORKSHOP, 4226 St. John's Blvd., Ste. 400, D.D.O., Que., Canada H9G 1X5, Tel: 514-696-4753, FAX: 514-696-5351; Empl.: 5

DESPATCH INDUSTRIES, 63 St. Anthony Parkway, P.O. Box 1320, Minneapolis, MN 55418, Tel: 612-781-5363, FAX: 612-781-5353; Empl.: 360; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436, FAX: 818-579-1936; FSC No.: 29867; Empl.: 45

DETROIT COIL CO., 2435 Hilton Rd., Ferndale, MI 48220, Tel: 313-398-5600, FAX: 313-398-0481; Empl.: 120; *Sls. Mgr.:* T. Dougherty

DETROIT TESTING LABORATORY, INC., 7111 E. Eleven Mile, P.O. Box 869, Warren, MI 48090-0869, Tel: 313-754-9000, FAX: 313-754-9045; FSC No.: 0739; Empl.: 125

DEUTSCH RELAYS, INC., 65 Daly Rd., East Northport, NY 11731, Tel: 516-499-6000, FAX: 516-499-6015; Empl.: 463; *Sls. Mgr.:* Glen Telshow

DEVAR, INC., 706 Bostwick Ave., Bridgeport, CT 06605, Tel: 203-368-6751, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295, FAX: 408-945-6504; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEVERE AND LAU COMPANY, 1767 South Norfolk Lane, Anaheim, CA 92802, Tel: 310-457-7912, FAX: 714-772-1934; FSC No.: 7302-8902; Empl.: 26; *Sls. Mgr.:* G. R. Bosworth

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, FAX: 313-426-5090; Empl.: 35; *Sls. Mgr.:* Robert Toth Jr.

DEXTER SCIENTIFIC, 308 Benham St., Palatka, FL 32177, Tel: 904-328-2450; Empl.: 1

DE YOUNG MFG., INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, FAX: 603-622-0487; Empl.: 10

DGS PRO AUDIO, P.O. Box 170426, Arlington, TX 76003, Tel: 800-292-2834, FAX: 817-473-7712; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Mike Manzella

DH PRINT, DIV. OF DH TECHNOLOGY, 860 College View Dr., Riverton, WY 82501, Tel: 307-856-4821, FAX: 307-856-0412; Empl.: 280; *Sls. Mgr.:* Roger Rayburn; *Dist. Mgr.:* Roger Rayburn

DIAGOSTIC INSTRUMENT CORP., 4 Copeland Dr., Box J, Ayer, MA 01432, Tel: 508-772-4572, FAX: 508-772-5210; Empl.: 70; *Sls. Mgr.:* James F. Hashem

DIALIGHT CORPORATION, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 908-223-9400, FAX: 908-223-8788; FSC No.: 83330; Empl.: 400; *Sls. Mgr.:* W. Moore; *Dist. Mgr.:* Gary Baker .... **B•1141-1147**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Shefler-Kahn Co.	602-581-0884
CA	Garden Grove, Elsco	714-891-4621
CA	Pleasanton, Moulthrop Sls.	510-463-0450
CA	San Diego, Varigon San Diego	619-576-0100
CO	Boulder, Comp. Prods. Sls.	303-530-2800
CT	Wallingford, John E. Boeing Co., Inc.	203-265-1318
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
FL	Oviedo, Panamtech Inc.	407-679-5506
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Chicago, Victory Sls.	708-490-0300
IN	Huntington, Electronic Reps.	219-356-3513
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Cedar Rapids, Lowell-Kangas & Assoc.	319-362-9290
KS	Shawnee, Lowell Kangas & Assocs.	913-631-3515
KY	Lexington, Electronic Reps.	606-277-0436
LA	Covington, Cartwright & Bean	504-892-1780
MA	Chelmsford, John E. Boeing Co., Inc.	508-256-5800
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NY	Melville, Parallax	516-351-1000
NY	Penfield, Gen-Tech Elctrns.	716-581-5159
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Tigard, Earl & Brown Assocs.	503-639-2100
PA	Broomall, L.D. Lowery	215-356-5300
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TN	Germantown, Cartwright & Bean	901-758-8113
TN	Knoxville, Cartwright & Bean	615-693-7450
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
VA	Earlysville, L.D. Lowery, Inc.	804-973-6672
WA	Redmond, Earl & Brown Assocs.	206-885-5064
WI	Brookfield, Victory Sls.	414-789-5770
Can	Kirkland, PQ, Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., Longman Sls., Inc.	416-670-8100
Can	Nepean, Ontario, Longman Sls., Inc.	613-564-0100
Can	Vancouver, B.C., Arwin Tech. Ltd.	604-980-4557

Local Distributors

AR	Little Rock, Carlton Bates	501-562-9100
CA	Garden Grove, Richey Impact, Inc.	714-895-0060
CA	Gardena, California Switch	213-770-2330
CA	Los Angeles, Bell Inds.	213-826-6778
CO	Denver, CSID	303-292-9594
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
LA	Lafayette, Ralph's of Lafayette	318-233-0105
MD	Baltimore, Resco	301-931-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, Chelsea Ind/RS Elec.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-3322

MO	Maryland Hts., L Comp	314-291-6200
NJ	Kenilworth, Federated Purchaser	908-272-0505
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Melville, Arrow Elctrns.	516-391-1300
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrn. Supp.	216-373-1300
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Trevose, Bell	215-953-2800
TX	Dallas, Norvell Elec., Inc.	214-233-0020
TX	Houston, Harrison Equip. Co.	713-879-2600
VA	Charlottesville, Virginia Elctrns.	804-296-4184
WA	Bellevue, Almac/Arrow	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Edmonton, Alb., Cardinal Ind. Elec.	403-483-6266
Can	Willowdale, Ont., Electro Sonic	416-494-1666

DIANACHART INC., 101 Round Hill Dr., Rockaway, NJ 07866, Tel: 201-625-2299, FAX: 201-625-2449; Empl.: 10; *Sls. Mgr.:* B. McWilliams

DI/AN CONTROLS, INC., 16 Jonathan Drive, Brockton, MA 02401, Tel: 508-599-8000, FAX: 508-599-8658; FSC No.: 06900; Empl.: 25; *Sls. Mgr.:* John Sheehy

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890, FAX: 207-655-4669; FSC No.: 08441; Empl.: 220; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIELECTRIC SCIENCES, INC., HVT Group, 88 Turnpike Road, Chelmsford, MA 01824, Tel: 508-250-1507, FAX: 508-250-1699; FSC No.: 50509; Empl.: 30; *Sls. Mgr.:* David J. Leary

DIE-TECH INC., 295 Sipe Rd., RDI, York Haven, PA 17370, Tel: 717-938-6771, FAX: 717-938-6099

DIETERICH STANDARD, A Dover Industries Company, P.O. Box 9000, Boulder, CO 80301, Tel: 303-530-9600, FAX: 303-530-7064; Empl.: 105; *Sls. Mgr.:* Robert Heiser; *Dist. Mgr.:* Robert Heiser

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911, FAX: 816-331-4914; FSC No.: 93652; Empl.: 40; *Sls. Mgr.:* L.M. Dietz

DIGALOG SYSTEMS, INC., 3180 South 166th St., New Berlin, WI 53151, Tel: 414-797-8000, FAX: 414-797-8003; Empl.: 35

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, FAX: 301-498-0771; Empl.: 40; *Sls. Mgr.:* Jim McLaughlin

DIGI-KEY CORP., 701 Brooks Ave. South, Thief River Falls, MN 56701-0677, Tel: 218-681-6674, 1-800-344-4539, FAX: 218-681-3380

DIGITAL DATA SYSTEMS, INC. (DDS), 1551 N.W. 65 Ave., Ft. Lauderdale, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (Digital), ESYLNK: 62756087, FAX: 305-581-13; FSC No.: 65136; Empl.: 20

DIGITAL DESIGN ANALYSIS, 150 El Camino Real, Ste. 200, Tustin, CA 92680, Tel: 714-573-8730, FAX: 714-573-8736; Empl.: 6; *Sls. Mgr.:* Darlene Kindstrand; *Dist. Mgr.:* Darlene Kindstrand

DIGITAL DYNAMICS, INC., 5274 Scotts Valley Dr., Scotts Valley, CA 95066, Tel: 408-438-4444; FSC No.: (S.I.C. Code – 3823); Empl.: 15

DIGITAL MOTOR, INC., 1075 N.W. Murray Rd., Ste. No. 255, Portland, OR 97229-5501, Tel: 503-629-9692, FAX: 503-690-9876; Empl.: 6

DIGITAL PRODUCTS, INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1234, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 100; *Dist. Mgr.:* Neil Peterson

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-4114, FAX: 213-543-1256; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC, 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin

DIGITRAN

A DIVISION OF XCEL CORPORATION

FAX: 909-391-4558

DIGITRAN DIVISION, XCEL Corporation, 4290 E. Brickell St., Ontario, CA 91761, Tel: 909-391-4321; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* W. Miller; *Dist. Mgr.:* W. Miller .... **B•1708, 1825**

Local Sales Offices & Reps

CA	Ontario, Xcel Corp.	909-391-4321
CO	Littleton, Romulus	303-770-4888
FL	Margate, EPM Corp.	305-977-0331
IL	Palatine, Technlg. Sls.	708-991-6600
MI	Troy, C.B. Jensen & Assoc.	313-643-0506
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Rochester, Apex	716-272-7040
OR	Beaverton, J.J. Backer	503-627-0775
TX	Richardson, Pro-Comp	214-669-1500
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	Riverside, Xcel Corp.	909-275-0257
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NJ	Toms River, Xcel Corp.	908-830-7525
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Xcel Corp.	216-239-4998
PA	Philadelphia, Powell Electr.	215-365-1900

DILL INSTRUMENTS INC., 436 W. Willard, Kalamazoo, MI 49005, Tel: 616-388-5708, FAX: 616-388-5704; Empl.: 10; *Sls. Mgr.:* Terry Simpson; *Dist. Mgr.:* Robert Boyle

DILLON, Weigh-Tronix, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594, FAX: 507-238-4195; Empl.: 500; *Sls. Mgr.:* Jim Rather

DILOG, 2652 McGaw, Irvine, CA 92714, Tel: 714-476-0303, FAX: 714-476-0633; FSC No.: 33-0243085; Empl.: 160; *Sls. Mgr.:* Dennis Edwards

DILWOL WIRE & CABLE INC., 435 Enfield Rd., Burlington, Ont., Canada L7T 2X5, Tel: 416-681-2343, FAX: 416-681-8440; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* James L. Harl

DIMENSIONS UNLIMITED, INC., 1800 Buerkle Rd., St. Paul, MN 55110, Tel: 612-770-5630, FAX: 612-770-0847; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178, FAX: 818-341-1736; FSC No.: 12060; Empl.: 55; *Sls. Mgr.:* Marvin Zidel; *Dist. Mgr.:* Sue Reinish

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, FAX: 516-997-7479; FSC No.: 50857; Empl.: 25; *Sls. Mgr.:* Bernard L. Kravitz

DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

FAX: 201-941-4919

DIO-REY, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli .... **B•1036-1042**

DIOTEC ELECTRONICS CORP., 18020 Hobart Blvd., Ste. B, Gardena, CA 90248, Tel: 310-767-1052, FAX: 310-767-7958; FSC No.: 4800; Empl.: 6; *Sls. Mgr.:* Joe S. Lin; *Dist. Mgr.:* Joe S. Lin

DIRECT CONVERSION TECHNIQUE, INC., 3132 N. Lowell Ave., Chicago, IL 60641, Tel: 312-283-1690, FAX: 1-800-282-3852; Empl.: 6; *Sls. Mgr.:* Thomas A. Ochal

DIRECT SOUND CORPORATION, The Park Square Bldg., 31 St. James Street, Ste. 901, Boston, MA 02116, Tel: 1-800-372-1616, FAX: 1-800-354-3317; Empl.: 3; *Sls. Mgr.:* A. Takayama .... **B•1709; C•1309**

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987, FAX: 714-432-7567; Empl.: 150

DISPLAY DEVICES, INC., P.O. Box 230677, Encinitas, CA 92023, Tel: 619-753-0113; FSC No.: 26107

DISPLAYS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-2541, FAX: 717-248-8680; Empl.: 30; *Sls. Mgr.:* Kit Kennedy

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 24; *Sls. Mgr.:* Chris Sherman; *Dist. Mgr.:* Kelly J. Mannatt

DISPLAY TECHNOLOGIES, INC., 1355 Holmes Rd., Elgin, IL 60123, Tel: 708-931-2100, 1-800-544-8823, FAX: 708-931-2120; Empl.: 350; *Sls. Mgr.:* Robert Valentine; *Dist. Mgr.:* Timothy Knutsen

DISTRIBUTED LOGIC CORP., See DILOG

DISTRIBUTED PROCESSING TECHNOLOGY CORP., 140 Candace Dr., Maitland, FL 32751, Tel: 407-830-5522, FAX: 407-260-5366; Empl.: 200; *Sls. Mgr.:* Jim Habuda; *Dist. Mgr.:* Tom Moch

DISTRIBUTOR SPECIALISTS, 1942 14th Street, Santa Monica, CA 90404-4606, Tel: 213-452-3445

DIVELBISS CORP., 9776 Mt. Gilead Road, Fredericktown, OH 43019, Tel: 614-694-9015, FAX: 614-694-9035; Empl.: 40; *Sls. Mgr.:* Terry Divelbiss; *Dist. Mgr.:* Tim Knaul

DIVERSIFIED ELECTRONICS, INC., P.O. Box 1140, Evansville, IN 47706-1140, Tel: 812-426-2806, FAX: 812-425-8930; Empl.: 55; *Sls. Mgr.:* John L. Smith

DIVERSIFIED OPTICAL PRODUCTS, INC., 282 Main St., Salem, NH 03079, Tel: 603-898-1880, FAX: 603-898-3970; FSC No.: IHT10; Empl.: 49; *Sls. Mgr.:* James A. Greene

DIVERSIFIED SYSTEMS, INC., 6232 La Pas Trail, Indianapolis, IN 46268, Tel: 317-299-9547, FAX: 317-298-2055; FSC No.: 5693;5999;R212;R498;R698;S901;S902;S903;S908; Empl.: 1000; *Sls. Mgr.:* Paul Madden

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, TELEX: 585326, FAX: 601-856-2888; Empl.: 1000; *Sls. Mgr.:* Barrie McArthur; *Dist. Mgr.:* Barrie McArthur

DIXSON, INC., 287 27 Rd., Grand Junction, CO 81503, Tel: 303-244-1241, FAX: 303-245-6267; Empl.: 250; *Sls. Mgr.:* Ray Carlson

DJ INSTRUMENTS, INC., 18 Republic Rd., N. Billerca, MA 01862, Tel: 508-667-5301, FAX: 508-667-6804; FSC No.: 57747; Empl.: 25; *Sls. Mgr.:* David First

D. L. CUSTOM, 7250 Victoria Park Ave., Markham, Ont., Canada L3R 2M5, Tel: 416-475-0275; *Sls. Mgr.:* Les Hull, Jr.

D. O. INDUSTRIES, 200 Commerce Dr., Rochester, NY 14623, Tel: 716-359-4000, TELEX: 200802, FAX: 716-359-4999; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, TELEX: 94-8161, FAX: 617-938-7219; Empl.: 120; *Sls. Mgr.:* B.J. Dolan; *Dist. Mgr.:* Frank Tiernan

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 908-329-2333, FAX: 908-329-1143; *Sls. Mgr.:* W. Rumpa

DOMINO, INC., P.O. Box 9309, Fort Wayne, IN 46899, Tel: 219-456-5512; FSC No.: 9Y350; Empl.: 19; *Sls. Mgr.:* Rick Smith

D1 INTERNATIONAL, INC., 95 E. Main St., Huntington, NY 11743, Tel: 516-673-6866, FAX: 516-673-6893; Empl.: 24; *Sls. Mgr.:* Bron Kutny

DONTECH, INC., 700 Airport Industrial Blvd., Doylestown, PA 18901, Tel: 215-348-5010, TELEX: 685 1155 DONTK, FAX: 215-348-9959; FSC No.: 63009; *Sls. Mgr.:* Jeffrey S. Reid, Dir. Mktg. & Sls.; *Dist. Mgr.:* Leda Petrou, Sls.

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424, FAX: 513-681-5604; Empl.: 60; *Sls. Mgr.:* Jeff Stegman

DORMEYER INDUSTRIES, A.F. Dormeyer Mfg. Co. Inc., 6585 N. Avondale Ave., Chicago, IL 60631-1521, Tel: 312-775-3600, FAX: 312-775-6495; Empl.: 150; *Sls. Mgr.:* R. Steinberg .... **B•1632-1635**

Local Sales Offices & Reps

CA	Torrance, Universal Comps.	310-783-0220
CT	Guilford, Anchor Engrg.	203-458-7496
IL	Chicago, Dormeyer Inds.	312-775-3600
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MA	Westborough, Anchor Engrg.	508-898-2724
MO	Bridgeton, Dytronix	314-291-4777
NY	Great Neck, Pacent Engrg.	516-482-4678
OH	Cleveland, KT/Depco	216-942-0051
PA	Glenshaw, Hollern Sls. Inc.	412-487-1246

Local Distributors

AL	Birmingham, W.W. Grainger	205-942-6741
AL	Huntsville, Reptron Elctrns.	205-722-9500
AZ	Phoenix, Minarik Elec.	602-233-3000
AR	Little Rock, W.W. Grainger	501-568-7800
CA	Glendale, Minarik Elec.	818-507-6500
CA	Los Angeles, Master Distr.	800-421-8153
CO	Commerce City, Minarik Elec.	303-289-5800
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, W.W. Grainger	312-486-9933
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IN	Ft. Wayne, W.W. Grainger	219-484-9565
IA	Des Moines, W.W. Grainger	515-266-3460
KY	Louisville, W.W. Grainger	502-499-0001
MA	N. Billercia, Minarik Elec.	508-663-0740
MA	Sharon, Adcour Inc.	617-784-8123
MI	Detroit, W.W. Grainger	313-873-1200
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MN	Plymouth, Leeds Elctrns.	612-557-1277
MO	Kansas City, W.W. Grainger	816-241-5600
MO	St. Louis, W.W. Grainger	314-231-5031
NJ	Newark, W.W. Grainger	201-648-0040
NC	Charlotte, W.W. Grainger	704-376-0785
NC	Raleigh, Reptron Elctrns.	919-870-5189
OH	Cleveland, W.W. Grainger	216-398-1880
OH	Solon, Reptron Elctrns.	216-349-1415
PA	Lansdale, Reptron/Pyttronic	215-855-0925
TX	Irving, Minarik Elec.	214-402-8188
WA	Redmond, Minarik Elec.	206-885-0832
WI	Milwaukee, Elctrn. Expeditors, Inc.	800-558-8547
WI	Milwaukee, Leeds Elctrns.	414-789-6995
Can	W.W. Grainger	800-633-8487

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541, FAX: 612-633-7025; Empl.: 200; *Sls. Mgr.:* D. Michael Hunter, Natl. Sls. Mgr.

DOUGLAS
CORPORATION

FAX: 612-942-3125

DOUGLAS CORP., 7180 Washington Ave. So., Eden Prairie, MN 55344-3512, Tel: 612-941-3847, 1-800-728-3189; Empl.: 500 .... **B•1826**

DOUGLAS ELECTRONICS, INC., 2777 Alvarado St., San Leandro, CA 94577, Tel: 510-483-8770, FAX: 510-483-6453; Empl.: 15

DOUGLAS INTERNATIONAL, INC., 312 West State Street, Geneva, IL 60134-0761, Tel: 708-232-7419, ESYLNK: 708-232-9394

DOUGLAS
RANDALL INC.

FAX: 203-599-1754

DOUGLAS RANDALL, P.O. Box 506, 100 Mechanic St., Bldg. 26, Pawcatuck, CT 06379, Tel: 203-599-2075; Empl.: 50; *Sls. Mgr.:* Gil Yanishevsky .... **A•2144-2145; B•1473-1478; D•1155-1157**

Local Sales Offices & Reps

AL	Madison, R.W. Mitscher	205-464-0745
CA	Tormace, O'Donnell Assoc.	310-316-9445
FL	Lutz, R.W. Mitscher	813-948-2351
FL	Tequesta, R.W. Mitscher	407-575-4485
GA	Lawrenceville, R.W. Mitscher	404-923-3239
IL	Arlington Hgts., Thermek Inc.	708-577-6900
MD	Gaithersburg, Deltatronics	301-253-0615
MI	Ypsilanti, Allied Entprs.	313-434-7616
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Plymouth, R.C.O.M.	612-557-2801
MO	Bridgeton, HiTec Central	314-291-5920
MO	Independence, HiTec Central	816-796-6684
NJ	Mahwah, North East Comps	201-825-0233
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, R.W. Mitscher	919-848-0941
OH	Cleveland, Allied Entprs.	216-779-0080
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Blue bell, Deltatronics	215-641-9930
TN	Johnson City, R.W. Mitscher	615-929-7258
TX	Austin, Electra Reps	512-339-1163
TX	Dallas, Electra Reps	214-248-3852
UT	Bountiful, Advance Control	801-298-8585
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, SPS Elctrns.	206-323-4140
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mill-Comm Dist.	818-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
CT	Wallingford, Control Design	203-269-9955
FL	Hollywood, MRO Elctrn. Distrs.	305-966-4847
FL	Orlando, Accurate Temperature Controls.	407-292-6800
LA	Jefferson, Butler & Land	504-734-8888
MA	Middleboro, Glynn Elctrns.	508-947-4262
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Minneapolis, Control Design	612-721-1628
NC	Burlington, AC DC Elctrns.	919-226-0496
OH	Richfield, Alpha Distrs.	216-659-7100
OK	Tulsa, Butler & Land	918-665-7979
PA	Narberth, Power Modules	215-668-0664
PA	Norristown, Power Modules	215-292-8900
PA	Yeadon, Y-L Prods.	215-583-2800
TX	Dallas, Butler & Land	214-343-8800
TX	Ft. Worth, Butler & Land	817-838-9100
TX	Houston, Butler & Land	713-896-0808
TX	Tomball, Woffard Elctrns.	713-351-2255

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052-5165, Tel: 206-881-7414, FAX: 206-861-8080; Empl.: 6; *Sls. Mgr.:* Phil Johnson

DOVER
ELECTRONICS
MANUFACTURING

FAX: 607-772-9274

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, TWX: 510-252-1990; Empl.: 371; *Sls. Mgr.:* Robert P. Egan .... **D•2310**

Local Sales Offices & Reps

NY	Binghamton, Dover Elctrns. Mfg.	607-772-7563

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, TELEX: 227450, TWX: 810-266-9006; Empl.: 7,000

DowKey®
Microwave
CORPORATION

FAX: 805-650-1734

DOW-KEY MICROWAVE CORPORATION, 1667 Walter St., Ventura, CA 93003, Tel: 805-650-0260; FSC No.: 00471; Empl.: 69; *Sls. Mgr.:* Jerry Satuloff; *Dist. Mgr.:* Jerry Satuloff .... **B•1710**

Local Sales Offices & Reps

AZ	Scottsdale, Detomasi & Grupp., Inc.	602-947-3724
CA	Dow-Key	805-650-0260
CA	Mission Hills, Detomasi & Grupp Inc.	818-365-8285
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	San Diego, Keller Simonsen Assocs.	619-453-5720
CA	Torrance, Detomasi & Grupp, Inc.	310-618-8898
CO	Parker, W. Howard Assoc.	303-841-5755
CT	Mount Carmel, Sci. Dvcs. Conn., Inc.	203-248-9361
FL	Indian Harbor Bch., South Eastern Comp. Sls.	407-773-3767
GA	Marietta, Gruber & Assocs.	404-993-6052
IL	Palatine, Wave Mktg.	708-934-8008
IN	Fort Wayne, Naunas Sls, Co.	219-432-4792
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Columbia, Delta III Assocs.	410-730-4700
MN	Bloomington, Bill Deming & Assocs.	612-888-5000
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NJ	Ridgefield Pk., Scientific Dvcs.	201-440-3430
NY	Rochester, Lamb Comps., Inc.	716-272-7720
OH	Miamisburg, Elctrns. Comps.	513-866-3340
TX	Richardson, Beacon Microwave	214-437-1505
TX	Round Rock, Beacon Microwave	512-244-6675
WA	Kirkland, Anzak Corp.	206-822-1510
Can	Nepean, Ont., Dynasty Comps.	613-723-0671

Local Distributors

MD	Beltsville, Allied Elctrns.	800-433-5700
MD	Beltsville, Applied Specs.	301-595-5393

DOWTY AVIONICS, 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5955, FAX: 818-447-0880; FSC No.: 10412; Empl.: 164; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Mgr. Business Dev.

DOWTY CUSTOM ELCTRNS. INC., THERMOCONTROL DIV., See Nexus Custom Elctrns., Thermocontrol Div.

DRACON DIV., See Harris Corp., Dracon Div.

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 908-287-3680, TELEX: 499-708, TWX: 710-997-9553, FAX: 908-248-9240; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* Chris Fensham

DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 708-662-7667, 800-323-9605, FAX: 708-662-0906; Empl.: 29; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera

DRESSER INSTRUMENT DIV., Dresser Industries, 250 East Main St., Stratford, CT 06497, Tel: 203-378-8281, FAX: 203-385-0408; Empl.: 1500; *Sls. Mgr.:* William Mahoney; *Dist. Mgr.:* Richard Gordon .... **B•1933**

Local Sales Offices & Reps

AL	Mobile, District Sls. Off.	205-473-1692
CA	Long Beach, Pacific Reg. Sls. Off.	310-595-4691
IL	Roselle, Midwest Reg. Sls. Off.	708-980-9030
PA	WillowGrove, Atlantic Reg. Sls. Off.	215-657-2886
TX	Houston, Southwest Reg. Sls. Off.	713-590-1092

Local Distributors

AL	Mobile, Bell & Co.	205-432-5666
AZ	Mesa, Aztech Controls Corp.	602-966-4400
CA	San Francisco, Leighton Stone Corp.	415-285-3600
CO	Englewood, Applied Control Equip.	303-799-9300
CT	Newington, Reet Corp.	203-667-1584
FL	Tampa, Solares Florida Corp.	813-622-8822

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OAKLAND, CA 94606

GA	Decatur, Solares S.E. Corp.	404-981-9282
HI	Honolulu, Process Vlv. & Control	808-834-7675
IL	Peoria, Tecco, Inc.	309-692-2312
IN	Indianapolis, Jay Instr.	317-639-6494
KS	Wichita, Tulsa Gauge & Instr.	316-267-6088
KY	Jefferstown, Jay Instr.	502-491-0560
MD	Millersville, Hi-Tech, Inc.	410-987-4000
MI	Warren, Smith Instr. & Equip.	313-755-3110
MN	Minneapolis, Power Sy & Engrg.	612-827-5743
MO	St. Louis, O'Brien Equip.	314-781-6400
NJ	Hohokus, Valley Tech. Sls.	201-670-8070
NY	Orchard Park, David S. Reynolds	716-821-5921
NC	Charlotte, Ind. Valve & Gauge	704-333-3786
OH	Medina, Stress Anal. Svcs.	216-725-7733
OK	Tulsa, Tulsa Gauge & Instr.	918-622-5061
OR	Portland, Steam Sy. & Rubber	503-228-9625
RI	Cranston, Intl. Supply	401-944-1600
SC	Greer, Trask Instrumn.	803-848-3993
TN	Memphis, Centro, Inc.	901-357-1261
TX	Dallas, Inotek Corp.	214-243-8370
VA	Midlothian, Associated Tech., Inc.	804-794-6094
WA	Seattle, Steam Supp. & Rubber	206-622-4690
WI	Mequon, Simone Engrg.	414-243-3600

DRI-DEK CORPORATION, 2706 South Horseshoe Dr., Naples, FL 33942, Tel: 800-348-2398, FAX: 800-828-4248; *Sls. Mgr.:* Carol Smykowski

DRIVECON CORPORATION, 1840 Industrial Dr., Ste. 220, Libertyville, IL 60048, Tel: 708-918-1406, FAX: 708-918-7427; Empl.: 8; *Sls. Mgr.:* Richard Parat; *Dist. Mgr.:* Richard Parat

DRUMLIN; Micro/Sys, Inc., 3447 Ocean View Blvd., Glendale, CA 91208, Tel: 818-244-4600, FAX: 818-244-4246

DSA, INC. DIRECT SOUND CORPORATION, See Direct Sound Corporation

DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538-7338, Tel: 510-657-7555, TELEX: 263608, FAX: 510-657-7576; Empl.: 75; *Sls. Mgr.:* Robert LeBrun

DUBBELDEE HARRIS DIAMOND CORP.:D. DRUKKER & ZN. N.V., 100 Stierli Ct, Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 708-584-2300, TELEX: 720426, FAX: 708-584-2792; FSC No.: 5830 Group 58; Empl.: 650; *Sls. Mgr.:* Warren Anderson, VP of Sls.; *Dist. Mgr.:* Sam Boskovich, Distr. Devel. Mgr.

DUMONT OSCILLOSCOPE, E & R Electronics, Inc., 323 New Road, Parsippany, NJ 07054, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS

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FAX: 714-557-6240

DUNCAN ELECTRONICS, 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261; FSC No.: 5905;Multiple; Empl.: 110; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Huntley .... **A•2078-2079**

Local Sales Offices & Reps

AL	Huntsville, L. & D., Inc.	205-837-1469
AZ	Tempe, Southwest E/M Engrg.	602-831-1795
AR	El Dorado, Kemp Instruments, Inc.	501-862-5869
CA	Irvine, English/Damco Sls.	714-753-1950
CA	Santa Clara, Caltron Comps.	408-980-0181
CT	Bloomfield, SIR/DSA	203-243-9235
FL	Boca Raton, R.O. Whitesell & Assoc.	407-393-6139
FL	Longwood, R.O. Whitesell & Assoc.	407-682-6662
FL	Palm Harbor, R.O. Whitesell & Assoc.	813-787-0898
GA	Atlanta, L. & D., Inc.	404-395-7079
IL	Arlington Hgts., KMA Sales Co.	708-398-5300
IN	Indianapolis, Mktg. Engrs., Inc.	317-872-5665
KS	Shawnee Mission, Florence & Meyer	913-722-5210
LA	Lafayette, Kemp Instruments, Inc.	318-269-9452
MA	Westford, SIR/DSA	508-692-2500
MI	Walled Lake, Elcon O.E.M. Sls.	313-960-9680
MN	New Brighton, The Mackubin Grp.	612-636-5533
NY	Buffalo, Advanced Comps.	716-832-6791
NY	Dix Hills, Sencor	516-499-7748
NY	E. Syracuse, Advanced Comps.	315-437-6700
NY	Endicott, Advanced Comps.	607-785-3191
NC	Raleigh, L. & D., Inc.	919-876-5301
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
OK	Tulsa, Kemp Instruments, Inc.	918-663-4501
PA	Wynnewood, Metz-Jade Assoc., Inc	215-896-7300
TX	Addison, Kemp Instrs., Inc.	214-931-7100
TX	Houston, Kemp Instruments, Inc.	713-466-1465
TX	Marble Falls, Kemp Instruments, Inc.	512-598-6115
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Milwaukee, KMA Sales Co.	414-259-1771

DUPLICON, INC., 516 E. Second St., S. Boston, MA 02127, Tel: 617-269-5859, FAX: 617-269-5484; FSC No.: 0ASD8; Empl.: 3; *Sls. Mgr.:* William A. Currier

DUPONT CONNECTOR SYSTEMS, See BERG Electronics

DUPONT ELECTRO-OPTIC PRODUCTS, Dupont Electronics, P.O. Box 13625, Research Triangle Park, NC 27709, Tel: 1-800-888-LAN1,. 919-481-5100, FAX: 919-481-0753; Empl.: 65; *Sls. Mgr.:* Glenn R. Constable

DUPREE, INC., 14395 Ramona Ave., Chino, CA 91710, Tel: 909-597-4889, FAX: 909-597-3043; Empl.: 65

DURACELL®

FAX: 203-791-3273

DURACELL INC., OEM Sales & Marketing, Berkshire Corporate Park, Bethel, CT 06801, Tel: 203-791-3274; Empl.: 8000; *Sls. Mgr.:* Cal Nicholson, Natl. Sls. Mgr. .... **D•1435-1438**

Local Sales Offices & Reps

CA	Newport Beach, Duracell Inc.	714-720-8111
CT	Danbury, Duracell Inc.	203-790-7541
IL	Oak Brook, Duracell Inc.	708-954-2714

Local Distributors

CA	Costa Mesa, Battery Specialties Inc.	714-755-0888, FAX:714-755-0889
CA	Mtn. View, Energy Sales. Inc.	415-969-0800,F, 415-961-2000
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242, FAX:619-274-2220
IL	Downers Grove, Telecommunication Dvcs.	312-971-3460,FAX:312-971-3903
MA	Sharon, Adcour	617-784-8123,FAX:617-784-5565
MN	St. Paul, DC Battery Prods.	612-646-7478, FAX:612-646-5018
NY	Bohemia, Battery Assemblers, Inc.	516-567-8855, FAX:516-567-8278
NY	Commack, Bren-Tronics Inc.	516-499-5155, FAX:516-499-5504
NY	Mt. Kisco, Multiplier Industries. Corp.	914-241-9510,FAX:914-241-1103
NC	Winston Salem, Progressive Technologies, Inc.	919-761-1375,FAX:919-748-0495
TX	Stafford, Southwest Electronics Inc.	713-240-4000, FAX:713-240-5672

DURAKOOL, See American Electronic Components

DUREL CORPORATION, Affiliate of 3M & Rogers Corp., 645 W. 24th St, Tempe, AZ 85282, Tel: 602-731-6200, FAX: 602-731-6210

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DURMITOR INC., Box 413, 23 Crossley Ct, King City, Ont., Canada LOG 1K0, Tel: 416-833-3148, FAX: 416-833-2112; FSC No.: IC560; Empl.: 6

DUTEC, INC., 4801 James McDivitt, P.O. Box 964, Jackson, MI 49204-0964, Tel: 800-248-1632, FAX: 517-750-4740; *Sls. Mgr.:* Bruce Reynolds, Gen. Mgr.

Local Sales Offices & Reps

FL	Pompano Beach, Digital I/O Assocs.	305-785-1255
TN	Knoxville, Will Hogue & Assocs.	615-691-9749
TX	Missouri City, Ron Stewart & Assocs.	713-438-2565
VA	Herndon, Instrulogic	703-318-0000

Local Distributors

AZ	Phoenix, Summit Elec.	602-957-1100
CA	Laguna Hills, Measurequipment	714-831-8766
CO	Englewood, Applied Controls Equipmt.	303-799-9300
GA	Dalton, Indl. Controls	706-275-4400
IL	Chicago, Don Johns Engrg.	312-666-2210
MA	Harvard, Douglas Lee Assocs.	508-772-9887
MI	Burton, Fenton Sys., Inc.	313-742-3580
NV	Sparks, Applied Indl. Ctrls.	702-356-7401
NM	Albuquerque, Summit Elec.	505-884-4400
NY	Oyster Bay, Cascade Grp.	516-624-9362
OH	Chesterfield, EQS Sys.	800-729-8084
OR	Portland, R & T Factors, Inc.	503-287-6114
UT	Salt Lake City, Protronix Controls	800-464-2456
WI	Waukesha, Wisconsin Controls, Inc.	414-542-1588
Can	Edmonton, Alberta, Dycor Indl. Research	800-663-9267
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396

DY 4 SYSTEMS INC., 21 Fitzgerald Rd., Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, FAX: 613-596-0574; FSC No.: 0BYC3; Empl.: 200; *Sls. Mgr.:* Don Waterman

DYLON GRAPHITE COMPANY, Dylon Industries, Inc., 7700 Clinton Rd., Cleveland, OH 44144, Tel: 216-651-1300, FAX: 216-651-1777; Empl.: 45; *Sls. Mgr.:* K.A. Partee

DYMEC INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870; Empl.: 50

DYNACAST INC., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-962-6300, FAX: 914-245-7185; Empl.: 150; *Sls. Mgr.:* David Simas

DYNACIRCUITS MFG., CO., 11230 W. Addison, Franklin Park, IL 60131, Tel: 708-451-1700, FAX: 708-451-9266; Empl.: 300; *Sls. Mgr.:* Dennis A. Dworzak

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; FSC No.: 9Y852; Empl.: 25; *Sls. Mgr.:* Sidney C. Oakleaf ... **A•2318-2321; D•1660-1664**

DYNALCO CONTROLS, 3690 N.W. 53 St., Ft. Lauderdale, FL 33309, Tel: 305-739-4300, FAX: 305-484-3376; Empl.: 85; *Sls. Mgr.:* Duane Dement

DYNALLOY, INC., 18662 MacArthur Blvd., Ste.103, Irvine, CA 92715, Tel: 714-476-1206, FAX: 714-476-3167; Empl.: 25

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMATION TRANSDUCERS CORPORATION, 348 Marshall St., Holliston, MA 01746, Tel: 508-429-8440, FAX: 508-429-1317 .... **A•2081-2083**

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC POWER SYSTEMS, 12 Sunhill Road, Nesconset, NY 11767, Tel: 516-361-6771, 1-800-422-0708, FAX: 516-361-6361; Empl.: 5; *Sls. Mgr.:* Dorian Robins; *Dist. Mgr.:* Jim Nemec

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 30; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 508-658-6100, FAX: 508-658-0522; Empl.: 125; *Sls. Mgr.:* Joe Portada .... **B•1935**

Local Sales Offices & Reps

CO	Northglean, Jim Reid;Reg. Mgr.	303-457-9666
WI	West Bend, Dennis Herr, Reg. Sls. Mgr.	414-675-2331

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPOWER CORPORATION, Box 9210, S. Burlington, VT 05407, Tel: 802-860-7200, FAX: 802-864-3782; Empl.: 100; *Sls. Mgr.:* John S. Hurst .... **D•1665-1667**

Local Sales Offices & Reps

MI	Farmington Hills, Dynapower Corp.	313-471-1800

DYNAROLL CORPORATION, 551 A Fifth St, San Fernando, CA 91340, Tel: 818-837-3456, FAX: 818-837-3466; *Sls. Mgr.:* Roy Wilson; *Dist. Mgr.:* Molly Kosmak

DYNISCO, 4 Commerical St, Sharon, MA 02067, Tel: 617-784-8400, TELEX: 174-292, FAX: 617-784-2902; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Richard McQuiggan

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, FAX: 516-669-0785; FSC No.: 72794; Empl.: 140; *Sls. Mgr.:* John Scappatura; *Dist. Mgr.:* John Scappatura

EAGLE ELECTRIC MFG. CO. INC., 45-31 Court Square, Long Island City, NY 11101, Tel: 718-937-8000, FAX: 718-482-0160; Empl.: 3000; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* Bob Lofgren

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; FSC No.: 34718; Empl.: 34; *Sls. Mgr.:* Gary Noble

EAGLE EP PICHER

FAX: 417-623-5556

EAGLE-PICHER, Box 47, Joplin, MO 64801, Tel: 417-623-8000; FSC No.: 81855; Empl.: 700; *Sls. Mgr.:* Douglas Pennington D•1440-1445

Local Sales Offices & Reps

AR	Hot Springs, ASI Inc.	501-767-5444
CA	Torrance, O'Donnell Assoc.	310-781-2235
OR	Beaverton, Pacific Mktg.	503-641-9373
TX	Irving, Space Elctrns.	214-251-3636
Can	Toronto, CEA Associated	416-231-9717

EAGLE-PICHER, P.O. Box 130, Bethel Road, Seneca, MO 64865; Tel: 417-776-2256, FAX: 417-776-2257; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* Earl Anderson; *Dist. Mgr.:* Earl Anderson D•1440-1442

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Shefler-Kahn Co. Inc.	602-581-0884
AR	Hot Springs, Automation Supp. Inc. (ASI)	501-767-5444
CA	Orange, Prism Assocs.	714-283-8744
CA	San Jose, O'Donnell Assocs.-North	408-263-6500
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CA	Torrance, O'Donnell Assoc.	213-539-9664
CO	Broomfield, Connors Co.	303-466-9628
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, Elctrn. Solutions, Inc.	404-396-2541
IL	Woodbridge, Golten Assocs.	708-985-5100
KS	Overland Park, Spectrum Sls.	913-648-6811
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MI	Livonia, Electro-Mktg. Grp., Inc.	313-421-7590
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NH	Nashua, Key Sls. of New England, Inc.	603-880-0110
NY	Massapequa Pk., HC Assocs.	516-541-0262
NY	Morrisville, Naylor Elec. Co.	315-684-9620
NC	Raleigh, L & D Inc.	919-876-5301
OH	Dayton, Electro-Mktg. Grp., Inc.	513-890-8322
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
TX	Dallas, Rem Air Comps.	214-234-1069
WA	Redmond, Pacific Mktg. Spec.	206-882-3144
Can	Mississauga, Continental Elctrn. Assocs.	416-602-9717

Local Distributors

AZ	Tempe, Lynntronics	602-433-0288
AR	Hot Springs, Automation Supp. Inc.	501-767-5444
CA	Anaheim, Carefree Unltd.	714-630-3433
CA	Mountain View, The Power Source	415-960-0700
CO	Denver, Car-Go Battery Co.	303-296-8763
FL	Dunedin, Battery Powered Lighting & Sys.	813-734-9498
GA	Smyrna, Mark C. Pope Assocs.	404-435-2471
IL	Cincinnati, M & B Battery	513-385-5900
IL	Villa Park, The Battery Shop	708-833-6300
KS	Wichita, RSC Elctrns.	316-267-5213
LA	New Orleans, William B. Allen	800-535-9593
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Methuen, Generation Elctrns., Inc	508-683-1177
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
NJ	Teterboro, Engrd. Assemblies	201-288-4477
OH	Cincinnati, M & B Battery	513-385-5900
PA	Bensalem, Scotts Emergency Lighting	215-639-1777
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Lubbock, R & R Elctrn. Supply Co.	806-765-7727
UT	Salt Lake City, Standard Supp. Co.	801-846-3371
WA	Seattle, Radar Electric	206-282-2511
WI	Milwaukee, Battery Shop	414-384-5410
Can	New Westminster, B.C., Magnacharge Battery	604-525-0391
Can	Toronto, Continental Elctrn. Assocs.	416-602-9717

EAGLE SIGNAL CONTROLS, Mark IV Industries, Inc., 8004 Cameron Rd., Austin, TX 78753, Tel: 512-837-8300, FAX: 512-837-8486; Empl.: 3000; *Sls. Mgr.:* Patrick Short

EAGLE
WICHITA

FAX: 316-942-5190

EAGLE WICHITA, P.O. Box 9446, Wichita, KS 67277, Tel: 316-942-5100 A•1626-1632

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 508-429-8370, 1-800-343-4912, FAX: 508-429-7893; *Sls. Mgr.:* Brian Gaynor

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 800-368-0880, FAX: 203-468-0060; Empl.: 40; *Sls. Mgr.:* Katina Boulais

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci B•1713

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg. Co. of AZ	602-949-9333
CA	Los Gatos, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Montrose, Signal Entprs.	818-957-0640
CA	San Diego, Signal Entprs.	619-679-5086
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Bethel, Ray Perron & Co.	203-798-0261
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Tampa, Florida Comp. sls.	813-873-3622
GA	Alpharetta, Pinnacle Mktg.	404-410-9980
IL	Arlington Hgts., Brainard-Nielsen Mktg., Inc.	708-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	410-730-4700
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Plymouth, Highland Elctrn. Sls.	612-557-7002
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
UT	Salt Lake City, Luscombe Engrg. Utah	801-268-3434
WA	Bellevue, Luscombe Engrg. N.W.	206-223-1541
WI	Mequon, Badgerep	414-241-9200

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
AZ	Scottsdale, Electronic Supp.	1-800-622-3726
CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	Cupertino, Cal. Switch & Signal	408-279-8848
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Fresno, Minarik Elec. Co.	209-255-8089
CA	Gardena, California Switch & Sig.	310-538-9830
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Ontario, Minarik Elec. Co.	714-391-0064
CA	Riverside, Electronic Supp.	909-683-7300
CA	S. San Francisco, Bell Elctrl. Supp.	415-589-7055
CA	Salinas, Bell Elctrl. Supp.	408-758-6110
CA	San Diego, Electronic Supp.	619-693-8222
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	San Jose, Electronic Supp.	408-453-3770
CA	San Jose, Minarik Elec. Co.	408-955-9030
CA	Santa Clara, Bell Elctrl. Supp.	408-727-2355
CA	Sunnyvale, Target Elctrns., Inc.	408-733-0384
CA	Van Nuys, Wes-Garde Comp. Grp.	213-873-4802
CO	Commerce City, Minarik Elec. Co.	303-289-5800
CO	Denver, CSID, Inc.	303-292-9594
CT	Hartford, Wes-Garde Comp. Grp.	203-525-6907
CT	Wallingford, Sager Elec. Supp. co.	203-265-4600
FL	Lakeland, Wes-Garde/Switch Controls, Inc.	813-644-7564
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Oviedo, Dixie Sls.	407-365-5211
GA	Atlanta, Motion Elctrns.	404-455-8262
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Carol Stream, Wes-Garde Comp. Grp.	708-653-1460
IL	Elk Grove, Martec Assoc.	708-956-8090
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IL	Schaumburg, Minarik Elec. Co.	708-885-9337
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	Baton Rouge, Menard Elctrns.	504-355-0323
LA	New Orleans, Menard Elctrns.	504-734-8445
ME	Bar Mills, Nelson & Wright	207-929-8238
MD	Columbia, Sager Elctrns.	410-995-4900
MD	Gaithersburg, Axis Elctrns.	301-840-9640, 800-368-2815
MD	Jessup, Treeko Sls.	410-470-3300
MA	Hingham, Sager Elec. Supp. Co.	617-749-6700
MA	N. Billerica, Minarik Elec. Co.	508-663-0740
MA	Walpole, Richey Impact Elctrns.	508-668-8200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	St. Claire Shores, SPEMCO Switches	313-771-2700
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	St. Louis, Beckwith, Inc.	314-343-6463
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Salem, Sager Elec. Supp. Co.	603-898-1348
NJ	Cranford, Garden State Indl. Elctrns., Inc.	908-272-6400
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
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NC	Charlotte, Resource/Dixie Elctrns.	704-521-8682
NC	Raleigh, Sager Service Plus	919-850-9550
NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131,800-334-8688
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Highland Hgts., Electronics Mktg. Corp.	216-442-3441
OH	Westerville, Wes-Garde Comp. Grp.	614-885-0319
OR	Portland, Minarik Elc. Co.	503-253-3402
PA	Harrisburg, Ad-Tech Elctrns.	717-561-9905
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Norristown, Kimberly-James Co.	215-666-7286
PA	Philadelphia, Sager Elctrns.	215-464-4336
PA	Wayne, Peak Elctrns. Corp.	215-293-9000
SC	Columbia, Resource/Dixie Elctrns.	803-779-5332
TN	Lawrenceburg, Mfg. Solutions	615-762-8773
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	Houston, Minarik Elec. Co.	713-847-0808
TX	Irving, Minarik Elec. Co.	214-402-8188
TX	San Antonio, Minarik Elec. Co.	210-822-7097
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VA	Glen Allen, Hermitage Distrs.	804-550-3030
WA	Bellevue, Minarik Elec. Co.	206-649-0880
WA	Seattle, Platt Elec.	206-624-4083
WI	Milwaukee, Marsh Elctrns. Corp.	414-475-6000

E-A-R SPECIALTY COMPOSITES, Cabot Safety Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-692-1111, FAX: 317-692-3111; *Sls. Mgr.:* Greg R. Handy

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NY	Rochester, Elcom Sls.	716-385-1400
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NC	Charlotte, Jake Rudisill Assocs.	704-377-6901
OH	Cincinnati, KCH Co.	513-931-1686
OR	Bellevue, Eltech Co.	206-643-4330
PA	Paoli, ETC Sales	215-296-3527
TX	Dallas, D.J. Sls. Co.	214-783-8876
TX	Richardson, D.J. Sls.	214-783-8876
WI	Racine, KMG Sls., Inc.	414-639-9005

Local Distributors

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MA	Hingham, Hingham Bay Corp.	617-740-1900

EASTERN ELECTRONICS MFG. CORP., National Patent Dev. Corp., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821, FAX: 203-289-7639; FSC No.: 203-289-7639; Empl.: 200; *Sls. Mgr.:* Wayne M. Baker

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 800-835-2393, FAX: 516-483-7071; Empl.: 6; *Sls. Mgr.:* L. Sherman; *Dist. Mgr.:* L. Sherman

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EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, 800-289-3866, TWX: 910-260-3713, FAX: 414-261-9097; Empl.: 350

EATON CORPORATION, Industrial Controls Division, 3122-14th Avenue, Kenosha, WI 53141, Tel: 414-656-4011, 800-356-5077, TELEX: 910-274-2356, FAX: 414-656-4370; Empl.: Approx. 300

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EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

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EBG-ELEKTRONISCHE BAUELEMENTE, Gesellschaft m.b.H., 8082 Kirchbach 384, Austria, Tel: (43) 03116 2625, TELEX: 312540, FAX: 43/3116/27540; Empl.: 63; *Sls. Mgr.:* Mag. G. Klauser

EBM INDUSTRIES, INC., 110 Hyde Road, Farmington, CT 06034, Tel: 203-674-1515, FAX: 203-674-8536; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski .... **C•1578-1579**

EBY COMPANY, 4300 H Street, Philadelphia, PA 19124, Tel: 215-537-4700, FAX: 215-537-4780; FSC No.: 72825; Empl.: 75; *Sls. Mgr.:* Alan S. Olshansky

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E-CAM TECHNOLOGY INC., E-Cam AG, 14455 N. Hayden Rd., Ste. 208, Scottsdale, AZ 85260, Tel: 602-443-1949, 800-638-3226, FAX: 602-998-0809; *Sls. Mgr.:* Lenny Axford .... **C•1310**

ECHO SPEECH CORP., 6420 Via Real, Carpinteria, CA 93013, Tel: 805-684-4593, FAX: 805-684-6628; *Dist. Mgr.:* Mark Pfeffer

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ECLIPTEK CORPORATION, 3545-B Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-433-1200; FSC No.: 0GUG6; Empl.: 70; *Sls. Mgr.:* Bob Bishop; *Dist. Mgr.:* Bob Bishop .... **A•1258, 1326, 1383-1387**

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AL	Huntsville, Ecliptek Corp.	205-830-4228
CA	San Jose, Ecliptek Corp.	408-441-6670
NJ	Marlton, Ecliptek Corp.	609-596-8500

ECLYPSE INTERNATIONAL CORP., 2042 S. Grove Ave., Ontario, CA 91761-9925, Tel: 909-947-8839, FAX: 909-947-9395; Empl.: 12; *Sls. Mgr.:* Brian Lincoln; *Dist. Mgr.:* Brian Lincoln

ECM MOTOR COMPANY, 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-7373; Empl.: 500; *Sls. Mgr.:* Robert Forschler

ECOSOFT, INC., 8295 Indy Court, Indianapolis, IN 46214, Tel: 317-271-5551, FAX: 317-271-5561; Empl.: 2; *Sls. Mgr.:* Emma Alkire

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ECS COMPOSITES, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871; FSC No.: 24995; Empl.: 112; *Sls. Mgr.:* Jill K. Gleysteen ... **C•1021**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
CA	Garden Grove, Elctrn. Pkg. Solutions	714-638-4455
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
CA	Mtn. View, Kim Buurma	415-962-9027
CO	Englewood, Electronic Comp. Sys.	303-762-9576
FL	Altamonte Springs, EMA	407-339-2333
FL	Winter Springs, Harold Scott	407-699-1888
GA	Roswell, EMA	404-992-7240
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Needham, Apex Assocs.	617-444-8070
NY	New York City, Smith Engrg. Sls.	516-689-6514
NC	Raleigh, EMA	919-846-6888
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OR	Grants Pass, ECS Inc.	503-476-8871
TX	Dallas, Advance Tech. Sls.	214-340-1300
Can	Stittsville, Ont., Production Case Co.	613-836-2248

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ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111-1980, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford .... **D•1010**

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AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Fremont, FLW Inc.	510-651-6511
CA	Oxnard, FLW Inc.	805-984-0167
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850

IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Independance, Ramsey Assocs.	816-373-3111
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811
MN	Minneapolis, Sector Eng. Sls. Inc.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Westfhal & Assocs.	505-268-1433
NY	Liverpool, Northern Tech Sls.	315-451-1090
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
PA	Pittsburgh, Instrmn. Sys.	412-823-7005
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280
Can	Toronto, Intertechnology, Inc.	416-445-5500

EDAC INC

FAX: 514-333-2881

EDAC INC., 5778 Thimens, St. Laurent, Que., CAN H4R 2K9, Tel: 514-333-7288, 1-800-565-2811; FSC No.: 31781; Empl.: 80; *Sls. Mgr.:* Terry Thornton; *Dist. Mgr.:* Terry Thornton .... **C•1311-1313**

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CA	Napa, Stewart Fullerton Assocs.	707-258-1160
CA	Redondo Beach, Jerde & Assocs.	310-372-8637
CA	San Diego, Centinske Sls.	619-487-3335
CO	Littleton, Romulus Elctrns.	303-770-4888
CT	Bloomfield, S.I.R. Assocs.	203-243-9343
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
FL	Maitland, Krutek & Assocs.	407-628-4837
GA	Norcross, F & J Squared	404-368-9191
IL	Lisle, W. G. Controls	708-963-5954
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Westford, S.I.R. Assocs.	508-692-2500
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Minneapolis, George Russell & Assocs.	612-854-1160
NY	Port Washington, Ashtec Inc.	516-767-0336
OH	Medina, J.C. Hofstetter	216-241-4880
OR	Beaverton, Quest Mktg. Inc.	503-641-7377
PA	Horsham, Jacobsen Assocs.	215-674-2937
SC	Tega Cay, F & J Squared	803-548-2133
TX	Dallas, Marketronics	214-388-2237
WA	Renton, Quest Mktg.	206-228-2660
Can	Montreal, Shelly Newman	514-486-6984
Can	North Vancouver, Arwin Technical Sls.	604-980-4557
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EDA INC., Div. of Connector, 637 S. Palm St. Ste. F, La Habra, CA 90631, Tel: 213-697-7151, FAX: 213-691-1509; Empl.: 160; *Sls. Mgr.:* Roy Wang

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EDITRON SYSTEMS INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0051, FAX: 201-837-0504; *Sls. Mgr.:* Joseph G. Bentitou

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EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; Empl.: 1000; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

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EEMCO, Datron, Inc., 4585 Electronics Pl, Los Angeles, CA 90039, Tel: 818-247-7060, FAX: 818-244-6621; FSC No.: 72121; Empl.: 200; *Sls. Mgr.:* Russell Johnson

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EFD INC., 977 Waterman Ave., E. Providence, RI 02914, Tel: 800-556-3484, 401-434-1680, FAX: 401-431-0237; Empl.: 150

EFECTOR, INC., a subsidiary of ifm electronic, 805 Springdale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, FAX: 215-524-2010; Empl.: 70; *Sls. Mgr.:* J. Kelly

EFI ELECTRONICS CORP., 2415 South 2300 West, Salt Lake City, UT 84119, Tel: 801-977-9009, 800-877-1174, FAX: 801-977-0200; Empl.: 130; *Sls. Mgr.:* Mark A. Norrie

EFOS INC., 5716 Coopers Ave., Unit 1-5, Mississauga, Ont., Can L4Z 2E8, Tel: 416-568-4268, FAX: 416-568-4280; Empl.: 25-50; *Sls. Mgr.:* Beverley Barber

EFRATOM, See Ball Corp., Efratom Div.

EG&G, INC., Electronics Components Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 329; *Sls. Mgr.:* J. Murachver

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, FAX: 818-442-8127; FSC No.: 18915; Empl.: 115; *Sls. Mgr.:* Bill Hayes; *Dist. Mgr.:* Bill Hayes .... **C•1022, 1135**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
CA	Huntington Beach, EG & G Rotron	714-848-7550
CO	Broomfield, Conners Co.	303-466-9628
FL	Winter Park, EG & G Rotron	407-671-5935
IL	Inverness, Heartland	708-358-6622
IN	Indianapolis, Heartland	317-845-5480
MD	Towson, Arbotek	301-825-0775
MA	Chelmsford, EG & G Rotron	508-256-6061
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NY	Syracuse, Hotze & Murcon	315-455-8807
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Portland, Halbar/RTS	503-244-4123
PA	Lancaster, EG & G Rotron	717-392-8805
TN	Mil Spec Sls.	615-360-7714
WA	Vashon, Halbar/RTS	206-285-1363
WI	Brookfield, Heartland	414-789-6860
Can	Bolton, Ontario, P.J. Heenan Ltd.	416-857-4948

Local Distributors

AZ	Phoenix, Aero-Space Southwest Inc.	800-289-2779,602-582-2779
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CO	Aurora, Jet Elctrns. Supp. Co., Inc.	303-364-1000
CT	S. Windsor, Car-Lac Elctrns.	203-282-0631
KS	Shawnee Mission, Aero-Space Computer Supp.	913-432-8508
MA	Milford, Car-Lac Elctrns.	508-478-7797
MA	Winchester, Webb Distr/Distrbn.	617-729-5800
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minneapolis, Stark Elctrns., Inc.	612-332-1325
NY	Bohemia, Car Lac Inds. Sls., Inc.	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Summit Distrs.	716-334-8110
OR	Beaverton, Murphy Elctrns.	503-642-2001
TX	Ft. Worth, Industrial Elctrns.	817-731-7321
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Mukwonago, Aero-Space Computer Supp.	414-547-8405
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280

EG&G ELECTRO-OPTICS, EG&G Optoelectronics, EG&G Inc., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, 1-800-950-3441, FAX: 508-745-0894; *Sls. Mgr.:* Jacques Murachver; *Dist. Mgr.:* Jacques Murachver

EG & G FLOW TECHNOLOGY, INC., Box 52103, Phoenix, AZ 85072, Tel: 602-437-1315, TELEX: 187-163, FAX: 602-437-4459; Empl.: 100; *Sls. Mgr.:* Ron Madison

EG & G FREQUENCY PRODUCTS INC., EG & G Inc., 4914 Gray Rd., Cincinnati, OH 45232, Tel: 513-542-5555, FAX: 513-542-5146; FSC No.: 58997; Empl.: 100; *Sls. Mgr.:* D. Hughes, Sls. Engr.

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 8581 Aero Drive, San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 30; *Sls. Mgr.:* Bill Oker

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 357-435, FAX: 408-745-6131; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 221 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65; *Sls. Mgr.:* Andrew Allen

EG&G OPTOELECTRONICS, EG&G Canada Ltd., 22001 Dumberry Road, Vaudreuil, Quebec, Canada J7V 8P7, Tel: 514-424-3300, TELEX: 05-823646, FAX: 514-424-3411

EG&G OPTOELECTRONICS- RETICON, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, FAX: 408-738-6979; Empl.: 200

EG & G POWER SYSTEMS, INC., 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, FAX: 818-967-3151; Empl.: 280; *Sls. Mgr.:* Dave Adams .... **D•1670-1671**

Local Sales Offices & Reps

CA	Orange, RD & D Sls. Engrg.	714-771-6110
CO	Littleton, Mercier & Assoc.	303-770-0666
FL	Deland, World Sls. Dev.	904-228-2727
FL	Orlando, Truex Assocs.	407-859-2160

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GA	Marietta, Electro-Comp Sls.	404-992-2344
MA	Dover, George Urban Assoc.	508-329-4068
NY	Fayetteville, Tri-Tech Elctrns., Inc.	315-446-2881
PA	Glenside, Koebert Assoc.	215-887-2310

EG&G ROTRON, Industrial Division, North Street, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 981511, FAX: 914-246-3802; FSC No.: 551496; Empl.: 75; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley

FAX: 617-246-0874

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* David Mendel .... **C•1580-1583**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, Sanford Sls. Assoc.	602-957-3570
CA	Huntington Bch., West Elctrn. Sls. Team	714-375-6500
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, West Elctrns. Sls. Team	619-233-0236
CO	Denver, Donohue Sls.	303-455-1719
CT	Stamford, Francis J. Bigda	203-322-0240
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
FL	Brandon, Over & Over, Inc.	813-684-6486
FL	Ft. Lauderdale, Over & Over Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
MI	Farmington Hills, Luebbe Sls. Co.	313-489-8828
MN	Bloomington, Prof. Sls. for Ind.	612-944-8545
MO	Chesterfield, Weisler & Assocs., Inc.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NY	Commack, ERA, Inc.	516-543-0510
NY	E. Rochester, Tri Tech Elctrns.	716-385-6500
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NY	Fishkill, Tri Tech. Elctrns.	914-897-5611
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Dayton, Luebbe Sls. Co.	513-438-0490
OH	Westlake, Luebbe Sls. Co.	216-899-0071
OR	Tigard, Halbar-RTS Inc.	503-624-5741
PA	Narbeth, Bresson Assocs.	215-664-6460
TX	Austin, Milco Mktg.	512-835-5359
TX	Houston, Milco Mktg.	713-469-5156
TX	Plano, Milco Mktg.	214-578-1996
WA	Redmond, Halbar-RTS Inc.	206-882-0990
WA	Vashon, Halbar-RTS Inc.	206-463-2277
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Calgary, Alberta, Cana Rep Grp., Inc.	403-255-0294
Can	Dartmouth, N.S., Cana Rep. Grp., Inc.	902-456-4400
Can	Edmonton, Alb., Cana Rep. Grp., Inc.	403-487-5578
Can	Markham, Ont., Cana Rep. Grp., Inc.	416-930-4621
Can	Montreal, Que., Cana Rep. Grp., Inc.	514-276-4477
Can	Oakville, Ont., Cana Rep. Grp., Inc.	416-338-3399
Can	Otawa Manotick, Ont., Cana Rep. Grp., Inc.	613-692-4682
Can	Surrey, B.C., Cana Rep. Grp., Inc.	604-599-1232

Local Distributors

AL	Birmingham, Newark	205-979-7003
AZ	Tempe, Bell	602-966-7800
AR	Little Rock, Newark	501-225-8130
CA	Agora Hills, Bell	818-879-9494
CA	Belmont, Richardson	415-592-9225
CA	Canoga Park, Caltronics	818-346-4936
CA	Cypress, Bell	714-895-7801
CA	Foster City, Newark	415-572-8300
CA	Fountain Valley, Comps. Center	714-979-0433
CA	Los Angeles, Newark	310-672-8548
CA	Redwood City, Stotts Friedman	415-368-3800
CA	Rocklin, Bell	916-652-0414
CA	San Diego, Bell	619-268-1277
CA	San Jose, Quement	408-998-5900
CA	Santa Ana, Elcom	714-432-6630
CA	Santa Clara, Comps. Center	408-988-3751
CA	Santa Fe Spgs., Bell	310-921-3611
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Woodland Hills, Richardson	818-347-5580
CO	Denver, Newark	303-757-3351
CT	Bloomfield, Newark	203-243-1731
CT	Wallingford, Bell	203-269-6801
FL	Altamonte Springs, Bell	407-339-0078
FL	Ft. Lauderdale, Newark	305-587-2372
FL	Miami, Elctrn. Equip.	305-526-6000
FL	Orlando, Newark	407-896-8350
FL	Sanford, Afcom	407-321-9225
FL	Sanford, Elctrn. Fasteners	407-321-4000
FL	Tampa, Reptron	813-854-2351
FL	Winter Park, Richardson	407-644-1453
GA	Norcross, Newark	404-448-1300
ID	Boise, Newark	208-342-4311
IL	Bensenville, Goold	708-860-7171
IL	Chicago, Newark	312-784-5100
IL	Elk Grove Village, Bell	708-640-1910
IL	LaFox, Richardson	708-208-2200
IL	Morton Grove, Nedco	708-967-0500
IN	Carmel, Altex	317-848-1323
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Newark	317-844-0047
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	Cedar Rapids, Newark	319-393-3800
KS	Overland Park, Newark	913-677-0727
KS	Wichita, RSC	316-267-5213
KY	Louisville, Newark	502-423-0280
LA	Metarie, Newark	504-838-9771
LA	Shreveport, Indl. Elctrn. Supp.	318-222-9459
MD	Beltsville, Newark	301-604-1700
MD	Columbia, Bell	410-290-5100
MD	Gaithersburg, Capitol Radio	301-840-5700
MA	Andover, Bell	508-474-8880
MA	Ashland, Quality Comps.	508-881-6504
MA	Tewksbury, Jaco	508-640-0010
MA	Winchester, Webb Dist. Inc.	617-729-5800
MA	Woburn, Newark	617-935-8350
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Flint, RS Elctrns.	313-742-5000
MI	Grand Rapids, Newark	616-455-9190
MI	Livonia, RS Elctrns.	313-525-1155
MN	St. Paul, Gopher	612-490-4900
MS	Jackson, Newark	601-956-3834
MO	Maryland Heights, RS Elctrns.	314-997-7709
MO	St. Louis, Newark	314-298-2505
MT	Helena, Newark	406-443-6192
NE	Omaha, Newark	402-592-2423
NV	Las Vegas, Newark	702-796-5090
NH	Nashua, Newark	603-888-5790
NH	Salem, Tech Mark	603-893-8380
NJ	Camden, G.R.S.	609-964-8560
NJ	Mountainside, Route Elctrns.	908-654-8283
NJ	Pennsauken, Newark	609-663-9490
NM	Albuquerque, Bell	505-292-2700
NY	Bohemia, Car-Lac	516-567-4200
NY	Brooklyn, Richardson	718-646-6300
NY	Buffalo, Summit	716-887-2800
NY	Cheektowga, Newark	716-862-9700
NY	Farmingdale, Semispecialists	516-293-2710
NY	Hauppauge, Farmont Elctrns.	516-231-3313
MI	Madison Hgts., Galco	313-542-9090
NY	Monsey, Nobel Elctrns.	914-352-0182
NY	Penn Yan, Advacom Tech.	315-536-2221
NY	Rochester, Summit	716-334-8110
NY	Valley Stream, Newark	516-561-8400
NC	Greensboro, Newark	919-292-7240
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Winston-Salem, Kirkman	919-722-9131
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, Cam Ohio	216-461-4700
OH	Columbus, Newark	614-447-8282
OH	Dayton, Stotts Friedman	513-298-5555
OH	Toledo, RS Elctrns.	419-893-0721
OH	Warren, REM Elctrns.	216-373-1300
OK	Altair	918-252-5781
OK	Oklahoma City, Newark	405-495-5000
OR	Beaverton, Component Resources	503-641-8488
OR	Portland, Newark	503-257-0741
PA	Allentown, Newark	215-434-7171
PA	Pittsburgh, Cam-RPC	412-963-6202
PA	Trevose, Bell	215-953-2800
RI	Walpole, Newark	401-943-3340
SC	Columbia, Newark	803-798-0198
TN	Knoxville, Newark	615-588-6493
TX	Austin, Wofford	512-339-1131
TX	Dallas, Richardson	214-239-3680
TX	Garland, Newark	214-494-5911
TX	Houston, Altair	713-462-3029
TX	Richardson, Jaco/QC	214-234-5565
TX	Stafford, Harrison Equip.	713-879-2727
UT	Midvale, Bell	801-561-9691
UT	Salt Lake City, Newark	801-484-8611
VT	South Burlington, Newark	802-860-1856
VA	Arlington, Newark	703-522-7552
VA	Charlottesville, Virginia Elec.	804-296-4184
WA	Bellevue, Newark	206-641-9800
WA	Redmond, Bell	206-867-5410
WA	Walpole, Richey Impact Elctrn.	508-668-8200
WV	Dunbar, Newark	304-768-6872
WI	Milwaukee, Newark	414-453-9100
WI	Waukesha, Bell	414-547-8879
Can	Calgary, Zentronics	403-295-8838
Can	Montreal, Zentronics	514-737-9700
Can	Ottowa, Electrosonic	613-728-8333
Can	Quebec City, Zentronics	418-654-1077
Can	Toronto, Electrosonic	416-494-1555
Can	Vancouver, Electrosonic	604-273-2911
Can	Winnipeg, Electrosonic	204-783-3105

EGIS CORPORATION, 655 Plum Tree Rd., Barrington Hills, IL 60010, Tel: 708-639-1555, FAX: 708-639-8710; Empl.: 6

EH ELECTRONICS, INC., See Wavetek San Diego, Inc.

EHRHORN TECHNOLOGICAL OPERS., INC., 4975. North 30th St., Colorado Springs, Colorado 80919-4101, Tel: 719-260-1191, FAX: 719-260-0395; FSC No.: 1106; Empl.: 5; *Sls. Mgr.:* Tim Coutts; *Dist. Mgr.:* Tim Coutts

EI & S, Prime Technology Inc., Twin Lakes Rd., P.O. Box 185, North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 14908; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson, Mktg. VP. ... **B•1482**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs.	602-589-0282
CA	Canoga Pk., C & W Comps. Sls.	818-700-2684
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Haywood, Pacific Mktg. Inc.	415-887-1620, 415-887-7595
CA	Newbury Pk., Interconn Tech. Mktg.	805-499-4024
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, EI&S	203-481-5721
DC	Washington, AM-Tech Assoc.	301-461-5599
FL	Lakeland, Munday Sls.	813-858-5606,818-858-7257
IL	Arlington Hgts., Mertons Assoc.	314-993-6600
IL	Arlington Hgts., MB Sls.	708-392-9499
MD	Ellicott City, Am-Tech Assoc.	301-461-5599
MA	Norwell, Norris Assocs.	617-659-7988, 617-659-0790
MA	Shrewsbury, Advanced Comps. Grp.	508-845-2023
MO	St. Louis, Mertens Co.	314-993-6600,314-993-6630
MO	St. Charles, Microtronics	314-946-8500
NY	Buffalo, Lynn Assocs., Inc.	716-631-0054, 716-631-0101
OH	Cleveland, John O. Olsen Co.	216-838-0510
NY	Hauppauge, Masin-Esco, Inc.	516-273-3500, 516-273-3516
PA	Gibsonia (West), John O. Olsen Co.	216-838-0510
PA	Malvern (East), Stitzer Assocs.	215-664-5500, 215-664-5503
OH	Westlake, Advanced Technlg. Assocs.	216-835-5050,216-835-3599
TX	The Colony, Juliana Co.	214-625-1075
WA	Seattle, Datacom Assoc.	206-285-2525
Can	St. Laurent,PQ, Electronique Versatech	514-335-3833

Local Distributors

AZ	Phoenix, Keystone Electro Sls.	602-995-3005
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Canoga Pk., Acort Inds.	818-700-2991
MD	Columbia, DK Elctrns.	301-995-1950
MA	Billerica, A. W. Mayer Co.	508-229-2255
MA	Newton, The Greene-Shaw Co.	617-969-8900
NJ	Oakland, Relay Specialties	201-337-1000

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440, 800-678-1040; Empl.: 2,000; *Sls. Mgr.:* Randall Jones .... **A•1588-1591, 2323**

Local Sales Offices & Reps

AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	Mountainview, The Pentagon Co.	415-961-3610
CT	W. Simsbury, Electrotechnika	203-658-6762
FL	W. Melbourne, Kennedy Assocs.	407-676-6875
IL	Wheaton, CS Tech. Sls.	708-653-8126
IA	Marion, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Annapolis, Rynone Assocs.	410-263-0794
MA	Needham, Sturgeon Tech.Sls.	617-444-6603
MN	Minneapolis, Electro-Serv Co.	612-338-3475
MO	St. Charles, MSB Assocs. Inc.	314-946-5577
NJ	Mt. Laurel, Paragon Sls.	609-778-1190
NY	Fairport, Advanced Comps.	315-437-6700
NC	New Hill, Tom Santel	919-362-4091
OH	Mansfield, Rich Tech Sls.	419-756-1953
OR	Mission Hills, Pentagon Co.	818-894-0299

E.I.L. INSTRUMENTS, INC., 10946A Golden West Drive, Hunt Valley, MD 21031-1320, Tel: 410-584-7400, FAX: 410-584-7561; Empl.: 500; *Sls. Mgr.:* Keith D. Hadley

EI MICROCIRCUITS, INC., 1651 Pohl Road, Mankato, MN 56001, Tel: 507-345-5786, FAX: 507-345-7559; Empl.: 60; *Sls. Mgr.:* Perry Eimers

EIP MICROWAVE, INC., 1589 Centre Pointe Dr., Milpitas, CA 95035, Tel: 408-945-1477, FAX: 408-945-0977; FSC No.: 34257; Empl.: 65; *Sls. Mgr.:* Rick Bush

EKTRON APPLIED IMAGING, INC., 23 Crosby Dr., Bedford, MA 01730, Tel: 617-271-1940, FAX: 617-271-1860; Empl.: 175; *Sls. Mgr.:* Richard Rollins

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FAX: 408-778-2597

ELAN SYSTEMS, INC., 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526; *Sls. Mgr.:* Bill White .... **A•1696-1697; D•1087**

Local Sales Offices & Reps

CA	Morgan Hill, Elan Sys., Inc.	408-778-7267

ELAN TECHNICAL CORP., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-335-2115, FAX: 203-335-2723

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-333-6314, FAX: 408-945-9305; FSC No.: 64762; Empl.: 112; *Sls. Mgr.:* Ralph Granchelli; *Dist. Mgr.:* Nancy Serdynski

ELASTOMERIC TECHNOLOGIES, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 387-236, FAX: 215-672-4633; FSC No.: 64914; Empl.: 43; *Sls. Mgr.:* John Seibert (West)/George Glatts (East) .... **C•1314**

Local Sales Offices & Reps

AL	Huntsville, Remco/Huntsville	205-533-3763
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Orange, Libratronix	714-871-1513
CA	San Jose, W I N	408-559-8118
CO	Monument, Sunbird Inds.	719-481-2900
FL	Ft. Lauderdale, Synergistic Tech. Inc.	305-791-8255
FL	Melbourne, Synergistic Tech. Inc.	407-242-9661
FL	Odessa, Synergistic Tech.	813-920-5814
GA	Lilburn, Remco/Atlanta	404-447-6937
IL	Des Plaines, Lincoln, Hodges	708-297-3810
IN	Ft. Wayne, Outman Sls.	219-489-7699
KS	Wichita, Baka Corp.	316-682-8411
MD	Gaithersburg, Carwithen	301-921-9545
MA	Needham, Comp. Technlg., Inc.	617-449-8490
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Bloomington, Northmark Assocs.	612-854-9299
MO	St. John, Baka Corp.	314-878-4224
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Tigard, L. D. Elctrns.	503-684-8221
PA	Hatboro, A.Q.S. Electro	215-674-3562
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-REP	713-271-5635
UT	Ogden, Sunbird Inds., Inc.	801-479-7151
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Janesville, Lincoln,Hodges	608-754-4214

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, FAX: 814-643-0426; FSC No.: 91662; Empl.: 300; *Sls. Mgr.:* C. Demars; *Dist. Mgr.:* M. Grove

EL-COM CABLETEK, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-432-6630

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 25; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 407-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek

ELCON INSTRUMENTS, INC., Whessoe, Plc, 137 Gibralter Street, Annapolis, MD 21401, Tel: 410-280-6686, FAX: 410-263-5790; Empl.: 10; *Sls. Mgr.:* Robert Siska

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 510-490-4200, FAX: 510-490-3740; FSC No.: 85901; Empl.: 120; *Sls. Mgr.:* Tom Johnson, Dir. of Sls.

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Carlsbad, Tarco/Prime Source	619-434-1297
CA	Los Gatos, Norwest Elctrns.	408-356-7670
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
MD	Towson, Arbotek Assocs.	410-825-0775
MA	Brookline, Harman Assocs.	617-232-6687
MI	Farmington, J P Bergin Assoc.	313-471-7940
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Cherry Hill, Tritek Sls.	609-667-0200
NY	Rochester, ELDRE Corp.	716-427-7280
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, Electronic Mktg. Assocs.	919-847-8800
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
OH	Centerville, Omega Sls.	513-434-5507
Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
UT	Murray, Waugaman Assocs./Utah	801-261-0802
WA	Redmond, Electronic Mktg. Grp.	206-882-0962

ELECSYS,INC., Div. of C & C Jetronic, 370 Wall St., Princeton, NJ 08540, Tel: 609-259-8866, FAX: 609-259-9347; Empl.: 3; *Sls. Mgr.:* Edward Hwung .... **A•1693**

ELECTRA-SSEMBLY, Lancer Chemical, 80 Cutter St. - Box 30, Warren, RI 02885, Tel: 401-245-5493

ELECTRA-TEC, INC., Div. of Impert Industries, Inc., 567 West M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-5880; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 908-464-3200, FAX: 908-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 .... **D•1252**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-630-5990

ELECTRICAL INSULATION SUPPLIERS, INC., 300 N. Mannheim Road, Hillside, IL 60162, Tel: 708-547-5400, FAX: 708-544-7297; Empl.: 550; *Sls. Mgr.:* Mike Driscoll

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224, FAX: 818-765-2939; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, FAX: 203-846-3933; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, INC., 23362 Madero, Suite C, Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim .... **B•1724-1725**

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-726-7723, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 508-359-4396, FAX: 508-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062-2319, Tel: 708-498-6520, FAX: 708-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

FAX: 716-759-2562

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-5428; FSC No.: 6U589; Empl.: 500; *Dist. Mgr.:* Mark Amatuzzo .... **D•1447**

Local Sales Offices & Reps

NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555

Local Distributors

AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	Costa Mesa, Battery Specialties	714-755-0888
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-943-0200
CO	Englewood, AVT, Inc.	303-795-1958
MA	Sutton, Engrd. Assemblies Corp.	508-865-0722
FL	St. Petersburg, Engrd. Assemblies Corp.	813-328-1970
GA	Norcross, Engrd. Assemblies & Comps. Corp.	404-446-3135
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Teterboro, Engrd. Assemblies Corp.	201-288-4477
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, K Power Elctrns.	713-783-2288
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Brampton, Innovative Power Pak	416-791-2132
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTROCUBE, 1307 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-301-0122, FAX: 818-357-8099; FSC No.: 14752; Empl.: 125; *Sls. Mgr.:* Harold Neubert .... **A•1067**

Local Sales Offices & Reps

AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Mountain View, Westech Sls.	415-961-1422
CA	Newport Beach, Forbes Pacific, Inc.	714-722-6174
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Roswell, JWL Assocs.	404-518-8500
IL	Downers Grove, Richmar Elctrns.	708-968-0118

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MA	Reading, Charles E. Godfrey Co.	617-944-2230
MI	Brighton, W. R. Hummon & Assoc.	313-486-5333
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Raytown, Centech Sls.	816-358-8100
NY	Great Neck, M. O. S. Assocs.	516-487-3966
NY	Rochester, Gislason Sls.	716-328-7400
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Dayton, K. W. Elctrns.	513-890-2150
PA	Allison Park, K. W. Elctrns.	412-492-0777
PA	Paoli, Tyler Griffin Co.	215-647-1550
TX	Plano, Richmar Elctrns.	214-424-8388
WA	Kirkland, James Findlay Co.	206-822-1510
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Tempe, Acacia Sls., Inc.	602-894-2874
CA	Chatsworth, Mil-Comm Dist.	818-998-3111
CA	Fremont, Acacia Sls., Inc.	510-623-7500
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Tustin, Projections Unltd.	714-544-2700
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
FL	Largo, Elctrn. Precepts of FL	813-544-3636
IL	Elk Grove Village, Nu-Way Elctrns.	708-437-7120
IL	Morton Grove, Nedco	708-967-0500
MD	Gaithersburg, MS Elctrns.	301-921-0200
MI	Madison Heights, Galco Ind. Elctrns.	313-542-9090
NJ	Newark, Meltronics	201-242-1686
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Masline Elctrns.	716-546-5373
OH	Englewood, ADS Electra	513-836-8636
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
PA	Levittown, Aim Elctrns.	215-946-3900
PA	McKean, Advacom	814-476-7774
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Redmond, Acacia Sls., Inc.	206-881-5566

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Anthony Cardone; *Dist. Mgr.:* Anthony Cardone

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FAX: 708-255-3827

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 708-259-0740; FSC No.: 10236; Empl.: 200; *Sls. Mgr.:* Frank Rafferty .... **D•1159**

Local Sales Offices & Reps

CA	Alameda, Liaison, Inc.	415-769-1991
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Altamonte Spgs., Quantum Sls.	407-788-0550
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Burlington, FJS Assocs.	617-273-5959
MO	St. Louis, Magna Engrg. Sls.	314-849-6590
NJ	Basking Ridge, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, Kruvand Assoc.	214-437-3355
UT	Centerville, West, Inc.	801-292-8787
WA	Bellevue, ElTech, Inc.	206-643-4330

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTRO-DYN ELECTRONICS, 1201-19th St., Niagara Falls, NY 14301, Tel: 716-284-8747, FAX: 716-284-9112; *Sls. Mgr.:* Paul Grzeskowiak

THE ELECTRODYNE COMPANY, INC., 4188 Taylor Rd., Batavia, OH 45013, Tel: 513-732-2822, TELEX: 241 463, FAX: 513-732-6953

ELECTROFILM, 25395 Rye Canyon Road, Valencia, CA 91355, Tel: 805-257-2242, FAX: 805-257-7738; FSC No.: 85932; Empl.: 77; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS INCORPORATED

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150; FSC No.: 57252; Empl.: 210; *Sls. Mgr.:* Jim Brush .... **A•1721, 1932-1934**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-437-9300
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Apopka, Micro Mktg., Inc.	407-889-2022
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	708-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
MA	Bedford, Vector Assocs.	617-271-0000
MN	Minneapolis, Ferrian Sls.	612-721-8915
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
NY	Clifton Park, Empire Technlg., Inc.	518-371-2480
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Lewisville, Component Circuits, Inc.	919-945-5678
OH	Cincinnati, Arthur Baier Co.	513-779-2395
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1144
OH	Toledo, Arthur Baier Co.	513-276-4128
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
OR	Portland, Demarest Assocs., Inc.	503-645-4788
PA	Erdenheim, OMNI Sls.	215-233-4600
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Ft. Worth, Merlin Elctrns.,	817-429-4420
TX	Missouri City, Jackson Arnold Assocs.	713-261-0798
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Demarest Assocs.	206-523-3210
Can	Montreal, Que., Solid State Engr. Co.	514-481-3313

ELECTRO FORCE CORP., 727 Oakstone Way, Anaheim, CA 92806, Tel: 714-774-3666; Empl.: 4

ELECTROHOME LIMITED, 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6, Tel: 519-744-7111, FAX: 519-749-3136; *Sls. Mgr.:* Alan Caskey

ELECTROID CO., Div.of Valcor Engrg. Corp., 45 Fadem Rd., Springfield, NJ 07081, Tel: 201-467-8100, TELEX: 139241, FAX: 201-467-5656; Empl.: 100; *Sls. Mgr.:* E.D. Lazorchak

ELECTRO IMPULSE, 1805 Corlies Ave. Box 278, Neptune, NJ 07754-0278, Tel: 908-776-5800, FAX: 908-776-6793; FSC No.: 91161; Empl.: 48; *Sls. Mgr.:* Mark Rubin

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 40; *Sls. Mgr.:* S. Kagan

For further information call toll free: 800-645-6342

ELECTRO INSULATION CORP., 3921 Ventura Drive, Arlington Hgts., IL 60004, Tel: 708-632-1020, FAX: 708-632-1089; Empl.: 25; *Sls. Mgr.:* Mike Kamperschroer; *Dist. Mgr.:* Mike Kamperschroer

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722, FAX: 717-848-4514; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROL, Hamlin, Inc., 612 East Lake St., Lake Mills, WI 53551, Tel: 414-648-3000, FAX: 414-648-3001; Empl.: 350; *Sls. Mgr.:* Mike Bucher .... **B•1513**

Local Sales Offices & Reps

AZ	Tempe, Westrep	602-820-9932
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Jose, Vernexx	408-972-4903
CO	Boulder, Design Tech. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Tampa, Electramark, Inc.	813-889-7775
GA	Atlanta, Wallace Elec. (Sen/Sw only)	404-634-3159
GA	Norcross, Electramark, Inc. (Relays only)	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Davenport, Rush & West	319-388-9609
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Gaithersburg, Naudain Assocs. South	301-258-5040
MA	Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Farmington Hills, J.L. Montgomery	313-489-0099
MN	Minneapolis, RK Sls.	612-571-1001
MO	St. Louis, Rush & West	314-965-3529
NJ	Hackensack, Coakley, Boyd, Abbett/Metro	201-440-4114
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Allison Pk., Bear Mktg.	412-492-1150
TN	Tullahoma, Wallace Elctrns. Sls.	615-455-0501
WA	Redmond, Earl & Brown	206-885-5064
WI	Watertown, Deaken Tech. Sls.	414-261-7600
Can	Ontario, Indigo	416-670-0284

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns	602-966-2256
AR	Springdale, Radio Inc.	501-751-8200
CA	Agoura Hills, Cypress Elctrns.	881-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Los Angeles, Master Distrs.	301-452-1229
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	San Jose, Capstone	408-453-9804
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone Elctrns.	303-375-2550
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Harrison Equip. Co.	303-694-6320
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elec.	203-262-1700
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, AA Elec.	404-449-8670

GA	Norcross, EMSCO	404-925-8366
GA	Norcross, Hammond Elctrns.	404-449-1996
ID	Boise, Radar Elec.	208-336-2227
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Itasca, Capstone	708-250-0300
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
KS	Wichita, Radio, Inc.	316-264-2798
MD	Baltimore, Bell Inds.	301-953-2566
MD	Columbia, DK Elctrns.	301-995-1950
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Sager Elec.	301-995-4900
MA	Andover, Bell Inds.	508-474-8880
MA	Hingham, Sager Elctrl. Supp.	617-749-6700
MA	Wilmington, Capstone	508-657-5874
MA	Wilmington, Heiland Elctrns.	508-657-4870
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MN	Thief River Falls, Voyager Elctrns.	612-571-7766
NH	Salem, Sager Elec.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Marlton, Capstone	609-596-7500
NJ	Oakland, Relay Specs.	201-337-1000
NJ	W. Berlin, Genl. Comps.	609-768-6767
NM	Alburquerque, Bell Inds.	505-292-2700
NM	Alburquerque, Harrison Intl.	505-291-9951
NM	Los Alamos, Capstone	505-662-0745
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Plainview, Astrex	516-433-1700
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone	919-954-0600
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Solon, Repco Elctrns.	216-248-8900
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Oswego, Bell Inds.	503-635-6500
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom Inc.	814-476-7774
PA	Pittsburgh, Bell Inds.	412-787-3883
PA	Trevosa, Bell Inds.	215-953-2899
SC	Greenville, EMSCO Inc.	803-233-4121
TX	Austin, Harrison Equip. Co.	512-258-1320
TX	Carrollton, Capstone	214-380-9049
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	El Paso, Harrison Equip. Co.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Tandy Elctrns.	812-870-5614
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equip. Co.	713-879-2727
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Richland, Radar Elec Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Green Bay, Automation Engrg.	414-449-6000
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, BC, ITT Multicomps.	604-291-8866
Can	Calgary, Alb., ITT Multicomps.	403-273-2780
Can	Concord, Ont., ITT Multicomps.	416-798-7884
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., ITT Multicomps.	613-596-6980
Can	Ville St. Laurent, PQ, ITT Multicomps.	514-335-7697
Can	Winnipeg, Manitoba, ITT Multicomps.	403-273-2780

ELECTRO MAGNETIC PROCESSES, INC., 20360 Plummer St., Chatsworth, CA 91311-5371, Tel: 818-882-6333, FAX: 818-709-4668; FSC No.: 51290; Empl.: 100

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 708-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

ELECTRO MAZE AIR FILTERS, 5936 Don Way, Carmichael, CA 95608, Tel: 916-485-4079, FAX: 916-485-7925; Empl.: 7

ELECTROMECH, INC., 2 Cordier St., Irvington, NJ 07111, Tel: 201-318-7999, FAX: 201-318-7995; Empl.: 40; *Sls. Mgr.:* Soloman Ezra .... **A•2324-2325; D•1672**

Local Sales Offices & Reps

NJ	Irvington, Electromech, Inc.	201-318-7999

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 26; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 990 Amelia, San Dimas, CA 91773, Tel: 909-394-9953, FAX: 909-394-0782; FSC No.: 52592; Empl.: 27 .... **B•1636-1637**

Local Sales Offices & Reps

OH	Dayton, Harvey Teplitz	513-898-5282

ELECTRO-MECH CO., 707 Hathaway Dr., Colorado Springs, CO 80915, Tel: 719-597-1620, FAX: 719-597-1628 .... **D•1673**

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg & Assocs.	602-468-0782
CA	Santa Clara, Caltronics	408-727-7552
GA	Roswell, JWL Assocs.	404-518-8500
IL	Cary, Bob Burns & Assocs.	708-516-3322
IA	Cedar Rapids, KKB & Co.	319-373-7111
MN	Minneapolis, Harold Mercer Co.	612-933-7111
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Berkley Hgts., Cambridge Allen & Assocs.	908-464-0203
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NC	Charlotte, JWL Assocs.	704-541-5750
OR	Lake Oswego, Abacus Sls.	503-777-8111

Local Distributors

AL	Birmingham, Forbes Elctrns.	205-251-3941
AL	Huntsville, Mock Elctrns.	205-539-2401
AL	Montgomery, Handeys Elctrn. Ctr.	205-262-4885
FL	Ft. Walton Bch., Key Elctrn. Supp.	904-863-2191
FL	Pensacola, Pensacola Elctrns.	904-478-3771
FL	Tampa, Applied Power	813-725-9587
GA	Norcross, Applied Power	404-263-0421
IL	Mount Prospect, Tri-State Elctrns.	708-255-0600
IA	W. Des Moines, Ramco Elec. Co.	515-225-6933
MA	Boston, IME	800-254-1700
MI	Brighton, Applied Power	313-227-3604
MN	St. Paul, DC Battery Prods.	612-646-7478
MO	Kansas City, Elctrn. Supp., Inc.	816-931-0250
NC	Greensboro, Guilford Elctrn. Supp.	919-275-1385
SC	Spartanburg, Harley's Whlse. Elctrns.	803-582-7961
TN	Clarksville, Randolph Hale & Mathews	615-647-2325
TN	Columbia, Randolph & Williams	615-388-7686
TN	Nashville, Randolph & Rice	615-255-5602
TN	Tullohoma, Randolph & Vandergriff	616-455-4531
TX	Dallas, Computer Comps.	214-239-0271
TX	Richardson / Dallas, Off the Shelf Comps.	214-238-9625
UT	Salt Lake City, Standard Supply	801-486-3371
WI	Madison, Wisconsin Elctrn. Supp.	608-222-3400

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, FAX: 818-350-8070; FSC No.: 07150; Empl.: 15; *Sls. Mgr.:* Terry Trumbull; *Dist. Mgr.:* Terry Trumbull .... **B•1714-1715**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Boulder, Design Technlg. Sls.	303-440-5121
FL	Orlando, Publicover	407-898-9361
IL	Chicago, IRI	708-967-8430
MD	Baltimore, Callas Elctrns., Inc.	410-744-7711
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Minneapolis, D. A. Case Assocs.	612-831-6777
NJ	Medford, Comp. Consits.	609-654-5300
NY	Mamaroneck, Bassin Tech.	914-698-9332
NY	Orchard Pk., SHR	716-662-0589
OH	Cincinnati, KCH Co.	513-931-1686
OR	Hillsboro, Doran Sls.	503-640-4500
RI	Smithfield, Todino Engr. Sls.	401-232-5656
TX	Richardson, McCoy Assocs.	214-864-1838
WA	Redmond, Doran Sls.	206-488-1200

Local Distributors

CA	Los Angeles, Elec. Switches	213-660-1310
CA	Los Angeles, Master Distrs.	310-452-1229
NY	Mamaroneck, Logicomp Elctrns.	800-431-2625

ELECTRO-METRICS, INCORPORATED, A Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 80; *Sls. Mgr.:* Colleen M. DiCaprio

Electro-Miniatures Corp.

FAX: 201-935-8153

ELECTRO MINIATURES CORP., 68 West Commercial Ave., Moonachie, NJ 07074, Tel: 201-460-0510; FSC No.: 17399; Empl.: 45; *Sls. Mgr.:* Barbara Triolo .... **B•1251-1253**

ELECTRO NATIONAL CORP., P.O. Box 402 Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 32; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., 3101-111th St. S.W., Everett, WA 98204, Tel: 206-355-1855, FAX: 206-355-1855; Empl.: 10

EAC

FAX: 818-442-6873

ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., El Monte, CA 91734, Tel: 818-442-3212; Empl.: 92 .... **B•1483**

ELECTRONIC COIL CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-5233, FAX: 203-243-2247; Empl.: 8; *Sls. Mgr.:* R.B. Gorski

ELECTRONIC COMPONENTS & MATERIALS, GTE Sylvania, 816 Lexington Ave., Warren, PA 16365, Tel: 814-726-6500, FAX: 814-726-6942; Empl.: 1800; *Sls. Mgr.:* Robert Scalise

FAX: 908-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 908-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore .... **A•1068-1073**

Local Sales Offices & Reps

CA	La Mirada, Select Elctrns.	714-739-8891
CA	Simi Valley, Elctrn. Concepts, Inc.	805-582-9501
CO	Englewood, TMC	303-770-8995
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	908-542-7880
MO	St. Louis, Harris-Hanson Co.	314-432-3611

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022

ELECTRONIC CONNECTION CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-3356, FAX: 203-243-2247; Empl.: 15; *Sls. Mgr.:* Ray Gorski, Jr.

ELECTRONIC CONNECTORS, INC., 125 South Fifth St., Reading, PA 19602, Tel: 215-374-3796, FAX: 215-374-0630; FSC No.: 15971; Empl.: 34; *Sls. Mgr.:* D. E. Fronheiser; *Dist. Mgr.:* D. E. Fronheiser

ELECTRONIC CONTROLS DESIGN, 4287-A SE International Way, Milwaukie, OR 97222, Tel: 503-659-6100, FAX: 503-659-4422; Empl.: 100; *Sls. Mgr.:* Steven Glass

ELECTRONIC DESIGN ENGINEERING, 1820 Temescal Av., Norco, CA 91760, Tel: 909-735-1761; Empl.: 3

ELECTRONIC DESIGNS INC., 42 South Street, Hopkinton, MA 01748, Tel: 508-435-2341, TELEX: 948004, FAX: 508-435-6302

ELECTRONIC DEVELOPMENT ASSOCIATES, 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St, Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596, FAX: 617-268-6754; FSC No.: 12619; Empl.: 25; *Sls. Mgr.:* R. B. Ross .... **D•1253**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer	205-883-4163
AZ	Tempe, Rusler Tech	602-897-2877
CA	All of CA, F.L.W.	800-339-6030
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Cape Canaveral, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
IL	Arlington Heights, Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Boston, Elctrn. Dev. Corp.	617-268-9696
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Union, Friedman Assocs.	908-964-6200
NM	Albuquerque, Mesa Technlg.	505-883-8833
NY	Victor, SAN WAL Technlg.	716-924-1950
NC	Raleigh, Teqspec	919-851-9112
OH	Cleveland, Tiby Co.	216-371-5335
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Hatboro, Rhodes Technlg.	215-672-3336
TX	Richardson, Scientific Sls.	214-231-6541
VA	Richmond, Advance Control Equip.	804-282-9499
WI	Milwaukee, Berndt Assoc.	414-545-8400
Can	Mississauga, Ont., Omnitronix Ltd.	416-828-6221

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler .... **A•2143**

Local Sales Offices & Reps

CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Nelson	408-437-9300
CO	Englewood, Dynatech	303-773-2830
FL	Melbourne, Kennedy	407-676-6875
GA	Lawrenceville, Funderburk	404-963-9495
IL	Arlington Hgts., Rozner Sls.	312-577-0067
IN	Carmel, Berndt Assoc.	317-844-0114
MA	Sharon, Cummings Assoc.	617-784-5600
MI	Livonia, Amtech	313-474-8300
MN	Burnsville, Xerotex Tech	612-894-5007
MO	St. Louis, Reptronics	314-997-4707
NY	Bohemia, Optimum Metro Sls.	516-244-5744
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Funderburk	919-846-2373
OH	Willoughby Hills, Versatron	216-944-0082
OR	Portland, Index Inc.	503-289-9627
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Dallas, Kruvand Assoc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Toronto, Norgay Entprs.	416-234-8966

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800
AZ	Costa Mesa, Orange Cnty. Comps.	714-979-3597
CA	San Jose, Compass	408-432-7515
CO	Englewood, Comp. Distrs.	303-770-6214
CT	Greenwich, Wise Comps.	203-531-4880
FL	Melbourne, Comp. Distrs.	407-724-9910
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Chicago, E.M.D.	708-577-0067
IN	Indianapolis, Gateway Megatech	317-844-3906
KY	Louisville, Peerless Elctrns.	502-637-7672
MA	Billerica, Mayer Elctrns.	617-229-2255
MI	Grand Rapids, SF Elctrns. Supp.	616-459-0216
MN	Minneapolis, Berquist Inc.	612-835-2322
MO	St. Louis, Ric-Tronics	314-576-9816
NY	Albany, Ed Taylor Co.	518-438-7811
NY	Buffalo, Summit Distr.	716-887-2815
NY	Elmsford, Multimetrics	914-347-3666
NY	Mt. Vernon, Janesway	914-699-6710
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrns.	919-782-2116
NC	Raleigh, Comp. Distr,	919-787-7311
OH	Willoughby, Gateway Megatech	216-953-0333
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, Advacom	814-476-7774
VA	Roanoke, Peoples Elctrns.	703-342-8933
WI	Racine, Badger Elctrns.	414-637-1256

ELECTRONIC DISPLAYS, INC., 780 Creel Dr., Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502; *Sls. Mgr.:* Bob Holmberg .... **B•1043**

ELECTRONIC ENCLOSURES, Div. Wyle Laboratories, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 310-643-8181, FAX: 310-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Robert Sproul

ELECTRONIC ENGRG. CO. OF CAL., See EECO

EEM/ELECTRONIC ENGINEERS MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

FAX: 203-755-0659

ELECTRONIC FILM CAPACITORS, INC., 41 Interstate Lane, Waterbury, CT 06705, Tel: 203-755-5629; Empl.: 65 .... **A•1075**

Local Sales Offices & Reps

CA	San Carlos, Francisco & Assocs.	415-591-8009
CA	Torrance, Orion Eclipse	213-326-0999
FL	Melbourne, Phoenix Comps.	407-723-4414
FL	Palm Harbor, Phoenix Comps.	813-786-1391
IL	Schaumburg, ABC Elctrn. Sls.	708-924-9974
MD	Columbia, PSA, South	301-953-4884
MA	Hudson, Compak, Inc.	508-568-0331
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NJ	E. Brunswick, Winch Sls., Assocs.	908-613-1515
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Columbus, Elctrn. Comps. Inc.	614-231-2318
OH	Miamisburg, Elctrn. Comps., Inc.	513-866-3340
OH	Rocky River, Elctrn. Comps. Inc.	216-331-5330
OH	Westlake, Elctrn. Comps. Inc.	216-835-4856
PA	Exton, The Wright Rep Co.	215-594-9654
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	509-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0552

Local Distributors

CA	Chatsworth, Passive Comps., Inc.	818-700-8838
CA	Garden Grove, Capacitor Supply	714-638-0510
CA	Irvine, IEC	714-837-9960
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, California Capacitor, Inc.	408-262-6000
CA	San Jose, Stotts Friedman	800-869-5558
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Melbourne, Pridmore	407-727-2491
GA	Norcross, NRC Elctrns.-Dixie	404-729-0411
IN	Indianapolis, Mar Elctrns. Inc.	317-633-6699
MA	North Adams, Elctrn. Supp.	413-664-1086
MI	Grand Rapid, Calder Elctrns.	616-698-7400
MN	North Plymouth, Leeds Electro Comps.	612-557-1277
NH	Hampstead, Astrum Elctrns.	603-329-5656
NJ	Ft. Lee, ATI Inc.	201-592-8810
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Bohemia, RBD Elctrns.	516-589-7717
OH	Dayton, Stotts Friedman	513-298-5555
PA	Harrisburg, Ad Tech Elctrns.	717-561-9905
PA	Norristown, Century Elctrns.	215-631-5400
VT	Charlotte, Kellner Elctrns	802-425-3250
WI	Salem, Badger Capacitor Sls.	414-281-1330

FAX: 516-752-1971

ELECTRONIC HARDWARE CORP, Formerly Jan Hardware Mfg. Co., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950; FSC No.: 23480; Empl.: 75; *Sls. Mgr.:* John Powers .... **C•1523-1529**

ELECTRONIC INDUSTRIES ASSOC., 2001 Pennsylvania Ave. NW, Washington, DC 20006, Tel: 202-457-4900, FAX: 202-457-4985

ELECTRONIC INNOVATIONS CORP. (E.I.C.), 3333 S. Wadsworth Blvd. C101, Lakewood, CO 80227, Tel: 303-987-2441, FAX: 303-988-5907; Empl.: 4

FAX: 908-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 908-922-9300; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann .... **D•1674-1683, 2104-2105**

Local Sales Offices & Reps

AL	Currie, Peak & Frazier	205-536-1506
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Huntington Beach, Tri-Tek	714-840-3501
CA	San Diego, Tri Tek	619-573-0157
CA	San Jose, Tri Tek/SD	408-554-0455
CO	Golden, Trembly Assoc.	303-279-3019
FL	Currie, Peak & Frazier	407-855-0843
IL	Elmhurst, Sector Engrg.	708-530-7850
IN	Indianapolis, Sector Engrg.	317-253-9221
MD	Landover, Seltronics	301-341-2700
MA	Winchester, FJS Assoc.	617-729-3135
MN	Edina, Dytec Instrs.	612-831-7169
NJ	Laurel Springs, Williams Assocs.	609-346-2876
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Whitney Point, Tae Rep	607-692-3705
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
TX	Houston, Kemp Instrs.	713-466-1465
WA	Redmond, Sci. Dvcs.	206-885-0004
WI	Milwaukee, Sector Engrg.	414-352-8280

ELECTRONIC MODULES, INC., 10410 Vista Park Rd., Dallas, TX 75238-1687, Tel: 214-340-6789; Empl.: 40-50; *Sls. Mgr.:* Leo Rios; *Dist. Mgr.:* Paul Stolar

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Div. of Astec America, Inc.

FAX: 319-377-3674

ELECTRONIC PACKAGING SYSTEM, 201 35th St., Marion, IA 52302, Tel: 319-377-3423; FSC No.: OH1KZ; Empl.: 5; *Sls. Mgr.:* G.R. Grishaber .... **C•1023**

ELECTRONIC PRECISION COMPONENTS, 519 South 5th Ave., Mt. Vernon, NY 10550-4430, Tel: 914-664-2333, FAX: 914-664-4729; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards .... **A•1633; D•1254**

FAX: 617-661-2989

ELECTRONIC PRECISION TECHNOLOGY INC., 126 Jackson St., Cambridge, MA 02140, Tel: 617-661-2454; Empl.: 4; *Sls. Mgr.:* Werner Christ ... **C•1315-1320**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108, FAX:205-533-4667
AZ	Tempe, Phase 4, Inc.	602-966-2018, FAX:602-968-7565
CA	Campbell, PCA Mktg. & Sls. Engrg.	408-559-2866, FAX:408-559-8277
CA	Dana Point, P C A	714-493-9822, FAX:714-240-1894
CO	Boulder, Comp. Prod. Sls. Co., Inc.	303-530-2800, FAX:303-530-9568
FL	Hialeah, Hughes Assocs.	305-362-8167, FAX:305-823-9873
FL	Melbourne, Hughes Assocs.	407-253-3031, FAX:407-253-3031
FL	Palm Harbor, Hughes Assocs.	813-785-6696, FAX:813-533-9108
GA	Marietta, Hughes Assocs.	404-578-0064, FAX:404-578-0820
IL	Crystall Lake, Komac Entrprs., Inc.	815-459-7456, FAX:815-459-8612

IN	Fishers, Carter, McCormic & Peirce Inc.	317-842-9277,FAX:317-577-2741
MD	Randallstown, Chesepeak Indl. Mktg.	301-653-0476,FAX:301-653-4675
MA	Concord, Noyes Assoc.	508-369-0425, FAX:508-371-2931
MI	Farmington Hills, Carter, McCormic & Pierce Inc.	313-477-7700,FAX:313-477-4149
MS	Corinth, Hughes Assocs.	601-287-2915, FAX:205-533-9108
MO	St. Louis, Acorn Elctrns.	314-421-1751, FAX:314-421-1752
NY	Peconic, HLJ Comp-Tech.	516-734-7760, FAX:516-734-7784
NC	Gary, Hughes Assocs.	919-467-7029, FAX:919-460-8607
OH	Englewood, Carter, McCormic & Peirce Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter,McCormic & Peirce Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter, McCormic & Peirce Inc.	412-826-3800,FAX:412-826-3800
PA	Southampton, Campbell Assocs.	215-322-6630, FAX:215-322-2627
TX	Plano, Connector Specs.	214-517-1207, FAX:214-517-3660
WA	Edmonds, Advanced Comp. Des. Corp.	206-745-5445,FAX:206-745-5445

Local Distributors

CA	Burbank, Atwater Elctrns., Co.	215-631-5404, FAX:215-631-5406
CA	Costa Mesa, Eric Elctrns.	714-751-1185, FAX:619-236-9910
CA	San Diego, Cableconn	619-571-7111, FAX:619-571-0309
CA	San Jose, Eric Elctrns.	408-432-1111, FAX:408-433-0570
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050, FAX:714-662-3929
CA	Santa Anna, Elcom Cabletek	714-432-6630, FAX:714-556-0468
CA	Sunnyvale, PSC	800-654-1518,FAX:408-737-0502
CO	Denver, QPS Elctrns.	303-373-2766, FAX:303-373-4029
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Schaumburg, QPS Elctrns.	708-884-6620, FAX:708-884-7573
MD	Beltsville, PSC/Petricko Sls.	800-333-5292, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	800-368-2815, FAX:301-840-9299
MA	Ashland, Quality Components	508-881-6504, FAX:508-881-1704
NJ	Burlington, Secom Elctrns.	609-386-9400, FAX:609-386-9333
PA	Clifton Hgts., Tri-Com	215-259-7400, FAX:215-259-4785
TX	Arlington, Bell Comp. Sls. Inc.	817-461-5303
Can	Mississagua, Ont., R. Theta	416-890-0221, FAX:416-890-1628

ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1444

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, FAX: 913-631-7849; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler

THE ELECTRONICS GROUP, INC., 2828 Interstate St., Charlotte, NC 28208, Tel: 704-391-9500, FAX: 704-597-9500 Ext. 20; Empl.: 30; *Sls. Mgr.:* Doug Mckenzie

Electronic Solutions
UNIT OF ZERO CORPORATION

FAX: 619-452-9464

ELECTRONIC SOLUTIONS, Zero Corporation, 6790 Flanders Dr., San Diego, CA 92121, Tel: 800-854-7086, TELEX: 910-335-1169; FSC No.: 61081; Empl.: 150 .... **C•1116-1117, 1128-1133**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
AZ	Tempe, Holder Hauer	602-431-1212
CA	San Diego, Amasco	619-292-7666
CA	Santa Clara, Amasco	408-987-7760
CA	Simi Valley, Amasco	805-581-2031
CA	Torrance, Amasco	310-781-9494
CO	Denver, Holder Hauer	303-427-3443
CT	Bethany, Trilogic	203-393-1040
FL	Altamonte Springs, EMA	407-339-2333
FL	Boca Raton, EMA	407-394-6709
GA	Roswell, EMA	404-992-7240
IL	Hoffman Estates, Micro-Tex, Inc.	708-765-3000
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Annapolis Junction, Stemler Assocs.	301-490-1078
MD	Rockville, Spectro Assocs.	301-294-9770
MA	Wilmington, Trilogic	508-658-3800
MI	Ann Harbor, The Sys. Grp.	313-930-1800
MI	Livonia, The Sys. Grp.	313-478-6700
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Trilogic	603-595-9859
NJ	Clementon, Systech Assocs., Inc.	609-784-8300
NJ	Florham Pk., Gebhardt Mktg.	201-377-3696
NM	Albuquerque, Holder Haver	505-888-9614
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Clarence Center, Tech-Mark, Inc.	716-741-9138
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Rochester, Gebhardt Mktg.	716-256-6240
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Charlotte, EMA	704-553-0110
NC	Raleigh, EMA	919-846-9317
OH	Cincinnati, The Sys. Grp.	513-742-2700
OK	Tulsa, Acudata, Inc.	918-743-1875
OR	Portland, Thorson Co. NW	503-293-9001
PA	Aston, Systech Assocs., Inc.	215-459-2223
PA	Bala Cynwyd, Systech Assocs., Inc.	215-238-0267
TX	Austin, Acudata, Inc.	512-478-1018
TX	Houston, Acudata, Inc.	713-580-2451
TX	Plano, Acudata, Inc.	214-424-3567
UT	Salt Lake City, Holder Hauer	801-487-7077
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WA	Lynnwood, Blair Hirsh Co., Inc.	206-774-8151
WI	Waukesha, Micro-Tex	414-542-5352

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, RS Elctrns.	205-721-9999
AZ	Phoenix, Force Elctrns.	602-437-1060
AR	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Chatsworth, Hall-Mark Elctrns.	818-773-4500
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Inglewood, Newark Elctrns.	310-672-8548
CA	Irvine, Hall-Mark Elctrns.	714-727-6000
CA	Rocklin, Hall-Mark Elctrns.	916-624-9781
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Jose, Hall-Mark Elctrns.	408-432-4000
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Clara, Force Elctrns.	408-748-1324
CO	Denver, Newark Elctrns.	303-757-8531
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Enlgewood, Harrison Equip. Co., Inc.	303-694-6320
CT	Cheshire, Hall-Mark Elctrns.	203-271-2844
CT	Danbury, Heilind Elctrns., Inc.	800-243-1043
CT	Danbury, Pilgram Elctrns.	203-792-7274
CT	Wallingford, Greene-Shaw Co., Inc.	203-265-3333
FL	Casselberry, Hall-Mark Elctrns.	407-830-5855
FL	Largo, Hall-Mark Elctrns.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns.	305-971-9280
GA	Duluth, Hall-Mark Elctrns.	404-623-4400
GA	Norcross, RS Elctrns.	404-242-0520
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Des Plaines, Advent Elctrns.	708-297-6200
IL	Wood Dale, Hall-Mark Elctrns.	708-860-3800
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Chelsea Elctrn. Dist. Grp.	317-253-9065
IN	Indianapolis, Hall-Mark Elctrns.	317-872-8875
IN	Indianapolis, RS Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Pk., Olive Elctrns., Inc.	913-362-1923
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MD	Jessup, Treeko Elctrns., Inc.	301-470-3300
MA	Billerica, Hall-Mark Elctrns.	617-935-9777
MA	Newton, Greene-Shaw Co., Inc.	800-678-6876
MA	Wilmington, Heilind Elctrns., Inc.	508-657-4870
MI	flint, RS Elctrns.	313-742-5000
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, Hall-Mark Elctrns.	313-462-1205
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrns.	313-967-1570
MN	Eden Prairie, Hall-Mark Elctrns.	612-881-2600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Earth City, Hall-Mark Elctrns.	314-291-5350
MO	Maryland Hgts., Olive Elctrns., Inc.	314-997-7709
NJ	Cranford, Garden State Ind. El., Inc.	908-272-6400
NJ	Moorestown, Hall-Mark Elctrns.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns.	201-515-3000
NM	Albuquerque, Harrison Int. Elctrns.	505-291-9951
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Fairport, Hall-Mark Elctrns.	716-425-3300
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Summit Distrs., Inc.	716-334-8110
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NC	Raleigh, Greene-Shaw Co., Inc.	508-791-7861
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Valley View, Newark Elctrns.	216-447-8866
OH	Worthington, Hall-Mark Elctrns.	617-888-3313
OK	Tulsa, Hall-Mark Elctrns.	918-254-6110
PA	Clifton Hgts., Tri-Com, Inc.	215-259-7400
SC	Gaffney, Newark Elctrns.	803-487-1900
TX	Austin, Force Elctrns.	512-258-8848
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Austin, Harrison Equip. Co., Inc.	512-258-1320
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Dallas, Hall-Mark Elctrns.	214-553-4300
TX	Dallas, Harrison Equip. Co., Inc.	214-239-2750
TX	El Paso, Harrison Int. Elctrns.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Force Elctrns.	512-476-2104
TX	San Antonio, Harrison Equip. Co., Inc.	512-490-0615
TX	Stafford, Harrison Equip. Co., Inc.	713-879-2789
WA	Seattle, Hall-Mark Elctrns.	206-547-0415
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	New Berlin, Hall-Mark Elctrns.	414-797-7844
WI	West Allis, Advent Elctrns.	414-475-6860
Can	Burnaby, BC, Semad	604-420-9889
Can	Calgary, Alb., Semad	403-252-5661
Can	Markham, Ont., Semad	416-475-8500
Can	Ottawa, Ont., Semad	613-727-8325
Can	Pt. Claire, Que., Semad	514-694-0864

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 140; *Sls. Mgr.:* Stephen J. Contons

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 508-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown

ES

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98685, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller .... **B•1484-1485**

Local Sales Offices & Reps

MN	Hopkins, The Kits Co.	612-933-1888
MN	Stillwater, The Kits Co.	612-439-8088
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064

EP/ELECTRONICS PRODUCTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, TELEX: 516-227-1901

ELECTRONICS REPRESENTATIVE ASSOC., 20 E. Huron St., Chicago, IL 60611, Tel: 312-649-1333, FAX: 312-649-9509

ELECTRONIC SYSTEMS DIVISION, Boeing Defense & Space Grp., P.O. Box 3999, M/S 3E-WF, Seattle, WA 98124-2499, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-1439; FSC No.: 81205; Empl.: 4,000; *Sls. Mgr.:* A.M. Sullivan

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 150; *Sls. Mgr.:* Leo Reynolds

ELECTRONICS TEST CENTRE, Alberta Research Council, 250 Karl Clark Road, Edmonton, AB, Canada T6N 1E4, Tel: 403-450-5370, TELEX: 0372147, FAX: 403-462-7285; Empl.: 16; *Sls. Mgr.:* Chris Talliss

ELECTRONIC TELE-COMMUNICATIONS, INC., 3605 Clearview Place, Atlanta, GA 30340-2178, Tel: 404-457-5600, FAX: 404-455-3822; Empl.: 200; *Sls. Mgr.:* Doug Altman; *Dist. Mgr.:* Doug Altman

ELECTRONIC TRANSFORMER CORP., P.O. Box 487, Paterson, NJ 07544-0487, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier

FAX: 909-695-7246

ELECTRO-NUMERICS, INC., 42213 Sarah Way, Temecula, CA 92590, Tel: 909-699-2437; FSC No.: 51666; Empl.: 16; *Sls. Mgr.:* Ro Shultz .... **D•1345**

Local Distributors

IL	Chicago, Dalec Distrs.	312-283-0300
CA	Costa Mesa, FLW, Inc.	714-751-7512
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NY	Syracuse, W.E.I., Inc.	315-437-4281
UT	Murray, Instr. Specialists, Inc.	801-261-0142
VA	Roanoke, Elctrl. Equip. Sls. Co.	703-985-0446

ELECTRO OPTICAL INDUSTRIES INC., 859 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 50

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 708-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 373 Route 46 West Bldg. E, Fairfield, NJ 07004, Tel: 201-882-0211; Empl.: 25; *Sls. Mgr.:* Frank J. Vallese

ELECTRO-PREP, INC., 14 Kendrick Rd, Unit 3, Wareham Ind. Park, Wareham, MA, MA 02571, Tel: 508-291-2880, FAX: 508-291-2882; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 60; *Sls. Mgr.:* Chris Allen; *Dist. Mgr.:* Mike Deming, V.P. Mktg. .... **C•1097**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-0242
AZ	Phoenix, Mercier & Assoc.	602-404-1318
CA	Los Gatos, Norwest Elctrns.	408-395-9019
CO	Littleton, Mercier & Assoc.	303-770-0666
FL	Altamonte Springs, DHR Mktg., Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
NC	Statesville, DHR Mktg., Inc.	704-872-0242
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-690-0870
UT	Sandy, Mercier & Assoc.	801-942-2665
WA	Seattle, Horton Assoc.	206-365-2795

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 800-688-1111, FAX: 818-786-4224; Empl.: 460; *Sls. Mgr.:* Gary Phillips

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 500; *Sls. Mgr.:* Dick Donaca, Sys.

Electro-Space Fabricators, Inc.

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* Robert J. Flynn .... **C•1026-1029**

Local Sales Offices & Reps

CA	Anaheim, Alpha Electro Sls.	714-665-6580
CA	Los Gatos, Shursales	408-399-7487
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Davie, DTS Mechanical Sls.	305-581-2884
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Northbrook, Howard Benjamin Assocs.	312-272-2900
MD	Manchester, Imagitron Sls. Co.	800-638-3592
NJ	Boonton, Winter Assocs.	201-334-3434
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Tonawanda, Promark Elctrns., Inc.	716-877-6300
OH	Galion, James R. Bright	419-468-3787
PA	Trevose, Omega Elctrns. Sls.	215-244-4000

TX	Dallas, DJ Sls. & Assocs.	214-783-8876
WA	Issaquah, Elctrns. Northwest	206-557-0851

Local Distributors

CA	Irvine, McGillis Inds.	714-551-4004
CA	Redwood City, HdB Elctrns.	415-368-1388
MD	Columbia, DK Elctrns.	301-995-1950
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106, TELEX: 163590 ESIUT, TWX: 910-867-4768, FAX: 214-470-2466; FSC No.: 33875; Empl.: 1047; *Sls. Mgr.:* Richard M. McCloskey

ELECTRO STANDARDS LAB., INC., Data Communications Products Div., 36 Western Industrial Dr., Cranston, RI 02921, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 40; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSULTING ASSOCS., 556 Lowell Rd., P.O. Box 552, Groton, MA 01450, Tel: 508-448-5485, FAX: 508-448-5583; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 6

ELECTRO-SUPPORT SYSTEMS, 43445 Business Park Dr., Temecula, CA 92590, Tel: 909-676-2751, FAX: 909-694-0097; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello .... **B•1716**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Irvine, Vale Elctrns.	714-551-4004
CA	San Ramon, W. Nott & Co.	415-820-8102
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Apopka, Floritronics	407-886-4818
GA	Albany, Holman-Gillespie	912-883-5565
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Wheeling, Electroswitch	708-593-2225
MD	Baltimore, Eastern Comps. Sls.	301-788-7050
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MA	Weymouth, Electroswitch	617-340-0066
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Roseville, Pro Tech Power Sls., Inc.	612-483-0409
MO	Chesterfield, Weisler & Assocs.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NH	Salem, Sales Engrg. Co.	603-893-5521
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Buffalo, Upstate Engrg.	716-632-0011
NY	Johnson City, Upstate Engrg.	607-729-0827
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Cary, L.G. White Co.	919-380-8084
NC	Winston-Salem, L.G. White Co.	919-765-1665
OH	Medina, Rockford Controls OH, Inc.	216-725-3705
PA	Pittsburgh, R. F. Clark	412-242-9500
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, L.G. White Co.	803-271-0630
TX	Plano, Brice Co.	214-442-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ashland, L.G. White Co.	804-752-7055
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
OH	Medina, R.C.O.	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTRO-TEC CORPORATION A KAYDON COMPANY, 1501 North Main St., Blackburg, VA 24060, Tel: 703-552-2111, FAX: 703-951-3832; Empl.: 200; *Sls. Mgr.:* John J. Daly

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137, FAX: 215-887-0131; Empl.: 14; *Sls. Mgr.:* Brian E. Hohman; *Dist. Mgr.:* Brian E. Hohman

ELECTROVERT USA CORP., 805 W. North Carrier Pkwy., No. 200, Grand Prairie, TX 75050, Tel: 214-606-1900, FAX: 214-606-1700; Empl.: 500; *Sls. Mgr.:* Craig Biggs

ELECTROWEAVE, INC., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-752-8932, FAX: 508-753-2173; FSC No.: 54207; Empl.: 25; *Sls. Mgr.:* Peter Andrews

ELEKTRISOLA INC., 126 High Street, Boscawen N, NH 03303, Tel: 603-796-2114, FAX: 603-796-2119; Empl.: 150; *Sls. Mgr.:* John W. Mueller

ELETECH ELECTRONICS, INC., 1262 E. Katella Ave., Anaheim, CA 92805, Tel: 714-385-1707, FAX: 714-385-1708; Empl.: 5

ELF ATOCHEM NORTH AMERICA, Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, FAX: 215-587-7497

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-829-1905, FAX: 702-829-1693; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR ELECTRONICS CORPORATION, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-733-5427, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275 .... **D•1684-1685, 2257-2259**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs., Inc.	205-534-6020
AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Carpenteria, Elgar Corp.	805-684-4400
CA	Redondo Beach, Ward/Davis Assocs.	310-643-6977
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Longwood, Southern Mktg. Assocs., Inc.	407-682-7317
FL	Satellite Bch., Southern Mktg. Assocs., Inc.	407-777-3587
GA	Alpharetta, Southen Mktg. Assocs., Inc.	404-664-9797
IL	Arlington Heights, Dytec/Midwest	708-255-3200
IN	Indianapolis, Dytec/Midwest	317 849-9898
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec/South	316-262-3189
MD	Columbia, Creative Mktg. Assoc.	410-880-4161
MA	Beverly, P. Jenks Assocs.	508-921-4600
MI	Troy, WKM Assocs.	313-588-2300
MN	Edina, Dytec Instrs.	612-831-7169
MO	Maryland Heights, Dytec/South Inc.	314-739-0665
NJ	Ridgewood, Elgar East	201-652-2898
NJ	Wayne, Advanced Tech. Mktg.	201-633-7070
NM	Albuquerque, Tech. Mktg. Specialists	505-291-1363
NY	Syracuse, Labtronics	315-455-7314
NC	Greensboro, Southern Mktg. Assocs., Inc.	919-632-9370
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
PA	Wexford, WKM Assocs.	412-934-2730
TX	Austin, Testech	512-338-9246
TX	Euless, Testech, Inc.	817-540-1944
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
TX	San Antonio, Jack Howard Assoc.	512-828-5741
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WI	Hartland, Dytec Midwest	414-367-4550
Intl	CA San Diego, Elgar Intl. Corp.	619-450-0085

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954, FAX: 801-635-2158; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher .... **D•1255**

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	818-990-4173
CA	Sunnyvale, N-S Westronics	408-745-1102
CT	Meriden, Polytek Assoc.	203-634-4499
MA	Ashland, Polytek Assoc.	508-881-4741
NJ	Marmore, SWR Tech., Inc.	609-390-0094
NM	Albuquerque, Technology Mktg. Assoc.	505-345-8921
PA	Broomall, SWR Tech., Inc.	215-353-6639

ELGIN ELECTRONICS, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, FAX: 814-864-1260; Empl.: 300; *Sls. Mgr.:* Paul R. Barlock; *Dist. Mgr.:* Stanley R. Carlburg

ELITE ELECTRONIC ENGINEERING CO., 1516 Centre Circle, Downers Grove, IL 60515, Tel: 708-495-9770, FAX: 708-495-9785; FSC No.: 099-9999; Empl.: 34

ELITE ELECTRONICS, INC., 1408 Summit - Suite #5, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, FAX: 409-846-4367; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELIWELL INC., 2121 Downer St., Baldwinsville, NY 13027, Tel: 315-638-9598, FAX: 315-638-9718; *Sls. Mgr.:* William Corcoran; *Dist. Mgr.:* Joseph Markert

ELMA

FAX: 510-656-3783

ELMA ELECTRONIC INC., 44350 Grimmer Blvd., Fremont, CA 94538, Tel: 510-656-3400; Empl.: 60; *Sls. Mgr.:* Kris Holla .... **B•1148, 1718-1720, 1827; C•1031-1033, 1530**

Local Sales Offices & Reps

AZ	Scotsdale, I.M. Systems	602-948-1495
CA	Fremont, Bear Resources	510-793-1064
CA	Fremont, ELMA Elctrn. Inc.	510-656-3400
CA	La Habra, West Coast Reps	213-690-9960
CA	Ontario, Elma Elctrn. Inc.	714-986-3753
IL	Schaumburg, Martan, Inc.	708-303-5660
MI	Ann Arbor, The Systems Grp.	313-930-1800
MN	Medina, James R. Johnson & Assocs.	612-478-9442
NH	Nashua, Bell Controls Inc.	603-882-6984
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
OH	Cincinnati, The Systems Grp.	513-742-2700
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Lakewood, The Systems Grp.	216-226-6535
OH	West Lake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
OR	Beaverton, Cascade Data Mktg.	503-626-9348
PA	Hatboro, Monument Tech. Assoc.	215-443-5493
TX	Austin, Strategic Solutions Inc.	512-343-6323
TX	Houston, Strategic Solutions Inc.	713-496-0363
TX	Lewisville, Strategic Solutions Inc.	214-434-1921
TX	Plano, Elma Elctrn. Inc.	214-964-1700
VA	Newington, Scott Data Corp.	703-550-1300
WA	Redmond, Cascade Data Mktg.	206-747-6190
WI	Mequon, Martan, Inc.	414-241-4955
Can	Mississauga, Ont., Tracan Elctrns. Corp.	416-625-7752
Can	N. Vancouver, Tracan Elctrns. Corp.	604-984-4141

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560, FAX: 415-494-1093; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMEC, INC., Technautic Corp., 300 N. McKemy Ave., Chandler, AZ 85226, Tel: 602-961-7100, FAX: 602-961-7173; FSC No.: 50691; Empl.: 55; *Sls. Mgr.:* Jim Hunt

ELMEC®
Delay Lines

FAX: 415-341-2370

ELMEC TECHNOLOGY OF AMERICA, INC., 1875 South Grant St., Ste. 560, San Mateo, CA 94402, Tel: 415-341-1611; *Sls. Mgr.:* Thomas Y. Miracle .... **A•1546-1551**

Local Sales Offices & Reps

CA	Seal Beach, TEXEL	213-596-9411
CA	Sunnyvale, Repron Assocs.	408-737-0510
CO	Denver, Promo Tech Sls.	303-692-8484
IL	Northfield, Feller Assocs. Inc.	708-446-8065
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MN	Minneapolis, HMR Inc.	612-888-2122
OR	Portland, General Elctrns., Inc.	503-297-8500
WA	Stanwood, General Elctrns., Inc.	206-652-5917

Elmwood
Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 1,000ò; *Sls. Mgr.:* Cesare Giammarco, Dir. of Sls. .... **B•1872-1873**

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-5548
AZ	Phoenix, O'Donnell SW	602-944-9542
CA	San Diego, O'Donnell South	619-578-1645
CA	San Jose, O'Donnell South	408-456-2950
CA	Torrance, O'Donnell South	301-781-2255
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
FL	Longwood, CBC Elctrns.	407-831-5380
FL	Tampa, CBC Elctrns.	813-969-1901
GA	Marietta, Tenn. Tech. Sls.	404-971-1419
IL	Arlington Heights, Thermek	708-577-6900
IN	Fort Wayne, O. H. Bromberg	219-456-6010
KY	Alexandria, O. H. Bromberg & Assocs.	606-635-3036
KY	Louisville, O. H. Bromberg	502-456-1498
MD	Towson, Arbotek	410-825-0775
MN	Mendota, G-II Sls.	612-454-3086
MO	Kansas City, Hill & Company	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NH	Barrington, Global Tech. Sls.	603-664-5780
NJ	Pitman, Colrud Corp.	609-589-5866
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
NY	E. Syracuse, Bastian Sales Agency	315-437-1482
NY	Fairport, Bastian Sls.	716-223-0237
NY	Islip, Cogent Technlgs.	516-277-7101
NY	Katonah, Cogent Technlg. Assocs.	914-232-2500
NC	Garner, Tenn-Tech	919-779-3309
OH	Cleveland, Allied Entprs.	216-779-0080
OH	Dayton, O. H. Bromberg	513-434-8788
OR	Hillsboro, Temco-Northwest	503-645-2030
NJ	Pittman, Colrud Corp.	609-589-5866
PA	Pittsburgh, Allied Entprs. East	412-788-2992
TX	Arlington, Ion Assocs.	817-695-8000
TX	Austin, Ion Assocs.	512-331-7251
TX	Houston, Ion Assocs.	713-537-7717
WA	Birch Bay; Temco B.C.	206-371-0423
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
WI	Mequon, Dickson-Zingler Assoc.	414-241-9140
Can	Mississauga, Ont., Andy Baumen Assocs.	416-828-2600

ELNA AMERICA, INC., 5686 Corporate Ave., Cypress, CA 90630, Tel: 714-761-8600, FAX: 714-761-9188; Empl.: 3500; *Sls. Mgr.:* Barbara Andrews; *Dist. Mgr.:* Barbara Andrews

ELNA FERRITE LABORATORIES, INC., PO Box 395, 234 Tinker St., Woodstock, NY 12498, Tel: 800-553-2870, FAX: 914-679-7010; Empl.: 14; *Sls. Mgr.:* Deborah McIntosh

ELNETIC ELECTRONICS, INC.:PLANT LOCATIONS, 1332 130th St., Gardena, CA 90247, Tel: 310-515-1546; FSC No.: 98460; Empl.: 10; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELNIK SYSTEMS, IPM, Inc., 3 Edison Place, Fairfield, NJ 07004, Tel: 201-882-8033, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

ELOGRAPHICS INC., 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, FAX: 615-482-4943; *Sls. Mgr.:* Joe Barresi

ELPAC COMPONENTS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6085; FSC No.: 12406; Empl.: 130; *Sls. Mgr.:* Jim Degerstrom; *Dist. Mgr.:* Jim Degerstrom .... **A•1076-1081**

Local Distributors

CA	Chatsworth, Mil-Comm	818-998-3111
CA	Irvine, Kelex	714-863-1230
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, PSC Elctrns.	800-654-1518
FL	Melbourne, New Yorker	407-727-0955
IL	Northbrook, Classic Components	312-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Andover, Aved Elctrns.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
NJ	S. Hackensack, Waltech	201-641-7300
NJ	Whippany, American Distr. Inc.	201-428-0510
NY	Mamaroneck, New Yorker Elec.	914-698-7600
NY	Elmsford, Ancar	914-592-7100
OH	Dayton, Electro Supply	513-299-5020
OK	Tulsa, Altair Co.	918-252-5781
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair	214-231-5166
VT	Charlotte, Kellner	802-425-3250
WA	Seattle, Kam Elec.	206-382-1300
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Classic	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6075; Empl.: 115; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers

ELPAKCO, INC., 70 Wilbur St., Lowell, MA 01851, Tel: 508-453-3000, FAX: 508-453-9348; Empl.: 10; *Dist. Mgr.:* Stephen Fallon

ELPAQ, Elmo Semiconductor, 7590 N. Glenoaks Blvd., Burbank, CA 91504-1052, Tel: 818-768-7500, FAX: 818-767-3195; Empl.: 150

ELPAZ INSTRUMENTS, INC., 3000 Reed Blvd., Murrysville, PA 15668, Tel: 412-327-8744, FAX: 412-733-7609; FSC No.: OA2J2; Empl.: 5; *Sls. Mgr.:* Jim Shipman; *Dist. Mgr.:* Jim Shipman

E-L PRODUCTS COMPANY, Sub. of Astronics Corporation, 77 Olean Rd., E. Aurora, NY 14224, Tel: 716-655-0800, FAX: 716-655-0309; FSC No.: 14550; Empl.: 75; *Sls. Mgr.:* Time Zeigler

ELTECH, 181 Gibraltar Rd., Horsham, PA 19044, Tel: 215-441-0404, FAX: 215-441-8299; Empl.: 50; *Sls. Mgr.:* Brad Lizotte .... **B•1149**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CO	Golden, Cristee-Meade	303-279-5070
IL	Rolling Meadows, Staffco	708-259-8756
IN	Angola, Staffco	219-833-3323
MI	Rockford, Staffco	616-866-3070
OH	Cleveland, Staffco	216-331-5100
RI	Warwick, Ertronics	401-732-3567
TN	Brentwood, Staffco	615-377-9938

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32120, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 75; *Sls. Mgr.:* Douglas S. Armstrong

ELTEK CORPORATION, 445 E. Main St., Hagerstown, IN 47346, Tel: 317-489-6121, FAX: 317-489-5491; Empl.: 7

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan .... **B•1250**

Local Sales Offices & Reps

CA	Van Nuys, Halbar Assocs.	818-906-3941
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO:DIVISION OF ZUMBACH ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549-1407, Tel: 914-241-1008, FAX: 914-241-7096; *Sls. Mgr.:* Thomas O'Connor

E-MARK, INC., 4 Daniels Farm Rd., Ste. 328, Trumbull, CT 06611, Tel: 203-452-1003, FAX: 203-452-1135; FSC No.: 0L7X6; Empl.: 4; *Sls. Mgr.:* Bryan West

EMC GLOBAL TECHNOLOGIES INC., 4059 Skyron Dr., Doylestown, PA 18901, Tel: 215-340-0650, FAX: 215-340-1737; Empl.: 70; *Sls. Mgr.:* Joel Hayes

EMCO, Components Specialties Inc., 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, FAX: 516-957-9142; Empl.: 20; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Angela Carolan

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, 800-546-3680, TELEX: 5101008006, FAX: 209-223-2779; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Jennifer Jackson ... **D•1686**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770; Empl.: 300; *Sls. Mgr.:* Nathan B. Barlow; *Dist. Mgr.:* Nathan B. Barlow

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* Dan Estes .... **C•1034-1037**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

E M D ELECTRONICS, Sigmatron L.P., 2201 Landmeier Rd., Elk Grove Village, IL 60007, Tel: 708-956-8000, FAX: 708-956-8082; Empl.: 150; *Sls. Mgr.:* Glen Holmes

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Anne Ledger .... **D•1256**

EMERSON & CUMING, INC., 77 Dragon Court, Woburn, MA 01888, Tel: 617-938-8630

EMERSON COMPUTER POWER, 9650 Jeronimo Rd., Irvine, CA 92718, Tel: 714-457-3600, FAX: 714-457-3788; Empl.: 20; *Dist. Mgr.:* R. Braud

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., 920 Candia Rd., Manchester, NH 03109, Tel: 603-669-5121, FAX: 603-669-5922; FSC No.: 85925; Empl.: 3000; *Sls. Mgr.:* Eileen M. Fagan

EMI TECHNOLOGY INC., See Penny & Giles Data Sys., Inc.

EMPIRE MAGNETICS, 5780 B LaBath Ave, Rohnert Park, CA 94928, Tel: 707-584-2801, FAX: 707-584-3418; Empl.: 10

Empro SHUNTS

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 .... **D•1257**

Local Sales Offices & Reps

CA	Montrose, Signal Entprs. Inc.	818-957-0640
GA	Atlanta, Brownell Electro Inc.	404-362-9009
IL	Chicago, Best Rep Co.	708-632-0473
MA	Burlington, E.I.L. Instr.	617-272-9450
NJ	Franklin, D. F. Tobias & Co.	201-209-8825
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-931-0403
WA	Seattle, Branom Instr. Co.	206-762-6050

Local Distributors

AZ	Tempe, Metermaster	602-431-0880
CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	Livermore, Std. Meter Lab	510-449-0220
CA	Santa Fe Springs, Dae Instr. & Svc., Inc.	213-942-8843
FL	Miami Beach, PA Instrs., Inc.	305-868-5686
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Hunt Valley, E.I.L. Instrs.	301-584-7400
NJ	Belleville, Miscorp	201-751-1190
OR	Portland, Westcon Inc.	503-283-0132
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WA	Seattle, Branom Instr. Co.	206-762-6050
WI	Milwaukee, E-M Instrs.	414-272-7799

E.M.S., Div. of Sandberg Industries, 14251 Chambers Rd., Tustin, CA 92680, Tel: 714-669-9473, FAX: 714-838-2967; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls. .... **C•1672**

Local Distributors

RI	Warwick, E.M.S.	401-884-4790

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100

ET Emulation Technology, Inc.

FAX: 408-982-0664

EMULATION TECHNOLOGY, INC., 2344 Walsh Ave., Bldg. F, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866; Empl.: 18; *Sls. Mgr.:* Joseph J. Bagliere, Jr., Mktg. Mgr. .... **C•1321**

Local Sales Offices & Reps

IL	Chicago, El/Mech Inc.	312-794-9100
OR	Beaverton, Blair Hirsh Co.	503-649-1007
TX	Carrollton, CTI Elctrns.	214-245-1266
WA	Kirkland, Turn-A-Round	206-822-4634
Can	Ottawa, Ont., E.G. Lomas Ltd.	613-725-2177

Local Distributors

MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
NJ	Union, Meridian Supply Co.	908-687-6220
TX	Allen, Prime Distributing Co.	214-231-0170
TX	Richardson, Off The Shelf Comps., Inc.	214-238-0808

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 75; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601 B Dover Rd.-Hwy.2, Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Jim Burcham; *Dist. Mgr.:* Jim Burcham

ENCORE ELECTRONICS, INC., 4400 Route 50, Saratoga Springs, NY 12866, Tel: 518-584-5354, FAX: 518-584-5963; Empl.: 20

Local Sales Offices & Reps

CA	Huntington Beach, Transducer Sys.	714-969-7690
PA	Blairsville, Meas. Instrs. East, Inc.	412-459-8090

ENDECO, Leads Metal Products Inc., 1125-C Brookside Ave., Indianapolis, IN 46202-2748, Tel: 317-631-7200, FAX: 317-631-7237; Empl.: 6; *Sls. Mgr.:* Eileen Alexander; *Dist. Mgr.:* Eileen Alexander

ENDEVCO CORPORATION, Meggitt Aerospace, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, FAX: 714-661-7231; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* B. Clark

ENDICOTT COIL CO., INC., 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187; FSC No.: 63312; Empl.: 120 ... **B•1045-1048; D•1687, 2106-2107**

Local Sales Offices & Reps

AZ	Finn-Patt	602-954-8275
CA	Granada Hills, Plustronics	818-830-3304, FAX:714-475-0717
CA	Imperial Counties, Mesa Comps., Inc.	619-278-8021,FAX:619-576-0964
CA	Newport Beach, Plustronics	714-476-8009, FAX:714-475-0717
CA	Saratoga, Testco, Inc.	408-253-1900, FAX:408-253-3444
CO	Seale & Assocs.	303-695-1980,FAX:303-695-1984
CT	Bloomfield, Sir/DSA	203-243-9343, FAX:203-243-8346
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240,FAX:708-956-8289
IA	Spectrum Sls.	319-366-0576,FAX:319-366-0635
KS	Overland Park, Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Freedman-Malta Assocs.	301-879-3148, FAX:301-838-0789
MA	Westford, SIR/DSA	508-692-2500, FAX:508-692-9085
MN	Minneapolis, OEM Prods.	612-831-7373, FAX:612-831-7376
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Budd Lake, Guido Assoc.	201-347-4643, FAX:201-691-1468
NC	Kernersville, Wallace Elctrns. Sls., Inc.	919-996-2742,FAX:919-996-1630
OH	EMA/DeMuesy	614-436-9452,FAX:614-436-0969
OH	EMA, Inc.	216-562-6104,FAX:216-562-7498
OH	Centerville, EMA, Inc.	513-433-2800, FAX:513-433-3147
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211,FAX:215-265-8764
WA	Bellevue, Testco, Inc.	206-454-7422, FAX:206-455-1706
WA	Vancouver, Testco, Inc.	206-693-7262, FAX:206-455-1706
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790, FAX:414-476-2682
Can	Delta, B C, Norgay Entprs. Ltd.	604-275-1121
Can	New Foundland, Indigo Elctrns., Ltd.	613-831-3106, FAX:613-831-3107
Can	Ontario, Indigo Elctrns., Ltd.	416-670-0284, FAX:416-670-1743
Can	Ottawa, Ont., Norgay Entprs. Ltd.	613-745-4051, FAX:613-745-5626
Can	Quebec, Indigo Elctrns., Ltd.	514-696-6104, FAX:514-626-1244
Can	Sackville. NS, Norgay Entprs. Ltd.	902-864-4321, FAX:902-865-9044
Can	Toronto, Ont., Norgay Entprs.	416-234-8966, FAX:416-234-8970
Can	Westmount, Que., Norgay Entprs. Ltd.	514-932-3233,FAX:819-657-4337

ENDRESS & HAUSER INSTRUMENTS, 2350 Endress Place, Greenwood, IN 46143, Tel: 317-535-7138, 800-428-4344, TELEX: 27-2195, FAX: 317-535-8498; Empl.: 200; *Sls. Mgr.:* Mike Stilabower

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 .... **D•2260**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS, 12004 NE 95th St., No. 840, Vancouver, WA 98682, Tel: 206-896-8310, FAX: 206-896-8457; Empl.: 25

ENERTECH CONSULTANTS, 300 Orchard City Dr.,Ste. 132, Campbell, CA 95008, Tel: 408-866-7266, FAX: 408-866-7279; Empl.: 20; *Sls. Mgr.:* Carolyn J. Persall

ENGINEERED ASSEMBLIES & COMPONENTS CORP., 380 North St., Teterboro, NJ 07608, Tel: 201-288-4477, 800-447-5639, FAX: 201-288-1515; Empl.: 106; *Sls. Mgr.:* Tim Teem / Peter Hunkeler; *Dist. Mgr.:* John Deleodice .... **D•1448-1449**

Local Sales Offices & Reps

FL	St. Petersburg, EAC-Engrd. Assemblies & Comp. Corp.	813-328-1970
GA	Norcross, EAC-Engrd. Assemblies & Comp. Corp.	404-446-3135
MA	Sutton, EAC-Engrd. Assemblies & Comp. Corp.	508-865-0722
NJ	Teterboro (Hdqtrs.), EAC-Engrd. Assemblies & Comp. Corp.	201-288-4477
NC	Raleigh, EAC-Engrg. Assemblies & Comp. Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 102

ENGINEERED MAGNETICS, INC., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-635-9555, TWX: 910-325-6208, ESYLNK: 310-631-0313; FSC No.: 06509; Empl.: 100; *Sls. Mgr.:* S. Miller

ENGINEERED SYSTEMS & DESIGNS, 119A Sandy Dr., Newark, DE 19713, Tel: 302-456-0446, FAX: 302-456-0441; Empl.: 12; *Sls. Mgr.:* Jamie C. Smith

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRUMENTS OPERATION, See Stemco Instruments, Colt Inds.

ENI, DIV. OF ASTEC AMERICA, INC., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, ESYLNK: 62855365, FAX: 716-427-7839; Empl.: 300 ..... **D•1011**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Chatsworth, Technlgs. West	818-700-6426
CA	Santa Clara, ENI	408-727-0993

CO	Golden, Trembly Assocs.	303-279-3019
FL	Cocoa Beach, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
GA	Snellville, Teqspec	404-972-7955
IL	Elmhurst, Sector Engrg.	708-530-7850
IN	Indianapolis, Sector Engrg.	317-253-9221
KS	Overland Pk., Ramsey Assocs.	913-541-1007
MD	Laurel, Elctrn. Mktg. Assoc.	301-953-7800
MA	Stow, HG Assocs.	508-897-3190
MI	Troy, WKM Assocs.	313-588-2300
MN	Minneapolis, Sector Engrg.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Great Neck, RTI, Inc.	516-829-3770
NY	Rochester, Taerep, Inc.	716-586-8710
NY	Whitney Pt., Taerep, Inc.	607-692-3705
NC	Winston Salem, Teqspec	919-765-5553
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	N. Salt Lake, Trembly Assocs.	801-295-4703
WA	Bellevue, Syntek	206-462-7700
WI	Milwaukee, Sector Engrg.	414-352-8280
Can	Dorval, Arritsu Wiltron Inst.	514-421-3737
Can	Mississauga, Arritsu Wiltron Inst.	416-890-7799
Can	Nepean, Arritsu Wiltron Inst.	613-828-4090
Can	Richmond, Arritsu Wiltron Inst.	604-244-3815

ENM COMPANY, 5617 Northwest Highway, Chicago, IL 60646, Tel: 312-775-8400, TELEX: 25-4068, FAX: 312-775-5968; Empl.: 100ò; *Sls. Mgr.:* Lee Bryant

ENNOVATION OF WISCONSIN, INC., 806 Elm St.-P.O. Box 258, Watertown, WI 53094, Tel: 414-261-2996, FAX: 414-261-3432; Empl.: 5; *Sls. Mgr.:* Enno Knief; *Dist. Mgr.:* Enno Knief

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125

Ensign Corporation
CUSTOM & PRE-DESIGNED TRANSFORMERS

FAX: 708-789-3206

ENSIGN CORP., 7960 S. Madison Street, Burr Ridge, IL 60521, Tel: 708-325-9343; Empl.: 150; *Sls. Mgr.:* J. Darrel Ensign **A•2326-2328**

Local Sales Offices & Reps

AL	Huntsville, El Tech	205-464-0599
AZ	Tempe, Gassner-Clark	602-968-9037
CA	Campbell, Kingway	408-866-5010
CA	Huntington Bch., Kingway	714-846-3834
CA	Tarzana, Kingway	818-609-1974
CO	Denver, Donohue	303-455-1719
CT	Meriden, Gerber	203-630-3477
FL	Boynton Bch., D-Assocs., Inc.	305-492-8634
FL	Orlando, D-Assocs., Inc.	407-321-9594
FL	Tampa, D-Assocs., Inc.	813-960-0935
GA	Lilburn, El Tech	404-564-1236
IL	Godfrey, Crosslink	618-466-1118
IL	Mt. Prospect, Dombrow	708-253-3326
IN	Indianapolis, J.H. Weaver	317-849-1659
KS	Prairie Vlg., Crosslink	913-649-7100
KY	Ft. Wright, El Tech	606-331-3495
MA	Burlington, Gerber	617-229-1150
MA	Marlboro, Gerber	508-481-3130
MA	S. Dartmouth, Gerber	617-990-3454
MI	Bloomfield Hills, Mac Kellar	313-335-4440
MI	Grand Haven, Mac Kellar	616-846-7990
MN	Minneapolis, Tek Rep	612-832-0277
NH	Hudson, Gerber	603-882-1566
NY	Fairport, Promark	716-425-8100
NY	Franklin Sq., Cooper-Simon	516-489-0404
NY	Tonawanda, Promark	716-877-6300
NC	Charlotte, El Tech	704-342-3648
OH	Cleveland, L.H. Kaiser	216-461-4930
OK	Tulsa, Comptech	918-266-1966
OR	Beaverton, Luscombe	503-636-6664
PA	Horsham, Jacobsen	215-674-2937
TX	Austin, Comptech	512-343-0300
TX	El Paso, Comptech	915-566-1022
TX	Harlingen, Comptech	210-421-4501
TX	Houston, Comptech	713-492-0005
TX	Irving, Comptech	214-751-1181
TX	San Antonio, Comptech	210-525-9913
VA	Herndon, Metal Resources	703-318-8682
WA	Bellevue, Luscombe	206-223-1541
WI	Milwaukee, Dombrow	414-263-4116

Can	Dorval, Que., Weiss	514-685-6644
Can	Mississauga, Ont., Weiss	416-673-0011
Can	Nepean, Ont., Weiss	613-225-1810
Can	Vancouver, B.C., Weiss	604-873-1112
Can	Winnipeg, Man., Weiss	204-772-3665

ENTECH CORP. OF VOLUSIA COUNTY, 8 Tower Circle West, Ormond Beach, FL 32174-8761, Tel: 904-672-7335, FAX: 904-672-7233

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYSTEMS CORP., PO Box 698, Dover, NH 03820, Tel: 603-742-7363, FAX: 603-742-7399; FSC No.: 79543; Empl.: 5; *Sls. Mgr.:* George Perrine

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46256, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 75; *Sls. Mgr.:* F. Paul McDonald; *Dist. Mgr.:* T.P. Wagner

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07004, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361, FAX: 201-227-6865; *Sls. Mgr.:* Robert L. Morrell **B•1936-1947**

ENTRELEC INC., 1950 Hurd Drive, Irving, TX 75038, Tel: 214-550-9025, FAX: 214-550-9215; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

ENVIRONMENTAL STRESS SYSTEMS, INC., 16310 N. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117; *Sls. Mgr.:* Mel Ainsworth; *Dist. Mgr.:* Mel Ainsworth

ENVIRONMENTAL TELESIS & CONTROLS, P.O. Box 180206, Austin, TX 78718, Tel: 512-835-0330, FAX: 512-832-1775; Empl.: 12; *Sls. Mgr.:* Anna Diaz

ENVIROPLAN, 3 Becker Farm Rd., Roseland, NJ 07068, Tel: 201-994-2300, FAX: 201-994-5100; Empl.: 50; *Sls. Mgr.:* Robert Mullowney

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21031, Tel: 410-785-3000, FAX: 410-771-5814; FSC No.: 17521; Empl.: 175; *Sls. Mgr.:* John D. Fabrizio

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* William Bolster; *Dist. Mgr.:* William Bolster

EPCO PRODUCTS INC., P.O. Box N. Cottage St., WAllkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

EPD ELECTRONICS, INC., 16921 S. Western Ave.-Bldg. 300, Gardena, CA 90247, Tel: 310-515-4996, FAX: 310-515-5011; Empl.: 6 **D•1073, 1688**

Local Sales Offices & Reps

IA	Burlington, JS Ridge Entprs., Inc.	319-754-8745
NJ	Bricktown, Bryan Elctrn. Sls. Co.	201-840-8487
OR	Portland, Dale G. Weber Co.	503-234-0686
TN	White House, Apple Sls. & Mktg.	615-672-4498

EPE TECHNOLOGIES, INC., Subsidiary of Square D, 1660 Scenic Avenue, Costa Mesa, CA 92627, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 300; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please call factory for sales representative and distributor information.

EPH ENGINEERING ASSOCIATES, INC., 21 East 400 South, Orem, UT 84058, Tel: 801-226-1383, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Kelly Irwin

EPIC RESINS, General Fiberglass Supply, Inc., 1415 Ellis St., Waukesha, WI 53186, Tel: 414-521-2255, FAX: 414-521-1320; Empl.: 20; *Sls. Mgr.:* Daniel Veenhuis

EPM CORPORATION, 8866 Kelso Dr., Baltimore, MD 21221, Tel: 410-686-7800, TELEX: 87569, FAX: 410-686-4662; Empl.: 75

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, FAX: 508-663-9782; FSC No.: 33246; Empl.: 26; *Sls. Mgr.:* Ann L. Delmarsh

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Pacific	602-994-4840
CA	Atherton, Wadsworth/Pacific	415-321-3619
CA	Fullerton, T.C. Rapp Co.	714-773-9350
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Tampa, Florida Elctron. Assoc.	813-972-7992
IL	Palatine, Crimson Sls. Inc.	708-304-8250
MA	Newton, Normell Assoc.	617-969-5478
MN	Minneapolis, InterTec Assoc.	612-921-8443
NY	Fair Haven, Feikert Assoc.	315-433-1124
OH	Dayton, J. Stephenson & Assoc.	513-435-0745
OR	Hillsboro, Ryan Tech. Svcs.	503-681-0790
PA	Bethlehem, Microstar	215-867-0612

THE EPPLEY LABORATORY, INC., 12 Sheffield Avenue, Newport, RI 02840, Tel: 401-847-1020, FAX: 401-847-1031; Empl.: 25

EPSCO INCORPORATED, 1115 Hilltop Dr., Itasca, IL 60143-1120, Tel: 708-250-0410, FAX: 708-250-0521; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Peters V.P. **D•1689**

Local Distributors

AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Santa Barbara, Abbeon Cal Inc.	805-966-0810
CO	Denver, Fisher Scientific	303-371-0888
CT	Stanford, Aero Quality Sls.	1-800-288-1954
IL	Chicago, Electro Inds.	312-736-0999
IL	Countryside, Inotek/Pacific Indicator	708-352-3500
IL	Elmhurst, McMaster-Carr Supp.	708-834-9600
IN	East Chicago, Acro Elctrns. Corp.	219-397-8681
LA	Lafayette, Ralph's Inc.	318-233-0105
LA	New Orleans, Radio Parts Inc.	504-581-5959
MA	Lynn, Land Elctrns.	617-592-2220
MI	Jackson, Fulton Radio Supp.	517-784-6106
MN	Minneapolis, Allied Elctrns.	612-881-0838
MO	Olivette, Fryer Co.	314-997-6807
NJ	Aberdeen, J.G. Elctrns.	908-583-5352
NJ	Bridgeport, VWR Scientific	609-467-2600
NJ	New Brunswick, McMaster-Carr Supp. Co.	908-329-3200
NM	Albuquerque, Southwest Metals & Supps.	505-247-2111
NY	Syracuse, Stewart Smith	315-437-7836
OH	Warren, Rem Elctrns. Supp.	216-373-1300
SC	Charleston, Wholesale Inds. Elec.	803-722-2634
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Angie Elctrns.	1-800-666-4616
WI	Milwaukee, Industrial Elctrns. Supp.	414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 708-232-9611, TELEX: 708-232-9613; Empl.: 20; *Sls. Mgr.:* R. Knox

EPSON®

FAX: 310-782-5350

EPSON AMERICA, INC./OEM DIV., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-787-6300; Empl.: 900; *Sls. Mgr.:* Walter Carlos, Dir. of Sls. **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

CA	Los Angeles, Epson America, Inc./OEM Div.	714-768-7474
CA	San Francisco, Epson America, Inc./OEM Div.	408-249-0710
IL	Chicago, Epson America, Inc./OEM Div.	815-455-7630
MA	Boston, Epson America, Inc./OEM Div.	617-245-8007

EPSON

FAX: 310-782-5320

EPSON AMERICA INC., Component Sales Dept., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-782-5318; *Sls. Mgr.:* Hideo Akiyama; *Dist. Mgr.:* Rob Turner **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

AL	Madison, Concord Comp Reps	205-772-8883, FAX:205-772-8262
AZ	Scottsdale, Fred Board Assocs.	602-994-9388, FAX:602-994-9477
AZ	Tucson, Fred Board Assocs.	602-299-1508, FAX:602-797-1683
CA	Cupertino, Costar, Inc.	408-446-9339, FAX:408-446-4885
CA	Encinitas, Bager Elctrns. Inc.	619-632-8816, FAX:619-632-8810
CA	Woodland Hills, Bager Elctrns.Inc.	818-712-0011, FAX:818-712-0160
CO	Colorado Springs, Western Region Mktg.	719-548-8282,FAX:719-548-0462
CO	Westminster, Western Region Mktg.	303-428-8088, FAX:303-426-8585
FL	Casselberry, Dyne-A-Mark	407-831-2822, FAX:407-834-4524
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501, FAX:305-772-0114
GA	Norcross, Concord Comp. Reps	404-416-9597, FAX:404-441-0790
IL	Itasca, LTD Technlgs.	708-773-2900, FAX:708-773-0358
IN	Indianapolis, C.C. Electro Sls.	317-921-5000, FAX:317-921-5005
KS	Shawnee Mission, Microtronics, Inc.	913-262-1444, FAX:913-262-1445
MD	Ellicott City, Technlg. Sls. Assocs.	301-461-7802, FAX:301-461-7888
MA	Needham Heights, Rosen Assocs. Inc.	617-449-4700,FAX:617-449-5245
MN	Eden Prairie, Electromark	612-944-5850, FAX:612-944-5855
NJ	Parlin, JMR Sls; Inc.	201-525-8000, FAX:201-525-8805
NY	Pittsford, Elcom Sls., Inc.	716-385-1400, FAX:716-248-8531
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967, FAX:315-685-6273
NY	Wading River, Niktronics	516-929-4671, FAX:516-929-1683
NC	Raleigh, WLA Assocs.	919-231-9939, FAX:919-231-9949
OH	Sheffield, J.D. Babb	216-934-4454, FAX:216-934-4454
OR	Tigard, Matrex Sls.	503-245-8080, FAX:503-246-1848
PA	Trevose, Omega Sls.	215-244-4000, FAX:215-244-4104
TX	Austin, Component Technlg. Sls.	512-250-2450, FAX:512-288-7328
TX	Dallas, Component Technlg. Sls.	214-783-8831, FAX:214-783-4801
TX	Houston, Component Technlg. Sls.	713-961-1262, FAX:713-462-9906
UT	Salt Lake City, Western Region Mktg.	801-268-9768,FAX:801-268-9796
WA	Bellevue, Matrex Sls.	206-643-0363, FAX:206-746-3672
WI	Milwaukee, LTD Technlgs.	414-774-1000, FAX:414-774-0593

Local Distributors

AL	Bell Inds., Inc.	205-837-1074,FAX:205-830-5598
AL	Huntsville, Nu Horizons Elctrns. Corp.	205-722-9330,FAX:205-722-9348
AZ	Tempe, Bell Inds., Inc.	602-966-7800, FAX:602-967-6584
CA	Agoura Hills, Bell Inds., Inc.	818-879-9494, FAX:818-991-7695
CA	Cypress, Bell Inds., Inc.	714-895-7801, FAX:714-891-4570
CA	Irvine, IEC Irvine	714-837-9960,FAX:714-837-8308
CA	Los Angeles, Bell Inds., Inc.	310-826-2355, FAX:310-820-8328
CA	Riverside, Elctrns. Supp.	714-683-7300, FAX:714-781-0453
CA	Rocklin, Bell Inds., Inc.	916-652-0414, FAX:916-652-0403
CA	Sacramento, Integrated Elctrns. (IEC)	916-363-6030,FAX:916-362-6926
CA	San Diego, Bell Inds., Inc.	619-268-1277, FAX:619-268-3733
CA	San Diego, Elctrns. Supp.	619-693-8222
CA	San Jose, Elctrns. Supp.	408-453-3770, FAX:408-453-0398
CA	San Jose, IEC San Jose	408-734-8500, FAX:408-435-8709
CA	San Jose, Merit Elctrns., Inc.	408-434-0800, FAX:408-434-0935
CA	Sunnyvale, Bell Inds., Inc.	408-734-8570, FAX:408-734-8875
CA	Vienna, Dove Elctrns.	703-893-1821, FAX:703-448-8598
CO	Denver, Bell Inds., Inc.	303-691-9010, FAX:303-691-9036
CO	Denver, Integrated Elctrns. (IEC)	303-292-5537, FAX:303-292-0114
CT	Wallingford, Bell Inds., Inc.	203-269-6801, FAX:203-269-6527
CT	Wallingford, Cronin Elctrns., Inc.	203-265-3134
CT	Wallingford, Nu Horizons Elctrns. Corp.	203-265-0162
FL	Altamonte Springs, Bell Inds., Inc.	407-339-0078, FAX:407-339-0139
FL	Ft. Lauderdale, Bell Inds., Inc.	305-421-1997, FAX:305-421-5706
FL	Ft. Lauderdale, Nu Horizons Elctrns. Corp.	305-735-2555,FAX:305-735-2880
FL	Melbourne, Pro-Formance Elctrns., Inc.	407-768-2866,FAX:407-768-2526
FL	Tampa, Bell Inds., Inc.	813-541-4434
GA	Norcross, Bell Inds., Inc.	404-446-7167, FAX:404-446-7264
GA	Norcross, Nu Horizons Elctrns. Corp.	404-416-8666,FAX:404-416-9060
IL	Bensenville, Voyager Elctrns.	708-860-1300, FAX:708-860-1573
IL	Elk Grove Village, Bell Inds., Inc.	708-640-1910, FAX:708-640-0474
IL	Hoffman Estates, IEC IL (Hoffman Estates)	708-843-2040,FAX:708-843-2320
IL	Urbana, Bell Inds., Inc.	217-328-1077, FAX:217-328-1148
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422, FAX:219-424-2433
IN	Indianapolis, Bell Inds., Inc.	317-875-8200, FAX:317-875-8219
IN	Indianapolis, Custom Svc. Elect.	317-879-9119, FAX:317-879-9136
IA	Bell Inds., Inc.	319-395-0730,FAX:317-875-8219
KS	Olathe, ECS Inc.	913-782-7787,FAX:913-782-6991
KY	East, Bell Inds., Inc.	800-582-7492
KY	West, Bell Inds., Inc.	800-445-8795
MD	Columbia, Nu Horizons Elctrns. Corp.	410-995-6330,FAX:410-995-6332
MD	Jessup, Bell Inds., Inc.	301-290-5100, FAX:301-953-0039
MA	Andover, Bell Inds., Inc.	508-474-8880, FAX:508-474-8902
MA	Needham, Cronin Elctrns., Inc.	617-449-5000, FAX:617-444-8395
MA	Wakefield, Nu Horizons Elctrns. Corp.	617-246-4442,FAX:617-246-4462
MI	Wixon, Bell Inds., Inc.	800-937-2355, FAX:513-435-6765
MN	Bell Inds., Inc.	612-941-1493,FAX:612-938-7410
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766, FAX:612-571-9519
MN	Thief River Falls, Digi-Key Corp.	612-944-5855, FAX:612-344-4539
MO	Bell Inds., Inc.	314-647-2355,FAX:317-875-8219
NJ	Edison, Dove Elctrns.	908-738-0321, FAX:908-738-0507
NJ	Fairfield, Bell Inds., Inc.	201-227-6060, FAX:201-227-2626
NJ	Flanders, Dove Elctrns.	201-927-6339
NJ	Mt. Laurel, Nu Horizons Elctrns. Corp.	609-231-0900,FAX:609-231-9510
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300,FAX:201-882-8398
NJ	West berlin, G.C.I. Corp.	609-768-6767, FAX:609-768-4289
NM	Albuquerque, Bell Inds., Inc.	505-292-2700, FAX:505-275-2819
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000,FAX:516-227-0082
NY	E. Setauket, Dove Elctrns.	516-689-7733, FAX:516-689-7362
NY	Rochester, Nu Horizons Elctrns. Corp.	716-292-0777,FAX:716-292-0750
NC	Bell Inds., Inc.	919-821-4041,FAX:919-821-4953
OH	Dayton, Bell Inds., Inc. (Industrial)	513-435-8660, FAX:513-435-6765
OH	Dayton, Bell Inds., Inc. (Military)	513-434-8231, FAX:513-434-8103
OR	Beaverton, IEC Beaverton (OR)	503-641-1690, FAX:503-646-3737
OR	Lake Oswego, Bell Inds., Inc.	503-635-6500, FAX:503-635-4095
PA	Pittsburgh, Bell Inds., Inc.	412-787-3883, FAX:412-788-4035
PA	Trevose, Bell Inds., Inc.	215-953-2800, FAX:215-364-4928
SC	Bell Inds., Inc.	800-322-7908,FAX:407-339-0139
TN	Bell Inds., Inc.	615-367-4400,FAX:205-837-1074
TX	Austin, Norvell Austin	512-343-2900, FAX:512-343-9602
TX	Austin, Omni Pro Elctrns.	512-794-9200, FAX:512-338-9576
TX	Dallas, Norvell Elctrns., Inc.	214-233-0020, FAX:214-490-7245
TX	Dallas, Omni Pro Elctrns.	214-713-9000, FAX:214-732-8743
TX	Houston, Norvell Houston	713-462-1666, FAX:713-462-3210
TX	Houston, Omni-Pro Elctrns.	713-270-1700, FAX:713-270-8020
TX	Richardson, Bell Inds., Inc.	214-690-0466, FAX:214-690-0822
UT	Midvale, Bell Inds., Inc.	801-255-9611, FAX:801-255-2477
UT	West Valley City, IEC Utah (Salt Lake)	801-977-9750,FAX:801-975-1207
WA	Bell Inds., Inc.	206-867-5410,FAX:206-867-5159
WA	Bellevue (WA), IEC Bellevue (MA)	206-455-2727, FAX:206-453-2963
WI	Waukesha, Bell Inds., Inc.	414-547-8879, FAX:414-547-6547

EQUIPMENT REMARKETING COMPANY, Boston Financial & Equity Corporation, 20 Overland Street, Boston, MA 02215, Tel: 617-267-8600, FAX: 617-267-2370

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 708-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 708-859-3255; Empl.: 300; *Sls. Mgr.:* Tom Nilles; *Dist. Mgr.:* Jerry Reidy

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506-9988, Tel: 708-897-4691, FAX: 708-897-5314; FSC No.: 14002;Multiple; Empl.: 78; *Sls. Mgr.:* Robert Golz .... **C•1038-1041**

ERA POLY-PLANAR DIV., See Poly-Planar, Inc.

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERCON INCORPORATED, 26 Emerson Road, Waltham, MA 02154, Tel: 617-899-1497, FAX: 617-899-2650; *Sls. Mgr.:* Dennis Ehrreich

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55121, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 24; *Sls. Mgr.:* Harry C. Sweere

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FAX: 214-680-1059

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Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.,Inc.	205-534-0044
AZ	Scottsdale, Sun Tech Sls.	602-860-8262
CA	Cupertino, PEI Assocs. Inc.	408-253-1960
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	San Diego, Elsco Elctrns.	619-292-1771
CO	Denver, AKI	303-388-4488
CT	Greenwich, Ericsson Comps. Inc.	203-625-7300
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
GA	Norcross, The Novus Grp., Inc.	404-263-0320
IL	Elk Grove Village, Carlson Elctrns. Sls.	708-956-8240
KS	Lenexa, Web Assoc./Elctrns., Inc	913-541-8585
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	Florissant, Web Assoc./Elctrns., Inc.	314-921-5720
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Parlin, JMR Sls., Inc.	201-525-8000
NY	Wading River, Niktronics	516-929-4671
NC	Cary, The Novus Grp., Inc.	919-460-7771
OH	Cleveland, RK Comp. Sls., Inc.	216-642-9312
TX	Dallas, Dynamark	214-437-3333
VA	Herndon, Stinson Assocs.	703-620-1331
WA	Redmond, EMG-Elec. Mktg. Grp.	206-882-0962
WA	Vancouver, EMG Elec. Mktg. Grp.	206-944-0761
WI	Milwaukee, Carlson Elctrns., Sls.	414-476-2790

Local Distributors

Can	Markham, Ont., Deskin Inc.	416-475-1412

ERICSON MANUFACTURING CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, TELEX: 98-5390, FAX: 216-951-1867; Empl.: 110; *Sls. Mgr.:* Dave Hardy

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERNI COMPONENTS, 520 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-6367, FAX: 804-379-2109; Empl.: 700; *Sls. Mgr.:* Thomas Noack

ESC ELECTRONICS CORPORATION

FAX: 201-947-0406

ESC ELECTRONICS CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400; Empl.: 120 **A•1552-1565, 2329**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Newbury Pk., Westaironics	805-499-9844
CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Denver, Donohue Sls. Co.	303-455-1719
FL	Palm Harbor, Sigma Tech. Assocs.	813-789-5522
IL	Elk Grove, Carlson Elctrn. Sls. Co.	312-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls. Co.	319-378-1450
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Ellicott City, Saltech	410-461-7350
MA	Swansea, Poisson Assocs., Inc.	508-677-3655
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NC	Winston-Salem, Murcota Corp.	919-722-9445
OR	Beaverton, Ravencraft	503-579-9261
TX	Plano, Zeus Engrg.	214-423-2027
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
EXP	NJ, Palisades Pk., ESC Elctrns. Corp.	201-947-0400
Can	Toronto, Ont., CEA Assocs.	416-231-9717

ESCOD INDUSTRIES, Insilco, 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, FAX: 413-536-8425; Empl.: 875

ESC TECHNOLOGIES, INC., 14115 Chadron Ave., Hawthorne, CA 90250, Tel: 310-970-4090, FAX: 310-970-0820; Empl.: 35; *Sls. Mgr.:* Gary L. Peterson; *Dist. Mgr.:* Gary L. Peterson

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 310-322-2136, FAX: 310-322-8127; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* Brian Way; *Dist. Mgr.:* Brian Way

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195

ESP SOLDER PLUS, 14 Blackstone Valley Pl., Lincoln, RI 02865, Tel: 800-338-4353, 401-333-3800, FAX: 401-333-4954; Empl.: 40; *Sls. Mgr.:* Ms. Kim Ranallo

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct #9, Ventura, CA 93003, Tel: 805-644-9544, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery, Pres. & G.M.

ESS, INC., 16310 No. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117

E-SWITCH, Electronic Components Groupe, 26 North Fifth St., Minneapolis, MN 55403, Tel: 612-375-9639, FAX: 612-375-1900; *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton **B•1722-1723**

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AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Tempe, ACS of Arizona	602-731-9711
CA	Orange, RD & D Sls., Engrg., Inc.	714-771-6110
CA	San Jose, Westron Assocs.	408-264-4070
CO	Littleton, Romulus Elctrns., Inc.	303-770-4888
FL	Melbourne, Phoenix Comps., Inc.	407-723-4414
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Palatine, Golbeck Milota	708-705-0602
IN	Fishers, Connect 21, Inc.	317-578-2121
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Madison Hgts., D.E.M. Sls., Inc.	313-583-1500
MN	Oakdale, Complete Sls.	612-731-2923
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashau, Bennetron	603-880-7008
NY	Syracuse, ADR Technlgs., Inc.	315-437-7087
OH	Cleveland, Comps. Inc.	216-243-9200
OK	Atoka, AID Elctrns., Inc.	405-889-7638
OR	Aloha, Turn-A-Round Sls.	503-649-1007
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Irving, AID Elctrns.	214-790-4761
VA	Sterling, Beacon North Inc.	703-470-2480
WA	Kirkland, Turn-A-Round Sls.	206-822-4634
WI	Madison, Golbeck Milota	608-222-7037
Can	Burlington, Ont., White Radio, Ltd.	416-632-6894

E-SYSTEMS, Greenville Div., P.O. Box 6056, Greenville, TX 75403-6056, Tel: 903-455-3450, FAX: 903-457-4413; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, FAX: 703-280-4627; Empl.: 2,180

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AL	Huntsville, South Tech Sls.	205-880-8200
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	Oceanside, Sierra-Pacific Engrg.	619-945-5917
CA	San Francisco, Ross Mktg.	408-988-8111
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CA	Tustin, Sierra-Pacific Engrg.	714-731-3411
CO	Denver, Promo Tech	303-692-8484
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Winter Springs, Sunland Assocs.	407-365-9533
GA	Atlanta, South Tech	404-822-1764
GA	Lilburn, South Tech Sls.	404-381-2088
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Lenexa, Midtec Assoc.	913-541-0505
MA	Boston, Eagle Assocs.	617-444-3446
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	St. Louis, Midtec Assoc.	314-275-8666
NH	Raymond, Eagle Assocs.	617-444-3446
NM	Albuquerque, Chaparral Elctrns.	505-271-2266
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NY	Rochester, Lamb Comps.	716-328-6350
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Beachwood, Thompson & Assoc., Inc.	216-831-6277
OH	Dayton, Thompson & Assoc., Inc.	513-435-7733
OH	Orient, Thompson & Assoc., Inc.	614-877-4304
OR	Tigard, Eltech	503-684-3458
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Sterling, Beacon North Inc.	703-478-2480
WA	Bellevue, Eltech	206-643-4330
WI	Milwaukee, Star Engineering	414-645-3680
Can	Dartmouth, N.S., Reptronics	902-465-4400
Can	Montreal, Que., Cana Rep Grp., Inc.	514-276-4477
Can	Oakville, Ont., Cana Rep Grp., Inc.	416-338-3399
Can	Ottawa,Ont., Cana Rep Grp., Inc.	613-692-4682
Can	Surrey, B.C., Cana Rep Grp., Inc.	604-599-1232

Local Distributors

CA	Van Nuys, Wes-Garde	1-800-275-7101
CT	Hartford, Wes-Garde	1-800-275-7091
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IL	Carol Stream, Wes-Garde	1-800-275-7095
KS	Overland Park, Wes-Garde	1-800-275-7099
MO	St. Louis, Wes-Garde	1-800-275-7097
NH	Nashua, Wes-Garde	1-800-275-7093
NJ	Mt. Laurel, Wes-Garde	1-800-275-7094
OH	Westerville, Wes-Garde	1-800-275-7096
OR	Wilsonville, Wes-Garde	1-800-275-7073
TX	Dallas, Wes-Garde	1-800-275-7103
Can	Burnaby, B.C., Cesco Elctrl. Supps.	604-273-2911
Can	Calgary, Alb., B & E Indust. Elctrns.	403-243-7215
Can	Calgary, Alb., Cardinal Indl. Elctrns.	403-259-6817
Can	Calgary, Alb., Electro Sonic	403-255-9550
Can	Calgary, Alb., Memco	403-258-3399
Can	Calgary, Alb., R.L. Brews & Sons Ltd.	403-243-1144
Can	Chomedey Laval, Que., Futech A.S.C. Inc.	514-668-8086
Can	Dartmouth, N.S., Arcom Elctrns.	902-464-1600
Can	Edmonton, Alb., Cardinal Indl. Elctrns.	403-483-6266
Can	Edmonton, Alb., R.L. Brews & Sons Ltd.	603-452-3730
Can	Langley, B.C., Panda Indust. Prods. Ltd.	604-888-2220
Can	Ottawa, Ont., Electro Sonic Inc.	613-728-8333
Can	Richmond, B.C., Electro Sonic	604-273-2911
Can	Saskatoon, Sas., Cardinal Indl. Elctrns.	306-934-3443
Can	St. Laurent, Que., Besco Elctrl. Supps.	514-337-6110
Can	St. Laurent, Que., Futech- St. Laurent	514-956-1630
Can	St. Laurent, Que., Westburne Que., Inc.	514-332-5331
Can	Surrey, B.C., Memco	604-590-1553
Can	Willowdale, Ont., Electro Sonic Inc.	416-494-1666
Can	Winnipeg, Man., Electro Sonic	204-783-3105
Can	Winnipeg, Man., Westburne Amesco Entprs.	204-786-4451

ETA POWER, See JETA Power Systems

ETI SYSTEMS, Polaris Indl. Entprs., 2251 Las Palmas Dr., Carlsbad, CA 92009, Tel: 619-929-0749, FAX: 619-929-0748; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Debbie Marshall **A•2084-2085**

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CA	Torrance, Allied Elctrns.	310-373-8828
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CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Ft. Lauderdale, Allied Elctrns.	305-733-3144
GA	Atlanta, Motion Elctrns.,Inc.	404-455-8262
GA	Duluth, Allied Elctrns.	404-497-9544
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PA	Newton Square, QDI	215-359-1000
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WA	Everett, Allied Elctrns.	206-353-7313
WI	New Berlin, Allied Elctrns.	414-796-1280

ETM ELECTROMATIC INC, 35451 Dumbarton Ct, Newark, CA 94560, Tel: 510-797-1100, FAX: 510-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

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ETRI, INC., 1503 Rocky River Rd., North, Monroe, NC 28110, Tel: 704-289-5423; *Sls. Mgr.:* Peter Pignetti .... **C•1585-1591**

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AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Scottsdale, Spectrum Mktg.	602-890-9000
CA	Cupertino, Prism Tech. Sls.	408-366-6766
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Bestronics	619-693-1111
FL	Boca Raton, Electrocraft	407-394-9686
FL	Largo, Electrocraft	813-544-1766
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Glen Ellyn, Lincoln, Hodges	708-469-6750
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Pasadena, EES	410-255-9686
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Salem, Sls. Engrg. Co.	603-893-5521
NJ	Medford, McCoy Grp.	609-953-0770
NY	Port Washington, Ashtec, Inc.	516-767-0336
OH	Dayton, K W Elctrns.	513-890-2150
OH	Shaker Hgts., K W Elctrns.	216-491-9177
PA	Pittsburgh, K W Elctrns.	412-492-0777
PA	Valley Forge, McCoy Grp.	215-783-1919
TX	Dallas, Fralia Co. & Assoc.	817-354-1144
VA	Remington, EES	703-439-2866
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MD	Columbia, Milgray Elctrns.	301-621-8169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Andover, Bell Industries	508-474-8880
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MA	Winchester, Webb Distribution	617-729-5800
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NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Pittsford, Milgray Elctrns.	716-381-9700
NC	Raleigh, Milgray Elctrns.	919-790-8094
OH	Cleveland, Milgray Elctrns.	216-447-1520
OR	Beaverton, Acacia/Deanco	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Reptron	215-643-2850
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
UT	Midvale, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WA	Redmond, Acacia/Deanco	206-881-5566
Can	Mississauga, Ont., R-Theta	416-890-0221

EUBANKS ENGINEERING, 950 E. Royal Oaks Dr., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403, FAX: 818-357-4718; Empl.: 90; *Sls. Mgr.:* James Reed

EURO-DIP, See Mill-Max Manufacturing Corp.

EURO QUARZ GMBH, See Raltron Electronics Corp.

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 510-653-3083

EVAPORATED COATINGS, INC., 2365 Maryland Rd., Willow Grove, PA 19090, Tel: 215-659-3080, FAX: 215-659-1275; Empl.: 40; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, FAX: 201-641-1640; Empl.: 53; *Sls. Mgr.:* Gil Griffith; *Dist. Mgr.:* Gil Griffith

FAX: 314-982-4078

EVEREADY BATTERY CO. INC., Checkerboard Square, St. Louis, MO 63164, Tel: 314-982-2000 .... **D•1450-1451**

Local Sales Offices & Reps

CA	Irvine	714-753-0588
GA	Duluth	404-279-0228
IL	Lisle	708-964-8668
MO	St. Louis	314-982-2000
NJ	Saddle Brook	201-845-5400
OH	Independence	216-447-1127
TX	Dallas	214-661-1351
WA	Battle Ground	206-687-0375

EVEREST ELECTRONIC EQUIPMENT, 2683 Hamilton Mill Rd., Buford, GA 30518, Tel: 404-932-2900, FAX: 404-932-5473; Empl.: 240; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Barry Holman

EVEREST ELECTRONIC EQUIPMENT, INC., 2100 E. Orangewood Avenue, Anaheim, CA 92806, Tel: 714-634-2200, FAX: 908-446-5362; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Barry Holman

EVEREST INTERSCIENCE, INC., P. O. Box 3640, Fullerton, CA 92634-3640, Tel: 800-422-4342, FAX: 714-992-0178; Empl.: 20; *Sls. Mgr.:* Patrick Cash; *Dist. Mgr.:* Marilyn M. Everest

EVERETT CHARLES TECHNOLOGIES, FIXTURE DIVISION, One Fairchild Square, Clifton Park, NY 12065, Tel: 518-877-7042; Empl.: 150; *Sls. Mgr.:* Jack Banyas

EVI, INC., 7138 Columbia Gateway Dr., Columbia, MD 21046, Tel: 410-290-1919, FAX: 410-290-1925; Empl.: 30

EVOX-RIFA INC., 100 Tri State Int'L, Ste 290, Lincolnshire, IL 60069, Tel: 708-948-9511, FAX: 708-948-9320; Empl.: 2000; *Sls. Mgr.:* George Sinnokrak; *Dist. Mgr.:* George Sinnokrak

EWALD INSTRUMENTS CORP., 28 Maple St., Kent, CT 06757, Tel: 203-927-3278, FAX: 203-927-3031

FAX: 908-446-5362

EWC, INC., 385 Highway 33, Englishtown, NJ 07726, Tel: 908-446-3110; FSC No.: 15387;MIL-T-27D; Empl.: 120; *Sls. Mgr.:* Jay Stevenson; *Dist. Mgr.:* Jay Stevenson .... **A•1235, 2331-2347**

Local Sales Offices & Reps

CA	Canoga Park, Cummings & Assocs.	818-340-6035
CA	Los Gatos, Featherstone Sls.	408-356-3243
CO	Broomfield, Summitwest Mktg.	303-460-9600
FL	Orlando, GRA-MAR	407-658-1971
IL	Wooddale, Dab Elctrns.	708-595-9210
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Prairie Village, Clyde Logsdon & Assoc.	913-381-3833
MA	Chelmsford, ISA Sls.	508-256-2287
MO	St. Louis, Clyde Logsdon & Assocs.	314-849-5125
NJ	Allenwood, ACI Sls.	201-223-5895
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Plainview, Winch Assocs.	516-681-3163
OH	Cincinnati, Frank E Kahsar Sls.	513-598-1484
PA	Youngswood, Pro Mark	412-925-1905
TX	Dallas, Rem Air Comps.	214-234-1069
WI	Waukesha, Dab Elctrns.	414-784-3544

EXAR CORP., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007, Tel: 408-434-6400, TWX: 910-339-9233, FAX: 408-943-8245; Empl.: 500; *Sls. Mgr.:* Fred Urrutia, Sls. Dir.; *Dist. Mgr.:* Jack Hanoka

EXATRON AUTOMATIC TEST EQUIP., 2842 Aiello Dr., San Jose, CA 95111, Tel: 408-629-7600, 800-EXA-TRON, FAX: 408-629-2832; Empl.: 24; *Sls. Mgr.:* Kathryn Henderson

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781, FAX: 312-262-1330; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 5-4 Stryker La., Belle Mead, NJ 08502, Tel: 908-874-4747, ESYLNK: 908-874-3278; *Sls. Mgr.:* Michi Chen .... **B•1062**

EXELTECH INC., 7018 Baker Blvd., Ft. Worth, TX 76118, Tel: 817-595-4969, FAX: 800-886-4683; Empl.: 12

EXFO. E.O. ENGINEERING, INC., 465 Godin Ave., Vanier, QC., Canada G1M 3G7, Tel: 418-683-0211, 1-800-663-EXFO, FAX: 418-683-2170; Empl.: 100; *Sls. Mgr.:* Germain Lamonde; *Dist. Mgr.:* John Spychka ... **B•1211**

Local Sales Offices & Reps

IL	Arlington Heights, EXFO E.O. Eng.	708-259-9440
NC	Wake Forest, EXFO E.O. Eng.	919-554-4884
PA	Horsham, EXFO E.O. Eng.	215-672-4065
TX	Dallas, EXFO E.O. Eng.	214-692-9018

Local Distributors

AZ	Phoenix, Jenson Tools, Inc.	602-968-6241
CA	Cypress, Ward/Davis Assoc.	714-827-8490
CA	Mountain View, Ichirep Co., Inc.	415-856-2503
CO	Lakewood, T.M.M.I.	303-232-1516
FL	Melbourne, Reynolds & Assocs.	407-259-7000
IL	South Holland, Fiber Solutions	708-339-2500
MD	Chelmsford, Fico, Inc.	508-250-4445
MI	Farmington Hills, Advanced Comms., Inc.	313-489-1400
NJ	New Jersey, Thaw Sls. & Mktg.	908-757-8150

NM	Albuquerque, T.M.M.I.	505-298-6893
NY	New York, Codenoll Tech. Corp.	914-965-6300
OH	Akron, Famous Telephone Inc.	216-762-8811
PA	Southampton, W.A. Drobile Inc.	215-364-2501
TX	Plano, Engrg. Equip. Sls. Inc.	214-578-1146
VA	Fairfax, Schibley Assocs., Inc.	703-591-3008
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511

EXPRESS TEST CORP., 975 Benicia Ave., P.O. Box 3419, Sunnyvale, CA 94088-3419, Tel: 408-737-3555, TELEX: 4942091, FAX: 408-737-3558; *Sls. Mgr.:* Frank S. Gavin

EXSELECT ENGINEERING LTD., 355 Rayette Rd., Concord, Ont., Canada LK42G2, Tel: 416-738-4077, FAX: 416-738-6604; Empl.: 28

EXTECH INSTRUMENTS CORP., 335 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, FAX: 617-890-7864

EXTRUSION TECHNOLOGY, INC., 82 Trim Way, Randolph, MA 02368, Tel: 617-963-7200, FAX: 617-963-7203; Empl.: 50; *Sls. Mgr.:* Matt Travers .... **B•1828; C•1042-1043**

EYRING, INC., 1455 W. 820 N., Provo, UT 84601, Tel: 801-375-2434, TELEX: 882000, FAX: 801-374-8339; Empl.: 150; *Sls. Mgr.:* David S. Turner

E-Z HOOK, Tektest Inc., 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, FAX: 818-446-0972; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* P.C. Wood; *Dist. Mgr.:* P.C. Wood

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247, FAX: 818-443-5594; FSC No.: 13345; *Sls. Mgr.:* Phelps Wood .... **B•1254-1259**

FAGOR ELECTRONIC COMPONENTS, INC., Fagor Electronica S. Coop., 2250 Estes Avenue, Elk Grove Village, IL 60007, Tel: 708-981-0161, FAX: 708-981-1311

FAIRBANKS SCALES:FAIRBANKS INC., 711 E. St. Johnsbury Rd., St. Johnsbury, VT 05819, Tel: 800-451-4107, 802-748-5111, FAX: 802-748-5216

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, FAX: 914-895-2629; FSC No.: 34899; Empl.: 2000; *Sls. Mgr.:* B. G. Tolen

FALCON ELECTRIC, 1960 Walker Ave., Monrovia, CA 91016, Tel: 800-842-6940, FAX: 818-285-0102; Empl.: 100; *Sls. Mgr.:* Ron Seredian, Acct. Mgr.; *Dist. Mgr.:* Ron Seredian, Acct. Mgr.

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610, FAX: 201-575-9234; Empl.: 23; *Sls. Mgr.:* Robert Antonelli; *Dist. Mgr.:* Lucille Ott

FAN-S CORP., See Qualtek Electronics Corp.

FARIA, THOMAS G., CORP., P.O. Box 983, Uncasville, CT 06382-0983, Tel: 203-848-9271, FAX: 203-848-2704; FSC No.: 09527; Empl.: 250; *Sls. Mgr.:* A. Knupp

FARNELL ADVANCE POWER, 32111 Aurora Rd., Solon, OH 44139, Tel: 216-349-0755, FAX: 216-349-0142; Empl.: 10 .... **D•1699-1704**

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388, FAX:602-944-9477
CA	Anaheim, Leonard P. Beckman	714-491-7441, FAX:714-491-2408
CA	Long Beach, L.A. Sls.	213-491-0791
CA	San Ramon, Synergy Sls.	510-830-0829, FAX:510-830-0951
CA	San Ramon, Tim Joynson	510-735-8206, FAX:510-735-8207
CO	Englewood, Comp. Sls., Inc.	303-779-8060, FAX:303-779-8357
FL	Orlando, Aurora-Schmitt Assocs.	407-297-6039
IL	Elk Grove, Carlson Elctrns.	708-956-8240, FAX:708-956-8289
MD	Baltimore, Herman K. Kramer	410-528-9120, FAX:410-528-9116
MD	Monkton, Imagitron Sls. Co; Inc.	301-374-5600, FAX:301-372-5888
MN	Minneapolis, Comps. Grp. Corp.	612-374-1250, FAX:612-374-5434
NH	Salem, Sls. Engrg.	603-893-5521, FAX:603-893-7680
NY	Clarence, R.W. Mitscher Co.	716-759-2350, FAX:716-759-6976
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313,FAX:516-434-1572
OH	Dayton, The Lyons Corp.	512-278-0714, FAX:512-278-3609
PA	Drexel Hill, DNE Sls. Co.	215-789-6822, FAX:215-789-3508
SC	Walhalla, Overton Assocs.	803-638-7101, FAX:803-638-2830
TX	Dallas, Blair Engrg., Inc.	214-241-5655, FAX:214-241-3642

FARRAND CONTROLS, Ruhle Companies, Inc., 99 Wall St., Valhalla, NY 10595, Tel: 914-761-2600, FAX: 914-761-0405; Empl.: 55 .... **B•1949**

FASCO MOTORS GROUP, 500 Chesterfield Center No. 500, Chesterfield, MO 63017, Tel: 314-532-3505, FAX: 314-532-9306; Empl.: 4000; *Dist. Mgr.:* R. J. Darragh/D. Schmitt Merchandising Mgr.

FASTEX, Illinois Tool Works, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 708-299-2222, FAX: 708-390-6183; FSC No.: 02768; Empl.: 175; *Sls. Mgr.:* Andy Flis; *Dist. Mgr.:* Andy Flis

FASTEX DISTRIBUTOR BUSINESS, Illinois Tool Works, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 708-350-8200, FAX: 708-595-2141; Empl.: 170; *Sls. Mgr.:* Andy Flis

FDK

FAX: 408-435-7478

FDK AMERICA, INC., Fuji Electrochemical Co., Ltd., 3099 N. First St., San Jose, CA 95134, Tel: 408-432-8331; *Sls. Mgr.:* Sumio Watanabe .... **A•1698, 2348; D•1096**

Local Sales Offices & Reps

CA	San Jose, FDK America, Inc.	408-432-8331
MA	Boston, FDK America, Inc.	617-487-3198
TX	Dallas, FDK America, Inc.	214-650-7742

F-DYNE ELECTRONICS, See Southern Electronics F-Dyne

FEE FIL-MAG, 9445 Farnham Street, San Diego, CA 92123, Tel: 619-569-6577, FAX: 619-569-6073; Empl.: 1200; *Sls. Mgr.:* Marc Jay Lampert; *Dist. Mgr.:* Jim Seifert .... **A•1634-1637, 2349-2351; D•2109**

Local Sales Offices & Reps

CA	San Diego, FEE Fil-Mag	619-569-6577
CA	Santa Clara, Fee Fil-Mag	408-562-6264
CO	Englewood, FEE Fil-Mag	303-721-8513
GA	Cummings, FEE Fil-Mag	404-889-8231
IL	Des Plaines, FEE Fil-Mag	708-297-6937
MA	Medfield, FEE Fil-Mag	508-359-9691
NJ	Fairfield, TAM	201-575-4130
Can	Don Mills, Ont., Canadian Source Corp.	416-445-0211

Local Distributors

CA	San Jose, CAPSTONE	408-453-9804
CA	Tustin, CAPSTONE	714-730-0349
CO	Aurora, CAPSTONE	303-375-1300
IL	Itasca, CAPSTONE	708-250-0300
MA	Wilmington, CAPSTONE	508-657-5874
NJ	Marlton, CAPSTONE	609-596-7500
NM	Los Alamos, CAPSTONE	505-662-0745
NC	Raleigh, CAPSTONE	919-954-0600
TX	Carrollton, CAPSTONE	214-380-9049
Can	Mississauga, Ont., CAPSTONE	416-670-2010

FEI MICROWAVE, INC., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, FAX: 408-730-1622; FSC No.: 21847; Empl.: 240; *Sls. Mgr.:* Joe Lee

FELLER US CORPORATION, AFN Div., 72 Veronica Ave./Unit 4, Somerset, NJ 08873, Tel: 908-247-7333, FAX: 908-247-7279; Empl.: 310; *Sls. Mgr.:* Elfie Schwarzinger

FEL-PRO CHEMICAL PRODUCTS L.P., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* James R. Hallstrom

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 908-238-1223, FAX: 908-238-7981; Empl.: 16 to 20; *Sls. Mgr.:* E. Wong; *Dist. Mgr.:* E. Wong .... **B•1063**

FENWAL INC., 400 Main St., Ashland, MA 01721, Tel: 508-881-2000, TELEX: 948421, FAX: 508-881-6729; Empl.: 1000; *Sls. Mgr.:* D. Rieley

FENWAL□ELECTRONICS
INCORPORATED

FAX: 508-473-6035

FENWAL ELECTRONICS, INC., 450 Fortune Blvd., Milford, MA 01757, Tel: 508-478-6000, TELEX: 299550; Empl.: 450; *Sls. Mgr.:* Herb Holmstedt; *Dist. Mgr.:* Herb Holmstedt .... **B•1875**

Local Sales Offices & Reps

CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
FL	Palm Beach Gardens, Graham Assoc., Inc.	407-622-4049
IL	Itasca, Janus Inc.	708-250-9650
IN	Indianapolis, CC Electro Sales, Inc.	317-921-5000
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MD	Gaithersburg, Naudain Assoc. So., Inc.	301-258-5040
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	So. St. Paul, Northport Engrg., Inc.	612-457-8000
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
NY	Huntington, CDB Entprs.	516-692-5200
NY	Penfield, Upstate Comps. Sls., Inc.	716-381-6070
NC	Raleigh, Prime Comps., Inc.	919-850-9866
PA	Allison Park, Bear Mktg., Inc.	412-492-1150
PA	Wynnewood, Metz-Jade Assoc.	215-896-7300
TX	Austin, W. Pat Fralia Co. & Assoc., Inc.	817-354-1144
TX	Euless, W. Pat Fralia Co. & Assoc., Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. & Assoc., Inc.	817-354-1144
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
EXP	MA, Milford, Fenwal Elctrns.	508-478-5255
Can	Que., John G. Weiss Co., Ltd.	514-685-6644

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	818-998-3111
CA	San Jose, Rose Elctrn. Distr.	408-943-0200
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
FL	Clearwater, Newark Elctrns.	813-443-0661
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100
MD	Ellicott City, Newark Elctrns.	301-461-2300
MA	Woburn, Newark Elctrns.	617-935-8350
MI	Oak Park, Newark Elctrns.	313-967-0600
NJ	Pennsauken, Newark Elctrns.	609-663-9490
NY	Buffalo, Summit Dists.	716-887-2800
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Newark Elctrns.	216-391-9330
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Fort Worth, Patco Supply	817-429-8596
TX	Garland, Newark Elctrns.	214-494-5911
Can	Que., John G. Weiss Co., Ltd.	514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282, FAX: 513-383-1157; Empl.: 600

FERNWOOD TRANSFORMER CO., Transistor Devices Inc., 560 Independence St., Belvidere, NJ 07823, Tel: 908-475-3207, FAX: 908-475-3242; FSC No.: 3S657; Empl.: 90 .... **A•2355**

FERRANTI-PACKARD, See F-P Electronics

FERRANTI VENUS, INC., Ferranti International, 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492, FAX: 516-752-7976; Empl.: 400; *Sls. Mgr.:* Thomas White

FERRAZ CORPORATION, 14 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, TELEX: 136045, FAX: 201-428-0599; Empl.: 100; *Sls. Mgr.:* Douglas L. Bennett; *Dist. Mgr.:* Douglas L. Bennett

FERRETEC INC., 3342 Gateway Blvd., Fremont, CA 94538-6525, Tel: 510-226-1216, FAX: 510-651-8771; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Dirk Hoekstra

FERRITE INTERNATIONAL, 15280 Wadsworth Rd., Wadsworth, IL 60083, Tel: 708-249-4900, FAX: 708-249-4988; Empl.: 60; *Sls. Mgr.:* George Orenchak

FERRO CORPORATION, Filled & Reinforced Plastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218, FAX: 812-423-1864; *Sls. Mgr.:* J. C. Vaughn

FERRO CORPORATION, Electronic Glass Department, 4150 East 56th Street, Cleveland, OH 44101, Tel: 216-641-8580, FAX: 216-641-8857; *Sls. Mgr.:* Tack Whang, Bus. Mgr.

FERRO CORPORATION, Electronic Materials Div., 27 Castilian Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165, FAX: 805-968-8624; *Sls. Mgr.:* William T. Faix, Nat. Sls. Mgr.

FERRO CORPORATION, Frit Division, 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-2049; *Sls. Mgr.:* James Stalder

FERRO CORPORATION, Powder Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-8596; Empl.: 300 ò

FERRO CORPORATION, Plastic Colorants & Dispersions, 3 Railroad Ave., P.O. Box 603, Stryker, OH 43557, Tel: 419-682-3311, TELEX: 419-682-4924; *Sls. Mgr.:* Robert T. Schneider

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, FAX: 315-536-8091; *Sls. Mgr.:* J. F. Arthur/W. Germond

FERROFLUIDICS CORP., 40 Simon St., Nashua, NH 03061, Tel: 603-883-9800, FAX: .603-883-2308; Empl.: 221; *Dist. Mgr.:* Kurt J. Lesker Company

FERRONICS, 45 O'Connor Rd., Fairport, NY 14450, Tel: 716-388-1020, FAX: 716-388-0036; FSC No.: 33062; Empl.: 49; *Sls. Mgr.:* Tim Reeder

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Tempe, Gassner & Clark	602-968-9037
CA	San Diego, Texel	619-576-2162
CA	San Jose, Texel/North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
FL	Oviedo, Comps. Co.	407-366-7399
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, John H. Weaver Co. Inc.	317-257-7661
IA	Cedar Rapids, Dytronix Inc.	319-377-8275
KS	Leawood, Dytronix Inc.	913-339-6333
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	St. Paul, Countryman Assoc.	612-645-9151
MO	Bridgeton, Dytronix Inc.	314-291-4777
NC	Raleigh, L & D	919-876-5301
NC	Wilmington, L & D	919-256-8110
OH	Cleveland, C. J. Voneman Co.	216-226-8000
OR	Portland, General Elctrns.	503-297-8500
TX	Dallas, Comp. Tech.	214-783-8831
TX	Houston, Comp. Tech.	713-690-3011
WA	Stanwood, General Elctrns.	503-297-8500
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Don Mills, Ont., R.D. Assocs.	416-444-0959

Local Distributors

CA	Los Alamitos, Dexter Magnetic Materials	714-952-2091
CA	Sunnyvale, Dexter Magnetic Materials	408-738-1080
GA	Norcross, Dexter Magnetic Materials	404-448-4998
IL	Chicago, Dexter Magnetic Materials	708-956-1140
MA	Billerica, Dexter Magnetic Materials	508-663-7500
MN	Chanhassen, Dexter Magnetic Materials	612-934-4635
NY	Hicksville, Dexter Magnetic Materials	516-822-3311
OH	Toledo, Dexter Magnetic Materials	419-385-4621
TX	Richardson, Dexter Magnetic Materials	214-699-1121

FERROXCUBE, See Philips Components Discrete Products Division

FETCO, 421 Cornwall Rd., Sanford, FL 32773, Tel: 407-321-3800 .... **A•2352-2354**

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 908-647-6601, FAX: 908-647-8464; Empl.: 65; *Sls. Mgr.:* Allan Kreutzer; *Dist. Mgr.:* James Murray

FIBERLIGN, Preform Line Products, 24 Colonnade Rd., Nepean, ON, Canada K2E 7J6, Tel: 613-226-4000, FAX: 613-226-4602; Empl.: 55; *Sls. Mgr.:* Jean Paul Clermont

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FORMAX, 1120 Federal Road, Brookfield, CT 06804, Tel: 203-775-9492, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

FORSTER ENTERPRISES, INC., 57 Bristol St., Waterbury, CT 06708, Tel: 203-574-3832, FAX: 203-755-2973; FSC No.: 3621; Empl.: 64; *Sls. Mgr.:* C. M. Colt

FORTE TECHNOLOGY, INC., 201 Carnegie Row, Norwood, MA 02062, Tel: 617-769-9150, FAX: 617-769-5308; Empl.: 20

FORTRON/SOURCE CORP., Power Supplies, 6818-G Patterson Pass Rd., Livermore, CA 94550, Tel: 415-373-1008, TELEX: 559291 FORTRON UD, FAX: 415-373-1168; Empl.: 150; *Sls. Mgr.:* Louie Aldama

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MD	Randallstown, Beacon North Inc.	800-877-3747
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VA	Sterling, Beacon North Inc.	703-478-2480
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PR	Hato Rey, Semtronic Assocs.	809-766-0700
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Can	Pointe Claire, PQ, Electro Source, Inc.	514-630-7486
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CA	Sunnyvale, N.S. Westronics	408-745-1102
CO	Englewood, Barnhill Assocs.	303-721-0800
CO	Grand Junction, Barnhill Assocs.	303-241-0039
CO	Littleton, Vic Myers Assocs. Inc.	303-730-7313
CO	Redondo Beach, Ward/Davis Assoc.	310-643-6977
FL	Longwood, Southern Mktg.	407-682-7317
GA	Marietta, Southern Mktg.	404-427-3540
IL	Decatur, Dataport Technlgs.	217-423-9948
IL	Elk Grove, Loren Green Assoc.	708-593-0282
IL	Schaumburg, Dataport Technlgs.	708-397-3411
KS	Lenexa, Dytec/South Inc.	913-888-0215
KS	Wichita, Dytec/South Inc.	316-263-7090
LA	Metairie, Data Mktg.	504-833-3655
MD	Columbia, Creative Mktg. Assocs. Ltd.	301-880-4161
MD	Laurel, FTS/Austron	301-725-3636
MN	Edina, Dytec Instrs.	612-831-7169
MN	Minneapolis, Dataport Technlgs.	612-546-0273
MO	Maryland Heights, Dytec/South Inc.	314-739-0665
NE	Omaha, Dataport Technlgs.	402-334-1222
NH	Concord, Concord Comms.	603-228-8627
NJ	Haddonfield, G.L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs.	908-964-6200
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NM	Albuquerque, Vic Myers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NC	Greensboro, Southern Mktg.	919-632-9370
OH	Dublin, Micro Sls.	614-792-9117
TX	Allen, FTS/Austron	214-727-3807
TX	Austin, Barnhill Assocs.	512-343-6448
TX	Austin, Data Mktg.	512-338-4701
TX	Dallas, Data Mktg.	214-661-0300
TX	Houston, Barnhill Assocs.	713-266-2666
TX	Houston, Data Mktg.	713-579-2995
TX	Richardson, Barnhill Assocs.	214-231-2573
TX	San Antonio, Data Mktg.	512-342-3031
UT	Orem, Barnhill Assocs.	801-226-1239
UT	Salt Lake City, Vic Myers Assocs.	801-467-1795
VA	Front Royal, FTS/Austron	703-636-7771
WA	Lynnwood, Bert Technlgs.	206-776-9205

FTS AUSTRON DATUM, INC., See Frequency & Time Sys. Inc., Datum Inc.

FTS SYSTEMS, INC., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484, Tel: 914-687-0071, TWX: 510-247-0547, FAX: 914-687-7481; Empl.: 100ò; *Sls. Mgr.:* Brian Adams

FAX: 908-272-2241

FUJIPOLY, AMERICA CORP., 750 Walnut Ave., Cranford, NJ 07016, Tel: 908-272-3850; Empl.: 100 .... **B•1830; C•1330-1332, 1663**

Local Sales Offices & Reps

CA	Conaga Pk., C&W Comp. Sls.	818-700-2684
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Palatine, Technlgy. Sls.	708-991-6600
MN	Anoka, Tech. Solutions Inc.	612-785-9303
NY	Clarence, R.W. Mitscher Co. Inc.	716-759-2350
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
TX	Plano, EMI Sys.	214-618-4337
WA	Bellevue, Quest Mktg. Inc.	206-747-9424
EXP	Israel, Elimec	972-3-9643441
Can	Toronto, Norgay Entprs. Ltd.	416-234-8966

FUJITSU AMERICA, INC., Computer Products Group, 3055 Orchard Dr., San Jose, CA 95134, Tel: 408-432-1300, TWX: 910-338-2193; *Sls. Mgr.:* Roger Baldelli; *Dist. Mgr.:* Dave Krevanko

FUJITSU MICROELECTRONICS INC., COMPONENT DIVISION, 3545 N. First St., San Jose, CA 95135, Tel: 408-922-9000, TWX: 910-338-0190, FAX: 408-432-9044; Empl.: 40; *Sls. Mgr.:* Don Dealtry; *Dist. Mgr.:* Hal Mumma

FAX: 408-432-9044

FUJITSU MICROELECTRONICS INC., Semiconductor Division & Electronic Components Div., 3545 North First St., San Jose, CA 95134-1804, Tel: 408-922-9000, TWX: 910-338-0190; Empl.: 1000; *Dist. Mgr.:* Clyde Brewer, Dir. Distr. Sls. .... **B•1489-1499, 1831; C•1334-1339**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Scottsdale, Aztech Comp. Sls., Inc.	602-991-6300
CA	Chula Vista, Solano Electronica (Sonika)	619-424-9190
CA	Newport Beach, Infinity Sls., Inc.	714-833-0300
CA	Roseville, Norcomp	916-782-8070
CA	Santa Clara, Norcomp	408-727-7707
CO	Boulder, Talisman Assocs.	303-444-7300
CT	Cheshire, Connecticut Applied Technlg.	203-272-6564
FL	Altamonte Springs, Semtronic Assocs., Inc.	407-831-8233
FL	Clearwater, Semtronic Assoc., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Norcoss, Fujitsu Microelctrns.	404-242-5862
ID	Meridian, Intermtn. Tech. Mktg.	208-888-6071
IL	Itasca, Beta Technlg.	708-250-9586
IL	Itasca, Fujitsu Microelctrns.	708-250-8580
IN	Greenwood, Valentine Assocs.	317-888-2260
IN	Kokomo, Valentine Assocs.	317-453-3799
IN	South Bend, Valentine Assocs.	219-288-7070
IA	Cedar Rapids, Electromec Sls.	319-393-1637
KS	Olathe, Rothkopf & Assocs., Inc.	913-829-8897
KY	Henderson, Valentine Assocs.	317-888-2260
MD	Towson, Arbotek Assoc., Inc.	410-825-0775
MA	Woburn, Mil-Bern Assocs.	617-932-3311
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MN	Burnsville, Electromec Sls.	612-894-8200
NJ	Marlton, BGR Assocs.	609-983-1020
MO	St. Louis, Rothkopf & Assocs., Inc.	314-961-4485
NJ	Fairfield, Tech Applications & Mktg.	201-575-4130
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Rochester, Quality Comps.	716-342-7229
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Cincinnati, Steman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-572-0003
OH	Vandilia, Stegman Blaine Mktg.	513-890-7975
OR	Beaverton, L-Squared Ltd.	503-629-8555
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Carrollton, Technical Mktg., Inc.	214-387-3601
TX	Houston, Technical Mktg., Inc.	713-783-4497
TX	Round Rock, Technical Mktg., Inc.	512-244-2291
UT	Salt Lake, R-Squared Mktg.	801-595-0631
WA	Kirkland, L-Squared Ltd.	206-827-8555
WI	Milwaukee, Beta Technlg.	414-543-6609
PR	Hato Rey, Semtronic Assocs.	809-766-0700
Can	Islington, Ont., Pipe Thompson Ltd.	416-236-2355
Can	Kanata, Ont., Pipe Thompson Ltd.	613-591-1821

ECD Direct Sales Offices

CA	Irvine, Fujitsu Microelectronics, Inc.	714-724-1634, FAX:714-724-1709
CA	San Jose, Fujitsu Microelectronics, Inc.	408-922-8900,FAX:408-428-0640
CA	Santa Clara, Fujitus Microelectroincs, Inc.	408-982-1820,FX,408-982-1825
GA	Norcross, Fujitsu Microelectronics, Inc.	404-242-5862,FAX:404-441-2016
IL	Itasca, Fujitsu Microelectronics, Inc.	708-250-8580, FAX:708-250-8591
MA	Waltham, Fujitsu Microelectronics, Inc.	617-487-0029,FAX:617-890-9002
AL	Huntsville, CSR Elctrns., Inc.	205-533-2444
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Chula Vista, Solano Electronica (Sonika)	619-424-9190
CA	Granite Bay, Norcomp	916-791-7776
CA	Irvine, Balzer-Wolf Assoc.	714-261-6877
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Santa Clara, Norcomp	408-727-7707
CO	Boulder, Talisman Assocs.	303-444-7300
CT	Cheshire, Connecticut Applied Tech.	203-272-6564
FL	Altamonte Springs, Semtronic Assocs.	407-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, CSR Elctrns., Inc.	404-396-3720
IL	Highland Park, Bransky Sls.	708-433-2375
IN	Ft. Wayne, Gen II Mktg., Inc.	219-436-4485
IN	Indianapolis, Gen II Mktg., Inc.	317-848-3083
IA	Cedar Rapids, Electromec Sls.	319-393-1637
IA	Marion, A.E.M., Inc.	319-377-1129
KS	Lenexa, A.E.M., Inc.	913-888-0022
KY	Louisville, Gen II Mktg., Inc.	502-491-5250
MD	Towson, Arbotek Assocs.	410-825-0775
MA	Norwell, Norris & Assocs.	617-659-7988
MI	Farmington, R.C. Merchant & Co.	313-476-4600

MI	St. Joseph, R.C. Merchant & Co.	616-983-7378
MN	Burnsville, Electromec Sls.	612-894-8200
MO	St. Louis, A.E.M., Inc.	314-298-9900
NJ	Fairfield, Tech. Appl & Mktg.	201-575-4130
NM	Albuquerque, FP Sls.	505-345-5553
NY	Rochester, H.C. Johnson Agency	716-586-0777
NC	Indian Trail, CSR Elctrns., Inc.	704-882-3995
NC	Matthews, CSR Elctrns., Inc.	704-882-3995
NC	Raleigh, CSR Elctrns., Inc.	919-878-9200
OH	Columbus, Mc Fadden Sls., Inc.	614-761-3177
OH	Madison, Mc Fadden Sls., Inc.	614-761-3177
OR	Beaverton, L Squared Ltd.	503-629-8555
PA	Horsham, Jacobsen Assocs.	215-674-2937
TN	Knoxville, CSR Elctrns., Inc.	615-637-0293
TX	Austin, Technical Mktg., Inc.	512-343-6976
TX	Carrollton, Technical Mktg., Inc.	214-387-3601
TX	Houston, Technical Mktg., Inc.	713-783-4497
UT	Salt Lake City, Hendrickson Sls.	801-467-1445
WA	Kirkland, L Squared Ltd.	206-827-8555
WI	Cedarburg, Bransky Sls.	414-377-6837
PR	Hato Rey, Semtronic Assocs.	809-766-0700
Can	Burnaby, B.C., DMI	604-430-3680
Can	Kanata, Ont., Renmark, Inc.	613-591-9555
Can	Mississauga, Ont., CMT Renmark, Inc.	416-612-0900
Can	Pointe-Claire, Que., CMT Renmark, Inc.	514-694-6088

FUKUSHIMA FUTABA ELECTRIC CO., R.G. Allen Co., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, FAX: 415-927-4548; FSC No.: 5830; Empl.: 48; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond

FURNAS ELEC., 1000 Mckee Street, Batavia, IL 60510, Tel: 708-879-6000, TELEX: 72-0458; Empl.: 1,500; *Sls. Mgr.:* Paul P. Welch

FURY PRODUCTS, Cowden Metal Specialties, 14165 Ramona Ave., Chino, CA 91710, Tel: 909-597-7860, FAX: 909-393-5582; FSC No.: CAGE OJTXO; Empl.: 200; *Sls. Mgr.:* Dan Fury .... **C•1045**

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AL	Huntsville, Shivers Instr.	205-881-7617
AZ	Phoenix, Zeus Elctrns.	602-263-6022
CA	San Jose, Amasco/No.	408-262-1500
CA	Torrance, Amasco/So.	213-781-9494
IL	Glen Ellyn, Lincoln Hodges	708-469-6750
MD	Laurel, CSDS	301-953-7884
MO	Kansas City, Turner Entprs.	816-333-4097
NJ	Woodbridge, Jade Mktg.	908-750-2998
NY	Fairport, Smith Tech. Sls.	716-223-5656
TX	Plano, Milco Mktg.	214-578-1996
WA	Bothell, Quadra Sls.	206-489-3428

FUSES UNLIMITED, D.E.I., 16216 Raymer St., Van Nuys, CA 91406, Tel: 818-786-8111, FAX: 818-786-8222; Empl.: 35; *Dist. Mgr.:* Pat White .... **B•1358**

FUTABA CORPORATION OF AMERICA, Electronic Components Div., 711 East State Pkwy., Schaumburg, IL 60173, Tel: 708-884-1444, FAX: 708-884-1635; Empl.: 50; *Sls. Mgr.:* Julie Bristol, Bill Lichtner; *Dist. Mgr.:* Julie Bristol

FUTURETECH, 525 Auburn St., Auburndale, MA 02166, Tel: 617-965-3834, TWX: 510-600-6663, FAX: 617-332-4760; Empl.: 2

F. W. CAPACITORS INC., 98 Toledo Rd.Hwy. 301 South, Florence, SC 29504-0636, Tel: 803-662-4728, 803-662-4844, FAX: 803-667-6142; FSC No.: 58368; Empl.: 12; *Sls. Mgr.:* Joseph A. (Jay) Falcone Jr.

GABRIEL ELCTRNS. INC., Box 70, Scarborough Indl. Pk., Scarborough, ME 04070, Tel: 207-883-5161, FAX: 207-883-4469; Empl.: 225; *Sls. Mgr.:* D. B. Crisman

GALILEO ELECTRO-OPTICS CORP., Galileo Park, P.O. Box 550, Sturbridge, MA 01566-0550, Tel: 508-347-9191, FAX: 508-347-3849; FSC No.: 28719; Empl.: 360; *Sls. Mgr.:* Robert White

GALIL MOTION CONTROL, INC., 575 Maude Court, Sunnyvale, CA 94086, Tel: 408 746-2300, FAX: 408 746-2315; Empl.: 13; *Sls. Mgr.:* Lisa Wade

GAMMA-F CORP., Vertex Communications, 3111 Fujita, Torrance, CA 90505, Tel: 310-539-6704, FAX: 310-539-7463; FSC No.: (CAGE) 50478; Empl.: 40; *Sls. Mgr.:* Gary R. Peale

FAX: 904-677-3039

GAMMA HIGH VOLTAGE RESCH. INC., 1096 N. U.S. Hwy, No. 1, Ormond Beach, FL 32174, Tel: 904-677-7070; Empl.: 15 .... **D•1706-1709**

Local Sales Offices & Reps

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NM	Albuquerque, Cleveland Entprs.	505-265-7893
TX	Dallas, Airep. Inc.	214-349-4360

GANDALF DATA INC., Gandalf Technologies Inc., 1020 S. Noel Ave., Wheeling, IL 60090, Tel: 708-541-6060, 800-GANDALF, FAX: 708-541-6803; Empl.: 200; *Sls. Mgr.:* Kerry Hawkins

GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

GAP INSTRUMENT CORP., 40 Oser Ave., Hauppauge, NY 11788, Tel: 516-273-0909, FAX: 516-273-0948; FSC No.: 00607; Empl.: 15

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, FAX: 312-847-2314; Empl.: 85; *Sls. Mgr.:* Robert Nesnidal; *Dist. Mgr.:* Robert Nesnidal

GAR ENTERPRISES DBA KGS ELECTRONICS, 418-A E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-574-1175, FAX: 818-574-0553; FSC No.: 16017; Empl.: 60; *Sls. Mgr.:* Nathan Sugimoto

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 909-624-5071, FAX: 909-624-7212; FSC No.: 53101; Empl.: 35; *Sls. Mgr.:* Hal Wolverton, Sls. Mgr.

GARRY ELECTRONICS, WPI, 23 Front Street, Salem, NJ 08079, Tel: 609-935-7603, FAX: 609-935-7555; Empl.: 100; *Sls. Mgr.:* Russ Morgan; *Dist. Mgr.:* Ryon Waddington

GASKET DYNAMICS, INC., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, 215-922-6046, FAX: 609-261-7300; Empl.: 19; *Sls. Mgr.:* William Ivey

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904, FAX: 516-352-2906; Empl.: 5; *Sls. Mgr.:* T. E. Schulz, Jr

GATES ENERGY PRODUCTS, Portable Battery Division, P.O. Box 147114, Gainesville, FL 32614-7114, Tel: 904-462-3911, TWX: 810-836-8500, FAX: 904-462-4726; Empl.: 2500; *Sls. Mgr.:* Don Stucker; *Dist. Mgr.:* Jeff Becker

GATES ENERGY PRODUCTS, Industrial Battery Division, 617 N. Ridgeview Dr., Warrensburg, MO 64093, Tel: 816-429-2165, FAX: 816-429-1758; Empl.: 475; *Sls. Mgr.:* Pat Harvey; *Dist. Mgr.:* Jeff Becker .... **D•1452-1453**

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MA	Stow, Gates Energy Prods.	508-897-6991
NJ	Belle Mead, Gates Energy Prods.	908-281-9707

Local Distributors

CA	Costa Mesa, Battery Specialties	714-755-0888, FAX:714-755-0889
CA	San Diego, Tauber Elctrns., Inc.	619-274-7242, FAX:619-274-2220
CA	San Jose, Rose Elctrns.	408-943-0440, FAX:408-943-0360
CO	Englewood, Kent Elctrns.	303-792-9100, FAX:303-792-3009
GA	Norcross, Engineered Assemblies	404-446-3135, FAX:404-446-3241
IL	Downers Grove, TDI Batteries	708-971-3460, FAX:708-971-3903
IL	Lisle, JaBro Batteries	708-964-9358, FAX:708-964-9081
MA	Sutton, Engineered Assemblies	508-865-0722, FAX:508-865-0723
MN	St. Paul, Kent Elctrns.	612-642-2828, FAX:612-642-1990
NJ	Teterboro, Engineered Assemblies	201-288-4477, FAX:201-288-1515
NC	Raleigh, Engineered Assemblies	919-790-9700, FAX:919-790-0223
OH	Columbus, Promark Elctrns.	614-351-2191, FAX:614-351-2180
OR	Beaverton, Micro Power Elctrns.	503-626-7086, FAX:503-643-1556
TX	Houston, Kent Elctrns.	713-780-7770, FAX:713-978-5892
TX	Stafford, Southwest Elctrns.	713-240-4000, FAX:713-240-5672
Can	Ottawa, Ont., Cantec Sys., Ltd.	613-725-3704, FAX:613-725-0490
Can	Vancouver, B.C., Enercell Technlgs., Inc.	604-298-1181,FAX:604-298-1518

GAVAGAN ELECTRONICS, 121 Old Brookfield Rd., Danbury, CT 06810, Tel: 203-748-5248, FAX: 203-730-9410; Empl.: 11

GAVITT WIRE & CABLE, 20 Central St., Brookfield, MA 01506, Tel: 508-867-6476, FAX: 508-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 40; *Sls. Mgr.:* Robert Heche; *Dist. Mgr.:* Robert Heche

GBC, INC., Lamp Division, P.O. Box 2205, Ocean, NJ 07712, Tel: 908-774-8502, FAX: 908-774-8041; Empl.: 5; *Sls. Mgr.:* C. Applegate

G.C. INDUSTRIES, SafetyTek Corporation, 49050 Milmont Drive, Fremont, CA 94538, Tel: 510-226-1329, FAX: 510-226-1112; Empl.: 12; *Sls. Mgr.:* Bryan Bates; *Dist. Mgr.:* Bryan Bates

GC INTERNATIONAL INC., 1301 Precision Dr., Plano, TX 75074, Tel: 214-423-8411, FAX: 214-423-4550; *Sls. Mgr.:* Hinkki Chen

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, FAX: 815-968-9731; Empl.: 260; *Sls. Mgr.:* Alan Walter, VP Mktg.; *Dist. Mgr.:* Vito Giovingo

GEC-MARCONI ELECTRONIC SYSTEMS CORP., 164 Totowa Rd., P.O.Box 975, Wayne, NJ 07474-0975, Tel: 201-633-6000, FAX: 201-633-6167; FSC No.: 0D0D0; Empl.: 2041; *Sls. Mgr.:* G. Solowey, Dir. Business Dev.; *Dist. Mgr.:* M. Gordon, Dir. Business Dev.

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5555, FAX: 814-349-5657; Empl.: 13

GEC PLESSEY SEMICONDUCTORS, 1500 Green Hills Road, Scotts Valley, CA 95066, Tel: 408-438-2900, FAX: 408-438-5576

GE FANUC AUTOMATION NORTH AMERICA INC., P.O. Box 8106, Charlottesville, VA 22906, Tel: 804-978-5000, 800-648-2001, FAX: 804-978-5205

GEIGER ELECTRONICS, INC., 42A Sandy Hollow Rd., Port Washington, NY 11050, Tel: 516-767-0700, FAX: 516-767-0700; FSC No.: 0JP62

GEMINI INC., 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631, FAX: 507-263-4887; *Sls. Mgr.:* John Weinel .... **C•1046-1047**

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IL	Palatine, JRS Assocs.	708-991-6626
IN	Noblesville, R & D Elctrns.	317-849-2026
IA	Cannon Falls, Gemini Inc.	800-533-3631
KS	Lenexa, Gemini Inc.	913-492-8267
MA	Brookline, Harman Assocs.	617-232-6687
MI	Dearborn, Pitcher-Poulin, Inc.	315-582-5450
MN	Cannon Falls, Gemini Inc.	507-263-3957
NY	Rochester, Gemini Inc.	716-254-0397
NC	Kernersville, Wallace ELctrns. Sls.	800-334-3518
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Plymouth Meeting, Gemini Inc.	215-825-6736
TX	Taylor, Gemini, Inc.	512-352-5207
WI	Wauwatosa, Larsen Assocs.	414-258-0529

GEMS SENSORS DIVISION, Div. of IMO Industries Inc., Cowles Rd, Plainville, CT 06062-1198, Tel: 203-747-3000, FAX: 203-747-4244; FSC No.: 04034; Empl.: 254; *Sls. Mgr.:* Edmund Beldowski; *Dist. Mgr.:* Edmund Beldowski

Local Sales Offices & Reps

CA	Sante Fe Springs, IMO Inds. Inc.	310-868-2268
CT	Rocky Hill, IMO Inds. Inc.	203-563-3737
GA	Atlanta, IMO Inds.Inc.	404-441-1210
OH	Cleveland, IMO Inds. Inc.	216-333-1805
Can	Mississauga, Ont., IMO Inds. (Canada) Inc.	416-564-3344

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENELCO, Division of Bindicator, P.O. Box 610286, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 GENELCO P THY, FAX: 313-987-4476; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

GENERAL AUTOMATION, A Div. of 769442 Ont. Ltd., RR No. 4 McMullen Rd., Kemptville, Ont., Canada KOG 1JO, Tel: 613-724-1993, FAX: 613-258-4701; FSC No.: 1429-1592; Empl.: 4-6; *Sls. Mgr.:* Bruce Murison

GENERAL CABLE CO., Fiber Optics Div., 1 Cragwood Rd., S. Plainfield, NJ 07080, Tel: 201-769-3200, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL CABLE CO., 4 Tesseneer Dr., Highland Hts., KY 41076, Tel: 606-572-8616, FAX: 606-572-9634; *Sls. Mgr.:* Dee Stinnette

GENERAL CHEMICAL CORPORATION, 400 Nichols Road, Pittsburg, CA 94565, Tel: 510-685-1450, FAX: 510-458-9271

GENERAL CONTROLS ELECTRONICS INC., 2350 Brickvale Ave., Elk Grove Village, IL 60007, Tel: 708-595-2152, FAX: 708-595-2271; Empl.: 200; *Sls. Mgr.:* Fritz von Mering

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-0100, Tel: 317-897-7000,1-800-626-9484, FAX: 317-898-2917; Empl.: 275; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley **C•1048**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg., Inc.	205-539-8059
AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Irvine, Groh Assoc.	714-837-9871
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Broomfield, Summit West Mktg.	303-460-9600
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Lighthouse Point, Krutek & Assoc.	305-783-2501
FL	Maitland, Krutek & Assoc.	407-628-4837
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Fishers, R & D Elctrns., Inc.	317-849-2026
IA	Cedar Rapids, Thomas Li Dowell & Assocs.	319-393-7920
KS	Overland Pk., Thomas Li Dowell & Assocs.	913-722-4242
MD	Marriotsville, Carr Assocs., Inc.	410-290-9781
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MA	West Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	South St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NJ	Mountainside, Henry G. Ritcher, Inc.	908-233-4615
NY	Fairport, Henry G. Ritcher, Inc.	716-223-6010
NC	Raleigh, Dixie Tech. Mktg., Inc.	919-859-0025
OH	Cleveland, Electronic Comps., Inc.	216-331-5330
OH	Columbus, Electronic Comps.,Inc.	614-231-2318
OH	Miamisburg, Electronic Comps., Inc.	513-866-3340
OH	Westlake, Electronic Comps.,Inc.	216-835-4856
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Austin, Advance Tech. Sls.	512-467-9209
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001
Can	Kanata, Ontario, Birde Mktg.,Inc.	613-592-5411
Can	Markham, Ontario, Birde Mktg.,Inc.	416-477-7722
Can	Saint Laurent, Quebec, Birde Mktg.,Inc.	514-335-4050
Can	Vancouver, B.C., Birde Mktg., Inc.	604-431-0426

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Livermore, Quail Elctrns., Inc.	510-373-6700
CA	San Diego, Acacia/Deanco	619-597-0577
CO	Wheatridge, Acacia/Deanco, Inc.	303-421-7004
IL	Chicago, Newark Elctrns.	312-784-5100
MA	Westborough, In-Stock Products Co.	508-870-5750
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
TX	Dallas, The Power Connection, Inc.	214-401-3490
Can	Markham,Ontario, Birde Mktg.,Inc.	416-477-7722

GENERAL DIGITAL CORP., 198 Freshwater Blvd., Enfield, CT 06082, Tel: 203-741-7171, FAX: 203-741-7071; Empl.: 50

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bldg. 25BE, Bridgeport, CT 06602, Tel: 203-382-3023, FAX: 203-382-2739; Empl.: 250; *Sls. Mgr.:* J. M. Collins

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* D.E. Allen

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; FSC No.: 1HL38; Empl.: 400; *Sls. Mgr.:* Donald B. Dickerman, Jr.

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL ELECTRONIC MATERIALS TECHNOLOGY, 4431 Corporate Ctr. Dr., Ste. 117, Los Alamitos, CA 90720, Tel: 714-761-5684, FAX: 714-761-8257; Empl.: 12; *Sls. Mgr.:* Jerry Wang; *Dist. Mgr.:* George Olenczuk

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, FAX: 201-239-4258; *Dist. Mgr.:* William W. Lentz

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 548; *Sls. Mgr.:* T.Turco/J.Zielezienski

GENERAL INSTRUMENT, Power Semiconductor Div., 600 W. John St., Hicksville, NY 11802, Tel: 516-933-3333, FAX: 516-933-3881; *Sls. Mgr.:* Tony Solla, Natl. Sls. Mgr.; *Dist. Mgr.:* Robert Graziano

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 30; *Sls. Mgr.:* Michael Lioz

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780, FAX: 516-226-8966; FSC No.: 11332; Empl.: 180

GENERAL POWER CORPORATION, 955 E. Ball Road, P.O. Box 65008, Anaheim, CA 92815, Tel: 714-956-9321, FAX: 714-491-8644; FSC No.: 04801; Empl.: 50; *Sls. Mgr.:* Ernest R. Murillo

GENERAL PROTECTION CO., INC., Circuit Protection Group, 6149 N. Talman Ave., Chicago, IL 60659, Tel: 312-761-0403, FAX: 312-262-9605; Empl.: 15; *Sls. Mgr.:* N.Pierson; *Dist. Mgr.:* N.Pierson

GENERAL RESISTANCE, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 05591; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson, Mktg. VP.; *Dist. Mgr.:* Keith MacDowall **A•1935; D•1264**

All States Not Listed Consult Factory, N. Branford, NJ 203-481-5721

Local Sales Offices & Reps

CA	Mountain View, Saber Entprs.	415-968-0427
NV	Clark County, Dick Cunningham	602-964-8594
TX	Dallas, Inotek	214-243-7000
EXP	Rajajinagar, Banaglore, Elctrns. Continental	366665

Instruments

AZ	Tempe, Dick Cunningham	602-964-8594
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Saber Entprs.	415-968-0427
CO	Littleton, Radco	303-794-4279
CT	Watertown, May Technlg.	203-274-3777
IL	Des Plaines, Marsland Assocs.	708-298-2620
LA	Baton Rouge, Inotek	214-243-7000
MD	Joppa, Please Consult Factory	203-481-5721
MA	Reading, May Technlg.	617-942-7135
MO	St. Louis, Marsland Assocs.	708-298-2620
NJ	Branchville, Consult Factory	203-481-5721
NY	Schenectady, Consult Factory	203-481-5721
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
OH	Dayton, RIXAN Assocs.	513-278-4216
TN	Hixson, Inotek	214-243-7000
TX	Dallas, Inotek	214-243-7000
TX	Plano, Dick Cunningham	602-964-8594
VA	Dumfries, Consult Factory	203-481-5721
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	708-298-2620
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396

Components

AZ	Tempe, Dick Cunningham	602-964-8594
CA	Saratoga (North), TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Brighton, W. R. Hummon & Assoc.	313-486-5333
OH	Dayton, RIXAN Assocs.	513-278-4216
TX	Richardson, Blackburn Assocs.	214-238-8181
VA	Sterling, Beacon North, Inc.	703-478-2480

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING RECORDER PRODUCTS DIVISION, 37 Broadway, Arlington, MA 02174, Tel: 617-641-2702, TELEX: 212838, FAX: 617-648-4906; *Sls. Mgr.:* Patrick Cooney **D•1413**

GENERAL SECURITY INC., 3677 23rd Ave. South, Lake Worth, FL 33461, Tel: 407-533-0064, ESYLNK: 800-572-8989, FAX: 407-547-2844; Empl.: 10; *Sls. Mgr.:* J.N. Benjamin

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; FSC No.: 61666; Empl.: 150; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., GTC, 216 W. Florence Av., Inglewood, CA 90301, Tel: 310-673-8422, FAX: 310-672-2905; FSC No.: IT853; Empl.: 66; *Sls. Mgr.:* Jack Hobb

GENERAL VIBRATIONS MFG. CO., 77 Hilliard St., Manchester, CT 06040, Tel: 203-646-0090, FAX: 203-646-0090; Empl.: 4

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

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CA	Santa Ana, Genicom Corp.	714-549-5101
CT	Suffield, Genicom Corp.	203-668-6530
FL	Bonita Springs, Genicom, Corp.	813-947-5622
VA	Waynesboro, Genicom Corp.	703-949-1666

Local Distributors

AL	Montgomery, Southern Controls Inc.	800-392-5770
CA	San Jose, JACO/Distel Inc.	408-432-9290
CA	Santa Ana, Norstan	800-854-8344
CA	Tustin, JACO/Distel Inc.	714-258-9003

CA	Westlake Village, JACO/Distel Inc.	800-824-0151
FL	Boca Raton, JACO/QC	407-241-7950
FL	Orlando, T & T Prods., Inc.	305-857-2282
GA	Norcross, JACO/QC	404-449-9508
ID	Coeur d'Alene, A-I Consolidated	800-635-1545
MD	Baltimore, Elctrn. Comp. Sls.	301-728-2772
MA	Columbia, JACO Elctrns. Inc.	301-995-6620
MA	Tewksbury, JACO Elctrns. Inc.	508-640-0010
NY	Hauppauge, JACO/Elctrns. Inc.	516-273-5500
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, JACO/QC	919-876-7767
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Electronics Mktg. Corp.	513-439-4711
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Addison, JACO/QC	214-733-4300
TX	Austin, JACO/QC	512-835-0220
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
TX	Sugarland, JACO/QC	713-240-2255
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252

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GENISCO ELECTRONICS, A Division of GTC, 1230 South Lewis Street, Anaheim, CA 92805, Tel: 714-563-4300; FSC No.: 07294; Empl.: 200; *Sls. Mgr.:* Doug Chapman/Tom Hudson .... **A•1641; B•1151**

Local Sales Offices & Reps

AL	Birmingham, Electro-South Inc.	205-822-5713
AL	Huntsville, EMA	205-830-4030
AZ	Phoenix, Mayco	602-867-3076
CA	Claremont, Cook Entprs.	714-626-3997
CA	San Jose, Kottmeier Assoc. Inc.	408-371-8700
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CA	Vista, DJM Elctrns.	619-726-1266
CO	Englewood, R.A. Mays Co.	303-761-9447
GA	Roswell, E M A	404-992-7240
KS	Lenexa, Midtech Assoc.	913-541-0505
MD	Rockville, Computer Power Techlg.	301-251-4717
NH	Brookline, EMC Sls.	603-672-4455
NM	Albuquerque, Mayco	505-299-4002
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
OH	Dayton, Jay Engrg.	513-253-2151
WA	Bellevue, Underwood-Hanify Inc.	206-643-1793

GENNUM CORP., P.O. Box 489, Sta. A, Burlington, ON, Canada L7R 3Y3, Tel: 800-263-9353, 416-632-2996, TELEX: 061-8525, FAX: 416-632-2055; Empl.: 210; *Sls. Mgr.:* Byron Nielsen

GENRAD, INC., 300 Baker Ave., Concord, MA 01742-2174, Tel: 508-369-4400, TELEX: 200272, TWX: 95-1037, FAX: 508-369-6974; Empl.: 1,370; *Sls. Mgr.:* John Bulman, VP. World Sls. Brd. Test

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9501, Tel: 414-644-8700, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

GENSTAR RENTALS, INC., 23901 Calabasas Rd., Ste. 1073, Calabasas, CA 91302, Tel: 800-422-3300, FAX: 818-876-0099; Empl.: 140; *Sls. Mgr.:* Irene E. Tricamo

GENTRAN, Safetytek Corp., 49050 Milmont Dr., Fremont, CA 94538, Tel: 510-226-9343, FAX: 510-226-1112; Empl.: 12

GENTRON CORPORATION

FAX: 602-443-1408

GENTRON CORPORATION, 7345 E. Acoma, Ste. 101, Scottsdale, AZ 85260, Tel: 602-443-1288; Empl.: 50; *Sls. Mgr.:* Rick Heinz .... **B•1504-1506**

GEOPHYSICAL SURVEY SYSTEMS, INC., 13 Klein Dr., North Salem, NH 03073-0097, Tel: 603-893-1109, FAX: 603-889-3984; FSC No.: 02-0278634; Empl.: 55; *Sls. Mgr.:* Thomas J. Fenner

GEOPOWER INC., 50 Spring St., Ramsey, NJ 07446, Tel: TEL:201-236-0156, FAX: 201-236-0224 .... **D•1858**

GEORATOR CORP., 9617 Center Street, Manassas, VA 22110-5512, Tel: 800-523-9938, FAX: 703-368-1078; FSC No.: 91723; *Sls. Mgr.:* Steve Hylton ...... **D•2261-2263**

Local Sales Offices & Reps

AL	Birmingham, Simpson, Kiritsy & Assoc.	205-951-0850,FAX:205-951-0358
CA	Downey, Sierra Indl. Eng. Co.	310-803-6330, FAX:310-803-0617
CA	Fremont, Coherent Automation	510-657-2100, FAX:510-657-2511
CT	Hamden, IMAC Engrg. Sls. Inc.	203-879-3555, FAX:203-879-9137
FL	Altemonte Springs, Machine Controls, Inc.	407-788-6606,FAX:407-862-9380
IL	Arlington Heights, Hill Sls. Corp.	708-255-4400,FX, 708-255-0192
NY	Victor, Controlled Motion Prods. Co.	716-924-3830, FAX:716-924-5458
OH	Dublin, Robert S. Howley Co., Inc.	614-889-1123, FAX:614-889-1146
PA	Jim Thorpe, Brisbane Indl. Dr. Co.	717-325-3684, FAX:717-325-3870
TX	Houston, King Mktg. Assocs. Co.	713-621-6915, FAX:713-621-7917
Can	Waterloo, Ont., Mfrs. Automation Peripheral Prods.	519-746-0401,FAX:519-746-3047

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FAX: 308-235-2609

GEORGE RISK INDUSTRIES, INC., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645; FSC No.: 24229; Empl.: 180; *Sls. Mgr.:* Mary Ann Brothers; *Dist. Mgr.:* Mary Ann Brothers .... **B•1832**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-997-7285
VA	Alexandria, Tech-Reps, Inc.	703-370-2600
CA	Los Altos, W.W. Posey Co.	415-969-7635
CO	Golden, F.J. Hurlbut Co.	303-279-7796
GA	Duluth, Stelmack Comps.	404-441-7927
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Eden Prairie, O'Reilly Assocs.	612-941-6480
NY	Huntington Station, Morgan Elctrns.	516-549-5180
PA	Horsham, Jacobsen Assocs.	215-674-2937

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810-3065, Tel: 508-475-5982, TELEX: 94-7150, FAX: 508-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GERTSCH INSTRUMENTATION DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505, FAX: 216-428-1068

GETTYS CORPORATION, an AEG Company, 2701 N. Green Bay Rd., Racine, WI 53404, Tel: 414-637-6591, TELEX: 201-309, FAX: 414-637-8400; Empl.: 173; *Sls. Mgr.:* Jim Vojtko

GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., PO Box 4356, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 50; *Sls. Mgr.:* Charles A. Ritter

GEYER SYSTEMS, See GSI Corp.

GGB INDUSTRIES, INC., Picoprobe Division, PO Box 10958, Naples, FL 33941, Tel: 813-643-4400, FAX: 813-643-4403; *Sls. Mgr.:* Greg Boll

GHIELMETTI, INC., 30961 Agoura Rd, Ste 311, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-707-1754; Empl.: 4; *Sls. Mgr.:* Rick Odorfer

GIANNINI INSTITUTE, 51-555 Madison St., Indio, CA 92201, Tel: 619-347-2833, FAX: 619-342-4006; FSC No.: 24727; Empl.: 10; *Sls. Mgr.:* Fred P. Ciambrone

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS-NEXES AUTOMATION, Giddings & Lewis, Inc., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54936-1658, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; FSC No.: 8P681; Empl.: 175

GIGA-TRONICS, INC., 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265; *Sls. Mgr.:* Dean Armann, Div. Sls. Mgr.

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GIMIX, INC., 3223 Arnold Lane, Northbrook, IL 60062-2406, Tel: 708-559-0909, FAX: 708-559-0942; Empl.: 14; *Sls. Mgr.:* Robert Phillips

GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, FAX: 201-768-2947; FSC No.: 22-2209693; Empl.: 130; *Sls. Mgr.:* Gerald C. Walsh

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GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 708-634-6080, 800-323-5350, FAX: 708-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

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GLENTEK, INC., 208 Standard St., El Segundo, CA 90245, Tel: 310-322-3026 .... **B•1262-1264**

GLOBAL COMPONENTS & CONTROLS, 3301-B Fairmont Ave., Wanamassa, NJ 07712-4010, Tel: 908-389-1470, FAX: 908-389-5284; Empl.: 4; *Sls. Mgr.:* John M. Chapski

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 50; *Sls. Mgr.:* Rachael Fernicola; *Dist. Mgr.:* Rachael Fernicola

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, FAX: 513-229-8531; Empl.: 580; *Dist. Mgr.:* Derek Keegan

GLOBETRON ELECTRONICS CORP., 3175 Dundas St. West, Oakville, Ont., Can L6J 4Z3, Tel: 416-825-1335, 1-800-800-4606, FAX: 416-825-0475; Empl.: 4; *Sls. Mgr.:* Alan Montgomery

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GLOBTEK, INC., 186 Veterans Drive, Northvale, NJ 07647, Tel: 201-784-1000, FAX: 201-784-0111; Empl.: 20; *Sls. Mgr.:* Tom Devaney; *Dist. Mgr.:* Bob Siepmann .... **C•1340, 1748; D•1730-1732**

Local Sales Offices & Reps

CA	La Mesa, Tektris Electro Corp.	619-697-4563
CO	Boulder, The Stratford Grp.	303-530-3194
CT	Ridgefield, Harbor Elctrns.	203-438-9625
FL	Valrico, Unirep, Inc.	813-681-3477
GA	Suwanee, Overton Assocs.	404-497-0166
IL	Chicago, Meca Sls.	312-334-4020
MD	Lisbon, S. K. MacDonald	301-982-1088
MI	Howell, Great Lakes Comp.	517-548-9100
NH	Amherst, Bennetron	603-880-7008
NJ	Bay Head, Cuccaro Co.	903-892-2511
NC	Raleigh, Bestec	919-790-8988
OH	Dayton, Thompson and Assoc.	513-435-7733
OR	Beaverton, Unicomp	503-643-1645
TN	New Tazewell, Overton Assocs.	615-626-6009
TX	Dallas, Exel Tech	214-239-3935
WA	Spokane, DES Elctrns.	509-922-2971

GLOLITE SALES LTD/GLOWLITE DIV., See Advanced Rubber Concepts

GME SYSTEMS, INC., 12300 Perry Highway, Pittsburgh, PA 15090, Tel: 412-935-0440, FAX: 412-935-9640; Empl.: 7; *Sls. Mgr.:* Bjorn Karlstrom; *Dist. Mgr.:* Raymond Rebholz

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GML CHIP COMPONENTS LIMITED, Hig, Phasell, Block 2 Flat 16 Baghlingampally, Hyderabad A.P., India 500 044, Tel: (91) 842-660106,661593, TELEX: 0425-2105 GML IN, FAX: (91) 842-661484; Empl.: 50

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, FAX: 206-284-3705; Empl.: 350; *Sls. Mgr.:* Gerry Gallagher .... **B•1836-1837; C•1665**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Irvine, Balzer-Wolf Assoc.	714-261-6877
CA	San Jose, GM Nameplate, Inc.	408-435-1666
CO	Englewood, Delltron	303-741-2122
FL	Orlando, Comp. Sls.	407-823-7480
HI	Honolulu, Menehune Unltd.	808-737-3472
ID	Eagle, GM Nameplate	208-939-7202
IL	Elmhurst, Utronix	708-834-1100
IN	Zionsville, Custom Engineered Parts, Inc.	317-873-5626
MI	Southfield, Ebling Entprs.	313-647-0330
MN	Burnsville, Electromec Sls., Inc.	612-894-8200
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mont Vernon, GM Nameplate, Inc.	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Akron, Augnat Assocs.	216-239-2499
OR	Portland, GM-Portland	503-223-9879
PA	Robinson Township, Allied Entrprs.	412-788-2992
TX	Dallas, Comp. Technlg.	214-783-8831
VA	Reston, Colrud Corp.	703-904-0240
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Monterrey, NL, Meixco, Grupo Etimex	83 43-00-41
EXP	Singapore, S & T Entprs.	065-745-9235
Can	Calgary, Alberta, Enerlec Sls. Ltd.	403-256-3627
Can	Richmond, BC, Enerlec Sls. Ltd.	604-273-0882

GMR CO., 804 Main St., Venice, CA 90291-3218, Tel: 310-399-1490, TELEX: 499 2468, FAX: 310-399-1901; Empl.: 62; *Sls. Mgr.:* Harvey Mushman

GMW

FAX: 415-368-0816

GMW ASSOCIATES, P.O. Box 2578, Redwood City, CA 94064, Tel: 415-368-4884; Empl.: 7; *Sls. Mgr.:* Ian Walker .... **B•1950-1951; D•1260-1263**

GPE

FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St., Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* James Au; *Dist. Mgr.:* James Au .... **D•1030-1032, 1734-1735**

Local Sales Offices & Reps

CA	Garden Grove, ELSCO Elctrns	714-891-4621
CA	Norwalk, Ed Rivers Assocs.	310-868-1471
CA	San Jose, Applied Eltcrns Mktg	408-441-9610
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Arlington Heights, M.J. Peterson & Assocs.	708-577-8200
MN	Maple Grove, Electronic Prods. for Ind.	612-493-3346
NJ	Wayne, Breen Assocs	201-696-8683
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
PA	Pittsburgh, K-T Mktg.	412-367-1011
TX	Richardson, Jim D. Gray & Assoc.	214-699-9976
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
Can	Ottawa, Ont., Current Mktg.	613-224-4811

GOLDEN POWER SYSTEMS, INC., 2125-B Madera Rd., Simi Valley, CA 93065, Tel: 805-582-4400, FAX: 805-582-3230; Empl.: 550; *Sls. Mgr.:* Mark Richey

GOLDSTAR PRECISION CO. LTD., Lucky Goldstar, 13013 E. 166th St., Cerritos, CA 90701, Tel: 310-404-0101, FAX: 310-921-6227; Empl.: 12; *Sls. Mgr.:* Reginald Bale; *Dist. Mgr.:* Reginald Bale

GOLDSTAR TECHNOLOGY, INC., 3003 N. First St., San Jose, CA 95134, Tel: 408-432-1331, FAX: 408-432-6053

GOOD-ALL ELECTRIC, INC., 3725 Canal Drive, Fort Collins, CO 80524, Tel: 303-484-3080, 800-826-7891, TWX: 910-930-9015, FAX: 303-484-8649; FSC No.: 22096; Empl.: 135; *Sls. Mgr.:* Sandi K. Salvhus

GORDON BRUSH MFG. CO., INC., 2150 Sacramento St., Los Angeles, CA 90021-1786, Tel: 213-627-6889, FAX: 213-623-4397; FSC No.: 17987; Empl.: 35

J. GORDON ELECTRONIC DESIGN, INC., 7671 Central Ave. NE, Minneapolis, MN 55432, Tel: 612-786-2405, FAX: 612-786-5778; Empl.: 3; *Sls. Mgr.:* Jim Hogenson

GORDON INSTRUMENTS, INC., 3645 California Rd., Orchard Park, NY 14127, Tel: 716-662-5353, 1-800-333-2672, FAX: 716-662-7839; Empl.: 20; *Sls. Mgr.:* John Savage

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 410-539-6537, FAX: 410-625-7510; Empl.: 150

GORDON PRODUCTS, 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501, FAX: 203-775-1162; Empl.: 45; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

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GORDOS, Crouzet Corp., 3237 Commander Dr., Carrollton, TX 75006-2506, Tel: 214-250-1647, 1-800-677-5311; *Sls. Mgr.:* Bill Wiberg .... **A•1695; B•1458-1463; D•1182-1183**

Local Sales Offices & Reps

AZ	Scottsdale, Jeff Miller	602-948-0751
CA	Costa Mesa, Automation Control & Data Inc.	714-751-6760,FAX:714-751-0726
CA	San Diego, Automation Control & Data Inc.	619-674-5811
CT	Westbrook, John Brewer	203-399-7311
GA	Marietta, Levine Lectronics	404-565-1556
IL	Schaumburg, Eric Pfister	708-885-5696
IN	Indianapolis, HI-Tek Sls. Co.	317-887-2564, FAX:317-888-6476
IA	W. Des Moines, HDI, Ltd.	515-225-3777
KS	Lenexa, Midtec Assocs.,Inc.	913-541-0505, FAX:913-541-1729
MA	Burlington, Anacon Sls. Assocs.	617-272-9080,FX, 617-272-9102
MN	St. Paul, Johnson Co.	612-429-2544
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Budd Lake, Guido Assocs.	201-347-4643, FAX:201-691-1468
NM	Albuquerque, Syntech	505-266-7051, FAX:505-266-7953
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507,FAX:513-434-5772
OH	Cleveland, Omega Sls., Inc.	216-360-9400, FAX:216-360-0712
OH	Powell, Jack Matthews	614-766-1932
OR	Portland, Control Devices Northwest	503-659-3216
PA	Valley Forge, Providence Mktg. Assocs., Inc.	215-935-3300,FAX:215-935-3387
TX	Dallas, Crouzet Corp.	214-250-1647
WA	Bellevue, Control Devices Northwest	206-451-8552
Intl	AR Rogers, Gordos	501-636-5000
Can	Montreal, Que., Crouzet Corp.	514-735-7926

Local Distributors

CA	Santa Monica, Master Distrs.	310-452-1229
IL	Chicago, Newark	312-784-3670
MA	Peabody, Time Elctrns.	508-532-6200
NJ	Oakland, Relay Specs.	201-337-1000
OH	Cincinnati, Aetna Elec.	513-871-8338
PA	Willow Grove, C.A. Briggs Co.	215-784-9250
SC	Columbia, Resources Elctrns.	803-779-5332
WI	Waukesha, Powermation	414-523-0600

W. L. GORE & ASSOCS., INC., 4747 E. Beautiful Lane, Phoenix, AZ 85044, Tel: 602-431-0077, FAX: 602-431-1512

W.L. GORE & ASSOCS., 555 Paper Mill Rd., Newark, DE 19714, Tel: 302-738-4880, TWX: 510-666-0825, FAX: 302-738-7710; Empl.: 2000; *Sls. Mgr.:* Daniel D. Johnson

W.L GORE & ASSOCIATES, INC., 1505 North Fourth St., P.O. Box 3000, Flagstaff, AZ 86003-3000, Tel: 602-526-3030, 1-800-344-3644, FAX: 602-526-2919; FSC No.: 60622; *Sls. Mgr.:* Jerry H. Johnson; *Dist. Mgr.:* Jerry H. Johnson

GORMAN MACHINE CORP., 7 Burke Dr., Brockton, MA 02401, Tel: 508-588-2900, FAX: 508-588-9560; Empl.: 25; *Sls. Mgr.:* Kenneth P. Gorman

GORMAN-REDLICH MFG. CO., 257 W. Union St., Athens, OH 45701, Tel: 614-593-3150, FAX: 614-592-3898; Empl.: 4; *Sls. Mgr.:* Jim Gorman

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FAX: 619-598-9828

GOSSEN/TEXMATE, 995 Park Center Dr., Vista, CA 92083-8397, Tel: 619-598-9899, 1-800-394-8344 .... **D•1145, 1204-1205, 1372-1387, 1965**

Local Sales Offices & Reps

Can	Toronto, Ont., R.H. Nichols	416-851-8871

Local Distributors

CA	Duarte, Pathfinder	818-357-1890
CA	Laguna Hills, Hill House	714-951-1048
CA	Palo Alto, Priz-Co.	415-493-8600
CA	San Bruno, Control Tech.	415-593-2111
CO	R&R Instrmn.	303-340-8728
IL	Algonquin, Marshall Wolf	708-658-8130
IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MI	Highland Pk., Marsh Instrs.	313-869-9200
MN	New Brighton, J & W Instrs.	612-784-5708
MT	Billings, Kirst Engrg.	406-656-9570
NJ	Landing, PC & S	201-398-5843
NJ	Marmora, Brooks Tech., Inc.	609-390-2380
NY	E. Syracuse, Liberty Elctrns.	315-437-8100
NC	Statesville, Statesville Process Instrs.	704-873-1835
OR	Portland, HIS Elctrns.	503-643-5648
PA	Bridgeville, Norton Equip. Comp.	412-221-3131
PA	Wayne, Mainline Instrs.	215-687-5307
TN	Knoxville, Southeastern Automation Grp.	615-675-3080
TX	Houston, Talon Tech. Sls.	713-999-8588
TX	Houston, The Metershop of Texas	713-957-8586
TX	Lewisville, KSE-Texas	800-594-2121
TX	Odessa, Whitlock Instrs Repair	915-337-3412
UT	Sandy, Industrial Instrs.	801-566-2980
WA	Bellevue, Eustis Comp.	206-451-0700
WI	Milwaukee, Gordon Hatch Co.	414-671-6550
PR	San Juan, Tomas Cuerda, Inc.	809-758-7830

GO SWITCH, P.O. Box 37290, Louisville, KY 40233, Tel: 502-969-2386, FAX: 502-969-5911; Empl.: 60; *Sls. Mgr.:* David Lambert; *Dist. Mgr.:* David Lambert

GOULD INC., Corporate Headquarters, 35129 Curtis Blvd., Eastlake, OH 44094, Tel: 216-953-5000, TELEX: 687-3157, FAX: 216-953-5050; Empl.: 8000

POWERDEX®

FAX: 216-953-5152

GOULD INC., Electronic Power Sources, 35129 Curtis Blvd., Eastlake, OH 44095-4001, Tel: 1-800-722-7890 .... **D•1454**

Local Sales Offices & Reps

OH	Eastlake, Gould Inc., Power Sources	800-722-7890

GOULD INC., FOIL DIV, Gould Inc., 35129 Curtis Blvd., Eastlake, OH 44095, Tel: 216-953-5000, FAX: 216-953-5174; Empl.: 15; *Sls. Mgr.:* John P. Callahan

GOULD INC., Test and Measurement Group, 8333 Rockside Rd., Valley View, OH 44125, Tel: 216-328-7000, TELEX: 196113GLD RS UT, FAX: 216-328-7400; FSC No.: 96795; Empl.: 550; *Sls. Mgr.:* C. Nazelli, Sls. V.P.

GOULD SHAWMUT, 374 Merrimac St., Newburyport, MA 01950, Tel: 508-462-6662/3131, FAX: 508-465-6419; FSC No.: 71424; *Sls. Mgr.:* Edward Calhoun

GOWANDA ELECTRONICS CORP., 1 Industrial Pl., Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211, FAX: 716-532-2702; FSC No.: 24226;15305; Empl.: 250; *Sls. Mgr.:* H.F. Gearhart; *Dist. Mgr.:* H.F. Gearhart .... **A•1239-1241**

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	205-837-8395
AZ	Mesa, Sys. Sls. of AZ Inc.	602-464-9989
NM	Albuquerque, Sys. Sls. of N.M.	505-889-2901
CA	Fremont, Ed Blake Assocs.	510-770-9058
CA	San Diego, Earle & Assocs.	619-278-5441
CA	Torrance, Orion-Eclipse	213-326-0999
CO	Parker, Parker-Webster Co.	303-841-4888
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Palatine, Key Entpr.	708-991-2144
IA	Cedar Rapids, Gavin Sales	319-366-1229
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	N. Reading, Lincoln Assocs.	508-664-6800
MI	Madison Heights, D.E.M. Sls.	313-583-1500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NY	Manhasset, Win-Cor Elctrn.	516-627-9474
NY	Pittsford, Andres Comps.	716-385-3818
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-572-0003
PA	Exton, Linear Sls.	215-524-8080
TX	Richardson, Texoma Tech. Sls.	214-238-8127
UT	Murray, Parker-Webster Co.	801-266-9939
WA	Olympia, Bergford & Assocs.	206-866-2001
WI	Milwaukee, Key Entpr.	414-762-2323
Can	St. Laurent, Componetics	514-331-9930

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
CA	Chatsworth, Passive Comps.	818-700-8838
NJ	E. Brunswick, Brothers Electrns.	201-238-2200
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Stanton, Inductive Comps.	714-828-3420
CT	Bridgeport, Park Distributors	203-366-7200
FL	Ft. Lauderdale, Component Distrs.	800-558-2351
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Chanhassen, G&F Distribution	612-934-2907
NY	Hauppauge, Broadline Electric	516-231-4100
PA	Exton, VSH Elctrns.	215-363-2250
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
Can	Pointe Claire, Que., Ferrotronics	514-426-0300

GOW-MAC INSTR. CO., P.O. Box 32, Bound Brook, NJ 08805-0032, Tel: 908-560-0600, TELEX: 833-174, FAX: 908-271-2782; Empl.: 52; *Sls. Mgr.:* Jeff Lawson

G P BATTERIES USA, Gold Peak International Ltd., 2772 Loker Ave. West, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 30; *Sls. Mgr.:* Gregg Kuehn; *Dist. Mgr.:* Bryan Myers

GP:50 NEW YORK, 2770 Long Rd., Grand Island, NY 14072, Tel: 716-773-9300, FAX: 716-773-5019; Empl.: 26; *Sls. Mgr.:* Pat Murphy

GP TRAINING SYSTEMS, GPS Technologies, Inc., 76 Robinson St., Pottstown, PA 19464, Tel: 215-327-8800, FAX: 215-327-1158; Empl.: 1681; *Sls. Mgr.:* Richard Smith; *Dist. Mgr.:* Stacey Jarlsberg

GRADO LABORATORIES, 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340, FAX: 718-633-6941

GRAFOPLAST S.P.A., Wiremarkers, 13, Via Arrivabene, Genova, Italy 16154, Tel: ò10. 621687, TELEX: ò283828, FAX: ò10. 674448; Empl.: 45; *Sls. Mgr.:* Giorgio Patrone

GRAHAM ELECTRONIC MANUFACTURING INC., 109-State Pl., Escondido, CA 92025, Tel: 619-747-9177, 800-628-4095, FAX: 619-747-9326; Empl.: 14; *Sls. Mgr.:* Samuel L. Band

GRALEX INDUSTRIES, 70 Oak St., Ste. 204, Norwood, NJ 07648, Tel: 800-486-4499, FAX: 201-767-7015; FSC No.: 11332; Empl.: 15; *Dist. Mgr.:* Jan Noothout .... **D•1353**

Local Sales Offices & Reps

CA	San Leandro, Coast	415-483-3774
IL	Franklin Park, Alca	708-451-6644
NJ	Norwood, Gralex Inds., Inc.	800-486-4499

Local Distributors

AZ	Phoenix, Metermaster	602-243-4111
AZ	Tempe, CMI Metermaster	602-431-0880
CA	Los Angeles, Crompton Metermaster	714-921-2101
CA	Los Angeles, Metermaster	213-685-4340
CA	Palo Alto, CMI Metermaster	415-960-8500
CA	Palo Alto, Metermaster	415-968-0313
GA	Atlanta, Metermaster	404-446-0166
GA	Atlanta, Metermaster	404-446-0188
IL	Chicago, Metermaster	312-593-8650
IL	Glendale Hgts., Crompton Metermaster	312-351-4554
MA	N.Billerica, Electra Test, Inc.	508-667-8541
MA	Waltham, Calibron Instrs.	617-894-6440
NJ	Somerset, CMI Metermaster	201-271-1277
NY	Great Neck, Instrument Mart	516-487-7430
OH	Cleveland, Crompton Metermaster	216-651-4100
TX	Dallas, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631

GRAND TRANSFORMER, INC., 1500 Marion St., Box 799, Grand Haven, MI 49417, Tel: 616-842-5430, FAX: 616-842-1780; Empl.: 125; *Sls. Mgr.:* Ted Jackson; *Dist. Mgr.:* G. V. Retzlaff, Exp. Sls. Mgr.

GRAPHICODE, INC., 19101 36th Ave. W., Ste.204, Lynnwood, WA 98036, Tel: 206-672-1980, FAX: 206-672-2705; Empl.: 5; *Sls. Mgr.:* Douglas M. Pratt

GRAPHICS MICROSYSTEMS, INC., 10375 Brockwood Rd., Dallas, TX 75225, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Eddie Deering

GRAPHITE METALLIZING CORP., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, Tel: 914-968-8400, TELEX: 13-1571, FAX: 914-968-8468; Empl.: 178; *Sls. Mgr.:* E. Walker .... **B•1265**

Local Sales Offices & Reps

OR	Beaverton, Graphite Metallizing	503-646-9964

GRASEBY INFRARED, Graseby PLC, 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50

GRASSLIN CONTROLS CORP.:GRASSLIN GMBH & CO., K.G., 24 Park Way, Upper Saddle River, NJ 07458, Tel: 201-825-9696, FAX: 201-825-8694; Empl.: 7; *Sls. Mgr.:* Gene K. Manghi

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 708-354-1040, FAX: 708-354-2820; FSC No.: 5930; Empl.: 615; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel .... **B•1507, 1729-1733, 1833; C•1341**

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Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	Irvine, Quadrep Southern Inc.	714-727-4222
CA	San Jose, Quadrep, Inc.	408-432-3300
CO	Denver, Lindberg Co.	303-758-9033
CT	Branford, Coakley Boyd & Abbett	203-481-2218
FL	Clearwater, Sunland Assocs.	813-536-2955
FL	Lauderhill, Sunland Assocs.	305-748-1303
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Tucker, Rep, Inc.	404-938-4358
IL	Itasca, LTD Elctrns.	708-773-2900
IN	Ft. Wayne, Menze Sls.	219-747-5616
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Gaithersburg, Naudain Assocs. Southern	301-258-5040
MA	Framingham, Coakley Boyd & Abbett	508-820-0800
MI	Royal Oak, Hilltronics Inc.	313-435-0920
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	Florissant, Spectrum Sls.	314-921-1313
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Hackensack, Coakley Boyd Abbett/Metro Div.	201-440-4114
NJ	Marlton, Naudain Assocs.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wantagh, Coakley Boyd Abbett	516-783-4102
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Morrisville, Reps, Inc.	919-469-9997
OH	Centerville, Bear Mktg. Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OR	Tigard, Eltech, Inc.	503-684-3458
PA	Allison Park, Bear Mktg.	412-492-1151
TN	Jefferson City, Rep, Inc.	615-475-9012
TX	Austin, Fralia & Co.	512-835-7911
TX	Euless, Fralia & Co.	817-267-3577
TX	Houston, Fralia & Co.	713-772-1572
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Eltech, Inc.	206-643-4330
WI	Mequon, Badgerep	414-241-9200
Can	Burnaby, BC, A.C. Simmonds & Sons Ltd.	604-451-9488
Can	Nova Scotia, A.C. Simmonds & Sons Ltd.	902-865-1889
Can	Pickering, Ont., A. C. Simmonds & Sons Ltd.	416-839-8041
Can	Ville LeMoyne, Quebec, A.C. Simmonds & Sons Ltd.	514-466-5250

Local Distributors

AL	Birmingham, Regan Controls	205-664-2877
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, LCOMP Inc.	602-730-1633
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Garden Grove, Richey/Impact Elctrns.	800-421-7258
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Inglewood, Newark Elect.	213-671-7377
CA	Los Angeles, Electric Switches	213-660-1310
CA	Mission Viejo, Distributed Motion	714-855-9902
CA	Novato, Westech Automation	415-382-2577
CA	Riverside, Electronic Supply	714-683-7300
CA	San Diego, Electronic Supply	619-693-8222
CA	San Diego, Richey/Impact Elctrns.	619-271-4511
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Francisco, Westech Automation	415-563-9876
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Richey/Impact Elctrns.	408-956-8010
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Tustin, Time Elctrns.	714-669-0216
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Denver, CSID, Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Kent/Shelley Ragon, Inc.	303-792-9100
CO	Englewood, Motion Solutions	303-792-5518
CO	Englewood, Time Elctrns.	303-721-8882
CT	Southbury, Time Elctrns.	203-271-3200
CT	Southington, Electro Mechanical Drives, Inc.	203-621-7335
CT	Wallingford, Sager	203-265-4600
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Orlando, Hammond Elctrns., Inc.	407-849-6060
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Peerless Radio	305-973-4141
GA	Duluth, Pioneer Technlgs./Georgia	404-623-1003
GA	Norcross, Hammond Elctrns., Inc.	404-449-1996
GA	Norcross, Time Elctrns.	404-368-0969
ID	Meridian, Pacific Control Sply.	208-286-7404
IL	Batavia, Control Source	708-406-0880
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Palatine, Ohm Elctrn.	708-359-5500
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Meunier Elctrn. Supp., Inc.	317-635-3511
IN	Indianapolis, Pioneer Standard	317-573-0880
IN	Indianapolis, Process Automation Devs.	317-879-1100
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Pk., Olive Elctrns.	913-362-1923
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Baltimore, Resco/Baltimore	410-931-8200
MD	Columbia, Sager Elctrns. Sply.	410-995-4900
MD	Columbia, Time Elctrns.	410-964-3090
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Peabody, Time Elctrns.	508-532-9900
MA	Westborough, Powell Elctrns.	508-366-6100
MI	Grand Rapids, Pioneer Standard	616-698-1800
MI	Livonia, Pioneer/STD Elctrns.	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Oak Park, Newark/Detroit Elctrns.	313-967-1570
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Electrol, Inc.	612-521-5051
MN	Minneapolis, Newark Elec.	612-331-6350
MN	St. Paul, Gopher Elctrns.	612-490-4900
MN	St. Paul, Kent/Shelley-Ragon, Inc.	612-642-2828
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MO	Kansas City, LComp, Inc.	816-241-0111
MO	Kansas City, Missouri Valley Elctrl.	816-471-5308
MO	Manchester, Time Elctrns.	314-391-6444
MO	Maryland Hgts., LComp, Inc.	314-291-6200
MO	Maryland Hgts., Olive Elctrns.	314-997-7709
NE	Omaha, Electrol, Inc.	402-691-0662
NH	Merrimack, Brevan Elctrns., Inc.	603-429-1900
NH	Salem, Sager Elect. Sply, Inc.	603-898-1348
NJ	Cliffwood, Federated Purch.	908-290-2900
NJ	Marlton, JRH Elctrns.	609-988-8696
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	West Berlin, General Comps.	609-768-6767
NY	Albany, Kom Lamb, Inc.	518-869-8746
NY	Amherst, Kom Lamb, Inc.	716-691-6400
NY	Binghamton, Pioneer STD Elctrns.	607-722-9300
NY	Buffalo, Summit Distrs.	716-887-2800
NY	East Syracuse, Time Elctrns.	315-432-0355
NY	Fairport, Pioneer-Standard Elctrns., Inc.	716-381-7070
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Kom Lamb, Inc.	716-323-1410
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Kom Lamb, Inc.	315-455-7436
NC	Cary, Powell Elec.	919-467-1212
NC	Charlotte, Regan Controls	704-523-9137
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Regan Controls	919-790-0811
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Cleveland, Pioneer STD Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Pioneer STD Elctrns.	513-236-9900
OH	Dayton, Stotts-Friedman Co., Inc.	513-298-5555
OH	Twinsburg, Exonic Sys.	216-425-2100
OH	Valley View, Newark Elect. Cleveland	216-447-8860
OH	Willoughby, Gateway Megatech	216-953-0333
OH	Youngstown, Brenner Indl. Sls.	216-788-8888
OK	Tulsa, Norvell	918-628-1916
OR	Beaverton, Component Resources	503-641-8488
OR	Eugene, Pacific Control Sply	503-342-7294
OR	Portland, Pacific Control Supply, Inc.	503-249-2033
OR	Portland, Radar Elec. Co.	503-232-3404
OR	Portland, Time Elctrns.	503-626-2979
PA	King of Prussia, Applied Controls, Inc.	215-265-3832
PA	Mars, Sager Elect. Supply Co.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Powell Elctrns.	215-365-1900
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PA	Pittsburgh, Exonic Sys.	412-967-9600
PA	Pittsburgh, Pioneer STD Elctrns. Inc.	412-782-2300
PA	Trevose, Bell Inds. Inc.	215-953-2800
RI	Pawtucket, Major/Edwards	401-725-7400
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SC	Columbia, Resource Elctrns.	803-779-5332
SC	Gaffney, Newark Elect. Gaffney	803-487-3739
TN	Knoxville, Tennessee Armature & Elect. Co.	615-524-3681
TN	Memphis, The Genie Grp.	901-360-0200
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Harrison Equip.	214-239-2750
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Stuart C. Irby Co.	214-934-3300
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elect.Houston	713-270-4800
TX	Houston, Norvell Elctrns.	713-462-1666
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, Motion Dynamics, Inc.	214-690-3488
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	West Valley, Time Elctrns.	801-973-8494
VA	Midlothian, Assocsiated Technlgs.	804-794-6094
WA	Kent, Component Resources, Inc.	206-454-8666
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Cascade Controls	206-881-8843
WA	Seattle, Radar Elect. Co., Inc.	206-282-2511
WI	Appleton, Doig Corp.	414-735-9155
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Classic Comps.	414-786-5300
WI	Thiensville, Doig Corp.	414-242-3256
Can	Burnaby, BC, ITT Multicomps.	604-421-6222
Can	Calgary, AL, Cardinal Ind'l. Elect.	403-259-6817
Can	Concord, Ont., ITT Multicomps.	416-798-4884
Can	Don Mills, Ont., Saynor Varah, Inc.	416-445-0723
Can	Edmonton, AL, Cardinal Ind'l. Elect.	403-483-6266
Can	Montreal, Que., Elctrn. Wholesalers	514-769-8851
Can	Ottawa Ont., Wackid Radio TV Labs	613-728-1821
Can	Richmond BC, Electrosonic, Inc.	604-273-2911
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GREENRAY INDS., INC., 840 W. Church Rd., Mechanicsburg, PA 17055, Tel: 717-766-0223, TWX: 510-650-4939, FAX: 717-790-9509; FSC No.: 16681; Empl.: 40

GREENSPRING COMPUTERS, INC., 1204 O'Brien Drive, Menlo Park, CA 94025, Tel: 415-327-1200, FAX: 415-327-3808; Empl.: 15

GREENWICH INSTRUMENTS USA, 3401 Monroe Rd., Charlotte, NC 28205, Tel: 704-376-1021, FAX: 704-335-8707; *Sls. Mgr.:* Cynthia Rider; *Dist. Mgr.:* Bruce Magruder

GREIBACH INSTRUMENTS DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590; Empl.: 35

THE GRIEVE CORPORATION, 500 Hart Rd., Round Lake, IL 60073-9989, Tel: 708-546-8225, TELEX: 72-2436, FAX: 708-546-9210; Empl.: 120; *Sls. Mgr.:* Frank Calabrese

GRM CORP., See Grim Corp.

GRIM CORPORATION, See Telegenix/GRIM Corp.

GRUENBERG OVEN CO., P.O. Box 3246, 2121 Reach Rd., Williamsport, PA 17701, Tel: 717-326-1755, TELEX: 350079; Empl.: 140; *Sls. Mgr.:* Stuart Lunick

GRUNER, Advanced Components Industries, Inc., 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060, FAX: 310-328-0062; *Sls. Mgr.:* Irma Spreitzer .... **B•1403**

Local Sales Offices & Reps

IL	Shaumburg, Terry McNulty & Assocs.	708-980-9868
MA	Hopkinton, Berkshire Elctrns., Inc.	508-435-9356

GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024, Tel: 313-476-7875, FAX: 313-496-7249; Empl.: 105; *Sls. Mgr.:* Ed Leininger

GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 410-252-1768, FAX: 410-561-1768; FSC No.: 60990; Empl.: 50; *Sls. Mgr.:* T.B. Weadock .... **C•1749-1751**

Local Sales Offices & Reps

AL	Huntsville, DTM, Inc.	205-539-8059
AZ	Tempe, EDS	602-438-1547
CA	Bonita, The Bryson Co.	619-428-2788
CA	Canoga Pk., GLM	818-346-0224
CA	Pleasanton, Advanced Tech. Sls.	510-847-2060
FL	Miami, SMI	305-387-5955
FL	Orlando, SMI	407-856-4140
FL	Tampa, SMI	813-933-5833
GA	Duluth, DTM, Inc.	404-381-5592
IL	Cary, J. D. Noble & Assocs., Inc.	708-639-2440
MA	Clinton, CWS, Inc.	508-368-8753
MN	Eden Prairie, Aldridge Assocs. Inc.	612-944-8433
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
NY	Pittsford, CCS, Inc.	716-383-0546
NC	Raleigh, DTM, Inc.	919-859-0025
NY	Syracuse, CCS Inc.	315-488-1250
TX	Allen, EDS	214-924-3753

GTE CONTROL DEVICES, INC., Route 35, P.O. Box 175, Standish, ME 04084, Tel: 207-642-4535, FAX: 207-642-0198; Empl.: Over 1,000; *Sls. Mgr.:* David Brown, Mktg. Mgr.; *Dist. Mgr.:* L.Smith

GTE ELECTRONIC REPAIR SERVICES, GTE Supply, GTE Pl. D03C39, West Airfield Dr., D/FW Airport, TX 75261, Tel: 214-615-7590, FAX: 214-456-3366

GTE GOVERNMENT SYSTEMS CORP., P.O. Box 7188, Mountain View, CA 94039, Tel: 415-966-2000, TWX: 910-379-6948, FAX: 415-966-2303; Empl.: 2,500; *Sls. Mgr.:* Evan S. Baker; *Dist. Mgr.:* Evan S. Baker

GTE PRODUCTS CORPORATION, Miniature Lighting Products, West Main Street, Hillsboro, NH 03244, Tel: 603-464-5533, 603-464-5538

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GTE SYLVANIA, INC., STANDISH, ME, See Sylvania GTE Control Devices

GTE TESTMARK LABS, GTE Industry Sls., 700 Hidden Ridge, Irving, TX 75015, Tel: 214-718-7124, FAX: 214-718-1473; Empl.: 60; *Sls. Mgr.:* Clifton E. Miller

GTI/ELECTRONICS DIV., 2426 Perry Highway, Hadley, PA 16130-8815, Tel: 412-253-3161, FAX: 412-253-3853; Empl.: 130; *Sls. Mgr.:* Richard C. Kaufman

GUARDIAN ELECTRONICS, General Cable Corporation, 4 Tesseneer Dr., Highland Heights, KY 41076, Tel: 606-572-8303, FAX: 800-547-8249; Empl.: 500; *Sls. Mgr.:* Mark Sitar ... **B•1509-1511, 1638-1643**

GUILDLINE INSTRUMENTS, 103 Commerce St., Ste. 160, Lake Mary, FL 32746, Tel: 407-333-3327, FAX: 407-333-3309; Empl.: 60; *Sls. Mgr.:* Michael S. Shaw

GULTON GRAPHIC INSTRUMENTS DIV., A Mark IV Company, Gulton Ind'l. Pk., E. Greenwich, RI 02818, Tel: 800-343-7929, 401-884-6800, TWX: 710-387-1500, FAX: 401-884-4872; Empl.: 400

GUNTHER, W., GMBH, Vimsberger Strasse 51, D 8500 Nurnberg 82, Germany, Tel: (0)911/65521 or 65520, TWX: 622351 Wigu d, FAX: (0)911/6552-239; Empl.: 280; *Sls. Mgr.:* Johann Eekhoff

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GUTWERK INSTRUMENTS INC., 801 Summit St., McKeesport, PA 15132, Tel: 412-672-3668, FAX: 412-672-7371 .... **D•1161**

GW INSTRUMENTS, INC., 35 Medford St., Somerville, MA 02143, Tel: 617-625-4096, FAX: 617-625-1322

HAAKE, See Fisons Instruments

HADES MANUFACTURING CORP., 151 Verdi St., Farmingdale, NY 11735, Tel: 516-249-4244, FAX: 516-249-1618; FSC No.: 51578; Empl.: 18; *Sls. Mgr.:* K. Norris

HADLEY, ROBERT M. CO., INC., 750 West 51st St., Los Angeles, CA 90037, Tel: 213-234-9091, FAX: 213-234-2779; FSC No.: 72964; Empl.: 135; *Sls. Mgr.:* James A. Hadley

HAEFELY, INC., 2616 Morse Lane, Woodbridge, VA 22192, Tel: 703-494-1900, FAX: 703-494-4597; Empl.: 800; *Sls. Mgr.:* Leo Makowski

HAFSTROM TECHNICAL PRODUCTS, INC., See Va-Tran Systems, Inc.

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HAMAMATSU CORP., Hamamatsu Photonics, K.K., PO Box 6910, 360 Foothill Rd., Bridgewater, NJ 08807, Tel: 908-231-0960, FAX: 908-231-1218; Empl.: 100; *Sls. Mgr.:* George Marshall; *Dist. Mgr.:* George Marshall .... **B•1162-1163, 1317-1321**

HAMAMATSU PHOTONICS K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, Japan, Tel: 053-452-2141, FAX: 053-456-7889; Empl.: 2000; *Sls. Mgr.:* H. Hiruma

HAMAMATSU PHOTONIC SYSTEMS CORP., Industrial Video, 47A Manning Rd., Billerica, MA 01821, Tel: 508-671-5000, FAX: 508-671-9415; Empl.: 25; *Sls. Mgr.:* Paul Roehrenbeck

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HAMEG INSTRUMENTS, 1939 Avenida Plaza Real, Oceanside, CA 92056, Tel: 619-630-4080, 800-247-1241; Empl.: 20; *Sls. Mgr.:* Ursula Meinhard; *Dist. Mgr.:* Viola Hauck .... **D•1404**

Local Sales Offices & Reps

NY	East Meadow, Hameg Instrs.	516-794-4080

Local Distributors

AK	Anchorage, Alascal, Inc.	907-248-4523
CA	San Diego, Instrument Engrs.	619-673-3644
CO	Aurora, R & R Instrmn.	303-364-8325
CT	Hamden, Kaufman Instrs.	203-776-7201
FL	Hialeah, Kimabll Elctrns.	305-822-5792
GA	Alpharetta, Techmart, Inc.	404-325-0759
GA	Calhoun, Learning Labs.	404-629-4624
IL	Countryside, Inotek	708-352-3500
IN	Lafayette, Lafayette Instrs.	317-423-1505
KS	Wichita, RSC Elctrns.	316-267-5213
MD	Hunt Valley, Tessco, Inc.	410-472-7000
MD	Silver Springs, Print Prods. Intl.	310-587-7824
MA	North Andover, Contact East	508-682-9844
MA	Waltham, Calibron Instrs.	617-894-6440
MN	Minneapolis, Tonka Tech. Labs.	612-593-1770
MS	Jackson, Sivad, Inc.	601-355-3110
MO	St. Louis, I.S.L. Corp.	314-423-3141
MO	St. Louis, Instru-Med (ICU)	314-845-2299
NJ	Elizabeth, NEI	908-355-5502
NM	Albuquerque, J. Smith & Assoc.	505-345-6504
NY	Franklin Square, RJT Educational	516-354-2983
TX	Dallas, Knight Elctrns.	214-340-0265
TX	Dallas, Tucker Elctrns.	214-348-8800

PR	Rio Padres, J & R Elctrns.	809-757-6079
Can	Mississauga, BCS Elctrns.	416-602-8550

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CO	Boulder, Design Tech. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Tampa, Electramark	813-889-7775
GA	Atlanta, Wallace Elctrn. Sls. (Sen/SW Only)	404-634-3159
GA	Norcross, Electramark (Relays only)	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Davenport, Rush & West	319-388-9609
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Gaithersburg, Naudain South	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MA	W. Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MI	Farmington Hills, J. L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R K Sls.	612-571-1001
MO	St. Louis, Rush & West	314-965-3529
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Allison Pk., Bear Mktg.	412-492-1150
TN	Tullahoma, Wallace Elctrn. Sls.	615-455-0501
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
WA	Redmond, Earl & Brown	206-885-5064
WI	Watertown, Deaken Tech. Sls.	414-261-7600
Can	Mississauga, Ont (East. Can.)ê, Indigo Elctrns.	416-670-0284

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
AR	Springdale, Radio Inc.	501-751-8200
CA	Agoura Hills, Cypress Elctrns.	881-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Los Angeles, Master Distrs.	310-452-1229
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	San Jose, Capstone	408-453-9804
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone Elctrns.	303-275-2550
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Harrison Equip. Co.	303-694-6320
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elec.	203-262-1700
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Hammond Elctrns.	404-449-1996
ID	Boise, Radar Elec.	208-336-2227
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Itasca, Capstone	708-250-0300
IL	Palatine, OHM Elctrns.	708-359-5500
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
KS	Wichita, Radio, Inc.	316-264-2798
MD	Baltimore, Bell Inds.	301-953-2566
MD	Columbia, DK Elctrns.	301-995-1950
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Sager Elec.	301-995-4900
MA	Andover, Bell Inds.	508-474-8880
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Capstone	508-657-5874
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Livonia, R S Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
NH	Salem, Sager Elec.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Marlton, Capstone	609-596-7500
NJ	Oakland, Relay Specs.	201-337-1000
NJ	W. Berlin, General Comps.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Harrison Intl.	505-291-9951
NM	Los Alamos, Capstone	505-662-0745
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone	919-954-0600
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Solon, Repco Elctrns.	216-248-8900
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Oswego, Bell Inds.	503-635-6500
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom Inc.	814-476-7774
PA	Pittsburgh, Bell Inds.	412-787-3883
PA	Trevosa, Bell Inds.	215-953-2899
SC	Greenville, Emsco Inc.	803-233-4121
TX	Austin, Harrison Equip. Co.	512-258-1320
TX	Carrollton, Capstone	214-380-9049
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	El Paso, Harrison Equip. Co.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Tandy Elctrns.	817-870-5614
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equip. Co.	713-879-2727
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Green Bay, Automation Engrg.	414-499-6000
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, BC, ITT Multicomps.	604-291-8866
Can	Calgary, AB, ITT Multicomps.	403-273-2780
Can	Concord, Ont., ITT Multicomps.	416-798-7884
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Nepean, ON, ITT Multicomps.	613-596-6980
Can	Ville St. Laurent, PQ, ITT Multicomps.	514-335-7697
Can	Winnipeg, ITT Multicomps.	403-273-2780

HAMLIN

Orders Placed by 3:00 p.m. are Shipped the Same Day

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(510) 835-1500
1026 6th. AVENUE
OAKLAND, CA 94606

HAMLIN INC./ELEC-TROL, 612 East Lake St., Lake Mills, WI 53551, Tel: 414-648-3000, FAX: 414-648-3001; Empl.: 350; *Sls. Mgr.:* Michael L. Bucher .... **B•1513**

Local Sales Offices & Reps

CA	Irvine, Groh Assocs.	714-837-9871
CA	San Jose, Vernexx	408-972-4903
CO	Boulder, Design Tech. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Tampa, Electramark	813-889-7775
GA	Atlanta, Wallace Elctrns. Sls. (Sen/SW)	404-634-3159
GA	Norcross, Electramark (Relays only)	404-446-7915
IL	Itasca, LTD Technologies	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Davenport, Rush & West	319-388-9609
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Gaithersburg, Naudain Assocs. South	301-258-5040
MA	Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assoc.	313-489-0099
MN	Minneapolis, R K Sls.	612-571-1001
MO	St. Louis, Rush & West	314-965-3529
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Allison Pk, Bear Mktg.	412-492-1150
TN	Tullahoma, Wallace Elctrn. Sls.	615-455-0501
TX	Dallas, Allied Comp.	214-238-0408
WA	Redmond, Earl & Brown	206-885-5064
WI	Watertown, Deaken Tech.	414-261-7600
Can	Ontario, Indigo Elctrns.	416-670-0284

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
AR	Springdale, Radio Inc.	501-751-8200
CA	Agoura Hills, Cypress Elctrns.	881-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Los Angeles, Master Distrs.	310-452-1229
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	San Jose, Capstone	408-453-9804
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone Elctrns.	303-375-2550
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Harrison Equip. Co.	303-694-6320
CO	Littleton, Indelco	303-795-3431
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elctrns.	203-262-1700
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Hammond Elctrns.	404-449-1996
ID	Boise, Radar Elec.	208-336-2227
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Itasca, Capstone	708-250-0300
IL	Palatine, OHM Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
KS	Wichita, Radio, Inc.	316-264-2798
MD	Baltimore, Bell Inds.	301-953-2566
MD	Columbia, DK Elctrns.	301-995-1950
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Sager Elec.	301-995-4900
MA	Andover, Bell Inds.	508-474-8880
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Wilmington, Capstone	508-657-5874
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Livonia, R S Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MN	Thief River Falls, Voyager Elctrns.	612-571-7766
NH	Salem, Sager Elec.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Marlton, Capstone	609-596-7500
NJ	Oakland, Relay Specialties	201-337-1000
NJ	West Berlin, Gen. Comps.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Harrison Intl.	505-291-9951
NM	Los Alamos, Capstone	505-662-0745
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Plainview, Astrex	516-433-1700
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone	919-954-0600
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Solon, Repco	216-248-8900
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Oswego, Bell Inds.	503-635-6500
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Portland, Radar Elctrns.	503-232-3404
PA	McKean, Advacom Inc.	814-476-7774
PA	Pittsburgh, Bell Inds.	412-787-3883
PA	Trevosa, Bell Inds.	215-953-2899
SC	Greenville, Emsco Inc.	803-233-4121
TX	Austin, Harrison Equip. Co.	512-258-1320
TX	Carrollton, Capstone	214-380-9049
TX	Dallas, Harrison Equip. Co.	214-239-2750

TX	El Paso, Harrison Equip. Co.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	Fort Worth, Tandy Elctrns.	817-870-5614
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equipment	713-879-2727
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Green Bay, Automation Engrg.	414-499-6000
WI	Mequon, Taylor Electric	414-241-4321
Can	Burnaby, BC, ITT Multicomponents	604-291-8866
Can	Calgary, AB., ITT Multicomponents	403-273-2780
Can	Concord, Ont., ITT Multicomponents	416-798-7884
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., ITT Multicomponents	613-596-6980
Can	Ville S. Laurent, PQ, ITT Multicomponents	514-335-7697
Can	Winnipeg, MB., ITT Multicomponents	403-273-2780

HAMLIN LCD STANDISH INDS., See Standish Industries, Hamlin LCD Div.

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HAMMOND MANUFACTURING CO., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710; Empl.: 1,450; *Sls. Mgr.:* Ray Shatzel .... **C•1049**

Local Sales Offices & Reps

AZ	Phoenix, Tritek	602-371-0860
CA	N. Hollywood, Bassett Sls. Corp.	818-766-2117
CA	San Carlos, Bridge Mktg.	415-965-8045
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Tampa, SRT Mktg.	813-884-4805
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Schank Elctrns. Mktg.	317-842-6204
MD	Hunt Valley, S.K. McDonald	410-584-8631
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
MI	Southfield, Component Assocs.	313-355-4110
MN	Golden Valley, Ambassador Inds. Mktg.	612-542-8437
MO	St. Louis, Kathrinus, Kelly & Baumhauer	314-647-2400
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OR	Lake Oswego, Joseph Blancard Sls.	503-620-6888
TX	Dallas, J. Y. Schoonmaker Co., Inc.	214-349-1650

Local Distributors

AL	Birmingham, ACK, Inc.	205-322-0588
AZ	Phoenix, Electronic Parts Co.	602-277-7281
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tucson, Southwest Sls.	602-628-1613
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
CA	Chatsworth, Poco Sls.	818-700-8727
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Redwood City, H.D.B.	415-368-1388
CA	San Diego, Western Radio Elec.	619-268-4400
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Ana, ITT Multicomponents	714-727-4001
CO	Denver, Fistell Elctrns.	303-629-1312
CT	Bridge Port, Park Distrbg.	203-366-7200
CT	Danbury, Pilgrim Elec.	203-792-7274
CT	Hartford, Hatry Elec.	203-527-1881
CT	New London, Jan Elctrn. Supp.	203-442-4386
CT	Norwalk, Cobra	203-847-6442
CT	Wallingford, Midstate Elec.	203-265-9900
DE	Wilmington, Whlsl. Elctrns.	302-652-3222
FL	Jacksonville, EMSCO	904-356-4851
FL	Orlando, EMSCO	407-849-6060
FL	Tampa, EMSCO	813-253-2684
FL	West Palm Beach, Atlantic Elect.	407-686-8553
GA	Atlanta, Ack, Inc.	404-351-6340
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Whitehead Elctrns.	404-923-6667
GA	Norcross, Wholesale Inds. Elec.	404-447-8431
IL	Benenville, Goold Elctrns.	708-860-7171
IL	Chicago, Newark Elec.	312-784-5100
IL	Joliet, Mainline Elec.	815-436-3900
IL	Niles, Joseph Elec.	708-312-297-4200
IL	Wheeling, Hawk Elec.	708-459-4030
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elec.	317-872-4910
IN	Indianapolis, Mar Elec.	317-633-6699
IA	Cedar Rapids, Dee Elec.	319-365-7551
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, W. B. Allen Supp.	504-525-8222
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, M. S. Elec.	301-921-0200
MA	Haverhill, Spartan Elctrns.	508-373-1200
MA	Needham, Y.D.I.	617-449-1005
MA	Springfield, Signal Elctrn. Supp.	413-739-3893
MA	Wellesley Hills, Target Elctrns. Supp.	617-235-2545
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Eden Prairie, Cassidy Elctrns.	612-895-9026
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	Kansas City, Electronic Supp.	816-931-0250
MO	Kansas City, Walters Ind. Elec.	816-561-7015
MO	St. Louis, Van Sickle Radio	314-621-5000
NH	Dover, American Radio Corp.	603-335-3118
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Raritan, Masters Elctrn. Supp.	201-725-3533
NJ	Totowa, Route Elctrns.	201-256-8555
NM	Albuquerque, Beta Tron Elctrns.	505-821-1122
NY	Buffalo, Genesee Ind. Elec.	716-873-9661
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, H.L. Dalis Inc.	718-361-8700
NY	Poughkeepsie, Chief Elctrns.	914-471-1300
NY	Rochester, Masline Elec.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elec.	315-337-5400
NY	Syracuse, Salina Elec.	315-422-2336
NY	Troy, Trojan Elec.	518-272-4481
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Roberts Elec.	216-238-1711
OH	Columbus, Thompson Elec. Supp.	614-228-6191
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrns. Supp.	216-373-1300
OK	Oklahoma City, Radio, Inc.	405-528-2391
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Toledo, International Co.	503-336-2221
PA	Drexel Hill, Kass Elec.	215-449-2300
PA	Erie, REM Elctrns.	814-453-5626
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elec.	215-293-9000
RI	Pawtucket, Major Elec. Supp.	401-725-7400
SC	Charleston, Wholsale Inds. Elctrns.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
SC	Taylors, Cantrell Wholesale	803-268-1194
TX	Corpus Christi, Douglas Elec.	512-883-5103
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wholesale Elec.	214-969-9400
TX	Ft. Worth, Allied Elec.	817-336-5401
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, The Altair Co.	713-462-3029
TX	Houston, Tri Star Eltrns.	713-667-7200
TX	Midland, ESI Supp.	915-694-9657
TX	San Antonio, Altex Elctrns.	512-828-0503
TX	San Antonio, Sherman Elec.	512-224-1001
UT	Salt Lake City, Standard Elec. Supp.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-941-1074
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Bellevue, Integrated Elec.	206-455-2727
WI	Oshkosh, Elctrn. Inds.	414-235-8930
WI	Racine, Badger Elctrn. Supp.	414-637-1256
WI	Waukesha, Hawk Elctrns.	414-547-4457

HANCOCK ELECTRONICS CORP., 350 Lincoln St., Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HANDLES UNLIMITED, Vemaline Products Division, 333 Strawberry Field Rd., Warwick, RI 02887-6979, Tel: 800-227-0254, 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; Empl.: 25; *Sls. Mgr.:* William Rife; *Dist. Mgr.:* William Rife

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Jim Trautwein; *Dist. Mgr.:* Jim Trautwein

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 7; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., N. Attleboro, MA 02760, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANDY & HARMAN PRECIOUS METALS REFINING, 300 Rye Street, S. Windsor, CT 06074, Tel: 1-800-421-0411, 203-289-4327, FAX: 203-289-6494

HANIFY-KING PC, 1 Federal St., Ste. 13 Fl., Boston, MA 02110-2003, Tel: 617-492-0700, TELEX: 6714194, FAX: 617-492-7908; *Sls. Mgr.:* Paul Blumeufeld

HANKSCRAFT MOTORS, Sub of Gerber Prod. Co., P.O. Box 190, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-4342; Empl.: 75

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Dennis M. Priscandaro; *Dist. Mgr.:* Dennis M. Priscandaro

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: under 50; *Sls. Mgr.:* Allan Hanscom

HANSEN CORP., Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-385-3013; Empl.: 400; *Sls. Mgr.:* Dennis E. Monforton

HANTRONIX INC.

FAX: 408-749-0477

HANTRONIX, INC., Liquid Crystal Display, 250 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-736-3191, TELEX: 880165; Empl.: 25; *Sls. Mgr.:* Jake B. Yu; *Dist. Mgr.:* Ken Mc Reynolds .... **B•1070-1071**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Laguna Hills, 4 Star Elctrn. Sls.	714-583-9781
CA	Riverside, 4 Star Elctrn. Sls.	909-780-5146
CA	San Jose, Luscombe Engrg.	408-370-2020
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Davie, Dan-Tech. Sls.	305-581-2882
IL	Arlington Hghts., Coombs Assoc.	708-439-9810
IN	Indianapolis, C.M.P. Engrg./Sls.	317-849-9277
KS	Prairie Village, Crosslink	913-649-7100
MD	Ellicot City, Technology Sls.	410-461-7802

HAMMOND

CABINETS
ENCLOSURES

In Stock

POCO SALES
8925 Fullbright Avenue
Chatsworth, CA 91311
(818) 700-8727

PoCo Sales

MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, C.M.P. Engrg./Sls.	313-477-7700
NJ	Lebanon, Sylvester Sls. Assoc.	908-735-2488
NJ	Medford, CEF Assoc.	609-953-8945
NY	Manluis, Lamtec Sls.	315-682-4780
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Cleveland, C.M.P. Engrg./Sls.	216-398-0400
OH	Dayton, C.M.P. Engrg./Sls.	513-836-0951
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Pittsburgh, C.M.P. Engrg./Sls.	412-826-3800
TX	Dallas, Innovative Tech. Sls.	214-699-3485
WA	Birch Bay, Temco North West	206-371-0423
WA	Bothell, Temco North West	206-481-6150
WI	Milwaukee, Coombs Assoc.	414-351-6123

Local Distributors

CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Industry, Ital Elctrns Sls.	818-968-8515
CA	Mission Viejo, Opto Plus	714-380-8654
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Diego, Mock 3	619-693-8230
CA	San Jose, Spectra Elctrn. Inc.	408-955-7800
CO	Aurora, Q P S	303-343-9260
CO	Littleton, Displays Plus	303-730-7333
IL	Chicago, Leed Elctrns., Inc.	312-625-2800
IL	North Brook, Classic Comps.	708-272-9650
IL	Schaumburg, Q.P.S.	708-884-6620
MA	Wilmington, North Star Elec.	508-657-5155
MN	Brooklyn Park, Tech. Comps.	612-561-5556
MN	Plymouth, Leeds Elctrns., Inc.	612-557-1277
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NM	Albuquerque, Betatron	505-821-1122
NY	Rochester, North Star Elect.	716-244-9846
OR	Salem, Light Wave Elctrns.	503-585-4770
PA	Prairie Village, Crosslink	913-649-7100
TX	Austin, Omni Pro	512-794-9200
TX	Austin, Wofford	512-339-1131
TX	Carrollton, Omni Pro	214-713-9000
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Dallas, Wofford	214-340-8555
TX	Houston, Omni Pro	713-270-1700
TX	Tomball, Wofford Elctrns.	713-351-2255
WI	New Berlin, Classic Comps.	414-786-5300
Can	Ontario, Intelatech, Inc.	416-629-0082

HARBIN ELCTRNS. CO., 3826 Old Getwell Rd., Memphis, TN 38118, Tel: 901-794-1667, FAX: 901-794-2515; Empl.: 15

HARBOUR IND. (CANADA) LTD., 1365 Industriel Blvd., Farnham, Quebec, Canada J2N 2X3, Tel: 514-293-5304, FAX: 514-293-2421; Empl.: 31; *Sls. Mgr.:* Marc Longpre

HARDIGG CASES, Hardigg Industries, 393 N. Main St. P.O. Box 201, South Deerfield, MA 01373, Tel: 413-665-2163, FAX: 413-665-8061; FSC No.: 11214; Empl.: 200; *Sls. Mgr.:* Stanley J. Morgan

HARDMAN: HARCROS CHEMICALS INC., 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, FAX: 201-751-8407; Empl.: 75; *Sls. Mgr.:* Donald J. Wirth

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, FAX: 215-696-2264; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* William J. Cuff

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93012, Tel: 805-987-9511, TELEX: 182327, FAX: 805-987-2547; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Jeff Shaffer

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Jim Klug

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 1-800-4 HARRIS, FAX: 407-724-3937; FSC No.: 34371; Empl.: 9000; *Sls. Mgr.:* Carlton Smith; *Dist. Mgr.:* Valerie Lewis

HARTING ELEKTRONIK, INC., 2155 Stonington Ave., Ste. 212, Hoffman Estates, IL 60195, Tel: 708-519-7700, ext. 200, FAX: 708-519-9771; Empl.: 24; *Sls. Mgr.:* Donald G. Blummer, Natl. Sls. Mgr. …………… **C•1343-1345**

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Phoenix, Dalis Elctrns.	602-272-2626
CA	Irvine, Kensington	714-588-0575
CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Foresight Elctrns.	408-980-9700
CA	Santa Clara, Trinity Elctrns.	408-980-9011

CT	Wallingford, Control Design Supp.	203-269-9955
IL	Arlington Hgts., LoDan Elctrns.	708-398-5311
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
MA	Woburn, Control Design Supp.	617-932-9404
MI	Madison Hgts., Tracer Control Co.	313-545-7140
MO	Maryland Hgts., French Gerleman Elec. Co.	314-569-3122
NM	Albuquerque, Bestech Elctrn. Comp. Sls.	505-298-0034
NC	Charlotte, Control Design Supp.	704-588-4410
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Malvern, Control Design Supp.	215-296-0150
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Omni Pro Elctrns., Inc.	800-926-8926
TX	Houston, TriStar Elctrns. Corp.	713-667-7200
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WI	New Berlin, Control Design Supp.	414-784-1015
Can	Kingston, Ont., Elctrn. Packaging Sys. Ltd.	613-384-1142
Can	Victoria, B.C., Pacific Coast Elctrns., Ltd.	604-385-5111

HARTLEY PRODUCTS, 5732 Oleander Dr., P.O. Box 4794, Wilmington, NC 28406, Tel: 919-392-0500, FAX: 919-392-1077; *Sls. Mgr.:* R. Schmetterer

HARWIL CORPORATION, 1548 17th St., Santa Monica, CA 90404, Tel: 310-829-2310, FAX: 310-829-2259; Empl.: 14

HASCO COMPONENTS INTERNATIONAL CO., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Chris Mennella …………… **B•1514-1520, 1735**

Local Sales Offices & Reps

AL	Huntsville, Hasco Comps. Intl. Corp.	800-852-5050
AK	Anchorage, Hasco Comps. Intl. Corp.	800-852-5050
AZ	Phoenix, Hasco Comps. Intl. Corp.	800-852-5050
CA	Irvine, Hasco Comps. Intl. Corp.	800-852-5050
CA	Los Angeles, Hasco Comps. Intl. Corp.	800-852-5050
CA	San Francisco, Hasco Comps. Intl. Corp.	800-852-5050
CT	Hartford, Hasco Comps. Intl. Corp.	800-852-5050
GA	Atlanta, Hasco Comps. Intl Corp.	800-852-5050
IL	Chicago, Hasco Comps. Intl. Corp.	800-852-5050
KS	Kansas City, Hasco Comps. Intl. Corp.	800-852-5050
LA	New Orleans, Hasco Comps. Intl. Corp.	800-852-5050
MA	Framingham, Hasco Comps. Intl. Corp.	800-852-5050
MO	Kansas City, Hasco Comps. Intl. Corp.	800-852-5050
NM	Albuquerque, Hasco Comps. Intl. Corp.	800-852-5050
NY	Port Washington, Hasco Comp. Intl. Corp.	800-852-5050
NY	Rochester, Hasco Comps. Intl. Corp.	800-852-5050
NC	Raleigh, Hasco Comps. Intl. Corp.	800-852-5050
OH	Cleveland, Hasco Comps. Intl. Corp.	800-852-5050
TX	Dallas, Hasco Comps. Intl. Corp.	800-852-5050
VA	Charlottesville, Hasco Comps. Intl. Corp.	800-852-5050
WA	Seattle, Hasco Comps. Intl. Corp.	800-852-5050
WI	Milwaukee, Hasco Comps. Intl. Corp.	800-852-5050

Local Distributors

AR	N. Little Rock, Control Design	501-851-3137
CT	Wallingford, Control Design	203-269-9955
FL	Sanford, Control Design	407-328-8011
GA	Stone Mountain, Control Design	800-432-0072
IL	Carrol Stream, Lectro Comps.	800-323-2282
MA	Woburn, Control Design	617-932-9404
MO	St. Louis, Control Design	314-432-1116
NJ	Rockaway, Tonar	201-586-9000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NC	Charlotte, Control Design	704-588-4410
PA	Philadelphia, Sharp Elctrns.	215-969-3300
WI	New Berlin, Control Design Supp.	414-784-1016
Can	Mississauga, C.E.A.	416-602-9717

HATHAWAY CORPORATION:MOTION CONTROL DIV., 10827 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800, FAX: 918-438-7629; Empl.: 80; *Sls. Mgr.:* David Richards

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, FAX: 408-434-9832; *Sls. Mgr.:* Willis Yeh …………… **D•1265, 1737**

Local Sales Offices & Reps

AL	Huntsville, B & C Instruments, Inc.	205-883-6530
CA	Sunnyvale, E.I.L. Instrs.	408-744-0271
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Indianapolis, Allied Elctrns.	317-875-0448
KY	Louisville, Allied Elctrns.	502-452-2293
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Boston, E.I.L. Instrs.	617-272-9450
MI	Grand Rapids, Allied Elctrns.	616-949-8200
NJ	Moorestown, Allied Elctrns.	609-234-7769
NY	Rochester, E.I.L. Instrs.	716-586-8251
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Dayton, E.I.L. Instrs.	513-435-2134
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Westcon Inc.	503-283-0132
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
SC	Greenville, Allied Elctrns.	803-288-8835
TX	Houston, E.I.L. Instrs.	713-271-3100
UT	Salt Lake City, Allied Elctrns.	801-261-5244
VA	McClean, E.I.L. Instrs.	703-569-2611
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Milwaukee, Allied Elctrns.	414-796-1280

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AK	Anchorage, Alaska Elctrnc. Supp.	907-563-3774
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Canoga Pk., RAG Elctrns.	818-998-6500
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Newtown, Conn Cal Labs	203-270-1263
FL	Melbourne, E.I.L. Instrs.	407-725-8300
GA	Duluth, Allied Elctrns.	404-497-9544
ID	Bridge View, E.I.L. Instrs.	708-430-2292
IL	Oak Forest, Allied Elctrns.	708-918-0250
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
IA	West Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, E.I.L. Instrs.	502-454-3420
LA	Metaire, Allied Elctrns.	504-885-1195
MD	Hunt Valley, Allied Elctrns.	410-584-7400
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Bloomington, Allied Elctrns.	612-881-0838
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-697-0038
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Clarksburg, Accutest Instrs.	800-524-0747
TX	Garland, Tucker Elctrns.	800-527-4642
WA	Bellevue, Vetco	206-869-7025

HAUEG DIVISION, A Subsidiary of Ametek Inc., 900 Greenbank Rd., Wilmington, DE 19808, Tel: 302-995-0400, 800-441-7777, FAX: 302-995-0491; *Sls. Mgr.:* Bill Wenner

HAVERLY SYSTEMS, INC., 12 Hinchman Ave., Box 919, Denville, NJ 07834, Tel: 201-627-1424, FAX: 201-625-2296; Empl.: 33; *Sls. Mgr.:* Ken Spencer

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852-HSIINTLWBY, FAX: 203-756-8724; FSC No.: 02005; Empl.: 100; *Sls. Mgr.:* Wendy Rossi

HAYES INSTRUMENT SERVICE INC., 530 Boston Rd., Billercia, MA 01821, Tel: 508-663-4800, FAX: 508-663-3812; Empl.: 25; *Sls. Mgr.:* Thomas P. Fitzgerald

HBM, INC., 19 Bartlett Street, Marlboro, MA 01752, Tel: 508-624-4500, FAX: 508-485-7480; Empl.: 105; *Sls. Mgr.:* Robert Gray

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, FAX: 213-888-9982; Empl.: 60; *Sls. Mgr.:* Sam Houston

HC Power, inc.

FAX: 714-261-6584

HC POWER INC., 17032 Armstrong Ave., Irvine, CA 92714-5716, Tel: 714-261-2200; FSC No.: 0D6P8; *Sls. Mgr.:* Jack Graham …………… **D•1738-1741**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Tektris	602-437-1915
CA	Huntington Beach, Tektris	714-964-8560
CA	La Mesa, Tektris	800-875-0855
CA	San Diego, ATA Assocs.	619-792-6079
CA	Santa Clara, Electro Venture	408-727-1553
CA	Valencia, Tektris	805-295-8747
CO	Englewood, Taylor Mktg.	303-850-0207

CO	Littleton, Taylor Mktg.	303-850-0207
FL	Oldsmar, Suncoast	813-787-9221
GA	Lawrenceville, Murcota	404-513-8093
IL	Elmhurst, Utronix	708-834-1100
IN	Indianapolis, JC Hofstetter	317-897-7914
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, The Beams Co.	314-434-8448
NH	Londonderry, Power Solutions Mktg.	603-432-5476
NY	Rochester, Power Conversion & Assoc.	716-426-3598
NC	Winston-Salem, Murcota	919-722-9445
OH	Dayton, JC Hofstetter	513-296-1010
OH	Medina, JC Hofstetter	216-725-4477
OR	Portland, Power Factor Assocs.	503-233-6969
PA	Pittsburg, JC Hofstetter	412-356-2305
RI	Barrington, Power Solutions Mktg.	401-245-5045
TX	Dallas, Dynamark	214-437-3333
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Sterling Park, Beacon North	703-478-2480
NY	Spring Valley, Powertronics	914-735-3775
Can	Lachine, Digidyne	514-631-1891
Can	Napean, Digidyne	613-727-5632
Can	Toronto, Digidyne	416-674-0444

HC PROTEK, 154 Veterans, Northvale, NJ 07647, Tel: 201-767-7242, FAX: 201-767-7343; *Sls. Mgr.:* Alex Orloff

HDR POWER SYSTEMS, INC., 4242 Reynolds Dr., Hilliard, OH 43026, Tel: 614-771-5500, FAX: 614-771-7219; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 95

H D SYSTEMS, INC., 89 Cabot Court, Hauppauge, NY 11788, Tel: 516-231-6630, FAX: 516-231-6803; Empl.: 5; *Sls. Mgr.:* Tetsuo Ikuta

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, FAX: 214-272-7817; Empl.: 45

HECON CORP., 15 Meridian Road, Eatontown, NJ 07724, Tel: 908-542-9200, TELEX: 13-2457; Empl.: 75; *Sls. Mgr.:* Kenneth W. Aurin

HEDRICH USA, INC., 4201-D Stuart Andrew Blvd., Charlotte, NC 28217, Tel: 704-522-0006, FAX: 704-522-0036

HEEGER, INC., 6400 Fleet St., City of Commerce, CA 90040, Tel: 213-728-5108, 728-4729, 728-6913, FAX: 213-728-4740; Empl.: 10; *Sls. Mgr.:* Robert A. Heeger

HEI CORPORATION, P.O. Box 88806, Carol Stream, IL 60188, Tel: 708-665-5500, FAX: 708-665-5769; Empl.: 20

HEIDENHAIN CORP., 115 Commerce Dr., Schaumberg, IL 60173, Tel: 708-490-1191, FAX: 708-490-3931; Empl.: 72; *Sls. Mgr.:* Rick Korte; *Dist. Mgr.:* Rick Glos

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Dale Nordquist .... **A•1700-1702**

Local Sales Offices & Reps

MN	Victoria, HEI Inc.	612-443-2500

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La.,P.O.Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 150; *Sls. Mgr.:* Dale Nordquist

HEINEMANN PRODUCTS, Eaton Corporation, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-896-0009, FAX: 609-896-1631; FSC No.: 74193; Empl.: 350; *Sls. Mgr.:* John McNamara .... **B•1360-1363**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. No.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, CompuTech Mktg.	303-773-3981
FL	Oviedo, Conley & Assocs.	407-365-3283
FL	Wellington, Conley & Assocs., Inc.	407-790-3926
GA	Duluth, Dixie Mktg.	404-381-5592
IL	Northbrook, D. Dolin Sls.	708-498-6770
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
IA	Hiawatha, Ard Sls. Co.	319-393-6392
KY	Alexandria, O.H. Bromberg & Assoc.	606-635-3063
KY	Louisville, O.H. Bromberg & Assocs.	502-456-1498
MD	Upperco, Imagitron Sls. Co., Inc.	301-374-5600
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber Sls. Co., Inc.	612-881-3620
MO	Kansas City, Hill & Co.	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, R. M. Scanlon & Assocs.	716-359-0773
NY	Syracuse, R.M. Scanlon & Assoc., Inc.	315-463-7682
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
OR	Beaverton, Westmark Elctrns., Inc.	503-641-8780
PA	Allison Park, KW Electrn. Sls.	412-366-9396
NJ	Lawrenceville, DVS Co.	609-896-1112
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WA	Bellevue, Westmark Elctrns., Inc.	206-454-1944
WI	Milwaukee, Key Entpr.	414-762-2323

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Chatsworth, POCO Sls.	818-700-8727
CA	Inglewood, Newark Elctrns.	301-671-7370
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Oakland, Brill Elctrns.	510-834-5888
CA	San Carlos, Campbell & George	415-594-1994
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Van Nuys, Fuses, Unltd.	818-786-8111
CO	Aurora, Jet Elctrns.	303-364-1000
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CT	Hartford, L. E. Whelan Co.	203-296-5000
CT	Wallingford, Green Shaw Co.	203-265-3333
FL	Oviedo, Dixie Sls.	407-365-1515
GA	Atlanta, Georgia Control Cen.	404-767-6677
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Morton Grove, Nedco Elctrns.	708-967-0500
IL	Northbrook, Classic Comps. Supp.	708-272-9650
IN	Carmel, Breakers Unltd.	317-896-5399
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, DK Elctrns., Inc.	301-995-1950
MD	Crofton, Custom Marine Svcs.	301-721-7354
MA	Andover, Bell Inds.	508-474-8880
MA	Needham, Power Electro Supp.	617-444-6866
MA	Newton, Green Shaw Co.	617-969-8900
MA	Woburn, Apparatus Svc.	617-933-5999
MI	Oak Pk., Newark Elctrns.	313-967-1570
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Heights, Lcomp, Inc.	314-291-6200
NJ	Lawrenceville, Riverside Comps. Supp.	609-896-1611
NY	Johnson City, Help Elctrns., Inc.	607-729-3528
NY	New Hyde Park, I/O Corp. of NY	516-355-0135
NY	Ronkonkoma, Arrow Elctrns.	516-467-1000
NY	Whitestone, Power Electro Supp. Co.	718-767-1447
NC	Charlotte, Motionex Inc.	704-377-1555
NC	Raleigh, Greene-Shaw Co.	919-954-7138
OH	Cleveland, I/O Corp. of Cleveland	216-642-7300
OH	Dayton, Duellman Elec.	513-461-8022
OH	Dayton, Stotts Friedman Co.	513-298-5555
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Taylor Elec.	503-233-5321
PA	Allison Park, Circuit Breakers, Inc.	412-487-9090
PA	Erie, REM Elctrns.	814-453-5626
PA	Fort Washington, I/O Corp. of Phila.	215-641-1870
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Chattanooga, Techni-Tronics, Inc.	615-332-2119
TX	Dallas, Geeco Sls. Co.	214-341-2626
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
VA	Ashland, Hanover Controls & Supp. Corp.	804-550-2449
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
WA	Seattle, H. C. Campbell Co.	206-433-1900
WI	Milwaukee, Hunt Co.	414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004, FAX: 718-565-2582; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, FAX: 805-928-2369; FSC No.: 13201; Empl.: 85

HELM INSTRUMENT CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, FAX: 419-893-1371; Empl.: 55; *Sls. Mgr.:* M. Wilhelm; *Dist. Mgr.:* N. Phillips

HENRICKS TECHNOLOGIES, INC., 365 College St., Forsyth, GA 31029, Tel: 912-993-1060, 800-241-0806, FAX: 912-993-1068; Empl.: 30; *Sls. Mgr.:* Paul D. Setters

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HERGA INC. HERGA ELECTRIC LIMITED, 602 Brandywine Parkway, West Chester, PA 19380, Tel: 215-430-1970, FAX: 215-430-7785; Empl.: 5

HERITAGE METAL FINISHING INC., 800 S. Market St. P.O. Box 446, Elizabethtown, PA 17022, Tel: 717-367-1561, FAX: 717-367-2474; Empl.: 43; *Sls. Mgr.:* Terry L. Rinesmith

HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 213-283-0411, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA, FAX: 405-224-9423; FSC No.: 65623; Empl.: 200; *Sls. Mgr.:* R. Helms, Kim Baker .... **B•1737, 1954-1955**

Local Sales Offices & Reps

AZ	Phoenix, Toweard Engrg. Assocs.	602-955-3193
CA	Arcadia, V. Gott & Assocs.	818-445-9729
CA	Palo Alto, Adtek Assocs.	415-327-0300
CA	San Diego, V. Gott & Assocs.	619-489-0893
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Oceanside. Current Inds.	516-678-3895
OR	Beaverton, Unicomp, Inc.	503-684-8221
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, Unicomp, Inc.	206-568-0511
WA	Spokane, Unicomp, Inc.	509-922-4883

Local Distributors

TX	Ft.Worth, Allied Elctrns. Inc.	817-595-3500

HERSEY MEASUREMENT CO., Flow Measurement, Inc., P.O. Box 4585, Spartanburg, SC 29305, Tel: 803-574-8960, 1-800-845-2102, FAX: 803-578-7308; Empl.: 80; *Sls. Mgr.:* Bob Hill

HERTNER DIV.:EXIDE CORP., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, FAX: 216-941-4330; FSC No.: 28398; Empl.: 100; *Sls. Mgr.:* R.C. Wright

HEURISTICS INCORPORATED, 9845 Horn Rd., Ste. 100, Sacramento, CA 95827, Tel: 916-369-6606, FAX: 916-369-6175; Empl.: 70; *Sls. Mgr.:* Mike McMann, Genl. Mgr.

HEWLETT-PACKARD COMPANY, Direct Marketing Organization, P.O. Box 58059, MS 51L-SJ, Santa Clara, CA 95051-8059, Tel: 800-452-4844; Empl.: 93,100

HEXACON ELECTRIC CO., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 908-245-6200, FAX: 908-245-6176; Empl.: 150; *Sls. Mgr.:* Robert L. Miller

HEYCO MOLDED PRODUCTS, INC., Box 160, Kenilworth, NJ 07033, Tel: 908-245-0033, 800-526-4182, FAX: 908-245-3238; FSC No.: 28520; Empl.: 135

HEYCO STAMPED PRODUCTS, See Cabletest International Inc.

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626, FAX: 617-646-2662; Empl.: 13

HIAC/ROYCO, Pacific Scientific Co., 11801 Tech Rd., Silver Spring, MD 20904, Tel: 301-680-7000, TELEX: 197635 PACSCIUT; Empl.: 125; *Sls. Mgr.:* Lou Sarto

HIBBING ELCTRNS. CORP., OECO Corp., 3125 East 14th Ave., P.O. Box 129, Hibbing, MN 55746-0129, Tel: 218-263-8971, FAX: 218-263-8970; Empl.: 405; *Sls. Mgr.:* Michael Walsh

HICKOK ELECTRICAL INSTRUMENT COMPANY, 10514 Dupont Ave., Cleveland, OH 44108, Tel: 216-541-8060, FAX: 216-761-9879; FSC No.: 28569; Empl.: 230; *Sls. Mgr.:* Bob Fiorille

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI-G COMPANY SUB. OF NYTRONICS, See Stuthers-Dunn, Inc. and Hi-G Co., Inc., Sub. of Nytronics.

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; FSC No.: 21052; Empl.: 50; *Sls. Mgr.:* Joseph F. Quinn

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814, FAX: 415-753-3301; Empl.: 12; *Sls. Mgr.:* David Taeler

HIGH REL GROUP, 2127 Ringwood Ave, San Jose, CA 95131, Tel: 408-321-6400, FAX: 408-321-6415; FSC No.: 4Y548; Empl.: 25; *Sls. Mgr.:* Beth Pagino

HIGH VOLTAGE SYSTEMS, INC., Universal Designs Corp., P.O. Box 649, Chappaqua, NY 10514, Tel: 914-238-8462, FAX: 914-238-8462; Empl.: 15; *Sls. Mgr.:* Vincent A. Gianguzzi

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636, FAX: 914-968-0347; Empl.: 12

HILEVEL TECHNOLOGY, 2991 Dow Ave., Tustin, CA 92680, Tel: 714-573-1888, FAX: 714-573-1899; Empl.: 30; *Sls. Mgr.:* Dolores DeRosa

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* Larry Copenhaver; *Dist. Mgr.:* Larry Copenhaver

HIPOTRONICS INC., Rte. 22, P.O. Box 414, Brewster, NY 10509, Tel: 914-279-8091, TELEX: 425476, TWX: 710-574-2420, FAX: 914-279-2467; FSC No.: 25284; Empl.: 230; *Sls. Mgr.:* Kenneth Johnson

HIRAM JONES ELECTRONICS, 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 213-875-0213, FAX: 818-982-7339; FSC No.: 04867; Empl.: 8

THE HIROL COMPANY, 1170 W. McNab Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-4900, FAX: 305-975-4734; Empl.: 45; *Sls. Mgr.:* Richard Diefenderfer .... **B•1072; C•1664, 1685**

Local Sales Offices & Reps

CA	Laguna Nigel, E.J. Stanton & Sons	714-496-4027
MA	Norton, Paul Vincent	508-285-9037
Intl	Singapore, Dynamar Computer	011-65-2813388
Intl	United Kingdom, Read Cosine Ltd.	0202-632274/5

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 2688 Westhills Ct., Simi Valley, CA 93065, Tel: 805-522-7958, FAX: 805-522-3217; Empl.: 55

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, FAX: 201-835-8354; *Sls. Mgr.:* A. Hoell, Opers. Mgr. Connectors .... **C•1347**

Local Distributors

CA	Irvine, Kensington Elctrns.	714-583-0575
CA	San Diego, Instrument Engrs.	619-673-3644
CA	San Jose, Spectra Elctrns.	408-955-7800
CO	Aurora, Jet Elctrns. Supp.	303-364-1000
CT	Bridgeport, Park Distrs.	203-366-7200
IL	Addison, Belford Elctrns.	708-691-1100
IL	Glendale Hgts., Mac Gregor & Co.	708-469-4080
IN	Carmel, Altex Elctrns., Inc.	317-848-1323
MA	Westboro, In Stock Prods.	508-870-5750
MN	Minneapolis, Elec-Trol	612-521-5051
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NJ	Union, Meridian Supply Co.	908-687-6220
NC	Fuguay-Varina, Rye Inds., Inc.	919-557-0511
TX	Richardson (exc. El Paso City), Centurion Mktg.	214-783-6762
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Montreal, Que., Hooker Elctrns.	514-487-5151

HISONIC, INC., 310 North Marion, P.O. Box 1130, Olathe, KS 66051, Tel: 913-782-0012, FAX: 913-782-0562; FSC No.: 11402; Empl.: 185; *Sls. Mgr.:* Jack O. Cooper III .... **A•2360**

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	407-423-4353
FL	Orlando, MacKay, Smith & Assocs.	407-423-4353
FL	Palm Coast, MacKay, Smith & Assocs.	904-445-8328
FL	St. Petersburg, MacKay, Smith & Assocs.	407-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-496-9913
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MA	Boston, Rosen & Assocs.	617-449-4700
MO	St. Louis, Florence & Meyer	913-722-5210
NC	Charlotte, MacKay, Smith & Assocs.	919-847-2277
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
TX	Austin, Aid Elctrns.	512-836-6724
TX	Irving, AID Elctrns.	214-790-4761

Local Distributors

FL		407-423-4353

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HITACHI AMERICA, LTD., Electron Tube Division, 3850 Holcomb Bridge Rd., Ste. 300, Norcross, GA 30092, Tel: 404-409-3000; Empl.: 50; *Sls. Mgr.:* Tim Patton; *Dist. Mgr.:* Steve Bubb .... **B•1073-1076**

Local Sales Offices & Reps

AL	Huntsville, Group 2000	205-536-2000
AL	Huntsville, Technlg. Mktg. Assoc.	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Agoura Hills, Quadrep Southern Inc.	818-597-0222
CA	Irvine, Quadrep	714-527-4222
CA	San Diego, Quadrep Southern Inc.	619-560-8330
CA	San Jose, Quadrep	408-432-3300
CO	Parker, Parker Webster	303-841-4888
CT	Wallingford, Technlg. Sls., Inc.	203-269-8853
FL	Deerfield Beach, Technlg. Mktg. Assoc.	305-427-1090
FL	Largo, Technlg. Mktg. Assoc.	813-531-4405
FL	Orlando, Technlg. Mktg. Assoc.	407-857-3760
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Norcross, Group 2000 Sls.	404-729-1889
ID	Ketchum, Crown Elctrns.	208-622-8125
IL	Chicago, Sumer Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
IN	Kokomo, M. Gottleib Assoc. Inc.	317-455-0444
IA	Cedar Rapids, Wes Tech Assocs.	319-393-9790
KS	Overland Park, Electri Rep	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	410-995-1900
MA	Waltham, Technlg. Sls. Inc.	617-890-5700
MI	Flint, M. Gottleib Assoc. Inc.	313-732-3922
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Minneapolis, Tek Rep Inc.	612-832-0277
MO	St. Louis, Electri Rep	314-993-4421
NJ	Teaneck, Strategic Sls., Inc.	201-833-0099
NM	Albuquerque, System Sls. of AZ	505-889-2901
NY	Fairport, Technlg. Sls., Inc.	716-223-7500
NC	Cary, Group 2000 Sls.	919-481-1531
OH	Beachwood, Thompson & Assoc.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OH	Orient, Thompson & Assoc.	614-877-4304
OK	Tulsa, West Assoc.	918-492-4300
OR	Portland, Crown Elctrns.	503-620-8320
PA	Warrington, Strategic Sls. Inc.	215-491-0340
PA	Willow Grove, Technlg. Sls., Inc.	215-784-0170
TX	Austin, West Assocs.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Murray, Parker Webster	801-266-9939
WA	Bellevue, Crown Elctrns.	206-453-5100
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Kanata, Ont., Hitachi Canadian Ltd.	613-591-1990
Can	Mississuaga, Ont., Longman Sls.	416-670-8100

Local Distributors

AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Reptron	205-722-9500
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling	602-437-5565
CA	Agoura Hills, Western Micro	818-707-0377
CA	Calabasas, Marshall Inds.	818-878-7028
CA	Chatsworth, Sterling	818-407-8850
CA	El Monte, Marshall Inds.	808-307-6000
CA	Irvine, Marshall	714-458-5394
CA	Irvine, Marshall Ind.	714-458-5398
CA	Milpitas, Marshall	408-942-4600
CA	Milpitas, Marshall Inds.	408-942-4700
CA	Orange, Western Micro	714-637-0200
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	San Diego, Marshall	619-578-9600
CA	San Diego, Sterling	619-271-6555
CA	San Diego, Western Micro	619-453-8430
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Saratoga, Western Micro	408-725-4753
CA	Tustin, Sterling	714-259-0900
CO	Englewood, Sterling	303-792-3939
CO	Thornton, Marshall	303-451-8383
CT	Milford, Milgray	203-878-5538
CT	Wallingford, Cronin	203-265-3134

CT	Wallingford, Marshall	203-265-3822
CT	Wallingford, Sterling	203-265-9539
FL	Altamonte Springs, Marshall	407-767-8585
FL	Altamonte Springs, Vantage	305-429-1001
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Orlando, Milgray	407-647-5747
FL	Tampa, Reptron	813-854-2351
FL	Tampa, Reptron	813-855-4656
GA	Atlanta, Marshall	404-923-5750
GA	Atlanta, Milgray	404-446-9777
GA	Norcross, Reptron	404-446-1300
IL	Palatine, Milgray	708-202-1900
IL	Schaumburg, Marshall	708-490-0755
IL	Schaumburg, Reptron	312-882-1700
IN	Indianapolis, Marshall	317-297-0483
KS	Kansas City, Marshall	913-492-3121
KS	Lenexa, Sterling	913-492-5406
KS	Overland Park, Milgray	913-236-8800
MD	Baltimore, Resco	301-931-8200
MD	Beltsville, Resco	301-937-9100
MD	Columbia, Milgray	301-995-6169
MD	Columbia, Sterling	301-290-3800
MD	Columbia, Vantage	301-720-5100
MD	Silver Springs, Marshall	301-622-1118
MA	Andover, Vantage	508-687-3900
MA	Burlington, Western Micro	508-273-2800
MA	Needham, Cronin	617-449-5000
MA	New England, Milgray	508-657-5900
MA	Wilmington, Marshall	508-657-9064
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Reptron	313-525-2700
MN	Minneapolis, Marshall	612-559-2211
MN	Minneapolis, Sterling	612-831-2666
MN	Minnetonka, Reptron	612-938-0000
MO	Bridgeton, Marshall	314-291-4650
NJ	Clifton, Vantage	201-777-4100
NJ	Edison, Sterling	908-417-1000
NJ	Fairfield, Marshall Inds.	201-882-0169
NJ	Marlton, Milgray	609-983-5010
NJ	Marlton, Western Micro	609-596-7775
NJ	Mt. Laurel, Marshall	609-234-9100
NJ	Parsippany, Milgray	201-335-1766
NM	Albuquerque, Sterling	505-884-1900
NY	Farmingdale, Milgray	516-420-9800
NY	Hauppauge, LI, Marshall	516-273-1515
NY	Johnson City, Marshall	607-798-1611
NY	Pittsford, Milgray	716-381-9700
NY	Rochester, Marshall	716-235-7620
NY	Smithtown, Vantage	516-543-2000
NC	Raleigh, Marshall	919-878-9882
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Reptron	614-436-6675
OH	Dayton, Marshall	513-898-4480
OH	Solon, Marshall	216-248-1788
OH	Solon, Reptron	216-349-1415
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Sterling	918-663-2410
OR	Beaverton, Marshall	503-644-5050
OR	Beaverton, Western Micro	503-629-2087
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall	512-837-1991
TX	Austin, Sterling	512-836-1341
TX	Carrollton, Marshall	214-233-5200
TX	Carrollton, Sterling	214-243-1600
TX	Dallas, Milgray	214-248-1603
TX	Houston, Marshall	713-895-9200
TX	Houston, Sterling	713-627-9800
TX	Stafford, Milgray	713-240-5360
UT	Salt Lake City, Marshall	801-485-1551
UT	Salt Lake City, Milgray	801-272-4999
UT	Salt Lake City, Sterling	801-972-5444
VA	Richmond, Sterling	804-226-2190
WA	Bothel, Marshall Inds.	206-486-5747
WA	Redmond, Western Micro	206-881-6737
WI	Milwaukee, Marsh	414-475-6000
WI	Waukesha, Marshall	414-797-8400
Can	Alberta, ITT	403-273-2780
Can	Alberta, ITT	403-436-9555
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	British Columbia, ITT	604-291-8866
Can	Manitoba, ITT	204-697-2300
Can	Ontario, ITT	416-736-1144
Can	Ontario, ITT	613-596-6980
Can	Pt. Claire, Que., Marshall Inds.	514-694-8142
Can	Quebec, ITT	514-335-7697

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HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 371 Van Ness Way, Ste. 120, Torrance, CA 90501, Tel: 310-328-6116, FAX: 310-328-6252; Empl.: 110; *Sls. Mgr.:* Richard Westle, Natl. Sls. Mgr.

HITECH EQUIPMENT CORP., 9400 Activity Rd., San Diego, CA 92126, Tel: 619-566-1892, FAX: 619-530-1458; Empl.: 12

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 708-746-2447, FAX: 708-746-4945; Empl.: 35; *Sls. Mgr.:* J. Gordon Johnson

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 15; *Sls. Mgr.:* Roger Meade

HITRAN

FAX: 908-782-9733

HITRAN CORPORATION, 362 Highway 31, Flemington, NJ 08822-1238, Tel: 908-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* James Hindle .... **A•2361; D•1744, 2266-2267**

Local Sales Offices & Reps

AL	Birmingham, Robertson Sls.	205-823-4187
AZ	Scottsdale, Electro Mktg.	602-991-0110
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
CT	W. Reading, Vesco, Inc.	203-790-0702
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500
NC	Charlotte, Servicon Sls. Corp.	704-588-1035
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
Can	Mississauga, Reemio	416-821-9375

Local Distributors

RI	Providence, WALCO Elec. Co.	401-467-6500,

HMC/HUB MATERIAL COMPANY, 33 Springdale Ave., Canton, MA 02021, Tel: 617-821-1870, FAX: 617-821-4133; FSC No.: SIC CODE 5085; Empl.: 20; *Sls. Mgr.:* Howard Chase

HMW ENTERPRISES, INC., 207 N. Franklin St., Waynesboro, PA 17268, Tel: 717-765-4690, FAX: 717-765-4660; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* M. K. Ensminger

HOBART TAFA TECHNOLOGIES, Hobart Bros. Co., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 60; *Sls. Mgr.:* Robert Unger; *Dist. Mgr.:* Robert Unger

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P.R., CO., MATERIALS PROC, 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Galen Martin

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, FAX: 612-421-1556; *Dist. Mgr.:* Paul Premo

HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Ray Pohlke; *Dist. Mgr.:* Ray Pohlke

HOKURIKU USA LTD., 117 Jetplex Circle, Ste. C-1, Madison, AL 35758, Tel: 205-772-9620, FAX: 205-772-3475; Empl.: 9; *Sls. Mgr.:* Kathleen Leverock

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* David Baron

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455, FAX: 312-728-2016; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 310-921-3438, FAX: 310-921-6313; FSC No.: 30528; Empl.: 85; *Sls. Mgr.:* Keith McKinney

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03063, Tel: 603-889-1121, FAX: 603-880-0939; FSC No.: RCA 294005; Empl.: 130; *Sls. Mgr.:* Brian Duffey; *Dist. Mgr.:* Jerry Vermette

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 53; *Sls. Mgr.:* Keith Thayer

HOLT INSTRUMENT, C.P.D. Engineering, Inc., 126 Mott St., PO Box 230, Oconto, WI 54153, Tel: 414-834-2222, FAX: 414-834-5710; FSC No.: 09435; Empl.: 10; *Sls. Mgr.:* C. P. De Witt

Local Sales Offices & Reps

CA	Torrance, Cutlass Elctrns., Inc.	714-549-9358
IL	I & C Sls.	1-800-536-5555
IN	I & C Sls.	1-800-536-3333
MI	Southgate, I & C Sls.	1-800-536-5555
OH	Cincinnati, I & C Sls.	1-800-536-5555
Can	Ontario, Duncan Instrs. Canada Ltd.	416-742-4448

HOMALITE™

FAX: 302-652-4578

HOMALITE, Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686; FSC No.: 4330,4240,4710,6605; Empl.: 35; *Sls. Mgr.:* Jack Whittaker .... **B•1077**

HOME AND BUILDING CONTROL, Honeywell Inc. MN 27-3176, Honeywell Plaza, Minneapolis, MN 55408, Tel: 1-800-328-5111; Empl.: 5000

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICROSWITCH DIV., 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Tom Mabrey; *Dist. Mgr.:* Frank Davis

HOOSIER MAGNETICS, INC., 6545 W. Central Ave. Rm.203, Toledo, OH 43617, Tel: 419-841-7173, FAX: 419-841-7359; FSC No.: 3160; Empl.: 90

HOPPECKE BATTERY SYSTEMS, INC., 10 Park Place, Bulter, NJ 07405, Tel: 201-492-0045, FAX: 201-492-2714; *Sls. Mgr.:* Ted Czauski, Dir. Mktg. & Sls.

HOPPER ELECTRONICS, 1943 West North Lane, Ste.9, Phoenix, AZ 85021-1932, Tel: 602-870-3093, FAX: 602-944-6704; Empl.: 10

HOTPACK CORP., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Hugh McKenna

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOUSE OF BATTERIES

FAX: 714-375-0235

HOUSE OF BATTERIES, 16512 Burke La., Huntington Beach, CA 92647, Tel: 1-800-432-3385, 714-375-0222; Empl.: 20; *Sls. Mgr.:* Pat Hoscoe .... **D•1446**

Local Sales Offices & Reps

AZ	Phoenix, JBS	602-893-2382
CA	Cupertino, Prism Tech. Sls.	408-435-7377
CA	Irvine, Atlas Tech. Sls.	714-474-9850
CA	Martinez, Tech Sls.	415-686-2680
CA	Norwalk, Ed Rivers Assoc.	310-868-1471
CA	San Diego, Jack Murphy Co.	619-697-2150
CA	Simi Valley, W.H. Daugherty Co.	213-622-2849
IL	Schiller Park, Wm. R. Bolles Assoc.	708-678-7888
MN	Afton, Real Elctrns.	612-436-1950
NY	Newburgh, Anderson Sls.	914-565-2493
OR	Portland, Roger Minthorne Co.	503-246-4556
TX	Richardson, Krone & Assocs.	214-437-1892
WI	Mequon, Wm. R. Bolles Assoc.	414-241-3320

HOUSTON ATLAS, Envirotech Controls, Inc., 22001 Northpark Dr., Kingwood, TX 77339-3804, Tel: 713-348-1000, TELEX: 6821159 BCAC UW, FAX: 713-462-1831; Empl.: 250; *Sls. Mgr.:* Marshall Brown

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, INC./BREVEL MOTORS, Box 287, One North Dixie Hwy., Milford, IL 60953, Tel: 815-889-4105, FAX: 815-889-4313; Empl.: 350; *Sls. Mgr.:* Hans Wolf; *Dist. Mgr.:* Dave Hotler

HP DIRECT, Hewlett-Packard, 1320 Kifer Rd., Sunnyvale, CA 94086, Tel: 800-538-8787; Empl.: 80,000

HUALON MICROELECTRONICS CORP., Chung Shan North Road, Taipei, Taiwan, Tel: 886-2-536-2151, FAX: 886-2-531-3241

HUALON MICROELETRONICS CORPORATION, Hualon Group, #1 R & D 4th Rd., S.B.I.P., Hsin-Chu, Taiwan, Tel: 415-288-0390, FAX: 415-288-0399; Empl.: 984; *Sls. Mgr.:* Mr. Tyrone Huang; *Dist. Mgr.:* Mr. Tyrone Huang

Local Sales Offices & Reps

CA	San Francisco, The Summa Grp. Ltd.	415-288-0390

HUBBELL INDUSTRIAL CONTROLS INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161, ESYLNK: 980-439, FAX: 216-428-7635

HUDSON TOOL & DIE CO., 1327 U.S. Hwy 1, Ormond Beach, FL 32174, Tel: 904-672-2000, FAX: 904-676-6212; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Interconnect Systems Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5772, FAX: 714-660-6981; FSC No.: 53669; *Sls. Mgr.:* Terry Jarnigan; *Dist. Mgr.:* Terry McCann

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 310-517-6000, TELEX: 67-7064, TWX: 910-347-7321, FAX: 310-517-6714; Empl.: 1000; *Sls. Mgr.:* D.B. Giguere

HUGHES AIRCRAFT CO., Industrial Products Division, 2051 Palomar Airport Rd., Carlsbad, CA 92009, Tel: 619-931-3000, FAX: 619-931-3334

HUGHES ELECTRONICS PRODUCTS CORP., 34467 Industrial Rd., Livonia, MI 48150, Tel: 313-427-8310, FAX: 313-427-2282; Empl.: 20; *Sls. Mgr.:* Richard L. Smith

HUGHES MICROELECTRONIC CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: &, FAX: 714-759-2280

HUGHES SEMICONDUCTOR PRODUCTS CTR., M/S B1250, 500 Superior Ave., Newport Beach, CA 92663, Tel: 714-759-2665, FAX: 714-759-2913; FSC No.: 62458; Empl.: 328; *Sls. Mgr.:* Del Brand; *Dist. Mgr.:* Kathie Lake

HUGHEY & PHILLIPS, INC., 2162 Union Pl., P.O. Box 2167, Simi Valley, CA 93062, Tel: 805-581-5591, FAX: 805-581-5032; FSC No.: 94295; Empl.: 40; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 6; *Sls. Mgr.:* Peter Hugin

HUMISEAL DIV., CHASE Corporation, 26-60 BQE West, Woodside, NY 11377, Tel: 718-932-0800, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150; *Sls. Mgr.:* William G. Lott

Humphrey Inc.

FAX: 619-565-6873

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631; Empl.: 325 .... **B•1956-1958**

Local Sales Offices & Reps

CA	Granada Hills, L.L. Stoakes, Inc.	818-368-6752, FAX:818-831-0015
CA	Palo Alto, Harris Engrg. Assocs.	415-328-3370, FAX:415-328-4191
CA	Playa Del Rey, L.L. Stoakes, Inc.	310-822-8553, FAX:213-200-3662
CA	San Diego, L.L. Stoakes, Inc.	619-452-1600, FAX:619-452-0966
CA	San Jose, ECC Products, Inc.	408-289-8545, FAX:408-289-9123
FL	Orlando, Gra-Mar, Inc.	407-658-1971, FAX:407-658-4101
IN	Fishers, Carter, McCormic & Peirce, Inc.	317-842-9277,FAX:317-577-2741
IA	Cedar Rapids, Dy-Tronix Inc.	319-377-8275, FAX:319-377-9163
KS	Leawood, Dy-Tronix Inc.	913-339-6333, FAX:913-339-9449
KS	Wichita, Dy-Tronix Inc.	316-838-0884, FAX:316-838-2645
LA	Broussard, The Instr. Shoppe	318-837-9976
MD	Annapolis Junction, Stemler Assocs., Inc.	301-490-1078,FAX:301-490-1073
MA	Wayland, High Tech Sls., Inc.	508-653-3838, FAX:508-651-3784
MI	Farmington Hills, Carter Technlg., Inc.	313-477-7700,FAX:313-477-4149
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777, FAX:314-291-3861
NY	E. Setauket, Eastern Metro Assocs., Inc.	516-928-2726,FAX:516-928-3807
OH	Englewood, Carter, McCormic & Peirce, Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter, McCormic & Peirce, Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter Technlg., Inc.	412-826-3800, FAX:412-826-5009
TX	Dallas, W.N. Rider Co.	214-357-2246, FAX:214-357-2246
TX	El PAso, Nokomis of El Paso, Inc.	915-778-2801

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778, FAX: 219-356-7891; *Sls. Mgr.:* Michael Khorshid .... **A•1936-1938**

Local Sales Offices & Reps

IN	Huntington, HEI	219-356-0756
MA	Burlington, Tri-Com Assocs., Inc.	617-272-8163
MN	Roseville, Pro Tec Power Sls., Inc.	612-483-0409
MO	St. Louis, Rep-Tronics	314-576-9816
PA	Greensberg, Pro-Mark	412-832-3800

Local Distributors

CA	Fountain Valley, Comp. Center	714-979-0433
CA	Los Angeles, Cal State Elctrns.	213-933-8187
CA	Monrovia, Daring	818-357-0021
FL	Ft. Lauderdale, NRC Elctrns., Inc.	305-772-4500
MO	St. Louis, Franklin Elctrns.	314-933-5333

HUNTSVILLE MICROSYSTEMS, INC., 3322 South Memorial Pkwy., Huntsville, AL 35801, Tel: 205-881-6005, TWX: 510-600-8258, FAX: 205-882-6701; Empl.: 50; *Sls. Mgr.:* Jim Bell

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003, FAX: 801-635-2495; FSC No.: 64109; Empl.: 35; *Sls. Mgr.:* C. R. Reeve

Local Distributors

TX	Fort Worth, Tandy Elctrns. Natl. Parts Div.	817-870-5600

hurst

FAX: 812-386-7504

HURST MANUFACTURING DIV., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Don Morrow .... **B•1266-1270**

Local Sales Offices & Reps

AZ	Phoenix, Sierra Ind. Eng.	602-272-0084
CA	Fremont, Coherent Automation	510-657-2100
CA	Los Angeles, Sierra Ind'l. Engrg. Co.	213-624-3123
IL	Chicago, Golten Assocs.	708-512-0093
IN	Indianapolis, Emerson Motor Div.	317-842-1342
MD	Glen Arm, Hodgins Assoc.	301-592-7047
MA	Lexington, Hathaway Elctrns.	617-861-7010
MI	Grand Rapids, Emerson Motor Div.	616-942-9500
MN	Wayzata, Cardinal Sls. Co.	612-475-0042
NJ	Sussex, Carbone Assocs.	201-875-1882
NM	Phoenix, Sierra Ind. Eng.	602-272-0084
NY	Youngstown, D & O Engrg.	716-754-2091
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
OH	Centerville, Omega Sls. Inc.	513-434-5507
OK	Edmond, Emerson Motor Div.	405-340-8228
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
TX	Arlington, Emerson Motor Div.	213-380-2670
WA	Seattle, Northmar	206-524-5170
WI	Milwaukee, Badgerep Inc.	414-241-9200
EXP	NY, Freeport, Churchin Assc. Ltd.	516-864-8589

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
CA	Glendale, Minarik Elec.	818-507-6500
CA	Santa Clara, Minarik Elec.	408-727-0575
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Commerce City, Minarik Elec.	303-289-5800
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Orlando, EMSCO	407-849-6362
GA	Norcross, EMSCO	404-925-8366
IL	Schaumburg, Minarik Elec.	708-885-9337
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Somerville, Electro Sls.	617-666-0500
MN	Mendota Hgts.	612-452-6467
NJ	Fanwood, MacPherson Controls	201-757-5110
NY	Long Island City, B & B Motor & Control	718-784-1313
NC	Greensboro, EMSCO	919-275-8776
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-8123
OR	Portland, Minarik Elec.	503-253-3402
PA	Philadelphia, H & R Corp.	215-426-1700
SC	Greenville, EMSCO	803-233-4121
TX	Dallas, Mechanical Southwest	214-634-0921
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Irving, Minarik Elec.	214-402-8188
WA	Redmond, Minarik Elec.	206-885-0832
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

HUTRONIX, INC., 101 W 11th Street, Douglas, AZ 85607, Tel: 602-364-2432, FAX: 602-364-6174; FSC No.: 70206; Empl.: 50; *Sls. Mgr.:* John Huls

HV COMPONENT ASSOCIATES INC., P O Box 2484, Farmingdale, NJ 07727, Tel: 908-938-4499, FAX: 908-938-4451; Empl.: 20; *Sls. Mgr.:* Dennis R. Dean

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654, FAX: 508-772-2963; Empl.: 74; *Sls. Mgr.:* Jim Gallagher

HYBRID DESIGNS, INC., 666 W. Baker, Costa Mesa, CA 92626, Tel: 714-557-9933, FAX: 714-557-0322; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Bob Soberman

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470,617-275-0218; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL, Frequency Products Div., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor

HYBRIDS INTERNATIONAL LTD.

THICK FILM DIV.

FAX: 913-764-6409

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400; Empl.: 45; *Sls. Mgr.:* Bob Goodwin .... **A•1406-1407, 1699**

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001, FAX: 602-791-3899; Empl.: 65; *Sls. Mgr.:* Tom Fern

HY-CAL ENGINEERING, Unit of General Signal, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, FAX: 818-444-1314; FSC No.: 12199; Empl.: 98; *Sls. Mgr.:* Douglas W. Rasmussen

HYCOMP, INC., 165 Cedar Hill St, Marlborough, MA 01752, Tel: 508-485-6300, FAX: 508-481-1547; FSC No.: 34707; Empl.: 43; *Sls. Mgr.:* David Petros

HYDRO-GEN PRODUCTS INC., P.O. Box 1517, Fort Collins, CO 80522-1517, Tel: 800-779-0126, FAX: 303-498-0528; Empl.: 25; *Sls. Mgr.:* Derek Bobo; *Dist. Mgr.:* Derek Bobo

HYLETRONICS:LITTON INDUSTRIES, 10 Maguire Rd., Lexington, MA 02173-3199, Tel: 617-276-3298, FAX: 617-276-2127; FSC No.: ODZK6; Empl.: 48; *Sls. Mgr.:* Rodney Hsing

HY MEG CORP., 854 Westgate, Addison, IL 60101, Tel: 708-543-9250, FAX: 708-543-9260; Empl.: 24; *Sls. Mgr.:* Vincent Cupidro

HYPATIA INC., 15270 SW Holly Hill Rd., Hillsboro, OR 97123-9074, Tel: 503-628-2936, FAX: 503-628-2936; *Sls. Mgr.:* Bruce Campbell

HYPERION INDUSTRIES CORP., 134 Coolidge Ave., Watertown, MA 02172, Tel: 617-926-0140, FAX: 617-926-3707; FSC No.: 09448; Empl.: 130; *Sls. Mgr.:* Aldo Bussi

HYPERLOGIC CORPORATION, 1855 E. Valley Pkwy., Ste.210, Escondido, CA 92027, Tel: 619-746-2765, FAX: 619-746-4089

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 508-568-0451, 800-225-9228, FAX: 508-568-0680; FSC No.: 50541; Empl.: 145; *Sls. Mgr.:* E. Dalrymple .... **C•1348-1352**

Local Sales Offices & Reps

AL	Huntsville, Elec. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, TC Elctrns. Sls., Inc.	602-994-5153
CA	Newbury Park, Interconn	805-499-4024
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	215-647-1550
FL	Melbourne, Synergistic Technlgs.	407-242-9661
GA	Atlanta, Elec. Mktg. Assoc.	404-448-1215
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Indianapolis, CC Elctrns.	317-921-5000
MD	Baltimore, Tyler Griffin Co.	301-995-1215
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Wellesley, Reps. Corp.	617-237-6476
MA	Wellesley, The Reps	617-237-6476
MN	Bloomington, Murnco, Inc.	612-854-4161
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Raleigh, Elec. Mktg. Assoc.	919-847-8800
SC	Greenville, Elec. Mktg. Assoc.	803-233-4637
TX	Irving, Trice Mktg.	214-255-1877
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, A.I.E. Inc.	206-455-4697

HY-Q INTERNATIONAL (USA) INC., 1438 Cox Rd., Erlanger, KY 41018, Tel: 606-283-5000, FAX: 606-283-0883; FSC No.: 1CU70; Empl.: 35; *Sls. Mgr.:* Pam Deshler .... **A•1408**

HYTEK MICROSYSTEMS, INC., 400 Hot Springs Rd., Carson City, NV 89706, Tel: 702-883-0820, FAX: 702-883-0827; FSC No.: 0ANM4; Empl.: 40; *Sls. Mgr.:* Jon Presnell

HYTRONICS CORPORATION, 15401 Roosevelt Blv., Clearwater, FL 34620, Tel: 813-536-7861; Empl.: 50; *Sls. Mgr.:* Jack Colgan

HYUNDAI ELECTRONICS AMERICA, Semiconductor Division, 166 Baypointe Parkway, San Jose, CA 95134, Tel: 408-473-9200, TELEX: 278841 HEA UR, FAX: 408-943-9567

HYUNDAI ELECTRONICS INDUSTRIES CO. LTD., San 136-1, Ami-ri, Bubal-eub, 1 Chon-Kun, Kyoungki-do, Korea, Tel: (0336)30-4114,(02)741-0661, FAX: (0336)30-2077/8,(02)744-3526

IBI SYSTEMS INC., 6842 NW 20 Ave., Ft. Lauderdale, FL 33309, Tel: 305-978-9225, FAX: 305-978-9226; Empl.: 7

IBM®

IBM UNITED STATES/US OEM MARKETING, 1133 Westchester Ave., White Plains, NY 10604, Tel: 1-800-969-8643 .... **D•1117-1141**

ICI INC., 1901 Petra La., Placentia, CA 92670, Tel: 714-579-7575, FAX: 714-579-3127; Empl.: 8

IC MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ICO-RALLY CORPORATION, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, FAX: 415-856-8378; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* B. Enad/A. Bourassa

ICS ELECTRONICS CORP., 744 S. Hillview Dr., Milpitas, CA 95035-5545, Tel: 408-263-5500, 1-800-952-4499, FAX: 408-263-5896; FSC No.: 58558; Empl.: 15; *Sls. Mgr.:* Bill Wallace; *Dist. Mgr.:* Jerry Mercola

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Scientific Dvcs.-Mtn.	602-839-6626
CA	Los Alamitos, Tritek Solutions	714-236-1190
CA	San Diego, Tritek Solutions	619-455-1911
CA	San Jose, Tritek Solutions	408-554-0455
CO	Denver, Scientific Dvcs.-Mtn	303-665-8089
CT	Mt. Carmel, Scientific Dvcs.-New Eng.	203-248-9361
FL	Ft. Lauderdale, Saber Assocs.	305-792-7280
FL	Melbourne, Saber Assocs.	407-724-0920
FL	Orlando, Saber Assocs.	407-724-0920
FL	Tampa, Saber Assocs.	407-724-0920
GA	Atlanta, Saber Assocs.	800-327-0853
IL	Chicago, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
IA	Cedar Rapids, KJS Mktg.	816-578-4751
MD	Burtonsville, Eastern Instrmn. Corp.	301-384-8500
MA	Waltham, Scientific Dvcs.-New Eng.	617-890-2252
MI	Detroit, TMS Inc.	313-462-2100
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, KJS Mktg.	314-770-1412
NJ	Teaneck, Scientific Dvcs.-East	201-440-3430
NM	Albuquerque, Scientific Dvcs.-Mtn	505-883-3668
NY	Liverpool, Northern Tech. Sls.	315-451-1091
NC	Raleigh, Saber Assocs.	800-327-0853
OH	Cleveland, TMS Inc.	216-327-3527
OH	Dayton, TMS Inc.	513-429-1142
PA	Horsham, Scientific Dvcs.-East	215-956-0700
PA	Pittsburg, TMS Inc.	412-221-2338
WA	Bellevue, The Western Rep	206-746-1127
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

Can	Montreal, Que., Multitest Elctrns.	514-337-0723
Can	Ottowa, Ont., Multitest Elctrns.	613-727-0848
Can	Toronto, Ont., Multitest Elctrns.	416-609-8396
Can	Vancouver, B.C., Jerome & Francis	604-986-1286

IC SENSORS, INC., 1701 McCarthy Blvd., Milpitas, CA 95035, Tel: 800-767-1888, FAX: 408-432-7322; Empl.: 160; *Sls. Mgr.:* Richard A. Auxer

idea

FAX: 310-690-1352

IDEA, INC., 1300 Pioneer St., Ste. B, Brea, CA 92621, Tel: 310-697-4332; *Dist. Mgr.:* Desiree A. Owsian .... **B•1164-1165**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CO	Longmont, Butler Tech. Sls.	303-651-7703
GA	Marietta, E-Squared Mktg.	404-565-2088
IA	Cedar Rapids, Tech. Elect., Inc.	319-366-5443
KS	Andover, QDC South	316-733-9756
KS	Overland Park, QDC Inds.	913-341-2214
MN	Eagan, QDC North	612-454-0893
MO	Ballwin, QDC East	314-458-1896
NH	Nashua, Bennetron	603-880-7008
OH	Columbus, The Bill Romine Co.	614-436-0565
TX	Carrollton, All Tech. Sls. & Mktg.	214-418-0850

Local Distributors

AL	Huntsville, CRI	205-722-0038
CA	Buena Park, Ford Elctrns., Inc.	714-521-8080
CA	San Jose, Rose Elctrn. Distrbg.	408-943-0200
CO	Denver, QPS Elctrns., Inc.	303-373-2766
FL	Delray Beach, Fastbolt Florida Corp.	407-272-3100
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
MN	Plymouth, Leeds Electro Comp.	612-557-1277
NH	Atkinson, Astrum Elec., Inc.	603-898-3399
NY	Farmingdale, Bulbtronics	516-249-2272
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
TX	Austin, Applied Prods.	512-832-9804
WI	Brookfield, Leeds Electro Comp.	414-789-6995
Can	Calgary, Alb., Memco Corp.	403-258-3399
Can	Markham, Ont., Carsten Elctrns.	416-477-9898
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Surrey, B.C., Memco Corp.	604-590-1553

IDEAL INDUSTRIES, INC., Becker Place, Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700; *Sls. Mgr.:* Bob Bukowsky

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707;10304-41; Empl.: 150; *Sls. Mgr.:* T. Bell

IDEAL SEMICONDUCTOR, 46721 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-7000, FAX: 510-226-1564

IDEAL TAPE CO., American Biltrite Inc., 1400 Middlesex St., Lowell, MA 01851, Tel: 508-458-6833, FAX: 508-458-0302

idec

FAX: 408-744-9055

IDEC CORPORATION, 1213 Elko Drive, Sunnyvale, CA 94089-2211, Tel: 408-747-0550, TELEX: 34-0601, TWX: 910-339-9383; FSC No.: 60886; Empl.: 90; *Sls. Mgr.:* Wallace Baldwin, Genl. Sls. Mgr. .... **B•1522-1523, 1738-1740**

Local Sales Offices & Reps

AL	Birmingham, Bryco Co.	205-672-9760
AZ	Phoenix, Western Automation	602-265-2788
CA	Laguna Hills, Western Automation	714-859-6988
CA	Sunnyvale, Idec Corp.	408-747-0550
CO	Lakewood, T.M.M.I.	303-232-1516
IL	South Barrington, Bu-Nell Engrg.	312-551-9000
IN	Indianapolis, Ronald Ray & Assoc.	317-841-9144
KS	Overland Park, TMW	913-383-1818
MA	Norwood, Hyland Assocs.	617-762-0345
MI	Detroit, IDEC Corp.	313-795-0291
MI	Farmington, Nova Elctrl. Assocs., Inc.	313-553-0100
MN	Minnetonka, S. J. Collins & Assocs.	612-933-7661
MO	St. Louis, TMW Co.	314-664-4005
NM	Albuquerque, T.M.M.I.	505-298-6893
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NY	Syracuse, Lachut Elctrl. Sls. Inc.	315-458-6480
NC	Kernersville, Heritage Sls. Assocs.	919-996-4374
OH	Cleveland, Matthew Haley Co.	216-892-1820
OH	Perrysburg, Matthew Haley Co.	419-874-0488
OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
PA	Cuddy, Brown-Yates Elec.Equip. Co.	412-221-4200
PA	Philadelphia, Fite-Walker, Inc.	215-233-2100
SC	Taylors, Heritage Sls. Assocs.	803-292-1723
TN	Knoxville, Tubbs Agy.	615-577-0689
TN	Memphis, Winstead Tech. Svcs.	901-372-4550
TX	Dallas, SW Mktg. Assocs.	214-341-8631
TX	Houston, SW Mktg. Assocs.	713-537-8166
UT	Salt Lake City, T.M.M.I.	801-487-7676
VA	Northboro, IDEC Corp.	508-393-2474
VA	Richmond, Dunnington & Assocs.	804-282-8383
WI	Appleton, Bu-Nell Engrg.	414-733-4242
WI	Waukesha, Bu-Nell Engrg.	414-784-0994

IDENTATRONICS, INC., 425 Lively Blvd., Elk Grove Village, IL 60007-2082, Tel: 708-437-2654, 1-800-323-5403, TELEX: 754319 CARD UD, FAX: 708-437-2660; Empl.: 50; *Sls. Mgr.:* Mike Sloe

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
idec CORPORATION
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

IDM (INTERNATIONAL DESIGN MODELING), 43 Smith Rd., Bedford, NH 03110, Tel: 603-472-7068, FAX: 603-472-7043

IEC ELECTRONICS CORP., 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, FAX: 315-331-3547; Empl.: 900; *Sls. Mgr.:* Stephen Hotchkiss; *Dist. Mgr.:* Stephen Hotchkiss

IEE (INDUSTRIAL ELECTRONIC ENGINEER, INC.), 7740 Lemona Ave., Van Nuys, CA 91409, Tel: 818-787-0311, FAX: 818-787-3953; Empl.: 300; *Sls. Mgr.:* R. Nisar .... **B•1078-1079, 1835**

Local Sales Offices & Reps

AL	Huntsville, TMA Technlg. Mktg. Assocs.	205-883-7893	FAX:205-882-6162
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971	FAX:602-263-8914
CA	Campbell, LCO Tech. Sls.	408-378-9900	FAX:408-370-0447
CA	Carlsbad, Zerimar Sls; Inc.	619-436-3379	
CA	Woodland Hills, Varigon, Inc.	818-594-5080	
CO	Golden, Cristee-Meade Co.	303-279-5070	FAX:303-232-0323
CT	North Haven, Kitchen & Kutchin, Inc.	203-239-0212	FAX:203-234-9108
FL	Deerfield, TMA Tech. Mktg. Assocs.	305-427-1090	FAX:305-427-1626
FL	Largo, TMA Technlg. Mktg. Assocs.	813-531-4405	FAX:813-545-8617
FL	Winter Park, TMA Tech. Mktg. Assocs.	407-671-2245	FAX:407-857-6412
GA	Norcross, TMA Tech. Mktg. Assocs.	404-446-3565	FAX:404-446-0569
IL	Highland Park, Bransky Sis.	708-433-2375	FAX:708-433-2377
IN	Indianapolis, Wilson Tech. Sls.	317-872-2513	FAX:317-872-0664
KS	Lenexa, Midtec	913-541-0505	FAX:913-541-1729
MA	Burlington, Kitchen & Kutchin, Inc.	617-229-2660	FAX:617-273-5895
MI	Southfield, L. H. Dickelman Co.	313-353-8210	FAX:313-353-1433
MN	Burnsville, 2M Sales, Inc.	612-890-7774	FAX:612-894-9342
MO	St. Louis, Midtec	314-275-8666	FAX:314-275-8859
NY	Buffalo, Advanced Comps., Inc.	716-832-6791	
NY	E. Syracuse, Advanced Comps. Corp., Inc.	315-437-6700	FAX:315-699-4611
NY	Endicott, Advanced Comps. Comp. Inc.	607-785-3191	
NY	Manhasset, Win-Cor elctrn. Sls.	516-627-9474	
OH	Richfield, Geotronix, Inc.	216-659-6100	FAX:216-659-3435
OH	Trotwood, Geotronix, Inc.	513-854-5939	FAX:513-837-0537
OR	Beaverton, Olson Tech. Sls. Corp.	503-643-9488	FAX:503-626-1985
PA	Allison Pk, Geotronix, Inc.	412-487-1770	FAX:412-487-1331
PA	Norristown, RJI	215-631-1414	FAX:215-631-1640
TX	Dallas, M-Rep, Inc.	214-484-5711	
VA	Springfield, Pantech	703-451-5700	FAX:703-451-5949
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792	FAX:206-883-9478
WI	Cedarburg, Bransky Sls.	414-377-6837	FAX:414-377-6837

Local Distributors

AZ	Phoenix, Tri-Tek, Inc.	602-371-0860	FAX:602-371-0874
CA	Garden Grove, Richey/Impact Elctrns.	714-895-0060	FAX:714-891-3563
CA	Gardena, California Switch & Signal Co.	213-538-9830	FAX:213-327-2741
CO	Denver, Integrated Elctrns. (IEC)	303-292-6121	FAX:303-297-2053
FL	Miami, Electronic Equip. Co., Inc.	305-526-6000	FAX:305-871-3736
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300	FAX:708-860-1573
IL	Chicago, Newark Elctrns.	312-784-5100	FAX:312-784-5100
MA	Needham, Cronin Elctrns. Inc.	617-449-5000	FAX:617-444-8395
MI	Southfield, Michigan Lectrols Corp.	313-353-1350	FAX:313-353-1433
MN	Minneapolis, Stark Elctrns.	612-332-1325	FAX:612-332-1783
NM	Albuquerque, Betatron Elctrns.	505-821-1122	FAX:505-828-0450
NY	Mamaroneck, Logicomp Elctrncs.	914-698-9332	FAX:914-698-9456
NY	Rochester, Masline Elctrns.	716-546-5373	FAX:716-546-2004
NC	Raleigh, So. Eastern Elctrns.	919-828-2311	FAX:919-828-2311
OH	Dayton, The Stotts-Friedman Co.	513-298-5555	FAX:513-298-3046
OH	Richfield, Alpha Distr. Corp.	216-659-7100	FAX:216-659-3459
SC	Taylors, Cantrell Whlsls.	803-268-1194	FAX:803-244-9080
TX	Richardson, The Altair Co.	214-231-4665	FAX:214-699-3207
TX	Stafford, Southwest Elctrns.	713-240-4000	FAX:713-240-5672

IEH CORP., 140 West 58th St.-8E, Bay Ridge, NY 11220, Tel: 718-492-4440, FAX: 718-492-9897; FSC No.: 97913; Empl.: 100; *Sls. Mgr.:* Terry Hart; *Dist. Mgr.:* Jenny Heredia

IEM-FUSION INC., 30275 Bainbridge Rd., Cleveland, OH 44139, Tel: 216-349-1960, FAX: 216-349-2206; Empl.: 4; *Sls. Mgr.:* Larry Shindell

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206, ESYLNK: 62951515, FAX: 818-848-8872; FSC No.: 98978; Empl.: 97; *Sls. Mgr.:* George S. Ollen .... **C•1592**

Local Sales Offices & Reps

AL	Huntsville, Mtn. Electro Mktg.	205-881-3937
AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CA	La Jolla, Coastal Elctrn. Sls.	619-459-4148
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Boulder, R.F. Mayo Assocs.	303-422-2155
CT	Danbury, Hathaway Elctrns.	203-790-6993
FL	Maitland, Hawkins-Frederickson	407-831-2474
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Park Ridge, Synmark Sls. Inc.	708-390-9696
IN	Indianapolis, Elctrn. Rep., Inc.	317-894-1414
KS	Wichita, Thunderbird Tech. Sls.	316-636-5777
KY	East, Catalyst Sls. Co.	800-873-0170
KY	Lexington, Elctrn. Reps., Inc.	606-277-0436
MD	Silver Springs, Mid-Atlantic Sls. Co.	301-593-7749
MA	Lexington, Hathaway Elctrns., Inc.	617-861-7010
MI	Canton, Techrep, Inc.	313-981-1950
MN	Minneapolis, Elec. Comp. Sls., Inc.	612-933-2594
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NJ	E. Brunswick, Shepard & Assocs.	908-254-5757
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, C.T. Carlberg & Assoc.	505-899-2155
NY	E. Syracuse, Advanced Comps. Corp.	315-437-6700
NC	Raleigh, Mtn. Electro Mktg.	919-839-8662
OH	Hamilton, Catalyst Sls. Corp.	800-873-0170
OR	Portland, Temper Tech. Mktg.	503-292-8201
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
TX	Houston, R.J. Powers & Assocs., Inc.	713-784-5860
VA	Charlottesville, Mid-Atlantic Sls. Co.	804-973-8099
Can	Mississauga, R-Theta Mfg.	416-890-0221

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-1533
CA	Burbank, IERC	818-842-7277
CA	San Jose, Rosé Elctrns.	408-943-0200
CA	Sunnyvale, PSC	408-737-1333
CO	Littleton, Indelco	303-795-3431
FL	Clearwater, Lynch Gentry Assocs.	813-433-2697
FL	Coral Springs, HAI Elctrns.	305-752-7551
FL	Sunrise, QAR/All American	305-572-7999
GA	Atlanta, Motion Elctrns., Inc.	404-455-8262
IL	Addison, Belford Elctrns.	708-691-1100
IN	Carmel, Altex Elctrn., Inc.	317-848-1323
MD	Gaithersburg, M.S. Elctrns.	301-921-0200
MD	Rockville, QAR/All American	301-251-1205
MA	Billerica, A.W. Mayer Elctrns.	617-229-2255
MI	Wyoming, North Coast Comps., Inc.	616-452-0800
MN	Eden Prairie, QAR/All American	612-944-2151
NM	Albuquerque, Walker Elctrns. Supp.	505-883-2992
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Bohemia, March Elctrns.	516-563-6000
NY	Mt. Vernon, QAR/All American	914-699-2240
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Cleveland, Advacom, Inc.	216-688-5311
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
OR	Portland, United Radio Supp.	503-233-5341
PA	Bristol, Aim Elctrns.	215-946-3900
RI	Pawtucket, Major Edwards Elctrns.	401-725-7400
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Houston, Lenert Co.	713-225-1465
TX	Mansfield, Mouser Elctrns.	817-483-0165

IET

FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959, 800-899-8438; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena .... **D•1214, 1266-1273**

IFR SYS. INC., 10200 W. York St., Wichita, KS 67215, Tel: 316-522-4981, TWX: 910-741-6952, FAX: 316-522-1360; Empl.: 550; *Sls. Mgr.:* T. Dideum

IICON CORPORATION, 16040 Caputo Drive, Morgan Hill, CA 95037, Tel: 408-779-7466, FAX: 408-779-7350; Empl.: 14; *Sls. Mgr.:* Ron De Jong

DDC
ILC DATA DEVICE CORPORATION®

FAX: 516-567-7358

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716-2482, Tel: 516-567-5600; FSC No.: 19645; Empl.: 700; *Sls. Mgr.:* Marshall Lacoff .... **D•1190-1191**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tuscon, Fred Board Assocs.	602-994-9388
CA	Fallbrook, Gary Chilcote & Assocs.	619-728-7678
CA	Garden Grove, ILC Data Dvcs. Corp.	714-895-9777
CA	Woodland Hills, ILC Data Dvcs. Corp.	818-992-1772
CO	Englewood, Quorum 3 Sls. Grp.	303-799-8100
CT	Canton Center, Dynamic Sls. of New Eng.	203-693-6567
FL	Boca Raton, Perrott Assocs.	407-362-0191
FL	Cassleberry, Perrott Assocs.	407-830-0094
FL	Melbourne, Perrott Assocs.	407-676-0305
FL	Palm Harbor, Perrott Assocs.	813-789-9393
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Itasca, Janus, Inc.	708-250-9650
IN	Carmel, Giesting & Assocs.	317-844-5222
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec South, Inc.	316-263-7090
MD	Baltimore, Bagoul/Grimm Assocs.	410-719-0770
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MI	Comstock Pk., Giesting & Assocs.	616-784-9437
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Eden Prairie, Comprehensive Tech.	612-941-7181
MO	Maryland Hgts., Dytec/South	314-739-0665
NJ	Marlton, BGR Assocs.	609-983-1879
NJ	Totowa, ILC Data Dvcs. Corp.	201-785-1734
NM	Albuquerque, Nelco Electronix	505-292-1399
NY	E. Rochester, Tri Tech Elctrns., Inc.	716-385-6500
NY	Fayetteville, Tri-Tech Elctrns, Inc.	315-446-2881
NY	Fishkill, Tri Tech Elctrns., Inc.	914-897-5611
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
NC	Raleigh, Montgomery Mktg; Inc.	919-851-0010
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Dayton, Lionel Fedotin	513-275-9345
OH	Euclid, Giesting & Assocs.	216-261-9705
OR	Portland, Venture Elctrns.	503-624-0617
PA	Pittsburgh, Giesting & Assocs.	412-828-3553
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Houston, Bonser-Philhower Sls.	713-782-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
VT	Graniteville, Dynamic Sls. of New Eng.	802-476-4223
VA	Sterling, ILC Data Dvcs. Corp.	703-450-7900
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Janus, Inc.	414-542-7575
Can	Ontario, Cantec Rep., Inc.	416-791-5922
Can	Ontario, Cantec Rep., Inc.	613-725-3704
Can	Quebec, Cantec Rep., Inc.	514-623-5496

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, FAX: 408-744-0829; Empl.: 375; *Sls. Mgr.:* Lynn Reiter; *Dist. Mgr.:* John Reilly

IC ILLINOIS CAPACITOR, INC.

FAX: 708-673-2850

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 708-675-1760; Empl.: 35; *Sls. Mgr.:* George Wundsan .... **A•1082-1083**

Local Sales Offices & Reps

AZ	Scottsdale, Lindberg Co.	602-998-2944
AR	Little Rock, Doby Assocs., Inc.	501-221-0326
CA	Anaheim, WestRep	714-527-2822
CA	San Diego, Westrep	619-674-1880
CO	Denver, Lindberg Co.	303-758-9033
GA	Roswell, JWL Assocs.	404-518-8500

IL	Lincolnwood, Illinois Capacitor, Inc.	708-675-1760
IN	Carmel, Valentine & Assocs.	317-846-0008
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM Inc.	913-888-0022
KY	Henderson, Valentine & Assocs.	502-826-9444
MD	Gaithersburg, Bresson Assocs.	301-330-8274
MD	Germantown, Bresson Assocs.	301-540-0110
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Canton, TechRep, Inc.	313-981-1950
MN	Bloomington, Horizon Technlgs.	612-884-6515
MS	Jackson, Doby Assocs.	601-981-1138
MO	Bridgeton, AEM, Inc.	314-298-9900
NJ	Woodbridge, Jade Mktg.	201-750-2998
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Electra Sls.	
NY	Rochester, Electra Sls. Corp.	716-427-7860
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
PA	Narberth, Bresson Assocs.	215-664-6460
TN	Collierville, Doby Assocs. Inc.	901-854-5482
TX	Dallas, Innovative Tech. Sls., Inc.	214-699-3485
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Caruso & Camelleri Assocs.	206-455-8811
WI	Milwaukee, Erdman Sls. Co.	414-281-1330

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AL	Huntsville, Resticap Inc.	205-883-4270
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Neumann Elctrns.	602-788-3737
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
AR	Springdale, Carlton Bates Co.	501-756-5012
CA	Irvine, Integrated Elctrns. Corp.	714-753-0127
CA	Milpitas, California Capacitor	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Norwalk, Myco Elctrnc. Supp.	213-404-2053
CA	Sacramento, Integrated Elctrns., Corp.	916-363-6030
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
CO	Englewood, Kimball Elctrns.	303-893-1413
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, GRS Midan Elctrns.	203-265-2077
CT	Wallingford, Midstate Elctrns. Co.	203-265-9900
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Melbourne, GRS Elctrns.	407-768-6966
FL	Melbourne, Pridmore Corp.	407-727-2491
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Whitehead Elctrns.	404-923-6667
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2241
IL	Hoffman Estates, Integrated Elctrns. Corp.	708-843-2040
IL	Northbrook, Classic Comps. Supp. Co.	708-272-9650
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Carmel, Altex	317-848-1323
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
IA	Des Moines, Mid-State Distrbg.	515-244-7231
IA	Mason City, Mid-State Distrbg.	515-423-8012
KS	Shawnee, Finnigan Elctrns.	913-268-6917
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Shreveport, Carlton Bates	318-636-9975
MD	Baltimore, Resco/Baltimore	301-931-8200
MD	Beltsville, Resco/Washington	301-937-9100
MD	Columbia, GRS Elctrns. Co. Inc.	410-995-6744
MA	Billerica, Mayer Elctrns. Co.	508-667-2545
MA	Woburn, Lorcor	617-935-5024
MI	Farmington Hills, Advent Elctrns., Inc.	313-477-1650
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, Walters Indl. Elctrns., Inc.	816-531-7015
MO	Springfield, Carlton Bates	417-862-1699
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NE	Omaha, Mid-State Distrbg.	402-592-5965
NJ	Camden, G.R.S. Elctrns. Co., Inc.	609-964-8560
NJ	Teterboro, EAC	201-288-4477
NJ	Union, Lectron Inds.	908-687-2626
NY	Buffalo, Summit Distrs. Inc.	716-887-2829
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Rochester, Help Elctrns.	716-264-9300
NY	Rochester, Summit Distrs., Inc.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Williamsville, Rome Elctrns.	716-626-1602
NC	Charlotte, EMC	704-394-6195
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Columbus, AESCO Elctrns.	614-882-6762
OH	Columbus, EMC	614-299-4161
OH	Highland Hgts., EMC	216-442-3441
OK	Oklahoma City, Carlton Bates Co.	405-681-4446
OK	Oklahoma City, RSC Elctrns.	405-631-7729
OK	Tulsa, Altair Elctrns.	918-252-5781
OK	Tulsa, Carlton Bates Co.	918-250-1626
OR	Beaverton, Integrated Elctrns. Corp.	503-641-1690
PA	Exton, VSH Elctrns.	215-363-2250
PA	No. Versailles, CMD	412-678-6020
PA	Philadelphia, Shap Elctrns. Co., Inc.	215-969-3300
PA	York, ECI	717-854-8880
RI	Pawtucket, Major/Edwards Elctrn., Supp. Inc.	401-725-7400
TN	Jackson, Carlton-Bates Co.	901-664-2714
TN	Memphis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-885-3232
TX	Austin, Carlton-Bates Co.	512-837-9098
TX	Ft. Worth, Carlton-Bates Co.	817-293-5558
TX	Houston, Altair Elctrns.	713-462-3029
TX	Houston, Carlton-Bates Co.	800-622-4420
TX	Richardson, Altair Elctrns.	214-231-5166
TX	Richardson, RSC Elctrns.	214-644-3444
TX	San Antonio, Carlton-Bates Co.	512-805-8300
TX	Texarkana, Carlton-Bates Co.	903-792-6923
UT	Salt Lake City, Integrated Elctrns. Corp.	801-977-9750
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Bellevue, Integrated Elctrns., Corp.	206-455-2727
WI	Milwaukee, Badger Capacitor Sls.	414-281-1330
WI	New Berlin, Classic Comps. Supp. Co.	414-786-5300
WI	New Berlin, NEP Elctrns.	414-785-9100

Illinois Lock

FAX: 708-537-1881

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 708-537-1800; Empl.: 120; *Sls. Mgr.:* Brian D. Reed .... **B•1742-1743**

IMAGE GRAPHICS, INC., 917 Bridgeport Ave., Shelton, CT 06484, Tel: 203-926-0100, FAX: 203-926-9705; FSC No.: 5M867; Empl.: 65; *Sls. Mgr.:* Putnam Morgan

IMAGENATION CORPORATION, 1200 N.E. Keyes Rd., Vancouver, WA 98684, Tel: 206-944-9131, FAX: 206-944-9131; FSC No.: 5998; Empl.: 7

IMAGE SYSTEMS CORP., 11595 K-Tel Dr., Hopkins, MN 55343, Tel: 612-935-1171, FAX: 612-935-1386; Empl.: 25; *Sls. Mgr.:* Marta Scheff Volbrecht

IMAGRAPH CORP., Microfield Graphics, 11 Elizabeth Drive, Chelmsford, MA 01824, Tel: 508-256-4624, FAX: 508-250-9155; Empl.: 30; *Sls. Mgr.:* Joseph Plonski

IMAGING TECHNOLOGY INC., 55 Middlesex Tpke., Bedford, MA 01730-1421, Tel: 617-275-2700, FAX: 617-275-9590; Empl.: 120; *Sls. Mgr.:* John Hughes; *Dist. Mgr.:* John Hughes

IMAGRAPH CORP., Microfield Graphics, 11 Elizabeth Drive, Chelmsford, MA 01824, Tel: 508-256-4624, FAX: 508-250-9155; Empl.: 30; *Sls. Mgr.:* Joseph Plonski

IMATRONIC, INC., 1275 Paramount Pkwy., Batavia, IL 60510, Tel: 708-406-1920, FAX: 708-879-6749; Empl.: 15; *Sls. Mgr.:* Annette J. Elias .... **B•1323**

I.M.C., (International Microtronics Corp.), 4016 E. Tennessee St., Tuscon, AZ 85714, Tel: 602-748-7900, FAX: 602-790-2808; FSC No.: 5371; Empl.: 22; *Sls. Mgr.:* O. Fest; *Dist. Mgr.:* O. Fest

IMC MAGNETICS CORP., 1900 E. Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, TWX: 910-951-0001, FAX: 602-968-5026; *Sls. Mgr.:* Joseph Gute

IMC MAGNETICS CORP., NMB Corp., 475 Wireless Blvd, Hauppauge, NY 11788, Tel: 516-231-8100, FAX: 516-231-0477; Empl.: 150; *Sls. Mgr.:* Bob Baker, Dir. of Sls.

IMC POWER SOURCES, 1435 Koll Circle, Ste. 102, San Jose, CA 95112, Tel: 408-441-9614, FAX: 408-441-7912; Empl.: 12; *Sls. Mgr.:* B. Burres

IM/D, E.P.E. Corp., 540 Commercial St., Manchester, NH 03101, Tel: 603-669-5224, FAX: 603-669-3826; Empl.: 20; *Sls. Mgr.:* Frank N. Haigh

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IMPERIAL ASTRONICS, Andig Inc., 19151 Parthenia St. J, Northridge, CA 91324, Tel: 818-886-7672; FSC No.: 50843; Empl.: 38; *Sls. Mgr.:* Laurie Lee, GM .... **A•1940-1943**

Local Sales Offices & Reps

CA	American Canyon, Jacobson & Assocs.	707-552-4412
MD	Churchton, Dawn Assoc.	301-261-5001
MA	Shrewsbury, Janco New England Inc.	508-754-9840
MN	Apple Valley, Comm-Link Inc.	612-322-1595
MO	Grandview, R.R. Burton & Assocs.	816-763-5385
NJ	Lakewood, Atek	908-905-4443
NM	Albuquerque, J. Smith & Assoc. Inc.	505-345-6501
OH	Cleveland, John O. Olsen Co. Inc.	216-838-0510
TX	Dallas, Weisler & Assoc. Inc.	214-437-2386

IMPULSE ENGINEERING, 7647 Pine Tree Pl., Goleta, CA 93117-1023, Tel: 805-685-2030, FAX: 805-968-1000; Empl.: 1

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES INC., 11930 31st Ct. N., St. Petersburg, FL 33716, Tel: 813-572-9010, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

INA BEARING CO., INC., 308 Springhill Farm Rd., Fort Mill, SC 29715, Tel: 803-548-8500, FAX: 803-548-8599; Empl.: 1300 ò; *Sls. Mgr.:* Richard Angell, VP Sls./Mktg.; *Dist. Mgr.:* Earl Dukes, VP

INCONIX CORP, See Hancock Electronics Corp.

INCOTHERM LIMITED, Inco Alloys Ltd., Holmer Road, Hereford, United Kingdom HR4 9SL, Tel: (44) 432 355880, FAX: (44)432 352711; Empl.: 10; *Sls. Mgr.:* C. Paul Furniss

ELINA FAN.

INDEK

FAX: 408-433-9330

INDEK CORPORATION, 2360 Qume Dr., No. A, San Jose, CA 95131, Tel: 408-432-1199; Empl.: 7; *Sls. Mgr.:* Charles Granata; *Dist. Mgr.:* Charles Granata, Dir. Sls. .... **C•1593-1596**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Dana Point, PCA MKtg. & Sls. Engrg.	714-493-9822,FAX:714-240-1894
CA	Santa Clara, I Squared Inc.	408-988-3400
CT	Guilford, Liberty Electro Mktg.	203-453-8508
FL	Hiahleah, Hughes Assocs.	305-362-8167
FL	Melbourne, Hughes Assocs.	407-253-3031
GA	Norcross, Mountain Electro Mktg.	404-448-5594, FAX:404-448-8230
IL	Deerfield, Brock & Cushman	708-405-9777, FAX:708-405-9778
IN	Valparaiso, Catalyst Sls.	219-477-4004
MA	Topsfield, Liberty Electro Mktg.	508-887-6655, FAX:508-887-2329
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	Florissant, Delltron	314-839-0033, FAX:314-839-4290
NJ	Cherry Hill, Vantage Sls. Co.	609-424-6777, FAX:609-424-8909
NY	Glen Cove, Dyno-Rep	516-676-1598, FAX:516-676-4355
NC	Cary, Hughes Assocs.	919-467-7029
OH	Columbus, Bill Romine Co.	614-436-0565
OH	Dayton, Bill Romine Co.	614-436-0565
TX	Austin, Kruvand Assocs.	512-219-9443
TX	Dallas, Kruvand Assocs.	214-437-3355
VA	Front Royal, Eltron Sls. Inc.	703-635-7201, FAX:703-635-1933
Can	Laval, Interep Technlgs. Ltd.	514-667-1444

Local Distributors

AZ	Phoenix, Force Electronics	609-437-1060, FAX:609-437-2369
AZ	Tempe, Time Elctrns.	602-967-2000

AR	Little Rock, Carton-Bates	501-562-9100
CA	El Segundo, Force Electronics	213-772-1324, FAX:213-536-0139
CA	San Diego, Force	619-569-9661
CA	San Diego, Time Elctrns.	619-578-2500
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, D.C. Elctrns.	408-453-2400
CA	San Jose, Daine Prods.	408-265-7220
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Englewood, Time Elctrns.	303-721-8882
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Southbury, Time Elctrns.	203-262-1319
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
GA	Norcross, Time Elctrns.	404-368-0969
IL	Palatine, Ohm Elctrns.	708-303-3000
IL	Schaumburg, Time Elctrns.	708-303-3000
MD	Columbia, Time Elctrns.	410-964-3091
MA	Peabody, Time Elctrns.	508-532-6200
MA	Westborough, In-Stock Prods.	508-870-5750, FAX:508-870-0573
MA	Wilmington, Heiland Electronics	508-657-4870, FAX:508-658-0278
MA	Winchester, Webb Distbn., Inc.	617-729-5800, FAX:617-729-6839
MN	Edina, Time Elctrns.	612-943-2433
MN	Fridley, Voyager Elctrns.	612-571-7766,F, 612-571-9519
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Beckwith Elec.	314-343-6463, FAX:314-343-7026
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	West Berlin, GCI Corp.	609-768-6767, FAX:609-768-3649
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Ronkonkoma, Conco Elctrns.	516-467-8200, FAX:516-467-3165
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Cincinnati, Hughes-Peters	513-351-3000
OH	Columbus, Hughes-Peter Inc.	614-294-5351, FAX:614-294-7115
OH	Columbus, Time Elctrns.	614-794-3301
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626, FAX:918-250-1178
OR	Beaverton, Time Elctrns.	503-626-2979
PA	Norristown, Century Elctrns. Comp.	215-631-5400, FAX:215-631-5406
TX	Austin, Carlton-Bates	512-937-9098
TX	Farmers Branch, Force Electronics	214-247-9955, FAX:214-247-0619
TX	Forthworth, Carlton-Bates	817-293-5558
TX	Houston, Force Electronics	713-561-8644
TX	Richardson, Time Elctrns.	214-644-4644
UT	Salt Lake City, Standard Supply	801-486-3371, FAX:801-466-2362
UT	West Valley, Time Elctrns.	801-973-8494
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184,FAX:804-971-8411
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Priebe Elctrns.	206-881-2363, FAX:206-881-0508
Can	Pointe Claire, Que., Ferrotronic Comps.	514-426-0300

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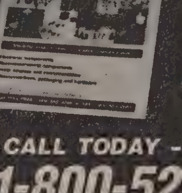

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INDIANA MICROELECTRONICS CENTER, Indiana Bus. Modernization & Technology Corp., 118 East Ludwig Rd., Fort Wayne, IN 46825, Tel: 219-482-8200, FAX: 219-482-8800; Empl.: 8

INDIUM CORPORATION OF AMERICA, 1676 Lincoln Ave., Utica, NY 13502, Tel: 315-853-4900, 1-800-4INDIUM, TELEX: 937363, FAX: 315-853-1000; Empl.: 150; *Sls. Mgr.:* Micheal W. Beam - Dir. Worldwide Sls.; *Dist. Mgr.:* Michael W. Beam

INDRAMAT, The Rexroth Corp., 255 Mittel Dr., Wood Dale, IL 60191, Tel: 708-860-1010, FAX: 708-530-4631; Empl.: 120; *Sls. Mgr.:* Richard J. Huss; *Dist. Mgr.:* Richard J. Huss

INDUCTOR SUPPLY, 1849 W. Sequoia Ave., Orange, CA 92668-1017, Tel: 714-978-2277, 800-854-1881, 800-472-8421, FAX: 714-978-2411; Empl.: 25; *Sls. Mgr.:* Neal McDonald

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 Labaya Dr., Westlake Village, CA 91362, Tel: 818-889-3179, FAX: 818-889-1490; Empl.: 10; *Sls. Mgr.:* L. Webb

INDUSTRIAL COMPUTER SOURCE, 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-271-9340, FAX: 619-271-9666; FSC No.: 7042; Empl.: 85; *Sls. Mgr.:* Nate Bailey

INDUSTRIAL CONTROL CO., 3100 Suntree Blvd., Rockledge, FL 32955, Tel: 407-259-7105; FSC No.: 90081; Empl.: 15; *Sls. Mgr.:* I. Nobilio

INDUSTRIAL CPU SYSTEMS, INTL, 111 W. Dyer Rd., Ste. D, Santa Ana, CA 92707, Tel: 714-957-2815, FAX: 714-957-3128; Empl.: 8; *Sls. Mgr.:* Dick McCormick

INDUSTRIAL DEVICES CORPORATION, 64 Digital Drive, Novato, CA 94949-5728, Tel: 415-883-3535, 800-747-0064, FAX: 415-883-2094; Empl.: 60; *Sls. Mgr.:* Louis Walton; *Dist. Mgr.:* Alan Statz

FAX: 201-489-6911

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989; FSC No.: 91802; Empl.: 275; *Sls. Mgr.:* Paul Flynn .... **B•1166-1167**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg. Co., Inc.	205-880-0592
CA	San Diego, Universal Comps. Co.	310-783-0220
CA	Santa Clara, WestRep	408-988-8833
CA	Torrance, Universal Comps.	213-783-0220
CO	Littleton, Harthun Assocs., Inc.	303-792-5545
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Electro-Mech Sls. Engrg. Co., Inc.	404-447-6478
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
IA	Cedar Rapids, KKB, Inc.	313-373-1730
MD	Columbia, PSA, Inc.	215-245-0513
MA	Westborough, Anchor Engrg.	617-870-0573
MI	E. Detroit, Fred Harris & Assocs.	313-776-5430
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Blue Springs, KKB, Inc.	816-229-0001
MO	St. Louis, KKB, Inc.	314-647-2000
NY	Glen Cove, Dyno-Rep	516-676-1598
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, Electro-Mech Sls. Engrg. Co., Inc.	919-790-9300
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Trevose, PSA, Inc.	215-245-0513
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-580-5754
TX	Richardson, R. F. Kimball Co.	214-231-3447
VA	Oakton, PSA, Inc.	301-953-4884
WA	Bothell, Temco Northwest	206-821-5434
WA	Hillsboro, Temco Northwest	503-645-2030

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
CA	Fremont, Allied Elctrns.	415-487-5250
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Los Angeles, Elec. Switches	213-664-1141
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	Sacramento, Zack Elctrns.	916-446-3131
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrn. Distrbg. Co.	408-943-0255
CA	Santa Ana, Sunray Lighting, Inc.	714-556-3630
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Tustin, Allied Elctrns.	714-669-4190
CO	Arvada, Denver Beta	303-431-7161
CO	Denver, Allied Elctrns.	303-790-1662
CO	Denver, Con. Parts	303-623-5313
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Whitehead Elctrns.	404-923-6667
ID	Boise, Radar/Elec.	208-336-2322
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rockford, Mid-West Associated	815-962-8036
IL	Wheeling, Hawk Elctrns.	800-843-4295
IL	Wood Dale, Electro-Kinetics	312-595-6700
IN	East Chicago, ACRO Elctrns.	312-375-1269
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Allied Elctrns.	317-875-0448
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, MAR Elctrns., Inc.	317-633-6699
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
LA	Lafayette, Ralph's	318-234-4507
MD	Baltimore, PEI/Genesis	301-931-8280
MD	Columbia, Sager Elctrns.	301-995-6580
MD	Gaithersburg, Capitol Radio Whlsrs.	301-881-2270
MD	Jessup, Treeko Elctrns.	301-792-0112
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, Coghlin Elect.	617-756-8311
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Shand Elctrns.	313-422-7000
MI	Saginaw, Shand Elctrns.	517-753-9900
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Minneapolis, Stark Elctrns.	612-332-1325
MS	Tupelo, Bluff City Elctrns.	601-842-6923
MO	Kansas City, RS/Olive Elctrns.	913-362-1923
MO	Maryland Hgts., RS/Olive Elctrns.	314-997-7709
MO	St. Louis, Van Sickle Radio-Elec.	314-621-5000
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Hanover, State Elctrns. Parts	201-887-2550

NJ	Oakland, Relay Spec.	201-337-1000
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Sager Elctrl. Supply Co.	516-348-1300
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Raleigh, Sager	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, PEI Genesis	918-622-8520
OR	Portland, United Radio Supp.	503-233-7151
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, PE/Genesis	215-673-0400
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	Columbia, Dixie Radio Supp.	803-779-5332
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Fort Worth, Swieco Elctrns.	800-255-9319
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Glen Allen, Hermitage Distrs.	804-798-3830
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000

INDUSTRIAL DIELECTRICS, INC., P.O. Box 357, Noblesville, IN 46060, Tel: 317-773-1766, FAX: 317-773-3877; Empl.: 250; *Sls. Mgr.:* Tom Merrell; *Dist. Mgr.:* Tom Merrell

INDUSTRIAL ELECTRONIC RESOURCES, 172 Business Center Drive, Corona, CA 91720, Tel: 909-734-1111, 800-433-5160, FAX: 909-734-2710; Empl.: 14

INDUSTRIAL ELECTRONICS CORP., 24175 Gibson Drive, Warren, MI 48089, Tel: 313-759-4450, FAX: 313-759-1589; Empl.: 30; *Sls. Mgr.:* Allen A. Russell

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181, FAX: 716-924-2169; Empl.: 40; *Sls. Mgr.:* David Dunnill; *Dist. Mgr.:* David Dunnill

INDUSTRIAL MIDWEC CAPACITOR, See Charles Inds. Ltd.

INDUSTRIAL MONITORING INSTRUMENTATION, PCB Piezotronics Inc., 3425 Walden Ave., Depew, NY 14043, Tel: 716-684-0003, FAX: 716-684-3823

INDUSTRIAL SERVICE TECHNOLOGY, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1033, 800-835-2611; Empl.: 13; *Sls. Mgr.:* Mark Welscott

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT CO., Inc., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe **D•1012, 2268-2271**

INDUSTRIAL TIMER CO., 30 Industrial Park Rd., P.O. Box 307, Centerbrook, CT 06705, Tel: 203-767-7130, FAX: 203-767-9137; Empl.: 55; *Sls. Mgr.:* Ann Fraser Carroll

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, FAX: 215-345-0111; FSC No.: 6115; Empl.: 14; *Sls. Mgr.:* Joanne Dorr; *Dist. Mgr.:* D. E. Sanderson

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, FAX: 302-658-2475; *Sls. Mgr.:* M. Schwartz

INFODEX

DISPLAY SYSTEMS TECHNOLOGIES

FAX: 203-879-3404

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-879-4944; FSC No.: 09087; Empl.: 44; *Sls. Mgr.:* Robert Vance **B•1012-1013, 1080**

Local Sales Offices & Reps

MA	Medfield, Nortech Engrg. Sls.	508-359-6063

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFOMETRIX, 2200 Sixth Ave. No. 833, Seattle, WA 98121, Tel: 206-441-4696, FAX: 206-441-0841; Empl.: 10; *Sls. Mgr.:* Paul Bailey

INFOPRINT, INC., Micro Electronic Business, Inc., 4315 N. Elston Ave., Chicago, IL 60641, Tel: 312-539-6045, FAX: 312-539-6645

INFORMATION RETRIEVAL SYSTEMS, INC., 1705 Second Ave. Ste. 3N, New York, NY 10128, Tel: 212-348-6268; Empl.: 3; *Sls. Mgr.:* Lynne McNamara

INFORMATION TRANSFER INC., Box 357, Bloomfield, NY 14469, Tel: 716-657-7074, FAX: 716-657-7432; FSC No.: 55137; Empl.: 50; *Sls. Mgr.:* John Dillman **D•1192-1193**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno-Metrics	205-830-2832
AZ	Chandler, VIC Myers Assocs.	602-345-6449
CO	Denver, VIC Myers Assocs.	303-730-7313
CA	Sunnyvale, Westech	408-735-8647
FL	Winter Park, Wade H. Boggs, Inc.	407-647-2226
MD	Baltimore, Stemler Assocs.	301-944-8262
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NM	Albuquerque, VIC Myers Assocs.	505-884-6878
UT	Salt Lake City, Vic Myers Assocs.	801-581-1760

INFRANOR, 45E Great Hill Road, Naugatuck, CT 06770, Tel: 203-729-8258, 800-BE-SERVO, FAX: 203-729-6969; Empl.: 11 **B•1271**

INJECTO MOLD INC., Crellin International, 2601 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-384-6000, FAX: 312-384-8910; Empl.: 170; *Sls. Mgr.:* Thomas R. Sund

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389; *Sls. Mgr.:* Adam P. Friedman **C•1136**

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
IL	Lombard, NyTron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, FAX: 703-731-4193; FSC No.: 11384; Empl.: 580

INMARK CORP., 4 Byington Pl., Norwalk, CT 06850, Tel: 203-866-8474, FAX: 203-866-0918; *Sls. Mgr.:* Roger Hibbert

INMET CORPORATION, 300 Dino Drive, Ann Arbor, MI 48103, Tel: 313-426-5553, FAX: 313-426-5557; FSC No.: 64671; Empl.: 40; *Sls. Mgr.:* Tim Solomon

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 40; *Sls. Mgr.:* Marshall Roper

INRECO, See Ransco Industries

INRESCO, INC., 2411 Atlantic Avenue, Manasquan, NJ 08736, Tel: 908-223-6330, FAX: 908-223-2571; Empl.: 8

INSERVCO, INC., 128 Commerce Drive, Box 110, LaGrange, OH 44050, Tel: 1-216-355-5102, FAX: 1-216-355-5342; Empl.: 100; *Sls. Mgr.:* C. Scott Sudnick

INSTEK CORPORATION, 1205 John Reed Ct., City of Industry, CA 91745, Tel: 818-336-6537, FAX: 818-369-1748; Empl.: 350; *Sls. Mgr.:* Michael Silverstein, National **D•1745**

Local Sales Offices & Reps

AL	Hoover, Henry Phillips Co., Inc.	205-733-0043
AZ	Tempe, Sertek, Inc.	800-334-7127
CO	Englewood, Sertek, Inc.	800-334-7127
GA	Roswell, Henry Phillips, Co., Inc.	404-992-3070
IL	Addison, Elctrn. Specs.	708-250-9080
IN	Mulberry, Maish Sls.	317-296-2322
MI	Warren, Burcaw Co.	313-573-4605
MN	Minneapolis, MSJ Mktg., Inc.	612-755-1865
NM	Sertek, Inc.	800-334-7127
NY	Little Neck, M S Sls.	718-224-9746
NC	Statesville, Henry Phillips Co., Inc.	704-876-0730
SC	Henry Phillips Co., Inc.	800-877-3070
TN	Henry Phillips Co., Inc.	800-877-3070
UT	Sertek, Inc.	800-334-7127

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Fred Pummill

INSTRUM, 176 W. Pomona Ave., Monrovia, CA 91016, Tel: 818-303-4210, FAX: 818-303-4210; Empl.: 5; *Sls. Mgr.:* Ralph Morrison

ICS

FAX: 708-543-6244

INSTRUMENTATION & CONTROL SYS., ICS.Inc., 520 Interstate Rd, Addison, IL 60101, Tel: 708-543-6200, TELEX: 271503 ICS UR; Empl.: 20; *Sls. Mgr.:* Harold Miller **B•1524-1525; D•2272-2273**

Local Sales Offices & Reps

MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050

UPS Representatives

TX	Dallas, Adair & Assocs.	214-321-9970
TX	Houston, Adair & Assocs.	713-827-7155

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Mobile, Allied Elctrns.	205-476-1875
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Fremont, Allied Elctrns.	510-770-0590
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Rocklin, Allied Elctrns.	916-632-3104
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Francisco, Allied Elctrns.	415-952-9599
CA	Torrance, Allied Elctrns.	310-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Jacksonville, Allied Elctrns.	904-346-0761
FL	Largo, Allied Elctrns.	813-541-4660
FL	Pompano Bch., Allied Elctrns.	305-978-3008
GA	Duluth, Allied Elctrns.	404-497-9544
GA	Roswell, Henderson Ind. Equip.	404-552-0185
IL	Des Plaines, Allied Elctrns	708-803-1040
IL	Libertyville, Allied Elctrns.	708-918-0250
IL	New Lenox, Allied Elctrns.	815-485-1511
IL	Oak Forest, Allied Elctrns.	708-535-0038
IL	Rockford, Powermation	815-397-0510
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MA	Norwood, Allied Elctrns.	617-255-0361
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Plymouth, Allied Elctrns.	313-416-9300

MN	Bloomington, Allied Elctrns.	612-881-0838
MN	St. Paul, Powermation	612-645-0781
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-697-0238
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Audubon, Universal Elctrn. Supp.	1-800-327-3529
NJ	Edison, Allied Elctrns.	908-572-9600
NJ	Moorestown, Allied Elctrns.	609-234-7769
NJ	Parsippany, Allied Elctrns.	201-428-3350
NY	Fairport, Allied Elctrns.	716-425-3850
NY	Lagrangeville, Allied Elctrns.	914-452-1470
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Cincinnati, Allied Elctrns.	513-771-6990
OH	Solon, Allied Elctrns.	216-248-4200
OH	Worthington, Allied Elctrns.	614-785-1270
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Allied Elctrns.	503-252-0335
PA	Camp Hill, Allied Elctrns.	717-975-3570
PA	Pittsburgh, Allied Elctrns.	412-367-4124
SC	Greenville, Allied Elctrns.	803-288-8835
TN	Memphis, Allied Elctrns.	901-367-2895
TX	Austin, Allied Elctrns.	214-553-4370
TX	Austin, Allied Elctrns.	512-219-7171
TX	El Paso, Allied Elctrns.	915-779-6294
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Allied Elctrns.	713-455-3993
TX	Humble, Allied Elctrns.	713-466-8005
UT	Salt Lake City, Allied Elctrns.	801-261-5244
VA	Alexandria, Allied Elctrns.	703-750-8206
VA	Springfield, Allied Elctrns.	703-644-9515
VA	Virginia Beach, Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Allied Elctrns.	1-800-433-5700
WI	Green BAy, Powermation	414-496-0944
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Waukesha, Powermation	414-523-0600

INSTRUMENTATION NORTHWEST, 14972 N.E. 31st Circle, Redmond, WA 98052, Tel: 206-885-3729, FAX: 206-867-0404; Empl.: 26; *Sls. Mgr.:* Robert Shea

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT DESIGN ENGINEERING ASSOCS., INC., See IDEA, Inc.

INSTRUMENTED SENSOR TECHNOLOGY, INC., 4704 Moore St., Okemos, MI 48864, Tel: 517-349-8487, FAX: 517-349-8469; Empl.: 10

INSTRUMENT ENCLOSURES, 4088 South K St., Tulare, CA 93274, Tel: 209-688-1100, FAX: 209-688-1193; FSC No.: 62012; Empl.: 40; *Sls. Mgr.:* Mike Love

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESEARCH CO., 6420A Dobbin Rd., Columbia, MD 21045, Tel: 410-740-3411, FAX: 410-740-2928; Empl.: 10

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

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FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400; Empl.: 25 .... **D•1013**

Local Sales Offices & Reps

AL	Eva, Barr Elctrn. Instrs.	205-796-7533
AZ	Mesa, DJM Elctrns.	602-821-1440
CA	Fremont, DJM Elctrns.	415-490-7406
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CO	Englewood, R.A. Mayes Co.	303-761-9447
FL	Barr Elctrns.	800-242-7138
KS	Lenexa, KJS Mktg.	913-962-1795
MD	Centerville, EMC Technologists	301-758-3510
MO	Maryland Heights, KJS Mktg.	314-770-1412
NH	Brookline, EMC Sls., Inc.	603-672-4455
NJ	N. Plainfield, Brady Co.	908-755-7900
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
PA	Sewickley, Teplitz/Byrne Assocs.	412-741-3628

TX	Richardson, Scientific Dvcs.	214-231-8106
VA	Sterling, EMC Technologists	703-450-7988
WA	Bothell, Del Black Assocs.	206-487-4396
Can	Nepean, Ont., Multilek, Inc.	613-226-2365

INSTRUMENT SOCIETY OF AMERICA, P.O. Box 12277, Research Triangle Park, NC 27709, Tel: 919-549-8411, TELEX: 802-540, FAX: 919-549-8288; Empl.: 102

Instrument Specialties Co., Inc.

FAX: 717-424-6213

INSTRUMENT SPECIALTIES CO. HEADQUARTERS, P.O. Box A, Delaware Water Gap, PA 18327-0136, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 330; *Sls. Mgr.:* John Blazejewski ... **C•1687-1694**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	San Jose, O'Donnell Assocs.	408-456-2950
CA	Torrance, O'Donnell Assocs.	310-781-2255
CO	Littleton, D. M. Harthun Assocs.	303-795-5545
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
FL	Deerfield Bch., Kinetic Sls., Inc.	305-480-6040
FL	Palm Harbor, Kinetic Sls., Inc.	813-934-3768
KS	Prairie Village, Thunderbird Tech. Sls. & Svcs.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls. & Svcs.	316-636-5018
MI	Howell, Great Lakes Comps.	517-548-9100
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Maryland Heights, Thunderbird Tech. Sls. & Svcs.	314-298-8940
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
TN	Franklin, D. L. Clark & Assocs.	615-790-7457
TX	Dallas, Materials Technlg.	214-484-4677
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
Can	Pickering, Ont., A. C. Simmonds & Sons	416-839-8041

INSTRUMENT SPECIALTIES CO., Western Div., 505 Porter Way, Placentia, CA 92670, Tel: 714-579-7100, FAX: 714-579-7105; Empl.: 25; *Sls. Mgr.:* William Oliver; *Dist. Mgr.:* Phil Strong .... **C•1687-1694**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs., S.W.	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs., Inc.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, D.M. Harthun Assocs., Inc.	303-792-5050
CO	Littleton, D.M. Harthun Assoc.	303-795-5545
FL	Altamonte Springs, Kinetic Sls.	407-339-3855
FL	Boca Raton, Kinetic Sls., Inc.	407-852-8595
FL	Palm Harbor, Kinetic Sls.	813-934-3768
ID	Boise, Temco Northwest	208-345-2051
KS	Leawood, Thunderbird Tech Sls. & Svs., Inc.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls.	313-636-5018
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
OR	Hillsboro, Temco Northwest	503-645-2030
TN	Franklin, D.L. Clark & Assoc., Inc.	615-790-7457
TX	Dallas, J.M. Spell	214-620-0040
TX	Dallas, Materials Technlg. Co.	214-484-4677
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

INSULATON COMPONENTS ASSOCIATES, INC., P.O. Box 4849, Downey, CA 90241, Tel: 310-861-7268, FAX: 310-861-7265

INSULCAST, Permagile Inds. Inc., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, 800-645-7546, TELEX: 221720 PERM UR, FAX: 516-349-1156; FSC No.: 13549; Empl.: 37; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

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FAX: 206-284-3705

INTAQ KEY PANELS, GM Nameplate, Inc., 2040 15th Ave. W., Seattle, WA 98119, Tel: 206-284-2200; FSC No.: 9905; Empl.: 350; *Sls. Mgr.:* Gerry Gallagher .... **B•1836-1837; C•1665**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev./Sls.	602-438-1547
AL	Huntsville, JWL Assocs.	205-883-1712
CA	San Diego, Omni	619-268-9606
CA	San Jose, G M California	408-435-1666
CA	Irvine, Balzer-Wolf Assoc.	714-261-6877
CO	Englewood, Delltron	303-741-2122
FL	Orlando, Comp. Sls.	407-823-7480
HI	Honolulu, Menehune Unlimited	808-737-3472
ID	Eagle, GM/West	208-939-7202
IL	Elmhurst, Utronix	708-834-1100
IN	Zionsville, WK/Custom Engrd. Pts.	317-873-5626
MI	Southfield, E&A Inds., Inc.	313-647-0330
MN	Burnsville, Electromec Sls., Inc.	612-894-8200
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mt. Vernon, GM/Northeast	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	West Caldwell, Grimm, Siegel & Assoc.	201-575-9300
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Akron, Augnat Assocs.	216-239-2499
OR	Portland, GM-Portland	503-223-9879
PA	Robinson Township, Allied Entprs.	412-788-2992
TX	Dallas, Comp. Techng.	214-783-8831
VA	Reston, Colrud Corp.	703-904-0240
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Singapore, S&T Entrps.	065-745-9235
Can	Calgary, Alb., Enerlec Sls. Ltd.	403-256-3627
Can	Richmond B.C., Enerlec Sls. Ltd.	604-273-0882

INTEC CONTROLS CORP., 55 West St., Walpole, MA 02081, Tel: 508-660-1221, FAX: 508-660-2374; Empl.: 40; *Sls. Mgr.:* Gerard Feldeisen; *Dist. Mgr.:* Gerard Feldeisen

INTEGRATED CIRCUITS INC. (ICI), See Interpoint Corporation

INTEGRATED CIRCUIT SYSTEMS INC., PO Box 968, 2435 Blvd. of the Generals, Valley Forge, PA 19482-0968, Tel: 215-666-1900, FAX: 215-666-1099; Empl.: 150; *Sls. Mgr.:* J. Black

INTEGRATED DEVICE TECHNOLOGY, INC., 2975 Stender Way, Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070, FAX: 408-492-8674; FSC No.: 61772; Empl.: 2090; *Sls. Mgr.:* Dan Lewis, VP; *Dist. Mgr.:* Bill Franciscovich

INTEGRATED ENGINEERING SOFTWARE, 347-435 Ellice Ave., Winnipeg, Man., Canada R3B 1Y6, Tel: 204-942-5636, FAX: 204-944-8010; Empl.: 14; *Sls. Mgr.:* Bennetta Benson

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121-1009, Tel: 619-259-2600, FAX: 619-755-8679; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Dennis R. Clark

INTEGRATED POWER DESIGNS, INC., 300 Stewart Rd., Wilkes-Barre, PA 18706, Tel: 717-824-4666, FAX: 717-824-4843; Empl.: 42; *Sls. Mgr.:* Steven Thompson .... **D•1747-1749**

Local Sales Offices & Reps

CA	Mountain View, Swanson Carlton	415-961-0565
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FL	Land O'Lakes, AJ's Power Source	813-996-2583
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MA	Wakefield, Howard Jappe Co.	617-245-9359
MI	Brighton, Reptronics	313-229-3066
MN	Eden Prairie, Professional Mktg.	612-934-5939
NJ	Madison, Venture Quest, Inc.	201-377-4922
NY	Fairport, Hi-Tec Sls.	716-223-5922
OH	Dayton, Electro-Mktg.	513-890-8322
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Plano, G.W. Prods.	214-422-1746
Can	Mississauga, Altus Technlgs.	416-670-0783

INTEGRATED SILICON SOLUTIONS INC., 680 Almanor Avenue, Sunnyvale, CA 94086, Tel: 408-733-4774, FAX: 408-245-4774

INTEGRATED SYSTEMS, INC., 3260 Jay St., Santa Clara, CA 95054, Tel: 408-980-1500, FAX: 408-980-0400; Empl.: 200; *Sls. Mgr.:* Dennis O'Donnell

INTEGRATED TECHNOLOGIES SOLUTIONS, INC.

FAX: 516-420-0453

INTEGRATED TECHNOLOGIES SOLUTIONS INC., 262 A Eastern Pkwy, Farmingdale, NY 11735, Tel: 516-420-9401; Empl.: 8; *Sls. Mgr.:* M. Lieber .... **D•2274-2275**

Local Sales Offices & Reps

CA	Chino, Deltatec Intl. Inc.	714-551-8546

INTEGRITY TECHNOLOGY CORPORATION, 1400 Coleman Ave., Ste. E15, Santa Clara, CA 95050, Tel: 408-262-8640, FAX: 408-262-1680; Empl.: 127; *Sls. Mgr.:* Larry Young

INTEK, INC., 751 Intek Way, Westerville, OH 43081, Tel: 614-895-0301, FAX: 614-895-0319; FSC No.: 6680; *Sls. Mgr.:* Robert Curry

INTEL CORPORATION, 3065 Bowers Ave., Santa Clara, CA 95051, Tel: 408-987-8080, TELEX: 34-6372, TWX: 910-338-0026

INTELLIGENT INSTRUMENTATION, A Burr-Brown Company, 1141 W. Grant Road,MS 131, Tucson, AZ 85705, Tel: 602-623-9801, FAX: 602-623-8965; *Sls. Mgr.:* Bill McGovern

INTELLIGENT INTERFACES, INC., P.O. Box 1486, Stone Mountain, GA 30086, Tel: 404-381-9891, 1-800-842-0888; FSC No.: OA4H9; Empl.: 3; *Sls. Mgr.:* Robert E. Jarvis

INTELLITECH, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-514-7999, FAX: 404-514-1285; Empl.: 6; *Sls. Mgr.:* Sam Zamarripa

INTELLUTION, INC., 315 Norwood Park South, Norwood, MA 02062, Tel: 617-769-8878, FAX: 617-769-1990; *Sls. Mgr.:* John Curtis; *Dist. Mgr.:* John Curtis

INTERACTION SYSTEMS INC., 86 Coolidge Ave., Watertown, MA 02172, Tel: 617-923-6001, FAX: 617-923-2112 .... **D•1097**

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AL	Huntsville, E.G. Holmes & Assocs.	205-859-4199
FL	Orlando, E.G. Holmes & Assocs.	407-281-0067
GA	Atlanta, E.G. Holmes & Assocs.	404-451-6161
NC	Apex, E.G. Holmes & Assocs.	919-387-1072

INTERACTIVE CIRCUITS SYSTEMS LTD., 5430 Canotek Rd., Gloucester, Ont., Canada K1J 9G2, Tel: 613-749-9241, 1-800-267-9794, FAX: 613-749-9461; Empl.: 20

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332, FAX: 714-770-8137; Empl.: 20; *Sls. Mgr.:* Pat Cooper

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MA	Medfield, Nortech Engrg. Sls., Inc.	508-359-6063

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR, FAX: 913-342-7043; Empl.: 150; *Sls. Mgr.:* Mike Richards; *Dist. Mgr.:* Carol Narr

INTERCONNECT SPECIALTIES, INC., 2861-B Saturn St., Brea, CA 92621, Tel: 800-752-4777, 714-961-7955, FAX: 714-996-9537; Empl.: 10; *Sls. Mgr.:* Diana Fitzpatrick

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood .... **D•1750**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882, FAX: 602-948-1924; FSC No.: 32311; Empl.: 85; *Sls. Mgr.:* Irv Wilson

INTERFACE ENGINEERING INC., 300 Centre St., Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545, FAX: 617-986-8932; FSC No.: 14352; Empl.: 25; *Sls. Mgr.:* Thomas Scanlon

INTERFACE PRODUCTS, INC., 4630 North Ave., Oceanside, CA 92056, Tel: 619-945-0230, FAX: 619-945-0239; FSC No.: 55300; Empl.: 75; *Sls. Mgr.:* William Lang

INTERFACE TECHNOLOGY, Dynatech Corp., 196 University Parkway, Pomona, CA 91768-4300, Tel: 714-595-6030, TELEX: 4945489, FAX: 714-595-7177; *Sls. Mgr.:* Lee Davis

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203, FAX: 415-340-1670; Empl.: 12; *Sls. Mgr.:* F. L. Nelson

INTERGRAPH CORP., Advanced Processor Division, 2400 Geng Rd., Palo Alto, CA 94303, Tel: 415-494-8800, FAX: 415-856-9224; *Sls. Mgr.:* James Pierce; *Dist. Mgr.:* James Pierce, Sls. Rep. Mgr.

INTERLOGIC INDUSTRIES, 85 Marcus Dr., Melville, NY 11747-4294, Tel: 516-420-8111, FAX: 516-420-8007; Empl.: 46; *Sls. Mgr.:* Bert Freifeld

INTERLOOP, 706 Charcot Ave., San Jose, CA 95131, Tel: 408-922-0520, FAX: 408-922-0545; Empl.: 3

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 708-729-5330, FAX: 708-729-4849; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265, FAX: 815-675-2112; Empl.: 1000

INTERMETRICS MICROSYSTEMS SOFTWARE, INC., 733 Concord Ave., Cambridge, MA 02138, Tel: 617-661-0072, 800-356-3594, FAX: 617-868-2843; Empl.: 6000; *Sls. Mgr.:* Harry Erickson

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833, FAX: 717-825-2852

INTERNATIONAL CMOS TECHNOLOGY, 2123 Ringwood Ave., San Jose, CA 95131, Tel: 408-434-0678, TWX: 910-997-1531

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Ken Reed .... **D•1033-1038**

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AR	Mabelville, Erickson Sls.	501-455-0618
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CA	Laguna Niguel, Aktron Sls.	714-496-5057
CO	Littleton, Romulus Elctrns.	303-770-4888
IL	Arlington Heights, MJ Petersen	708-577-8200
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
IA	Cedar Rapids, Delltron Co.	319-393-0075
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MA	Framingham, Stone Comp. Sls.	508-875-3226
MA	Long Meadow, Stone Comp. Sls.	413-567-1019
MI	Brighton, AP Assocs.	313-229-6550
MN	Minneapolis, Intl. Elctrns. Inc.	612-571-0000
MO	Florissant, Delltron Co.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	Melville, ICC	516-293-1500
NY	N. Syracuse, Entec Grp. Inc.	315-458-7936
NC	Raleigh, Spears	919-790-7606
OH	Cincinnati, Bob Gilbert Assocs.	513-574-1932
OR	Portland, Adapt E2	503-297-2151
TX	Dallas, Erickson Sls. Inc.	214-739-5833
VA	Lynchburg, James A. Griffin Co.	804-237-0598
WA	Bellevue, Adapt E2	206-637-0302
Can	Markham, Ont., Kellock Sls. & Mktg. Ltd.	416-471-0202

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CA	San Diego, Tauber Elctrns. Corp.	619-274-7242
CT	Bridgeport, Park Distr.	203-366-7200
CT	East Haven, JV Elctrns.	203-469-2321
FL	Ft. Lauderdale, Bros. Elctrns.	305-561-6700
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Bensenville, Voyager Elctrns. Corp.	312-860-1300
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Chelmsford, Shelly Ragon	508-250-9666
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Sharon, Adcour Passive Comps.	617-784-8123
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Southfield, R M Elctrns.	313-262-1582
MN	Eden Prarie, Cassidy Elctrns.	612-944-0100
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NJ	Bellmaur, Mid-Atlantic Elctrns.	609-931-5303
NJ	Clifton, Vantage Comps.	201-667-1840
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Sparta, Instruments & Equip.	201-729-4293
NY	Commack, Vantage Comps. Corp.	516-543-2000
OH	Columbus, Thompson Elctrns.	614-228-6191
PA	Philadelphia, Mur'Tronics	215-632-4330
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Wholesale Elctrns.	214-969-9400
TX	Fort Worth, Allied Elctrns.	817-336-7414
TX	Ft. Worth, C & W Supp. Co.	817-831-0395
WA	Seattle, Vesco	206-575-3607

INTERNATIONAL COMPONENTS CORP., 420 North May St., Chicago, IL 60622, Tel: 312-829-7101, FAX: 312-829-0422; Empl.: 92; *Sls. Mgr.:* David Schmidt

INTERNATIONAL CONFIGURATIONS, INC., 7 Moody Rd., P.O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, FAX: 203-749-2985; FSC No.: 62484; Empl.: 4-6; *Sls. Mgr.:* Ov. L. Baldwin .... **C•1353**

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INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518, FAX: 201-482-4958; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 708-358-4622, FAX: 708-358-4623; Empl.: 6; *Sls. Mgr.:* T. Pretto .... **D•1039**

Local Sales Offices & Reps

CA	Valley Center, Team Sls.	619-749-2033
MA	Still River, Still River Technlg.	508-456-3369

INTERNATIONAL EYELETS, INC., 5674 El Camino Real No. L, Carlsbad, CA 92008-9812, Tel: 619-931-1446, 1-800-333-9353, FAX: 619-931-8667; FSC No.: 5325; Empl.: 5; *Sls. Mgr.:* Sally Dalrymple

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Dist. Mgr.:* John Mesenbring

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY COMPANY, Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 150; *Dist. Mgr.:* Keith MacDowall .... **D•1354**

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CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, II Consult Factory	203-481-5721
FL	Lakeland, Munday Sls., Co.	813-858-5606
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
PA	Malvern, Stitzer Assocs.	215-644-5500

Local Distributors

CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster	619-560-4841
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GA	Kennesaw, CMI Metermaster	404-425-8902
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Glendale Heights, CMI Metermaster	312-351-4554
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	New Orleans, Industrial Instr. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Southbridge, CMI-Metermaster	508-765-1676
MI	Ferndale, Ram Meter Inc.	313-398-6767
MN	Minneapolis, Process Meas. Co.	612-544-4035
NJ	Pensauken, E.I.L. Instrs., Inc.	609-488-0474
NY	Clarence, E.I.L. Instrs.	716-634-8500
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	Long Island City, Metermod Instr. Corp.	718-726-4850
NY	Rochester, E.I.L. Instrs.	716-586-8251
NC	Charlotte, E.I.L. Instrs.	704-376-2237
OH	Cleveland, Process Measurement Corp.	216-587-3600
OH	Dayton, E.I.L. Instrs., Inc.	513-435-2134
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
TX	Dallas, E.I.L. Instrs., Inc.	214-357-0297
TX	Garland, CMI Metermaster	214-271-5671
TX	Houston, CMI Metermaster	713-644-1631
TX	Houston, E.I.L. Instrs., Inc.	713-271-3100
VA	Norfolk, E.I.L. Instrs., Inc.	804-855-9553
VA	Springfield, E.I.L. Instrs., Inc.	703-569-2611
WA	Redmond, E.I.L. Instrs., Inc.	206-882-3222
Can	Longueuil, Que., E.I.L. Instrs.	514-651-4844
Can	Mississauga, Toronto, E.I.L. Instrs.	416-624-6660
Can	Toronto, Ont., Versatile Measuring Instrs.	416-239-8161
AZ	Tempe, CMI Metermaster	603-431-0880

INTERNATIONAL LIGHT, 17 Graf Rd., Newburyport, MA 01950-4092, Tel: 508-465-5923, TELEX: 94-7135, FAX: 508-462-0759; Empl.: 19; *Sls. Mgr.:* Bob Angelo; *Dist. Mgr.:* Bob Angelo

INTERNATIONAL MACHINE & TOOL CORP., 115 Maple St., Warwick, RI 02888, Tel: 401-467-6905, FAX: 401-467-5885; Empl.: 35; *Sls. Mgr.:* Peter S. Piscopio

INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700, FAX: 401-683-5571; FSC No.: 4$177; Empl.: 32; *Sls. Mgr.:* William Hall .... **A•1944-1945**

Local Sales Offices & Reps

FL	Satellite Bch., BWS Microwave Mktg.	407-773-6170
GA	Marietta, BWS Microwave Mktg.	404-499-7492
MA	Attleboro, Antex-Overseas Sls.	508-699-6911
PA	Downingtown, Grasso Tech. Sls.	215-458-8967
TX	Double Oak, Carolyn Bender Assoc.	214-539-9461

INTERNATIONAL MICROELECTRONIC PRODUCTS, 2830 N. First St., San Jose, CA 95134, Tel: 408-434-1489, FAX: 408-434-0335

INTERNATIONAL MICROELECTRONICS, P.O. Box 170415, Arlington, TX 76003, Tel: 817-473-1730, FAX: 817-473-0525

INTERNATIONAL MICROSYSTEMS, 521 Valley Way, Milpitas, CA 95035, Tel: 408-942-1001, FAX: 408-942-1051; Empl.: 10; *Sls. Mgr.:* Peter Schade

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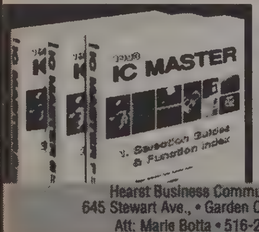

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Local Distributors

CA	Santa Ana, Tech-Ser, Inc.	408-496-1004
CA	Torrance, Tech-Ser, Inc.	213-370-7200
CO	Aurora, R&R Instrmn.	303-340-8728
IL	Chicago, Data Elctrns.	312-283-0300
MA	Waltham, Calibron/Burton Instr.	617-894-6440
MO	Manchester, Universal Precision Instr.	314-394-4693
NY	Rochester, Masline Elctrns.	716-546-5373
TX	Dallas, Textrol Inc.	214-637-6262

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 508-481-7495, FAX: 508-481-0222; Empl.: 10; *Sls. Mgr.:* Donald Rickert

INTERNATIONAL POWER DC POWER SUPPLIES, INC., 360 Bernoulli Circle, Oxnard, CA 93030-5167, Tel: 805-981-1188, FAX: 805-981-1184; Empl.: 25; *Sls. Mgr.:* Ron Ostlund

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INTERNATIONAL POWER DEVICES INC., 20 Linden St., Boston, MA 02134, Tel: 617-782-3331; Empl.: 150; *Sls. Mgr.:* Russell Mitnik; *Dist. Mgr.:* Cathleen Joyce .... **D•1751-1755**

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CA	Corona, Diane Ward	909-279-2838
CA	San Ramon, Synergy Sls.	510-830-0829
CO	Denver, Motion Technlg.	303-757-3003
FL	Maitland, Hawkins Fredrickson Assocs.	407-831-2474
FL	Pompano Beach, Hawkins Frederickson Assoc.	305-979-0330
FL	Tampa, Hawkins Frederickson Assoc.	813-651-1063
GA	Norcross, Macro Mktg.	404-662-5580
IL	Chicago, M. Gottlieb Assocs.	312-775-8620
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MA	Lexington, Kanan Technigs.	617-861-7300
MN	Minneapolis, Stan Clothier Co.	612-944-6904
NJ	Glen Gardner, Daner-Hayes	800-225-8760
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NY	Massapequa, Daner-Hayes	800-225-8760
NY	Rochester, Indl. Tech. Sls.	716-872-1628
NC	Raleigh, C-Tech Sls.	919-782-8100
OH	Dayton, Electro-Mktg., Inc.	800-338-6856
OR	Beaverton, Pacific Mktg. Specialists Inc.	503-641-9373
TX	Dallas, Seaton Corp.	214-980-9860
TX	Houston, Seaton Corp.	713-731-2649
VA	Richmond, Glasscock Assocs.	804-798-2125
Can	Kanata, Ont., Canadian Mktg. Techlgs.	613-591-9555
Can	Mississauga, Ont., Canadian Mktg. Technlgs.	416-612-0900
Can	Pointe Claire, Que., Canadian Mktg. Technlgs.	514-694-6088

Local Distributors

AL	Huntsville, Future Elctrns., Corp.	205-830-2322
AZ	Phoenix, Future Elctrns., Corp.	602-968-7140
AZ	Tempe, Bell Inds.	602-966-7800
CA	Agoura Hills, Bell Industries	818-879-9494
CA	Chatsworth, Future Elctrns., Corp.	818-772-6240
CA	Cypress, Bell Inds.	714-895-7801
CA	Irvine, Future Elctrns., Corp.	714-250-4141
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Rocklin, Bell Inds.	916-652-0418
CA	San Diego, Future Elctrns., Corp.	619-625-2800
CA	San Jose, Future Elctrns., Corp.	408-434-1122
CA	Santa Anna, Foresight Elctrns.	714-833-2134
CA	Santa Clara, ForeSight Elctrns.	408-980-9700
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-691-9270
CO	Denver, Future Elctrns., Corp.	303-232-2008
CT	Bethel, Future Elctrns., Corp.	203-743-9594
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Future Elctrns., Corp.	407-767-8414
FL	Largo, Future Elctrncs.	813-530-1222
FL	Oldsmar, Applied Power	813-854-4004
GA	Norcross, Applied Power, Inc.	404-263-0421
GA	Norcross, Future Elctrns., Corp.	404-441-7676
IL	Elk Grove Village, Bell Inds.	708-640-1910
IL	Hoffman Estates, Future Electronics	708-882-1255
IL	Roselle, Foresight Elctrns.	708-980-9890
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, Bell Inds.	410-290-5100
MD	Columbia, Future Elctrns., Corp.	410-290-0600
MA	Andover, Bell Inds.	508-474-8880
MA	Bolton, Future Electronics	508-779-3000
MI	Brighton, Applied Power, Inc.	313-227-3604
MI	Detroit, Future Elctrns., Corp.	313-261-5270
MI	Livonia, L.W.C. Distributors	313-464-7700
MN	Eden Prairie, Future Elctrns., Corp.	612-944-2200
MO	St. Louis, Future Elctrns., Corp.	314-469-6805
NH	Windham, Orion Inds.	603-437-4446
NJ	Marlton, Future Elctrns., Corp.	609-596-4080
NJ	Parsippany, Future Elctrns.	201-299-0400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Future Elctrns., Corp.	516-234-4000
NY	Rochester, Future Elctrns., Corp.	716-272-1120
NY	Syracuse, Future Elctrns., Corp.	315-451-2371
NC	Charlotte, Future Elctrns., Corp.	704-455-9030
NC	Raleigh, Future Elctrns., Corp.	919-790-7111
OH	Dayton, Bell Inds.	513-435-8660
OH	Mayfield Heights, Future Elctrns.	216-449-6996
OR	Beaverton, Bell Inds.	503-644-3444
OR	Beaverton, Future Elctrns., Corp.	503-645-9454
PA	Philadelphia, Future Elctrns., Corp.	609-778-7600
PA	Trevose, Bell Inds.	215-953-2800
TX	Dallas, Future Elctrns., Corp.	214-437-2437
TX	Dallas, Seaton Elctrns.	214-980-9860
TX	Houston, Future Elctrns., Corp.	713-556-8696
TX	Houston, Seaton Elctrns.	713-731-2649
UT	Midvale, Bell Inds.	801-561-9691
UT	Salt Lake City, Future Elctrns., Corp.	801-972-8489
WA	Bothell, Future Elctrns., Corp.	206-489-3400
WI	Waukesha, Bell Inds.	414-547-8879
WI	Waukesha, Future Elctrns., Corp.	414-786-1884
Can	Calgary, Alb., Future Elctrns., Corp.	403-250-5550
Can	Edmonton, Alb., Future Elctrns., Corp.	403-438-2858
Can	Mississauga, Future Electronics	416-612-9200
Can	Montreal, Que., Future Elctrns. Corp.	514-694-7710
Can	Ottawa, Ont., Future Elctrns., Corp.	613-820-8313
Can	Quebec City, Que., Future Elctrns., Corp.	418-877-6666
Can	Vancouver, B.C., Future Elctrns., Corp.	604-294-1166

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, FAX: 214-494-2690; Empl.: 200; *Sls. Mgr.:* Barry Papermaster, Mktg. VP

International Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434 .... **D•2110-2111**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Scottsdale, Power Up Elctrns.	602-955-1105
CA	Dana Point, Electro Venture South	714-496-5225
CA	Los Altos Hills, H B Mktg.	415-941-4080
FL	Palm Beach Gardens, Graham Assocs., Inc.	407-622-4049
IL	Arlington Hgts., Phoenix Elctrn. Sls.	708-394-4422
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Brighton, A P Assocs.	313-229-6550
MN	Minneapolis, Engineering Prods. Assoc., Inc.	612-835-9022
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Jericho, J-Square Mktg.	516-935-3200
NY	Manlius, Smith Tech. Sls.	315-682-1777
NC	Winston-Salem, Murcota	919-722-9445
OH	Cincinnati, KCH Co.	513-931-1686
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
WA	Bellevue, Caruso & Camelleri Assoc.	206-455-8811
WI	Brookfield, McMahon Sls., Inc.	414-782-3335

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
GA	Norcross, Applied Power, Inc.	404-263-0421
MI	Brighton, Applied Power, Inc.	313-227-3604
NH	Windham, Orion Inds., Inc.	603-437-4446
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns. Inc.	713-351-2255

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FAX: 310-322-3332

INTERNATIONAL RECTIFIER CORP., 233 Kansas St., El Segundo, CA 90245, Tel: 310-322-3331; Empl.: 2400; *Sls. Mgr.:* Curtis Jones, V.P.; *Dist. Mgr.:* Don Prescott, V.P. .... **B•1526**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Phoenix, Sun State Tech. Sls.	602-220-0595
CA	Fair Oaks, Brooks Tech. Grp.	916-965-3255
CA	Gilroy, Intl. Rectifier	408-848-8467
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Westlake Village, First Rep	805-373-0887
CO	Englewood, Thorson Rocky Mountain, Inc.	303-773-6300
CT	Fairfield, N.R.G. Ltd., Inc.	203-384-1112
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
FL	Kissimmee, Intl. Rectifier	407-933-2383
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Rolling Meadows, International Rectifier	708-934-0020
IL	Rolling Meadows, Phase II Mktg., Inc.	708-806-1330
IN	Carmel, Tech. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Tech. Mktg. Corp.	219-432-5553
IN	Kokomo, Tech. Mktg. Corp.	317-459-5152
KY	Louisville, Tech. Mktg. Corp.	502-245-7411
MA	Burlington, Nova Sls., Inc.	617-272-5221
MA	Tewksbury, A/D Sls., Inc.	508-851-5400
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	Bridgeton, Hitec Central, Inc.	314-291-5920
MO	Independence, Hitec Central, Inc.	816-796-6684
NJ	W. Caldwell, Tech. Mktg. Grp.	201-226-3300
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NY	Bohemia, Intl. Rectifier	516-244-8047
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Fishkill, Intl. Rectifier	914-896-4262
NY	Melville, Tech. Mktg. Grp.	516-351-8833
NC	Burlington, Intl. Rectifier	919-584-0340
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Dayton, Luebbe Sls. Co.	513-438-0490
OH	Northfield, Intl. Rectifier	216-467-0852
OH	Westlake, Luebbe Sls. Co.	216-899-0071
OR	Beaverton, Electra Tech. Sls., Inc.	503-643-5074
PA	Boothwyn, Intl. Rectifier	215-494-5080
PA	Broomal, L. D. Lowery, Inc.	215-356-5300
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
TX	Austin, BP Sls.	512-346-9186
TX	Houston, BP Sls.	713-782-4144
TX	Richardson, BP Sls.	214-234-8438
UT	Salt Lake City, Thorson Rocky Mtn., Inc.	801-942-1683
WA	Kirkland, Electra Tech. Sls., Inc.	206-821-7442
WI	Brookfield, International Rectifier	414-784-2480
WI	Wauwatosa, Phase II Mktg., Inc.	414-771-9986
Can	Markham, Ont., Intl. Rectifier	416-475-1897

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902, FAX: 704-264-8865; Empl.: 1700; *Sls. Mgr.:* Hugh Bolen; *Dist. Mgr.:* Hugh Bolen

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, FAX: 305-885-3127; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111, FAX: 402-694-6180; Empl.: 45; *Sls. Mgr.:* Wayne Roblee .... **A•1704-1705**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Mission Viejo, EAB Assocs. Inc	714-859-7701
CO	Longmont, Tri-Tech Sls.	303-440-7862
IL	Lemont, Trend Tronics, Inc.	708-972-1166
MD	Laurel, CSDS	301-953-7884
MA	Scituate, Olsen Tech Sls. Inc.	617-545-5101
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
MN	Elk River, Ertech, Inc.	612-441-0602
NE	Omaha, IONEB	402-895-4431
NJ	Manalapan, DMR Mktg.	908-303-0510
NC	Summerfield, Harrington Inds.	919-643-9293
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Southampton, Campbell Assocs.	215-322-6630
TN	McMinnville, B & D Mktg.	615-473-7155
TX	Ft. Worth, Merlin Elctrns.	817-429-4420

INTERNATIONAL SENSOR TECHNOLOGY, 17771 Fitch St., Irvine, CA 92714, Tel: 714-863-9999, FAX: 714-474-7417; *Sls. Mgr.:* Jack McCann

INTERNATIONAL TECHNOLOGIES, INC., 68 Albany Rd., Warwick, RI 02888, Tel: 401-781-5595, FAX: 401-467-5885; Empl.: 15; *Sls. Mgr.:* R.W. Elsdoerfer

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 10; *Sls. Mgr.:* Lloyd Estin

INTERNATIONAL TEST INSTRUMENTS, 3002 Dow Ave., Ste. 110, Tustin, CA 92680, Tel: 714-573-9000, FAX: 714-573-9500; Empl.: 10; *Sls. Mgr.:* Hank Pselos

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495, FAX: 805-967-8199; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth, Mktg. Mgr.

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW), FAX: 415-340-1670; Empl.: 35

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FAX: 206-882-1990

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98052, Tel: 206-882-3100; FSC No.: 50821; Empl.: 500; *Sls. Mgr.:* D.T. Baughman, Dir. of Sls. .... **A•1706-1707; D•2112-2123**

Local Sales Offices & Reps

AL	Huntsville, Novus Grp.	205-534-0044
AZ	Tempe, Gassner & Clark	602-968-9037
TX	Irving, Kite Elctrn. Sls.	214-986-0321
CA	Los Altos, Cain-White & Co.	415-948-6533, 415-948-0115
CA	San Diego, Varigon San Diego	619-576-0100
CA	Woodland Hills, Varigon Inc.	818-594-5080
CO	Parker, TMA/Colorado	303-841-3435
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Novus Grp.	404-263-0320
IL	Elgin, Elctrn. Comp. Intl. Ltd.	708-888-0099, 708-888-0998
IN	Ft. Wayne, Corrao Marsh Inc.	219-482-2725
IN	Greenfield, Corrao Marsh Inc.	317-462-4446
FL	Maitland, Jack Krutek & Assoc.	407-628-4837
MD	Marriotsville, Neal Deoul Assoc.	410-795-5775
MD	Owings Mills, Neal Deoul Assocs.	410-363-4311
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MN	Minneapolis, Intertec	612-921-8443
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
NJ	Flanders, K & R Engrg. Sls.	201-584-5235, 800-631-9362
NY	Quality Comps.	315-682-8885
NC	Cary, Novus Grp.	919-460-7771
OH	Mayfield Village, Arthur H. Baier Co.	216-292-7500
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Houston, Kite Electrn. Sls.	713-469-6729
Can	Calgary, Alb., Cana Rep. Grp. Inc.	403-243-5148
Can	Montreal, Que., Cana Rep Grp. Inc.	514-276-4477
Can	Surrey, BC, Cana Rep Grp. Inc.	604-589-8595
Can	Willowdale, Ont., Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
MO	Earth City, Midwest Tech. Sls.	314-298-8787
UT	Salt Lake City, TMA/Colorado	801-483-1009

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INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

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Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Arvada, Arrowhead Sls. Corp.	303-423-5556
FL	Largo, Electrocraft, Inc.	813-544-1766
IL	Palatine, North Central Sls.	708-359-5556
IN	Indianapolis, Gen II Mktg., Inc.	317-848-3083
MA	Milford, Selmark Assocs., Inc.	508-478-9088
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	Bridgeton, AEM, Inc.	314-298-9900
NY	Manhasset, Win-Cor Elctrn. Sls. Corp.	516-627-9474
NY	Rochester, BKT Assocs., Inc.	716-461-9880
OH	Cincinnati, Applied Data Management	513-579-8108
PA	Allison Park, Elctrn. Mktg. Consultant, Inc.	412-366-7187
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
CA	Milpitas, Kent Elctrn. Corp.	408-956-5300
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Bridgeport, Park Distrs. Inc.	203-366-7200
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Melbourne, Pridmore Corp.	407-727-2491
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
MA	Ashland, March Elctrns.	508-881-6715
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	Roseville, Chris Elctrns. Distr.	612-631-2647
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	East Brunswick, Brothers Elctrns.	908-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	Bohemia, March Elctrns.	516-563-6000
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
OH	Englewood, Argent Inds., Inc.	513-836-8633
OH	Englewood, ADS Electra, Inc.	513-836-8636
PA	Exton, VSH Elctrns.	215-363-2250
PA	McKean, Advacom, Inc.	800-678-0512
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	Allen, Turner Distrbg. Co.	214-231-0170
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Oconomowoc, GW Elctrns. Ltd.	414-567-9445

INTRA-COMPUTER INC., 87-46 Van Wyck Expwy., Jamacia, NY 11418, Tel: 718-297-5500, FAX: 718-297-5518; Empl.: 9; *Sls. Mgr.:* Art Yaglian

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Local Sales Offices & Reps

AL	Huntsville, Currier, Peak & Frazier	205-536-1506
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Jose, O'Donnell Assocs.	408-456-2950
FL	Orlando, Currier, Peak & Frazier	407-855-0843
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
MD	Columbia, Delta III	301-730-4700
MA	Canton, Intronics	617-828-4992
MO	Webster Grove, EPI, Inc.	314-962-1411
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Camp Hill, Quick Response Tech Sls.	717-763-9577
PA	Camp Hill, Quick Response Tech. Sls.	717-763-9577
TN	Smyrna, Currie, Peak & Frazier	615-459-0743
TX	Richardson, Scientific Sls.	214-231-6541
VA	Midlothian, Delta III	804-379-1816
WI	Milwaukee, Coombs Assoc.	414-351-6123
Can	Toronto, Strategic Elctrns.	416-620-5381

ION PHYSICS CORPORATION, 11 Industrial Way, Atkinson, NH 03811, Tel: 603-893-6687, FAX: 603-893-6729

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* Larry Swift

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Local Sales Offices & Reps

AL	Huntsville, RO Whitesell	205-883-5110
AZ	Mesa, SW Sls.	602-345-8080
CA	Los Gatos, Luscombe Engrg. Co. North	408-370-2020
CA	Montrose, Luscombe Engrg. Co. South	818-249-9000
CO	Westminster, Straube	303-426-0890
CT	Branford, Coakley Boyd & Abbett Inc.	203-481-2218
FL	Boca Raton, South Atlantic Comp. Sls.	407-391-1034
FL	Orlando, South Atlantic Comp. Sls.	407-857-3650
FL	Seminole, South Atlantic Comp. Sls.	813-595-6397
GA	Norcross, South Atlantic Comp. Sls.	404-447-6154
IL	Itasca, Circuit Sls. Inc.	708-773-0200
IN	Ft. Wayne, RO Whitesell	219-489-0588
IN	Indianapolis, RO Whitesell	317-876-9000
IN	Kokomo, RO Whitesell	317-457-9127
IA	Cedar Rapids, CH Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MA	Framingham, Coakley Boyd & Abbett Inc.	508-820-0800
MA	W. Bridgewater, Coakley Boyd & Abbett Inc.	508-559-6700
MI	Grand Blanc, RO Whitesell	313-695-0770
MI	Grand Rapids, RO Whitesell	616-942-5420
MI	Southfield, RO Whitesell	313-352-5454
MI	St. Joseph, RO Whitesell	616-983-7337
MN	Minneapolis, Tecteam Sls.	612-854-6616
MO	St. Louis, J G Macke Co.	314-432-2830
NJ	Hackensack, Coakley Boyd & Abbett Inc.	201-440-4114
NM	Albuquerque, SW Sls.	505-899-9005
NY	E. Syracuse, Electra Sls. Corp.	315-463-1248
NY	Rochester, Electra Sls. Corp.	716-427-7860
NC	Charlotte, South Atlantic Comp. Sls.	704-525-0510
NC	Raleigh, South Atlantic Comp. Sls.	919-859-9970
OH	Cincinnati, RO Whitesell	513-528-5644
OH	Cleveland, RO Whitesell	216-447-9020
OH	Columbus, RO Whitesell	614-888-9396
OH	Dayton, RO Whitesell	513-298-9546
OR	Tigard, Halbar-RTS Inc.	503-624-6862
PA	Broomall, LD Lowery Inc.	215-356-5300
PA	Pittsburgh, RO Whitesell	412-963-6161
TN	Knoxville, RO Whitesell	615-694-9476
TX	Arlington, ION Assocs., Inc.	817-695-8000
TX	Austin, ION Assocs., Inc.	512-794-9006
TX	Houston, ION Assocs., Inc.	713-537-7717
UT	Salt Lake City, Straube	801-263-2640
WA	Redmond, Halbar-RTS Inc.	206-882-0990
WI	Brookfield, Circuit Sls. Inc.	414-784-7773
Can	Mississauga, Ont., CMT Renmark	416-612-0900

Local Distributors

AZ	Scottsdale, Spirit Elctrns. Inc.	602-998-1533
CA	Chatsworth, Passive Comps. Inc.	800-634-3462
CA	San Diego, Neumann Elctrns.	619-695-3005
CO	Aurora, Capstone	303-375-1300
FL	Boca Raton, NRC	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Hillside, Schuten Elctrns.	708-544-9600
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, JACO Elctrns.	301-995-6620
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, JACO Elctrns., Inc.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NY	Valley Stream, L&S Elctrns.	516-561-2474
NC	Wilmington, Justin Elctrns.	919-763-1234
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Bell Inds. Inc.	513-435-8660
OH	Dayton, Stotts Friedman	513-298-5555
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Addison, JACO Elctrns.	214-733-4300
TX	Richardson, Bell Inds. Inc.	214-690-0466
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Pointe-Claire, Que., Future Elctrns.	514-694-7710
KY	Versailles, RO Whitesell	605-873-1182

IRC-SHALLCROSS, U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150; *Sls. Mgr.:* Hugh Bolen

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IRONWOOD ELCTRNS., INC., P.O. Box 21-151, St. Paul, MN 55121, Tel: 612-431-7025, FAX: 612-432-8616; Empl.: 6; *Sls. Mgr.:* Betty F. Fedde; *Dist. Mgr.:* Paul Jasmin

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 508-667-7110; Empl.: 10

ISC CARDIAN ELECTRONICS INC., See Cardion, Inc., A Siemens Co.

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito ... **A•1085, 2146; B•1364**

Local Sales Offices & Reps

CA	Chula Vista, Inter Elctrns.	619-476-0577
CT	Groton, Primary Source	203-445-4968
NM	Albuquerque, FP Sls.	505-345-5553
IN	Indianapolis, Insul Reps.	317-251-1994
LA	Hammond, Design Mktg. of LA, Inc.	504-542-1115
MA	Lawrence, Primary Source	508-682-5600
AZ	Tempe, F P Sls.	602-894-5303
MO	Grandview, R.R. Burton & Assoc.	816-763-5385
NH	Hampton, Primary Source	603-926-8044
GA	Alpharetta, R A Sls.	404-442-6749
NY	North Port, R. P. Luce & Co.	516-754-5064
NC	New Bern, R A Sls.	919-244-2672
OH	Mentor, Sales Plus	216-942-7811
PA	Montgomeryville, Quick Response	215-362-9225
SC	Easley, R A Sls.	803-859-1859
TN	Knoxville, Insul Reps	615-691-7586

Local Distributors

MA	Billerica, Baldwin Comps. Ctr.	508-667-6710
NJ	Westwood, Seacor	201-666-5600
NY	Ronkonkoma, Baldwin Comps.	516-588-5700

ISLAND COMPONENTS GROUP, 340-A Central Ave., Bohemia, NY 11716, Tel: 516-563-4224, FAX: 516-563-4363; Empl.: 10; *Sls. Mgr.:* Roy A. Koch

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FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 Robbins La., Ste. 270, Syosset, NY 11791-6093, Tel: 516-937-3475, 800-626-6116; Empl.: 10; *Sls. Mgr.:* Ken Kawaller .... **A•2087, 2362; C•1354, 1753; D•1041**

Local Sales Offices & Reps

IN	Indianapolis, C.C. Electro Sales	317-921-5000, 800-423-7799
KS	Chanute, Mi Ja Sls. Co.	316-431-1444
MN	St. Paul, Countryman Assoc.	612-645-9151

ISOCOM INC., 274 E. Hamilton Ave., Ste.E, Campbell, CA 95008, Tel: 408-370-2212, FAX: 408-370-2309; *Sls. Mgr.:* Stephen Parry; *Dist. Mgr.:* Glenda Rees

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOTEK CORPORATION, 566 Wilbur Ave., Swansea, MA 02777, Tel: 508-673-2900, FAX: 508-676-0885; Empl.: 4; *Sls. Mgr.:* William Poisson .... **A•1953-1955**

ISOTEMP RESEARCH, INC.

FAX: 804-977-1849

ISOTEMP RESEARCH, INC., P.O. Box 3389, Charlottesville, VA 22903, Tel: 804-295-3101; FSC No.: 031785; Empl.: 65; *Sls. Mgr.:* Andrew Bell .... **A•1410-1411**

Local Sales Offices & Reps

CA	Fremont, Edward Blake Assocs.	510-770-9058
CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118

IL	Lemont, Trend-Tronics	708-972-1166
IL	Woodridge, Trend-Tronics	312-985-0626
KS	Lenexa, Mid-Tec Assocs.	913-541-0505
MD	Columbia, G Squared Technologies	410-730-9209
MN	Columbia, G Squared Technlgs.	301-730-9209
MO	St. Louis, Mid-Tec Assocs.	314-275-8666

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ITF CORP., P.O. Box 543, Buford, GA 30518, Tel: 404-945-3844, FAX: 404-945-7766; Empl.: 2; *Sls. Mgr.:* Michael Wegner; *Dist. Mgr.:* Michael Wegner

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, FAX: 607-272-4550; Empl.: 100

ITI FERROTEC, 131 Stedman St., Chelmsford, MA 01824, Tel: 508-452-0212, FAX: 508-452-0104 .... **C•1597**

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; FSC No.: FSCM 38747; Empl.: 104; *Sls. Mgr.:* Derk Wissink

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 1500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT CANNON/SEALECTRO, 585 East Main St., New Britian, CT 06051, Tel: 203-223-2700, TELEX: 71-425-501, FAX: 203-225-2781; FSC No.: 98291; Empl.: 350; *Sls. Mgr.:* Ray Champi; *Dist. Mgr.:* Karen Muratori

ITT

FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 18 Technology Dr., Ste. 200, Irvine, CA 92718, Tel: 714-727-3001; FSC No.: 61725; Empl.: 10; *Dist. Mgr.:* J. Harrison .... **A•2147; B•1527-1535**

Local Sales Offices & Reps

AL	Huntsville, Mtn. Mktg.	205-881-3937
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Burbank, Darco	818-504-2425
CA	San Jose, Vernexx	408-972-9072
CA	San Marcos, Falcon	619-591-0504
CO	Denver, Promotech	303-692-8484
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Orlando, Bolton	407-856-0612
FL	St. Petersburg, Bolton	813-864-2294
GA	Norcross, Mtn. Mktg.	404-448-5594
IL	Inverness, Heartland Tech. Sls.	708-358-6622
IN	Ft. Wayne, M/S Sls.	219-436-3023
IN	Indianapolis, M/S	317-881-0110
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Lutherville, DGR	301-583-1360
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	St. Louis Pk., Neotech	612-545-5656
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
NY	Manhasset, Win Cor Elctrns.	516-627-9474
NY	Victor, Net Sls. Co.	716-924-1844
NC	Chapel Hill, Mtn. Mktg.	919-933-0388
OH	Centerville, Omega Sls.	513-434-5507
OH	Cleveland, Omega Sls.	216-360-9400
OK	Broken Arrow, DJ Sls.	918-258-1445
TX	Austin, DJ Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
TX	Houston, DJ Sls.	713-690-2640
UT	Bountiful, Anderson Assoc.	801-292-8991
WA	Camas, EMG	206-834-6548
WA	Redmond, EMG	206-882-0962
WI	Brookfield, Heartland	414-789-6860

Local Distributors

AL	Huntsville, Time	800-772-8638
AL	Madison, Gateway Megatech	205-464-9300
AZ	Tempe, Cypress	602-966-2256
AZ	Tempe, Richey Impact Elctrns.	800-421-7258
AZ	Tempe, Time	800-772-8638
CA	Agoura Hills, Cypress	818-597-9491
CA	Costa Mesa, Cypress	714-549-2424
CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, Richey Impact Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Milpitas, Sierra West	408-945-1050
CA	Oakland, Brill	510-834-5888
CA	Sacramento, Integrated Elctrns.	916-363-6030
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Richey Impact Elctrns.	800-772-8638
CA	San Diego, Time/Harper	800-772-8638
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	San Jose, ITT Multicomps.	408-453-1404
CA	Santa Clara, Cypress	408-980-8400
CA	Santa Clara, Richey Impact Elctrns.	408-727-7411
CA	Santa Monica, Master Distrs.	310-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, Time	800-772-8638
CA	Tustin, Time	800-772-8638
CA	Woodland Hills, Time	800-772-8638
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Time	800-772-8638
CT	New Haven, Greene Shaw Co.	203-265-3333
CT	Southbury, Time	800-772-8638
FL	Ft. Lauderdale, Time	800-772-8638
FL	Orlando, Time	800-772-8638
FL	Pompano Bch., Peerless Radio	305-973-4141
FL	Sunrise, All American	305-572-7999
GA	Atlanta, Peerless Radio	404-612-9090
GA	Norcross, Time	800-772-8638
GA	Roswell, Gateway Megatech	404-642-8787
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Hoffman Estates, Integrated Elctrns.	708-843-2040
IL	Schaumberg, Time	800-772-8638
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, CSE	317-879-9119
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Columbia, Peerless Radio	410-997-1717
MD	Columbia, Time	800-772-8638
MD	Jessup, TREEKO Sls.	301-470-3300
MD	Rockville, All American	301-251-1205
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Peabody, Time	800-772-8638
MA	Wakefield, All American	617-246-2300
MA	Walpole, Richey Impact Elctrns.	508-668-8200
MA	Woburn, Control Design Supp.	617-932-9404
MI	Livonia, Key Elctrns.	313-489-5455
MN	Eden Prairie, All American	612-944-2151
MN	Eden Prairie, Cypress	612-934-2104
MN	Edina, Time	800-772-8638
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Control Design Supp.	612-721-1628
MN	Plymouth, Leeds	612-557-1277
MO	Manchester, Time	800-772-8638
NH	Merrimac, Brevan Elctrns.	603-429-1900
NJ	Marlton, Time	800-772-8638
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	W. Berlin, GCI	609-768-6767
NJ	Wayne, Time	800-772-8638
NY	E. Syracuse, Time	800-772-8638
NY	Hauppauge, Time	800-772-8638
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Masline	716-546-5373
NY	Rome, Rome Elctrns.	800-366-7663
NY	Ronkonkoma, All American	516-981-3935
NC	Century Elec. Comp.	919-596-2220
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Time	800-772-8638
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Schuster	216-425-8134
OH	Columbus, Time	800-772-8638
OH	Willoughby, Gateway Megatech	216-953-0333
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Time	800-772-8638
PA	Norristown, Century Elec. Comp.	215-631-5400
PA	Wayne, Peak Elctrns.	215-293-9000
TX	Austin, Time	800-772-8638
TX	Irving, Cypress	214-255-0065
TX	Richardson, Time	800-772-8638
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, All American	801-261-4210
UT	W. Salt Lake, Integrated	801-298-1869
UT	W. Valley, Time	800-772-8638
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bothell, Cypress	206-483-1144
WA	Kirkland, Time	800-772-8638
WA	Seattle, Richey Impact Elctrns.	206-575-1910
WI	Brookfield, Leeds Electro Comps.	414-789-6995
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT CONOFLOW, ITT Fluid Technology Corp., Route 78, St. George, SC 29477, Tel: 803-563-9281, TELEX: 4945706, FAX: 803-563-2131; *Sls. Mgr.:* Thomas Floro

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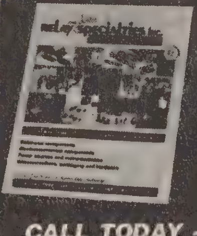

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ITT POMONA ELECTRONICS, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, Tel: 909-469-2900, FAX: 909-629-3317; FSC No.: 05276; Empl.: 140 .... **C•1355**

Local Sales Offices & Reps

AL	Hazel Green, Braden & Assocs.	205-828-6290
AZ	Phoenix, More Sls.	602-331-8115
AR	Mablevale, Erickson Sls., Inc.	501-455-0618
CA	Burbank, Darco	818-504-2425
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CA	So. San Francisco, Carelli/EMA	415-873-2524
CO	Broomfield, Connors Co.	303-466-9628
FL	Maitland, EIR Inc.	407-660-9600
IL	Barrington, W. M. Linz	708-382-9720
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-273-9063
IA	West Des Moines, Nevco	515-225-9866
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MD	Baltimore, David S. Linz, Inc.	410-882-6289
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MN	Minneapolis, Hei-lite Sls., Inc.	612-550-0506
OH	Cleveland, Marlow Assocs.	216-831-8232
MO	Kansas City, Nevco, Inc.	816-741-0601
NJ	Livingston, Tobias, API	908-686-1121
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Beachwood, Elctrns. Salesmasters, Inc.	800-544-4383
OR	Beaverton, Eclipse Mktg. Grp. Ltd.	503-642-1661
PA	Philadelphia, David S. Linz, Inc.	215-379-0734
TX	Dallas, Erickson Sls., Inc.	214-739-5833

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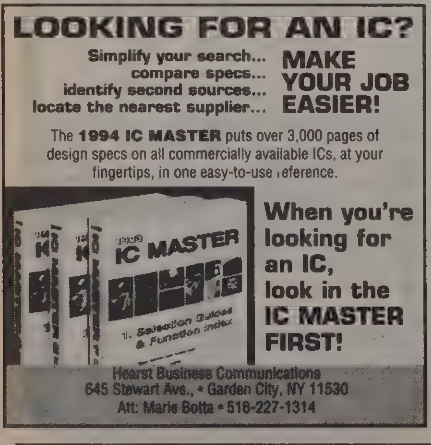
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AL	Huntsville, ACM, Inc.	205-881-5493
CA	Playa-del-Ray, Corcoran Assoc.	213-823-4589
FL	Cassel Berry, Dyne-A-Mark	407-831-2822
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
GA	Norcross, ACM, Inc.	404-448-7025
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	West Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
MN	Hopkins, Forsythe Assoc.	612-933-8267
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	402-788-2536
NY	E. Rochester, L-Mar Assocs., Inc.	716-681-9100
NY	Poughkeepsie, L-Mar Assoc. Inc.	914-462-8025
NC	Raleigh, C-Tech	919-782-8100
OH	Solon, J R Thornberry Co. Inc.	216-248-4995
TX	Austin, Electra Reps, Inc.	512-339-1163
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Lynchburg, Paktron Div.	804-239-6941
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Hartland, Selective Sls. Inc.	414-367-1133
Can	Markham, Ont., Avotronics	416-475-2024
Can	Pointe Claire, Que., Avotronics	514-697-2135

Local Distributors

AZ	Phoenix, Future Elctrns.	602-272-7951
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Irvine, Future Elctrns.	714-250-4141
CA	San Diego, Future Elctrns.	619-278-5020
CA	San Jose, Future Elctrns.	408-434-1122
CA	Van Nuys, E.W. Elctrns.	818-782-9020
CO	Westminster, Future Elctrns., Inc.	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
FL	Altamonte Springs, Future Elctrns., Inc.	305-767-8414
FL	Clearwater, Future Elctrns., Inc.	813-578-2770
FL	Ft. Lauderdale, N R C Elctrns.	305-772-4500
GA	Augusta, Dixie Elctrns., Inc.	404-722-2055
GA	Norcross, Future Elctrns., Inc.	404-441-7676
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Schaumburg, Future Elctrns.	312-882-1255
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Custom Svcs. Elec.	317-879-9119
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Future Elctrns.	301-290-0600
MD	Jessup, Treeko Sls.	301-470-3300
MD	Spencerville, U.S. Elctrns.	301-384-3300
MA	Billerica, Mayer Elctrns.	508-667-6900
MA	Westboro, Future Elctrns.	617-366-2400
MI	Livonia, Future Elctrns.	313-261-5270
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmaur, Mid Atlantic Elctrns.	609-931-5303
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Future Elctrns. Inc.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Charlotte, Future Elctrns.	704-529-5500
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrn. Mktg. Corp.	513-439-4711
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Future Elctrns.	503-646-9454
PA	McKean, Advacom, Inc.	814-476-7774
SC	Columbia, Dixie Elctrns., Inc.	803-779-5332
SC	Greenville, Dixie Elctrns., Inc.	803-297-1435
SC	N. Charleston, Dixie Elctrns.	803-552-2671
TN	Gray, Dixie Elctrns., Inc.	615-477-3838
TN	Knoxville, Dixie Elctrns., Inc.	615-938-4131
TX	Austin, Altair Co.	512-837-4970
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Future Elctrns., Inc.	214-437-2437
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
WA	Redmond, Future Elctrns., Inc.	206-881-8199
WI	Mequon, Taylor Elec.	414-241-4321
WI	Racine, Badger Elctrns. Co. Inc.	414-637-1256
WI	Waukesha, Bell Inds.	414-547-8879
EXP	Bucks, Eng., C & CD Ltd.	494-882-848
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Edmonton, Future Elctrns.	403-438-2858
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Point Claire, Que., Future Elctrns.	514-694-7710
Can	St. Foy, Que., Future Elctrns.	418-682-8092
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns.	204-786-7711

ITW Switches

FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040; Empl.: 500; *Dist. Mgr.:* P. Smentek .... **B•1746-1755**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
AZ	Glendale, The Knight Co.	602-433-2166
CA	Los Angeles, The Knight Co.	310-670-2833
CA	Santa Clara, ITW Switches	312-282-4040
CO	Parker, ITW Switches	312-282-4040
CT	Clinton, Selmark Assoc.	203-573-9088
FL	Coral Springs, HHP Assocs.	305-753-8389
FL	Palm Bay, HHP Assocs.	407-951-9236
FL	Tarpon Springs, HHP Assocs.	813-937-6099
FL	Winter Park, HHP Assocs.	407-740-0320
GA	Atlanta, Electro Mech.	404-447-6478
IL	Downer's Cove, Golten Assoc.	708-985-5100
IA	Cedar Rapids, R. F. Welch Co.	319-362-6824
MD	Baltimore, Chesapeake Tech.	301-236-0530
MD	Burtonsville, Chesapeake Tech.	301-236-0530
MA	Milford, Selmark Assoc.	508-478-9088
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, ITW Switches	312-282-4040
NJ	Red Bank, Varrelman-Gorman Co.	908-219-0088
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-790-9300
OH	Medina, Rockford Controls	216-725-3705
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Oreland, Precision Mktg.	215-233-9233
TX	Richardson, ITW Switches	214-235-9515
WA	Redmond, Earl & Brown Co.	206-885-5064

Local Distributors

AL	Huntsville, Powell Elctrns.	205-837-5300
AZ	Tempe, Control Design	602-829-7981
CA	Brea, Aero Flight	714-773-4251
CA	Fremont, Kea Elctrns.	510-651-2600
CA	Garden Grove, Richey/Impact	714-895-0060
CA	Gardena, Cal Switch	213-538-9830
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Torrance, Time	213-320-0880
CO	Denver, CSID	303-292-9594
CT	Hartford, L.E. Whelan	203-296-5000
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Maitland, Elctrns. Equipmt.	407-539-0888
FL	Miami, Elctrn. Equip.	305-526-6000
FL	Orlando, Sager Elctrns.	407-354-1130

FL	Wellington, Wings Electro Sls.	407-798-6606
IL	Chicago, Newark Distrs.	312-784-5100
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wheeling, Hawk Electronics	708-459-4030
IN	Indianapolis, R.S. Elctrns.	317-253-9065
KS	Overland Park, Olive Elctrns.	913-362-1923
KS	Wichita, R.S.C. Elctrns.	316-267-5213
MD	Annapolis Junction, Powell Elctrns.	301-880-3255
MD	Columbia, Sager Elctrns.	301-995-4900
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Kensington, Marine Air Supply	301-949-9560
MA	Hingham, Sager	617-749-6700
MA	Westborough, Powell Elctrns.	508-336-6100
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Heights, R.S. Elctrns.	314-997-7709
NH	Salem, Sager	603-898-1348
NJ	Little Falls, Powell	201-890-0010
NY	Buffalo, Summit	716-887-2800
NY	Endwell, Astrex/ASI	607-754-3823
NY	Farmingdale, Iris Elctrns.	516-420-8400
NY	Hauppauge, Sager	516-348-1300
NC	Winston Salem, Kirkman	919-722-9131
OH	Akron, Aesco	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Advacom	513-274-5900
OR	Beaverton, Comp. Resources	503-641-8488
PA	Mars, Sager Elctrns.	412-772-2233
PA	Mc Kean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic	215-643-2850
PA	Philadelphia, Powell	215-365-1900
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wes Garde	214-357-1768
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Irving, Powell Elctrns.	214-550-0547
TX	Tomball, Wofford	713-351-2255
WA	Kent, Comp. Resources	206-454-8666
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
Can	Markham, Ont., Semad	416-475-8500

IVEK CORP., Fairbanks Rd., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 25; *Sls. Mgr.:* Mark Tanny

IVO

FAX: 908-542-2938

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 908-542-5151, 800-932-0489; Empl.: 10; *Sls. Mgr.:* Frederick Hickey **B•1756, 1960-1962; D•1162**

Local Distributors

CA	Long Beach, Elect. Power Controls	310-498-6699
FL	Clearwater, General Controls	813-446-6622
SC	Greenville, Automation Supply	803-233-2145

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, FAX: 408-435-0670; Empl.: 350; *Sls. Mgr.:* Scott Lodor; *Dist. Mgr.:* Cliff Knudsen

JAE
Electronics

FAX: 714-753-2699

JAE ELECTRONICS INC., 142 Technology Drive, Irvine, CA 92718, Tel: 714-753-2600; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff, Dir. Field Sls. **C•1356-1357**

Local Sales Offices & Reps

CA	Santa Clara, Pinnacle Sls.	408-249-7400
FL	Ft. Lauderdale, JAE Elctrns.	305-563-3484, 800-248-0737

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 25; *Sls. Mgr.:* John S. Jaidinger

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, FAX: 312-463-1504; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

Janco
AN ESOP CORP.

FAX: 818-842-3396

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91508, Tel: 818-846-1800; FSC No.: 91812; Empl.: 144; *Sls. Mgr.:* Gary Smith **B•1758-1759**

Local Sales Offices & Reps

AZ	Mesa, Sys. Sls. of AZ. Inc.	602-464-9989
CA	San Diego, Zerimar Sls.	619-436-3379
CA	San Jose, Wes Tron Assocs.	408-264-4070
CA	So. Calif., Gabriel & Assoc.	714-666-0660
CO	Aurora, Key Specs.	303-690-6106
FL	Orlando, MacKay, Smith & Assocs.	305-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
IL	Addison, Vikeland Sls.	708-832-8425
IN	Greenwood, Valentine & Assocs.	317-888-2260
KS	Wichita, Dy-Tronix Inc.	316-838-2645
MD	Ellicott, Tech. Sls. Inc.	800-225-4335
MA	Swansea, Eastrep Co.	617-672-0788
MN	St. Paul, Debeck-Hays Assocs.	612-835-3610
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777
NJ	Kenvil, CFE/GRAY	201-927-6662
NY	Fairport, TAC Sls. Inc.	716-377-2250
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Columbus, Rathsburg Assocs., Inc.	614-457-2242
PA	Southeastern, Quality Comps.	215-687-3553
TX	Irving, Trice Mktg. Corp.	214-255-1877
WA	Seattle, Norwest	206-827-9562

Local Distributors

CA	Burbank, Merit Comp. Supp.	818-842-7607
CA	Westlake Village, Tech-Cable Prods.	818-991-4697

JAN CRYSTALS, Bob Whan and Son Electronics, 2341 Crystal Dr., Ft. Myers, FL 33907, Tel: 813-936-2397, 1-800-526-9825, FAX: 813-936-3750; Empl.: 28

JAN HARDWARE MFG. CO., See Electronics Hardware

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 6600 Park of Commerce Blvd., Boca Raton, FL 33487-8295, Tel: 407-241-8600, FAX: 407-241-3328; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

J.A.W. INDUSTRIES, INC., 1750-A Costner Dr., Warrington, PA 18976, Tel: 215-343-8990, FAX: 215-343-8942; Empl.: 20; *Sls. Mgr.:* J. McLaughlin; *Dist. Mgr.:* J. McLaughlin

JAYCO

FAX: 714-998-4954

JAYCO INTERFACE TECHNOLOGY, 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701; Empl.: 33 **B•1840-1841**

Local Sales Offices & Reps

AZ	Scottsdale, Michael J. Dildine Assoc.	602-966-4200
CA	Los Angeles, Satori Elec.	310-214-1791
CA	San Diego, Coastal Elctrn. Sls.	619-459-4148
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Denver, AKI Enterprises	303-756-0700
GA	Atlanta, Satori Elec.	404-242-0606
IL	Elgin, MacKellar Assoc.	708-468-8900
MI	Bloomfield Hills, MacKellar Assoc.	313-335-4440
NJ	Wayne, Breen Assoc.	201-696-8683
NY	New York, Breen Assocs.	201-696-8683
OH	Columbus, MacKellar Assoc.	614-848-3552
OR	Portland, TAC Assoc.	503-648-6110
TX	Dallas, REM Comps.	214-234-1069

JAYCOR, P.O. Box 85154, San Diego, CA 92186, Tel: 619-453-6580, FAX: 619-535-9763; FSC No.: 3M687; Empl.: 800; *Sls. Mgr.* Steven Lutjens

JB ELECTRONIC TRANSFORMERS INC., 2310 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150; *Sls. Mgr.:* Donald M. Gould

JBM ELECTRONICS, INC., 1 Commerce Drive, Bedford, NH 03110-6802, Tel: 603-623-0222, FAX: 603-623-0446; FSC No.: 62694; Empl.: 40; *Sls. Mgr.:* Susan Bennett; *Dist. Mgr.:* Susan Bennett **A•1567, 2363; D•2127**

Local Distributors

FL	Casselberry, Aerco, Inc.	407-695-0600
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
NH	Atkinson, Astrum Elctrns.	603-898-3399
SC	Lamar, Aerco, Inc.	803-326-5463
Can	Markham, Ont., SEMAD;Div. of DGW	416-475-8500

J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111, FAX: 203-624-8142; Empl.: 25; *Sls. Mgr.:* Lillian Sharron

JC SYSTEMS, INC., 11535 Sorrento Valley Rd. Ste. 400, San Diego, CA 92121, Tel: 619-793-7117, FAX: 619-793-1931; Empl.: 12; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 424 Crown Point Circle, Grass Valley, CA 95945-0512, Tel: 916-273-4608, FAX: 916-273-0769; Empl.: 50; *Sls. Mgr.:* Reece Kendall **A•2088-2091**

Local Sales Offices & Reps

NJ	Matawan, Tim Reilly Assocs.	908-566-4555

JEFFERS ELECTRONICS, 1331 W. Fairway Dr., Nogales, AZ 85621, Tel: 602-281-4925, FAX: 602-281-0090; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

JEMA

FAX: 708-251-3738

JEMA, 1000 Skokie Blvd., Wilmette, IL 60091, Tel: 708-251-3600; Empl.: 10; *Sls. Mgr.:* Dale R. Thompson; *Dist. Mgr.:* Chris Gantz **D•1024-1025, 1042-1047**

JEMTEC ELECTRONICS CO.,SEE SCIENTIFIC COLUMBUS CO.

W. S. JENKS & SON, 1933 Montana Ave. NE, Washington, DC 20002, Tel: 202-529-6020, 800-673-8199, FAX: 202-832-3411

JENSEN TOOLS, INC., Stanley Works, 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, FAX: 800-366-9662; Empl.: 250; *Sls. Mgr.:* Patrick Acton

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 908-353-5700, FAX: 908-353-1021; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo **D•1756-1760**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA
POWER SYSTEMS, INC

FAX: 310-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 310-427-0095; Empl.: 110 **D•1762-1763**

Local Sales Offices & Reps

AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Santa Clara, Gagner-Toomey Assoc.	408-244-2200
CO	Golden, J.F. Hurlbut Co.	303-279-7796
CT	Vernon, George Urban & Assocs.	617-329-4068
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, ATS, Inc.	913-782-8702
MA	Dover, The Urban Grp.	617-329-4068
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
MO	Bridgeton, Advanced Tech. Sls.	314-291-5003
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Franklin Square, Cooper-Simon Emtec	516-489-0404
OH	Mentor, Sls. Plus	216-942-7811
TX	Dallas, MGR Elctrns.	214-238-5246
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Ben Latawiec **C•1358-1359**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301-9619, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 125; *Sls. Mgr.:* Carrie Glover **A•1722-1723; D•1275**

Local Sales Offices & Reps

AZ	Scottsdale, TDSI/AZ	602-998-2444
CA	Coronado, RF Assocs.	619-575-9011
CA	San Jose, MC Microwave, Inc.	408-446-4100
CO	Franktown, Exelcis	303-841-4305
FL	Stuart, Microwave Comps.	407-286-4455
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Chelmsford, Matrix Sls.	508-459-4000
NY	Melville, RF Elctrn. Sls.	516-420-8890
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Clifton Elctrns.	703-360-9129
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Ottawa, Ont., Giga-Tron Assocs., Ltd.	613-225-4090

Local Distributors

MA	New England Area, East Coast Microwave	617-279-0900

JH AMERICA, INC., JBT International, Inc., 20809 Higgins Court, Torrance, CA 90501, Tel: 310-328-0051, FAX: 310-328-0057; *Sls. Mgr.:* Mark Zimmermann **C•1754-1755**

Local Sales Offices & Reps

CA	Palm Springs, R D Sls.	619-324-5044
CA	Sunnyvale, Logan Sls.	408-732-6020
FL	Longboat Key, VSI, Inc.	813-383-1440
MI	Ann Arbor, VSI, Inc.	313-995-1200
NY	Rochester, VSI, Inc.	
NC	Raleigh, VSI, Inc.	919-870-0060
RI	Coventry, VSI, Inc.	401-826-0040

Local Distributors

AZ	Scottsdale, Memory Plus Dist.	602-820-8819
AZ	Tempe, Comtel Corp.	602-829-9471
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Chula Vista, Sonika Elctrn.	619-424-9190
CA	San Diego, Deco Elctrns.	619-693-1595
FL	Orlando, Computel	407-682-3957
IL	Elk Grove Vlg., Lutubusiness Sys.	708-803-6466
NJ	Kennilworth, Computel	201-241-5400
NC	Charlotte, Computel	704-376-4414
OH	Dayton, Tech. Dvc.	513-890-6811

JKL
COMPONENTS
CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331-2376, Tel: 818-896-0019; FSC No.: 55335; Empl.: 35; *Sls. Mgr.:* Ernie Soares; *Dist. Mgr.:* Ernie Soares **B•1168**

Local Sales Offices & Reps

AL	Huntsville, Southern Sls.	205-830-9322
CA	Burbank, Darco Elctrn. Sls.	818-504-2425
CT	W. Hartford, Conti-Younger & Assoc.	203-521-0602
IL	Elk Grove, Control Sls.	708-595-2110
NY	Henrietta, CMJ, Inc.	716-334-3277
MD	Baltimore, Universal Elctrns.	301-461-9946
MA	Burlington, Conti-Younger	617-273-1582
MI	Farmington Hills, Clark Sls.	313-553-0610
MN	Bloomington, Mumco	612-854-4161
OH	Cincinnati, Clark Sls. Co.	513-922-7555
OH	Painsville, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
CA	San Diego, Richie/Impact Sls.	619-271-4511
AZ	Phoenix, Capital Elctrns.	602-252-5897
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Diego, Richie/Impact Sls.	619-271-4511
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Wallingford, Sager Elec.	203-265-4600
FL	Ft. Lauderdale, Powell Elec.	305-484-8377
GA	Norcross, Specialty Distrbg. Co.	404-446-3190
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Lenexa, Amer. Elec. & Cable	913-469-0099
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elec.	617-749-6700
MA	Westborough, Powell Elec.	617-366-6100
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Richland, ATR Ent.	314-765-5219
MN	Fridley, Voyager Elec.	612-571-7766
NJ	Clifton, Vantage Comps.	201-777-4100
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	Apalachin, Rogan Elec.	607-625-2949
NH	Salem, Sager Elec.	603-898-1348
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Bristol, Aim Elec.	215-785-3500
PA	Philadelphia, Powell Elec.	215-365-1900
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
OH	Yellow Springs, Electro-Shield	513-767-1054
TX	Ft. Worth, T & S. Supp.	817-248-4781
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Oshkosh, Electronic Inds.	414-235-8930

JMJ TECHNICAL PRODS., 517 Kimball Turn, Westfield, NJ 07090, Tel: 201-589-4257, FAX: 908-789-2447; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut **C•1531**

JMK
INCORPORATED

FAX: 603-886-4115

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: 603-886-4100; Empl.: 100; *Sls. Mgr.:* J. Kennedy **A•1596-1597**

Local Sales Offices & Reps

CA	Woodland Hills, Cummings & Assoc. South	818-340-6035
MN	St. Paul, Arko Sls.	612-777-7454

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman **A•2354-2369**

JOBMASTER CORP., 9010 Liberty Rd., P.O. Box 207E, Randallstown, MD 21133-0207, Tel: 410-655-1400, 1-800-642-1400, FAX: 410-521-5461; Empl.: 16 **A•1320**

JOEMEX ELECTRICS, 19 Hammond 508, Irvine, CA 92718, Tel: 714-855-4472

JOHANSON DIELECTRICS, INC., 15191 Bledsoe St., Sylmar, CA 91342, Tel: 818-364-9800, FAX: 818-364-6100; Empl.: 300 **A•1089**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls. Inc.	205-533-1735
AZ	Tempe, Reptronix, Inc.	602-230-2630
CA	Costa Mesa, Richland Tech. Sls.	714-646-6640
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
CT	Waterbury, Compak Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sales Co.	305-938-4333
FL	Altamonte Springs, VG Sales Co.	407-831-8688
FL	Largo, VG Sales Co.	813-536-7787
GA	Norcross, Elctrn. Sls. Inc.	404-448-6554
IL	Lisle, WG Controls	708-963-5954
IN	Indianapolis, M & L Elctrns.	317-359-4742
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Columbia, PSA South	301-730-0359
MA	Hudson, Compak Inc.	508-568-0331
MI	Farmington, JP Bergin Assocs.	313-471-7940
MN	St. Paul, Cahill, Schmitz & Cahill, Inc.	612-646-7217
MO	Florissant, Spectrum Sls.	314-921-1313
NM	Albuquerque, Reptronix, Inc.	505-292-1718
NY	Apalachin, T Squared Elctrns.	607-625-3983
NY	Bellmore, Compar New York Inc.	516-221-7300
NY	Syracuse, T Squared Elctrns.	315-463-8592
NY	Victor, T Squared Elctrns.	716-924-9101
NC	Cary, Elctrn. Sls., Inc.	919-467-8486
NC	Charlotte, Elctrn. Sls., Inc.	704-543-8705
OH	Columbus, Dolfuss-Root & Co.	614-885-4844
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OR	Portland, Caruso & Camelleri Assoc.	503-246-5439
PA	Trevose, PSA, Inc.	215-245-0513
TX	Arlington, Ion Assocs., Inc.	817-695-4905
TX	Austin, Ion Assocs., Inc.	512-794-9006
TX	Houston, Ion Assocs., Inc.	713-537-7717
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Oakton, PSA South	703-281-1806
PR	Mayaquez, V.G. Sls.	809-831-4050
Can	Kanata, Ont., J-Squared Technlgs.	613-592-9540
Can	Rexdale, Ont., J-Squared Technlgs.	416-674-0927

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Carson, Newark Elctrns.	213-516-6511
CA	Cypress, Bell Inds.	714-895-7801
CA	El Toro, Pace Elctrns.	714-588-2345
CA	Foster City, Newark Elctrns.	415-572-8300
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	Irvine, Kelex	714-863-1230
CA	Los Alamitos, SEMI DICE	213-594-4631, 714-952-2216
CA	Los Angeles, Penstock	213-383-6100
CA	Rocklin, Bell Inds.	916-652-0414
CA	San Diego, Bell Industries	619-268-1277
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Co-Linear Sls.	408-441-6566
CA	Santa Clara, Pace Elctrns.	408-748-3748
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Capacitor Connection	408-737-8985
CA	Sunnyvale, Penstock	408-730-0300
CA	Van Nuys, C.W. Swift	818-989-1133
CA	Yorba Linda, Corona Elctrns.	714-283-8185
CO	Denver, Bell Inds.	303-691-9010
CO	Denver, Newark Elctrns.	303-757-8531
CT	Bloomfield, Newark Elctrns.	203-243-1731
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Orlando, Newark Elctrns.	407-896-8350
FL	Palm Bay, Penstock	407-724-5300
FL	Pompano Bch., ASAP Elctrns.	305-975-2477
GA	Atlanta, Penstock	404-951-0300
GA	Norcross, Bell Inds.	404-446-7167
IL	Chicago, Newark	312-784-5100
IL	Elk Grove Village, Bell Inds.	708-640-1910
IL	Palatine, Penstock	708-934-3700
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Olathe, Penstock	913-829-9330
MD	Columbia, Bell Inds.	410-290-5100
MA	Andover, Bell Inds.	508-474-8880
MA	Marborough, Penstock	508-624-7300
MA	Middleboro, Glynn Elec. Inc.	508-947-4262
MA	South Easton, Semi Dice	508-238-8344
MN	Hibbins, Minntech	218-262-5227
MN	Minneapolis, Newark Elctrns.	612-331-6350
MS	Jackson, Newark Elctrns.	601-956-8300
NH	Atkinson, Astrum	603-898-3399
NJ	Fairfield, Bell Inds.	201-625-7777
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	Fairfield, Penstock	201-808-1414
NJ	Fairfield, Prime Comps.	516-244-8190
NJ	Rockaway, NASCO	201-227-6060
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Central Islip, Semi Dice, Inc.	516-234-7676
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727, 415-961-5414
NY	Sodus, Pace Elctrns.	800-228-7223
OH	Dayton, Bell Inds.	513-435-8660
OR	Beaverton, Bell Industries	503-644-1500
PA	Trevose, Bell Inds.	215-953-2800
TX	Allen, Prime Distr.	214-542-7915
TX	Allen, Prime Distribution	214-542-7915
TX	Dallas, Penstock	214-701-9555
TX	Garland, Newark Elctrns.	214-487-8144
TX	Richardson, Bell Inds.	214-690-0466
UT	Midvale, Bell Inds.	801-561-9691
WA	Bellevue, Penstock	206-454-2371
WA	Redmond, Bell Inds.	206-867-5410
WI	Waukesha, Bell Industries	414-547-8879

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 **A•1088**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Reptronix, Ltd.	602-230-2630
CA	Los Angeles, RF Assocs., Inc.	213-478-1586
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890,801-263-2640(UT
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sls.	305-938-4333
FL	Largo, VG Sls.	813-536-7787

IL	Lisle, W.G. Controls	708-963-5954
IN	Kokomo, Schillinger Assocs.	317-457-7241
IA	Hiawatha/Cedar Rapids, ARD Sales Co.	319-393-6392
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Hudson, Compak, Inc.	508-568-0331
MN	St. Paul, Cahill, Schmirz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix Inc.	505-292-1718
NY	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Syracuse, L.D. Allen, Inc.	315-487-8387
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Dayton, Scott Elect. Inc.	513-294-0539
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Euless/Ft. Worth, W. Pat Fralia & Assocs.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
VA	Oakton, PSA South	301-953-4884
WA	Seattle, Northmar	206-524-5170
Can	Montreal, A. C. Simmonds, LTD.	514-466-5250
Can	Toronto, A. C. Simmonds, LTD.	416-839-8041

Local Distributors

CA	Sunnyvale, Penstock	408-730-0300
CA	Van Nuys, C.W. Swift	818-989-1133
FL	Miami, All American	305-621-8282
FL	Winter Pk., Pelcor	407-644-1594
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Beltsville, Resco/Washington	301-937-9100
MA	Seekonk, M-Squared	508-761-5490
MO	Baltimore, Resco/Baltimore	301-931-8200
NJ	Rockaway, Tonar	201-586-9000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
Can	St. Laurent, Q.C., Braydon Elctrns.	514-332-5650
Can	Willowdale, Electro Sonic	416-494-1555

JOHNSON, E. F., CO., 299 Johnson Ave., Waseca, MN 56093, Tel: 1-800-247-8256, FAX: 507-835-6287; Empl.: 800; *Sls. Mgr.:* Kevin Lohmann; *Dist. Mgr.:* Kevin Lohmann

JOHNSON CONTROLS BATTERY GROUP, INC., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 250; *Sls. Mgr.:* James L. Winistorfer, Dir. Sls. & Mktg.

JOHNSON YOKOGAWA CORP., 4 Dart Road, Newnan, GA 30265, Tel: 404-254-0400, FAX: 404-254-0928; Empl.: 700; *Sls. Mgr.:* Chuck Micallef

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, FAX: 714-554-0306; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. .... **C•1360-1361**

Local Sales Offices & Reps

AZ	Scottsdale, JK & Assocs.	602-990-8804
CA	Los Angeles, Quattro Sls. Assocs.	213-372-4221
CA	Orange County, Quattro Sls. Assocs.	800-735-4510
CA	Pleasanton, Leddy Assocs.	510-417-1033
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CA	San Fernando Valley, Quattro Sls. Assocs.	805-523-2978
FL	Longwood, Mathias Assocs., Inc.	407-682-1700
IL	Schaumburg, Terry McNulty & Assocs.	708-980-9868
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MI	Rochester Hills, Geotronix, Inc.	313-373-4334
NJ	Fairfield, Brunetta Mktg. Svcs.	201-227-2522
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Portland, Evergreen Mktg. Grp.	503-598-7667
PA	Allison Park, Geotronix, Inc.	412-487-1770
WA	Edmonds, Evergreen Mktg. Grp. Inc.	206-485-8063
Can	Nepean, Ont., Tech-Trad, Inc.	613-727-1272

Local Distributors

FL	Miami, Elec. Equip.	305-526-6060
OH	Richfield, Alpha Distr. Corp.	216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* Rich Gerszberg

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-773-5582; Empl.: 275; *Sls. Mgr.:* Todd Leverich

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS CORP., P.O. Box 817, 6868 Cortona Dr., Goleta, CA 93116, Tel: 800-752-8068, 805-968-3551, FAX: 805-968-2335; FSC No.: 23663; Empl.: 240; *Sls. Mgr.:* M. Young

JOSLYN JENNINGS CORPORATION

FAX: 408-286-1789

JOSLYN JENNINGS CORPORATION, 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* Dwane Gisi ...... **A•1090; B•1536-1538; D•1277**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Crown Systems	602-274-3180
CA	Encino, King-Way Assocs.	818-788-4124
CA	San Jose, H. W. Assocs.	408-996-9940
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Kingston, Leonard D. Allen, Inc.	914-338-7588
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Bear Mktg., Inc.	412-531-2002
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

CA	Carlsbad, Surcom Assocs.	619-438-4420
IL	La Fox, Richardson Elctrns., Ltd.	312-456-0600
TN	Bristol, Kintronics	615-878-3141

JOULE POWER, INC., Joyce Industrial Pk., Summer Rd., Boxborough, MA 01719, Tel: 508-263-9712, FAX: 508-263-9071 .... **D•1765**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Scottsdale, Sun Tech Mktg.	602-483-1082
CA	San Jose, Silicon Valley Sls.	408-432-1967
FL	Altamonte Springs, Over & Over	407-332-1222
GA	Norcross, Over & Over	404-449-6205
MA	Tyngsboro, AMS Mktg.	508-649-3383
NY	Commack, RC Eng. Sls.	516-543-3325
NC	Raleigh, Over & Over	919-876-7338
OH	Cincinnati, Century Tech. Sls.	513-677-5088
PA	Wayne, John Lyons Mktg.	215-687-2277
TX	Plano, Aticus	214-964-0663
UT	Ogden, Doug Taylor & Assocs.	801-546-9570
VA	Alexandria, Mid-States Mktg.	703-370-2600
WA	Lake Oswego, SPS Elctrns.	503-697-7768
Can	Montreal, Que., Solid State Engrg.	514-481-3313

JOVIL MANUFACTURING CO., INC., Precision Rd., Danbury, CT 06810, Tel: 203-792-6700, TELEX: 969634, FAX: 203-790-8645; Empl.: 25; *Sls. Mgr.:* Keith Fredlund

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418, FAX: 717-236-1895; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474-0248, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 1-800-947-1110, FAX: 708-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky .... **C•1363**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc	205-837-7105, FAX:205-837-7305
AZ	Scottsdale, Carefree Elctrns.	602-951-9121, FAX:602-951-1381
CA	Canyon Country, Interconn Tech. Mktg.	805-298-3199,FAX:805-298-3883
CA	Cupertino, Prism Tech. Sls. Co.	408-257-6766, FAX:408-257-8847
CA	Newsbury Park, Interconn Tech. Mktg.	805-499-4024,FAX:805-499-7937
CA	San Marcos, Falcon Sls. & Technlg.	619-591-0504, FAX:619-591-4241
CA	Trabuco Canyon, Interconn Tech. Mktg.	714-589-4655,FAX:714-589-3793
FL	Altamonte Spgs., Over & Over, Inc.	407-332-1222, FAX:407-332-4433
FL	Brandon, Over & Over, Inc.	813-684-6486, FAX:813-684-6486
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115, FAX:305-484-8131
GA	Norcross, Over & Over, Inc.	404-449-6205, FAX:404-449-6177
IL	Itasca, Circuit Sls.	708-773-0200, FAX:708-773-2721
IN	Indianapolis, Elctrn. Sls. & Engrg. Co.	317-849-4260,FAX:317-841-0231
IA	Blue Grass, Acorn Elctrns.	319-381-2702, FAX:319-381-2702
KS	Overland Pk, Acorn Elctrns.	913-649-6402, FAX:913-649-8005
MA	Canton, The T.M.R. Grp.	617-828-1848, FAX:617-828-2459
MI	Bloomfield Hills, Trilogy Mktg., Inc.	313-338-2470, FAX:313-338-6720
MN	St. Paul, Countryman Assoc. Co.	612-645-9151, FAX:612-641-6153
MO	St. Louis, Acorn Elctrns.	314-421-1751, FAX:314-421-1752
NJ	Madsion, Venture Quest, Inc.	201-377-4922, FAX:201-377-0453
NY	Holbrook, Venture Quest, Inc.	516-588-5130, FAX:516-588-4424
NY	Marcellus, Franklin Sls. Corp.	315-673-1009, FAX:315-673-4428
NY	New Hartford, Franklin Sls. Corp.	315-793-3161, FAX:315-793-3139
NY	Pittsford, Franklin Sls.	716-248-8251, FAX:716-248-3866
NC	Charlotte, Over & Over, Inc.	704-542-9111, FAX:704-542-9937
NC	Raleigh, Over & Over	919-876-7338, FAX:919-876-8098
OH	Cincinnati, Stegman Blaine Mktg., Inc.	513-729-1969,FAX:513-729-1984
OH	Cleveland, Stegman Blaine Mktg., Inc.	216-572-0003,FAX:216-238-3229
OH	Stow, Stegman Blaine Mktg., Inc.	216-688-9603, FAX:216-688-6421
OH	Vandalia, Stegman Blaine Mktg., Inc.	513-890-7975,FAX:513-890-5191
OR	Aloha, Turn-A-Round Sls.	503-649-1007, FAX:503-649-1008
OR	Hillsboro, Turn-A-Round Sls.	503-640-4641, FAX:503-640-4640
PA	Fort Washington, SMC Inc.	215-628-3394, FAX:215-628-3395
TX	Arlington, T-Tec Sls.	817-274-0505, FAX:817-274-9662
TX	El Paso, T-Tec Sls.	915-581-7920, FAX:915-585-1886
TX	Gilmer, T-Tec Sls.	903-734-4526, FAX:903-734-5316
TX	Houston, T-Tec Sales	713-578-9666, FAX:713-578-5666
VA	Fairfax Station, Sac Communications Inc.	703-643-2344,FAX:703-643-1842
WA	Kirkland, Turn-A-Round Sls.	206-822-4634, FAX:206-828-0633
WI	Brookfield, Circuit Sls.	414-784-7773, FAX:414-784-4528
EXP	Mexico, Guadalajara, T-Tec Sls.	011-523-6353
Can	St. Lazare, Que, Atkinson & Ross Assoc.	514-424-5679,FAX:514-424-5678
Can	Vancouver, BC, Fairwest Sls.	604-685-1473, FAX:604-681-7712
Can	Whitby, Ont., Atkinson & Ross Assoc.	416-666-8359,FAX:416-666-8360

Local Distributors

AL	Huntsville, Comp. Distrs. Inc.	205-851-7800, FAX:205-859-2249
AZ	Tucson, SWS Elctrns; Inc.	602-628-1613, FAX:602-628-1921
CA	Brea, I.S.I.	714-961-7955,FAX:714-996-9537
CA	Campbell, Prime Electro	408-374-0707, FAX:408-374-7711
CA	Fremont, Vic/Tal Sls.	510-651-6420, FAX:510-651-8795
CA	Huntington Bch., On-Line Elctrns.	714-847-5111, FAX:714-847-4485
CA	Irvine, Kensington Elctrns.	714-588-0575, FAX:714-588-0176

CA Manhattan Bch., Prime Electro. 310-379-3642, FAX:310-379-7768
CA Norwalk, Myco Elctrn. Supp. 213-404-2053, FAX:310-926-8536
CA S. San Francisco, Peters-De Laet Inc. 415-873-6671,FAX:415-873-1680
CA San Carlos, Logan Elctrns. 415-594-0700, FAX:415-594-1687
CA San Diego, Deco Elctrns. 619-693-1595, FAX:619-693-0245
CA San Diego, Mock III 619-693-8230, FAX:619-693-3355
CA San Diego, Western Fastener 619-292-5115, FAX:619-292-0427
CA San Jose, Spectra Elctrns. 408-955-7800, FAX:408-955-7810
CA Santa Clara, Bravo Foresight Elctrns. 408-980-9700,FAX:408-980-8805
CA Santa Clara, Trinty Elctrns. 408-980-9011, FAX:408-980-9014
CO Englewood, Comp. Distrs. Inc. 303-770-6214, FAX:303-770-6057
CO Littleton, Indelco ... 303-795-3431,FAX:303-794-8298
CT Wallingford, Midstate Elctrns. 203-265-9900, FAX:203-269-2374
FL Clearwater, Comp. Distrs. Inc. 813-796-0466, FAX:813-796-0846
FL Ft. Lauderdale, Comp. Distrs. 305-973-6175, FAX:305-973-6915
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900, FAX:305-977-0489
GA Athens, Dixie Elctrns. 706-613-7755, FAX:706-613-7856
GA Atlanta, KSM Elctrns. 404-458-2013, FAX:404-451-0891
GA Norcross, Comp. Distrs. Inc. 404-441-3320, FAX:404-449-1712
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IL Bensenville, Voyager I 708-860-1300, FAX:708-860-1572
IL Glendale Hgts., KSM Elctrns. 708-529-1700, FAX:708-529-3668
IL Palatine, OHM Elctrns. 708-359-5500, FAX:708-359-9686
IL Wood Dale, NEP Elctrns. 708-595-8500, FAX:708-595-8706
IN Beech Grove, Wire Supp. Inc. 317-786-4485, FAX:317-787-0706
IN Carmel, Altex Elctrns. 317-848-1323, FAX:317-844-6593
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
IA Cedar Rapids, Dee Elctrns. 319-365-7551, FAX:319-365-8506
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640, FAX:301-840-9299
MA Franklin, JEM Elctrns. 508-520-3105, FAX:508-520-3109
MA Nutting Lake, QPL Elctrns. Distrs. 508-671-9473, FAX:508-671-0006
MA Westborough, In-Stock Prods. 508-870-5750, FAX:508-898-3616
MI Grand Rapids, S.F. Elctrn. Supp. Inc. ... 616-459-0216, FAX:616-459-5601
MI Livonia, Michigan Lectrols Corp. 313-427-0300, FAX:313-427-4045
MI Wyoming, E.C. Elctrns. 616-530-0576, FAX:616-530-8598
MN Fridley, Voyager II 612-571-7766, FAX:612-571-9519
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NE Lincoln, Scott Elctrns. 402-466-8221, FAX:402-466-4187
NE Omaha, Scott Elctrns. 402-734-6750, FAX:402-734-1442
NV Reno, Peters-De Laet Inc. 702-827-5599, FAX:702-827-4150
NJ Cherry Hill, Jeta Corp. 609-663-7272, FAX:609-663-1688
NJ Moorestown, Marlac Elctrns. 609-234-4200, FAX:609-239-0672
NJ Woodbridge, Calmm Elctrns. 908-750-4497, FAX:908-750-4212
NM Albuquerque, Betatron Elctrns. 505-821-1122, FAX:505-828-0450
NM Albuquerque, TMA, Inc. 505-345-8921, FAX:505-344-1113
NY Penn Yan, Advacom 315-536-2221, FAX:315-536-0828
NY Rochester, Simcona Elctrns. 716-328-3230, FAX:716-436-5926
NY Ronkonkoma, Jet Comps. 516-471-3124, FAX:516-981-1521
NY Ronkonkoma, Spectrum Comp. Supp. Corp. 516-737-6900,FAX:516-737-6642
NC Charlotte, Dixie Elctrns. 704-521-0602, FAX:704-558-4696
NC Hickory, Dixie Elctrns. 704-328-1130, FAX:704-328-8318
NC Raleigh, Dixie Elctrns. 919-829-0704, FAX:919-829-0375
NC Winston-Salem, Dixie Elctrns. 919-724-5961, FAX:919-723-7024
OH Columbus, Spectra Elctrns. 614-885-8881, FAX:614-885-3233
OH Dayton, Advacom 513-274-5900, FAX:513-274-9124
OH Midpark, Advacom 216-826-3300, FAX:216-826-1669
OH South Euclid, Circuit Elec. 216-382-0330, FAX:216-382-4411
OK Tulsa, Wofford Elctrns. 918-622-9555, FAX:918-622-3999
OR Beaverton, Micro Power Elctrns. 503-626-7086, FAX:503-643-1556
PA East York, Advacom 717-741-9277, FAX:717-741-9462
PA Export, Advacom 412-325-7551, FAX:412-733-9826
PA McKean, Advacom 814-476-7774, FAX:814-476-7724
PA Philadelphia, Shap Elctrns. 215-969-3300, FAX:215-934-5539
SC Columbia, Dixie Elctrns. 803-779-5332, FAX:803-765-9276
SC Greenville, Dixie Elctrns. 803-297-1430, FAX:803-297-1439
SC N. Charleston, Dixie Elctrns. 803-552-2671, FAX:803-552-2676
TN Gray, Dixie Elctrns. 615-477-2131, FAX:615-477-4407
TN Oak Ridge, Dixie Elctrns. 615-481-3393, FAX:615-481-3397
TX Austin, Wofford Elctrns. 512-339-1131, FAX:512-853-7351
TX Dallas, Comp. Distrs. Inc. 214-644-0373, FAX:214-644-1115
TX Dallas, Wofford Elctrns. 214-320-0294, FAX:214-320-2017
TX El Paso, Schick Entprs. 915-772-3283, FAX:915-772-3034
TX Laredo, Indux S.A. Mexico 512-727-5935
TX N. Richland Hills, Swieco Elctrns (Dixie) 817-281-1811,FAX:817-281-1783
TX Tomball, Wofford Elctrns. 713-351-2255, FAX:713-351-2722
WA Redmond, Priebe Elctrns. 206-881-2363, FAX:206-881-0508
WI New Berlin, NEP Elctrns. 414-785-9100, FAX:414-785-9131
Can Burnaby, BC, Brockton Elctrns. Ltd. 604-291-6665, FAX:604-291-6664
Can Darthmouth, NS, Arcom Elctrns. 902-464-1600, FAX:902-469-6825
Can Edmonton, AB, Elctrn. Connections 403-469-7222, FAX:403-463-8149
Can Markham, Ont., ARMA Elctrns. Sls., Inc. 416-475-1858,FAX:416-475-2019
Can Markham, Ont., Fastronics, Inc. 416-474-0808, FAX:416-474-1994

J.S.T. Corp. PIPS Distributors

AZ Marana, The Paul Co. 602-682-4330, FAX:602-682-2264
AZ Tempe, Optimum Assembly 602-968-2335, FAX:602-968-2337
CA Anaheim, Sophic Inds. 714-632-2460, FAX:714-632-1941
CA Santa Ana, Paul Kaplin Co. 714-556-7007, FAX:714-751-6003
CA Tracy, Ferreira Inds. 209-832-0114, FAX:209-832-0412
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IN Plainfield, AES Interconnections 317-272-2551, FAX:317-272-3082
MD Columbia, Custom Cables 301-290-9777, D:301-381-2036
MA Westborough, In-Stock Prods. 503-970-5750, FAX:503-898-3616
MI Livonia, Michigan Lectrols Corp. 313-427-0300, FAX:313-427-4045
MN Roseville, TLC Distbn. 612-483-2226, FAX:612-481-0287
NJ Madison, Pyxis Corp. 201-377-4922, FAX:201-377-0453
NJ Pennsauken, Ram Elctrns. Inds., Inc. ... 609-488-0601, FAX:609-488-9196
NY Dryden, Sturges Elctrns. 607-844-8604, FAX:607-844-8416
NC Kernsville, EDC Inc. 919-993-0468, FAX:919-993-0368
OH Dayton, Cables To Go 513-224-8646, FAX:800-331-2841
OR Beaverton, ACA Mfg. 503-646-3377, FAX:503-646-1671
TN Franklin, Telco 615-377-9910,FAX:615-377-9940
TN Greenville, Precision Wire Assemblies Inc. 615-636-1416,FAX:615-638-9078
TX El Paso, Border Grp. 915-581-7920, FAX:915-585-1886
WA Vancouver, Unitrek Corp. 206-699-2765, FAX:206-694-9230
Can Mississauga, Ont., Sycor Technlg. 416-821-3591, FAX:416-821-7260

JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St., Harbor City, CA 90710, Tel: 310-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC.
1-800-545-5833
FAX: 413-863-2305

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, 800-545-5833; FSC No.: 3357; Empl.: 148 .... **C•1756**

Local Sales Offices & Reps

AL Huntsville, Innovative Sls. 205-772-7500
AZ Phoenix, O'Donnell Associates 602-944-9542
CA Laguna Hills, Bart Budge Assoc. 714-582-8720
CA Los Altos, Ewing Foley 415-941-4525
CO Boulder, Stratford Grp. 303-530-3194
FL Largo, Q Rep. 813-397-8431
ID Boise, Jas. J. Backer 208-378-4680
IL Arlington Heights, Rozner Sls. Co. 708-577-0067
IA Cedar Rapids, Lowell-Kangas 319-362-9290
KS Shawnee, Lowell-Kangas 913-631-3515
MD Baltimore, Spindler & Wafer 301-744-1133
MA Hudson, O.K. Engrg. 508-562-1010
MN Hopkins, Pathway Sls. 612-933-8267
MO St. Louis, Lowell-Kangas 314-821-4050
NJ Middletown, Elctrn. Mktg. 908-615-9484
NM Albuquerque, O'Donnell Assocs. 505-889-4522
NY Fairport, Senntec Sls. 716-425-3954
NC Greensboro, Reynolds Whitlock 919-691-1138
OH Worthington, Simcox Assocs, ... 614-885-8776
OR Beaverton, Jas. J. Backer Co. 503-627-0775
PA Willow Grove, Meldena Sls. 215-657-7760
SC Greenwood, Reynolds Whitlock 803-229-6801
TX Dallas, Stevens Sls. Co. 214-702-0132
WA Seattle, Jas. J. Backer Co. 206-285-1300

Local Distributors

AL Madison, Sea Wire & Cable 205-772-9616
CA Concord, Control Master 415-939-3600
CA Menlo Park, Bay Associates 415-321-2940
CT Manchester, I.M.S. 203-649-4415
FL Altamonte Springs, Royce Elctrns. 305-869-4700
FL Ft. Lauderdale, Pacer Elctrns. 305-749-1910
MA Lowell, Colonial 508-459-6400
MA Woburn, Pacer Elctrns. 617-935-8330
MN Bloomington, K. L. Tannehill 612-881-6700
NH Amherst, North Country Wire & Cable 603-889-0063
NY Rochester, Simcona Elctrn. 716-328-3230
NC Raleigh, Wholesale Electric 919-878-9400
OH Dayton, Astro Inds. 513-429-5900

PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2255

JUDD WIRE INC., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, 800-344-5251, FAX: 619-744-6089; FSC No.: 3357 .... **C•1756**

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JRL
JULIE RESEARCH
LABORATORIES, INC.

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer .... **A•1956; D•1278-1281**

JUMO PROCESS CONTROL, INC., 735 Fox Chase, Coatsville, PA 19320, Tel: 215-380-8002, FAX: 215-380-8009; *Sls. Mgr.:* Gunnar Oberg

KAHLE ENGINEERING, 50 S. Center St. Bldg. No. 1, Orange, NJ 07050, Tel: 201-678-2020, FAX: 201-678-0326; Empl.: 50; *Sls. Mgr.:* Daniel Fowler

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., Inductotherm Industries, Inc., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech .... **D•1766-1769**

Local Sales Offices & Reps

AZ	Tempe, Groit Group Inc.	602-968-4428
CA	Agoura Hills, Griot Group Inc.	818-706-7601
CA	Irvine, Griot Group Inc.	714-727-4110
CA	Santa Clara, Groit Group Inc.	408-727-2880
CO	Denver, Griot Group Inc.	303-427-1111
NM	Albuquerque, Griot Group Inc.	505-883-1022
OR	Beaverton, Griot Group Inc.	503-646-5627
UT	Salt Lake City, Griot Group Inc.	801-328-9471
WA	Seattle, Griot Group Inc.	206-454-8592

KALAMAZOO TECHNICAL FURNITURE, See TECLAB

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; Empl.: 8; *Sls. Mgr.:* Charles Kerchner; *Dist. Mgr.:* Charles Kerchner

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 708-343-7004, FAX: 708-343-7016; Empl.: 250; *Sls. Mgr.:* Kent Prather

KAMAN INSTRUMENTATION, 1500 Garden of the Gods, P.O. Box 7463, Colo Springs, CO 80907, Tel: 719-599-1132, FAX: 719-599-1823; FSC No.: 21732; Empl.: 100; *Sls. Mgr.:* Steve Perry

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 410-749-2424, FAX: 410-749-5725; FSC No.: 50140; Empl.: 425; *Sls. Mgr.:* Jim Price

K & L OSCILLATEK, A DOVER TECHNOLOGY CO., See Oscillatek, A Dover Technology Co.

K & M ELECTRONICS INC., 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, FAX: 413-737-0608; FSC No.: 66613; Empl.: 300; *Sls. Mgr.:* Robert Patrick .... **A•1957**

Local Sales Offices & Reps

CA	Fremont, C/G Assocs., Inc.	415-790-1193
OH	Akron, Augnat Assoc.	216-666-2819

KAPPA
TECHNOLOGIES INC

FAX: 908-388-4786

KAPPA TECHNOLOGIES, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 908-396-9400, 1-800-223-0603; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* D. Pearl .. **A•1568-1569, 1642-1645, 2370-2373; D•2128-2129**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
CA	Sunnyvale, Matek Sls.	408-245-5300
CA	West Hills, Bennet Tech. Sls.	818-385-8974
CO	Wheatridge, Wescom Mktg.	408-422-8957
CT	Plainville, Northeast Reps.	203-747-2423
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
KS	Andover, QDC Inds.	316-733-9756
KS	Overland Park, QDC Inds.	913-341-2214
MD	Middletown, S.T. Woolard Co.	301-371-4500
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MA	Hingham, Northeast Reps.	617-749-8700
MN	Eagan, QDC Inds.	612-454-0893
MO	Ballwin, QDC Inds.	314-458-1896
NH	Mt. Vernon, Northeast Reps.	603-673-1406
NY	Cazenovia, S.T. Woolard Co., Inc.	315-655-8145
NY	Plainview, Neptune Elctrns. Co.	516-349-1600
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Austin, Gardin-Moore Sls.	512-794-2900
TX	Dallas, Gardin-Moore Sls.	214-985-1193
TX	Houston, Gardin-Moores Sls.	713-496-7651
TX	Plano, Gardin-Moore Sls.	214-985-1193
TX	Stafford, Gardin-Moore Sls.	713-240-6767
UT	Salt Lake City, Wescom Mktg. Inc.	801-269-0419

Local Distributors

CA	Sherman Oaks, DLDI	818-986-9455,800-624-2617

KATRONIC ELEKTRONIC GES.M.B.H., OrtenburgerstraBe 28, Austria, Tel: 04762-5340, FAX: 534075; Empl.: 74; *Sls. Mgr.:* Herbert Sandner

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 708-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-708-949-4250; *Sls. Mgr.:* Gene Larson

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Bill Fry

KAY ELEMETRICS CORP., 12 Maple Ave., P.O. Box 2025, Pine Brook, NJ 07058-2025, Tel: 201-227-2000, FAX: 201-227-7760; FSC No.: 80138; Empl.: 50; *Sls. Mgr.:* Stephen P. Crump .... **A•1846**

KAY-RAY/SENSALL, INC., 1400 Business Center Drive, Mt. Prospect, IL 60056, Tel: 708-803-5100; Empl.: 170

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, FAX: 718-257-4740; Empl.: 100; *Sls. Mgr.:* A Bueller

KCK

FAX: 708-577-0201

KCK AMERICA INC., Mitsubishi Materials Corporation, 4080 Winnetka Ave., Rolling Meadows, IL 60008, Tel: 708-577-0200; Empl.: 500; *Sls. Mgr.:* K. G. Such, V.P. .... **A•1091, 1647; B•1365**

Local Sales Offices & Reps

AL	Southern Elctrn. Reps.	205-461-8925
AZ	Inmark	602-830-9104
CA	Los Angeles, English/Damco Sls. Co., Inc.	213-772-7272
CA	Orange County, English/Damco Sls. Co., Inc.	714-753-1950
CA	San Diego, English/Damco Sls. Co., Inc.	619-271-0333
CO	Tech. Mktg. Co.	303-989-3611
FL	Kinetic Sls. Inc.	407-339-3855
GA	Atlanta, Advantage Comp. Sls.	404-458-3577
ID	Sierra Tech. Sls.	801-566-9719
IL	BNI Elctrns., Inc.	708-595-9210
IN	J & B Engry. Sls. Co., Inc.	219-483-2813
KS	Microtronics, Inc.	913-262-1444
MD	Karr Assocs.	410-280-2448
MA	JMG Inc.	617-762-5333
MI	DEM Sls., Inc.	313-583-1500
MN	E.I. Sls. Co.	507-345-5786
MS	Southern Elctrn. Reps.	205-461-8925
MO	Microtronics, Inc.	913-262-1444
MT	Sierra Tech. Sls.	801-566-9719
NJ	JMR Sls., Inc.	908-525-8000
NY	Metropolitan, JMR Sls., Inc.	908-525-8000
NY	Upstate, R Squared	315-457-3754
NC	Raleigh, Vantage Mktg. Inc.	919-870-7123
OH	Northern, J & B Engrg. Sls. Co., Inc.	216-766-5754
OH	Southern, J & B Engrg. Sls. Co., Inc.	513-848-2626
PA	Eastern, Check Assocs.	215-487-3007
PA	Western, J & B Engrg. Sls. Co., Inc.	216-766-5754
TN	Eastern, Electronic Comp. Mktg.	615-828-5741
TN	Western, Southern Elctrn. Reps.	205-461-8925
TX	Passive Comps. Assocs.	214-824-6162
UT	Sierra Tech Sls.	801-566-9719
WI	Larsen Assocs., Inc.	414-258-0529
WY	Eastern, Tech. Mktg. Co.	303-989-3611
WY	Western, Sierra Tech. Sls.	801-566-9719
Can	JRL Assocs.	416-754-3280

Local Distributors

AZ	Fountain Hills, RCD Inds., Inc.	602-837-9387
CA	Chatsworth, Passive Comps., Inc.	818-700-8838
CA	Huntington Beach, Surface Mount Distbn.	714-841-4556
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, California Capacitor	408-262-6000
CA	San Diego, Neumann Elctrns., Inc.	619-695-3005
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Surface Mount Distbn.	408-451-9200
CA	Santa Maria, Garrett Instrs.	805-922-0594
CO	Aurora, QPS Elctrns.	303-343-9260
FL	Ft. Lauderdale, Brothers Elctrns. of FL	305-561-6700
FL	Longwood, RM Elctrns Co., Inc.	407-767-8005
FL	Melbourne, Pridmore Corp.	407-727-2491
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
IL	Wheeling, Alpha Tek Elctrns.	800-798-2277
IN	Indianapolis, Custom Srvc. Elctrns., Inc.	317-879-9119
MI	Farmington Hills, Key Elctrns.	313-489-5455
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Grand Rapids, RM Elctrns. Co., Inc.	616-531-9300
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Roseville, Parts 1	612-633-8079
NH	Derry, Brothers Elctrns.	603-437-8437
NH	Nashua, Brevan Elctrns.	603-429-1900
NJ	Bloomfield, Solid State, Inc.	201-429-8700
NJ	East Brunswick, Brothers Elctrns., Inc.	908-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	East Rochester, Rome Elctrns., Inc.	716-248-0160
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Syracuse, ADR Tech., Inc.	315-437-7087
NY	Williamsville, Rome Elctrns., Inc.	716-626-1602
NC	Raleigh, Century Elctrnic Comps., Inc.	919-782-2116
OH	Solon, Repco Elctrns.	800-544-1858
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Norristown, Century Elctrn. Comps., Inc.	215-631-5400
TX	Arlington, Bell Comps.	817-461-5303
TX	Austin, SMEC	800-336-7632
TX	Richardson, CTC	214-437-2211
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns.	416-477-9898
Can	Scarborough, Ont., U-Tech Elctrns.	416-609-2900
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321

KD COMPONENTS, INC., 2151 Challenger Way, Carson City, NV 89706, Tel: 702-883-8003, FAX: 702-883-1150; FSC No.: 58421; Empl.: 44; *Sls. Mgr.:* John Horn

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700; FSC No.: 64537; Empl.: 385

KDS AMERICA, Daishinku Corp., 10901 Granada Ln., Overland Pk., KS 66211, Tel: 913-491-6825, FAX: 913-491-6812; Empl.: 12; *Sls. Mgr.:* Tom Lawrence-East Reg.; *Dist. Mgr.:* Sara Peterson, Claudia Broome

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY

FAX: 216-248-6168

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 800-552-1115; Empl.: 750; *Sls. Mgr.:* David Brock .... **D•1283-1288**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-830-9224
AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Los Alamitos, Tritek Solutions	714-236-1190
CO	Denver, Aztec Entrprs.	303-779-5285
FL	Orlando, W. A. Brown Instrs.	407-648-9660
IL	Buffalo Grove, Torkelson	708-520-0710
IN	Indianapolis, Torkelson	317-244-7867
IA	Cedar Rapids, Torkelson	319-373-0200
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Lynnfield, Keithley	800-552-1115
MI	Detroit, EQS Sys.	313-455-7920
MN	Minneapolis, Torkelson	612-835-2414
NJ	Paramus, Keithley	800-552-1115
NM	Albuquerque, Aztec Entrprs.	505-262-1688
NY	Melville, Keithley	800-552-1115
NY	Syracuse, Labtronics	315-455-7314
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OR	Wilsonville, Syntek	503-682-2750
PA	Huntington Valley, Sci-Rep	215-322-6500
TX	Austin, Testech	512-338-9246
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech	214-644-5010
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, Syntek	206-462-7700
WI	Waukesha, Torkelson Assocs., Inc.	414-784-7736

KEITHLEY METRABYTE, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989, FAX: 508-880-0179; FSC No.: 1 FG 11; Empl.: 140; *Sls. Mgr.:* Gary Marraccini; *Dist. Mgr.:* Gary Marraccini

KEL AM, See Teltec, Inc.

KELLER-PSI, 503 No. 11 Vista Bella, Oceanside, CA 92056, Tel: 619-967-6066, FAX: 619-967-0563; Empl.: 8; *Sls. Mgr.:* Dick Grove; *Dist. Mgr.:* Dick Grove

KEL CONNECTORS, INC., KEL Corp., 1250 Oakmead Pkwy., No. 105, Sunnyvale, CA 94086, Tel: 408-720-9044, FAX: 408-720-1989; *Sls. Mgr.:* Jim Eilers

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTECH INC., 7508 Hitech Rd., Roanoke, VA 24019, Tel: 703-362-8466, FAX: 703-362-3957; Empl.: 35; *Sls. Mgr.:* William Sinclair

k KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP., High Voltage Power Supplies & Industrial Printers, 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700; Empl.: 170; *Sls. Mgr.:* T. Chadurjian, Power Supp., D. Raymond, Printers .... **D•1098, 1770-1771**

Local Sales Offices & Reps

IL	Park Ridge, Probe Elec.	312-696-2828
NY	Commack, R.C. Engrg.	516-543-3325
PA	Glenside, Koebert Assoc.	215-887-2310

KELTRON CORP., Miniprinter/Security Systems Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent .... **D•1098**

Local Sales Offices & Reps

IL	Palatine, Key Entprs.	708-991-2144
MD	Baltimore, Advanced Tech. Sls., Inc.	301-323-3140
NY	Amsterdam, Traxonics	518-843-1445
PA	Oreland, Precision Mktg. Grp.	215-233-9233
WI	South Milwauke, Key Entprs.	414-762-2323

Local Distributors

AL	Decatur, Mgt. Security, Inc.	205-355-3030
CA	San Francisco, SF Fire & Burg.	415-861-0994
DC	District of Columbia, Ellenco Inc.	301-927-4370
FL	Miami, Glanz Technlg., Inc.	305-893-1269
GA	Albany, Tri-L Sys.	912-888-1266
IL	Chicago, Natl. Guardian Alarm	312-775-8600
MA	Georgetown, B & B Engrg.	508-352-6402
MI	Bloomfield Hills, W.E. Healy & Assocs.	313-335-9245
NC	Raleigh, National Security	919-821-1150
OK	Tulsa, Pendergraph, Inc.	918-835-8403
TX	Amarillo, Firehawk Safety Sys.	806-374-9613
WI	Brookfield, John Guetzke & Assocs., Inc.	414-784-5929

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston

KEMET®

FAX: 803-963-6521

KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor, VP-Domestic Sls.; *Dist. Mgr.:* Dan Manly .... **A•1092-1093**

Local Sales Offices & Reps

AL	Huntsville	205-830-1090
AZ	Tempe	602-831-2151
CA	Newport Beach	714-640-9320
CA	Santa Clara	408-986-0424
CO	Englewood	303-220-0759
FL	Orlando	407-855-8886
GA	Norcross	404-441-7701
IL	Schaumburg	708-517-1030
IN	Carmel	317-844-7756
MD	Columbia	410-992-5600
MA	Wakefield	617-245-4646
MI	Farmington Hills	313-489-5850
NY	Elmsford	914-347-4390
NC	Raleigh	919-872-2877
OH	Columbus	614-885-3330
PA	Exton	215-363-8310
SC	Greenville	803-242-5789
TX	Irving	214-556-0009
WA	Kirkland	206-828-4853
Can	Montreal	514-694-9525
Can	Ontario	416-542-7930

Local Distributors

CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Culver City, Hamilton/Avnet Elctrns.	213-558-2100
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Denver, Integrated Elctrns.	303-292-5537
GA	Duluth, Pioneer Technlgs.	404-623-1003
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Columbia, TTI	301-955-1331
NJ	Old Bridge, Arm Bar Inds.	908-679-3377
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Central Islip, Semicap Elctrns.	516-582-4400
NY	Hauppauge, L.I., Jaco Elctrns.	516-273-5500
NY	Westbury, Hamilton-Avnet	516-997-6868
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Elctrns.	216-587-3600
TX	Fort Worth, TTI Elctrns.	817-740-9000
Can	Vancouver, B.C., Deskin Sls.	604-324-8343

KEMLON PRODUCTS & DEVELOPMENT COMPANY, 6310 Sidney, Houston, TX 77021, Tel: 713-747-5020, FAX: 713-747-0049; Empl.: 165; *Sls. Mgr.:* Bob Horton

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENMAR/TSI, 3020 Barrow Drive, Raleigh, NC 27604, Tel: 919-876-6049, FAX: 919-876-6292; Empl.: 110

M.S. KENNEDY CORP., 8170 Thompson Rd., Cicero, NY 13039, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 60; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 610 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* R. Thompson

KENWOOD

FAX: 310-537-8235

KENWOOD U.S.A., 2201 E. Dominguez St., Long Beach, CA 90810, Tel: 310-761-8295 .... **D•1406-1407, 1772-1775**

Local Sales Offices & Reps

CA	Belmont, Western Digital & Instrmn.	415-591-6535, FAX:415-591-9180
CA	Long Beach, Kenwood U.S.A.	310-761-8295, FAX:310-761-8246
CO	Lakewood, Tech. Mktg. Co.	303-989-3611, FAX:303-989-7225
CT	Killingworth, Paul Gallagher	203-663-2338, FAX:203-663-2338
GA	Marietta, Adams	404-973-0853,FAX:404-973-1903
IL	Mt. Prospect, Best Rep	708-632-0473, FAX:708-632-0475
IN	Carmel, New Era Sls.	317-844-4530, FAX:317-844-4534
IA	Cedar Rapids, KKB & Co.	319-373-1730, FAX:319-373-2019
MD	Hampstead, Technical Instr. Sls.	410-239-4452, FAX:410-239-4440
MA	Framingham, Paul Gallagher	508-626-2346, FAX:508-872-5677
MI	Warren, Burcaw	313-573-4605,FAX:313-573-6048
MI	Wyoming, Burcaw	616-532-2756, FAX:616-532-3847
MN	Apple Valley, Alliance Tech Prods.	612-432-2111, FAX:612-432-5060
MN	St. Paul, Alliance Tech Prods.	612-481-0518
MO	Blue Springs, KKB & Co.	816-229-0001, FAX:816-228-1466
MO	St. Louis, KKB & Co.	314-647-2400, FAX:314-647-3773
NY	Woodside, Greater Metro Sls.	718-424-1911, FAX:718-458-6791
NC	Greensboro, Adams	919-272-6838, FAX:919-273-6850
NC	Raleigh, Adams	919-972-0410,FAX:919-972-0410
OH	Cincinnati, Dietrich	513-984-8924, FAX:513-984-5351
OH	Cleveland, Dietrich	216-642-7965, FAX:216-642-3080
OK	Tulsa, Jim Wisdom & Assocs.	918-665-8899, FAX:918-665-9456
OR	Aloha, Cain Sweet	503-591-0647, FAX:503-591-0856
PA	Lansdale, Technical Instr. Sls.	215-361-7850, FAX:215-361-7803
PA	Pittsburgh, Dietrich	412-892-2992
TX	Richardson, Jim Wisdom & Assocs.	214-470-9093, FAX:214-470-9122
VA	Woodford, Technical Instr. Sls.	804-633-4586, FAX:804-633-4586
WA	Bellevue, Cain Sweet	206-462-2118, FAX:206-451-9418

Local Distributors

CA	Chatsworth, Testek Corp.	818-701-9911, FAX:818-701-6011
CA	El Monte, Marshall Inds.	818-307-6393, FAX:818-307-6299
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Milpitas, R & D Elctrn. Parts	408-262-7144, FAX:408-262-7154
CO	Aurora, R & R Instrmn.	303-340-8228
FL	Orlando, Emsco	407-849-6362,FAX:407-843-0909
FL	Tampa, Sunex Elctrn. Supp., Inc.	813-885-4074, FAX:813-888-6487
IL	Niles, Joseph Elctrns.	708-297-4240, FAX:408-297-6923
IN	Indianapolis, Meunier Elctrns.	317-635-3511, FAX:317-631-4707
MD	Baltimore, Davis Instrs.	410-358-3900, FAX:410-358-0252
MD	Hunt Valley, E.I.L. Instrs., Inc.	410-584-7400, FAX:410-584-7561
MA	N. Andover, Contact East	508-682-2000, FAX:508-688-7829
MN	Minneapolis, Stark Elctrns., Inc.	612-332-1325, FAX:612-332-1783

MO	St. Louis, Scherrer Instrs.	314-644-5362, FAX:314-644-3530
NJ	Elizabeth, NEI	800-248-1634
NJ	Mickleton, Total Video Prods., Inc.	609-423-7400, FAX:609-423-4742
NY	Bayside, Technimart	718-479-1890
NY	Rochester, Transcat	800-828-1470, FAX:800-395-0543
PA	Philadelphia, Sunshine Instrs.	215-673-5600, FAX:215-673-5609
TN	Columbia, Randolph & Williams, Inc.	615-388-7566,FAX:615-381-7516
TX	Dallas, Inotek	214-243-2924,FAX:214-243-7814
TX	Dallas, M. Hutton & Co.	214-239-0580, FAX:214-239-5264
TX	Laredo, Franco Sls.	512-727-0003, FAX:512-727-0364
VA	Richmond, Avec Elctrns.	804-359-6071, FAX:804-359-5609
WA	Seattle, Radar Elec.	206-282-2511, FAX:206-282-1598
WI	Appleton, Appleton Elctrns.	414-734-5767, FAX:414-734-5172

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KEPCO, INC., 131-38 Sanford Ave., Flushing, NY 11352, Tel: 718-461-7000, TWX: 710-582-2631; Empl.: 300; *Sls. Mgr.:* Frank Toich .... **D•1777-1806**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Mesa, Aztec Entprs.	602-649-9158
CA	Arcadia, Synertek Mktg.	818-357-0371
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Sunnyvale, N-S Westronics	408-745-1102
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Waterbury, R. Perron Co.	203-756-9684
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Melbourne, W. A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Plainfield, Kepco, Inc.- Illinois	815-436-8808
LA	Metairie, Data Mktg. Assocs., Inc.	504-833-3655
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Plymouth, EQS	313-455-7920
MN	Plymouth, Kepco Inc.	612-559-1128
MO	St. Louis, Ramsey Assocs.	314-532-9388
NM	Albuquerque, Aztec Entrps.	505-262-1688
NY	Holbrook, Kepco Inc.-Long Island	516-472-5688
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Chesterland, EQS	216-729-2222
OH	Dayton, EQS	513-236-7676
OR	Beaverton, H. Levinson Co.	503-690-1312
PA	West Chester, Kepco,-Pennsylvania	215-594-0856
PA	Wexford, EQS	412-935-0455
TX	Austin, Data Mktg. Assocs., Inc.	512-338-4701
TX	Dallas, Data Mktg. Assocs., Inc.	214-661-0300
TX	Houston, Data Mktg. Assocs., Inc.	713-579-2995
TX	San Antonio, Data Mktg. Assocs., Inc.	210-342-3031
UT	Salt Lake City, Aztec Entprs., Inc.	801-467-4675
WA	Seattle, H. Levinson Co.	206-382-1300
WA	Seattle, KAM Elctrns.	206-382-1300
WI	Milwaukee, Star Engineering	414-645-3680
Can	Montreal, P.Q., Multitest Elctrns., Inc.	514-337-0723
Can	Ottawa, Multitest Elctrns., Inc.	613-727-0848
Can	Scarborough, Ont., Multitest Elctrns., Inc.	416-609-8396

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026-2992, Tel: 314-343-1630, FAX: 314-343-0668; FSC No.: 5999; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 908-291-0500, 800-631-2165, FAX: 908-291-8097; FSC No.: 28222; Empl.: 55

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave., Des Plaines, IL 60018, Tel: 708-297-1600, FAX: 708-390-9338; Empl.: 425; *Sls. Mgr.:* Nick Bohun; *Dist. Mgr.:* Carl Voelkel

KESTREL SYSTEMS CO., 948 N. Hwy 101 74, Leucadia, CA 92024, Tel: 619-944-2957, FAX: 619-944-6010; Empl.: 6; *Sls. Mgr.:* Mark J. Prager

KETEMA

FAX: 714-630-4131

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 100; *Sls. Mgr.:* Helen Hannah .... **B•1876-1878**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Alpine, Wes-K/Raltech	619-445-1126
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CA	Los Altos, W.W. Posey Co.	415-969-7635
CO	Westminster, Straube Assocs.	303-426-0890
FL	Winter Springs, T-Squared Mktg.	407-699-9992
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
IA	Cedar Rapids, M.I.N.K. Assocs. Inc.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs., Inc.	913-341-8309
MA	Framingham, Marathon Sls. Ltd.	508-875-3566
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	Bridgeton, M.I.N.K. Assocs., Inc.	314-291-5454
NJ	Moorestown, TAI Corp.	609-778-5353
NY	Islip, Cogent Technlg. Assoc.	516-277-7101
NY	Katonah, Cogent Technlg. Assocs.	914-232-2500
NY	Rochester, R.M. Scanlon & Assoc.	716-646-1349
NY	Syracuse, R.M.-Scanlon Assocs.	315-463-7682
NY	Webster, R.M. Scanlon Assocs.	716-671-6809
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Blair-Hirsh Co.	503-641-1875
TX	Bedford, R-Squared/El-Tec	817-268-2896
TX	Dallas, R-Squared/El-Tec	214-702-8566
TX	Houston, R-Squared/El-Tec	713-820-3210
TX	Round Rock, R-Squared/El-Tec	512-255-4245
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Lynnwood, Blair-Hirsh Co.	206-774-8151
WI	Brookfield, Heartland Tech. Mktg.	414-789-6860
Can	Mississauga, Ont., Bestec Elctrns. Ltd.	416-671-1077

Local Distributors

CA	Chatsworth, Passive Comps.	818-700-8838
CA	Los Alamitos, Dexter Magnetic Matls.	714-952-2091
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Jose, Elctrn. Supp.	408-453-3770
CA	Sunnyvale, Dexter Magnetic Matls.	408-738-1080
CA	Torrance, TSC Elctrns. Ltd.	310-534-2739
GA	Norcross, Dexter Magnetic Matls.	404-448-4998
IL	Chicago, Leeds Elctrns., Inc.	312-625-3800
IL	Elk Grove Vl, Dexter Magnetic Matls.	708-956-1140
MA	Billerica, Dexter Magnetic Matls.	508-663-7500
MA	Wilmington, North Star Elctrns.	508-657-5155
MN	Chanhassen, Dexter Magnetic Matls.	612-934-4635
MN	Plymouth, Leeds Elctrns., Inc.	612-557-1277
NY	Hicksville, Dexter Magnetic Matls.	516-822-3311
NY	Rochester, North Star Elctrns.	716-244-9846
OH	Toledo, Dexter Magnetic Matls.	419-385-4621
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Richardson, Dexter Magnetic Matls.	214-699-1121
WI	Brookfield, Leeds Elctrns., Inc.	414-789-6995
Can	Mississauga, Ont., R-Theta, Inc.	416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

KEYMARC ELECTRONICS, INC., 2310 205th St., Ste. 101, Torrance, CA 90501, Tel: 310-212-7724, FAX: 310-212-6545; Empl.: 35; *Sls. Mgr.:* Robert Chan; *Dist. Mgr.:* James A. Sia .... **C•1598-1601**

Local Sales Offices & Reps

AL	Huntsville, L & D Sls.	205-837-1469
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Santa Clara, Cindel	408-988-8331
CT	Bloomfield, Zaslow Sls.	203-242-7781
DE	Denver, TechRep Sls.	303-758-7031
FL	Del Ray Bch., Phelps Assocs., Inc.	407-276-7591
GA	Dunwoody, L & D Sls.	404-395-7079
IL	Palatine, Vine Sls.	708-934-5476
MN	Minneapolis, Holmgren & Assocs.	612-574-9983
NY	Islip, Cogent Tech. Assoc.	516-277-7101
NC	Raleigh, L & D Sls.	919-879-5301
OR	Beaverton, Elctrn. Sources	503-627-0838
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
Can	Vancouver, Fairwest Sls.	604-685-1473

Local Distributors

CA	Gardena, California Switch & Signal	310-538-9830
CO	Littleton, Display Plus	303-730-7333
NH	Atkinson, Astrum Elctrns.	603-898-3399
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
TX	Tomball, Wofford Elctrns., Inc.	713-351-2255

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, FAX: 814-781-7648; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock .... **B•1879-1883**

Local Sales Offices & Reps

AZ	Tempe, Border States Tech.	602-839-1053
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	San Jose, Westron Assoc.	408-264-4070
CA	Santee, ProSales	619-596-2190
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	Crystal Lake, David J. Brock	815-477-8966
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-489-0588
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
NM	Albuquerque, Border States Tech.	505-292-7400
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-342-0438
TX	Houston, Benson Engrg.	713-333-3112
Can	Birmingham, Mi, Gregory J. Lukas	313-642-9155

Keystone's Natl. Distrs. for all locations

Local Distributors

AL	Huntsville, Newark Elctrns.	205-837-9091
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Los Angeles, Newark Elctrns.	800-367-3573
CO	Denver, Newark Elctrns.	303-757-3351
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Plantation, Newark Elctrns.	305-424-4400
GA	Atlanta, Dexter Corp.	404-448-4998
IL	Newark Elctrns.	800-367-3573
IL	Elk Grove Vlg., Dexter Corp.	800-345-4082
IN	Indianapolis, Allied Elctrns.	317-875-0448
KY	Louisville, Allied Elctrns.	502-452-2293
MA	Billerica, Dexter Corp.	508-663-7500
MI	Farmington Hills, Newark Elctrns.	313-737-5150
MN	Digi-Key Corp.	800-344-4539
MN	Thief River Falls, Digi Key	800-344-4539
MO	St. Louis, Newark Elctrns.	314-291-7031
NY	Buffalo, Summit Distrs.	800-678-6648
OH	Toledo, Dexter Corp.	419-385-4621
PA	Summit Distrs.	800-678-6648
TX	Fort Worth, Allied Elctrns.	800-433-5700
EXP	Germany, Dexter Corp.	089-857-3071
Can	Summit Distrs.	800-678-6648
Can	Mississauga, Ont., Newark Elctrns.	416-670-7799

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491, FAX: 416-727-7118; Empl.: 20

KEYTRONICS, INC., 707 North St., Endicott, NY 13760, Tel: 607-754-5405, FAX: 607-754-9791; FSC No.: 51181; Empl.: 75; *Sls. Mgr.:* Judith M. Olson

KGS ELECTRONICS, INC., 418-A E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-574-1175, FAX: 818-574-0553; Empl.: 60 .... **D•1807, 2276**

Local Sales Offices & Reps

NJ	Wayne, BIZ Intl.	201-694-2417
TX	Hurst, McGarrah & Assocs.	817-268-3557

KIKUSUI

KIKUSUI INTERNATIONAL CORP.

FAX: 310-986-1624

KIKUSUI INTERNATIONAL CORP., 1980 Orizaba Ave., Signal Hill, CA 90804-1203, Tel: 310-986-1677, 800-545-8784; *Sls. Mgr.:* Joe Engler; *Dist. Mgr.:* Tom Haygarth .... **D•1289, 1409, 1808-1809**

Local Sales Offices & Reps

AZ	Chandler, Vic Myers Assocs.	602-345-6449
CA	Santa Clara, W-J Elctrns. Sls.	408-982-9222
CA	Torrance, Amasco South	213-781-9494
CO	Littleton, Vic Myers Assocs.	303-730-7313
FL	W. Melbourne, Trilogic Sunforce	407-722-1324
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
MD	Wheaton, KMA Sls.	301-460-8876
MA	Billerica, Eastronix	508-670-2400
MI	Bloomfield Hills, MacKellar Assoc. Inc.	313-335-4440
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-1400
NM	Albuquerque, Vic Myers Assocs., Inc.	505-884-6878
NC	Raleigh, Trilogic Sunforce	919-233-0270
OH	Columbus, MacKellar Assoc. Inc.	614-848-3552
OR	Wilsonville, Syntek, Inc.	503-682-2750
PA	Horsham, PA Scientific Dvcs.	215-956-0700
UT	Salt Lake City, Vic Myers Assoc. Inc.	801-581-1760
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
PR	San Juan, David S. Terrent	809-762-2688
Can	Burnaby, BC, Interfax Sys., Inc.	604-430-1410
Can	Nepean, Ont., Interfax Sys., Inc.	613-726-8888
Can	Rexdale, Ont., Interfax Sys., Inc.	416-674-8970
Can	St. Laurent, Que., Interfax Sys., Inc.	514-336-0392

KILO INTERNATIONAL, 1952 Ironton Blvd., Provo, UT 84606, Tel: 801-377-5530, FAX: 801-377-5573; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis

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FAX: 805-684-9679

KILOVAC CORP., Box 4422, Santa Barbara, CA 93140-4422, Tel: 805-684-4560, App. Hot Line 800-253-4560; FSC No.: 18741; Empl.: 107; *Sls. Mgr.:* Patrick McPherson, VP Sls. & Mktg. .... **B•1540-1545**

Local Sales Offices & Reps

CA	Chatsworth, Cygnus Sls. Engrg. Corp.	818-727-0312
CA	Morgan Hill, Power Connection	408-779-8888
CO	Englewood, Omega Limited	303-762-1921
FL	Orlando, Comp. Design Mktg.	407-240-3903
GA	Atlanta, Electro Tech	404-262-1522
GA	Norcross, Benchmark Technical	404-446-1711
IL	Elgin, Gassner & Clark, Inc.	708-695-9540
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660
KS	Wichita, Baka Corp.	316-682-8411
MN	Bloomington, Jay Borman Sls.	612-830-1337
MO	St. Louis, Baka Corp.	314-569-1250
NH	Nashua, Bell Controls	603-882-6984
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Raleigh, Benchmark Tech.	919-850-0633
OH	Cleveland, Electronic Components, Inc.	216-331-5330
OH	Columbus, Electronic Comp., Inc.	614-231-2318
OH	Miamisburgh, Electronic Comps., Inc.	513-866-3340
OR	Beaverton, Components West, Inc.	503-642-9110
PA	Trevose, PSA North	215-245-0513
TX	Dallas, Caton Sls. Co.	214-350-1612
WA	Redmond, Components West, Inc.	206-885-5880
Can	Brit. Columbia, Macom Agencies, Ltd.	604-271-2661

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KIMBALL ELECTRONIC LAB. INC., 8081 W. 21 Lane, Hialeah, FL 33016, Tel: 305-822-5792, FAX: 305-362-3125; Empl.: 15; *Sls. Mgr.:* Brenda Wright

KINEMETRICS, INC., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402, FAX: 818-795-0868; Empl.: 75; *Sls. Mgr.:* Mel Lund

KINETICSYSTEMS CORP., 900 N. State St., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 100; *Sls. Mgr.:* Norman R. Ellison, Dir. Domestic Sls.

Kingbright

FAX: 909-468-0505

KINGBRIGHT USA CORP., Kingbright Elec. Co., Ltd., 225 Brea Canyon Rd., City of Industry, CA 91789, Tel: 909-468-0500 .... **B•1169**

For all states not listed contact Mfr. at 909-468-0500

Local Sales Offices & Reps

AL	Madison, Contact Manufacturer	909-468-0500
AZ	Tempe, ACS of Arizona	602-731-9711
CO	Denver, Parker-Webster	303-841-4888
CO	Parker, Parker Wesbster Sls.	303-841-4888
FL	Ft. Lauderdale, Solutions	305-989-2931
IL	Buffalo Grove, Service Technlgs.	708-634-4995
IN	M/S Sls.	219-436-3023
IN	Greenwood, M/S Sls.	317-881-0110
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
MD	Gaithersburg, KSA of New England	508-443-5881
MA	Sudbury, KSA of New England	508-443-5881
MN	Oakdale, Complete Sls.	612-731-2923
MO	St. Louis, Rush & West Assocs.	314-965-3322
NJ	N. Brunswick, Unirep	908-940-1851
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	East Syracuse, Fountain, Young & Co.	315-437-7733
OH	Cleveland, RK Comps. Sls.	216-642-9312
PA	Pittsburgh, RK Comps. Sls.	412-775-0747
UT	Murray, Parker Webster Sls.	801-266-9939
WI	Colgate, Svc. Technlgs., Inc.	708-634-4995
Can	Churchill, Ont., Rystyn	705-456-3213

Local Distributors

AZ	Tempe, CDS/AZ	602-829-7981
AR	N. Little Rock, CDS/AR	501-851-3137
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Costa Mesa, Orange Cnty. Comps.	909-979-3597
CA	Los Angeles, Electric Switches Inc.	213-660-1310
CA	Milpitas, Sierra West Elctrns.	408-945-1050
FL	Lauderdale, Lantern Elctrns.	305-979-3188
FL	W. Palm Bch., Atlantic Elctrns., Inc.	813-531-5900
IL	Morton Grove, Nedco Elctrns.	708-967-0500
IA	Des Moines, Mid-State Distbg. Co.	515-244-7231
MN	Eitzen, Capacitor Assoc.	507-495-3306
MO	St. Louis, Ric-Tronics, Inc.	314-997-4707
NJ	Bloomfield, Solid State, Inc.	201-429-8700
NY	East Syracuse, ADR Technlgs., Inc.	315-437-7087
NY	Melville, Kelvin Elec.	516-433-1700
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Salem, Light-Waves Elec.	503-585-4770
TX	Carrollton, LCD Elctrns., Inc.	214-245-0600
TX	Houston, CDS/Houston	713-868-4018
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
UT	Nephi, CDS/UT	801-623-2908
WA	Kent, Shannon Indl.	206-575-8600
EXP	City of Industry, Kingbright USA Corp.	909-468-0500
Can	Montreal, Megastar Electroniques, Inc.	514-329-0042

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000, TELEX: 6818293, FAX: 914-793-5092; Empl.: 308; *Sls. Mgr.:* E. Lagarto; *Dist. Mgr.:* Joel Cohn

KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Joe Carlin; *Dist. Mgr.:* Joe Carlin

KIP TRANSFORMERS INC., P.O. Box 6162, 13 Town Line Rd., Wolcott, CT 06716, Tel: 203-758-7085, FAX: 203-596-8041

KIRKWOOD INDUSTRIES INC., 4855 West 130 St., Cleveland, OH 44135, Tel: 216-267-6200, TELEX: 980630, FAX: 216-362-3804; *Sls. Mgr.:* Tom Bauer

KISTLER INSTRUMENTS CORP., 75 John Glenn Dr., Amherst, NY 14228-2171, Tel: 716-691-5100, FAX: 716-691-5226; Empl.: 67; *Sls. Mgr.:* Mike Murphy

KISTLER-MORSE, P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Stan Isenhath, Jack Smith

KIT MASTER, 11 South Broad St., Peekskill, NY 10566, Tel: 914-736-1010, FAX: 914-736-1899 .... **C•1541**

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

KLEIN TOOLS, INC., 7200 McCormick Blvd., P.O. Box 599033, Chicago, IL 60659-9033, Tel: 708-677-9500, TELEX: 72-4431; Empl.: 1000; *Sls. Mgr.:* Ron Bost

KLOCKNER MOELLER, 25 Forge Pkwy., Franklin, MA 02038, Tel: 508-520-7080, FAX: 508-520-7084; Empl.: 250; *Sls. Mgr.:* T. Thornton; *Dist. Mgr.:* P. Feruglio

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007, FAX: 201-447-0014; Empl.: 35; *Sls. Mgr.:* E. Verder

KMS ADVANCED PRODUCTS, INC., 700 KMS Place, P.O. Box 1868, Ann Arbor, MI 48106-1868, Tel: 313-769-1780, FAX: 313-769-8660; Empl.: 50; *Sls. Mgr.:* Bill McManus

KNIGHTFIRE TECHNOLOGY, 2139 University Dr., Ste.211, Coral Springs, FL 33071, Tel: 305-344-3682, FAX: 305-752-4353; FSC No.: FSC 6130; Empl.: 4; *Sls. Mgr.:* Sue Pantelakis

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Atlanta, GA 30326, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 780; *Sls. Mgr.:* Robert Chamberlain, Sr. V.P., Sls.

KNOWLES ELECTRONICS, INC., 1151 Maplewood Dr., Itasca, IL 60143, Tel: 708-250-5100, TELEX: 433-0330, FAX: 708-250-0575; *Sls. Mgr.:* W. Jeff Taylor

knurr

FAX: 805-584-8371

KNURR USA INC., Knurr A.G., 1890 N. Voyager Ave., Simi Valley, CA 93063, Tel: 805-526-7733; Empl.: 20; *Sls. Mgr.:* Georg Wolf (acting) .... **C•1050-1052**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer Inc.	205-883-4163
AZ	Phoenix, Facilutions	602-581-5253
CA	Daly City, Knurr USA	415-878-3300
CA	Laguna Hills, Knurr USA	714-581-8350
CA	Sherman Oaks, Knurr USA	818-986-3455
CA	Simi Valley, Knurr USA, Inc.	805-526-7733
CO	Englewood, Elctrn. Comp. Sys.	303-762-9576
FL	Longwood, Mathias Assocs. Inc.	407-682-1700
IL	Barrington, MCT Elctrns.	708-438-3200
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Ann Arbor, Lintott Assoc.	313-662-1611
MN	Brunsville, Schneiberg Co.	612-890-2416
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NJ	Fair Lawn, The Jette Grp.	201-794-9610

NY	Babylon, The Jette Grp.	516-669-6788
NY	Rochester, Tech. Comp. Sls.	716-342-2406
OH	Westlake, KRW Sls.	216-871-7521
PA	West Chester, Pantech Inc.	215-436-5440
SC	Columbia, Knurr USA East	803-871-6147
TX	Dallas, Kite	214-986-0321
VA	Springfield, Pantech Inc.	703-451-5700
WA	Seattle, Temper Tech. Mktg.	503-292-8201
Can	Oakville, Ont., Elctrn. Design Consulting	416-827-5398

Local Distributors

CO	Aurora, Ty Henkin	303-364-1000
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511

KOA

FAX: 814-362-8883

KOA SPEER ELECTRONICS, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536; FSC No.: 09021; Empl.: 3000; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* Fred L. Schenfield .... **A•1002, 1095, 1242-1243, 1858, 1958-1971**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
Can	Mississauga, Ont., Indigo Elctrns.	416-670-0284
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Plainville, Northeast Representatives	203-747-2423
FL	Boca Raton, APM Assocs.	407-395-7308
FL	Tampa, APM Assocs.	813-886-2457
FL	Winter Park, APM Assocs.	407-678-2777
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	708-593-3450
IN	Fort Wayne, John F. Kilfoil	219-483-6208
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Representatives	617-749-8700
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Mont Vernon, Northeast Representatives	603-880-8199
NJ	Cherry Hill, Metz-Benham Assoc.	609-424-0404
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Kanata, Ont., Indigo Elctrns.	613-591-1053
Can	Montreal, Que., Indigo Elctrns.	514-696-6104

Local Distributors

AL	Huntsville, Reptron	205-722-9500
AZ	Ftn. Hill, RCD Inds.	602-483-6412
AZ	Scottsdale, Shelley- Ragon	602-998-0399
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Huntington Beach, SMD, Inc.	714-841-4556
CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Mission Hills, T.T.I.	818-891-8885
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, T.T.I.	619-748-2025
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Jaco	408-432-9290
CA	San Jose, Shelley Ragon	408-432-0600
CA	San Jose, Surface Mount Distrs.	408-432-7274
CA	Santa Ana, TTI	714-641-9393
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Tustin, Capstone Elctrns.	714-730-0349
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Westlake Village, Jaco	805-495-9998
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, T.T.I.	303-429-6806
CO	Englewood, Shelly-Ragon Elec. Parts	303-762-0670
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, T.T.I.	203-284-7474
CT	Wallingford, Utronics	203-265-2724
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Clearwater, Atlantic Elctrns.	813-531-5900
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Largo, Shelley-Ragon	813-545-0057
FL	Orlando, TTI	407-859-1000
FL	Tampa, Reptron	813-855-4656
FL	Tampa, Reptron Elec.	813-854-2351
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Reptron	404-446-1300
GA	Norcross, T.T.I.	404-662-0911
IL	Bensenville, Goold Elctrns.	708-860-7171
IL	Glendale Heights, Shelley-Ragon	708-529-9977
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Rosemont, Advent Elctrns.	708-298-4210
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IL	Schaumburg, TTI	708-884-6500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-931-8200
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Chelmsford, Shelly-Ragon	508-250-9666
MA	Norwood, EMTEL Electronics	617-769-9500
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, North Star Elect.	508-657-5155
MA	Wilmington, T.T.I.	508-658-4700
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Farmington Hills, Key Elctrns.	313-489-5455
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	Minnetonka, Reptron	612-938-0000
MN	Minnetonka, T.T.I.	612-933-8555
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-429-3111
NE	Lincoln, Scott Elctrns.	402-466-8221
NV	Las Vegas, Kiesub Corp.	702-733-3888
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mount Laurel, TTI Inc.	609-234-6400
NJ	Mt. Laurel, Capstone Elctrns.	609-727-7800
NJ	Rockaway, Nasco	201-625-7777
NM	Albuquerque, Betatron	505-821-1122
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Bohemia, Prime Comps.	516-244-8190
NY	Buffalo, Summit Distrs.	716-887-2845
NY	Hauppauge, Jaco	516-273-5500
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, T.T.I.	516-737-2000
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Jaco	919-876-7767
NC	Raleigh, Reptron	919-832-3117
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Dayton, T.T.I.	513-898-8330
OH	Independence, TTI	216-328-9755
OH	Solon, Reptron	216-349-1415
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Sager Electronics	215-464-4336
PA	Philadelphia, Shap	215-969-3300
RI	Pawtucket, Major Edwards	401-725-7400
TX	Addison, Jaco/QC Elctrns.	214-733-4300
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Fort Worth, Chaparral Elctrns.	817-232-2777
TX	Fort Worth, TTI	817-847-6666
TX	Ft. Worth, Carlton Bates	817-293-5558
TX	Ft. Worth, T.T.I.	817-740-9000
TX	Ft. Worth, T.T.I. Inc.	817-595-3100
TX	Houston, Altair Co.	713-462-3029
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-466-2106
Can	Markham, Ontario, Semad	416-475-8500
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

KOBOLD INSTRUMENTS INC., 1810 Parkway View Dr., Pittsburgh, PA 15205, Tel: 412-788-2830, 800-998-1020, FAX: 412-788-4890; *Sls. Mgr.:* James M. Hall

KOEP PRECISION STANDARDS, INC., 500 B Great Bay Blvd., Tuckerton, NJ 08087, Tel: 609-296-9686, FAX: 609-296-9733; FSC No.: 57114; Empl.: 3; *Dist. Mgr.:* N/A

KOLIN INDS., INC., Box 300, Dept. EEM, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5785; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KOLLMORGEN

Motion Technologies Group

Industrial and Commercial Products

FAX: 703-731-0847

KOLLMORGEN MOTION TECHNOLOGIES GROUP, 201 Rock Rd., Radford, VA 24141, Tel: 800-77-SERVO; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Pete Dougherty .... **B•1273-1277**

Local Sales Offices & Reps

AZ	Mesa, Western Automation Inc.	602-830-6315
AZ	Tempe, Thor Engrg.	602-438-8494
CA	Corona, Western Automation, Inc.	714-278-1900
CA	Hermosa Bch., Western Automation Inc.	310-798-8532
CA	La Jolla, KSA Inc.	619-453-5720
CA	Laguna Hills, Industrial Drives	714-581-3626
CA	Laguna Hills, Western Automation	714-859-6988
CA	Meadow Vista, O'Donnell Assocs. North	916-878-9087
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	San Jose, O'Donnell Assocs. North	408-456-2950
CA	San Marcos, Western Automation Inc.	619-727-8895
CA	Valencia, Western Automation, Inc.	805-254-7845
CO	Westminster, MJM Mktg. Inc.	303-428-9611
FL	Lakeland, Ludlum Assoc., Co. Inc.	813-683-0200, 800-525-1354
GA	Atlanta, Industrial Apparatus Co.	404-875-8086
IL	Skokie, Koepke & Assoc. Inc.	708-581-0000
MD	Annapolis, Homersmith, Inc.	301-269-6493
MA	Wellesley, Electro Kinetics	617-235-9415
MI	Sterling Hgts., Alliance Sls. Co.	313-726-8670
MN	New Brighton, The Mackubin Grp.	612-636-5533
NJ	Williamstown, Homersmith Inc.	609-567-7464
NY	Commack, Indl. Drives PMI Motion Technlgs.	516-864-1000
NY	E. Rochester, A&D Devices	716-385-2778
NY	Plainview, Motion Control Sls.	516-756-5656
NC	Charlotte, Motion Technlg. Inc.	704-525-9855, 800-438-1380
OH	Columbus, Exonic Sys.	614-337-8883
OH	Dayton, Exonic Sys.	513-434-4100
OH	Farmersville, The Kilroy Corp.	513-696-2277
OH	Medina, Cygnus	216-725-1663
OH	Toledo, Exonic Sys.	419-866-8600
OH	Twinsburg, Exonic Sys.	216-425-2100
OK	Broken Arrow, DJ Sls.	918-258-1445
PA	Downingtown, Homersmith, Inc.	215-269-3637
PA	Media, Homersmith, Inc.	215-543-2434
PA	Pittsburgh, Exonic Sys.	215-825-6797
TX	Austin, DJ Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
TX	Dallas, EC Sys. Inc.	214-960-1961
TX	Houston, DJ Sls.	713-690-2640
VA	Radford, The Hatfield Co.	703-639-5471
WA	Bellevue, Thorson Co. N.W.	206-455-9180
Can	Rexdale, Ont., Canadian Drives, Inc.	416-745-1137

Local Distributors

CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	S. San Francisco, Steven Engrg.	800-258-9200
CO	Denver, Tech Sls. Inc.	303-935-0109
CO	Denver, Warren Fluid Power	303-377-2736
DE	New Castle, J.C. Bennington Co.	302-322-3700
FL	Orlando, Ross Equip.	407-872-0874
IL	Chicago, Kelburn Engrg. Co.	312-775-8383
IN	Indianapolis, J. N. Fauver Co.	317-872-3060
KY	Louisville, J.N. Fauver Co.	502-267-7461
MI	Madison Heights, J. N. Fauver Co.	313-585-5252
NJ	Fairfield, Dodge Newark	201-575-7033
NY	Rochester, Magna Prods. Corp.	716-647-2280

NC	Jamestown, HSI-Piedmont Inc.	919-883-3999
OH	Twinsburg, Exonic Sys.	216-425-2100
PA	Pittsburgh, Exonic Sys.	215-825-6797
TX	Dallas, Cates Drives & Controls	214-960-1961
TX	Houston, Cates Control Sys.	713-644-3911
TX	Houston, Resch. Des. Inc.	713-995-8591
WA	Fall City, Pacific Motion Grp.	206-222-7387
WI	Elm Grove, Triphase Automation	414-821-5099
WI	Oneida, MCL Inds. Inc.	414-434-4100

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 800-223-7150, TWX: 510-687-8967

KONTRON ELEKTRONIK-US KONTRON ELEKTRONIK GMBH-SUB. BM, 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-6575, FAX: 508-927-6511; Empl.: 30

KOOLTRONIC, INC., P.O. Box 300, Hopewell, NJ 08525, Tel: 609-466-3400, FAX: 609-466-1114; Empl.: 200; *Sls. Mgr.:* John J. Drages

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901; Empl.: 200

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, FAX: 715-268-8183; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., 27 Spruce Cabin Road, Cresco, PA 18326, Tel: 717-595-2212, FAX: 717-595-2024; Empl.: [illegible]

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 908-636-1900, FAX: 908-636-1982; FSC No.: 55259; Empl.: 15; *Sls. Mgr.:* Bob Fiordalisi **A•1648-1649**

Local Sales Offices & Reps

CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-576-2162
CA	Seal Beach, Texel	310-596-9411
CA	Simi Valley, Texel	805-582-1223
CO	Englewood, Tech. Mktg. Co.	303-989-3611
FL	Longwood, J-Squared Mktg., Inc.	407-884-0810
IL	Chicago, Tech. Sls.	312-237-7210
KS	Kansas City, Abrams & Assocs.	913-432-2303
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	908-537-7888
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322

KRENZ INSTRUMENTS, INC., 7234 Via Mariposa, Bonsall, CA 92003, Tel: 619-630-3488, FAX: 619-630-4267; Empl.: 35; *Sls. Mgr.:* Michael Merget, G.M.

KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 708-293-0850, FAX: 708-293-1255; Empl.: 35; *Sls. Mgr.:* Kevin Michael

Bantry Components, Inc.

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 100; *Sls. Mgr.:* Bert A. Spiller **A•1973-1979**

Local Sales Offices & Reps

CA	Copperopolis, Francisco & Assocs.	800-759-9607
FL	Boca Raton, Sls. Specialists	813-754-1329
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Aurora, EMA Inc.	216-562-6104
OH	Centerville, EMA Inc.	513-433-2800
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
TX	Austin, Southwest Sys. Technlg.	512-467-2040
TX	Dallas, Southwest Sys. Technlg.	214-443-2688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792

Local Distributors

FL	Boca Raton, NRC Elctrns.	407-241-8600
MA	Billerica, Baldwin Comps.	617-667-6710
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 508-583-8989; Empl.: 35 **A•1650; D•1291**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-883-8455
AZ	Phoenix, Odyssey 1	505-345-9659
CA	Huntington Bch., Sci-Dev West	714-236-1190
CA	San Jose, Scientific Devs. West	408-554-0455
FL	Orlando, Gentry Elctrns., Inc.	407-859-4422
FL	Tampa, Gentry Elctrns., Inc.	813-888-9218
GA	Atlanta, Gentry Elctrns., Inc.	404-315-0092
IL	Chicago, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-3430
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
PA	Pittsburgh, EQS Sys.	216-729-2222
PA	Spring House, Scientific Devices East	215-643-3335
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Columbia, Gentry Elctrns., Inc.	803-772-6786
TN	Knoxville, Gentry Elctrns., Inc.	615-584-0281
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Bellevue, Sci. Dvcs. N. W.	206-747-5169
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRUEGER COMPANY, 1544 W. Mineral Rd., Tempe, AZ 85283, Tel: 800-245-2235,602-820-5330, FAX: 602-820-1707

KSI, See Kaiser Systems, Inc.

K-TRONICS, See U. S. Elco Inc. (Under Elco)

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 320; *Sls. Mgr.:* George Boctor

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Scottsdale, Dave Menegey Assocs.	602-994-9519
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Walnut Creek, Dale-Dahl Assocs.	415-933-9595
CO	Boulder, Measurement Cnslts.	303-449-7506
MA	Brockton, JHL Assocs.	508-580-1703
MN	Minneapolis, Instrmn. Resources, Inc.	612-537-2434
MO	St. Louis, Ozark Elctrn. Mktg.	314-423-7200
NM	Albuquerque, Amonette Entprs.	505-344-4143
OH	Dayton, Kulite Midwest	513-439-1958
PA	Philadelphia, Rabal Assocs., Inc.	215-922-6914
TX	Webster, Kulite Southwest	713-486-9748
UT	Centerville, MC 2	801-298-3388
WA	Seattle, Brett Assocs.	206-431-8090

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Tom Setliff

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, FAX: 405-567-4153; Empl.: 60; *Sls. Mgr.:* Freda Pickard

KYCON

FAX: 408-295-8054

KYCON CABLE & CONNECTOR, INC., 1810 Little Orchard St., San Jose, CA 95125, Tel: 408-295-1110, 800-544-6941; Empl.: 16; *Sls. Mgr.:* Wendy Wuerth; *Dist. Mgr.:* Wendy Wuerth **C•1364-1367, 1757**

Local Sales Offices & Reps

AZ	Tempe, ACS of Arizona	602-731-9711
CA	Aliso Viejo, Pro Assocs.	714-588-2700
CA	San Diego, Pro-Assocs.	714-588-2700
CA	San Jose, Kycon Sls. Off.	408-295-1110
CA	Sunnyvale, Repron	408-737-0510
GA	Alpharetta, Pinnacle	404-410-9980
MA	Sudbury, KSA of New England	508-443-5881
MN	Burnsville, Vermilyea Sls.	612-435-1726
MO	Chesterfield, Weisler and Assocs.	314-537-0010
NJ	Middletown, Varrelman-Gorman	908-219-0088
NY	Smithtown, Varrelman-Gorman	516-724-0907
NY	Webster, Frank J. Muto	716-671-2387
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TX	Dallas, Weisler and Assocs.	214-437-2386
TX	Houston, Weisler & Assocs.	713-849-3799
WA	Bellvue, Quest Mktg.	206-747-9424
Can	Laval, Que., Interep Technlgs. Ltd.	514-667-1444

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
AZ	Tempe, Team Elctrns.	602-731-9712
CA	San Diego, Cableconn	619-571-7111
CA	San Diego, Mock III Sls. Co.	619-693-8230
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CO	Denver, Southwest Elctrns., Inc.	303-430-4000
FL	Orlando, Wallace Elctrns.	407-578-1000
MA	Ashland, Quality	508-881-6500
MA	Wilmington, North Star Elctrns.	508-657-5155
NY	Hauppauge, Century Elctrns. Comps.	516-273-1551
NY	Rochester, North Star Elctrns.	716-244-9846
NC	Raleigh, Century Elctrns. Comps.	919-596-2220
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Norristown, Century Elctrns. Comps.	215-631-5400
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Austin, Wallace Elctrns.	512-469-0400
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Ft. Worth, Southwest Elctrns., Inc.	817-338-1497
TX	Richardson, Southwest Elctrns., Inc.	214-234-3050
TX	San Antonio, Southwest Elctrns.	512-222-2425
TX	San Antonio, Wallace Elctrns.	512-342-2314
TX	Stafford, Southwest Elctrns.	800-231-3612
WA	Redmond, Murphy Elctrns.	206-881-1234
Can	St. Laurent, Que., Ferrotronic Comps., Inc.	514-333-7288

KYOCERA INDUSTRIAL CERAMICS CORP., 8611 Balboa Avenue, San Diego, CA 92123, Tel: 619-576-2688, TELEX: 4723069 (KYOSDGO), ESYLNK: 619-569-9412; Empl.: 100; *Sls. Mgr.:* Lyle Gibson

KYOCERA NORTHWEST, See AVX Corp.

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 708-450-2600, TELEX: 6781028, FAX: 708-450-0943; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Drive, Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 32; *Sls. Mgr.:* Neil Parmenter, Dir. of Sls.

LABTRONICS INC., 75 Rickson Ave., Guelph, Ont., Canada N1G 3B6, Tel: 519-767-1061, FAX: 519-836-4431

LAFRANCE CORP., 8425 Executive Ave., Philadelphia, PA 19153-3893, Tel: 215-365-8000, FAX: 215-365-4420; Empl.: 300; *Sls. Mgr.:* Brian Mc Henry

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* Michael Swartz

LAMBDA ELECTRONICS INC., 515 Broad Hollow Rd., Melville, NY 11747-3700, Tel: 516-694-4200, FAX: 516-293-0519; Empl.: 1100; *Sls. Mgr.:* John Valenti

LAMBDA Qualidyne Inc.

FAX: 619-575-7185

LAMBDA QUALIDYNE INC., Lambda Group of Unitech, plc, 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-1100; Empl.: 400; *Sls. Mgr.:* Barry A.Chenes, Dir. of Mktg. **D•1810-1815**

LAMB ELECTRIC DIVISION, A Subsidiary of Ametek Inc., 627 Lake St., Kent, OH 44240, Tel: 216-673-3451, FAX: 216-673-8994

LAMBERT ENGINEERING INC., 1155 S.W. Division, Ste. B-13, Bend, OR 97702-2181, Tel: 503-388-2623, FAX: 503-388-1794; Empl.: 9

LAMB INDUSTRIES, INC., 4826 S.W. Scholls Ferry Rd., Portland, OR 97225, Tel: 503-297-8878,800-824-9374, FAX: 503-297-8879; Empl.: 6; *Dist. Mgr.:* Andrew Semon .... **B•1760-1765**

Local Sales Offices & Reps

IL	Chicago, Meca Sls. Inc.	312-334-3201, FAX:312-334-4020
MN	Stillwater, Prof. Elctrns.	612-439-8088, FAX:612-439-1061
OR	Portland, Lamb Inds., Inc.	503-297-8878, FAX:503-297-8879

Local Distributors

AL	Mobile, Control Design/AL	205-666-6693
AZ	Tempe, Control Design/AZ	602-829-7981
AR	Maumet, Control Design/AR	501-851-3137
CA	Anaheim, Control Design/S. CA	714-821-1516
CA	Chatsworth, EW Elctrns.	818-718-2500
CA	Industry, Ital Elctrns.	818-968-8515
CA	Irvine, Kelex Elctrns.	800-422-7224
CA	Irvine, Mann SW	800-553-5543
CA	San Carlos, Control Design/N. CA	415-592-4806
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	Tustin, Western Switches	800-454-8144
CA	Van Nuys, Wes-Garde/CA	213-873-4802
CO	Denver, Control Design/CO.	303-296-1922
CT	Hartford, Wes-Garde/CT	203-527-7705
CT	Wallingford, Control Design/CT	203-269-9955
FL	Altamonte Springs, Control Design/FL.	305-788-3220
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Lakeland, Wes-Garde/FL	800-275-7102
FL	Pompano Bch., Control Design/FL. ...	305-782-1311
FL	Tampa, Reptron Elctrns.	800-659-1361
GA	Stone Mountain, Control Design/GA ..	404-979-3500
IL	Carrol Stream, Wes-Garde/IL	800-275-7095
IL	Franklin Park, Stetco Inc.	800-251-4558
IL	Schaumburg, Control Design/IL	708-307-8900
IN	Indianapolis, Control Design/IN	317-788-4559
IA	Marion, Control Design/IA	319-373-2923
KS	Kansas City, Control Design/KS	913-362-4248
MA	Woburn, Control Design/MA	617-932-9404
MI	St. Clair Shore, Spemco	800-482-2828
MN	Fridley, Voyager Elctrns. II	612-571-7766
MN	Minneapolis, Control Design/MN	612-721-1628
MN	Minneapolis, Tortec Corp.	612-866-3662
MN	Roseville, Parts One	612-633-8079
MO	St. Louis, Control Design/MO	314-426-3150
MO	St. Louis, Wes-Garde/MO	314-567-7776
NH	Nashua, Wes-Garde/NH	603-880-1971
NJ	Mt. Laurel, Wes-Garde/NJ	609-778-8190
NJ	Wycoff, B & R Elect.	201-670-7200
NY	Woodside, Switches Unlimited	800-221-0487
NC	Charlotte, Control Design/NC	704-588-4410
OH	Westerville, Wes-Garde/OH	614-885-0319
OR	Portland, Radar Elctrns.	503-232-3404
PA	Malvern, Control Design/PA	215-296-0150
TX	Dallas, Control Design/TX	214-358-1441
TX	Dallas, Wes-Garde/TX	800-275-7103
UT	Nephi, Control Design/UT	801-623-2908
WA	Redmond, Priebe Elctrns.	800-426-9911
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Milwaukee, Badger Sls.	414-281-1330
WI	New Berlin, Control Design/WI	414-784-1015

LAMINATION SPECIALTIES CORP., 235 N. Artesian, Chicago, IL 60612, Tel: 312-243-2181, FAX: 312-243-2873; *Sls. Mgr.:* James R. Barth

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LJ TECHNICAL SYSTEMS, 19 Power Drive, Hauppauge, NY 11788, Tel: 516-234-2100, FAX: 516-234-2656; Empl.: 25; *Sls. Mgr.:* Christopher Rowe

LMB HEEGER, INC., 6400 Fleet St., Commerce, CA 90040, Tel: 213-728-5108, 213-728-4729, FAX: 213-728-4740; *Sls. Mgr.:* Robert Heeger

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CO	Boulder, Component Products Sls.	303-530-2800
CT	Madison, Focus Sls.	203-245-4314
GA	Alpharetta, Pinnacle Mktg.	404-410-9980
IL	Glenview, Prime Dvcs.	708-729-2550
KS	Overland Pk., Acorn Elctrns.	913-649-6402
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MN	Minneapolis, D.A. Case Assocs.	612-831-6777
MO	St. Louis, Acorn Elctrns.	314-421-1751
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NJ	Burlington, VDE Elctrn. Sls.	609-387-9331
NJ	Flanders, K & R Engrg. Sls.	201-584-5235
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CA	Fullerton, Interconnect Specs.	714-773-0411
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LORAL MICROWAVE NARDA, 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711; FSC No.: 99899; Empl.: 400; *Sls. Mgr.:* Robert Nopper

LORAL MICROWAVE-NARDA WEST, 11040 White Rock Rd. 200, Rancho Cordova, CA 95670-6001, Tel: 916-638-5500, FAX: 916-638-8682; Empl.: 115; *Sls. Mgr.:* Leon Becker

LORAL MICROWAVE-WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 109

LORAL TERRACOM, Sub. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123-1595, Tel: 619-278-4100, TELEX: TERRACOM A SDG 18-2774, FAX: 619-292-1140; Empl.: 130; *Sls. Mgr.:* Michael A. Lapadula

LORANGER INTL. CORP., 817 Fourth Ave., Warren, PA 16365, Tel: 814-723-2250, FAX: 814-723-5391; Empl.: 55; *Sls. Mgr.:* J. Albert Loranger

LORCH ELECTRONICS:DIV. OF VERNITRON CORP., 2801 - 72nd St., No., St. Petersburg, FL 33710, Tel: 813-347-2181, FAX: 813-347-3881; FSC No.: 29971; Empl.: 50; *Sls. Mgr.:* Carol McCoy

LORLIN TEST SYSTEMS, Axiam, Inc., 4 Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, FAX: 203-744-6185; Empl.: 30; *Sls. Mgr.:* John Seacord

LORTEC POWER SYSTEMS, INC., 145 Keep Court, Elyria, OH 44035-2214, Tel: 216-327-5050, FAX: 216-327-9628; Empl.: 45; *Sls. Mgr.:* Dale Lamirand

LOVE CONTROLS DIVISION, Dwyer Instruments, Inc., 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 708-541-3232, TELEX: 297115, FAX: 708-541-7366; FSC No.: 8L919; Empl.: 72; *Sls. Mgr.:* James Nolan; *Dist. Mgr.:* Jim Clark

low key

FAX: 508-281-6321

LOW KEY CORPORATION, Strong Group, 105 Maplewood Ave., P.O. Box 1195, Gloucester, MA 01930, Tel: 508-281-0448; Empl.: 25; *Sls. Mgr.:* Brian Hendricks .... **B•1842-1843**

Local Sales Offices & Reps

AL	Huntsville, MacKay Smith Assocs.	205-539-8005
CO	Englewood, Elctrn. Comp. Sls.	303-762-9576
CT	Plainville, Northeast Rep., Inc.	203-866-6030
FL	Orlando, MacKay Smith Assocs.	407-423-4353
GA	Tucker, MacKay Smith Assocs.	404-496-9913
IL	Skokie, Electro Tech Mktg.	312-676-3151
IN	Greenfield, France Entprs.	317-462-6098
MD	Baltimore, Hagy Assocs.	301-529-3995
MA	Hingham, Northeast Rep., Inc.	617-749-8700
NH	Mt. Vernon, Northeast Rep. Inc.	603-673-1406
NJ	Lebanon, F.F. Sylvester Assocs.	201-735-2488
NY	Coram, F.F. Sylvester Assocs.	516-473-2018
NC	Raleigh, MacKay Smith Assocs.	919-847-2277
PA	Newtown Sq., Hagy Assocs.	215-459-0504
UT	Salt Lake City, Elctrn. Comp. Sls.	
Can	St. Lazare, Que., Atkinson & Ross Assoc.	514-424-5679
Can	Witby, Ont., Atkinson & Ross Assoc.	416-666-8359

LSI COMPUTER SYSTEMS, INC., 1235 Walt Whitman Rd., Melville, NY 11747, Tel: 516-271-0400, FAX: 516-271-0405

LSI LOGIC CORP., 1551 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-8000, TELEX: 172153; *Dist. Mgr.:* John Mucciaro

LTI, INC., Autotech Technologies, LP, 363 St. Paul Blvd., Carol Stream, IL 60188, Tel: 708-668-8886, FAX: 708-668-9480; Empl.: 60; *Sls. Mgr.:* Ray Szydzik

LTX CORPORATION, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-461-1000, FAX: 617-461-0993; Empl.: 1,500; *Sls. Mgr.:* Roger Blethen, Sr. V.P. Sls.

LUCAS CONTROL SYSTEMS PRODUCTS, Lucas Industries PLC, 1000 Lucas Way, Hampton, VA 23666, Tel: 804-766-1500, FAX: 804-766-4258; Empl.: 375; *Sls. Mgr.:* Leroy Nopper, V.P. Sls.

LUCAS DEECO, Lucas Industries, 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 510-471-4700, FAX: 510-489-3500; Empl.: 75; *Sls. Mgr.:* Bill Lepior, Natl; *Dist. Mgr.:* Harvey Goldman

LUCAS EPSCO, INC., 99 South St., Hopkinton, MA 01748-2204, Tel: 508-435-2400, TELEX: 95-1110, FAX: 508-435-2022; FSC No.: 15894; Empl.: 240; *Sls. Mgr.:* John M. Shalhoub

LUCAS LEDEX, Lucas Industries, P.O. Box 427, 801 Scholz Dr., Vandalia, OH 45377-0427, Tel: 513-898-3621, FAX: 513-898-8624; FSC No.: 54-0840753; Empl.: 200; *Sls. Mgr.:* Leroy Nopper ..... **B•1647-1651, 1766, 1967**

LUCAS NOVA SENSOR, Lucas Industries, 1055 Mission Court, Fremont, CA 94539, Tel: 510-490-9100, FAX: 510-770-0645; Empl.: 80; *Sls. Mgr.:* Bill Michaels

LUCAS SCHAEVITZ, INC., Lucas Industries PLC., 7905 N. Route 130, Pennsauken, NJ 08110-1489, Tel: 609-662-8000, FAX: 609-662-6281; FSC No.: 93190; Empl.: 175; *Sls. Mgr.:* Leroy Nopper

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LUCAS WESTERN INC., Electro Systems Division, 610 Neptune Ave., Brea, CA 92621, Tel: 714-671-4500, TWX: 910-240-3603, FAX: 714-671-4503; Empl.: 210; *Sls. Mgr.:* Jerry Neumayer

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LUFF RESEARCH, INC., 22 N. Tyson Ave., Floral Park, NY 11001, Tel: 516-358-2880, FAX: 516-358-2757

LUFT INSTRUMENTS, INC., Hillside Rd., P.O. Box 214, Lincoln, MA 01773, Tel: 617-259-9215, FAX: 617-259-9215; Empl.: 12

LUMBERG, INC., 11351 Business Ctr. Dr., Richmond, VA 23236, Tel: 804-379-2010, FAX: 804-379-3232; Empl.: 8; *Sls. Mgr.:* John R. Naudziunas

LUMEX OPTO/COMPONENTS, INC., 290 E. Hellen Rd., Palatine, IL 60067-6955, Tel: 708-359-2790, FAX: 708-359-8904; Empl.: 150; *Sls. Mgr.:* Hank Zabawski; *Dist. Mgr.:* Tanya Bons

LUMIDOR SAFTEY PRODUCTS, SafteyTek Corp., 11221 Interchange Circle South, Miramar, FL 33025, Tel: 305-433-7000, FAX: 305-433-7730; Empl.: 50; *Sls. Mgr.:* Bryan Bates; *Dist. Mgr.:* Bryan Bates

LUMINATOR AIRCRAFT PRODUCTS, 1200 E. Plano Parkway, Plano, TX 75074, Tel: 214-424-6511, FAX: 214-423-8515; FSC No.: 22973; Empl.: 70; *Sls. Mgr.:* Gordy Treichler

Local Sales Offices & Reps

CA	Long Beach, Luminator Aircraft	714-968-8748
KS	Wichita, Lee Prods.	316-264-2172

Local Distributors

GA	Smyrna, Electro Air	404-432-1900
NY	Purchase, Aerotech World Trade	716-428-3500

LUMINTECH

FAX: 201-374-2554

LUMINTECH INC., 171 Colt St., Irvington, NJ 07111, Tel: 201-374-1091; Empl.: 4; *Sls. Mgr.:* Subhash Goyal .... **A•2376**

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AL	Guntersville, Tek-Rep Mktg.	205-582-7663
AZ	Phoenix, Van Dahl Engrg.	602-866-6988
CA	Misson Viejo, Champa Assocs.	714-581-3459
CA	Napa, Stewart-Fullerton Assoc.	707-258-1160
CA	Solana Bch., D2 Sls., Inc.	619-481-9310
CA	Tarzana, Tarco/Prime Source	818-708-8058
CO	Franktown, MRC	303-660-8750
FL	Margate, EPM	305-977-0331
FL	Orlando, EPM	407-425-6149
GA	Dunwoody, Tek-Rep Mktg.	404-963-1600
IL	Glen Ellyn, Lincoln Hodges	708-469-6750
IA	Cedar Rapids, J. R. Sls. Engrg.	319-393-2232
MA	Swansea, Poisson Assocs.	508-677-3655
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	St. Charles, Buckman & Assocs.	314-947-4727
NJ	E. Brunswick, Shepard Assocs.	908-254-5757
NJ	Totowa, Shepard Assocs.	201-256-1774
NY	Chester, Shepard Assocs.	914-469-2011
NY	Jericho, Shepard Assocs.	516-822-3700
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Columbus, The Bill Romine Co.	614-436-0565
PA	Dowingtown, Grasso Tech. Sls.	215-458-8967
TX	Austin, THT Sls.	512-835-2794
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
VA	Herndon, Eastern Elctrns.	703-904-7272
WA	Redmond, VMI	206-882-2999
WI	Janesville, Antek Mktg. Corp.	608-754-4214
Can	Toronto, RepTech	416-863-9510
Can	W. Vancouver, Leister Blake Entpr.	604-926-6127

LUMITRON, PO Box 267, Summit, NJ 07902-0267, Tel: 908-273-8998, FAX: 908-273-0853; FSC No.: 51702; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNAIRE ENVIRONMENTAL, INC., Lunaire Limited, 4 Quality St., Williamsport, PA 17701, Tel: 717-326-1770, FAX: 717-326-7304; Empl.: 130; *Sls. Mgr.:* Stu Lunick

LUNDAHL INSTRUMENTS, INC., Ezra C. Lundahl Inc., 429 South Main, Logan, UT 84321, Tel: 801-753-7300, FAX: 801-753-7490; Empl.: 17; *Sls. Mgr.:* Val Potter

LUTRON ELECTRONICS CO., 7200 Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

LUTZE, INC., 1911-A Associates Ln., Charlotte, NC 28217-9805, Tel: 704-357-8835, 800-447-2371, FAX: 704-357-8836; Empl.: 6

LUXO CORPORATION, P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, 800-222-5896, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LUXTRON INC., 15 Hale St., Haverhill, MA 01830-4803, Tel: 508-372-5211, FAX: 508-372-7051; *Sls. Mgr.:* Bruce F. Morse

LXD

FAX: 216-786-8711

LXD, INC., 7650 First Place, Cleveland, OH 44146, Tel: 216-786-8700; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Patrick Bowen; *Dist. Mgr.:* Patrick Bowen .... **B•1086-1087**

Local Sales Offices & Reps

AL	Huntsville, Tronex Grp.	205-859-5609
AZ	Phoenix, FP Sls.	602-894-5303
CA	Los Angeles, Universal Comps.	310-783-0220
CA	Milpitas, Telesis Sls.	408-946-7300
CA	San Diego, Universal Comps.	619-232-5163
CO	Denver, Tri Tec Sls.	303-440-7862
CT	New Haven, Sturdy Corp.	203-888-1480
CT	Newton, Sturdy Corp.	203-426-4403
FL	Plantation, Tronex Grp.	305-587-4797
GA	Alpharetta, Tronex Grp.	404-751-0794
ID	Coeur D'Alene, Matrex Mktg.	208-765-5810
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Fort Wayne, RL Bontempo Assoc.	219-478-1057
IN	Indianapolis, R. L. Bontempo Assocs.	317-843-2142
IA	Cedar Rapids, KKB & Co.	319-373-1730
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MO	Kansas City, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NH	Derry, Sturdy Corp.	603-434-8440

NJ	Haddon Field, Sunday O'Brein	609-429-4013
NJ	Tenafly, November Sls.	201-894-8964
NY	Rochester, J.G. Welch Assoc.	716-244-1100
NC	Raleigh, EEI Corp.	919-876-7591
NC	Raleigh, Tronex Grp.	919-859-2117
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Midwest Mktg.	513-433-2511
OR	Tigard, Matrex Mktg. & Sls.	503-245-8080
TX	Austin, THT Sls.	512-835-2796
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
WA	Bellevue, Matrex Mktg. & Sls.	206-643-0363
Can	Concord, Ont., ITT Multicomponents	416-736-1144

Local Distributors

NC	Charlotte, EMC Inc.	704-394-6195
OH	Columbus, EMC Inc.	614-299-4161
OK	Tulsa, Merlin Elctrns.	918-251-2084
TX	Austin, Omnipro Elctrns.	512-794-9200
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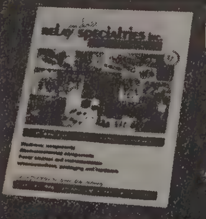

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LYNN ELECTRONICS, 915 Pennsylvania Blvd., Feasterville, PA 19053, Tel: 215-355-8200, 800-523-6075, FAX: 215-364-2944; FSC No.: 19151; Empl.: 70

LYNTRONICS, INC., 569 Acorn St., Unit 5, Deer Park, NY 11729, Tel: 516-243-6397, FAX: 516-243-0232; FSC No.: OBSY 9; Empl.: 20; *Sls. Mgr.:* Gary L. Miller

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, FAX: 818-840-9581; FSC No.: 05791; Empl.: 85; *Sls. Mgr.:* Kory L. Wardle; *Dist. Mgr.:* Kory L. Wardle

LYON METAL PRODUCTS, INC., Box 671, Aurora, IL 60507, Tel: 708-892-8941, FAX: 1-800-367-6681; FSC No.: 1-800-323-0082; Empl.: 600; *Sls. Mgr.:* J. L. Wiebusch

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 90

LZRelectronics, inc.
FAX: 301-921-0705

LZR ELECTRONICS, INC., 8051 Cessna Ave., Gaithersburg, MD 20879, Tel: 301-921-4600; Empl.: 35; *Sls. Mgr.:* John Andreoli; *Dist. Mgr.:* Greg Mozingo ..... **B•1844; C•1400-1414, 1758-1761; D•1048-1050, 1818-1827, 2277**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7871
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CA	Los Alamitos, Power Specialists	310-594-9418
CA	San Jose, Bytec Sls.	408-435-8004
CA	Simi Valley, Power Specialists	805-581-4785
CO	Littleton, Megatronix	303-730-6262
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Boca Raton, Tech. Sls. Specialists	407-391-3718
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Palatine, Vine Sls., Inc.	708-934-5476
KS	Overland, Acorn Elctrns.	913-649-6402
MD	Lutherville, DGR	410-583-1360
MA	Norwood, JMG, Inc.	617-762-5333
MI	Warren, Burcaw Co.	313-573-4605
MO	St. Louis, Acorn Elctrns.	314-421-1751
NJ	Clifton, R.O.I. Sls.	201-340-1515
NJ	Totowa, R.O.I. Sls.	201-812-9606
NM	Albuquerque, Nelco Electronix	505-293-1399
NC	Raleigh, Lamons Sls. Co.	919-846-1652
OR	Beaverton, Blair Hirsh Co.	503-641-1875
PA	Hatboro, AQS Electro	215-674-4421
TN	Greenville, Lamons Sls.	615-639-8711
TX	Plano, Connector Specs.	214-517-1207
UT	Bountiful, Charles Fields & Assocs.	801-299-8228
WA	Lynnwood, Blair Hirsch Co.	206-774-8151
WI	Genoa City, Vine Sales, Inc.	414-279-3871

Local Distributors

CA	Brea, J.I.T. Supp.	714-256-9100
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Bensenville, Voyager Elctrns.	708-860-1300
MD	Gaithersburg, MS Elctrns.	301-921-0200
MN	Minneapolis, Voyager Elctrns.	612-571-7766
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU, FAX: 212-532-4263; Empl.: 10,000 ..... **B•1293**

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MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 46; *Sls. Mgr.:* D. L. Dubov

MACOM, INC., 100 Chelmsford St., Lowell, MA 01851, Tel: 617-272-3000

M/A-COM, INC., Antenna & Cable Division, 110 Haverhill Rd., Amesbury, MA 01913, Tel: 508-388-5210, FAX: 508-388-9758; FSC No.: 11556; Empl.: 400; *Sls. Mgr.:* H. Adjemian

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M/A-COM MICROELECTROINCS DIVISION, M/A-COM, 1011 Pawtucket Blvd., P.O. Box 3295, Lowell, MA 01853-3295, Tel: 508-442-5000, TELEX: 200155, TWX: 710-332-0258; FSC No.: 96341; Empl.: 2000; *Sls. Mgr.:* Tom Rose; *Dist. Mgr.:* Larry Ward

M/A-COM OMNI SPECTRA, INC., 140 Fourth Avenue, Waltham, MA 02254-9101, Tel: 617-890-4750, FAX: 617-890-2381; FSC No.: 26805; Empl.: 750

M/A-COM PHI, INC., M/A COM, Inc., 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651, FAX: 213-618-9191; FSC No.: 50998; Empl.: 260; *Sls. Mgr.:* Charlie Hancock

MACROAMP INC., P.O. Box 1512, Ukiah, CA 95482, Tel: 800-458-8892, FAX: 707-462-3068; Empl.: 25; *Sls. Mgr.:* M. Allan Freebury

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MACROLINK, 1500 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-8800, FAX: 714-777-8807; Empl.: 40; *Sls. Mgr.:* Bill Goodale

MACROMATIC DIVISION, Milwaukee Elctrns. Corp., 5855 N. Glen Park Rd., Milwaukee, WI 53209, Tel: 414-228-5500, FAX: 414-228-5501; FSC No.: 98664; Empl.: 100-150; *Sls. Mgr.:* J. Scholler

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820, FAX: 612-633-1851; Empl.: 40; *Sls. Mgr.:* Mark Crellin

MAG-HEAD ENGINEERING CO., 686-Mendelssohn Ave., Minneapolis, MN 55427, Tel: 612-545-1321, FAX: 612-545-0335; FSC No.: (Cage) 0DU70; Empl.: 30; *Sls. Mgr.:* Gary Hoonsbeen

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CA	Sunnyvale, N-S Westronics	408-745-1102
CA	Ventura, Power Partners	805-966-3309
IL	Park Ridge, Elctrn. Instr.	708-298-2290
LA	Metairie, Data Mktg. Assoc.	504-883-3655
MI	Ann Arbor, Tech. Sls. Assoc.	313-995-4082
MN	Minnetonka, Elctrn. Instr.	612-933-7793
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
OH	Dayton, Tech. Sls. Assoc.	513-298-2062
OH	Piqua, Tech. Sls. Assoc.	513-778-0247
TX	Austin, Data Mktg.	512-338-4701
TX	Dallas, Data Mktg.	214-661-0300
TX	Houston, Data Mktg.	713-579-2995
TX	San Antonio, Data Mktg.	210-342-3031

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CA	Los Angeles, Power Partners, Inc.	310-215-0800
FL	Land O'Lakes, AJ's Power Source	813-996-2583

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

MAGNECOMP
FAX: 803-878-0507

MAGNECOMP, INC., P.O. Box 625, Gravley Rd., Pickens, SC 29671, Tel: 803-878-4700; Empl.: 10; *Sls. Mgr.:* T. Sullivan ..... **A•2377**

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 708-564-8800, FAX: 708-564-3027; FSC No.: 94696; Empl.: 400; *Sls. Mgr.:* G.W. Edwards

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MAGNETEK POWER CONVERSION SYSTEMS, Teledyne, Inc., 901 E. Ball Rd., Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; FSC No.: 90911; *Sls. Mgr.:* Fred Tamjidi

MAGNETEK POWER TECHNOLOGY SYSTEMS, MagneTek, Inc., 901 E. Ball Road, Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; Empl.: 450; *Sls. Mgr.:* Robert Swette

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MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-7100; Empl.: 963; *Sls. Mgr.:* Mike Dorton .... **A•1248-1249, 2383-2387**

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AZ	Phoenix, Toward Engr. Assocs.	602-955-3193
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CA	San Marino, L.H. Lutz	818-799-2074
CT	Berlin, D.S. Miga	203-828-7765
FL	Lake Worth, A. R. Opitz	407-967-5929
IL	Elgin, R.J. Harris	708-888-2175
IN	Martinsville, W.E. Heacock	317-349-1254
KS	Lenexa, D. J. McCarl	913-492-6719
MA	Acton, S. Feldhusen	508-264-4850
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NY	Rush, R.C. Moore	716-533-9336
NC	Greensboro, E. A. Siebenaler	919-288-3669
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TX	Garland, F. H. Hall	214-475-8066
VA	Falls Church, BFI Int'l	703-847-6815

Local Distributors

IL	Elk Grove Village, Dexter/MMD	1-800-345-4082

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GA	Suwanee, Overton Assocs.	404-497-0166
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NC	Raleigh, Overton Assoc.	919-783-6565
PA	Hatboro, AQS Electro	215-674-4421
PA	Sewickley, Teplitz-Byrne Assoc.	412-741-3628
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TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Dallas, Southwest Elctrn. Ind.	214-690-9881
WA	Olympia, Bergford & Assocs.	206-866-2001

MAGNETIC TECHNOLOGIES CORP., 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 80; *Sls. Mgr.:* Gordon H. McNeil

MAGNETOELASTIC DEVICES, 17 Downing Three, 2C, Pittsfield, MA 01201, Tel: 413-445-5608, FAX: 413-442-3750

MAGNETROL INTERNATIONAL, 5300 Belmont Rd., Downers Grove, IL 60515-4499, Tel: 708-969-4000, FAX: 708-969-9489; *Sls. Mgr.:* Roger T. Piegza, Natl. Sls. Mgr.

MAGNET SALES & MFG., INC., 11248 Playa Court, Culver City, CA 90230-6162, Tel: 310-391-7213, 800-421-6692 (N. CA and out of state), FAX: 310-390-4357; FSC No.: 17853; Empl.: 50; *Sls. Mgr.:* Chuma Ho; *Dist. Mgr.:* Anil Nanji

FAX: 708-789-0614

MAGNET SCHULTZ OF AMERICA, 401 Plaza Drive, Westmont, IL 60559, Tel: 708-789-0600; FSC No.: 27190; Empl.: 100; *Sls. Mgr.:* Robert E. Kester ... **B•1652-1653**

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CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CA	Valencia, DJM Elctrns. Inc.	805-254-2677
CO	Denver, Neil Binge & Assocs.	303-698-1481
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
GA	Tucker, Hile Assocs.	404-939-9560
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IL	Westmont, Regdon Solenoid, Inc.	708-789-0600
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MA	Mattapoisett, Mark-Rep Assocs.	508-758-2318
MI	Ada, Erin Engrg.	616-676-0665
MN	Minneapolis, Holmgren	612-574-9983
NH	Plaistow, Mark-Rep Assocs.	603-382-9563
NJ	Red Bank, Varrelman-Gorman Co.	201-219-0088
NM	Albuquerque, Wistech	505-883-2552
NC	Greensboro, Hile Assocs.	919-288-1500
OH	Dayton, Electro. Mktg. Grp.	513-890-8322
OR	Portland, D.A. Sullivan Co.	503-292-2448
PA	Huntingdon Valley, Edwin Leiby & Assocs.	215-659-8938
TX	Plano, K & H Sales	214-423-6520
VA	Alexandria, Edwin Leiby & Assocs.	703-360-9039
WI	Butler, Richmar Elctrns.	414-781-1730
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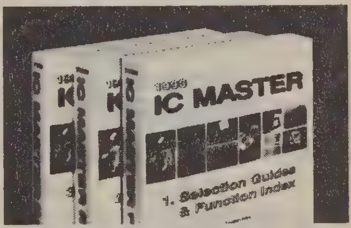

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MAGNOS, 9 Bonazzoli Ave., Unit 17, Hudson, MA 01749, Tel: 508-562-1173, TELEX: 951417MAGN, FAX: 508-562-1175; Empl.: 5 .... **D•1296**

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IN	Ft. Wayne, J & B Eng. Sls.	219-483-5873
MA	Chelmsford, Matrix Sls. Inc.	508-459-4000
MN	Minneapolis, Bill Deming & Associates	612-888-5000
MO	Maryland Hts., KJS Mktg.	314-770-1412
NY	Clark Mills, KLM Garner, Inc.	315-853-6126
NY	Ryebrook, Tekmar Sls.	914-632-2828
PA	Conshohoken, M. Lader Co.	215-825-3177
TX	Garland, Carey, McMahill Assocs.	214-681-1414
WA	Issaquah, Sea-Port Tech. Sls.	206-391-6714
Can	Quebec, R F Microwave	613-592-3379

MAGNUM OPUS CUSTOM ELCTRN. ENGRG., 284 Kennedy St., Iselin, NJ 08830, Tel: 908-283-4925, FAX: 908-283-4925; *Sls. Mgr.:* R. Galanty .... **D•1142**

MAGTECH CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92173, Tel: 619-662-2235, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* H. Cooperman

MAG-TEK, 20725 S. Annalee Ave., Carson, CA 90746, Tel: 213-631-8602, TWX: 510-600-0621 MAG TEK CRSN, FAX: 213-631-3956; *Dist. Mgr.:* Shelley Schira

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CA	Chatsworth, Cygnus Sls. & Engrg.	818-727-0312
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CT	Hartford, D.A. Crowley & Assocs.	203-956-9007
CT	New Britain, D.A. Crowley & Assocs.	203-223-8798
FL	Coral Springs, Steve Bruegger	305-341-5102
FL	Dade City, Marty Spahr	904-523-0996
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IL	Hoffman Estates, John Aguilar	708-843-7440
IL	Schaumburg, Seas (Silvers Elctrns.)	708-893-7999
IN	Huntington, Elctrn. Reps.	219-356-3513
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Lexington, Elctrn. Reps.	606-277-0436
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NJ	Mt. Laurel, S.J. Assocs.	609-866-1234
NY	Canandaigua, S.J. Assocs.	716-394-3281
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OH	Cleveland, RK Comps.	216-642-9312
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OR	Beaverton, UniComp, Inc.	503-643-1645
PA	Pittsburgh, R.K. Comps.	412-775-0747
SC	Mauldin, Carl Hart	803-288-2323
VA	Danville, F.B.D. Sls.	804-836-1499
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VA	Manassas(Northern), F.B.D. Sls. Corp.	703-369-7212
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AZ	Prescott, IMEC	602-445-8727
MA	Lee, Francis Biasin	413-243-0970
NJ	Upper Montclair, McCarron Entprs.	201-783-3112
NM	Albuquerque, IMEC	505-294-1124
TX	Dallas, S & B Sls.	214-369-5936

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OH	Cleveland, ESI	216-831-9555,FAX:216-831-8647
TX	Dallas, Eltec Sls.	817-268-2896,FAX:817-282-3010

MALLORY CONTROLS, Emerson Electric, 2831 Waterfront Pkwy-E. Drive, Indianapolis, IN 46214, Tel: 317-328-4010, FAX: 317-328-4244; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones .... **A•1099, 2092-2093**

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CA	Los Angeles, Manhattan Elec. Cable Corp.	800-423-4040
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CA	El Toro, Sourcery Wire & Cable	714-380-0466
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CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CO	Denver, CSID	303-292-9594
CT	Greenwich, Wise Comps.	203-531-4880
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Pensacola, Elctrn. Supp. Co.	904-432-6916
FL	Tamarac, Pacer Elctrns.	305-749-1910
FL	Tampa, Dow Elctrns.	813-626-5195
LA	Harahan, MG Elctrns.	504-733-0070
MD	Owings Mill, Cameo Elctrns.	800-227-7077
MA	Burlington, QPL	617-229-2424
MA	Hudson, Metro Wire & Cable	508-562-6288
MA	Woburn, Pacer	617-935-8330
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NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Cincinnati, Hughes Peters	800-543-4483
OH	Columbus, Hughes Peters	800-282-1262
OH	Strongsville, Calvert Wire & Cable	800-321-1203
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PA	Montgomeryville, Pytronic Inds.	800-562-5780
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TX	Austin, Wholesale Elctrn. Supp.	512-478-9568
TX	Houston, Houston Wholesale Elctrns.	713-644-8320
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MANNCORP, Box 8, Huntingdon Valley, PA 19006, Tel: 215-364-6100, FAX: 215-364-6110; Empl.: 15; *Dist. Mgr.:* Mickey Hoffer

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MANTEX CORP., 1800 Metamora Rd., P.O. Box 15, Oxford, MI 48371, Tel: 313-628-8210, FAX: 313-628-1520; Empl.: 100; *Sls. Mgr.:* Dave Wm. Rice

MANU-TRONICS, INC., 8701-100th St., Lakeview Corporate Pk., Kenosha, WI 53142-7799, Tel: 414-947-7700, FAX: 414-947-7729; Empl.: 250; *Sls. Mgr.:* Frank Montabana

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CA	Shingle Springs, LK Allen Comms.	916-676-2533
CO	Scientific Dvcs. West	303-665-8089
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CO	Littleton, K. C. Marketers, Inc.	303-972-8411
FL	Clearwater, Beacon Microwave	813-796-2378
GA	Alpharetta, Panterra Sls.	404-772-9944
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IL	Schaumburg, K.W. Meyers	708-882-4808
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KS	Pomona, Comms. Equip. Specs.	913-566-8387
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Local Sales Offices & Reps

PA	Sewickley, Teplitz-Byrne Assoc.	412-741-3628
WA	Bothell, D. Bartholomew	206-483-8617
WI	Green Bay, Winn Agency	414-336-7476
Can	Montreal, Metrone	514-483-2323

WILD OATS

FAX: 803-249-5191

MARKAT DIV., Wild Oats Corp., 1432 Fox Hollow Way, N. Myrtle Bch., SC 29582-2514, Tel: 803-249-5191; Empl.: 211; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

Markel CORPORATION

FAX: 215-270-3138

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960; FSC No.: 03890; Empl.: 228; *Sls. Mgr.:* Allan R. Soldwisch; *Dist. Mgr.:* L. J. Clemente .... **C•1666**

Local Sales Offices & Reps

AL	Montgomery, MYA, Inc.	205-284-1948
AZ	Scottsdale, Mid/West Co.	602-991-0427
CA	Montrose, Signal Enterprises	818-957-0640
CA	Santa Cruz, WestCal Sls.	408-423-9344
CO	Evergreen, Mid/West Co.	303-374-4829
FL	Ft. Lauderdale, Hawkins Frederickson	305-321-6702
FL	Maitland, Hawkins Frederickson	407-831-2474
IL	Schiller Pk., Wm. R. Bolles	312-678-7888
MD	Glen Burnie, C.W. Boss Co.	301-744-4611
MA	Hopedale, D.M.A. Mktg.	508-473-9994
MI	Northville, L. George & Assoc.	313-380-6300
MN	Brooklyn Park, Technical Comps. Grp.	612-561-5556
MO	Florissant, Mid/West Co.	314-837-3361
NJ	Colonia, Heft & Ficarra	201-381-5193
NY	Lynbrook, Heft & Ficarra	516-599-3351
NY	Rochester, Ontec	716-464-8636
OH	Chagrin Falls, Electrolock	216-543-6626
OR	Hillsboro, Temco NW	503-645-2030
PA	Flourtown, CGM Inc.	215-233-0333
SC	Greenville, Electrolock Inc.	803-297-9830
TN	Murfreesboro, Alpha Mktg.	615-896-6102
WA	Bothell, Temco NW	206-481-6150
WI	Mequon, Wm. R. Bolles	414-241-3320
EXP	Plymouth Meeting, PA, Ballagh & Thrall	215-825-5710
Can	Rexdale,Ont, True North Technology	416-744-2233

Local Distributors

CA	Los Angeles, Natl. Wire & Cable	213-225-5611
CA	Santa Clara, Amax Wire & Cable	408-727-3234
CO	Denver, Brownell Elctrns.	303-333-3541
CT	Hartford, Wes-Garde	203-527-7705
FL	Davie, Arco Distrs.	305-473-2550
FL	Lakeland, Switch Controls	800-282-7619
GA	Atlanta, Accu-Tech Cable	404-455-6422
IL	Chicago, Fay Electric Wire	708-267-9222
IL	West Chicago, J.J. Glenn	708-293-7800
IN	Indianapolis, Marian Rubber	317-638-6525
KS	Wichita, Midwest Aircraft Supp.	316-267-3318
LA	New Orleans, Radio Parts	504-581-5959
MD	Rockville, Read Plastics	301-881-7900
MI	St. Clair Shores, Spemco	313-771-2700
MN	Bloomington, K.L. Tannenill	612-881-6700
MO	St. Louis, Midwest Switch	314-567-7164
NY	Rochester, Simcona Elctrns.	716-328-3230
OH	Chagrin Falls, Electrolock	216-543-6626
OR	Wilsonville, O.T.S. Wire	503-682-7050
SC	Greenville, Electrolock, Inc.	803-297-9830
AR	Little Rock, Hisco	501-568-3105
CT	Manchester, IMS Inc.	203-288-7005
VA	Roanoke, Control Distbn.	703-774-4586
Can	Mississauga, Ont., Marflex-Barrett Ltd.	416-828-0220

MARKEM CORP., 150 Congress St., Keene, NH 03431, Tel: 603-352-1130, TELEX: 710-366-1800, FAX: 603-357-5871; FSC No.: 38360; Empl.: 1400; *Sls. Mgr.:* Rich Howsen

MARKETECH, INC., 11061 173rd Ave., N.W., Elk River, MN 55330-7034, Tel: 612-441-8664, FAX: 612-441-8692; FSC No.: 1505; Empl.: 13; *Sls. Mgr.:* Richard Duggan

MARK EYELET INC., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, TELEX: 69-6191, FAX: 203-755-9410; Empl.: 90; *Dist. Mgr.:* Andrew Babiak

MARKING METHODS, INC., 301 South Raymond Ave., Alhambra, CA 91803-1531, Tel: 818-282-8823, FAX: 818-576-7564; Empl.: 37; *Sls. Mgr.:* Ralph Gallella

MARKS POLARIZED CORP., 275-D Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-8900, FAX: 516-273-1190; FSC No.: 1240,1270,5895; Empl.: 10; *Sls. Mgr.:* Ronald M. Miller

MARKTECH INTERNATIONAL CORP., 5 Hemlock St., Latham, NY 12110, Tel: 518-786-6591, FAX: 518-786-6599; Empl.: 42

MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988, FAX: 714-982-8989; Empl.: 10; *Sls. Mgr.:* LeRoy Tichy

marlow industries, inc.

FAX: 214-341-5212

MARLOW INDUSTRIES, INC., 10451 Vista Park Rd., Dallas, TX 75238-1645, Tel: 214-340-4900; FSC No.: 55686; Empl.: 160; *Sls. Mgr.:* John Nelson; *Dist. Mgr.:* David Marlow .... **C•1602-1605**

MARQUARDT SWITCHES INC., 2711 Rte. 20 East, Cazenovia, NY 13035, Tel: 315-655-8050, TELEX: 703-287-UD, FAX: 315-655-8042; *Sls. Mgr.:* R. A. Philipchik, V.P. Mktg.; *Dist. Mgr.:* P. D'Addario

MARSH-MCBIRNEY, INC., 4539 Metropolitan Court, Frederick, MD 21701, Tel: 800-368-2723, 301-874-5599, TWX: 710-828-0083, FAX: 301-874-2172; Empl.: 105; *Sls. Mgr.:* Fred McKinney; *Dist. Mgr.:* Jan L. Pillar

MARSH PRODUCTS, INC., Spectrum Companies, Intl., 336 McKee St., Batavia, IL 60510, Tel: 708-879-8008, FAX: 708-879-8072

MARTEL ELECTRONICS, 90 Indian Rock Rd., Windham, NH 03087, Tel: 603-893-0886, FAX: 603-898-6820; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS. INC., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286, FAX: 216-442-7713; Empl.: 4; *Sls. Mgr.:* Christopher Martin; *Dist. Mgr.:* Christopher Martin

MARWAY PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; Empl.: 28; *Sls. Mgr.:* Jose Molina .... **D•2278-2281**

Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds, Inc.	602-439-0134
CA	Milpitas, Ward Elctrn. Packaging Sls.	408-945-0420
CA	Santa Ana, Marway Prods., Inc.	714-973-1800
CO	Monument, Sunbird Inds., Inc.	719-481-2900
CT	Meriden, PCS-Power Conversion Sys.	203-235-4886
FL	Land O' Lakes, AJ's Power Source, Inc.	813-996-2583
MD	Landover, Sel-Tronics, Inc.	301-341-2700
NH	Londonderry, PCS- Power Conversion Sys.	603-434-2371
OR	Portland, Underwood Assocs.	503-224-0583
TX	Richardson, BP Sls.	214-234-8438
WA	Seattle, Underwood Assocs.	206-870-7475
WA	Vancouver, Underwood Assocs.	206-695-2311

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, FAX: 203-744-6185; Empl.: 42; *Sls. Mgr.:* John M. Seacord

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 54; *Sls. Mgr.:* Don Royer, Natl. Sls. Mgr.; *Dist. Mgr.:* Scott Radwill, Intl. Sls. Mgr.

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MASTER BOND, 154 Hobart St., Hackensack, NJ 07601, Tel: 201-343-8983, FAX: 201-343-2132; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

MASTER CIRCUITS INC., 424 Apperson Way North, Kokomo, IN 46901, Tel: 317-457-6605, FAX: 317-452-3584; Empl.: 20; *Sls. Mgr.:* Felicia Abdon

MASTER DISTRIBUTORS, P.O. Box 25662, Los Angeles, CA 90025, Tel: 213-452-1229 **A•1250, 2424; B•1375, 1382, 1406, 1416, 1488, 1508, 1512, 1521, 1557, 1686, 1757; C•1439, 1626, 1642**

MASTER ELECTRONIC CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 310-452-1336, TELEX: 182041 MASTER SNM, FAX: 310-399-8600; Empl.: 74; *Sls. Mgr.:* Jamil Nizam; *Dist. Mgr.:* Belinda Valle **B•1558-1561**

Local Sales Offices & Reps

CA	Los Angeles, Master Distrs.	310-829-4656
CA	Santa Monica, Master Distrs.	310-452-1229

Local Distributors

AZ	Phoenix, Master Distrs.	602-267-1111
CA	Los Angeles, Brill Elctrns.	310-452-8002
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Oakland, Master Distrs.	510-835-1500
CA	Santa Monica, Master Distrs.	310-452-1336

MASTER MAGNETICS INC., The Magnet Source, 607 S. Gilbert St., Castle Rock, CO 80104, Tel: 800-525-3536, FAX: 303-688-5303; FSC No.: 5999; Empl.: 47; *Sls. Mgr.:* Jennifer Brown; *Dist. Mgr.:* Ed J. Hocks **A•1319**

Local Sales Offices & Reps

CA	Placentia, A-L-L Magnetics	714-632-1754
CO	Castle Rock, The Magnet Source	303-688-3966
FL	Miami, Miami Magnet Co., Inc.	305-823-1603

MATEC INSTRUMENTS, INC., 75 South St., Hopkinton, MA 01748, Tel: 508-435-9039, FAX: 508-435-5311; Empl.: 55; *Sls. Mgr.:* Ken Bishop

MATERIALS RESEARCH CORPORATION, 560 Rte. 303, Orangeburg, NY 10962, Tel: 914-359-4200, FAX: 914-359-3454; Empl.: 780; *Sls. Mgr.:* Edward Erny

Local Sales Offices & Reps

CA	Santa Clara	408-748-0902
NY	Orangeburg, Materials Rsch. Corp.	914-359-4200
TX	Dallas	214-235-9008

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MATH ASSOCS. INC., General Microwave Corp., 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8950, FAX: 516-226-8966; *Sls. Mgr.:* Bruce Berman

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 310-479-7180, FAX: 310-479-0942; *Sls. Mgr.:* Lorr Kramer

THE MATHWORKS, INC., Cochituate Pl., 24 Prime Park Way, Natick, MA 01760, Tel: 508-653-1415, FAX: 508-653-2997

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036, FAX: 317-248-8369; Empl.: 10 **D•1195**

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-231-8000, FAX: 919-231-8001; Empl.: 65; *Sls. Mgr.:* Sheldon Shapiro

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-222-2301, FAX: 818-222-2304; FSC No.: 33281; Empl.: 47; *Sls. Mgr.:* Randy Sue Rabideau **B•1562-1565**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assoc., Inc.	800-255-1965
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Los Alamitos, Tritek Solutions, Inc.	714-236-1190
CA	San Diego, Tritek Solutions, Inc.	619-455-1911
CA	San Jose, Tritek Solutions, Inc.	408-554-0455
CO	Louisville, Mountain States Reps.	303-665-8089
CT	Meriden, Polytek Assocs.	800-358-7348
FL	Melbourne, Reynolds Assocs., Inc.	800-251-1965
FL	Newport Richey, Reynolds Assocs.	800-255-1965
GA	Duluth, Reynolds Assoc., Inc.	800-255-1965
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
ME	Polytek Assocs.	800-358-7348
MA	Ashland, Polytek Assocs.	800-358-7348
MA	Falmouth Hgts., RJC Assocs.	508-540-8832
MI	Southfield, Comtel Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	Manchester, Comtel Midwest	314-227-7220
MT	Westcon, Inc.	800-547-4515
NH	Polytek Assocs.	800-358-7348
NY	Polytek Assocs.	800-358-7348
NC	Raleigh, Polytek Assocs.	800-255-1965
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Columbus, Comtel Instr.	614-876-8305
OH	Dayton, Comtel Instr.	513-426-5310
OR	Portland, Westcon, Inc.	800-547-4515
PA	Polytek Assocs.	800-358-7348
PA	Pittsburgh, Comtel Instr.	412-922-5720
SC	Reynolds & Assocs.	800-255-1965
TN	Reynolds Assocs., Inc.	800-255-1965
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Mountain States Reps.	303-665-8089
VT	Polytek Assocs.	800-358-7348
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Kent, Westcon, Inc.	800-547-4515
WI	New Berlin, Comtel Midwest	414-544-6042
Can	St. Laurent, Que., Electrodesign Ltd.	514-331-3202

MATROX ELECTRONIC SYSTEMS, LTD., 1055 St. Regis Blvd., Dorval, Que., Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 400; *Sls. Mgr.:* Ed Dwyer, VP Sls.

MATSUO
FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491; Empl.: 654; *Sls. Mgr.:* Ted Wiltse/John Carpenter **A•1100-1105**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
CA	Los Altos, Recht Assocs.	415-964-6231
CA	Mission Viejo, Angle Assocs.	714-582-8858
FL	Plantation, Gallagher	305-473-2101
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Des Plaines, ESCO Assocs.	708-298-5310
IN	Crawfordsville, Ed Mar Rep Assocs.	317-364-1871
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Madison Hgts., D.E.M. Sls.	313-583-1500
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NM	Albuquerque, FP Sls.	505-345-5553
NY	Plainview, Neptune Elctrns.	516-349-1600
NC	Raleigh, South Tech. Sls.	919-573-1313
OH	Columbus, Ed Mar Rep Assocs.	614-431-5151
OR	Beaverton, Elctrn. Sources, Inc.	503-627-0838
TX	Plano, RAM Elctrns.	214-578-5400
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Elctrns.	714-892-7749
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	W. Covina, CSI	818-960-4761
CA	Yorba Linda, Corona Elctrns.	714-283-8185
FL	Boca Raton, NRC Elctrns.	407-241-8600
GA	Norcross, NRC-Jaro	404-729-0411
GA	Norcross, Spectrum Elctrns.	404-448-1516
IL	Arlington Heights, Mar/Lyn	312-364-0444
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
MI	Farmington Hills, Key Elctrns.	313-489-5455
MN	New Brighton, Parts 1	612-633-8079
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Buffalo, Summit	716-887-2800
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
OH	Cleveland, Repco	216-248-8900
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TN	Knoxville, Venture Elctrns. Sls.	615-544-0723
TX	Dallas, Omni-Pro	214-233-0500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019-0339, Tel: 717-432-8686, FAX: 717-432-8688; Empl.: 25; *Sls. Mgr.:* Frank A. Ulrich; *Dist. Mgr.:* Frank A. Ulrich

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski **A•2095-2103**

Local Sales Offices & Reps

CT	Killingworth, Gallagher Assocs.	203-663-2338
MA	Framingham, Gallagher Assocs.	617-626-2346
TX	Dallas, THT Sls. Co.	214-783-1501

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Margate, Allied Elctrns.	305-973-3070
LA	Lafayette, Ralphs Elctrns. Supply	800-825-4507
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Montville, Servo Sys. Co.	800-922-1103
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Akron, Stotts-Friedman	216-253-7000
OH	Cincinnati, Stotts-Friedman	513-574-7701
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Appleton, Appleton Elctrns.	414-734-5767

MAURY MICROWAVE CORP., 2900 Inland Empire Blvd., Ontario, CA 91764, Tel: 909-987-4715, FAX: 909-987-1112; FSC No.: 13047; Empl.: 75; *Sls. Mgr.:* M. A. Maury, Jr.

MAXELL CORP. OF AMERICA, 22-08 Rte. 208 S., Fair Lawn, NJ 07410, Tel: 201-794-5900, FAX: 201-796-8790; *Sls. Mgr.:* Ian D. Irving

MAXIM INTEGRATED PRODUCTS, 120 San Gabriel Dr., Sunnyvale, CA 94086, Tel: 408-737-7600, FAX: 408-737-7194

MAX LEVY AUTOGRAPH, INC., 220 West Roberts Ave., Philadelphia, PA 19144-4298, Tel: 215-842-3675, FAX: 215-842-3637; FSC No.: 35885; Empl.: 20; *Sls. Mgr.:* Gary Cohen

MAXMAR CONTROLS INC., 99 Castleton St., Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567; *Sls. Mgr.:* Max Birrer; *Dist. Mgr.:* Max Birrer

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Sam Robinson

MAXUS ELECTRONIC CORP., 2760 29th St., Boulder, CO 80301, Tel: 303-447-1226, FAX: 303-447-1446; Empl.: 6; *Sls. Mgr.:* Cory J. Gates

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, FAX: 619-279-1554; Empl.: 600; *Sls. Mgr.:* Michael M. Plum, V.P. Mktg.

MBD INTERNATIONAL, P.O. Box 870577, Dallas, TX 75287-0577, Tel: 214-788-5277, FAX: 214-404-0471; Empl.: 5; *Sls. Mgr.:* Robert McLeod; *Dist. Mgr.:* Robert McLeod

MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

MCCOY/OVENAIRE/SPECTRUM, A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 450 .... **A•1412-1417**

Local Sales Offices & Reps

AL	Madison, Arthur, Harris, Assocs.	205-461-9896, FAX:205-461-9897
AZ	Mesa, Sedco Sls.	602-461-9069, FAX:602-461-1695
CA	Chatsworth, Wes-K/Raltech, Inc.	818-700-0933, FAX:818-709-9832
CA	Goleta, Thorson Co.	805-964-8751, FAX:805-964-8753
CA	San Diego, Thorson Co.	619-292-8525, FAX:619-292-9052
CA	San Mateo, Melvin Sls.	415-349-7445, FAX:415-349-6340
CA	Signal Hill, Thorson Co.	310-595-0361, FAX:310-595-1389
CO	Grand Function, Krebill Comp. Sls.	303-243-8220, FAX:303-243-7939
CO	Littleton, Advanced Tech Mktg.	303-798-4200
FL	Longwood, Septer & Assocs., Inc.	407-774-3161, FAX:407-774-2585
FL	Oviedo, Conley & Assocs.	407-365-3283, FAX:407-365-3727
GA	Marietta, Arthur, Harris, Assocs.	404-565-5506, FAX:404-971-9778
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IL	Northfield, Feller Assoc.	708-446-8065
IN	Ft. Wayne, Skyline Sls. & Assocs., Inc.	219-489-4992,FAX:219-489-6194
IN	Kokomo, Skyline Sls. & Assocs., Inc.	317-452-6500, FAX:317-452-6006
IA	Cedar Rapids, Jack L. Tucker & Assoc.	319-395-7616,FAX:319-395-7873
KY	Lexington, Skyline Sls. & Assocs., Inc.	606-276-5061,FAX:606-276-5142
MD	Towson, Dickison Sls.	410-823-0923, FAX:410-321-9664
MA	Norwood, Naton Assoc.	617-762-3224, FAX:617-769-4849
MN	Minneapolis, Dunlop Conslts.	612-557-1076
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	East Amherst, Foster & Wager, Inc.	716-688-7864
NY	Endicott, Foster & Wager, Inc.	607-748-5963, FAX:607-748-5965
NY	Liverpool, Foster & Wager, Inc.	315-457-7954, FAX:315-457-7076
NY	New Rochelle, Ascor Elctrns.	914-235-8838, FAX:914-235-2690
NY	Rochester, Foster & Wager, Inc.	716-385-7744, FAX:716-586-1359
NC	Greensboro, Arthur, Harris, Assocs.	919-275-3030, FAX:919-275-3877
NC	Matthews, Arthur, Harris, Assocs.	704-845-1085, FAX:704-845-1086
OR	Tigard, Eltech Incorp.	503-684-3458, FAX:503-684-6043
PA	Ft. Washington, Beta Sls.	215-643-6650, FAX:215-643-6651
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447, FAX:214-231-8314
VA	Charlottesville, PDQ Sls.	804-979-7085, FAX:804-979-2155
WA	Bellevue, Eltech. Incorp.	206-643-4330, FAX:206-643-0525
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200
EXP	Oradell, NJ, Sylvan Ginsbury	201-261-3200, FAX:201-261-2729
Can	Brampton, Ont., Elctrns. Sls. Prof. (ESP)	416-458-1103,FAX:416-458-4469
Can	Chateauguay, Que., Elctrns. Sls. Prof. (ESP)	514-227-2639,FAX:514-227-1518
Can	Ottawa, Ont., Elctrns. Sls. Prof. (ESP)	613-567-8547,FAX:613-567-8548
Can	Scarborough, Ont., Elctrns. Sls. Prof. (ESP)	416-321-9693,FAX:416-321-9794

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 407-845-2837, TELEX: 44105 (MCE UI), FAX: 407-863-8275; Empl.: 58; *Sls. Mgr.:* Thomas Munn

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 310-948-4414, FAX: 310-948-1291; FSC No.: 25750; Empl.: 30

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, FAX: 516-586-5120; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Don Worden .... **B•1368**

Local Sales Offices & Reps

CA	Jamul, Power Partners	619-669-0354
CA	Los Angeles, Power Partners	310-215-0800
CA	San Bruno, Gateway Elctrl. Sls.	415-875-1600
CA	Ventura, Power Partners	805-659-5356
CO	Denver, Computer Power & Air	303-534-4235
FL	Vero Bch., E.J. Ruth Assoc.	407-234-5460
IL	Crystal Lake, Carzoli Engr. Sls.	815-459-4397
IN	Fort Wayne, Progressive Controls	219-482-1409
LA	New Orleans, Indcom Sys.	504-486-4455
MA	Woburn, EMS	617-229-6686
MN	St. Louis Pk., Electro Midwest	612-922-7017
NJ	Oakland, Midlantic Mktg.	201-848-1144
OK	Oklahoma City, Circa Inc.	405-236-2606
OK	Tulsa, Allan & Assoc.	918-451-2962
TN	Ramona, Powerforce Sys.	615-681-6255
TX	Houston, Koenig & Assoc.	713-453-8844
TX	Richardson, Devices, Inc.	214-250-2093
UT	Salt Lake City, S&T Mktg.	801-268-8183
WV	Huntington, Seco, Inc.	304-522-9732

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Local Sales Offices & Reps

AL	Huntsville, James E. Heusser Agy.	205-836-3896
CA	Cotati, Joseph Foster	707-792-4392
CA	Downey, Sierra Indl. Eng. Co.	310-803-6330
CO	Northglenn, Dan Ryall	303-452-8185
CT	Bristol, Eric Peterson	203-297-7464
IN	Bremen, Jan Richard Stahly	219-282-3592
IA	Des Moines, Jerry Bunch Electrical Sls.	515-287-7057
MI	Chelsea, Rick Mayday	313-995-2965
MN	Eagan, Stan Lock	612-890-9347
MS	Brandon, Service Electrical Sls.	601-992-9122
MO	St. Peters, Neil Klocke	314-947-2259
NJ	Plainfield, Don MacGillivray	908-753-4890
NM	Albuquerque, Paul Atkinson	505-292-1222
NY	Rochester, Integra Sls., Inc.	716-328-2110
OH	Euclid, Joe Ciulla	216-574-7164
PA	Coatesville, Emmett Ferra	215-380-8289
SC	Columbia, Harold Heaton	803-733-0941
TN	Nashville, Richard Hardy	615-748-1150
TX	Dallas, Raley Sls. Co.	214-368-1683
UT	Salt Lake City, Kev Paul	801-484-9941
VA	Richmond, Wynn Meredith	804-275-7970
WI	Kenosha, Wally Coats	312-299-2354
Can	Mississauga, Ont., Marr Elec. Ltd.	416-277-9481

Local Distributors

AL	Birmingham, Control Comps., Inc.	205-942-3760
AZ	Tempe, Lcomp	602-730-1633
CA	Gardena, California Switch & Signal	213-770-2330
CA	Tustin, Western Switches	714-259-8144
CT	Wallingford, Cronin Elctrns.	203-624-3134
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141
FL	Tampa, Raybro Elec. Supplies, Inc.	813-228-8571
IL	Wheeling, Hawk Elctrns.	708-459-4050
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Livonia, RS Elctrns.	313-525-1155
MI	St. Clair Shores, SPEMCO	313-771-2700
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Oakland, Relay Specialties Inc.	201-337-1000
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Woodside, Switches Unltd., Inc.	718-478-5000
NC	Charlotte, Southeastern Elctrns.	704-523-1122
OH	Maumee, RS Elctrns.	419-893-0721
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Erie, Seaway Elec. Supp.	814-455-1304
WA	Renton, Dunn Elctrns.	206-271-6213
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* R. O'Neill

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FAX: 516-587-0624

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams .... **A•2392-2403**

Local Sales Offices & Reps

MA	Orange, MCI Transformer	508-544-8272
NH	Nashua, Key Sls. of New England, Inc.	603-888-8742

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FAX: 510-651-1020

MCKENZIE TECHNOLOGY, 910 Page Ave., Fremont, CA 94538, Tel: 510-651-2700; FSC No.: 5938; Empl.: 175; *Sls. Mgr.:* Kari Trautman; *Dist. Mgr.:* Vicky Wodopianov .... **C•1415**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Pleasanton (N), Moulthrop Sls.	510-463-0450
CA	San Marcos, Falcon	619-591-0504
CO	Aurora, Interconnect Sls.	303-751-8777
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Apopka, Cartwright & Bean, Inc.	407-889-9100
FL	Deerfield, Cartwright & Bean, Inc.	305-429-3400
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Woodbridge, Golten Assocs., Inc.	708-985-5100
IN	Fishers, Connect 21	317-578-2121
MD	Ellicott City, Tech. Sls.	410-461-2400
MA	Hudson, Compak Inc.	508-568-0331
MI	Brighton, Elctrn. Sources	313-227-3598
MN	Edina, GP Sls. Inc.	612-831-2362
NJ	Medford, The McCoy Grp.	609-953-0770

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NY	Manlius, Lamtec	315-682-4780
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Loveland, Centruy Tech. Sls.	513-677-5088
OR	Beaverton, Westmark Elctrns.	503-641-8780
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, JYSCO.	214-349-1650
WA	Bellevue, Westmark Elctrns.	206-454-1944
Can	Ontario, Cana Rep Grp.	613-692-4682

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, D.C. Elctrns.	602-438-1234
AZ	Tempe, TTI	602-431-1191
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fountain Valley, Comps Ctr., Inc.	714-979-0433
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	Milpitas, R&D Elctrn. Parts	408-262-7144
CA	Milpitas, TTI	408-946-5577
CA	Mission Hills, TTI	818-891-8885
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Diego, TTI	619-748-2025
CA	San Jose, D.C. Elctrns.	408-453-2400
CA	Santa Ana, TTI	714-641-9393
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CA	Torrence, Kent Elctrns.	714-773-0781
CA	Tustin, D.C. Elctrns.	714-259-9066
CO	Denver, Alliance Elctrns.	303-433-1648
CO	Englewood, Kent Elctrns.	303-762-0670
CT	South Bay, Heilind Elctrns.	203-262-1700
CT	Wallingford, TTI	203-284-7474
FL	Largo, Electronic Precepts of FL, Inc.	813-544-3636
FL	Largo, Kent Elctrns.	813-545-0057
FL	Longwood, RM Elctrns.	407-767-8005
FL	Orlando, TTI	407-859-1000
GA	Norcross, TTI	404-662-0911
IL	Elk Grove Vlg., Kent Elctrns.	708-529-9977
IL	Schaumburg, TTI	708-884-6500
IN	Indianapolis, RM Elctrns.	317-843-9403
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
MD	Columbia, Kent Elctrns.	301-720-6000
MD	Columbia, TTI	410-995-1331
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Tewksbury, TTI	508-857-2000
MA	Wilmington, Heilind Elctrns.	800-800-1666
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Duluth, Parts 1	218-624-0651
MN	Minnetonka, TTI	612-933-8555
MN	Roseville, Parts 1	612-633-8079
MN	St. Paul, Kent Elctrns.	612-642-2828
MN	Stillwater, Elctrn. Depot Supp. Co.	612-439-9409
MO	Hazelwood, Kent Elctrns.	314-895-1515
MO	Independence, Kent Elctrns.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Mt. Laurel, TTI	609-234-6400
NY	Rochester, Cam RPC Elctrns.	800-827-2650
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Century Elctrns.	919-596-2220
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
OR	Beaverton, Kent Elctrns.	503-626-8300
PA	Pittsburgh, CAM RPC Elctrns.	412-782-3770
TX	Austin, Kent Elctrns.	512-834-1900
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, TTI	817-834-2202
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, TTI	713-879-5800
TX	Richardson, Kent	214-669-2600
WA	Redmond, TTI	206-882-0291
WA	Kent, Comp. Resources, Inc.	206-340-1646

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60440-4999, Tel: 708-759-9500, TWX: 910-683-1899, FAX: 708-759-5018 FSC No.: 16469; Empl.: 127; *Sls. Mgr.:* Ron Adamson

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FAX: 609-799-1081

MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed …… **C•1606-1607**

Local Sales Offices & Reps

AL	Huntsville, Raycom	205-895-9264
AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	San Mateo, Halbar Assocs.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Boulder, Comps. Prods. Sls.	303-530-2800
FL	Orlando, Raycom	407-859-5504
IL	Elmhurst, Scott Assocs.	708-279-5681
MD	Rockville, Marktron	301-251-8990
MA	Chelmsford, JEBCO	508-256-5800
MI	Farmington, Marlow Assocs.	313-478-2240
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Lebanon, Sylvester Sls. Assocs.	201-735-2488
NM	Albuquerque, S & S Technlgs.	505-298-7177
NY	Rochester, Talty Assocs.	716-323-1210
NC	Raleigh, Raycom	919-266-9827
OH	Cleveland, Marlow Assoc.	216-831-8232
OH	Dayton, Marlow Assoc.	513-274-9666
OR	Tigard, Halbar-RTS	503-624-5741
PA	Allison Park, Marlow Assoc.	412-487-0664
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
TX	Dallas, REM-AIR	214-234-1069
WA	Redmond, Halbar-RTS	206-882-0990
Can	Guelph, Ont., Hammond Mfg. Co.	519-822-2960

Local Distributors

FL	Ft. Lauderdale, Component Distrs.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MI	Ann Arbor, Wedemeyer Elctrn. Supp. Co.	313-665-8611
NC	Raleigh, Component Distrs.	919-834-9465
TX	Dallas, Component Distrs.	214-644-0373
Can	Guelph, Ontario, Hammond Mfg. Co.	519-822-2960

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Local Sales Offices & Reps

AZ	Tempe, Border States Tech. Assocs. Inc.	602-839-0248
CA	Laguna Hills, Western Automation	714-859-6988
CA	Oakland, Powermatic Assocs.	510-635-6825
CO	Boulder, Comp. Prod. Sls. Co.	303-530-2800
FL	Winter Pk., Southland Comps. Inc.	407-629-5550
GA	Norcross, F & J Squared Assocs.	404-368-9191
IL	Elmhurst, Scott Assocs., Inc.	708-279-5681
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Chelmsford, John E. Boeing Co.	508-256-5800
MI	Sterling Hgts., Alliance Sls. Co.	313-726-8670
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Totowa, R.O.I. Sls. Co.	201-812-9606
NY	Endwell, Reagan/Compar, Inc.	607-754-2171
NC	Charlotte, F & J Squared Assocs.	803-548-2133
OH	Cleveland, Marlow Assocs.	216-831-8232
PA	Huntingdon Valley, Inacker Sls. Inc.	215-947-5660
PA	Pittsburgh, Marlow Assocs., Inc.	412-487-0664
TX	Dallas, The Power Connection	214-401-3490
WA	Redmond, HALBAR-RTS, Inc.	206-882-0990

MCSI, 2598-G Fortune Way, Vista, CA 92083, Tel: 619-598-2177, FAX: 619-598-2450; Empl.: 25; *Sls. Mgr.:* Jim Edwards

Local Sales Offices & Reps

CA	Laguna Hills, Computech Assocs.	714-837-8421
CA	Sunnyvale, Qualtech Assocs.	408-732-4800
CT	Orange, Isdale Assocs.	203-387-2704
GA	Duluth, Dixie Tech. Mktg.	404-381-5592
IL	Arlington Heights, Coombs Assocs., Inc.	708-439-9892

3M AUDIO AND VIDEO MARKETS DIVISION, 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-7644, FAX: 612-737-5583; Empl.: 38,351

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3M ELECTRICAL SPECIALITIES DIVISION, 6801 River Place Blvd., Bldg. 130-3N-56, Austin, TX 78726-9000, Tel: 800-328-1368; *Sls. Mgr.:* Mike Martin …… **C•1667; D•2311**

Local Sales Offices & Reps

CA	Los Angeles	213-726-6563
GA	Atlanta	404-447-7000
MN	St. Paul	612-736-3269
PA	Philadelphia	215-638-6300

3M PHOTODYNE PRODUCTS, See 3M Telecom Markets Divison

3M-ELECTRONIC PRODUCTS DIVISION, 6801 River Place Blvd., Austin, TX 78726, Tel: 1-800-225-5373 Sls. & Prod. Info., TELEX: 29-7023, FAX: 512-984-6972; *Sls. Mgr.:* Joe Bruzzone …… **C•1667; D•2311**

Local Sales Offices & Reps

CA	Campbell, Olsheski & Assoc.	408-378-6003
CA	Danville, Olsheski & Assoc.	415-820-9144
CA	Valencia, Cessing Assocs.	805-295-0225
CO	Wheatridge, Cluff & Assoc.	303-425-6604
CT	Chesire, The Macinnis Co.	203-372-3797
FL	Apopka, Cartwright & Bean, Inc.	407-889-2168
FL	Deerfield Beach, Cartwright & Bean, Inc.	305-429-3400
GA	Atlanta, Wallace Elctrn. Sls.	800-334-3518
IL	Lombard, RMP/McBride Corp.	312-932-9090
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Cedar Rapids, T. Dowell & Assoc.	319-364-3880
KS	Overland Park, T. Dowell & Assoc.	913-599-1100
LA	Slidell, Wallace Elctrn. Sls.	504-643-4751
MD	Lisbon, S.K. MacDonald, Inc.	301-442-1590
MA	Norwood, The Macinnis Co.	617-762-8090
MI	Warren, Burcaw Co.	313-573-6048
MI	Wyoming, Burcaw Co.	313-573-4605
MN	Edina, Restronics, Inc.	612-941-9135
MO	St. Louis, T. Dowell & Assoc.	314-849-4334
NJ	Cherry Hill, S.K. MacDonald, Inc.	609-482-2666
NY	Hauppauge, Aurora-Schmitt Assoc.	516-434-1572
NY	Syracuse, T-Squared Elctrns., Co.	315-463-8592
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Beachwood, Elctrns. Salemasters	216-831-9555
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
PA	Monroeville, S.K. MacDonald, Inc.	412-373-1723
TN	Tullahoma, Wallace Elctrn. Sls.	800-334-3518
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
Can	London, Ont., David Allen	

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Acacia/Deanco, Inc.	602-894-2874, 602-882-9054
AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
CA	Chatsworth, Hall-Mark	818-773-4500
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Fremont, Acacia/Deanco, Inc.	415-623-7500
CA	Garden Grove, Richey/Impact Elctrns.	714-895-0060
CA	Irvine, Acacia/Deanco, Inc.	714-660-0834, 213-971-2428
CA	Rocklin, Hall-Mark	916-624-9718
CA	San Diego, Acacia/Deanco, Inc.	619-565-4365
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Richey/Impact Elctrns., Inc.	619-271-4511
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Jose, Hall-Mark	408-432-0900
CA	San Jose, Powell Elctrns., Inc.	408-943-9020
CA	San Jose, Richey/Impact Elctrns., Inc.	408-432-7100
CA	San Jose, Shelley/Ragon	408-432-0600
CA	Santa Clara, DC Elctrn. Supp.	408-980-1199
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Tustin, DC Elctrns.	714-259-9066
CA	Tustin, Hall-Mark	714-669-4700
CO	Denver, CSID/Integrated Fastn. Inc.	303-292-9594
CO	Englewood, Hall-Mark	303-790-1662,303-790-4991
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
CO	Englewood, Shelley/Ragon	303-762-0670

CT	Cheshire, Hall-Mark	203-271-1704
CT	East Haven, JV Elctrns.	203-469-2321
CT	Yalesville, Schaal Assocs., Inc.	203-269-3779
FL	Casselberry, Hall-Mark	407-830-5855
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Largo, Hall-Mark	813-541-7440
FL	Pompano Beach, Hall-Mark	305-971-9280
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
FL	Winter Park, Deanco	305-671-5100
GA	Marietta, Deanco	404-429-0126
GA	Norcross, Hall-Mark	404-447-8000
IL	Bensenville, Magnuson Elctrns.	312-595-7575
IL	Wood Dale, Hall-Mark	312-860-3800,312-860-0239
IL	Wood Dale, NEP Elctrns., Inc.	312-595-8500
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422
IN	Indianapolis, Bell Inds., Inc.	317-875-8200, 800-622-4814,
IN	Indianapolis, Hall-Mark	317-872-8875
IN	Indianapolis, Magnuson Elctrns., Inc.	317-247-5108
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
KS	Lenexa, Hall-Mark	913-888-4747
MD	Annapolis Jct., Powell Elctrns., Inc.	301-880-3255, 301-953-3435
MD	Columbia, Aztech Elctrns.	301-995-6800, 800-777-5977
MD	Columbia, Hall-Mark	301-998-9800
MD	Gaithersburg, Deanco	301-948-5444
MA	Billerica, Hall-Mark	508-667-0902
MA	Burlington, Schaal Assocs./Deanco	617-272-1506
MA	Canton, Richey/Impact Elctrns.	617-821-1500
MA	Westboro, Powell Elctrns.	508-366-6100
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Hall-Mark	313-462-1205
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Eden Prairie, Hall-Mark	612-941-2600
MN	St. Paul, Shelley/Ragon Elctrns.	612-642-2828
MO	Earth City, Hall-Mark	314-291-5350
MO	Hazelwood, Shelley-Ragon, Inc.	314-895-1515
MO	Independence, Shelley/Ragon Inc.	816-254-3410
MO	St. Charles, Lectronix, Inc.	314-946-6424, 800-325-3348
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Fairfield, Deanco	201-575-7960
NJ	Parsippany, Hall-Mark	201-515-4475
NJ	Teterboro, EAC	201-772-6400,201-288-4477
NJ	Mt. Laurel, Hall-Mark	609-235-1900
NY	Fairport, Hall-Mark	716-425-3300
NY	Farmingdale, Addem Distrs.	516-752-9303
NY	Hauppauge, Schaal Assocs., Inc.	516-434-7100
NY	Ithaca, Deanco	607-257-4444
NY	Medford, Shelley-Ragon, Inc.	516-447-2000
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Raleigh, Deanco, Inc.	919-851-2065
NC	Raleigh, Hall-Mark	919-872-0712
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns. Mktg. Corp.	513-439-4711
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Highland Heights, Elctrns. Mktg. Corp.	216-442-3441
OH	Solon, Hall-Mark	216-349-4632
OH	Worthington, Hall-Mark	614-888-3313
OK	Tulsa, Hall-Mark	918-254-6110
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Acacia/Deanco, Inc.	503-646-3377
OR	Beaverton, Shelley/Ragon	503-641-1691
OR	Tualatin, Moore Elctrns., Inc.	503-692-5333
TX	Houston, Hall-Mark	713-781-6100
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Richardson, Kent Electrns.	214-669-2600
TX	Austin, Hall-Mark	512-258-8848
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Norvell Elctrns., Inc.	512-837-5555
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	El Paso, ERA Elctrns.	915-855-3600
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Plano, Tactic Elctrns.	214-422-0777
UT	W. Valley City, Hall-Mark	801-972-1008
WA	Redmond, Acacia/Deanco, Inc.	206-881-5566
WA	Redmond, Shelley/Ragon Elctrns.	206-883-2220
WA	Seattle, Hall-Mark	206-547-0415
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	Milwaukee, Elctrn. Expeditors, Inc.	414-228-8100
WI	New Berlin, Hall-Mark	414-797-7844

3M PRIVATE NETWORK PRODUCTS, 3M, 6801 River Place Blvd., Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-6628; Empl.: 50; *Sls. Mgr.:* R.C. Ware

3M TELECOM MARKETS DIVISION, 6801 River Place, Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-3408; *Sls. Mgr.:* W.E. Metzler

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628

MDM, INC., 9601 Irondale Ave., Chatsworth, CA 91311, Tel: 818-700-8400, FAX: 818-700-1938; FSC No.: 60994; Empl.: 150; *Sls. Mgr.:* Steven J. LaLonde

MDS CALIBRATION LAB. INC., 437-H. Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

MEASUREMENT SYSTEMS, INC., 777 Commerce Dr., Fairfield, CT 06430, Tel: 203-336-4590, FAX: 203-336-5945; Empl.: 97; *Sls. Mgr.:* Gerard M. Lacrocque, Nat'l. Sls. Mgr. .... **D•1163**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Anaheim, Gabriel & Assoc.	714-531-7674
IA	Cedar Rapids, S & O Sls.	319-393-7331
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Hudson, Data Rep	508-481-0333
MN	Edina, Elctrn. Sls., Inc.	612-933-9070
MO	St. Louis, J. S. DeWeese Co.	314-469-7350
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Richmond, Robert Elctrn. Sls.	804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-45-44973366, FAX: 011-4544681514; Empl.: 50

Local Sales Offices & Reps

CA	San Rafael, Wright Assocs.	415-457-9940
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Tustin, Schoenbachler-Dobson	715-544-1888
FL	Tampa, Florida Comps. Sls.	813-873-3622
IL	Schiller Park, W.R.B. Inc.	708-678-7888
IN	Ft. Wayne, Menze Sale	219-747-5616
KS	Overland Park, M.I.N.K. Assocs., Inc.	913-341-8309
MD	Gaithersburg, Naudian Assoc. Southern	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-536-9512
MO	Bridgeton, M.I.N.K. Assocs., Inc.	314-291-5454
NY	Great Neck, Pacent Engrg.	516-482-4678
NJ	Union, Pacent Engrg.	201-687-7197
NJ	Burlington, VDE Elctrns.	609-387-9331
NC	Silver City, Crossroads Elctrns.	919-742-2372
TX	Richardson, R.F. Kimball Co.	214-231-3447
WI	Mequon, W M Bolles Assoc. Inc.	414-241-3320

Local Distributors

CA	Gardena, California Switch & Signal	310-538-9830
CA	Los Angeles, Electric Switch	213-660-1310
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Wes-Garde Comp. Grp.	213-873-4802
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Switch Controls, Inc.	813-644-7564
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Spemco Inc.	313-771-2700
MN	Minneapolis, Carl Bergquist Co.	612-835-2322
MO	St. Louis, Wes-Garde Comp.	314-567-7776
NH	Nashua, Wes-Garde Comp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
TX	Dallas, Wes-Garde Comps.	214-357-1768
WI	Milwaukee, Progressive Image	414-321-4722

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson .... **B•1369-1374**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech.	205-350-0630
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Los Angeles, Universal Components Co.	213-641-4255
CA	Sunnyvale, Pass Associates	408-735-9040
CO	Denver, Advent Comps. Corp.	303-455-1985
FL	Tampa, Florida Comp. Sls., Inc.	813-873-3622
GA	Marietta, Tenn Tech.	404-971-1419
IL	Barrington, Perhats Assocs.	708-381-6360
IN	Indianapolis, Rockford Controls Ohio	317-251-2866
KS	Prairie Village, C. Logsdon & Assoc.	913-381-3833
MD	Pikesville, Muncy Sls.	301-484-6376
MA	Danvers, Global Technical Sales	508-774-0111
MN	St. Paul, Mackubin Grp.	612-636-5686
MO	St.Louis, C. Logsdon & Assoc.	314-849-5125
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Port Washington, Ashtec, Inc.	516-267-0981
NC	Garner, Tenn Tech.	919-779-3309
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
OK	Barrington, Global Technical Sales	603-664-5780
OR	Hillsboro, Doran Sales Assoc.	503-640-4500
RI	Lincoln, Global Technical Sales	401-334-3830
TX	Dallas, Control Comps. Corp.	214-458-8877
WA	Redmond, Doran Sales Assoc.	206-448-1200
Can	Downsview, Ont., Har Tech	416-665-7773
Can	Pointe Claire, Que., Har Tech	514-694-6110

Local Distributors

CA	Gardena, Cal Switch	213-770-2330/213-538-9830
CA	San Carlos, Campbell & George Co.	415-594-1994
CO	Denver, Consolidated Parts	800-748-2963
FL	Ft. Lauderdale, Zelcon, Inc.	305-565-2555/6
FL	Lakeland, Wes-Garde Comps. Grp.	800-282-7619
IL	Carol Stream, Wes-Garde Comps. Grp.	800-323-9431
IL	Chicago, Nep Elctrns.	708-625-8400
MA	Danvers, RCI	617-777-4441
MI	St. Clair Shore, Spemco Switch, Inc.	313-771-2700
MN	Minneapolis, Berquist	612-835-2322
NY	Bohemia, Genelco	800-645-9802
NY	Plainview, Linrose Elctrns.	516-293-2520
NY	Woodside, Switches Unlimited	800-221-0487
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
TX	Arlington, Bell Components Sls., Inc.	817-461-5303
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-9999
Can	St. Laurent, Que., Tara Inds. Corp.	514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, FAX: 206-236-5480; Empl.: 40; *Sls. Mgr.:* Jim Innes .... **C•1610-1611**

Local Sales Offices & Reps

WA	Mercer Island, Mechatronics Inc.	206-232-4800

MECH-TRONICS, 100 Campus Dr., RR 30, Mount Holly, NJ 08060, Tel: 609-267-0680, FAX: 609-267-7621; *Sls. Mgr.:* Peter Reed

MECO PRECISION/INDS. INC., 955 Connecticut Ave., Bridgeport, CT 06607, Tel: 203-333-4900, FAX: 203-333-4519; FSC No.: OSBC1; Empl.: 10

MEDA, INC., Macintyre Electronics Design Assocs., 485 Spring Pk. Pl., Ste 350, Herndon, VA 22070, Tel: 703-471-1445, FAX: 703-471-9130; Empl.: 6; *Sls. Mgr.:* Barbara Vayda

Local Distributors

CA	Carlsbad, ASC Scientific	619-431-2655
MA	Worcester, Walker Scientific Inc.	508-852-3674
PA	Media, Phase Two Technlgs., Inc.	215-340-0313

BRILL ELECTRONICS
(510) 834-5888
810 E. 10th. St., Oakland, CA 94606
MEC MASTER ELECTRONIC CONTROLS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

MEDIA RECOVERY INC., Box 1407, Graham, TX 76450, Tel: 800-527-9497, 817-549-5462 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEDICAM TECHNOLOGIES INC., 35 Sagamore Park Dr., Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 4; *Sls. Mgr.:* Robert C. Rush

MEGA CIRCUIT, INC., 1040 S. Westgate, Addison, IL 60101, Tel: 708-629-1800, FAX: 708-629-1800; Empl.: 45; *Sls. Mgr.:* Jim Malavia

MEGADATA CORP., 35 Orville Dr., Bohemia, NY 11716, Tel: 516-589-6800, FAX: 516-589-6858; FSC No.: 53436; Empl.: 40; *Sls. Mgr.:* Steve Sloan

MEGA SYSTEMS & CHEMICALS, 4828 S. 40th St., Phoenix, AZ 85040, Tel: 602-437-9105, FAX: 602-437-2613; Empl.: 15

Local Sales Offices & Reps

OR	Portland, Mega Sys. & Chemicals	503-228-4773
EXP	Milano, Italy, High Purity Tech.	02-26821604
EXP	Swindon, England, Wessex Semicon	602-437-9105

(MEI) MARPET ENTERPRISES, INC., 107 Audubon Rd., Wakefield, MA 01880, Tel: 617-246-2040, FAX: 617-246-0603; Empl.: 30; *Sls. Mgr.:* John A. Pope

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MEKTRONIX TECHNOLOGY, INC., 507 N. Milwaukee Ave., Libertyville, IL 60048-2000, Tel: 708-680-3300, FAX: 708-680-1868; Empl.: 5; *Sls. Mgr.:* Gregory Mayworm

MELCHER

Tel: 800-828-9712

MELCHER, INC., Melcher AG, 187 Billerica Rd., Chelmsford, MA 01824, FAX: 508-256-4642 ; Empl.: 280; *Sls. Mgr.:* Rob Sinclair .... **D•2131-2135**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AZ	Scottsdale, Power Up Elctrns.	602-955-1105
CA	Cupertino, PEI Assocs.	408-253-1960
CA	La Habra, West Coast Reps.	213-690-9960
CO	Parker, TMA	303-841-3435
FL	Orlando, Currie, Peak & Frazier	407-855-0843
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810
IA	Cedar Rapids, Tech. Sls. Assoc.	319-373-0686
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MA	Chelmsford, Melcher, Inc.	800-828-9712
MA	Whitinsville, Power Factor Assoc.	508-234-6415
MI	Troy, CB Jensen & Assocs.	313-643-0506
MN	Wayzata, Cardinal Sls.	612-475-0042
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Centerville, EMA, Inc.	513-433-2800
PA	Nottingham, Excel Tech	717-529-6059
TX	Richardson, Jim D. Gray & Assocs., Inc.	214-699-9976
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Spokane, APC	509-922-7959
WI	Brookfield, McMahon Inc.	414-782-3335
Can	Ontario, Melcher Corp.	416-727-9341

melcor

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 1040 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178; FSC No.: 32333; Empl.: 275; *Sls. Mgr.:* M.A. Levine .... **C•1613-1616**

Local Sales Offices & Reps

CA	San Jose, Shaw Tech, Inc.	408-866-6628
CO	Fort Collins, Rep Sls., Inc.	303-226-1504
NY	W. Henrietta, Exogray Tech. Sls.	716-334-1340

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

MELFESS FIVE INC., See Peripheral Resources

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527, FAX: 616-657-2528; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMCOR-TRUOHM INC.

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool .... **A•1984, 2105**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
CA	American Canyon, Jacobson & Assoc.	707-552-4412
CA	Huntington Bch., Mil-Com Sls.	714-840-2424
FL	Indialantic, Raycom	305-727-8860
GA	Atlanta, Murcota	404-875-2525
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, Menze Sls.	219-747-5616
MI	St. Clair Shores, J.M. Thorpe	313-779-6363
MO	St. Charles, Hayes Elec. Sls. Co.	314-946-6677
NH	Atkinson, Mark Rep Assoc.	603-382-9563
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Marcellus, Mullahy Sls. Inc.	315-685-6280
NC	Burlington, Murcota	919-585-1577
NC	Winston-Salem, Murcota	919-723-1001
OH	Cleveland, Glover Sls.	216-842-4520
PA	Newtown Square, G.M. Conneen	215-353-2241
TX	Dallas, SW Elctrn. Ind.	214-233-9816
TX	Houston, SW Elctrn. Ind.	713-729-1670

MEMODYNE, 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-6556 (in MA), 800-255-1510, FAX: 617-964-2444; Empl.: 40; *Sls. Mgr.:* Leonard Sacon

MEMORY PROTECTION DEVICES, INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-293-5891, FAX: 516-752-1971; *Sls. Mgr.:* Thomas Blaha .... **D•1455**

Local Sales Offices & Reps

CA	Irvine, English/Damco Sls. Co., Inc.	714-753-1950
CA	Mountain View, Griffith, Nunley & Assocs.	415-961-6740
FL	Tampa, SRT Mktg.	813-884-4805
IL	Downers Grove, Momak Sls.	708-963-6400
MD	Lisbon, S.K. MacDonald, Inc.	301-982-1088
MI	Brighton, A.P. Assocs., Inc.	313-229-6550
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
NH	Hampton, Primary Source	603-926-8044
NJ	Cherry Hill, S.K. MacDonald, Inc.	609-482-2666
NJ	New Brunswick, Synergy Sls.	908-828-5090
OR	Beaverton, Advanced Power Prods., Inc.	503-646-0994
OR	Monroeville, S.K. MacDonald, Inc.	412-373-1723
WI	Fontana, Momak Sls.	414-363-7744

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Phoenix, Lynntronics	602-841-3900
CA	Costa Mesa, Battery Specialties	800-854-5759
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Huntington Beach, House of Batteries	714-642-8222
CA	Irvine, Powell Elctrns.	714-263-9363
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Powell Elctrns.	408-943-6438
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Nesco Battery Sys.	818-781-0505
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Englewood, AVT, Inc.	303-779-8056
CO	Englewood, Cypress Elctrns.	303-792-5829
FL	Fort Lauderdale, Powell Elctrns.	305-484-8377
FL	St. Petersberg, Engrd. Assemblies & Comps. Corp.	813-328-1970
GA	Norcross, Applied Power	404-263-0421
GA	Norcross, Engrd. Assemplies & Comps. Corp.	404-446-3135
IL	Morton Grove, Power Pak	312-966-6000
MD	Annapolis Junction, Powell Elctrns.	301-880-3255
MA	Methuen, Generation Elctrns.	508-683-1177
MA	Sutton, Engrd. Assemblies and Comp. Corp.	508-865-0722
MA	Westborough, Powell Elctrns.	508-366-6100
MI	Brighton, Applied Power	313-227-3604
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Thief River Falls, Digi Key Corp.	218-681-6674
NJ	Little Falls, Powell Elctrns.	201-890-0010
NJ	Mountainside, Mars Elctrns.	908-233-0044
NJ	Teterboro, Engrd. Assembilies & Comp. Corp.	201-288-4477
NY	Buffalo, Summit Distrs.	716-887-2800
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Engrd. Assemblies & Comps. Corp.	919-790-9700
OH	Columbus, Promark Elctrns.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Dallas, Cypress Elctrns.	214-255-0065
TX	Ft. Worth, Tandy Natl. Parts	817-870-5600
TX	Irving, Powell Elctrns.	214-550-0457
UT	W. Valley City, Denver Beta Wintronics	801-966-0378
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Seattle, Powell Elctrns.	206-439-8550
WI	Milwaukee, Taylor Elctrns.	414-241-4321
Can	Calgary, Alberta, Electro Sonic, Inc.	403-255-9550
Can	Ottawa, Ont., Electro Sonic, Inc.	613-728-8333
Can	Richmond, B.C., Electro Sonic, Inc.	604-273-2911
Can	Willow Dale, Ont., Electro Sonic Inc.	416-494-1666
Can	Winnipeg, Man., ELectro Sonic, Inc.	204-783-3105

MEMTEC CORP., 19-B Keewaydin Dr., Salem, NH 03079, Tel: 603-893-8080, FAX: 603-893-8699; Empl.: 35

MEMTRON®

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 530 N.Franklin, Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 130; *Sls. Mgr.:* Daniel T. Ortner .... **B•1845**

Local Sales Offices & Reps

AZ	Tucson, Multi-Innovations	602-326-8997
CA	San Diego, Champa Assocs.	714-581-3459
CA	Saratoga, Edward King & Assocs.	408-741-0434
CO	Westminister, Glennmar	303-423-1572
FL	Mount Dora, Hedrick, Walker	904-735-2600
GA	Lawrenceville, Tek-Rep Mktg., Inc.	404-804-0358
IL	Wheaton, CS Tech. Sls.	312-653-8126
IN	Noblesville, Phoenix Mktg.	317-776-1871
MA	Framingham, Stone Comp. Sls. Corp.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
MO	Saint Charles, Buckman & Assocs.	314-946-6201
NY	Islip, Cogent Tech.	516-277-7101
NY	Liverpool, Alfred Lee Sls.	315-451-0968
NY	Victor, Net Sls.	716-924-1844
OH	Delaware, Bill Romine Co.	614-363-1600
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Richardson, Zonk & Assocs.	214-238-7651, 512-346-7651
WA	Renton, K. R. Jensen Sls.	206-277-2772
EXP	Corpus Christi, TX, Radesa Co.	512-993-4528
Can	Toronto, Ont., Reptech	416-863-9510

MENSOR CORPORATION, 2230 IH-35 South, San Marcos, TX 78666, Tel: 512-396-4200, FAX: 512-396-1820

MEPCO/CENTRALAB CORP., See Philips Components Discrete Products Division

MEP CONTROLS, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 25

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11525 Sorrento Valley Rd., San Diego, CA 92121-1307, Tel: 619-481-0210; Empl.: 160 .... **A•2106-2107; B•1770-1771**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Irvine, Harper & Strong	714-261-7233
CA	Sacramento, TSI	916-451-9068
CA	San Diego, Harper & Strong	619-549-5360
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over	407-339-5073
FL	Ft. Lauderdale, Over & Over	305-485-0115
GA	Norcross, Over & Over Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Overland Pk, Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Elec. Comps. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Englewood Cliff, Ed Glass Assoc.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.	716-381-8500
NY	Endwell, Empire Tech. Assoc., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TX	Austin, Philips Comps.	512-832-9819
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
Can	Alberta, Philips Comps.	403-239-7075
Can	Scarborough, Ont., Philips Comps.	416-292-5161

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CO	Englewood, Kent, Shelley-Ragon	303-762-0670
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Chicago, Nep Elctrns.	708-595-8500
IN	Indianapolis, Marshall Inds.	317-297-0483
MD	Columbia, TTI, Inc.	301-995-1331
MA	Peabody, Hamilton/Avnet	508-532-3701
MI	Livonia, Marshall Inds.	313-525-5850
MN	St. Paul, Kent, Shelley-Ragon	612-642-2828
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Independence, TTI, Inc.	216-328-9755
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Kent, Shelley-Ragon	503-641-1691
PA	Mars, Hamilton/Avnet	412-772-1881
TX	Ft. Worth, TTI, Inc.	817-595-3100
WA	Redmond, Hamilton/Avnet	206-881-6697
WI	New Berlin, Nep Electronics	414-785-9131
Can	Nepean, Ont., Hamilton/Avnet	613-226-1700

MERCOTAC INC., 6195 Corte del Cedro E, Carlsbad, CA 92009, Tel: 619-431-7723, FAX: 619-431-0905; Empl.: 19; *Sls. Mgr.:* Bruce Enigenburg; *Dist. Mgr.:* Bruce Enigenburg

MERCURY COMPUTER SYSTEMS, INC., 199 Riverneck Rd., Chelmsford, MA 01824, Tel: 508-256-1300, FAX: 508-256-3599; Empl.: 160; *Sls. Mgr.:* Ed Hennessy

MERCURY PLASTICS, A UNIT OF ZERO CORP., See Zero Plastics, A Unit of Zero Corp.

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-822-9300, FAX: 401-822-9311; Empl.: 25; *Sls. Mgr.:* John E. Powell, Jr.

MERET OPTICAL COMMUNICATIONS, INC., An Amoco Co., 1800 Stewart St., Santa Monica, CA 90404-4998, Tel: 310-828-7496, FAX: 310-828-7567; FSC No.: 53071; Empl.: 85

For all states not listed call Meret MN. Ofc. 310-828-7496

MERIAM INSTRUMENT, Scott Fetzer, 10920 Madison Ave., Cleveland, OH 44102, Tel: 216-281-1100, FAX: 216-281-0228; Empl.: 85; *Sls. Mgr.:* Russ Arslanian; *Dist. Mgr.:* Russ Arslanian

MERITEC, Associated Enterprises, 1359 W. Jackson St., P.O. Box 8003, Painesville, OH 44077, Tel: 216-354-3148, FAX: 216-354-0509; Empl.: 200; *Sls. Mgr.:* Richard Wilkinson; *Dist. Mgr.:* Craig Fosnaught

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242, FAX: 312-221-3047; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., P.O. Box 2751, Bonita Springs, FL 33959, Tel: 813-591-1626, FAX: 813-947-1821; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl., West Caldwell, NJ 07006, Tel: 201-575-1300, FAX: 201-575-0531; FSC No.: 12457; Empl.: 150; *Sls. Mgr.:* Tom Cox

J. R. MERRITT CONTROLS, INC., 320 Martin Luther King Dr., Norwalk, CT 06854, Tel: 203-855-9100, 800-333-5762, FAX: 203-855-1038; *Sls. Mgr.:* Douglas Holzwarth

MESA POWER SYSTEMS, 2350 Meyers Ave., Escondido, CA 92029, Tel: 619-489-8162, FAX: 619-489-5718; FSC No.: 46937; Empl.: 20

MESA TECHNOLOGY, Peak Technologies, 8990 Old Annapolis Road, Columbia, MD 21045, Tel: 410-992-0516, 410-992-0517, FAX: 410-290-9171; Empl.: 364; *Sls. Mgr.:* Howard Parker

MES INDUSTRIES CO., LTD., Fl. No. 93 Lo-Li Rd., Taipei, Tel: 886-2-2180302, FAX: 886-2-2181480; Empl.: 25

MESUR-MATIC ELCTRNS., 309 Lowell St., Peabody, MA 01960, Tel: 508-745-7000; Empl.: 18; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METCAL, INC., 1530 O'Brien Dr., Menlo Park, CA 94025, Tel: 800-776-1778, FAX: 415-325-5932; Empl.: 100; *Sls. Mgr.:* Bob Simpson; *Dist. Mgr.:* Bob Simpson

METERMASTER, 2507 W. Erie Dr., Tempe, AZ 85282, Tel: 602-431-0015, FAX: 602-431-1836; *Sls. Mgr.:* Steve Alexander

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-9600, FAX: 708-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* Suzi Landeene

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 708-392-3500, FAX: 708-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Suzi Landeene

METRA CORPORATION, 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, FAX: 408-432-9644; Empl.: 24

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105; *Sls. Mgr.:* Charles Weaver

METRICOR, INC., 18800 - 142nd Ave. NE, Woodinville, WA 98072, Tel: 206-483-5577, FAX: 206-485-2592; Empl.: 42

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, FAX: 904-863-6371; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 60; *Sls. Mgr.:* W. B. Brown

METRO CIRCUITS, PJC Technologies, Inc., 205 LaGrange Ave., Rochester, NY 14613, Tel: 716-254-2980, FAX: 716-254-4614; Empl.: 36; *Sls. Mgr.:* Burhan Capar

METROLAB INSTRUMENTS SA, 110,Chemin du Pont-du-Centenaire, Geneva, Switzerland CH-1228, Tel: ò41(22)7941121, FAX: ò41(22)7941120

METRO-MARK INC., 11574 Encore Circle, Minnetonka, MN 55343, Tel: 612-935-8844, FAX: 612-935-5718 .... **B•1846**

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 10

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John Tarsia

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Ginsberg; *Dist. Mgr.:* R. Brauch

METRUM, P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4700, FAX: 303-773-4762; Empl.: 350; *Sls. Mgr.:* J. Smith

FAX: 908-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 908-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter .... **A•1106-1114, 1651-1653; C•1416-1419, 1617**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
CA	Pleasanton, CFMC	510-417-0450
MD	Rockville, C.E. Tech. Elctrns.	301-666-0315
MD	Rockville, Metuchen Capacitors	301-590-0094
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase Comps.	814-763-3640

MEXITRONIX (WOMAN OWNED), 2651 Airway Ave., Ste. A, Kingman, AZ 86401, Tel: 602-757-9798, FAX: 602-757-8741; Empl.: 5

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 25; *Sls. Mgr.:* Brian Meyer

MEYLAN CORPORATION, 543 Valley Rd., Upper Montclair, NJ 07043-1844, Tel: 201-744-6400, FAX: 201-744-1011; Empl.: 8; *Sls. Mgr.:* Stanley Mills

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL, INC.
THE SOURCE FOR
MEPCOPAL
[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

MFE INSTRUMENTS, Stocker & Yale, Inc., 133 Brimbal Ave., PO Box 490, Beverly, MA 01915-0490, Tel: 508-921-9104, 800-472-4633, ESYLNK: 953145, FAX: 508-921-9110; FSC No.: 6640,6685,6625,6660; *Sls. Mgr.:* John Lepore; *Dist. Mgr.:* John Lepore

Local Distributors

CA	Los Angeles, E.I.L Instrs.	213-685-7020
MD	Baltimore, E.I.L Instrs.	410-584-7400

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, FAX: 914-576-6570; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday .... **A•1419**

Local Sales Offices & Reps

CA	Carlsbad, Mkt. Resource Network	619-721-6717
CA	San Jose, Mac Tron	408-446-8224
AL	Madison, Benchmark Tech. Sls.	205-464-0033
CT	Southington, Orion Group	203-621-8371
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
MA	Peabody, The Orion Group	508-532-6266
MD	Annapolis, Rynone Assocs.	301-263-0794
NY	Smithtown, T & K Sls.	516-724-3456
MN	Minneapolis, Ferrian Sls. & Assocs.	612-721-8915
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Core II Mktg.	503-649-0877
OR	Portland, Core II	503-649-0871
PA	Prospect Park, Elf Sls. Co.	215-534-3340
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, R 2 Mktg. Inc.	801-595-0631

Local Distributors

CA	Burbank, Atwater Elctrns.	818-841-9050
CA	San Jose, Turbo Elctrns.	408-441-6616
CA	Sunnyvale, PSC Elctrns.	408-737-1333
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 310-447-6633, 800-533-2297, FAX: 310-820-6958

MFM TECHNOLOGY, INC.
An Affiliate of UNITRODE Corporation

FAX: 516-467-5176

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151; Empl.: 25 .... **B•1298**

Local Sales Offices & Reps

MI	Troy, Kinetic Technlgs.	313-828-9700
TX	Dallas, Automated Motion Ctrl. Inc.	214-340-4192
WI	Brookfield, Automation Prods. Co.	414-785-6668
Can	Downsview, Ont., Newsonian Mechtronics, Inc.	416-663-2516
CA	San Jose, Motion Control-North	408-997-0544

MG ELECTRONICS

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey .... **D•1051**

MGR INDUSTRIES INC., 450B Industrial Dr., Ft. Collins, CO 80524, Tel: 303-221-2201, FAX: 303-484-4078; Empl.: 2; *Sls. Mgr.:* R. Vangermeersch

MHOTRONICS., INC., 960 Corporate Woods Pkwy., Vernon Hills, IL 60061, Tel: 708-913-9566, FAX: 708-913-9587; Empl.: 45; *Sls. Mgr.:* David McFadden

MIAMI MAGNET CO., INC., The Magnet Source, 6073 Bldg. C 26 N.W. 167th St., Miami, FL 33015, Tel: 800-222-7846, FAX: 305-823-1603; FSC No.: 5999; Empl.: 38; *Sls. Mgr.:* Gale Peregrin; *Dist. Mgr.:* C. Peregrin .... **A•1319**

Local Sales Offices & Reps

CA	Placentia, A-L-L Magnetics Inc.	714-632-1754
CO	Castle Rock, Master Magnetics	303-688-3966
FL	Miami, The Magnet Source	305-823-0641

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590, FAX: 517-726-0078; Empl.: 50; *Sls. Mgr.:* Tom Krul

MICREL SEMICONDUCTOR, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-944-0800, FAX: 408-944-0970; FSC No.: 60496; Empl.: 135; *Sls. Mgr.:* Mike O'Neal; *Dist. Mgr.:* Mike O'Neal

MICRO ALLIANCE, INC., 1384-A Poinsettia Dr., Vista, CA 92083, Tel: 619-598-1900; Empl.: 10; *Sls. Mgr.:* Ed Larson

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904, FAX: 714-957-1614; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

MICROBAR SYSTEMS, INC., 3350 Scott Blvd. 3902, Santa Clara, CA 95054-3119, Tel: 408-748-2920, FAX: 408-748-2924

MICRO-CERAMX TECHNOLOGY, A MicroSemi Company, 501 South Andreasen Dr., Escondido, CA 92029, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, FAX: 602-345-3390; Empl.: 1500; *Sls. Mgr.:* Lanny Flessas; *Dist. Mgr.:* Lanny Flessas

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-COAX, Box 993, Collegeville, PA 19426, Tel: 215-489-3700, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Bruce Ash

MICROCOMPATIBLES INC., 301 Prelude Drive, Silver Springs, MD 20901, Tel: 301-593-0683, FAX: 301-593-5151; Empl.: 4; *Sls. Mgr.:* Linda Esterling

MICRO-COMP INDUSTRIES, 3350 Scott Blvd., Bldg.57, Santa Clara, CA 95054, Tel: 408-727-3000, FAX: 408-970-0548

MICRO CRYSTAL DIVISION / SMH

FAX: 708-593-5062

MICRO CRYSTAL/DIVISION SMH, 702 West Algonquin Rd., Arlington Heights, IL 60005, Tel: 708-806-1485; *Sls. Mgr.:* William Kaczmarski; *Dist. Mgr.:* William Kaczmarski .... **A•1420-1423**

Local Sales Offices & Reps

AZ	Scottsdale, E D P & Assoc.	602-991-6119
CA	Huntington Beach, Force 1 Sls.	714-963-3949
CA	San Jose, Circuit Sls.	408-441-6441
FL	Pompano Bch., H H P Assocs.	407-740-0320
FL	Winter Park, HHP Assocs.	407-740-0320
IL	Arlington Heights, Greenslade Sls.	708-593-3450
IN	Fort Wayne, M/S Sls. and Assocs., Inc.	219-436-3023
IN	Greenwood, M/S Sls. and Assocs., Inc.	317-881-0110
MD	Kensington, Koebert Assocs., Inc.	301-493-8924
MN	Afton, Real Elctrns. Sls. Assocs.	612-436-1950
NH	Nashua, Bell Controls	603-882-6984
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Fort Worth, Merlin Elctrns.	817-429-4420
TX	Grapevine, Merlin Elctrns.	817-329-8922

MICRO DATA SYSTEMS, P.O. Box 3278, Thomasville, GA 31799, Tel: 912-226-1709, TELEX: 6503406939 MCI CW; Empl.: 5; *Sls. Mgr.:* Sid Davis; *Dist. Mgr.:* Sid Davis

MICRODIMENSIONS, INC., 7345 Production Dr., Mentor, OH 44060, Tel: 216-974-8070, FAX: 216-974-1648; Empl.: 40

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

MICRODRY, INC., 7450 Hwy. 329, Crestwood, Kentucky 40014, Tel: 502-241-8933, FAX: 502-241-8648; Empl.: 16; *Sls. Mgr.:* Mark Arsenault, Tech. Sls. Engr.

MICRO ELECTRONIC BUSINESS, 4315 N. Elston, Chicago, IL 60641, Tel: 312-539-2994 .... **D•1099**

MICRO ELECTRONIC SYSTEMS, INC., 119 Northrup St., Bridgewater, CT 06752, Tel: 203-350-5004, FAX: 203-350-6966; Empl.: 3; *Sls. Mgr.:* L.M. Green

MICRO ELECTRONIC TECHNOLOGIES, 35 South St., Hopkinton, MA 01748, Tel: 508-435-9057, FAX: 508-435-6481; Empl.: 53; *Sls. Mgr.:* Mike Levangie; *Dist. Mgr.:* Ed Begley

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 160; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

MICRO INDUSTRIES

FAX: 614-548-6184

MICRO INDUSTRIES, 8399 Green Meadows Dr., N., Westerville, OH 43081-9486, Tel: 614-548-7878; Empl.: 75; *Sls. Mgr.:* William Jackson .... **D•1143**

MICRO INSTRUMENT COMPANY, 2250 Micro Pl., Escondido, CA 92029, Tel: 619-746-2010, FAX: 619-746-0433; FSC No.: FSCM 24836; Empl.: 40; *Sls. Mgr.:* C.Marks(East), C. Haas(West)

MICRO-INTEGRATION CORP., 215 Paca St., Cumberland, MD 21502, Tel: 800-832-4526, TELEX: 961-134, FAX: 301-777-3307; *Sls. Mgr.:* Janine Filion; *Dist. Mgr.:* P. Edward Fisher

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, FAX: 201-992-0513; FSC No.: 00929; Empl.: 40

MICRO LAMPS™, INC.

FAX: 708-879-0126

MICRO LAMPS, INC., 1530 Hubbard Ave., Batavia, IL 60510-1488, Tel: 708-879-0900; Empl.: 12; *Sls. Mgr.:* Edward R. Beutler .... **B•1174**

MICRO-LINK PRODS., Sea-ILAN Inc., 14602 N. U.S. 31, Carmel, IN 46032, Tel: 317-846-1721, FAX: 317-848-2254; Empl.: 20; *Sls. Mgr.:* Jan Collins

MICROLOGIC, INC., 108 Water St., Watertown, MA 02172, Tel: 617-923-1700, FAX: 617-923-4316; *Sls. Mgr.:* Barry J. Sanders

MICROLOGIC, INC., 108 Water St., Watertown, MA 02172, Tel: 617-923-1700, FAX: 617-923-4316; *Sls. Mgr.:* Barry J. Sanders

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MN	Maple Grove, Elctrn. Prods. For Ind. ...	612-784-5554
TN	Nashville, Strategic Mktg. Inc.	615-883-7882

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TX	Ft. Worth, Industrial Elect.	817-731-7321
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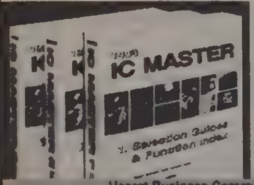

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CA	Torrance, Universal Comp. Co.	310-783-0220
CO	Englewood, Omega, Ltd.	303-762-1921
FL	Winter Pk., HPP Assoc. Inc.	407-740-0320
IL	Wheaton, CS Tech. Sls.	708-653-8126
IN	Fishers, R & D Elctrn. Sls.	317-849-2026
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM, Inc.	913-888-0022
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Wellesley, Logan Sls.	617-235-6868
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
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NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Cary, Arthur, Harris & Assoc.	919-460-8660
OH	Cleveland, J.O. Olsen Co.	216-838-0510
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Pittsburgh, J.O. Olsen Co.	412-381-4254
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
Can	Brampton, Ont., Reemco Inc.	416-624-2730

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CA	Oakland, Brill Elctrns.	510-834-5888
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CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	310-452-1229
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
FL	Pompano Beach, Peerless Radio Corp.	800-327-4993
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
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MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
MN	Thief River Falls, Digi-Key Corp.	800-344-4539
NJ	Oakland, Relay Specialties	800-526-5376
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
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NY	Lynbrook, Peerless Radio	516-593-2121
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CO	Englewood, Midwest CATV	303-799-4343
FL	Boca Raton, Passive Dvcs., Inc.	407-998-0600
FL	Hialeah, Hero Comm.	305-887-3203
FL	Miami, Centennial So.	800-468-5465
FL	Miami, Gendra Intl.	305-372-8845
FL	Mt. Dora, FM Technlg. Assoc., Inc.	904-383-3682
FL	Ocala, Broadcasters Gen. Store	904-622-9058
FL	Panama City, Bay Elctrns. Supp.	904-785-7258
GA	Lawrenceville, John Weeks Entprs.	404-963-7870
IL	Rolling Meadows, Antec Comm.	708-677-2600
IN	Richmond, Allied Broadcast Equip.	317-962-8596
LA	Mamou, Satellite Earth Stas.	318-468-2203
MI	Bloomfield Hills, Nat. Satellite Corp.	313-644-4052
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NE	Dakota City, ATV Research, Inc.	402-987-3771
NH	Bow, Earth Terminal, Inc.	603-224-5166
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TX	Houston, Elctrn. Comps. Dist.	713-529-8806
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IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
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MN	N. Mankato, E.I. Sls.	507-345-5786
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
VA	Powhatan, Eagle Sls. Corp.	804-492-9027
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

MID-EASTERN INDUSTRIES, Technology Dynamics Inc., 100 School Street, Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 06179; Empl.: 15; *Sls. Mgr.:* Daniel Ellenback .... **D•1832-1835**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
FL	Clearwater, Tech-Rep Assocs.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Hgts., Greenslade Sls. Inc.	708-593-3450
MD	Columbia, Delta III Assocs.	410-730-4700
MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
OH	Chagrin, J.J. Bair & Co.	216-543-8617
TX	Dallas, Tesco Elctrn. Sls. Co.	214-553-1200
UT	Midvale, Christec	801-566-3694
WI	Wauwatosa, Greenslade Sls. Inc.	414-258-2727

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06851, Tel: 203-866-2342, FAX: 203-847-7147; Empl.: 10; *Sls. Mgr.:* Helen Monroe; *Dist. Mgr.:* Helen Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

MIDORI

FAX: 714-449-0139

MIDORI AMERICA CORP., 2555 E. Chapman Ave., Ste. 400, Fullerton, CA 92631, Tel: 714-449-0997; Empl.: 3 .... **A•2109**

MIDSTATES MARKETING, INC., 1122 E. Washington St., Ste 100, Indianapolis, IN 46202, Tel: 317-639-9999; Empl.: 3

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, FAX: 915-772-1116; Empl.: 275; *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Bob Walasiak

MIDWEST COMPONENTS,INC., See Therm-O-Disc, Div. Midwest Component Product Group

MIDWEST CONTAINER SYSTEMS, 5604 Intl. Pkwy., Minneapolis, MN 55428, Tel: 612-533-4532, FAX: 612-533-9260; Empl.: 3; *Sls. Mgr.:* John Poyer

MIDWEST MICROWAVE, 6564 South State Rd., Saline, MI 48176-9569, Tel: 313-429-4773, 800-521-4410, FAX: 313-429-1415; FSC No.: 34078; Empl.: 120; *Sls. Mgr.:* William H. Lavery

MIKRON INSTRUMENT COMPANY, INC., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, FAX: 201-891-1205; Empl.: 50; *Sls. Mgr.:* John Merchant

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. # C, Chatsworth, CA 91311, Tel: 818-998-3111

MIL ELECTRONICS, INC., One Chestnut St., Nashua, NH 03060, Tel: 603-882-3200, FAX: 603-881-8661; FSC No.: 07862; Empl.: 40

MILES PLATTS INC., 901 Touhy Ave., Elk Grove Village, IL 60007, Tel: 1-708-364-0363, FAX: 708-364-0614; Empl.: 7; *Sls. Mgr.:* J. L. Packwood

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-975-2711, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611, FAX: 213-264-3203; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415, FAX: 207-864-3344; Empl.: 8

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447; *Sls. Mgr.:* Mrs. Fran Bounar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 510-791-5188, TELEX: 466465, FAX: 510-791-5237; FSC No.: 52426; Empl.: 42; *Sls. Mgr.:* Philip Hamad; *Dist. Mgr.:* Philip Hamad

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger .... **D•1299**

Local Sales Offices & Reps

CA	San Diego, Advanced Prods. Sls.	619-530-0200
CA	Westlake Vl., Advanced Prods. Sls.	818-706-8351
MD	Laurel, CSDS Inc.	301-490-3800
MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5291
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, CSDS Inc.	703-385-0139
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner .... **C•1421**

Local Sales Offices & Reps

AL	Huntsville, DHR Mkyg., Inc.	205-536-9775, FAX:205-539-8313
AZ	Scottsdale, Trinity Sls.	602-483-1943, FAX:602-483-2038
AR	Mabelvale, Erickson Sls., Inc.	501-455-0618
CA	Campbell, PCA	408-559-2866,FAX:408-559-8277
CA	Dana Point, PCA	714-493-9822,FAX:714-240-1894
CO	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
CT	Hartford, D.A. Crowley & Assocs.	203-956-9007, FAX:203-956-5351
FL	Boca Raton, Tech Sls. Specialists	407-391-3718, FAX:407-750-1178
GA	Duluth, DHR Mktg., Inc.	404-564-0529, FAX:404-564-1127
GA	Roswell, Contact Factory	516-922-6000, FAX:516-922-9253
IL	Elk Grove Village, Control Sls.	708-595-2110, FAX:708-595-9592
IN	Indianapolis, M & L Sls.,Inc.	317-359-4742, FAX:317-359-0320
IN	Valparaiso, Catalyst Sls.	219-477-4004, FAX:219-477-4355
KS	Overland Park, Acorn Elctrns., Inc.	913-649-6402, FAX:913-649-8005
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MN	St. Paul, Johnson Co.	612-429-2544, FAX:612-429-3104
MO	St. Louis, Acorn Elctrns., Inc.	314-421-1751, FAX:314-421-1752
NH	Amherst, D.A. Crowley & Assocs.	603-673-7050, FAX:603-672-0817
NJ	Ft. Lee, Nexus Technlg.	201-947-0151, FAX:201-947-0163
NY	Fairport, Senntec	716-425-3954, FAX:716-425-7933
NC	Raleigh, Contact Factory	516-922-6000, FAX:516-922-9253
OH	Dayton, Catalyst Sls. Co.	513-256-3344, FAX:513-256-1173
OR	Tigard, Halbar-RTS, Inc.	503-624-5741, FAX:503-684-1803
PA	Doylestown, G. A. Recentio Assocs.	215-348-7577, FAX:215-348-8458
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434, FAX:412-826-3436
TX	Dallas, Erickson Sls., Inc.	214-739-5833, FAX:214-739-2329
WA	Redmond, Halbar-RTS, Inc.	206-882-0990, FAX:206-881-3323
WI	Brookfield, Control Sls.	414-797-9500, FAX:414-797-0784
Can	Mississauga, True North Technlg.	416-677-9788, FAX:416-677-8048
Can	Montreal, Que., True North Technlg.	514-343-9393, FAX:514-343-9390
Can	Ottawa, True North Technlg.	613-564-0629

Local Distributors

AL	Huntsville, Electronic Fasteners	205-430-0400
AL	Huntsville, Nu Horizons	205-722-9330
AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tucson, Pioneer Screw & Nut	602-623-9800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Anaheim, Bisco	714-635-0380
CA	Chatsworth, Alatec Prods.	818-727-7800
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fremont, Acacia/Deanco	510-623-7500
CA	Fremont, Alatec Prods.	510-657-7701
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Los Gatos, Gourmet Elctrns.	408-374-0552
CA	North Hollywood, Electronic Hardware	818-982-6100
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Jose, Bisco	408-435-8980
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Pro-Fasteners	408-943-9177
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sunnyvale, PSC	408-737-1333
CO	Denver, Hardware Specialty	303-371-8553
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Southbury, Heilind Elctrns	203-262-1700
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Sanford, Elctrn Fasteners	407-321-4000
FL	Sunrise, All American	305-572-7999
FL	Tampa, Century Fasteners	813-886-5770
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
GA	Norcross, Nu Horizons	404-416-8666
IL	Addison, Belford Elctrns.	708-691-1100

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IN	Indianapolis, PEI/Genesis Elctrns.	317-328-7700
IN	South Bend, PEI/Genesis Elctrns.	800-348-2996
LA	Shreveport, Carlton-Bates	318-636-9975
MD	Columbia, Nu Horizons	301-995-6330
MD	Gaitherburg, Capitol Fasteners	301-948-9310
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Hunt Valley, Alatec Prods.	301-667-0063
MD	Ijamsville, Hardware Specialty	301-831-1212
MA	Marlborough, Hardware Specialty	508-481-8622
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Wakefield, Nu Horizons	617-246-4442
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Wyoming, North Coast Comps.	616-452-0800
MN	Minneapolis, Aero-Space Computer	612-884-4725
MN	Roseville, Chris Elctrns.	612-631-2647
MO	Kansas City, Aero-Space Computer	913-432-8508
MO	Springfield, Carlton-Bates	417-862-1699
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Blackwood, Hardware Specialty	609-228-6800
NJ	Mt. Laurel, Nu Horizons	609-231-0900
NJ	Pine Brook, Nu Horizons	201-882-8300
NJ	Union, Meridian Supply	908-687-6220
NM	Albuquerque, Bestech Sls.	505-298-0034
NY	Amityville, Nu Horizons	516-226-6000
NY	Bohemia, Car-Lac	516-567-4200
NY	Bohemia, Edge Elctrns.	516-567-6300
NY	Buffalo, Rome Elctrns.	716-626-1602
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Mineola, Hardware Specialty	516-741-7100
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Help Elctrns.	716-475-0850
NY	Rochester, Nu Horizons	716-292-0777
NY	Rochester, Rome Elctrns.	716-248-0160
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Syracuse, Hardware Specialty	315-434-9093
NC	Raleigh, Century Fasteners	919-787-1800
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Advacom	513-274-5900
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Comp. Resources	503-641-8488
PA	Erie, REM Elctrns.	814-453-5626
PA	Export, Advacom	412-325-7551
PA	Harrisburg, Ad-Tech	717-561-9905
PA	McKean, Advacom	814-476-7774
PA	North Huntingdon, REM Elctrns.	412-864-7423
PA	Philadelphia, PEI/Genesis	800-523-0727
TN	Memphis, Carlton-Bates	901-365-3539
TX	Allen, Prime Distbg.	214-231-0170
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	El Paso, McNicol Elctrns.	915-566-2936
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-351-2255
TX	Richardson, Off The Shelf Comp.	214-238-0808
UT	Salt Lake City, Standard Supply	801-486-3371
WA	Kent, Comp. Resources	206-340-1646
WA	Redmond, Acacia/Deanco	206-881-5566
WI	Brookfield, Bisco Inds.	414-789-7325
WI	Milwaukee, Progressive Image	414-321-4722

MR

FAX: 310-430-8309

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 310-598-2454; FSC No.: 34238; Empl.: 50; *Sls. Mgr.:* S. Kistner; *Dist. Mgr.:* C. Brown ...... **A•1987**

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Sacramento, Mills Resistor Co.	916-422-5461
CT	Rocky Hill, Jim McPhail	203-721-1802
MA	Waltham, Dynasel Assocs.	617-890-6777
MI	Milford, Elctrn. Comp. Sls., Inc.	313-360-3790
OR	Gaston, SPS Elctrns.	206-323-4140
PA	Montgomeryville, Quick Response Tech. Sls.	215-362-9225
TX	Houston, Ev Smith Co.	713-649-5756
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

FL	Ft. Lauderdale, Jaro Elctrns.	800-327-5551
PA	Harrisburg, ADTECH	717-939-8337
PA	McKean, Advacom	814-476-7774

MILTON ROSS CO., 262 Valley Rd., Warrington, PA 18976, Tel: 215-491-0600, FAX: 215-491-9479; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Marianne Skukowski

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650; *Sls. Mgr.:* Robert Ceonzo

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

MRC

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 75; *Sls. Mgr.:* John Dorsha ...... **A•1988-1992**

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-441-5541
IL	Arlington Heights, Kettner & Assocs.	708-364-0830
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4484
MA	Stoughton, EECS-Mel Botsian	617-344-5139
MN	Plymouth, Kettner & Assocs.	612-559-5150
NY	Rochester, Gislason Sls.	716-328-7400
NY	Whitestone, M. H. Lynn co.	718-352-9233
NC	Kernersville, Heritage Electrical Assoc.	800-877-4372
OH	Westlake, Assocd. Elctrl. Comps.	216-835-9960
WI	Mequon, Kettner & Assocs.	414-241-4697

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 6755 Earl Dr., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-590-7330; *Sls. Mgr.:* David Niehaus

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 575; *Sls. Mgr.:* J. Anderson

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Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, James Gerry Co.	213-283-7694
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Centerville, West Inc.	208-888-6227
CO	Denver, West Inc.	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Longwood, Delmac	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KS	Wichita, Magna Eng. Sls. Co.	316-744-0851
MD	North East, Magna Eng. Sls. Co.	410-398-4215
MA	Burlington, F.J.S. Assocs.	617-273-5959
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-849-6590
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Lake Oswego, Caruso & Assocs.	503-635-5282
TX	Dallas, Kruvand Assoc., Inc.	214-437-3355
WA	Bellevue, Caruso & Co.	206-455-8811

MINGSTON ELECTRONICS, INC,, MEC Inc.(Taiwan), 14145 Proctor Ave. Unit 8, City of Industry, CA 91746, Tel: 818-330-2086, FAX: 818-330-9988; Empl.: 3; *Sls. Mgr.:* Johnny Chao

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 13 Neptune Avenue, P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Intl.); FSC No.: 15542 ...... **A•1724-1845**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Tustin, Youngewirth & Olenick Assocs.	714-838-5144
CO	Parker, W. Howard Assocs.	303-841-5755
FL	Clearwater, Beacon Microwave & Instrmn., Inc.	813-796-2378
FL	Longwood, Beacon Microwave & Instrs.	407-332-1940
GA	Atlanta, Beacon Microwave & Instrmn., Inc.	404-256-9640
IL	Mundelein, Cain-Forlaw, Inc.	708-540-9962
IN	Wolcottville, Cain-Forlaw Co., Inc.	219-854-2632
MD	Columbia, M. Lader Co.	800-442-3177
MA	Chelmsford, Advanced Technlg. Mktg., Inc.	508-458-0200
MO	Mini-Circuits	417-335-5935,FAX:417-335-5945
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Bklyn (Distbn. Ctr.), Mini-Circuits	800-654-7949
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600
NY	Skaneateles, Robtron, Inc.	315-685-5731
NC	Greensboro, M. Lader Co.	800-442-3177
OH	Worthington, Cain-Forlaw Co. Inc.	614-436-3004
OR	Aloha, Cain-Sweet Co.	503-591-0647
PA	Conshohocken, M. Lader Co.	215-825-3177, 800-442-3177
TX	Richardson, Beacon Microwave & Instrn., Inc.	214-437-1505
TX	Round Rock, Beacon Microwave & Instrmn. Inc.	512-244-6675
VA	Strasburg, M. Lader Co.	800-442-3177
WA	Bellevue, Cain-Sweet Co.	206-462-2118
Can	Burnaby, B.C., Giga-Tron Assocs. Ltd.	604-299-4244
Can	Burnaby, BC, Cain-Sweet Co.	604-420-6886
Can	Ottawa, Ont., Giga-Tron Assocs., Ltd.	613-225-4090

Local Distributors

AL	Huntsville, Component Distrs., Inc.	205-851-7800, 800-888-0331
AZ	Arizona/New Mexico, Mini-Circuits	800-654-7949
CA	Los Altos, Mini-Circuits	415-948-6533, 800-654-7949
CA	Tustin, Mini-Circuits	714-838-5144,800-654-7949
FL	Palm Bay, Component Distrs., Inc.	407-724-9910, 800-558-2351
GA	Norcross, Component Distrs., Inc.	404-441-3320, 800-874-7209
IL	Mundelein, CFC Distrs., Inc.	708-540-9962
MD	Columbia, MLC Distrs.	800-442-3177
MO	Mini-Circuits	417-335-5935
NM	Mini-Circuits	800-654-7949
NC	Greensboro, MLC Distrs.	800-442-3177
PA	Conshohocken, MLC Distrs.	215-825-3177, 800-442-3177
TX	Dallas, Comp. Distrs., Inc.	214-644-0373, 800-848-4234
WA	Bellevue, Mini-Circuits	206-462-2118,800-654-7949

MSI

FAX: 508-695-8758

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000; *Sls. Mgr.:* Heather Edwards ...... **A•1710, 1993**

Local Sales Offices & Reps

CA	L.S. Engrg.	415-967-5880,FAX:415-967-5884
CA	S. California Tech. Sls.	818-704-9087, FAX:818-704-8632
FL	JDM Assocs.	407-725-2823,FAX:407-725-7861
IL	ABC Elctrn. Sls.	708-924-9974,FAX:708-924-9975
MN	InterTec Associates	612-921-8443, FAX:612-929-4488
NH	Shain Assocs.	603-881-4881,FAX:603-880-8924
NY	LFG Micro	516-399-3199,FAX:516-399-3182
VA	Glasscock Assocs.	804-798-2125, FAX:804-798-2109
WA	Bellevue, Advanced Power Comps.	206-641-9127, FAX:206-641-8655
Can	Ontario, ON, Intrade Canada	613-727-1272, FAX:613-727-0246

MSI

FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 163 .... **A•1993**

Local Sales Offices & Reps

AZ	Scottsdale, IMA Sls., Inc.	602-946-4940, FAX:602-947-7638
CA	Brea, S.C.T.S.	213-691-1114,FAX:213-690-0504
CA	Mountain View, L.S. Engrg.	415-967-5880, FAX:415-967-5884
CA	Woodland Hills, S.C.T.S.	818-704-9087, FAX:818-704-8632
FL	Palm Bay, JDM Assocs.	407-725-2823, FAX:407-725-7861
FL	Pompano Beach, J.P. Elctrns.	305-782-6830, FAX:305-782-1640
IL	Elk Grove, ABC Elctrns.	708-228-1204, FAX:708-228-1249
ME	Bethel, Shain Assocs., Inc.	207-836-3200
MA	Norwell, Shain Assocs., Inc.	617-982-1474, FAX:617-740-2680
MN	Minneapolis, Intertec Assocs.	612-921-8443, FAX:612-929-4488
NH	Nashua, Shain Assocs., Inc.	603-881-4881, FAX:603-880-8924
NJ	Princeton, Wexler-Court Sls. Co.	609-452-8670, FAX:609-452-9213
NY	Mastic Beach, LFG Micro	516-399-3199, FAX:516-399-3182
NY	Rochester, Phase Two Sls.	716-235-3889, FAX:716-235-1351
NY	Rockville Centre, Milano Bros. Intl.	516-764-2200, FAX:516-764-4006
TX	Richardson, Barry Sls.	214-234-0255, FAX:214-235-0271
VA	Ashland, Glasscock Assoc.	804-798-2125, FAX:804-798-2109
WA	Bellevue, Advanced Power Comps.	206-747-9127, FAX:206-641-8655
Can	Nepean, Ont., Intrade Canada	613-727-1272, FAX:613-727-0246

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262 .... **A•1993**

MINNESOTA WIRE & CABLE CO., 1835 Energy Park Drive, St. Paul, MN 55108-2721, Tel: 612-642-1800, 1-800-258-6922(MWCC), FAX: 612-642-9201; Empl.: 165; *Sls. Mgr.:* Paul Wagner

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MINT SYSTEMS CORPORATION, 1633 South Main Street, Milpitas, CA 95035-6262, Tel: 408-262-7171, FAX: 408-262-5387; *Sls. Mgr.:* Rudy Juang .... **D•1300-1301, 2283**

MIRAGE/KLM, 16890 Church St., P.O. Box 1000, Morgan Hill, CA 95037, Tel: 408-779-7363, FAX: 408-779-8845; Empl.: 50; *Sls. Mgr.:* Nancy Nykaza

MISCO

FAX: 612-825-7010

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010; FSC No.: 14208; *Sls. Mgr.:* Tad Thompson .... **D•1052**

Local Sales Offices & Reps

CA	Newport Bch., Spa Elctrn. Sls.	714-863-1193
FL	Longwood, M & H Assocs.	407-332-7912
OH	Brecksville, Audio Mktg. Assocs.	216-526-2426
TX	Arlington, Electronic Prod. Reps.	817-467-0377
WA	Lynnwood, Pacnor Mktg., Inc.	206-771-6016

MITCHELL ELECTRONICS CORP., 84 West Grand Street, Mt. Vernon, NY 10552, Tel: 914-699-3800, TELEX: 914-699-1022; Empl.: 25; *Sls. Mgr.:* Jonathan Lerner .... **A•2433**

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, 800-724-3911, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 115; *Sls. Mgr.:* J. Robinson

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR DIV. OF MITEL CORP., 360 Legget Dr., P.O. Box 13089, Kanata, Ont., Canada K2K 1X3, Tel: 613-592-2122, TELEX: 053-3221, TWX: 613-562-8529; Empl.: 1000; *Sls. Mgr.:* Ron Chon

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 350

MITRONICS, P.O. Box 2129, Rolling Hills, CA 90274, Tel: 310-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Bob Crooks, V.P. Sls.; *Dist. Mgr.:* Bob Crooks, V.P. Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Elctrn. Device Grp., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-730-4972; Empl.: 200; *Sls. Mgr.:* Mike Bocian; *Dist. Mgr.:* Tom Zellman

Local Sales Offices & Reps

CA	Cypress, Mitsubishi Elctrns. Sls. Reg. Off.	714-236-6270
CA	San Diego, Mitsubishi Elctrns. Reg. Sls. Off.	619-451-9618
CA	Sunnyvale, Mitsubishi Elctrns.-Reg. Sls. Off.	408-730-5900
CA	Torrance, Mitsubishi Elctrns. (Southwest)	213-515-3993
CO	Denver, Mitsubishi Elctrns. (Rocky Mtn.)	303-740-6775
CO	Englewood, Mitsubishi Elctrns. Reg. Sls. Off.	303-220-0744
FL	Boca Raton, Mitsubishi Elctrns.	407-487-7747
GA	Mitsubishi Elctrns. (S. Atlantic)	404-368-4850
GA	Norcross, Mitsubishi Elctrns. Reg. Sls. Off.	404-448-1263
IL	Mt. Prospect, Mitsubishi Elctrns.-Reg. Sls. Off.	708-298-9223
MA	Woburn, Mitsubishi Elctrns. (Northeast)	617-932-5700
MA	Woburn, Mitsubishi Elctrns. Sls. Reg. Off.	617-937-4300
MN	Minnetonka, Mitsubishi Elctrns.-Reg. Sls. Off.	612-938-7779
NJ	Somerset, Mitsubishi Elctrns.-Reg. Sls. Off.	201-469-8833
NY	Fishkill, Mitsubishi Elctrns. Reg. Sls. Off.	914-896-0896
NC	Cary, Mitsubishi Elctrns. Reg. Sls. Off.	919-460-0404
TX	Carrollton, Mitsubishi Elctrns. Reg. Sls. Off.	214-245-0047
TX	Carrollton, Mitsubishi Elctrns.-Reg. Sls. Off.	214-484-1919
TX	Irving, Mitsubishi Elctrns. Sls. Reg. Off.	214-929-0046
Can	Kanata, Ont., Mitsubishi Elec. Sls. Canada, Inc.	613-591-3348
Can	Mississauga, Mitsubishi Elctrns.Reg. Sls. Off.	416-670-8711

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711, FAX: 913-894-9713; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, 800-227-8766, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste. 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R.L. Dohanian, Dir. Sls. Dev.

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R. L. Dohanian, Dir. Sls. Dev.

MMG-NORTH AMERICA, 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, FAX: 201-345-1172; Empl.: 150

MOBILE-TRONICS CO., INC., Box 1147, San Clemente, CA 92674, Tel: 714-361-4305, FAX: 714-361-4356; Empl.: 2

MODOR TECHNICAL PRODUCTS INC., 13400 Wright Cir., Tampa, FL 33626, Tel: 813-855-5736, FAX: 813-855-7942; Empl.: 13; *Sls. Mgr.:* S. James Bottone

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman .... **D•1837-1844, 2136**

Local Sales Offices & Reps

CA	Murrieta, MIL-COM Sls., Inc.	714-677-2097
CA	Santa Clara, Integrated Tech Sls.	408-727-3406
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Clearwater, CM Mktg.	813-443-6390
KS	Prairie Village, Thunderbird Tech. Sls.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls.	316-636-5777
MD	Towson, Advanced Tech. Sls., Inc.	410-296-9360
MN	St. Paul, K-Rep	612-681-9510
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NY	Great Neck, F & F Metro Inc.	516-482-4080
NY	Williamsville, NV Elect. Assoc.	716-632-1347
OH	Dover, A-J Assocs.	216-343-2224
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, M-Rep Co.	214-484-5711

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 310-542-8561, FAX: 310-371-6331; Empl.: 250; *Sls. Mgr.:* Tom Miller

MODULAR MINING SYSTEMS, INC., 3289 E. Hemisphere Loop, Tuscon, AZ 85706, Tel: 602-746-9127, FAX: 602-889-5790; Empl.: 60; *Sls. Mgr.:* J.Michael Canty

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* H. N. Patel

MODUPOWER BY SEMTECH

MODUPOWER, INC., See Semtech Corporation

MOHAWK/CDT, 9 Mohawk Dr., Leominster, MA 01453, Tel: 508-537-9961, 800-422-9961, FAX: 508-537-4358; Empl.: 140

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., P.O. Box 369, LaVerne, CA 91750-0369, Tel: 909-392-5833, FAX: 909-392-5838; Empl.: 25; *Sls. Mgr.:* Gabriel Cote, Jr.

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 158; *Sls. Mgr.:* Chris Stone

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 708-968-7000, FAX: 708-968-5068; Empl.: 100; *Sls. Mgr.:* J.D. Wilson

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 908-938-9473, TWX: 710-723-6943; Empl.: 125

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 708-969-4550, TELEX: 25-4069, FAX: 708-969-1352; Empl.: 7,483; *Sls. Mgr.:* Bill Cox; *Dist. Mgr.:* Bill Hickey

MOLI ENERGY LIMITED, 20000 Stewart Crescent, Maple Ridge, B.C., Canada V2X 9E7, Tel: 604-465-7911/1-800-663-MOLI, TELEX: 04-356708, FAX: 604-465-4398; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Mary Connolly

MOLON MOTOR & COIL CORPORATION, 3737 Industrial Avenue, Rolling Meadows, IL 60008, Tel: 708-253-6000, FAX: 708 259-5491; *Sls. Mgr.:* Timothy Wiemer

MONARCH INSTRUMENT, Monarch International Inc., 11 Columbia Drive, Amherst, NH 03031, Tel: 603-883-3390, 800-999-3390, FAX: 603-886-3300; FSC No.: Cage Code 1Z500; Empl.: 26; *Sls. Mgr.:* Richard Peters, Paul Coughlin, Prod. Mgrs.; *Dist. Mgr.:* Myron Kasok

MONICOR ELECTRONIC CORP., 2964 N.W. 60th St., Ft. Lauderdale, FL 33309, Tel: 305-979-1907, FAX: 305-979-2611; Empl.: 6

MONITOR PC

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510; FSC No.: Cage Number 54331; *Sls. Mgr.:* Pat Courington, East. Reg. Mgr.; *Dist. Mgr.:* Robert Blasier, West. Reg. Sls. Mgr. .... **A•1324, 1424-1429**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Oceanside, Monitor Prods. Co.	619-433-4510
CO	Westminster, Straube Assocs.	303-426-0890
FL	Coral Springs, Graham Assocs.	305-341-5102
FL	Jacksonville, Monitor Prods. Co.	904-725-4384
FL	Largo, Graham Assocs.	904-523-0996
FL	Melbourne, Graham Assocs.	407-773-6631
FL	Palm Beach, Graham Assocs.	407-622-4049
FL	Winter Garden, Graham Assocs.	407-656-9369
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Jas. J. Backer Co.	208-378-4680
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
KS	Overland Park, Markline Tech.	913-681-8880
MD	Baltimore, Muncy Sls. Assocs.	410-484-6376
MA	Chelmsford, Technlg. Reps.	508-250-4762
MN	Anoka, Technical Solutions, Inc.	612-785-9303
NH	Technlg. Reps.	603-774-6323
NC	Matthews, CSR Elctrns.	704-847-5806
NC	Raleigh, CSR Elctrns.	919-878-9200
OR	Beaverton, Jas. J. Backer Co.	503-627-0168
RI	Technlg. Reps.	401-789-7530
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Huntsville, Component Distr.	205-851-7800
AL	Huntsville, Resistacap, Inc.	205-883-4270
AL	Huntsville, Time Elctrns.	205-721-1134
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Scottsdale, Added Value Elec.	602-951-9788
AZ	Tempe, Timer	602-967-2000
CA	Agoura Hills, Time Elctrns.	818-707-6223
CA	Chatsworth, Passive Technlg.	818-882-2277
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Culver City, Combined Services	213-558-2859
CA	Culver City, Time Elctrns.	213-558-2859
CA	El Segundo, Force Elctrns.	213-522-1324
CA	San Diego, Added Value Elec.	619-558-8890
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sherman Oaks, Delay Line Distrs.	818-986-9455
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	310-320-0880
CA	Tustin, Added Value Elctrns.	714-259-7986
CA	Tustin, Time Elctrns.	714-669-8719
CA	Westlake Village, Added Value Elec.	818-889-2861
CO	Colorado Springs, Time Elctrns.	719-637-0055
CO	Engelwood, Component Distrib.	303-770-6214
CO	Engelwood, Time Elctrns.	303-721-8882
CO	Wheatridge, Added Value Elctrn.	303-422-1701
CT	Bridgeport, Park Distrs.	203-366-7200
FL	Boca Raton, NRC Elctrns.	507-241-8600
FL	Clearwater, Component Distrib.	813-796-0466
FL	Ft. Lauderdale, Component Distrib.	305-973-6175
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Melbourne, Comp. Dist.	407-724-9910
FL	Melbourne, Rome Elctrns.	407-242-8151
FL	Orlando, Time Elctrns.	407-841-6565
GA	Atlanta, Time Elctrns.	404-984-0126
GA	Norcross, Component Distrib.	404-441-3320
GA	Norcross, Time Elctrns.	404-368-0969
IL	Franklin Park, Stetco, Inc.	708-671-4208
IL	Schaumberg, Time Elctrns.	708-303-3000
MD	Columbia, Time Elctrns.	301-964-3090
MA	Pepperell, DSC, Inc.	508-433-9524
MN	Edina, Time Elctrns.	612-830-1252
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Rictronics, Inc.	314-997-4707
NH	Salem, Diamond Elect.	603-894-4420
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Wayne, Time Elctrns.	201-685-8250
NY	Deer Park, Brookdale Elec.	516-242-8033
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Hauppauge, Time Elctrns.	516-434-3344, 516-273-0100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Columbus, Time Elctrns.	614-794-3301
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Portland, Time Elctrns.	503-626-2979
PA	Levittown, Aim Elctrns.	215-946-3900
TX	Allen, Sunbelt Elctrns.	214-235-0587
TX	Austin, Carlton-Bates	512-837-9098
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Component Distrs., Inc.	214-644-0373
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Carlton-Bates	817-831-0395
TX	Richardson, Time Elctrns.	214-644-4644
UT	W. Valley City, Added Value Elec.	801-975-9500
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Kirkland, Time Elctrns.	206-820-1525
Can	Time Elctrns.	416-672-5300

MONOLITHIC SYS. CORP., 7050 South Tuscan Way, Englewood, CO 80112, Tel: 303-790-7400, FAX: 303-790-7118; Empl.: 50; *Sls. Mgr.:* C. Edward O'Neal; *Dist. Mgr.:* C. Edward O'Neal

MONROE ELECTRONICS, INC., 100 Housel Ave., Lyndonville, NY 14098, Tel: 716-765-2254, FAX: 716-765-9330; Empl.: 50; *Sls. Mgr.:* Steven D. Kelly

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 650-397-7820, FAX: 314-694-7625; Empl.: 39,281

MONTROSE/CDT, Cable Design Technologies, 28 Sword Street, Auburn, MA 01501, Tel: 508-791-3161, FAX: 508-793-9862; Empl.: 250; *Sls. Mgr.:* Michael McLaughlin, OEM Sls. Mgr.; *Dist. Mgr.:* Bill Wilmot

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818-0230, Tel: 401-885-0911, FAX: 401-885-4565; FSC No.: 5120,5180; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

MOORE PRODUCTS CO., Sumneytown Pike, Spring House, PA 19477, Tel: 215-646-7400, FAX: 215-283-6358; Empl.: 10000; *Sls. Mgr.:* E.M. Coll

MOORE REED & CO. LTD., Southway Walworth, Andover, Hampshire SP 105AB, Tel: 0264-324155, TELEX: 47654, FAX: 0264-356561; Empl.: 150; *Sls. Mgr.:* W. North

MORGAN-MATROC, Electro Ceramics Division, 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* D.W. Bacso .... **B•1974**

Local Sales Offices & Reps

CA	El Toro, Morgan Matroc, Inc.	714-768-8672

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 508-764-4394, FAX: 508-764-7350; FSC No.: 95548; Empl.: 25

MORRIS ENTERPRISES, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS ASC

FAX: 617-245-4531

MORS COMPONENTS, 134 Water St., PO Box 544, Wakefield, MA 01880-4444, Tel: 617-246-1007; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino .... **B•1778-1781; C•1532**

Local Sales Offices & Reps

AZ	Phoenix, More Sls., Inc.	602-331-8115
AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Arcadia, HMC, Inc.	818-447-0958
CA	San Jose, Vernexx	408-972-9072
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Wheaton, CS Technical Sls.	708-653-8126
IN	Fort Wayne, Nationwide Comps., Inc.	219-436-6095
IA	Marion, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Frederick, Glasscock Assoc. Inc.	301-694-5048
MA	Andover, Crawford Assocs.	508-470-2122
MI	Brighton, W. R. Hummon	313-486-5333
MN	St. Paul, Countryman Assocs. Co.	612-645-9151
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Edison, R.E. Breuer Co., Inc.	908-561-6161
NY	Rochester, Lamb Comps.	716-328-6350
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Portland, Elctrn. Solutions.	503-292-8204
PA	Trevose, PSA, Inc.	215-245-0513
TX	Houston, Aticus	713-466-9994
TX	Plano, Aticus	214-964-0663
VA	Ashland, Glasscock Assoc.	804-798-2125
WA	Bellevue, E2	206-637-0302
WV	New Town, Nationwide Comps., Inc.	304-343-3167
EXP	Singapore, JFL Elctrns. Pte. Ltd.	65-382-5551
Can	Mississauga, Ont., InTELaTECH	416-629-0882

Local Distributors

AZ	Phoenix, Control Design Supp.	602-829-7981
AR	Little Rock, Carlton-Bates Co.	800-482-9313
CA	Burbank, Switching Devices	213-849-3211
CA	Fremont, KEA Elctrns.	510-651-2691
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Milpitas, Sierra West	408-945-1050
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Santa Monica, Master Dists.	213-452-1229
CA	Tustin, Western Switches	714-259-8144
CO	Denver, Control Design	303-296-2010
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, Control Design	203-269-9955
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
FL	Largo, Electronic Precepts	813-544-3636
GA	Atlanta, Motion Elctrns.	404-455-8262
GA	Roswell, Gateway Megatech	404-642-8787
IL	Bensenville, Voyager Elctrns.	708-860-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Desmoines, Mid-State Distrbg.	515-244-7231
IA	W. Des Moines, Ramco Co.	515-225-6933
KS	Wichita, Radio, Inc.	316-264-2798
MD	Beltsville, PSI/Petricko Sls.	301-937-4960
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Marlboro, Hardware Specialty Co.	508-481-8622
MA	Westborough, In Stock Prods.	508-870-5750
MA	Wilmington, North Star Elec.	508-657-5155
MA	Woburn, Control Design	617-932-9404
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	St. Clair Shores, Spemco	313-771-2700
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Hibbing, MinnTech Elctrns.	218-262-5228
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	E. Brunswick, Brothers Elctrns.	908-238-2200
NJ	Oakland, Relay Specialties	201-337-1000
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Raleigh, Century Elctrns	919-596-2220
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, Radar Elctrns.	503-232-3404
PA	McKean, Advacom	814-476-7724

PA	Norristown, Century Elctrns.	215-631-5404
PA	Philadelphia, Shap Elctrns.	215-969-3300
RI	Pawtucket, Major/Edwards	401-725-7400
TX	Carrollton, LCD Elctrns.	214-245-0600
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Wofford Elctrns.	713-351-2255
UT	Nephi, Control Design Supply	801-530-4845
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Nep Elctrns.	414-785-9100
WI	Waukesha, Hawk Elctrns.	414-547-4457
Can	Mississauga, Ont., InTELaTECH	416-629-0082

MORS TECHNOLOGIES INC., Mors Group-France, 225 Industrielle, Delson, Quebec, Canada J0L 1G0, Tel: 514-638-4150, FAX: 514-638-2270

MOSAIC SEMICONDUCTOR INC., Implex Inc., 7420 Carroll Rd., San Diego, CA 92121, Tel: 619-271-4565, FAX: 619-271-6058; Empl.: 45; *Sls. Mgr.:* Steve Fallaize, Bob Lindskog; *Dist. Mgr.:* Ron Larose

MOSEL-VITELIC, 3910 N. First St., San Jose, CA 95134-1501, Tel: 408-433-6000, FAX: 408-433-0331

MOTION ENGINEERING, INC., 520 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-962-5409, FAX: 805-962-8001; Empl.: 6; *Sls. Mgr.:* Matt Cheresh

MOTION SCIENCE INC., 830-6 Jury Ct., San Jose, CA 95112, Tel: 408-993-0300, FAX: 408-993-0123; Empl.: 27

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 908-709-0025, FAX: 908-709-1144; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOR CAPACITORS, INC., 6655 N. Avondale Ave., Chicago, IL 60631, Tel: 312-631-0713, FAX: 312-774-8778; Empl.: 14 .... **A•1116**

Local Sales Offices & Reps

CA	Santa Clarita, T & C Engrg.	805-254-8778
NY	Garden City, Maximum Sls.	516-294-5029
OH	Cincinnati, Technicol Engrg.	513-851-8549
PA	Pittsburgh, EJ Sls. Co.	412-967-0360
WI	Milwaukee, KMA Sls. Co.	414-259-1771

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801, FAX: 505-822-8812; Empl.: 600; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., 4000 Commerical Ave., Northbrook, IL 60062, Tel: 708-205-2867, TELEX: 671-5420 MOT APD; Empl.: 2500

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 2100 East Elliot, Tempe, AZ 85284, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Ted Jaros; *Dist. Mgr.:* Brian Hilton

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 .... **B•1299-1301**

Local Sales Offices & Reps

OH	Dayton, Motor Technology, Inc.	513-294-1041

MOTORTEST, INC., PO Box 292633, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-841-9007

MOTOR-TRONICS, INC., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7425, FAX: 619-727-4436; *Sls. Mgr.:* Bill Linko

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 800-346-6873, FAX: 619-449-6041; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* C. Degurse

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* K. Jenkins

MOUSER ELECTRONICS, 370 Tomkins Court, Gilroy, CA 95020, Tel: 800-346-6873, FAX: 408-842-7375; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* J. Treadway

MOUSER ELECTRONICS, 12 Emery Ave., Randolph, NJ 07869, Tel: 800-346-6873, FAX: 201-328-7120; Empl.: 300

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 250

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; FSC No.: 40920; Empl.: 1900; *Sls. Mgr.:* T. A. Rudziensky; *Dist. Mgr.:* R. F. Chartier

MPC, Div. of Consulting Systems, 638 Main St., Danville, NH 03819, Tel: 603-642-5913, 1-800-238-8380, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse .... **D•1846**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MP/CAPAR, Multi Products International, 250 Lackawanna Ave., P.O. Box 737, West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; *Sls. Mgr.:* Irwin Wolberg, VP Sls. & Mktg.

MSC AUTOMATION, Miller Sales Co., 1111 Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-9200, 800-323-5294, FAX: 708-526-9206; Empl.: 23; *Sls. Mgr.:* Paula Bilinski; *Dist. Mgr.:* Dan de Ramos

Local Sales Offices & Reps

MN	Golden Valley, MSC Minn.	612-544-1045

MSD, INC., Magnecraft, 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, FAX: 803-393-4123; Empl.: 210; *Sls. Mgr.:* Bob Forbes

MSD3, 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267, FAX: 408-778-2597; *Sls. Mgr.:* Bill White

FAX: 408-778-2597

MSD3, 365 Woodview Ave., Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267; *Sls. Mgr.:* Bill White .... **A•1696-1697; D•1087**

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, FAX: 718-397-0972; FSC No.: 18518; Empl.: 18; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Toward Engr. Assocs.	602-955-3193
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Redwood City, Tri-Rep	415-364-2550
FL	Casselberry, Perrott Assoc.	407-830-0094
FL	Tampa, Perrott Assoc.	813-985-1900
IL	Chicago, Technical Sls.	312-237-7210
IN	Ft. Wayne, Menze Sls.	219-747-5616
MD	Laurel, CSDS Inc.	301-792-9850
MA	Chelmsford, BBC	508-937-3400
NC	Winston-Salem, Murcota	919-722-9445
WA	Bellevue, Caruso & Camelleri Assocs.	206-455-8811

MSI MICRO-MACHINING SYSTEMS INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Andezzone

M. SYSTEM TECHNOLOGY, INC., 15028 Beltway Dr., Dallas, TX 75244, Tel: 800-544-3181, FAX: 214-385-2299; Empl.: 10; *Sls. Mgr.:* Jeff Blair

MTE CORP., W147 N 9525 Held Dr., Menomonee Falls, WI 53051, Tel: 414-253-8200, TELEX: 62939600, ESYLNK: 414-253-8222; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* John Houdek; *Dist. Mgr.:* John Houdek

M-TEK, 2419 Smallman St., Pittsburgh, PA 15222, Tel: 800-245-5101 , 412-261-9030, FAX: 412-261-7220; FSC No.: 56452; Empl.: 20; *Sls. Mgr.:* John Hartnett

MTI INTERNATIONAL INC., W133 N5139 Campbell Dr., Menomonee Falls, WI 53051, Tel: 414-783-6080, FAX: 414-783-4959; Empl.: 210

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603, FAX: 605-665-1709; FSC No.: 23875; Empl.: 200; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Les Jensen .... **A•1431**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Mountain View, Bridge Mktg.	415-965-8045
CO	Denver, Promotech Sls.	303-692-8484
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Altomonte Springs, Ram Elctrns. Sls. Inc.	407-260-0904
IL	Arlington Hgts., KMA Sales	708-398-5300
IN	Ft. Wayne, Arete Sls., Inc.	219-423-1478
IN	Greenwood, Arete Sls., Inc.	317-882-4407
MA	Burlington, Gerber Sls., Inc.	617-229-1150
MA	Everett, Gerber Sls.	617-389-1957
MA	Marlboro, Gerber Sls., Inc.	508-460-9588
MA	Waltham, Gerber Sls. Corp.	617-893-1009
MA	Woburn, Gerber Sls., Inc.	617-933-8797
MI	Farmington Hills, Tritech Sales, Inc.	313-442-1200
MN	Edina, OHMS Technology Inc.	612-932-2920
NH	Hudson, Gerber Sls., Inc.	603-595-6568
NJ	E. Brunswick, Winch Sales Associates	201-613-1515
NJ	Medford, McCoy Grp. Inc.	609-953-0770
NJ	Mountain Lakes, Ergodyne Corp.	201-263-4585
NY	Pittsford, James E. Zimmerman Sales	716-381-3186
NY	Plainview, Winch Sales Associates	516-681-3163
NC	Raleigh, Tingen Tecn. Sls., Inc.	919-870-6670
OH	Dayton, Lyons Corporation	513-278-0714
OH	Richfield, Lyons Corporation	216-659-9224
OH	Westerville, Lyons Corporation	614-895-1447
OR	Portland, K-Tek Intl. Inc.	503-624-0315
TX	Austin, Ram Electronics Sales, Inc.	512-250-5082
TX	Houston, Ram Electronics Sales, Inc.	713-580-7394
TX	Plano, Ram Electronic Sales, Inc.	214-578-5400
UT	Midvale, Component Sales, Inc.	801-561-5099
WA	Redmond, S.E.A.	206-883-4999
WA	Vancouver, S.E.A.	503-643-3093
WI	Milwaukee, KMA Sales	414-259-1771
Can	Burnaby, BC., Kaytronics	604-294-2000
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kantata, Ont., Kaytronics	613-564-0080
Can	Ville St. Laurent, Que., Kaytronics	514-745-5800
Can	Vit Laurent, Que., Kaytronics	514-745-5800

Local Distributors

AZ	Phoenix, Sterling Electronics	602-437-5565
CA	Fremont, Acacia	510-623-7500
CA	Los Angeles, Bell Industries	310-447-6340
CA	Santa Clara, Kent, Shelly-Ragon Inc.	619-471-9561
CA	Sunnyvale, Bell Industries	408-745-0400
CO	Lakewood, Acacia	303-232-2882
FL	Miami, All American	305-621-8282
GA	Duluth, Pioneer Electronics	404-623-1003
IL	Elk Grove Vl., Bell Industries	708-640-1910
IN	Indianapolis, Pioneer Electronics	317-573-0880
MD	Columbia, Sterling	301-251-1205
MA	Andover, Bell Industries	508-474-8880
MN	Eden Prairie, Pioneer	612-944-3355
MN	Minneapolis, Stark Electronics	612-332-1325
MO	St Louis, Ric-tronics	314-997-4707
NJ	W. Berlin, GCI	609-768-6767
NY	Ronkonoma, M-tron Components	516-467-5100
OH	Dayton, Pioneer Electronics	513-236-9900
OR	Lake Oswego, Bell Industries	503-644-1500
NM	Betatron, Albuquerque	505-821-1122
TX	Houston, Kent, Shelly-Ragon Inc.	713-780-7770
TX	Houston, Sterling	713-627-9800
WA	Redmond, Kent, Shelly-Ragon Inc.	206-883-7200
WA	Redmond, Priebe Electronics	800-426-9911
Can	Mississauga, Ont., Zentronics	416-564-9600

MTS SENSORS DIVISION, MTS Sys. Corp., P.O. Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200

MTS SYSTEMS, 14000 Technology Dr., Eden Prairie, MN 55344, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 612-937-4515; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

MTX OAKTRON, 700-30th St., Monroe, WI 53566, Tel: 608-328-5560, FAX: 608-328-5575; FSC No.: 07109; Empl.: 120; *Sls. Mgr.:* J. F. Disch

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 100; *Sls. Mgr.:* J. E. Wisneski

MULTICOMP., INC., 3005 S.W. 154th No. 3, Beaverton, OR 97006, Tel: 503-626-4200, FAX: 503-643-4889; Empl.: 150 .... **A•1255, 2434-2435**

Local Sales Offices & Reps

OR	Portland, Intertech Sls.	503-775-7885

FAX: 707-575-7573

MULTI-CONTACT USA, 5560 Skylane Blvd., Santa Rosa, CA 95403, Tel: 707-575-7575; *Sls. Mgr.:* Herbie Gander, West Coast Sls.; *Dist. Mgr.:* Walter Roberts, Genl. Mgr. .... **C•1422-1424**

Local Sales Offices & Reps

IL	Chicago, Multi-Contact	312-286-1666
MA	Woburn, Multi-Contact	617-935-4104
TX	Arlington, Multi-Contact	817-943-0031

MULTICORE SOLDERS, INC., 1751 Jay Ell Drive, Richardson, TX 75081, Tel: 214-238-1224, FAX: 214-437-0288; Empl.: 1000

MULTINATIONAL RESOURCES, INC., 19 Harvey Rd., Ste. 17, Bedford, NH 03110, Tel: 603-622-3550, FAX: 603-641-6991 ... **B•1044, 1853-1854; C•1584; D•1850**

MULTIPOWER, INC., Spectrum Electronics Corp., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 33 ... **D•1847**

MULTI PRODUCTS INTERNATIONAL, 250 Lackawanna Ave., West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; Empl.: 28; *Sls. Mgr.:* Irv Wolberg ... **A•2436; D•1848**

Local Sales Offices & Reps

AZ	Phoenix, JBS Assocs.	602-893-2382
CA	Santa Clara, Nova Tronix	408-727-9530
CO	Denver, Comp. Prods. Sls.	303-530-2800
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Lawrenceville, Tek Rep Mktg.	404-963-1600
IL	Des Plaines, Esco Assocs.	312-298-5310
IN	Frankfort, C-S Elctrns. Sls.	317-659-1874
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Sterling, Beacon North	703-478-2480
MA	Harvard, Cycle Sls.	508-456-6868
MI	Lathrup VL, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Inds.	612-646-9428
NY	Rochester, Ontec Elctrns.	714-464-8636
OH	Dayton, K.W. Elctrn.	513-890-2150
PA	Langhorne, Beacon North	703-478-2480
PA	Pittsburgh, KW Elctrns.	412-366-9396
TX	Dallas, AID Elctrns.	214-790-4761
WA	Bellevue, Eltech	206-643-4330
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

MULTISENS INC, 2633 Blv. Le Corbusier, Laval, Que., Canada H7S 2E8, Tel: 514-973-8228, FAX: 514-973-1966; Empl.: 20; *Sls. Mgr.:* Jean-Francois Olivier; *Dist. Mgr.:* Alain Saint-Louis

MULTI-TECH INDUSTRIES, INC., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 908-462-6100, TELEX: 908-409-6695; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

MULTI-TECH SYSTEMS, INC., 2205 Woodale Dr., Mounds View, MN 55112, Tel: 612-785-3500, 800-328-9717, FAX: 612-785-9874; Empl.: 235; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard/Jim Stacklie

MUPAC CORP., Carlo Gavazzi Co., 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110, FAX: 508-588-0498; FSC No.: 51398; Empl.: 180; *Sls. Mgr.:* Ted Brewster

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MURATA ERIE NORTH AMERICA

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 26-1301; Empl.: 1250; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Barbara Buckalew, Dist. Mktg. Mgr. ... **A•1117-1121, 1256-1257, 1432-1436, 1571, 1660-1663, 1708-1709, 1847, 1995, 2110-2112; B•1326, 1885, 1976-1977; C•1425; D•1053-1055**

Local Sales Offices & Reps

AL	Huntsville, Jack Harvey & Assoc., Inc.	205-461-8591
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Fountain Valley, Bager Elctrns.;Inc.	714-957-3367
CA	Long Beach, Murata Erie	310-436-8700
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, CK Assocs.	619-279-0420
CA	Woodland Hills, Bager Elctrns., Inc.	818-712-0011
CO	Englewood, Thom Luke Sls.	303-649-9717
FL	Deerfield Beach, Glen White Assocs.	305-570-8545
FL	Palm Harbor, Glen White Assoc.	813-787-8503
FL	Sanford, Glen White Assoc.	407-322-4875
GA	Alpharetta, Jack Harvey & Assocs.	404-475-2654
GA	Smyrna, Murata Erie	404-433-7867
IL	Park Ridge, Metcom Assoc. Corp.	708-696-1490
IN	Carmel, Jack Harvey & Assocs., Inc.	317-575-4600
IN	Kokomo, Jack Harvey & Assoc., Inc.	317-453-4260
IA	Cedar Rapids, Stan Clothier Co., Inc.	319-393-1576
KS	Lenexa, Stan Clothier Co., Inc.	913-492-2124
KY	Prospect, Jack Harvey & Assoc., Inc.	502-228-4100
MD	Bowie, Glen White Assoc.	301-805-1989
MD	Glen Arm, Glen White Assoc.	410-592-9105
MD	Townson, Glen White Assoc.	301-337-7008
MA	Braintree, Murata Erie	617-356-4155
MA	Needham, Apex Assocs.	617-444-8070
MI	Hudsonville, Jack Harvey & Assoc., Inc.	616-669-7980
MI	W. Bloomfield, Jack Harvey & Assoc., Inc.	313-737-9122
MN	Eden Prairie, Stan Clothier Co., Inc.	612-944-3456
MO	St. Charles, Stan Clothier Co., Inc.	314-928-8078
NJ	Springfield, Radix, Inc.	201-467-4970
NY	Fairport, Technology Sls., Inc.	716-223-7500
NY	Ithaca, Technlg. Sls., Inc.	607-257-7070
NY	Pleasant Valley, Jack Harvey & Assoc., Inc.	914-635-2711
NC	Huntersville, Glen White Assoc.	704-875-3777
NC	Raleigh, Glen White Assoc.	919-848-1931
OH	Dayton, KW Electrn. Sls., Inc.	513-890-2150
OH	Shaker Hgts., KW Elctrn. Sls., Inc.	216-491-9177
OR	Beaverton, Murata Erie	503-646-4973
OR	Beaverton, Westmark Elec., Inc.	503-641-8780
PA	Allison Park, KW Elctrn. Sls., Inc.	412-492-0777
TN	Gray, Glen White Assoc.	615-477-8850
TN	Knoxville, Jack Harvey & Assoc., Inc.	615-694-7541
TX	Austin, RAM Elec. Sls., Inc.	512-250-5082
TX	Houston, RAM Elec. Sls., Inc.	713-580-7394
TX	Plano, RAM Elec. Sls., Inc.	214-578-5400
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bellevue, Westmark Elect., Inc.	206-454-1944
WI	West Allis, Metcom Assoc. Corp.	414-476-1300
PR	Hato Rey, Semtronic Assocs., Inc.	809-766-0700
Can	Mississauga, Ont., Gidden Morton Assocs.	416-671-8111
Can	Nepean, Ont., Gidden Morton Assocs.	613-820-3822
Can	St. Laurent, Que., Gidden Morton Assocs.	514-335-9572

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Future Elctrns.	602-968-7140
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Phoenix, Time Elctrns.	602-967-2000
AZ	Phoenix, TTI, Inc.	602-861-0222
AZ	Tempe, Acacia Sls./Deanco	602-894-2874, 602-882-9054
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Camarillo, Milgray Elctrns.	805-484-4055
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Chatsworth, Sterling Elctrns.	818-407-8850
CA	Culver City, Avnet, Inc.	310-558-2973
CA	Fremont, Acacia/Deanco	510-623-7500
CA	Garden Grove, Natl. Elctrns. Corp.	800-854-2451
CA	Inglewood, Newark Elctrns., Inc.	310-672-8548
CA	Irvine, Acacia/Deanco	213-971-2428,714-660-0834
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-891-8885
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Future Elctrns.	619-625-2800
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Diego, TTI, Inc.	619-748-2025
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Future Elctrns.	408-434-1122, 408-434-1114
CA	San Jose, Passive Technlg.	408-435-5566
CA	San Jose, TTI, Inc.	408-946-5577
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Sterling Elctrns.	714-259-0900
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	310-320-6372
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Englewood, Time Elctrns.	303-721-8882
CO	Lakewood, Future Elctrns.	303-232-2008
CO	Westminister, TTI, Inc.	303-429-6806
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Bethel, Future Elctrns.	203-743-9594
CT	Milford, Milgray Elctrns.	203-878-5538
CT	Wallingford, Sterling Elctrns.	203-265-9535
CT	Wallingford, TTI, Inc.	203-284-7474
DC	D.C. Area, TTI, Inc.	301-621-5335
FL	Altamonte Springs, Future Elctrns.	800-950-0168
FL	Lake Mary, Milgray Elctrns.	407-321-2555
FL	Largo, Future Elctrns.	813-530-1222
FL	Orlando, Time Elctrns.	407-841-6565
FL	Orlando, TTI, Inc.	407-859-1000
GA	Athens, Dixie Elctrns.	706-613-7755
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Milgray Elctrns.	404-446-9777
GA	Norcross, TTI, Inc.	404-662-0911
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Hoffman Estates, Future Elctrns.	708-882-1255
IL	Palatine, Milgray Elctrns.	708-202-1900
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
IL	Schaumburg, Sterling Elctrns.	708-303-9900
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Schaumburg, TTI, Inc.	708-884-6500
IN	Time Elctrns.	800-331-5114
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Time Elctrns.	800-325-9085
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
KS	Time Elctrns.	800-325-9085
KS	Lenexa, Sterling Elctrns.	913-492-5406
KS	Overland Park, Milgray Elctrns.	913-236-8800
KY	Time Elctrns.	800-331-5114
MD	Baltimore, Resco(Baltimore)	410-931-8200
MD	Beltsville, Resco(Washington)	301-937-9100
MD	Columbia, Future Elctrns.	301-290-0600
MD	Columbia, Milgray Elctrns.	410-995-6169
MD	Columbia, Sterling Elctrns.	301-290-3800
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, TTI, Inc.	410-995-1331
MA	Bolton, Future Elctrns.	508-799-3000
MA	Hopkinton, Interface Elctrns. Corp.	508-435-0100
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray Elctrns.	508-657-5900
MA	Wilmington, TTI, Inc.	508-658-4700
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Time Elctrns.	800-331-5114
MI	Farmington Hills, Advent Elctrns., Inc.	313-477-1650
MI	Livonia, Future Elctrns.	313-261-5270
MI	Oak Park, Newark Elctrns.	313-967-1570
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Sterling Elctrns.	612-831-2666
MN	Minnetonka, TTI, Inc.	612-933-8555
MO	Manchester, Time Elctrns.	314-230-7500
MO	St. Louis, Future Elctrns.	314-469-6805
NE	Time Elctrns.	800-325-9085
NJ	Edison, Sterling Elctrns.	201-417-1000
NJ	Marlton, Future Elctrns.	609-596-4080
NJ	Marlton, Interface Elctrns.	609-988-5448
NJ	Marlton, Milgray Elctrns.	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NJ	Parsippany, Future Elctrns.	201-299-0400
NJ	Parsippany, Milgray Elctrns.	201-335-1766
NJ	Rockaway, Tonar Inds.	201-586-9000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Pittsford, Milgray Elctrns.	716-381-9700
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Time Elctrns.	716-383-8853
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Syracuse, Future Elctrns.	315-451-2371
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Concord, Future Elctrns.	704-455-9030
NC	Hickory, Dixie Elctrns.	704-328-1130
NC	Raleigh, Future Elctrns.	919-790-7111
NC	Raleigh, Milgray Elctrns.	800-562-3118, 919-790-8094
NC	Raleigh, Sterling Elctrns.	819-790-8634
NC	Raleigh, Time Elctrns.	800-638-1812
NC	Winston Salem, Dixie Elctrns.	919-724-5961
OH	Centerville, Elctrn. Mktg. Corp.	513-439-4711
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Cleveland, Newark Elctrns.	216-391-9330
OH	Cleveland, Newark Elctrns.	216-886-6463
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Time Elctrns.	614-794-3301
OH	Columbus, Time Elctrns.	800-331-5114
OH	Dayton, TTI, Inc.	513-898-8330
OH	Highland Hgts., Elctrn. Mktg. Corp.	216-442-3441
OH	Independence, TTI, Inc.	216-328-9755
OH	Mayfield Heights, Future Elctrns.	216-449-6996
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Portland, Time Elctrns.	503-684-3780
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Time Elctrns.	215-337-0900

SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Gaffney, Newark Elctrns.	803-487-1982
SC	Greenville, Dixie Elctrns.	803-297-1430
SC	N. Charleston, Dixie Elctrns.	803-552-2671
SD	Time Elctrns.	800-331-5114
TN	Gray, Dixie Elctrns.	615-477-2131
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Austin, Time Elctrns.	512-346-7346
TX	Carrollton, Sterling Elctrns.	214-243-1600
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Ft. Worth, TTI, Inc.	817-834-2202
TX	Ft. Worth, TTI, Inc. Intl.	817-740-9191
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Future Elctrns.	713-556-8696
TX	Houston, Newark Elctrns.	713-270-4800
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Time Elctrns.	713-530-0800
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Time Elctrns.	214-644-6668
TX	Stafford, Milgray Elctrns.	713-240-5360
UT	Murray, Milgray Elctrns.	801-261-2999
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
UT	W. Valley City, Time Elctrns.	801-973-8494
VA	Richmond, Sterling Elctrns.	804-323-5510
WA	Bothell, Future Elctrns.	206-489-3400
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia/Deanco	206-881-5566
WA	Redmond, TTI, Inc.	206-882-0291
WI	Time Elctrns.	800-331-5114
WI	Mequon, Taylor Elec. Co., Inc.	414-241-4321
WI	Yaukesha, Future Elctrns.	414-786-1884
Can	Calgary, Alberta, Future Elctrns.	403-250-5555
Can	Edmonton, Alb., Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Future Elctrns.	416-612-9200
Can	Mississauga, Ont., Migray Elctrns.	416-678-0958
Can	Mississauga, Ont., Time Elctrns.	416-601-4368
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Tonar Inds.	514-694-5293
Can	Pointe-Claire, PQ, Milgray Elctrns.	514-426-5900
Can	Quebec, PQ, Future Elctrns.	418-877-6666
Can	Vancouver, BC, Future Elctrns.	604-294-1166
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

MURATA MANUFACTURING CO., LTD., 26-10, Tenjin 2 Chome, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: MURATA J 64270, FAX: 075-955-6526; Empl.: 21,696; *Sls. Mgr.:* O. Otaka

MUSASHINO Corporation

FAX: 714-458-1166

MUSASHINO CORPORATION, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-458-1155 ...... **A•1437-1439; C•1649-1651**

THE MUSHIELD CO. INC., P.O. Box 439, 5 Springfield Rd., Goffstown, NH 03045, Tel: 603-666-4433, TELEX: 95-5439, FAX: 603-666-4013; FSC No.: 57284; Empl.: 8 ...... **C•1698**

MUTUAL INDUSTRIES, INC., 707 West Grange Street, Philadelphia, PA 19120, Tel: 215-927-6000, FAX: 215-927-3388

MWS

Wire Industries

FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553; FSC No.: 51668; Empl.: 65; *Sls. Mgr.:* Greg Fancon ...... **C•1764-1767**

NAMCO CONTROLS CORPORATION, 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slaybaugh, Pres.; *Dist. Mgr.:* Bill Carson, Bill O'Brien

NAMIKI, Precision of America, Inc., 201 West Passaic St., Rochelle Park, NJ 07662, Tel: 201-368-0123, FAX: 201-368-2244

NANONICS CORPORATION, 21636 N. 14th Ave., Phoenix, AZ 85027, Tel: 602-581-6188, FAX: 602-581-8242; Empl.: 15

NATEL

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063-3449, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 171; *Sls. Mgr.:* Tom Guerriere ...... **D•1196-1197**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Newbury Park, Natel Engrg. Co., Inc.	805-376-5500
CA	Simi Valley, Natel Engrg. Co., Inc.	805-581-3950
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Saber Assocs.	800-432-6288
MA	Topsfield, Natel Engrg. Co., Inc.	508-887-7939
NY	Bohemia, Natel Engrg. Co., Inc.	516-563-4911
OH	Dayton, Rixan Assocs., Inc.	513-222-0011
OH	Stow, Rixan Assocs., Inc.	216-686-2909
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	Salt Lake City, Krebill Comp. Sls.	801-943-5311
WA	Mercer Island, Eagle Entprs., Inc.	206-232-7401

Local Distributors

FL	Orlando, Florida Electro Comps.	407-282-3454
MO	Florissant, Central Tech Sls.	314-831-4069
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Advanced Power Comps., Inc.	206-747-9217

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 708-231-5900, FAX: 708-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, FAX: 714-898-6769; Empl.: 50

NATIONAL INFORMATION SYSTEMS, INC., 4040 Moorpark Ave., San Jose, CA 95117-1852, Tel: 408-985-7100, 800-441-5758, FAX: 408-246-3127; Empl.: 50

NATIONAL INSTRUMENTS, 6504 Bridge Point Pkwy., Austin, TX 78730-5039, Tel: 512-794-0100, TELEX: 756737 Nat Inst Aus, FAX: 512-794-8411; Empl.: 700; *Sls. Mgr.:* Don Nadon, VP Sls. ...... **D•1147, 1198, 1302**

Local Sales Offices & Reps

CA	Manhattan Beach, Natl. Instrs.	310-546-8591
CA	Milpitas, Natl. Instrs.	408-453-3120
CA	Ontario, Natl. Instrs.	714-360-3565
CA	Riverside, Natl. Instrs.	714-275-0655
CO	Colorado Springs, Natl. Instrs.	719-542-3036
CT	Southington, Natl. Instrs.	203-276-8176
FL	Orlando, Natl. Instrs.	407-438-8700
GA	Kennesaw, Natl. Instrs.	404-499-0505
IL	Plainfield, Natl. Instrs.	815-436-7775
MD	Rockville, Natl. Instrs.	301-258-0125
MA	Norwell, Natl. Instrs.	617-659-9444
MA	Woburn, Natl. Instrs.	617-938-8508
MI	Brighton, Natl. Instrs.	313-227-9773
MN	Minneapolis, Natl. Instrs.	612-374-5488
NJ	Rutherford, Natl. Instrs.	201-460-7883
NY	Bayshore, Natl. Instrs.	516-666-0062
NY	Rochester, Natl. Instrs.	716-227-7530
OH	Mogadore, Natl. Instrs.	216-325-3156
TX	Austin, Natl. Instrs.	512-261-6338
TX	Richardson, Natl. Instrs.	214-699-7474
WA	Bellevue, Natl. Instrs.	206-451-9161
Can	Cambridge, Ont., Natl. Instrs.	519-622-9310
Can	Pointe-Claire, Que., Natl. Instrs.	514-694-8521

Local Distributors

Can	Mississauga, Ont., Allan Crawford Assocs.	416-890-2010
Can	N. Vancouver, BC, Allan Crawford Assocs.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs.	613-596-9300
Can	Pointe-Claire, PQ, Allan Crawford Assocs.	514-697-3333

NATIONAL LAMINATION CO., National Material Ltd., 555 Santa Rosa Dr., Des Plaines, IL 60018, Tel: 708-298-7676, FAX: 708-635-8624; Empl.: 225; *Sls. Mgr.:* J. Timothy Bross

NATIONAL MANUFACTURING CO., INC., 12 River Rd., Chatham, NJ 07928, Tel: 201-635-8846, FAX: 201-635-7810; Empl.: 150; *Sls. Mgr.:* Otto Stahl, Jr.

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, 2900 Semiconductor Dr., Santa Clara, CA 95052-8090, Tel: 800-272-9959, FAX: 800-432-9673; Empl.: 26,000

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

N

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611; FSC No.: 04569; Empl.: 225 ...... **C•1768-1790**

Local Sales Offices & Reps

AZ	Mesa, System Sls.	602-464-9989
AR	Mt. Home, P.M.I. Sls. Co.	501-425-4101
CA	San Diego, C.K. Sales	619-279-0420
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Arvada, Arrowhead Sls. Co.	303-423-5597
CT	Avon, Tom Maguire Assoc.	203-673-3019
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Northfield, H. S. Tollaksen	708-441-6644
MD	Glen Burnie, Faion Lott	410-744-4611
MA	Norwood, Tom Maguire Assocs., Inc.	617-551-0500
MI	Brighton, W.R. Hummon & Assocs.	313-486-5333
NH	Windham, Tom Maguire Assocs.	603-437-1245
NJ	Wayne, GT Assoc.	201-694-6040
NM	Albuquerque, Sys. Sls. of New Mexico	505-889-2901
NY	Sodus, S.T. Woolard	315-655-8145
OH	Cincinnati, Century Tech. Sls., Inc.	513-677-1788
OH	Cleveland, Century Tech. Sls., Inc.	216-871-2854
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco, Inc.	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
UT	Odgen, Summit Mktg.	801-479-7151
WA	Redmond, Halbar Assocs.	206-882-0990

NATIONWIDE ELECTRONIC SYSTEMS, See Weschler Instruments, Hughes Corp.

NAVAN CORPORATION, P.O. Box 1329, Media, PA 19063, Tel: 215-352-8464; FSC No.: 7042; Empl.: 6; *Sls. Mgr.:* Howland St. Clair

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337-2559, Tel: 612-890-1360, FAX: 612-890-1014; FSC No.: 25441; Empl.: 25; *Sls. Mgr.:* J. A. Carlson

NCGI/STRUTHERS-DUNN, INC., INDUSTRIAL/COMMERCIAL RELAYS, See MSD, Div. of Magnecraft

NCI, 6438 University Drive, Huntsville, AL 35806, Tel: 205-837-6667, FAX: 205-837-5221; Empl.: 8; *Sls. Mgr.:* Hal Newcomb; *Dist. Mgr.:* David Newcomb

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, TELEX: 6879018 Comten, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 1000; *Sls. Mgr.:* Gerry Fisher; *Dist. Mgr.:* Gerry Fisher

NCR CORPORATION, Microelectronics Products Division, 2001 Danfield Court, Fort Collins, CO 80525, Tel: 303-226-9500, FAX: 303-226-9556

NDK

FAX: 415-623-6590

NDK AMERICA, INC., 47671 Westinghouse Dr., Fremont, CA 94539, Tel: 415-623-6500; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, VP ...... **A•1440-1441**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Carefree	602-951-9121
CA	Irvine, Quad-Rep South, Inc.	714-727-4222
CA	Orangevalle, I Square, Inc.	916-989-0843
CA	San Diego, Quad-Rep.	619-560-8330
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Englewood, CSI	303-779-8060
CT	Woodbury, Anacon	203-266-0707
GA	Atlanta, Elctrn. Mktg. Assoc.	404-448-1215
ID	Boise, Intermountain Tech.	208-888-6071
IL	Chicago, M. Gottlieb & Assocs.	312-775-1151
IN	Carmel, Fred A. Dorsey & Assocs.	317-844-4842
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Annapolis, E.E.S Assoc.	301-269-4234
MA	Burlington, Anacon Sls. Assocs., Inc.	617-272-9080
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MO	St. Louis, Rush & West Assocs.	314-965-3322
MT	Boise, Inter-Mtn. Tech.	208-888-6071
NE	Davenport, Rush & West	319-388-9494
NV	Santa Clara, I Squared	408-988-3400
NY	Syracuse, Rep Tech., Inc.	315-437-2845
NJ	Fairfield, Tech. Applications & Mktg.	201-575-4130
NY	Fairfield, TAM	201-575-4130
NC	Raleigh, Elctrn. Mktg. Assoc.	919-847-8800
OH	Cincinnati, Makin Assocs.	513-871-2424
OH	Columbus, Makin Assocs.	614-848-5424
OH	Solon, Makin Assocs.	216-248-7370
OR	Tigard, Comps. West	503-684-1671
PA	Solon, Makin Assocs.	216-248-7370
SC	Greenville, Elctrn. Mktg. Assoc.	803-233-4637
TX	Dallas, T.L. Mktg.	214-490-9300
UT	Boise, Inter-Mtn Tech.	208-888-6071
VT	Wilmington, Anacon	617-270-3712
WA	Redmond, Comps. West	206-885-5880
WI	Chicago, M. Gottlieb Assocs.	312-775-1151

Local Distributors

AL	Huntsville, Time Elctrns.	214-721-1134
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-988-7200
CA	Orange, Capstone Elctrns.	714-730-0349
CA	San Diego, Time Elctrns.	619-986-0129
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Englewood, Time Elctrns.	303-721-8882
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
GA	Norcross, Time Elctrns.	404-448-4488
IL	Chicago, Capstone Elctrns.	708-250-0300
MD	Columbia, Time Elctrns.	301-964-3090
MA	Boston, Capstone Elctrns.	508-657-5874
MA	Peabody, Time Elctrns.	508-532-9900
MN	Edina, Time Elctrns.	612-943-2433
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Time Elctrns.	609-996-6700
NM	Los Alamos, Capstone Elctrns.	505-662-0745
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-434-3344
NC	Raleigh, Capstone Elctrns.	919-954-0600
OH	Columbus, Time Elctrns.	614-794-3309
OR	Portland, Time Elctrns.	503-684-3782
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Capstone Elctrns.	214-380-9049
UT	West Valley City, Time Elctrns.	801-973-8494
WA	Kirkland, Time Elctrns.	206-820-1525
Can	Ontario, Capstone Elctrns.	416-670-2010
Can	Ontario, Time Elctrns.	416-672-5300

NEARFIELD SYSTEMS, INC., 1330 E. 223rd St. 524, Carson, CA 90745, Tel: 310-518-4277., FAX: 310-518-4279; Empl.: 6

NEC

FAX: 1-800-729-9288

NEC ELECTRONICS, INC., 475 Ellis Street, Mountain View, CA 94039-7241, Tel: 1-800-366-9782, TWX: 910-379-6985; Empl.: 1650; *Sls. Mgr.:* Mike Despotes, Sls. V.P.; *Dist. Mgr.:* Richard Calogero .... **A•1122-1129; B•1088-1090, 1327-1335, 1566-1570**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999,	FAX:205-464-0895
AZ	Phoenix, Oasis Sls., Inc.	602-277-2714,	FAX:602-263-9352
CA	Encino, NEC Elctrns., Inc.	818-342-3112,	FAX:818-342-0842
CA	San Diego, Mission Technlg.	619-674-6191,	FAX:619-674-6196
CA	San Jose, Exis	408-456-1650,	FAX:408-433-0450
CA	Santa Ana, NEC Elctrns.	714-546-0501,	FAX:714-432-8793
CA	Santa Clara, NEC Elctrns.	408-986-1020,	FAX:408-988-4165
CO	Aurora, NEC Elctrns.	303-755-6353,	FAX:303-755-6728
CO	Englewood, Compass Mktg. & Sls., Inc. of Colo.	303-721-9663,	FAX:303-721-0195
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311,	FAX:203-272-7672
FL	Altamonte Springs, V.G. Sls., Inc.	407-831-8688,	FAX:407-830-0627
FL	Cooper City, NEC Elctrns., Inc.	305-436-8114,	FAX:305-436-8116
FL	Ft. Lauderdale, V.G. Sls. Inc.	305-938-4333,	FAX:305-938-4331
FL	Largo, V.G. Sls. Co., Inc.	813-536-7787,	FAX:813-530-9126
FL	Maitland, NEC Elctrns.	407-875-1145,	FAX:407-875-0962
GA	Norcross, NEC Elctrns.	404-447-4409,	FAX:404-447-8228
GA	Norcross, 20th Century Mktg. Inc.	404-446-1999,	FAX:404-662-8128
IL	Arlington Hgts., NEC Elctrns.	708-577-9090,	FAX:708-577-2147
IL	Schaumburg, Martan Inc.	708-303-5660,	FAX:708-303-5745
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462,	FAX:317-573-5472
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553,	FAX:219-432-5555
IN	Kokomo, Technlg. Mktg. Corp.	317-459-5152,	FAX:317-457-3822
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576,	FAX:319-393-7317
KS	Overland Pk., AME Sls.	913-492-3971,	FAX:913-492-4002
KY	Louisville, Technlg. Mktg. Corp.	502-245-7411,	FAX:502-245-4818
MD	Glen Burnie, TRI-MARK Inc.	301-761-6000,	FAX:301-761-6006
MA	Natick, NEC Elctrns.	508-650-4100,	FAX:508-655-1605
MA	Woburn, Compass Technlg.	617-933-3336,	FAX:617-932-3354
MI	Dearborn, NEC Elctrns., Inc.	313-336-5225,	FAX:313-336-7922
MI	Kentwood, Miltimore Sls.	616-554-9292,	FAX:616-554-9210
MI	Novi, Miltimore Sls.	313-349-0260,	FAX:313-349-0756
MI	Troy, NEC Elctrns.	313-680-0506,	FAX:313-680-1015
MN	Eden Prairie, Stan Clothier Co.	612-944-3456,	FAX:612-944-6904
MN	Minneapolis, NEC Elctrns.	612-844-0209,	FAX:612-844-0509
MO	St. Charles, AME Sls.	314-928-2599,	FAX:314-447-8797
NJ	Fairfield, Metro Logic Corp.	201-575-5585,	FAX:201-575-8023
NJ	Moorestown, TAI Corp.	609-778-5353,	FAX:609-778-7828
NY	Fairport, NEC Elctrns.	716-425-4590,	FAX:716-425-4594
NY	Fishkill, NEC Elctrns.	914-897-2101,	FAX:914-897-2215
NY	Pittsford, Elcom Sls.	716-385-1400,	FAX:716-248-8531
NY	Skaneateles, Elcom Sls.	315-685-8245,	FAX:315-685-6273
NC	Cary, NEC Elctrns.	919-460-1890,	FAX:919-469-5926
NC	Charlotte, Quantum Mktg. Inc.	704-523-8822,	FAX:704-527-3222
NC	Raleigh, Quantum Mktg. Inc.	919-846-5728,	FAX:919-847-8271
OH	Centerville, TMC of Ohio	513-898-8867,	FAX:513-271-6321
OH	Cincinnati, TMC of Ohio	513-271-3860,	FAX:513-271-6321
OH	Columbus, NEC Elctrns.	614-436-1778,	FAX:614-436-1769
OH	Middleburg Hgts., TMC of Ohio	216-885-5544,	FAX:216-885-5011
OH	Pepper Pike, NEC Elctrns.	216-831-0067,	FAX:216-831-0758
OR	Portland, Venture Elctrns.	503-624-0617,	FAX:503-620-4682
OR	Tigard, NEC Elctrns.	503-671-0177,	FAX:503-643-5911
PA	Allentown, NEC Elctrns.	215-391-9094,	FAX:215-391-9107
PA	Trevose, NEC Elctrns., Inc.	215-244-8196,	FAX:215-244-9071
TN	Erwin, 20th Century Mktg.	615-531-6854,	FAX:615-539-0676
TX	Austin, TL Mktg., Inc.	512-837-7272,	FAX:512-837-6886
TX	Dallas, NEC Elctrns.	214-931-0641,	FAX:214-931-1182
TX	Dallas, TL Mktg., Inc.	214-490-9300,	FAX:214-960-6075
TX	Houston, NEC Elctrns.	713-320-0524,	FAX:713-320-0574
TX	Houston, TL Mktg., Inc.	713-587-8100,	FAX:713-580-7517
UT	Salt Lake City, Compass Mktg. & Sls., Inc.	801-355-9663,	FAX:801-264-6607
WA	Bellevue, Venture Elctrns.	206-454-4594,	FAX:206-454-9003
WI	Mequon, Martan Inc.	414-241-4955,	FAX:414-241-8365
PR	Mayaguez, V. G. Sls. Co., Inc.	809-831-4150,	FAX:809-831-4050
Can	Burnaby, BC, Kaytronics Western	604-294-2000,	FAX:604-294-4585
Can	Calgary, B.C., Kaytronics	403-275-7000,	FAX:403-295-0732
Can	Kanata, Ont., Kaytronics	613-592-6606,	FAX:613-592-0373
Can	Mississauga, Ont., Kaytronics	416-507-6400,	FAX:416-507-6444
Can	Ville St-Laurent, Que., Kaytronics	514-745-5800,	FAX:514-745-5858

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235,	FAX:205-881-1490
AL	Huntsville, Reptron Elctrns.	205-722-9500,	FAX:205-722-9565
AZ	Phoenix, Marshall Inds.	602-496-0290,	FAX:602-893-9029
AZ	Phoenix, Sterling Elctrns.	602-437-5565,	FAX:602-437-5588
AZ	Tempe, Insight Elctrns.	602-829-1800,	FAX:602-967-2658
CA	Agoura Hills, Western Microtechnology	818-707-0731,	FAX:818-706-7651
CA	Calabasas, Marshall Inds.	818-878-7000,	FAX:818-880-6846
CA	Camarillo, Milgray Elctrns.	805-484-4055,	FAX:805-388-8169
CA	Chatsworth, Sterling Elctrns.	818-407-8850,	FAX:818-407-1837
CA	Costa Mesa, Eric Elctrns.	714-751-1185,	FAX:714-432-7365
CA	El Monte, Marshall Inds. Corp.	818-307-6000,	FAX:818-307-6297
CA	Fountain Valley, Bell Microproducts	714-963-0667,	FAX:714-968-3195
CA	Irvine, Insight Elctrns.	714-727-3291,	FAX:714-727-1804
CA	Irvine, Marshall Inds.	714-859-5050,	FAX:714-581-5255
CA	Irvine, Milgray Elctrns.	714-753-1282,	FAX:714-753-1682
CA	Milpitas, Bell Micro Corp.	408-434-1150	
CA	Milpitas, Marshall INds.	408-942-4600,	FAX:408-262-1224
CA	Orange, Western Microtechnology	714-637-0200,	FAX:714-998-1883
CA	Rancho Cordova, Marshall Inds.	916-635-9700,	FAX:916-635-6044
CA	San Diego, Insight Elctrns. Corp.	619-587-9757,	FAX:619-587-1380
CA	San Diego, Marshall Inds.	619-578-9600,	FAX:619-586-0469
CA	San Diego, Western Microtechnology	619-453-8430,	FAX:619-453-1465
CA	San Jose, Bell Microproducts	408-451-9400,	FAX:408-451-1600
CA	San Jose, Eric Elctrns. Corp.	408-432-1111,	FAX:408-434-0309
CA	San Jose, Merit Elctrns., Corp.	408-434-0800,	FAX:408-434-0935
CA	San Jose, Milgray Elctrns.	408-456-0900,	FAX:408-456-0300
CA	San Jose, Sterling Elctrns.	408-435-0835,	FAX:408-428-0108
CA	Saratoga, Western Micotechnlg. Corp.	408-725-1660,	FAX:408-255-6491
CA	Sunnyvale, Insight Elctrns.	408-720-9222,	FAX:408-720-8390
CA	Tustin, Sterling Elctrns.	714-259-0900,	FAX:714-259-0946
CA	Westgate Vlg., Bell Microproducts	805-496-2606,	FAX:805-496-6119
CA	Westlake, Insight Elctrns.	818-707-2101,	FAX:818-707-0321

CO	Englewood, Sterling Elctrns.	303-792-3939,	FAX:303-792-3433
CO	Thornton, Marshall Inds.	303-451-8383,	FAX:303-457-2899
CT	Milford, Milgray Elctrns.	203-878-5538,	FAX:203-878-6970
CT	Wallingford, Marshall Inds.	203-265-3822,	FAX:203-284-9285
CT	Wallingford, Sterling Elctrns.	203-265-9535,	FAX:203-269-9742
FL	Altamonte Springs, Marshall Inds.	407-767-8585,	FAX:407-767-8676
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880,	FAX:305-977-4887
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112,	FAX:305-735-1121
FL	Lake Mary, Milgray Elctrns.	407-321-2555,	FAX:407-322-4225
FL	St. Petersburg, Marshall Inds.	813-573-1399,	FAX:813-573-0069
FL	Tampa, Reptron Elctrns. Corp.	813-854-2351,	FAX:813-855-0942
GA	Norcross, Marshall Inds.	404-923-5750,	FAX:404-923-2743
GA	Norcross, Milgray Elctrns.	404-446-9777,	FAX:404-446-1186
GA	Norcross, Reptron Elctrns.	404-446-1300,	FAX:404-446-2991
IL	Palatine, Milgray Elctrns.	708-202-1900,	FAX:708-202-1985
IL	Schaumburg, Marshall Inds.	708-490-0155,	FAX:708-490-0569
IL	Schaumburg, Reptron Elctrns.	708-882-1700,	FAX:708-882-8904
IL	Schaumburg, Sterling Elctrns.	708-303-9900,	FAX:708-303-9933
IN	Indianapolis, Marshall Inds.	317-297-0483,	FAX:317-297-2787
KS	Lenexa, Marshall Inds.	913-492-3121,	FAX:913-492-6205
KS	Lenexa, Sterling Elctrns.	913-492-5406,	FAX:913-492-6681
KS	Overland Park, Milgray Elctrns.	913-236-8800,	FAX:913-384-6825
MD	Columbia, Milgray Elctrns.	301-995-6169,	FAX:301-381-3066
MD	Columbia, Sterling Elctrns.	301-290-3800,	FAX:301-290-3876
MD	Columbia, Vantage Comps.	301-720-5100,	FAX:301-381-2172
MD	Silver Springs, Marshall Inds.	301-622-1118,	FAX:301-622-0451
MA	Burlington, Western Microtechnology	617-273-2800,	FAX:617-229-2815
MA	Hopkinton, Interface Elctrns. Corp.	508-435-0100,	FAX:508-435-6516
MA	Wilmington, Bell Microproducts	508-658-0222,	FAX:508-694-9987
MA	Wilmington, Marshall Inds.	508-658-0810,	FAX:508-657-5931
MA	Wilmington, Milgray Elctrns.	508-657-5900,	FAX:508-658-7989
MA	Woburn, Sterling Elctrns.	617-938-6200,	FAX:617-933-5468
MI	Livonia, Marshall Inds.	313-525-5850,	FAX:313-525-5855
MI	Livonia, Reptron Elctrns.	313-525-2700,	FAX:313-525-3209
MN	Minneapolis, Sterling Elctrns.	612-831-2666,	FAX:612-831-3043
MN	Minnetonka, Reptron Elctrns.	612-938-0000,	FAX:612-938-3995
MN	Plymouth, Marshall Inds.	612-559-2211,	FAX:612-559-8321
MO	Bridgeton, Marshall Inds.	314-291-4650,	FAX:314-291-5391
NJ	Clifton, Vantage Comps. Corp.	201-777-4100,	FAX:201-777-6194
NJ	Edison, Sterling Elctrns.	908-417-1000,	FAX:908-417-1017
NJ	Fairfield, Marshall Inds.	201-882-0320,	FAX:201-882-0095
NJ	Marlton, Interface Elctrns.	609-988-5448,	FAX:609-988-5566
NJ	Marlton, Milgray Elctrns.	609-983-5010,	FAX:609-985-1607
NJ	Marlton, Western Microtechnology	609-596-7775,	FAX:609-985-2797
NJ	Mt. Laurel, Marshall Inds.	609-234-9100,	FAX:609-778-1819
NJ	Parsippany, Milgray Elctrns.	201-335-1766,	FAX:201-335-2110
NM	Albuquerque, Sterling Elctrns.	505-884-1900,	FAX:505-884-1904
NY	Bohemia, Edge Elctrns. Corp.	516-567-6300,	FAX:516-567-0611
NY	Endicott, Marshall Inds.	800-678-0010,	FAX:607-785-5546
NY	Farmingdale, Milgray Elctrns.	516-420-9800,	FAX:516-752-9870
NY	Pittsford, Milgray Elctrns.	716-381-9700,	FAX:716-381-9495
NY	Rochester, Marshall Inds.	716-235-7620,	FAX:716-235-0052
NY	Smithtown, Vantage Comps.	516-543-2000,	FAX:516-543-2030
NC	Raleigh, Marshall Inds.	919-878-9882,	FAX:919-872-2431
NC	Raleigh, Milgray Elctrns.	919-790-8094,	FAX:919-872-8851
NC	Raleigh, Reptron Elctrns.	919-870-5189,	FAX:919-870-5210
OH	Colmbus, EMC (Elctrn. Mktg.) Corp.	614-299-4161,	FAX:614-299-4121
OH	Dayton, Marshall Inds.	513-898-4480,	FAX:513-898-9363
OH	Highland Heights, Electronic Mktg.	216-442-3441,	FAX:216-442-8122
OH	Independence, Milgray Elctrns.	216-447-1520,	FAX:216-447-1761
OH	Solon, Marshall Inds.	216-248-1788,	FAX:216-248-2312
OH	Solon, Reptron Elctrns.	216-349-1415,	FAX:216-349-1634
OH	Solon, Sterling Elctrns.	216-248-1122,	FAX:216-248-0554
OH	West Chester, Sterling Elctrns.	513-779-0418,	FAX:513-779-0418
OK	Tulsa, Sterling Elctrns.	918-663-2410,	FAX:918-663-6212
OR	Beaverton, Insight Elctrns.	503-644-3300,	FAX:503-641-4530
OR	Beaverton, Marshall Inds.	503-644-5050,	FAX:503-646-8256
OR	Beaverton, Western Microtechnology	503-629-2082,	FAX:503-629-8645
PA	Pittsburgh, Marshall Inds.	412-788-0441,	FAX:412-788-0447
TX	Austin, Marshall Inds.	512-837-1991,	FAX:512-832-9810
TX	Austin, Sterling Elctrns.	512-836-1341,	FAX:512-836-3279
TX	Carrollton, Sterling Elctrns.	214-243-1600,	FAX:214-243-4091
TX	Dallas, Milgray Elctrns.	214-248-1603,	FAX:214-248-0218
TX	Houston, Marshall Inds.	713-467-1666,	FAX:713-467-9805
TX	Houston, Sterling Elctrns. Corp.	713-627-9800,	FAX:713-629-3939
TX	Mansfield, Mouser Elctrns. Corp.	800-346-6873,	FAX:817-483-0931
TX	Richardson, Insight Elctrns.	214-783-0800,	FAX:214-680-2402
TX	Richardson, Marshall Inds.	214-705-0600,	FAX:214-705-0675
TX	Stafford, Milgray Elctrns.	713-240-5360,	FAX:713-240-5404
UT	Murray, Milgray Elctrns.	801-261-2999,	FAX:801-261-0880
UT	Salt Lake City, Marshall Inds.	801-973-2288,	FAX:801-973-2296
UT	Salt Lake City, Sterling Elctrns.	801-972-5444,	FAX:801-972-5498
VA	Richmond, Sterling Elctrns.	804-226-2190,	FAX:804-226-2414
WA	Bothell, Marshall Inds.	206-486-5747,	FAX:206-486-6964
WA	Kirkland, Insight Elctrns.	800-677-7716,	FAX:206-821-2976
WA	Kirkland, Western Microtechnology	206-828-2741,	FAX:206-828-2719
WI	Milwaukee, Marsh Elctrns. Corp.	414-475-6000,	FAX:414-771-2847
WI	Waukesha, Marshall Inds.	414-797-8400,	FAX:414-797-8270
Can	Brampton, Ont., Marshall Inds.	416-458-8046,	FAX:416-458-1613
Can	Burnaby, B.C., ITT Multicomps.	604-421-6222,	FAX:604-421-0582
Can	Calgary, Alb., ITT Multicomps.	403-273-2780,	FAX:403-273-7458
Can	Calgary, Alb., MEMCO	403-258-3399,	FAX:403-258-3459
Can	Concord, Ont., ITT Multicomps. Corp.	416-798-4884,	FAX:416-798-4889
Can	Mississauga, Ont., Milgray Elctrns.	416-678-0958,	FAX:416-678-1213
Can	Nepean, Ont., ITT Multicomps.	613-596-6980,	FAX:613-596-6987
Can	Pointe Claire, Que., Marshall Inds.	514-694-8142,	FAX:514-694-6989
Can	Saskatoon, Saskatchewan, MEMCO	403-258-3399,	FAX:403-258-3459
Can	St. Laurent, Que., ITT Multicomps.	514-335-7697,	FAX:514-335-9330
Can	Surrey, BC, Memco Corp.	604-590-1553,	FAX:604-590-5008
Can	Victoria, B.C., MEMCO	604-383-2400,	FAX:604-590-5008
Can	Winnipeg, Manitoba, ITT Multicomps.	204-697-2330,	FAX:204-697-2293
Can	Winnipeg, Manitoba, MEMCO	403-258-3399,	FAX:403-258-3454

NECOA, INC., Nittoku Engineering Group, 9321A Philadelphia Rd., Baltimore, MD 21237, Tel: 410-574-4960, FAX: 410-574-7083; Empl.: 20; *Sls. Mgr.:* Larry Whyte

NEC TECHNOLOGIES, INC., 1414 Massachusetts Ave., Boxborough, MA 01719, Tel: 508-264-8000, TELEX: 910-997-0594, FAX: 508-264-8673; Empl.: 2100; *Sls. Mgr.:* Robert Byrnas, V.P. Sls.

NEDAP N.V., P.O. Box 6, Groenlo, Holland 7140 AA, Tel: ò31-5440-71111, TELEX: 44253, FAX: ò31.5440.62745; Empl.: 420; *Sls. Mgr.:* W. Bonnemeier

NEDCO ELECTRONICS, INC., 8246 LeHigh, Morton Grove, IL 60053, Tel: 708-967-0500, FAX: 708-967-0505; Empl.: 10

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833, FAX: 818-303-2286; Empl.: 52; *Sls. Mgr.:* Louis P. Lang

NEL FREQUENCY CONTROLS, INC., 357 Beloit St., Burlington, WI 53105, Tel: 414-763-3591, FAX: 414-763-2881; FSC No.: 00815; Empl.: 160; *Sls. Mgr.:* Dick Griebel, VP Sls. & Mktg.; *Dist. Mgr.:* Boyd Recknagel

DIRK A. NELSON, P.E.- CONSULTING ENGINEER, 0882 County Rd. 130, Glenwood Springs, CO 81601, Tel: 303-945-7005, FAX: 303-945-7005; Empl.: 1

NEMCO ELECTRONICS, 675 Mariners Island Blvd., San Mateo, CA 94404, Tel: 800-227-4058, FAX: 415-571-0825; FSC No.: 5910

NEMETH ENGINEERING ASSOCIATES, INC., 5901 West Highway 22, Crestwood, KY 40014, Tel: 502-241-1502, FAX: 502-241-5907; Empl.: 36

NEPENTHE, INC., 2479 E. Bayshore Rd. 800, Palo Alto, CA 94303, Tel: 415-496-6666, FAX: 415-856-8650; FSC No.: 415.856 8650; Empl.: 20; *Sls. Mgr.:* Kirk Feyerabend

NESCO BATTERY SYSTEMS, National Electro-Sales Corp., 7110 Gerald Ave., Van Nuys, CA 91406-3779, Tel: 818-781-0505, 1-800-423-2664, FAX: 818-786-2758

NESHAMINY TRANSFORMER CORP., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411, FAX: 215-794-3894; Empl.: 70; *Sls. Mgr.:* Tom Linton

NES, INC.(NATIONWIDE ELECTRONIC SYSTEMS), See Weschler Instruments, Hughes Corp.

NESLAB INSTRUMENTS INC., P.O. Box 1178, Portsmouth, NH 03802-1178, Tel: 800-258-0830, FAX: 603-436-8411; Empl.: 250; *Sls. Mgr.:* Tim Lefebvre

NETCOM, INC, 3000 Commerical Ave.,P.O.Box 3025, Northbrook, IL 60065-3025, Tel: 708-564-5100, FAX: 708-564-2279; FSC No.: 57193; Empl.: 105; *Sls. Mgr.:* Wayne Roeder

NETECH CORPORATION, 60 Bethpage Dr., Hicksville, NY 11801, Tel: 800-547-6557, FAX: 516-433-7458; FSC No.: 11-2846463; Empl.: 15; *Sls. Mgr.:* Tom Riordan

NETWORKS INTERNATIONAL CORPORATION, 13924 W. 108th St., Lenexa, KS 66215, Tel: 913-469-6494, FAX: 913-469-6495; Empl.: 23; *Sls. Mgr.:* Abhay Bisarya; *Dist. Mgr.:* Abhay Bisarya

NETWORK TECHNOLOGIES INC., 1275 Danner Drive, Aurora, OH 44202, Tel: 216-562-7070/800-742-8324, FAX: 216-562-1999

NEURAL SYSTEMS INC., 2827 West 43rd Ave., Vancouver, BC, Canada V6N 3H9, Tel: 604-263-3667, FAX: 604-263-3667; Empl.: 2; *Sls. Mgr.:* Gary Josin

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NEWBRIDGE MICROSYSTEMS, Newbridge Networks Corporation, 603 March Rd., Kanata, Ontario, Canada K2K-2M5, Tel: 613-592-0714, 800-267-7231, FAX: 613-592-1320; Empl.: 33; *Sls. Mgr.:* Garry Heidinger

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FAX: 714-474-7062

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NICHIFU AMERICA, INC., 60 Robinson St, Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

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Nissei Electronics

FAX: 415-961-7259

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CA	Mountain View, Straube Assocs., Inc.	415-969-6060
CA	San Diego, West Elect. Sls. Co.	619-566-8430
CO	Englewood, Delltron Co.	303-741-2122
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CA	Santa Clara, Tritek-SDW, Inc.	408-554-0455
CO	Louisville, SDW Mountain States	303-665-8089
FL	Cape Canaveral, TeqSpec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
GA	Snellville, Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
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MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NH	Nashua, Intersell	603-880-6500
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NC	Winston-Salem, Teqspec III	919-765-5553
OH	Dayton, WKM Assoc.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
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TX	Richardson, Testech, Inc.	214-644-5010
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WI	Milwaukee, Pat Lind Elctrns.	414-224-0146

NORTHEAST INNOVATIONS, INC., PO Box 1214, Concord, NH 03302, Tel: 603-736-8260, FAX: 603-736-4506; Empl.: 15; *Sls. Mgr.:* Robert Shipione

NORTHERN AMPOWER CORP., 47087 Grand River, Novi, MI 48374, Tel: 313-349-4860, FAX: 313-349-5692; Empl.: 30; *Sls. Mgr.:* Ronald Kirsch

NORTHERN MAGNETICS INC., 16124 Wyandotte, Van Nuys, CA 91406, Tel: 818-997-8675, FAX: 818-997-3935; Empl.: 12

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, FAX: 201-575-5973; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES INC., 35 Rivera Dr., Unit No. 5, Markham, Ont., CAN L3R 8N4, Tel: 416-475-9320, 1-800-456-1875, FAX: 416-475-5719; Empl.: 95; *Sls. Mgr.:* Mark A. Finlay

North Hills

A Porta Systems Company

FAX: 516-682-7704

NORTH HILLS SIGNAL PROCESSING, 575 Underhill Blvd., Syosset, NY 11791, Tel: 516-682-7740; FSC No.: 98821; Empl.: 40; *Sls. Mgr.:* Steve Muth .... **A•2438-2441**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
CA	Campbell, Sedillo Co., Inc.	408-374-5222
CA	North Palo Alto, Tri-Rep	415-965-1822
CA	Palo Alto, Tri Rep	415-965-1822
CA	South El Toro, Par Mktg.	714-768-6021
CO	Littleton, Mercier & Assoc.	303-770-0666
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	Clearwater, Brennan Assocs.	813-446-5006
IL	Wheaton, Vine Tech. Sls.	913-642-7220
IA	Cedar Rapids, Tech Alliance	319-373-0686
MD	Baltimore, Stemler Assocs. Inc.	410-944-8080
MD	Laurel, CSDS	301-953-7884
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MI	Farmington Hills, Rathsburg Assoc. Inc.	313-489-1500
MN	Eden Prairie, COM-TEK Sls.	612-941-7181
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Alpha Tech. Sls.	314-537-2647
MO	St. Louis, Thunderbird Tech. Sls.	314-298-8984
NJ	Kenville, CFE Gray	201-927-6662
NY	Whitney Point, T.A.E. Reps	607-692-3705
PA	Philadelphia, Paragon Sls.	215-778-6328
TX	Argyle, Milestek, Inc.	817-455-7444
TX	Boerne, Max Lipscomb & Assoc.	512-981-8708
TX	Dallas, C.J. Tellier	214-231-6348
TX	Houston, Ocean Electric	713-441-1481
WI	Genoa City, Vine Tech. Sls.	414-279-3871
Can	Montreal, Componetics Ltd.	514-331-9930

Local Distributors

MD	Laurel, Rayma	1-800-447-2962
TX	Argyle, Miles Tek, Inc.	817-455-7444

NORTH IOWA ELECTRONICS, INC., Winnebago Industries, Inc., 325 N. State St., Garner, IA 50438, Tel: 515-923-3751, FAX: 515-923-2325; Empl.: 90

NORTHLAKE ENGINEERING, INC., 8320 193 Rd., Bristol, WI 53104-0370, Tel: 414-857-9600, FAX: 414-857-6819; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTH TEXAS CIRCUIT BOARD, 1501 W. Shady Grove Rd., Grand Prairie, TX 75050, Tel: 214-790-7610, FAX: 214-986-2381; FSC No.: 5S424; Empl.: 70; *Sls. Mgr.:* Keith Larson; *Dist. Mgr.:* Keith Larson

NORTHWEST ANALYTICAL INC., 520 N. W. Davis St., Portland, OR 97209, Tel: 503-224-7727, FAX: 503-224-5236; Empl.: 26; *Sls. Mgr.:* Lynn Theis; *Dist. Mgr.:* Kathryn Botsford

NORTHWEST ETCH TECHNOLOGY, 2601 So. Hood St., Tacoma, WA 98409, Tel: 206-572-2401, 1-800-343-2401, FAX: 206-383-8325; Empl.: 30

NWμ

FAX: 503-929-6428

NORTHWEST MICROCIRCUITS, INC., 211 S. 9th - P.O. Box 1479, Philomath, OR 97370, Tel: 503-929-6424; Empl.: 15; *Sls. Mgr.:* Matt Graham .... **A•1712**

NORTON ASSOCIATES, INC., 9 Endo Blvd., Garden City, NY 11530, Tel: 516-745-1411, FAX: 516-745-1412; FSC No.: 08739

NORWESCO, INC., See Norwesco Interconnect Devices

NORWESCO INTERCONNECT DEVICES, 2633 Plastics Drive, Gastonia, NC 28053, Tel: 704-868-3581, FAX: 704-867-0577; Empl.: 80; *Sls. Mgr.:* Gary Munn

NOVA ELECTRIC CORP., Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch .... **D•2284-2285**

Local Sales Offices & Reps

CO	Englewood, Odyssey 1	303-773-8176
CT	W. Hartford, Power Factor Assoc.	203-233-0600
FL	Orlando, Truex Assoc.	407-859-2160
KS	Kansas City, Harris-Hansen Co.	816-763-6200
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Whitinsville, Power Factor Assoc.	508-234-6415
MI	Detroit, Comtel	313-358-2505
OH	Cleveland, Comtel Assoc.	216-442-8080
PA	Philadelphia, Rabal Assoc.	215-922-6914
TX	Dallas, Carey McMahill Assoc.	214-681-1414
UT	Odyssey 1.	801-485-4728
WA	Bellevue, Topp	206-747-5400
Can	Ottawa, Ont., Subtec	613-723-7720

NOVOTECHNIK U.S., INC., 237 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-2244, FAX: 508-485-2430; FSC No.: MULTIPLE; Empl.: 8 .... **A•2114**

NRD INC., Subsidiary of Mark IV Inds., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James Curtis; *Dist. Mgr.:* Larry Keating

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Cindy Habick; *Dist. Mgr.:* Mary Damiano .... **A•2149; B•1572-1576**

NTK

TECHNICAL CERAMICS

FAX: 708-390-6482

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), 1200 Business Ctr. Dr., Suite 300, Mt. Prospect, IL 60056, Tel: 708-824-1133; FSC No.: 95-246-1286; *Sls. Mgr.:* Ted Kato, Sls. Mgr.; *Dist. Mgr.:* Manabu Sato .... **A•1664-1667, 1849**

Local Sales Offices & Reps

AZ	Mesa, NTK Tech. Ceramics	602-820-4900
CA	San Jose, NTK Tech. Ceramics	408-727-5180
FL	Longwood, D-Assocs.	407-321-9594
IL	Mt. Prospect, NTK Tech. Ceramics	708-824-1133
IN	Ft. Wayne, T.X. Sls.	219-489-4447
MA	Farmingham, NTK Tech. Ceramics	508-820-0220
MI	Detroit, NTK Tech. Ceramics	313-489-0123
NJ	Millburn, NTK Tech. Ceramics	201-376-6070
TX	Dallas, NTK Tech. Ceramics	214-404-1173
Can	Ontario, NGK Spark Plugs Canada	416-291-9746

NUCLEAR MEASUREMENTS GROUP, Oxford Instruments, Inc., PO Box 2560, Oak Ridge, TN 37831-2560, Tel: 615-483-8405, TELEX: 557482, TWX: 810-572-1018, FAX: 615-483-5891; Empl.: 120; *Sls. Mgr.:* Roger Stevens

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN, FAX: 215-343-4670; FSC No.: 96696; Empl.: 130; *Sls. Mgr.:* Tom O'Malley; *Dist. Mgr.:* Tom O'Malley

NUCLEONIC PRODS., See Thomson Electron Tube & Devices Corp. Thomson CSF

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, 800-762-4278, FAX: 215-822-1427; FSC No.: 58561; Empl.: 10; *Sls. Mgr.:* Robert F. Scheuerle

NU DATA, INC., 32 Fairview Ave., Little Silver, NJ 07739, Tel: 908-842-5757, FAX: 908-842-1161; Empl.: 20; *Sls. Mgr.:* Mark Leiberman; *Dist. Mgr.:* George Serbe

NWL CAPACITORS, NWL Transformers, 1 Industrial Drive, Snow Hill, NC 28580, Tel: 919-747-5943, FAX: 919-747-8979; Empl.: 39; *Sls. Mgr.:* Gary W. Greiser **A•1136-1138**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Marrieta, Mil-Com Sls.	714-677-2097
CT	Darien, C.W. Assocs.	203-656-2339
FL	Tampa, SRT Mktg.	813-884-4805
IL	Arlington Heights, Berndt Assocs., Inc.	708-632-0900
MI	Livonia, Amtech Reps., Inc.	313-474-8300
NJ	Haddonfield, M&S Mesa Inc.	609-429-7055
NM	Albuquerque, TMMI Westfahl	505-268-1433
NY	Nassau, Jones Sudders	518-766-9575
OH	Maineville, George Barnett & Co.	513-677-0922
OR	Lake Oswego, Salestech Assocs.	503-636-9559
TX	Euless, Fralia Co. & Assocs.	817-354-1144
VT	White River Jct., Cornerstone Inds.	802-295-5260
WA	Redmond, Salestech Assocs.	206-869-5412
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400

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[209] 441-1725
[800] CAL-SWCH

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 225; *Sls. Mgr.:* Helmut Herder **A•1136-1138, 2437; D•1851**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Murrieta, Mil Com Sls.	714-677-2097
NJ	Princeton, Mutronics Assocs.	609-394-3737
NM	Albuquerque, Westfahl & Assocs.	505-268-1433
WA	Redmond, Salestech Assocs.	206-869-5412

WILLIAM F. NYE, INC., P.O. Box 8927, New Bedford, MA 02742-8927, Tel: 508-996-6721, TELEX: 940807, FAX: 508-997-5285; Empl.: 36; *Sls. Mgr.:* Donald R. Fairbanks **C•1134**

Local Sales Offices & Reps

IL	Elgin, Mark C. Biteler	708-697-5446
MI	Pleasant Ridge, Brian C. Holley	313-542-2720

NY-GLASS PLASTICS INC., Calnetics Corp., 1255 Railroad St., Corona, CA 91720, Tel: 909-737-9110, FAX: 909-737-9815; Empl.: 90; *Sls. Mgr.:* Chris Ward

NYTRON INDUCTORS, INC.(VSD, INC.), Offered by: Dale Electronics, Inc., E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301, FAX: 605-665-1627; FSC No.: 83125; Empl.: 450; *Sls. Mgr.:* Mike Husman **A•1231**

OAK◆GRIGSBY

FAX: 708-556-4216

OAKGRIGSBY INC., 88 N. Dugan Rd., Sugar Grove, IL 60554, Tel: 708-556-4200; FSC No.: 76854; Empl.: 300; *Sls. Mgr.:* Lou Falco **B•1654, 1790-1795, 1979**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Scottsdale, Carefree Elctrns. Sls.	602-951-9121
CA	Laguna Hills, Fitch Assocs.	714-951-0196
CA	San Jose, Vernex & Assocs.	408-972-9072
FL	Longwood, Septer & Assocs.	407-774-3161
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IL	Sugar Grove, OakGrigsby, Inc.	708-556-4200
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Parker, S.W. Wollard Assocs.	913-898-6552
MA	Acton, James Inds. East	508-264-4456
MN	Bloomington, Murnco & Assocs.	612-854-4161
NY	Fairport, A.C.S.	716-223-2430
OH	Beachwood, Elctrn. Sls. Masters, Inc.	216-831-8647
PA	Plymouth Meeting, CMS Sls. & Mktg., Inc.	215-834-6840
TX	Dallas, Dal/Tex Rep., Inc.	214-991-7799
Can	Mississauga. Ont., GMA (Toronto)	416-671-8111
Can	Nepean, Ont., GMA (Ottawa)	613-820-3822
Can	St. Laurent, Que., GMA (Montreal)	514-335-9572

Local Distributors

AZ	Tempe, L-Comp.	602-730-1633
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Gardena, Cal Switch	310-538-9830
FL	Pompano, Peerless	305-973-4141
FL	W. Palm Bch., Wings Electro Sls. Co.	407-798-6606
GA	Atlanta, Peerless	404-612-9090
ID	Boise, Radar	208-336-2227
IL	Addison, L Comp	708-628-1400
IL	Chicago, Newark	312-907-5453
IL	Crystal Lake, Sub Sem	815-459-4139
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Rosemont, Advent Elctrns.	708-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IN	Indianapolis, Advent Elctrns.	317-872-4910
MD	Columbia, Peerless	410-997-1717
MA	Canton, Richey/Impact Elctrns.	617-821-1500
MA	Walpole, Richey Impact	508-668-8200
MA	Westborough, In-Stock Prods.	508-870-5750
MA	Wilmington, North Star	508-657-5155
MA	Wilmington, North Star Elctrns.	508-657-5155
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Berquist	800-328-3882
MO	Kansas City, L-Comp	816-241-0111, FAX:816-241-7373
MO	Maryland, L-Comp	314-291-6200, FAX:314-298-7231
NY	Hauppauge, Fairmont Elec.	516-231-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Component Distr.	919-787-7311
OH	Centerville, IPD	513-435-2086
OR	Portland, Radar Electric Co., Inc.	503-232-3404, FAX:503-235-0428
TX	Austin, Wofford Elctrns., Inc.	512-339-1131, FAX:512-835-7351
TX	Carrolton, Northstar Elctrns.	214-980-2999, FAX:214-980-2997
TX	Dallas, Component Distr.	214-644-0373
TX	Dallas, Wofford Elctrns., Inc.	214-340-8555, FAX:214-340-9555
TX	El Paso, Ideal Indl. Elctrns.	915-779-6647, FAX:915-779-0617
TX	El Paso, Ideal Indl. Elec.	915-779-6647
TX	Houston, Wofford Elctrns., Inc.	713-351-2255, FAX:713-351-2722
WI	Milwaukee, Progressive Image, Inc.	414-321-4722
WA	Richland, Radar Electric Co., Inc.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Electric Co., Inc.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Electric Co., Inc.	509-747-3053, FAX:509-456-8069
WI	Milwaukee, Progressive Image	414-321-4722, FAX:414-321-4665
Can	Downsview, Ont., Westburne Elctrns.	416-635-2980,FAX:416-635-0019
Can	Downsview, Ont., Westburne Elec. Supp.	416-635-2980
AZ	Tucson, Carefree Elctrns. Sls.	602-882-8642

OAK SWITCH SYSTEMS, See OakGrigsby, Inc.

OAL ASSOCIATES, INC., 16744 W. Bernardo Dr., Rancho Bernardo, CA 92127-1904, Tel: 619-451-1799, FAX: 619-451-2799; Empl.: 18; *Sls. Mgr.:* Dave Dorfman

OAS INC., See Optimum Applied Systems

OCEAN MOTIONS CO., P.O. Box 130, Barrington, RI 02806, Tel: 401-246-1394, FAX: 401-246-0075; FSC No.: 64654; *Sls. Mgr.:* C. Thorp **B•1980**

Local Sales Offices & Reps

CO	Denver, Control Agcy., Inc.	303-694-9214
UT	Salt Lake City, Control Agcy.	801-268-9880, FAX:801-268-9924

OCE GRAPHICS USA, INC., 385 Ravendale Dr., Mountain View, CA 94039-7169, Tel: 415-964-7900, FAX: 415-961-6152; *Sls. Mgr.:* Gary Gedeon; *Dist. Mgr.:* Gary Gedeon

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-430-1500, FAX: 303-426-8126

OCULAR INC., 746 Lingco Dr., Richardson, TX 75081, Tel: 214-437-3888, FAX: 214-437-2562; Empl.: 110; *Sls. Mgr.:* Marvin Smith **B•1096-1097**

Local Sales Offices & Reps

AL	Madison, Southern Elctrn. Reps.	205-461-8925
AZ	Phoenix, JBS Assocs., Inc.	602-244-1212
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Jose, Kottmeier Assocs.	408-371-8700
CO	Arvada, Arrowhead Sls.	303-423-5556
FL	Hollywood, Advantage Comp.	305-962-2255
FL	Hollywood, Advantage Comps.	305-962-2255
GA	Atlanta, Southern Elctrn. Reps.	404-458-3577
IL	Arlington Hgts., Coombs & Assocs.	708-439-9810
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Kansas City, EPI, Inc.	913-432-1792
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MA	Swansea, Wm. Poisson & Assocs.	508-677-3655
MN	Hopkins, Pathway Sls.	612-891-4841
NV	Sacramento, Kottmeier Assocs.	408-371-8700
NJ	Wayne, Breen Assocs.	201-696-8683
NM	Albuquerque, Nelco Electronix	505-293-1399
PA	Newtown, Industrial Sls. Assocs.	215-860-2076
TX	Dallas, Component Technlg.	214-783-8831
WA	Renton, K.R. Jensen Sls. Co.	206-277-2772
WI	Milwaukee, Coombs & Assocs.	414-351-6123
Can	Montreal, A.R. Greg & Assocs.	514-694-6378

ODU-USA, INC., ODU-Kontakt GmbH, Germany, 4620 Calle Quetzal, Camarillo, CA 93012, Tel: 805-484-0540, FAX: 805-484-7458; Empl.: 5; *Sls. Mgr.:* Ona Collins; *Dist. Mgr.:* Kenneth E. Rhines

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; Empl.: 700; *Sls. Mgr.:* Dave Fuller, VP Sls.

OFTI, 2 Liberty Way, Westford, MA 01886, Tel: 508-692-6606, FAX: 508-692-6620; Empl.: 72

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4740; Empl.: 51; *Sls. Mgr.:* Doug Groteluschen

OGDEN MANUFACTURING CO., 48 W. Seegers Road, Arlington Heights, IL 60005, Tel: 708-593-8050, FAX: 708-593-8062; Empl.: 250; *Dist. Mgr.:* Gordon D. Hollander

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett .. **B•1982-2003; D•1313**

Local Sales Offices & Reps

AL	Huntsville, Datarep Inc.	205-881-0361
CA	Costa Mesa, FLW of Northern CA	510-651-6511
CA	Fremont, FLW of Southern CA	714-751-7512
CO	Denver, MC Squared Inc.	303-286-1414
FL	Margate, Datarep	305-968-6568
FL	Orlando, Datarep	407-843-5224
GA	Marietta, FLW	404-424-1731
IL	Columbia, R.L. Weisheimer & Assocs.	314-487-7328
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
KS	Kansas City, R.L. Weisheimer & Assocs.	816-561-1711
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MI	Livonia, TMS Inc.	313-462-2100
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E.R. Mertz, Inc.	201-232-4643
NJ	Haddonfield, G.L. Williams & Assoc.	609-428-6060
NY	Latham, L-Tron Corp.	518-785-5032
OH	Columbus, Ohio Semitronics Inc.	614-486-9561
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OK	Stillwater, Acudata Inc.	405-743-1886
PA	Pittsburg, TMS	412-221-2338
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Marion, Zelco Assocs.	803-423-0299
TX	Austin, Acudata Inc.	214-424-3561
TX	Houston, Acudata Inc.	713-580-2451
TX	Plano, Acudata Inc.	512-478-1018
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WA	Vancouver, Syntek	206-737-2957
Can	Brossard, Ont., CTH Industrial Controls.	514-671-2181
Can	Edmonton, Alb., CTH Instrs.	403-466-2900
Can	Sarnia, Ont., Armatek Controls	519-332-0100
Can	Toronto, Ont., Armatek Controls	416-251-3111

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OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 708-675-2600, TELEX: 72-4433; FSC No.: 44655; *Sls. Mgr.:* Kirk Schwiebert; *Dist. Mgr.:* Ed Kason .... **A•1259, 1996-2000, 2442; D•1056**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Denver, West, Inc.	303-477-8180
FL	Altamonte Spgs., Over & Over	407-332-1222
GA	Norcross, Over & Over	404-449-6205
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, Leslie M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
MA	Norwood, MacInnis Co.	617-762-8090
MI	Farmington Hills, R.C. Merchant Co.	313-476-4600
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Florissant, Spectrum Sls.	314-921-1313
NY	Manhasset, Win-Cor Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770
OR	Portland, Caruso & Camelleri Assoc.	503-246-5439
PA	Narbeth, Bresson Assocs.	215-664-6460
PA	Warrendale, Baehr Greenleaf & Assoc.	412-934-3088
TX	Richardson, Pro-Comp Sls.	214-669-1500
WA	Bellevue, Caruso & Camelleri Assoc.	206-455-8811
EXP	Skokie, IL, Ohmite Mfg. Co.	708-675-2600
Can	Pickering, Ont., A.C. Simmonds & Sons	416-839-8041

Local Distributors

AR	Ft. Smith, Carlton Bates	501-646-8201
CA	El Monte, Kimball & Stark	818-444-2594
CA	Fountain Valley, Component Ctr.	800-879-3550
CA	Oakland, Brill Elctrns.	415-834-5888
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Livonia, RS Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-490-4900
NJ	Camden, GRS Elctrns.	609-964-8560
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-337-5400
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns. Supp.	216-373-1300
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Richardson, Altair Co.	214-231-5166
TX	Stafford, Harrison Equip.	713-879-2600
WA	Richland, Radar Elec.	509-943-8336
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Don Mills, Ont., Saynor Varah	416-445-2340
Can	Willowdale, Ont., Electro-Sonic	416-494-1666

OHMTEK INC., Vishay, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025, FAX: 716-283-5932; FSC No.: 57489; Empl.: 205; *Sls. Mgr.:* William Cuviello .... **A•2001-2004**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C.	619-535-9080
CA	Tustin, V.E.C.-Los Angeles	714-544-7024
CO	Loveland, V.E.C.-Rocky Mtn.	303-667-7500
GA	Roswell, JWL Assocs.	404-518-8500
IL	Skokie, IRI-Illinois	708-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
MA	Sterling, Compatable Comps. Inc.	508-422-7641
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, IRI of MN.	612-854-8027
NJ	Flanders, K & R Eng. Sls., Inc.	201-584-5235
NY	Fairport, L-Mar Assocs.	716-425-9103
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OR	Beaverton, Unicomp., Inc.	503-643-1645
PA	Horsham, TMI, Inc.	215-441-4300
TX	Austin, BPA, Inc.	512-346-9186
TX	Richardson, BPA, Inc.	214-234-8438
WA	Snohomish, UniComp	206-568-0511
WI	Brookfield, IRI-Wisconsin	414-789-9393
Can	Burnaby, B.C., Kaytronics	604-294-2000
Can	Calgary, Alberta, Kaytronics	403-275-7000
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Mississauga, Kaytronics, Inc.	416-669-2262
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

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OKAYA ELECTRIC AMERICA, INC., Okaya Electric Industries, Tokyo, Japan, 503 Wall Street, Valparaiso, IN 46383, Tel: 219-477-4488; Empl.: 11; *Sls. Mgr.:* David Rickards; *Dist. Mgr.:* David Rickards .... **A•1139-1140, 1598-1599; B•1098-1099**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc., Inc.	205-533-9108, FAX:205-533-4667
AZ	Scottsdale, Lindberg Co.	602-998-2944, FAX:602-998-2356
CA	Huntington Beach, Regan-Munro Sls.	714-841-1411,FAX:714-841-3598
CO	Denver, Lindberg Co.	303-758-9033, FAX:303-758-5863
IL	Highland Park, Bransky Sls.	708-433-2375, FAX:708-433-2377
IA	Cedar Rapids, Advanced Technical	319-393-8280, FAX:319-393-8273
KS	Olathe, Advanced Technical	913-782-8702, FAX:913-782-8641
MD	Cazenovia, St. Woolard Co., Inc.	301-371-4500, FAX:301-371-7353
MA	Milford, AFM Grp.	508-478-3355, FAX:508-478-4084
MI	Southfield, R.C. Nordstrom	313-559-7373, FAX:313-559-0075
MN	Minneapolis, Electro-Serv	612-338-3475, FAX:612-338-6048
MO	Bridgeton, Advanced Technical	314-291-5003, FAX:314-291-7958
NM	Albuquerque, Lindberg Co.	505-881-1006, FAX:505-881-1007
NY	Islip, Cogent Technlg. Assoc.	516-277-7101, FAX:516-277-7614
NC	Raleigh, Vantage Mktg.	919-870-7123, FAX:919-870-7772
OH	Cincinnati, Stegman Blaine	513-729-1969, FAX:513-729-1984
OH	Cleveland, Stegman Blaine	216-572-0003, FAX:216-238-3229
OH	Vandalia, Stegman Blaine	513-890-7975, FAX:513-890-5191
OH	Westerville, Stegman Blaine	614-523-1300, FAX:614-523-1333
OK	Tulsa, Delta Comps.	918-592-7711, FAX:918-587-9437
PA	Harleysville, Thomas Jackson Assoc.	215-256-8877,FAX:215-256-9255
TX	Seagoville, Delta Comps.	214-287-6333, FAX:214-287-1453
UT	Salt Lake City, Lindberg Co.	801-484-8689, FAX:801-484-9691
WA	Seattle, J.J. Assocs.	206-246-6619, FAX:206-241-8120
Can	Calgary, Alberta, Cana Rep. Grp.	403-255-0294, FAX:403-255-4902
Can	Montreal, Quebec, Cana Rep. Grp.	514-276-4477, FAX:514-276-3646
Can	Surrey, BC, Cana Rep. Grp.	604-599-1232, FAX:604-599-3616
Can	Willowdale, Ont., Cana Rep.Grp.	416-250-6683, FAX:416-250-6684

Local Distributors

CA	Chatsworth, E W Elctrns.	818-718-2500, FAX:818-718-9007
CA	Huntington Bch, Capacitor Assocs.	714-843-1815, FAX:714-843-0947
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642,FAX:310-379-7768
CA	Santa Ana, BDS Elctrns.	714-662-1050, FAX:714-662-3929
CA	Santa Clara, Bravo Elctrns.	408-980-8500, FAX:408-980-0299
CO	Arvada, Denver Beta Wintronic Co.	303-431-7161, FAX:303-431-4964
CO	Littleton, Indelco, Inc.	303-795-3431, FAX:303-795-8298

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FL	Ft. Lauderdale, Gulf Comps., Inc.	305-525-2770,	FAX:305-527-0049
FL	Melbourne, Pridmore Elctrns.	407-727-2491,	FAX:407-723-1213
FL	Orlando, ATCOM	407-354-0435,	FAX:407-354-0438
IL	Franklin Pk., Stetco Inc.	708-671-4208,	FAX:708-671-5270
IL	Hillside, Schuten Elctrns.	708-544-9600,	FAX:708-544-9684
IL	Morton Grove, Nedco Elctrns.	708-967-0500,	FAX:708-967-0505
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699,	FAX:317-633-6687
MA	Burlington, Atlantic Comps. Supp. (ATCOM)	617-270-0051,	FAX:617-270-4056
MA	Sharon, Adcour, Inc.	617-784-8123,	FAX:617-784-5563
MI	Battle Creek, Great Lakes Elctrns. Supp.	616-963-6282,	FAX:616-963-3432
MI	Madison Hgts., Galco Indl. Elctrns., Inc.	313-542-9090,	FAX:313-542-8031
MN	Eagan, Capacitor Assocs.	800-328-0003,	FAX:612-456-5850
MN	Eitzen, Capacitor Assocs.	507-495-3306,	FAX:507-495-3454
NJ	Wyckoff, B & R Elctrns.	201-670-7200,	FAX:201-670-6849
OH	Chagrin Falls, Comm-Omni	216-247-7030,	FAX:216-247-6199
PA	Philadelphia, Shap Elctrns. Co., Inc.	215-969-3300,	FAX:215-934-5539
TX	Dallas, Comp. Dist., Inc.	214-644-0373,	FAX:214-644-1115
WI	Mequon, Taylor Elctrc. Co.	414-241-4321,	FAX:414-241-4025
Can	Gloucester, Ottowa, Elctrn. Whlsrs.	613-746-4413,	FAX:613-746-6260
Can	Montreal, Que., Elctrn. Whlsrs.	514-769-8851,	FAX:514-769-9060
Can	See-Foy, Que., Elctrn. Whlsrs.	418-657-5020,	FAX:418-657-5234

OKI SEMICONDUCTOR, INC., 785 N. Mary Ave., Sunnyvale, CA 94086, Tel: 408-720-1900,800-TEAM-OKI, TELEX: 296687 OKI SNTA, FAX: 408-720-1918

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07004, Tel: 201-575-1101, FAX: 201-575-7178; Empl.: 40; *Sls. Mgr.:* Dick Kopp

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07004, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Robert T. Mello

OLYMPUS CORPORATION, Industrial Fiberoptics Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Tel: 516-488-3880, FAX: 516-488-3973

OMATION INC., 801 Presidental Dr., Richardson, TX 75081, Tel: 214-231-5167, 800-553-9119, FAX: 214-783-9072; Empl.: 15; *Sls. Mgr.:* Nancy James

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OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 800-826-6342; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi .... **B•1796, 1886-1887, 2004-2005; C•1547, 1792; D•1016, 1101, 1166, 1199, 1314, 1362-1363, 1415**

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OMICRON ELECTRONIC, Ang-Kauffmann-Str. 8, Hohenems, Austria A-6845, Tel: 0/5576/4010-0, FAX: 0/5576/5153; Empl.: 16; *Sls. Mgr.:* Reinhard Kuntner; *Dist. Mgr.:* Marc Andreas Vogg

OMNICOMP GRAPHICS CORP., 1734 W. Sam Houston Pkwy N., Houston, TX 77043, Tel: 713-464-2990, TELEX: 285801, FAX: 713-827-7540; Empl.: 40

OMNIBYTE CORP., 245 W. Roosevlet Rd., Bldg. 1, West Chicago, IL 60185-3790, Tel: 708-231-6880, FAX: 708-231-7042; Empl.: 24; *Sls. Mgr.:* Greg Urban

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OMNIPRINT, INC., 6A Vanderbilt, Irvine, CA 92718, Tel: 714-457-0229, 800-878-6880; Empl.: 15; *Sls. Mgr.:* Stephen Bergeron; *Dist. Mgr.:* Rita Bell ... **D•1102-1104**

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FAX: 602-582-0665

OMNI SWITCH USA, INC., 21620 N. 19th Ave., Ste. A 103, Phoenix, AZ 85027, Tel: 602-582-0629; Empl.: 100; *Sls. Mgr.:* Peggy Ann Wenzel, V.P. .... **C•1137**

Local Sales Offices & Reps

AZ	Phoenix, Omni Switch USA, Inc.	602-582-0629
CA	Irvine, Vale Elctrns.	714-551-4004
CA	Santa Clara, Premier Tech. Sls.	408-736-2260
CO	Westminster, Glenmar	303-423-1572
CT	Darien, CW Assocs.	203-656-2339
GA	Lilburn, Pinnacle Mktg.	404-410-9980
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Indianapolis, C.C. Electro Sls.	317-921-5000
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Plymouth, C.C. Electro Sls.	313-455-0000
NM	Albuquerque, Power Entprs.	505-271-9266
NY	Eastchester, W.D. Sls.	914-779-8738
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Cleveland, C.C. Electro Sls.	216-228-4338
TX	Dallas, Leon de Mexico	214-243-1089

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FAX: 708-893-9991

OMNI VISION INC., 168 N. Brandon Dr., Glendale Heights, IL 60139, Tel: 708-893-1720; *Sls. Mgr.:* Walt Kowalski .... **B•1101**

OMRON ELECTRONICS, INC., Control Components Division, 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, 1-800-626-6766, FAX: 708-843-7787; Empl.: 300; *Dist. Mgr.:* Mac Rowell

OMRON ELECTRONICS, INC., F A Systems Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-7787; Empl.: 300; *Sls. Mgr.:* Sal Scafidi

ONAN POWER/ELECTRONICS, 9713 Valley View Rd., Minneapolis, MN 55344-3577, Tel: 612-943-4600, FAX: 612-943-4627; FSC No.: 3Z577; Empl.: 500; *Sls. Mgr.:* Jim Vogt

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 708-816-6000,800-327-8801, TWX: 757024 ONEAC USA; Empl.: 150; *Sls. Mgr.:* Byron Brooks

ONSET COMPUTER CORP., 536 MacArthur Blvd., P.O. Box 3450, Pocasset, MA 02559-3450, Tel: 508-563-9000, FAX: 508-563-9477; Empl.: 12; *Sls. Mgr.:* Lon Hocker

ONSHORE TECHNOLOGY, 1917 W. 3rd St., Tempe, AZ 85281, Tel: 602-921-3000; Empl.: 200; *Sls. Mgr.:* R. Mandell; *Dist. Mgr.:* L. Anthole

ONTRACK DATA RECOVERY, INC., Ontrack Computer Systems, Inc., 6321 Bury Drive, Ste.15-19, Eden Prairie, MN 55346, Tel: 800-872-2599, FAX: 612-937-5750

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-462-6490; FSC No.: 24699; Empl.: 18 .... **D•1017**

OPTEK TECHNOLOGY INC., 1215 West Crosby Rd., Carrollton, TX 75006, Tel: 214-323-2200, FAX: 214-323-2396; Empl.: 2000; *Sls. Mgr.:* Cornelius Clark; *Dist. Mgr.:* Wayne Davis

OPTELECOM, INC., 9300 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-840-2121, FAX: 301-948-6357; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Harish K. Jain .... **B•1223-1227**

OPTICAL CABLE CORP., P.O. Box 11967, Roanoke, VA 24022-1967, Tel: 1-800-622-7711, TELEX: 705-290, FAX: 703-265-0724; FSC No.: 6Y528; Empl.: 68; *Sls. Mgr.:* Luke J. Huybrechts, VP/Sls.; *Dist. Mgr.:* Chuck Surat, Natl. Accts. Exec.

OPTICAL ELECTRONICS, INC., P.O. Box 11140, Tucson, AZ 85734, Tel: 602-889-8811

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 497-4643, FAX: 201-228-0915; Empl.: 33; *Sls. Mgr.:* Diane M. Fiore

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OPTIMA ELECTRONIC PACKAGING SYSTEMS, 2166 Mountain Industrial Blvd, Tucker, GA 30084-5088, Tel: 404-496-4000; FSC No.: 10110; Empl.: 150 .... **C•1056-1061**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg., Inc.	205-772-9999
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Oviedo, Conley & Assocs., Inc.	407-365-3283
GA	Tucker, Optima EPS	404-496-4000
IL	Arlington Heights, Berndt Assocs., Inc.	708-632-0900
MA	Milford, Selmark Assocs., Inc.	508-478-9088
MI	Madison Hgts., DEM Electronic Sls., Inc.	313-583-1500
MO	St. Louis, Rush & West Assocs., Inc.	314-965-3322
NJ	Berkeley Heights, Cambridge Allen & Assocs.	908-464-0203
NY	Manlius, Lamtec Sls. Corp.	315-682-4780
NC	Chapel Hill, T.A. Barker Assocs.	919-968-7808
OH	Cleveland, C.A. Robinson Co., Inc.	216-473-6044
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
UT	Salt Lake City, Sierra Technical Sales	801-566-9719
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, El Tech	206-746-7780

OPTIMA PRECISION, INC., 775 SW Long Farm Rd., West Linn, OR 97068, Tel: 800-544-4118, 503-638-2525, FAX: 503-638-4545; Empl.: 6

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OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100, FAX: 914-741-0729; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001, FAX: 914-693-8733; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

OPT INDUSTRIES, INC., 300 Red School Lane, Phillipsburg, NJ 08865, Tel: 908-454-2600, FAX: 908-454-3742; FSC No.: 53342/80223; Empl.: 264; *Sls. Mgr.:* Frank McMahon; *Dist. Mgr.:* Pam Nolf, Sls. Adm.

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
AZ	Paradise Valley, Techrep-Arizona	602-991-6646
CA	Irvine, Componant Mktg. Assoc.	714-727-0688
CA	Milpitas, Marcon Sls.	408-263-3660
CO	Franktown, MRC	303-660-8750

CT	Canterbury, Deltech Sls.	203-546-6322
FL	Clearwater, Tech-Rep Assoc.	813-572-9900
FL	Ft. Lauderdale, Tech-Rep Assoc.	305-791-2708
FL	Merritt Island, Tech-Rep Assoc.	407-453-3313
GA	Lawrenceville, E-Squared Mktg.	404-995-7206
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Ft. Wayne, Johnson GP.	219-471-7100
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
KS	Wichita, DLE Elctrns.	316-683-6400
MD	Annapolis, Elctrn. & Technlg. Sls.	410-974-9351
MA	Littleton, Deltech Sls.	508-486-8294
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Spring Lake, Johnson Gp.	616-842-7706
NY	E. Rochester, Alan Lupton Assoc.	716-381-4800
NY	Glen Cove, Dyno Rep, Inc.	516-676-1598
OH	Cincinnati, Stegman Blaine Mktg.	513-521-0958
OH	Cleveland, Stegman Blaine Mktg.	216-572-9797
OH	Vandalia, Stegman Blaine Mktg.	513-890-7486
OR	Portland, E2	503-297-5968
OR	West Linn, Power Factor & Assoc.	503-657-6969
PA	Phila, Rabal Assoc.	215-922-6914
TX	Austin, Sunbelt Comps.	512-335-0499
TX	Dallas, Sunbelt Comps.	214-248-8000
TX	Missouri City, Sunbelt Comps.	713-499-4722
WA	Bellevue, E2	206-637-0302

Local Distributors

CA	Santa Ana, Norstan Elctrns. Inc.	714-NORSTAN
NY	Hauppauge, Jaco	516-273-5500
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
TX	Dallas, Assoctd. Aircraft Supp. Co., Inc.	214-331-4381

OPTIVISION, INC., 1477 Drew Ave., Suite 102, Davis, CA 95616, Tel: 916-757-4850, 800-562-8934, FAX: 916-756-1309; Empl.: 26; *Sls. Mgr.:* Kathy Ernest

OPTO DIODE CORP., 750 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-499-0335, FAX: 805-499-8108; FSC No.: 67109; Empl.: 12

OPTOELECTRONICS, INC., 5821 N.E. 14th Ave., Ft. Lauderdale, FL 33334, Tel: 305-771-2050, FAX: 305-771-2052; Empl.: 30; *Sls. Mgr.:* L. R. Hufft; *Dist. Mgr.:* L. R. Hufft

OPTOELECTRONICS TEXTRON, 1309 Dynamic St., P.O. Box 750039, Petaluma, CA 94975-0039, Tel: 707-763-5900, FAX: 707-762-7383; Empl.: 100

OPTO PLUS ò INC., 23382 Madero, Unit A, Mission Viejo, California, CA 92691, Tel: 714-380-8654, 800-554-6786, FAX: 714-380-0761; Empl.: 7

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 708-537-4277, FAX: 708-537-4785; Empl.: 25; *Sls. Mgr.:* Thomas W. Hegberg, Sls. Mgr.

OPTOTEK LIMITED, 62 Steacie Dr., Kanata, Ont., Canada K2K 2A9, Tel: 613-591-0336, FAX: 613-591-0584; FSC No.: 38183; Empl.: 30

OPTO 22, 43044 Business Park Dr., Temecula, CA 92590, Tel: 714-695-9299, FAX: 714-695-2712

OPTREX, Asahi Glass, 23399 Commerce B-8, Farmington Hills, MI 48335, Tel: 313-471-6220; Empl.: 25

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FAX: 310-214-1721

OPTREX/SATORI, 3830 Del Amo Blvd. Ste. 101, Torrance, CA 90503, Tel: 310-214-1791; Empl.: 12; *Sls. Mgr.:* David Liu; *Dist. Mgr.:* Dave Liu **B•1102-1103**

Local Sales Offices & Reps

AZ	Scottsdale, JKA Associates	602-990-8804
CA	Santa Clara, Nova-Tronix	408-727-9530
CA	Torrance, Satori Elec.	213-378-9478
CO	Denver, Aki Entprs.	303-388-4488
CO	Denver, AKI Entprs.	303-388-4488
GA	Atlanta, Satori Elec.	404-320-8482
OR	Portland, Venture Elctrns.	503-624-0617
OR	Portland, Venture Elex	503-624-0617
WA	Seattle, Venture Elctrns.	206-454-4594
TX	Dallas, Satori Elec.	214-518-1946
WA	Bellevue, Venture Elex.	206-454-4594
WA	Bellvue, Venture Elex	206-454-4594

Local Distributors

CA	Buena Park, Cypress Elctrns.	213-744-0355
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Jose, Sierra West	408-435-7477
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Englewood, Cypress Elctrns.	303-792-5829
OR	Beaverton, Cypress Elctrns.	503-641-2233
OR	Beaverton, I E C	503-641-1690
OR	Beaverton, IEC	503-641-1690
WA	Bellevue, I.E.C.	206-455-2727
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Bothwell, Cypress Elctrns.	206-483-1144

OPTRONIC LABORATORIES, INC., 4470 35th St., Orlando, FL 32811, Tel: 407-422-3171, 800-899-3171, TELEX: 910-240-5263, FAX: 407-648-5412; FSC No.: 59938; Empl.: 36; *Sls. Mgr.:* William A. Schneider, VP of Sls. & Opers.

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ORBIT INDUSTRIES, Countis Industries, 2670 Lockheed Way, Carson City, NV 89706, Tel: 702-882-6123; Empl.: 11; *Sls. Mgr.:* James T. Countis

ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas **B•1849; D•1167**

Local Sales Offices & Reps

CA	San Diego, D. Cary	619-222-8839
MA	Tweksbury, Delcon Sls.	508-851-9911

ORBIT INSTRUMENT OF CAL., Orbit Instrument Corp., 5606 Corporate Ave., Cypress, CA 90630, Tel: 714-527-0561, FAX: 714-527-7552; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon **B•1849; D•1167**

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ORCAD, 3175 N.W. Aloclek Dr., Hillsboro, OR 97124-7135, Tel: 503-690-9881; Empl.: 70; *Sls. Mgr.:* Stephen Holmes **D•1148**

Local Distributors

AZ	Scottsdale, Tusar	602-998-3688
CA	Garden Grove, Avcom EDA	714-897-0319
CA	San Diego, Insight Elctrns.	619-587-1100
CA	Sunnyvale, Avcom EDA	408-733-5000
FL	W. Melbourne, Trilogic Sunforce	407-722-1324
MA	Wilmington, Trilogic Inc.	508-658-3800
MI	Bloomfield Hills, MacKellar Assocs.	313-335-4440
NJ	Freehold, Beta Lambda, Inc.	908-294-9500
NC	Raleigh, Trilogic Sunforce	919-755-1700
OK	Tulsa, Abcor, Inc.	918-299-1468
TX	Dallas, Abcor, Inc.	214-739-3158
TX	Houston, Abcor, Inc.	713-486-9251
WA	Kirkland, Avcom EDA	206-828-2725

ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-897-5128, TELEX: 4994037, FAX: 913-897-5468; *Sls. Mgr.:* Manford Eaton

OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl, C100, Beaverton, OR 97006, Tel: 503-644-4999, 503-629-8081, FAX: 503-629-0688; Empl.: 12; *Sls. Mgr.:* Wayne Hunter

ORIEL CORP., 250 Long Beach Blvd., Stratford, CT 06497-0872, Tel: 203-377-8282, FAX: 203-378-2457; Empl.: 120; *Sls. Mgr.:* Thom. Connolly

ORIENTAL MOTOR USA CORP., 2580 W. 237th Street, Torrance, CA 90505-5217, Tel: 310-515-2264, FAX: 310-515-2879; Empl.: 60; *Sls. Mgr.:* 4; *Dist. Mgr.:* Greg Johnston

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-271-5770, FAX: 908-271-5774

ORION DEVELOPMENT CORP., P.O. Box 2323, Merrifield, VA 22116-2323, Tel: 703-698-8126, 800-992-8170, FAX: 703-698-0857; Empl.: 2; *Sls. Mgr.:* Richard A. Long

ORION INSTRUMENTS, INC., 180 Independence Dr., Menlo Park, CA 94025, Tel: 415-327-8800, 800-767-4666, TELEX: 530942, FAX: 415-327-9881; *Sls. Mgr.:* Eric Mudama

ORLANDO DEVELOPMENT CENTER, Micro Energy Inc., 745 W. State Rd. 434, Longwood, FL 32750-4909, Tel: 407-831-2000, FAX: 407-831-1100; Empl.: 250; *Sls. Mgr.:* Bill Maxwell

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, FAX: 716-385-5999; Empl.: 50; *Sls. Mgr.:* Gregory Woods

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; Empl.: 130; *Sls. Mgr.:* Bill Moore, V.P. of Sls.

OSCILLATEK
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OSCILLATEK, A Dover Technologies Company, 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777; FSC No.: 57693; Empl.: 80; *Sls. Mgr.:* William J. Beck **A•1442-1448**

Local Sales Offices & Reps

AZ	Tempe, Cain Technlg.	602-966-4322
CA	Fahmer-Miller	408-727-9800
CA	Santa Clara, Fahrner Miller Assoc.	916-677-5838
CA	Van Nuys, Cain Technlg.	818-904-9392
CO	Englewood, Cain Technlg.	303-220-8118
CT	Adelco	617-444-4754
FL	Clearwater, Beacon Elctrns.	813-796-2378
GA	Atlanta, Beacon Elctrns.	404-449-8464
IL	RK Elctrns.	708-695-8552
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Gooddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Needham, Addelco Corp.	617-444-4754
MN	Chanhassen, Barnes Sls.	612-934-2907
MO	MTS	314-298-8787
NJ	Spectrum	914-472-8600
NY	Advanced	315-437-6700
NY	Advanced	607-785-3191
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Syracuse, Advanced Comps. Corp.	315-437-6700
OR	Thorson NW	503-293-9001
OR	Portland, Thorson Co. Northwest	503-293-9001
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
TX	Rep-Tec	214-956-8700
TX	Dallas, Rep-Tec	214-956-8700
VA	Alexandria, Mid States Mktg.	703-370-2600
WA	Thorson NW	206-455-9180
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Mississauga, BBD	416-821-7800

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

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OSHINO LAMPS LIMITED, 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan 140, Tel: 03-3471-8548, TELEX: 0242-2117; Empl.: 300; *Sls. Mgr.:* T. Koyama **B•1176-1177**

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Local Sales Offices & Reps

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AZ	Tempe, Vikeland Sls.	602-839-9370
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Trabuco Canyon, Interconn	714-589-4655
CO	Englewood, CompuTech Mktg.	303-773-3981
CT	Glastonbury, Pace Assocs.	203-659-2266
FL	Maitland, Hawkins-Frederickson	407-831-2474
GA	Atlanta, Overton Assoc.	404-497-0166
IL	Lisle, W-G Controls	708-963-5954
IA	Cedar Rapids, W-G Controls	319-373-1009
MN	St. Paul, Vikeland Sls.	612-645-4647
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Englewood, Gray Assocs.	201-894-0894
NJ	Kenvil, Gray Assoc.	201-927-6662
NY	Syracuse, Canavan-Scanlon Assocs., Inc.	315-437-1271
NY	Yaphank, Gray Assoc.	516-924-2471
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
OR	Lake Oswego, Luscombe Engr.	503-636-6664
PA	Pittsburgh, Catalyst Sls.	412-733-5450
PA	West Chester, All Tech. Mktg.	215-344-0134
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Bellevue, Luscombe Engr.	206-223-1541
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LComp., Inc.	602-730-1633
CA	Anaheim, Deco Elctrns., Inc.	714-630-8252
CA	Gardena, California Switch & Signal	1-800-421-2471
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, HdB	415-368-1388
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Tustin, Western Switches & Controls, Inc.	714-259-8144
CA	Van Nuys, Wes Garde Components	213-873-4802
CO	Aurora, Jet Elctrn. Supp., Co., Inc.	303-364-1000
CT	West Hartford, Wes Garde Components	203-527-7705
FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Wes Garde Components	813-644-7564
IL	Addison, LComp., Inc.	312-628-1400
IL	Carol Stream, Wes Garde Components	1-800-323-9431
IL	Crystal Lake, Sub Sem	815-459-4139
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Park, Wes-Garde	913-262-2718
KS	Wichita, LComp.,Inc.	316-265-5100
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Walpole, Richey Impact	508-668-8200
MI	St. Clair Shores, SPEMCO, Inc.	313-771-2700
MN	Minneapolis, Dot Elctrns.	612-926-9505
MN	Minneapolis, Elctrn. Center, Inc.	612-371-5200
MO	Maryland Hgts., LCOMP, Inc.	800-325-1393
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	Mt. Laurel, Wes Garde Components	609-778-8190
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Woodside, Switches Unltd., Inc.	718-478-5000
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Westerville, Wes Garde Components	614-885-0319
OR	Wilsonville, Wes Garde Comp.	503-682-1333
PA	Exton, USH Elctrns.	215-363-2250
PA	McKean, Advacom	814-476-7774
TX	Dallas, GEECO Sls. Co.	214-341-0610
TX	Dallas, Wes Garde Components	214-357-1768
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Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps. Corp.	602-481-0044, FAX:602-481-0072
CA	Anaheim, Gabriel & Assocs.	714-666-0660, FAX:714-666-0753
CA	San Jose, Westron Assocs.	408-264-4070, FAX:408-264-1808
CO	Denver, Advent Comps. Corp.	303-455-1985, FAX:303-455-0900
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650, FAX:407-857-3298
GA	Alpharetta, Pinnacle Marketing Inc.	404-410-9980, FAX:404-410-9981
IL	Itasca, LTD Technlgs., Inc.	708-773-2900, FAX:708-773-0358
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616, FAX:219-747-3561
KS	Prairie Vlg., Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040,FAX:301-258-5146
MA	Norwell, Norris & Assocs.	617-659-7988, FAX:617-659-8172
MI	Royal Oak, Hilltronics Inc.	313-435-0920, FAX:313-435-3215
MN	Minneapolis, Josco Melius Inc.	612-861-3343, FAX:612-861-3046
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114,FAX:201-440-4623
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300, FAX:609-596-5367
NY	Skaneateles, Empire Technical Assocs.	315-685-5703,FAX:315-685-5979
NC	Raleigh, Pinnacle Mktg., Inc.	919-848-0404, FAX:919-848-0101
OH	Beavercreek, Electro Com (U.S. Gov't. Sls)	513-427-2696,FAX:513-427-2697
TX	Dallas, Control Comps. Corp.	214-458-8877, FAX:214-788-1259
WA	Kirkland, James Findlay Co.	206-822-1510, FAX:206-822-0359
WI	Mequon, Badgerep, Inc.	414-241-9200, FAX:414-241-8300
Can	Etobicoke, Ont., Millennium Mktg.	416-798-3044

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805, FAX:602-275-4807
AZ	Tempe, LCOMP	602-730-1633,FAX:602-831-8757
AZ	Tuscon, Beswitched	602-792-2554
CA	Cupertino, Cal Switch	408-973-7800, FAX:408-725-8885
CA	Gardena, Cal Switch	310-770-2330, FAX:310-327-2741
CA	Hayward, TPS Aviation	510-475-1010, FAX:510-475-8817
CA	Los Angeles, Electric Switches, Inc.	213-660-1310, FAX:213-660-5130
CA	Santa Ana, Norstan Elctrns.	714-540-4165, FAX:714-250-0135
CO	Aurora, Jet Elctrn. Supply Co., Inc.	303-364-1000, FAX:303-364-0800
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Lakeland, Wes-Garde Comps.	813-644-7564, FAX:813-644-1722
FL	Orlando, Sager Elctrns.	407-354-1130, FAX:407-354-1137
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141,FAX:305-977-4273
GA	Atlanta, Peerless Radio	404-612-9090, FAX:404-612-0242
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Addison, LCOMP	708-628-1400, FAX:708-628-1400
IL	Carol Stream, Wes-Garde Comps. Grp.	708-653-1460,FAX:708-653-1491
KS	Wichita, Airtechnics, Inc.	316-267-2849, FAX:316-267-1482
MD	Columbia, Peerless Radio Corp.	800-225-0709
MD	Columbia, Sager Elctrns.	301-995-4900, FAX:301-381-9380
MD	Kensington, Marine Air Supp.	301-949-9560, FAX:301-942-1536
MD	Owings Mills, Miltech Elctrns.	410-356-3200, FAX:410-356-0967
MA	Hingham, Sager Elec. Supp.	617-749-6700, FAX:617-749-3842
MI	Grand Rapids, RM Elctrns.	616-531-9300, FAX:616-531-2990
MI	St. Clair Shores, Spemco	313-771-2700, FAX:313-771-3491
MO	Kansas City, LCOMP	816-241-0111, FAX:816-241-7373
MO	Maryland Heights, LCOMP	314-291-6200, FAX:314-298-7231
NH	Salem, Sager Electrl. Supply	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300, FAX:516-348-1006
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Dayton, Stotts Friedman/Sager	513-298-5555, FAX:513-298-3046
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Sager Elctrns.	215-464-4336, FAX:215-464-4079
TX	Dallas, Associated Aircraft Supp.	214-331-4381, FAX:214-339-9840
WI	Milwaukee, Progressive Image Inc.	414-321-4722, FAX:414-321-4665
Can	St. Laurent, Que., Ferrotronic Comps. Inc.	514-333-7288,FAX:514-333-2881

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OTTOTEK, IMC, 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900; *Sls. Mgr.:* Otto H. Fest, Jr. .... **D•1364-1367**

Local Sales Offices & Reps

AZ	Tucson, IMC-OTTOTEK	602-748-7900
MA	Wilbraham, NEDT	413-596-8823
MI	Warren, Burcaw Co.	313-573-4605
MI	Wyoming, Burcaw Co.	616-532-2756
EXP	Tucson, AZ, OTTOTEK, Div. of IMC	602-748-7900

Local Distributors

AL	Birmingham, Brownell Electro, Inc.	205-332-3375
AL	Mobile, Brownell Electro, Inc.	205-479-5406
CO	Aurora, R&R Instrmn.	303-340-8728
CO	Denver, Brownell Electro, Inc.	303-333-3541
FL	Miami, Brownell Electro, Inc.	305-884-3197
FL	Orlando, Brownell Electro, Inc.	407-843-6771
GA	Forest Pk., Brownell Electro, Inc.	404-362-9009
IL	Chicago, Data Elctrns.	312-283-0674
IL	Wood Dale, Brownell Electro, Inc.	708-616-8770
MA	Woburn, Brownell Electro, Inc.	617-935-7820
MN	Edina, Brownell Electro, Inc.	612-942-8172
MO	Manchester, Universal Precision Instrs.	314-394-4693
NJ	Edison, Brownell Electro, Inc.	908-287-2030
NY	New York, Brownell Electro, Inc.	212-924-6000
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Brownell Electro, Inc.	704-597-1270
NC	Raleigh, Brownell Electro, Inc.	919-876-6524

OR	Portland, Brownell Electro, Inc.	503-226-3286
PA	Bridgeville, Brownell Electro, Inc.	412-221-0075
PA	Trevose, Brownell Electro, Inc.	215-364-1401
SC	Columbia, Brownell Electro, Inc.	803-772-6111
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EXP	Tucson, AZ, OTTOTEK Div. of IMC	602-748-7900
Can	Brampton, Ont., Mod-Tronic Inst. Ltd.	416-457-6322
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OUPIIN AMERICA, INC., 65 W. Easy Street 201, Simi Valley, CA 93065, Tel: 805-520-0862, FAX: 805-520-0864; *Sls. Mgr.:* Randy Ryan

OUTLAND TECHNOLOGY INC., 1808-B Faith Pl., Gretna, LA 70056, Tel: 504-367-0104, FAX: 504-367-6754; Empl.: 4; *Sls. Mgr.:* George J. Mayfield; *Dist. Mgr.:* George J. Mayfield

OVENAIRE-AUDIO-CARPENTER, Oak Crystal Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 910-997-8053, FAX: 804-295-7265; FSC No.: 12020; Empl.: 190; *Sls. Mgr.:* Robert J. Mete

OVEN INDUSTRIES, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 48; *Sls. Mgr.:* T. M. Nolan

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MA	Needham, Com Sls.	617-444-8071

Local Distributors

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IL	Hillside, Schuten Elctrns.	312-449-5430
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, M.A.R. Elctrns.	317-633-6699
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MI	Farmington Hills, Advent Elctrns.	313-477-1650
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Salem, Diamond Elctrns.	603-894-4420
TX	Richardson, CTC	214-437-2211
WI	Neguon, Lakeview	414-377-8250
WA	Redmond, Priebe Elctrns.	800-426-9911

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PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, FAX: 715-723-7890; FSC No.: 60162; Empl.: 7; *Sls. Mgr.:* Patrick Brennan; *Dist. Mgr.:* Patrick Brennan

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PACIFIC ATLANTIC ELCTRNS., Patronix, Inc., Box 754, El Cerrito, CA 94530, Tel: 510-237-5837, FAX: 510-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 310-532-6600, FAX: 310-532-5044; Empl.: 1000; *Sls. Mgr.:* Alan Manzo; *Dist. Mgr.:* Alan Manzo

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PACIFIC INDUSTRIAL COMPONENTS CORP., 24907 Avenue Tibbets Unit-C, Valencia, CA 91355, Tel: 805-257-7901, FAX: 805-257-6490; *Sls. Mgr.:* Ray Pross **B•1104**

Local Sales Offices & Reps

IL	Elk Grove Village, Pacific Comps.	708-228-0030

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 510-827-9010, FAX: 510-827-9023; Empl.: 30

PACIFIC MICROCOMPUTERS, Fairway Optical Data Sys., Inc., 2440 Grand Ave. Ste. C, Vista, CA 92083, Tel: 619-727-9494, FAX: 619-727-9499; Empl.: 15; *Sls. Mgr.:* Guy Halac

PACIFIC MICROTRONICS CORP., 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, FAX: 212-517-5516; *Sls. Mgr.:* S. Miliziano; *Dist. Mgr.:* E. Dietz

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433, FAX: 714-891-1928; FSC No.: 57148; Empl.: 50; *Sls. Mgr.:* Russ Engle **D•2286-2290**

Local Sales Offices & Reps

AZ	Zeus Elctrns., Inc.	602-285-9126
AL	Huntsville, W A Brown Instrs.	205-830-9224
AZ	Phoenix, Zeus Elctrns. Inc.	602-263-6022
CA	Santa Clara, Amasco Corp.	408-987-7760
CA	Torrance, Amasco Corp.	310-781-9494
CO	Wheatridge, Zeus Elctrns., Inc.	303-321-4246
CT	Mt. Carmel, Sci. Dvcs.	203-248-9361
FL	Melbourne, W.A. Brown Instrs.	407-723-0766
FL	Orlando, W.A. Brown Instrs.	407-648-9660
GA	Norcross, W.A. Brown Instrs.	404-449-7160
ID	East, Zeus Elctrns., Inc.	800-528-4512
ID	West, Westcon Inc.	800-547-4515
IL	Elmhurst (N), Sector Eng. Sls. Inc.	708-530-7850
IN	Indianapolis, Sector Eng. Sls., Inc	317-253-9221
KS	Merriam, TecRep Corp.	913-262-9500
MA	Waltham, Sci. Dvcs.	617-890-2252
MI	Plymouth, EQS Sys.	313-455-7920
MN	Minnetonka, Elctrn. Instrs.	612-933-7793
MO	St. Louis, TecRep Corp.	314-454-9110
MT	Zeus Elctrns., Inc.	800-528-4512
NV	Zeus Elctrns., Inc.	800-528-4512
NY	Liverpool, Northern Tech. Sls. Assocs., Inc.	315-451-1091
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OH	Dayton, EQS Sys.	513-236-7676
OR	Portland, Westcon	503-283-0132
PA	Huntingdon Valley, Sci-Rep Inc.	215-322-6500
PA	Wexford, EQS Sys.	412-935-0455
TX	Richardson, Beacon Microwave	214-437-1505
TX	Round Rock, Beacon Microwave	512-244-6675
UT	Salt Lake City, Zeus Elctrns. Inc.	801-534-0500
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Kent, Westcon, Inc.	206-824-8922
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280
WY	Zeus Elctrns., Inc.	800-528-4512

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt **A•2006-2009**

Local Sales Offices & Reps

CA	San Jose, Comtech Mktg.	408-294-5448

Local Distributors

CA	San Jose, Comtech Mktg.	408-294-5448

PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61109, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 350; *Dist. Mgr.:* Robert E. Burke

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 210; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064-1482, Tel: 310-478-1134, FAX: 310-312-0826; Empl.: 22; *Sls. Mgr.:* Laura Barba

PACIFIC TRANSFORMER CORP., 4729 E. Wesley Dr., Anaheim, CA 92807, Tel: 714-779-0450, 1-800-325-0501, FAX: 714-779-0718; FSC No.: 66827; Empl.: 85; *Sls. Mgr.:* Bill Chidester

PACKAGING PLUS, INC., 5800 Main Steet NE, Minneapolis, MN 55432, Tel: 612-574-9909, FAX: 612-574-1441; Empl.: 25; *Sls. Mgr.:* Mike Hickman

PACKARD ELECTRIC, General Motors, P.O. Box 431, Warren, OH 44486, Tel: 216-373-2121, 1-800-PACKARD, FAX: 216-759-6195; Empl.: 64,000; *Sls. Mgr.:* George A. Kralovich, Dir. Sls. Engrg.

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PACTEC CORP., LAFRANCE CORP., 8425 Executive Ave., Philadelphia, PA 19153, Tel: 215-365-8400; Empl.: 250; *Sls. Mgr.:* Brian McHenry; *Dist. Mgr.:* Edward Fitzpatrick **C•1002, 1062-1068**

Local Sales Offices & Reps

AL	Madison, Scott Ray	205-464-0370
CA	Anaheim, Jonathan Winters	714-779-8092
CA	San Jose, Michael Bennett	510-625-6068
FL	Palm Harbor, Roger Hauck	813-784-7895
IL	Bolingbrook, John Nelson	708-852-9908
MA	South Easton, Maurice Raymond	508-238-9283
EXP	Philadelphia, PA, PacTec Export Sls. Dept.	215-365-8400
NC	Thomasville, Keith Pierce	919-869-0130
OH	Perrysburg, Bruce Brown	419-874-1110
PA	Philadelphia, Jim Bowdler	215-365-8400
TX	Dallas, Craig Ladue	214-340-6288
WA	Seattle, Mike Werttemberger	206-481-0998
WI	Appleton, Ed Sabish	414-731-7212

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tucson, Elctrn. City	602-662-1173
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Gardena, California Switch & Signal	800-225-7924
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Jose, Quement Elctrns.	408-998-5355
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-748-1342
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CO	Aurora, Jet Elctrns.	303-364-1000
CO	Littleton, Display's Plus	303-730-7333
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, Sager Elec. Supp.	203-265-6865
FL	Largo, Electronic Precepts of FL	800-367-4649
FL	Orlando, Sager Elec. Supp.	407-354-1130
GA	Norcross, American Elctrn. Supp.	800-562-8740
GA	Norcross, Sager Elec. Supp.	404-446-0085
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove, Martec Assocs.	708-956-8090
IL	Mt. Prospect, Tri State Elctrns.	708-255-0600
IL	Northbrook, Classic Comps.	708-291-0019
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Overland Park, Olive Elctrns.	913-362-1923
MD	Beltsville, P.S.I.	800-333-5292
MD	Columbia, Sager Elec. Supp.	410-995-4900
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Westborough, In-Stock Products Co.	800-225-3018
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MN	Minneapolis, Berquist	612-835-2322
MN	Roseville, Parts I	612-633-8079
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
MO	Maryland Hts., Olive Elctrns.	314-997-7709
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Salem, Sager Elctrl. Supp.	603-898-1348
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NY	Buffalo, Summit Distr.	716-887-2899
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Sager Elec. Supp.	516-348-1300
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Summit Distr.	716-334-8110
NC	Raleigh, Sager Elec. Supp.	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes-Peters	614-294-5351
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, Radar Elec.	503-232-3404

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PA	Exton, VSH Elctrns.	215-363-2250
PA	Mars, Sager Elec. Supp.	412-772-2233
PA	Philadelphia, Sager Elec. Supp.	215-464-4336
TX	Dallas, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Ft. Worth, Tandy Natl. Pts.	800-322-3690
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
TX	Richardson, Off-the-Shelf Comps.	214-247-0052
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, BC, Intek Elctrns.	604-294-8100
Can	Kingston, Ont., Elctrn. Packaging Sys.	613-384-1142
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Vancouver, BC, Future Elctrns.	604-294-1166

PADS SOFTWARE, INC., 119 Russell St., Littleton, MA 01460, Tel: 508-486-9521, FAX: 508-486-8217; Empl.: 46; *Sls. Mgr.:* Donna Andersson, Telesls. Mgr.; *Dist. Mgr.:* Sandra Jarry, Dir. of Sls., N.A.

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, FAX: 206-329-1615; FSC No.: 13624; Empl.: 96; *Sls. Mgr.:* John Sagvold, Steve Evans

PAKTRON, See ITW Paktron

PAKTRONICS CONTROLS, INC., P.O. Box 185669, Ft. Worth, TX 76181, Tel: 817-284-5241, FAX: 817-284-1712; Empl.: 30; *Sls. Mgr.:* Arthur B. Vega

PALOMAR ENGINEERS, Box 462222, Escondido, CA 92046, Tel: 619-747-3343; FAX: 619-747-3346; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999, FAX: 414-637-2303; FSC No.: K 8-67203; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02154-3497, Tel: 617-899-2719, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

PANASONIC FACTORY AUTOMATION CO., Matsushita Elect. Corp. of America, 9377 W. Grand Ave., Franklin Park, IL 60131, Tel: 708-288-4471, FAX: 708-288-4430

Panasonic
Industrial Company
FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sales GP, Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1457**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs. Inc.	818-906-3941
CA	San Diego, Tauber & Assocs.	619-274-7242
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555

Local Distributors

AL	Huntsville, Resistacap Inc.	205-883-4270
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242
CA	San Jose, Rose Elec. Distrbg. Co.	408-943-0440
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CA	Van Nuys, NESCO	818-781-0505
CO	Littleton, AVT	303-798-1958
FL	St. Petersburg, Micro Precision	813-854-2861
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Morton Grove, Power Pak Inc.	708-966-6000
IL	Palatine, Ohm Elctrns.	708-359-5500
MD	Beltsville, Mark Elctrns.	301-792-0072
MA	Canton, Impact Sls. Co. Inc.	508-668-8200
MI	Danvers, Generation Elctrns. Inc.	508-683-1177
MA	Sutton, Engrd. Assemblies, Inc.	508-865-0722
MI	Brighton, Applied Power Inc.	313-227-3604
MN	Thief River Falls, Digi-Key	800-344-4539
MN	Minneapolis, Stark Elctrns. Supp. Inc.	612-332-1325
NJ	Clifton, Engineered Assem.	201-288-4477
NC	Raleigh, Engrd. Assemblies Inc.	919-790-9700
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Promark Elctrns. Inc.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Norvell Elctrns. Inc.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-595-3500
WI	Fond Du Lac, Fedco Elctrns., Inc.	414-922-6490
WI	Mequon, Taylor Elec. Co.	414-241-4321

PANASONIC INDUSTRIAL COMPANY, Custom Peripheral Dept., Two Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-6313, FAX: 201-348-7849; *Dist. Mgr.:* Edmund Silvia Jr., Prod. Mgr.

PANASONIC INDUSTRIAL CO., 1616 McCandless Dr., Milpitas, CA 95035, Tel: 408-946-7200, FAX: 408-946-3753

PANASONIC INDL. CO. STANDARD COMPS. SECTOR, Matsushita Elec. Corp. of America, Two Panasonic Way Panazip: 7H-4, Secaucus, NJ 07094, Tel: 201-392-4818, FAX: 201-392-6263; FSC No.: 54473; Empl.: 60; *Sls. Mgr.:* Hank Miyai; *Dist. Mgr.:* Dick Robert

PANAVISE PRODUCTS, INC., 1485 Southern Way, Sparks, NV 89431, Tel: 702-353-2900, FAX: 702-353-2929; Empl.: 35; *Sls. Mgr.:* Mark Thorsell; *Dist. Mgr.:* Mark Thorsell

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 800-777-3300, FAX: 708-532-1811; FSC No.: ;06383; Empl.: 2000

PANEL COMPONENTS CORPORATION
FAX: 800-645-5360

PANEL COMPONENTS CORP., 100 Interpower Ave., Oskaloosa, IA 52577, Tel: 515-673-0097; Empl.: 30 ..... **A•2443; B•1376-1377; C•1426-1438, 1793-1801; D•2291**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg. Inc.	205-536-9775
AZ	Phoenix, C.T. Carlberg & Assoc.	602-468-0750
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Englewood, Omega Ltd.	303-762-1921
FL	Altamonte Springs, DHR Mktg. Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Northbrook, Raines & Assocs.	708-498-0890
IN	Indianapolis, Rockford Controls	317-846-7415
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Roeland Park, M-S-B Assocs., Inc.	913-432-2131
MD	Frederick, Glasscock Assoc.	301-694-5048
MA	Scituate, Olsen Tech. Sls.	617-545-5101
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, M-S-B Assocs., Inc.	314-946-5577
NJ	Kenvil, CFE/Gray	201-927-6662
NM	Albuquerque, C.T. Carlberg & Assoc.	505-899-2155
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Medina, Rockford Controls	216-725-3705
OR	McMinnville, Electro-Design	503-472-0481
PA	Philadelphia, Eastern Sci. Mktg.	215-368-4570
PA	Pittsburg, Rockford Controls Ohio	412-331-0306
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Nashville, DHR Mktg.	615-331-2745
TX	Lewisville, Jim Hughes Co.	214-221-1536
VA	Ashland, Glasscock Assoc.	804-798-2125
WA	Redmond, Electro-Design	206-867-9300
EXP	Burnaby, B.C., Darmac Agencies, Ltd.	604-520-7121
Can	Ottawa, Ont., Ellam & Assoc.	613-727-3892

PANELTEC, 3307 Edward Ave., Santa Clara, CA 95054, Tel: 408-496-1175, FAX: 408-970-1277; Empl.: 105; *Sls. Mgr.:* Daniel Johnston

PAN INTERNATIONAL (USA), INC., 9477 E. Archibald Ave., Rancho Cucamonga, CA 91730, Tel: 909-945-1365, FAX: 909-989-9935; Empl.: 24; *Sls. Mgr.:* Barry Park; *Dist. Mgr.:* Barry Park, Natl. Sls. Mgr.

PAN-MAGNETICS, See Tamura Corp. of America

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FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810; Empl.: 30 ..... **C•1633-1637**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	Dana Point, Papst Mechatronic Corp.	714-661-1447
CA	Los Gatos, Luscombe Engrg. Co of San Francisco	408-370-2020
CA	Montrose, Luscombe Engrg. Co. of So. Calif.	818-249-9000
CA	Mountain View, Papst Mechatronic Corp.	415-903-9311
CA	San Diego, Luscombe Engrg. Co. of So. Calif.	619-689-0018
CO	Englewood, Quorum 3	303-799-8100
CT	Meriden, Delta Conn	203-634-8558
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Arlington Heights, Brainard-Nielsen Mktg.	708-437-2700
IL	Arlington Heights, Papst Mechatronic Corp.	708-981-1404
IL	Arlington Hgts., Brainard-Nielsen Mktg.	708-437-2700
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Framingham, Papst Mechatronic Corp.	508-875-8986
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Kenvil, C.F.E. Gray Assocs., Inc.	201-927-6662
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NY	Yaphank, C.F.E. Gray Assocs., Inc.	516-924-2471
NC	Charlotte, Over & Over, Inc.	704-542-9111
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Venture Elctrns.	503-624-0617
PA	Knoxville, Trinkle Sls., Inc.	215-922-2080
RI	Newport, Papst Mechatronic Corp. Hq.	401-849-8810
TX	Dallas, JYSCO/Comps., Inc. (except El Paso)	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Manitowoc, Brainard-Nielsen Mktg.	414-682-1201

PARADIGM TECHNOLOGY, INC., 71 Vista Montana, San Jose, CA 95134, Tel: 408-954-0500, FAX: 408-954-8913

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222, FAX: 818-281-5867; FSC No.: 59465 .... **A•2444**

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112-1290, Tel: 800-272-7537, 800-C-PARKER, TELEX: 980636; Empl.: 26,669

PARKER HANNIFIN CORPORATION, Compumotor Division, 5500 Business Park Drive, Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015

PARKER HANNIFIN CORP., Daedal Div., P.O. Box 500, Sandy Hill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626; *Sls. Mgr.:* R. Mitchell; *Dist. Mgr.:* R. Mitchell

PARKER HANNIFIN CORP., Hose Products Division, 30240 Lakeland Blvd., Wickliffe, OH 44092, Tel: 216-943-5700, FAX: 216-943-7088

PARKER HANNIFIN CORPORATION, Hydraulic Valve Division, 520 Ternes Ave., Elyria, OH 44036-2026, Tel: 216-366-5200, FAX: 216-366-5253

PARKER HANNIFIN CORP., Instrumentation Connectors Div., 9400 S. Memorial Pkwy., Huntsville, AL 35802, Tel: 205-881-2040, FAX: 205-881-5730

PARKER HANNIFIN CORP., Parflex Div., 1300 N. Freedom Street, Ravenna, OH 44266, Tel: 216-296-2871, FAX: 216-296-8433

PARKER HANNIFIN CORP., Pneumatic Division, 8676 E M-89, Richland, MI 49083, Tel: 616-629-5000, FAX: 616-629-5385

PARKER HANNIFIN CORP., Refrigerating Specialties Division, 2445 South 25th Ave., Broadview, IL 60153, Tel: 708-681-6300, FAX: 708-681-6306

PARKER HANNIFIN CORPORATION, Rotary Actuator Division, 135 Quadral Dr., Wadsworth, OH 44281-0450, Tel: 216-336-3511, TELEX: 216-334-3335

PARKER HANNIFIN CORP., Schrader Bellows Division, 257 Huddleston Avenue, Cuyahoga Falls, OH 44221, Tel: 216-923-5202, FAX: 1-800-426-3259

PARKER HANNIFIN CORPORATION, Seal Grp., 18321 Jamboree Rd., Irvine, CA 92715, Tel: 714-833-3000, FAX: 714-851-2127

PARKER HANNIFIN CORP., Tube Fittings, 3885 Gateway Blvd., Columbus, OH 43228, Tel: 614-279-7070, FAX: 614-279-7685

PARLEX CORPORATION, 145 Milk St., Methuen, MA 01844, Tel: 508-685-4341, FAX: 508-685-8809; FSC No.: 18377; Empl.: 375; *Sls. Mgr.:* Robert D. Cyr

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FAX: 718-774-0583

PAR METAL PRODUCTS, INC., Par Industrial Complex, 1246 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI ATTN:PAR; FSC No.: 3449;3469; Empl.: 100; *Sls. Mgr.:* J. Troiano .... **C•1069**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARSYTEC INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-293-9500, FAX: 708-293-9525; Empl.: 7; *Sls. Mgr.:* Reinhard Rinn

PARVEX SERVO SYSTEMS, GEC Alsthom International, Inc., 4 Skyline Dr., Hawthorne, NY 10532, Tel: 914-345-5150, FAX: 914-345-5295

PASO SOUND PRODUCTS, 14 First St., Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 18; *Sls. Mgr.:* Ken O'Brien

PASS & SEYMOUR CANADA, INC., Legrand, 448 North Rivermede Rd., Concord, Ont L4K 3M9, Tel: 416-738-9195, FAX: 416-738-9721; Empl.: 40; *Sls. Mgr.:* Dennis Conard

PASS & SEYMOUR/LEGRAND, Pass & Seymour/Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232, FAX: 315-468-6305; Empl.: 1700; *Sls. Mgr.:* Sergio Palluci, Sls. Mgr./Kristin Northrop, Prod. Mgr.

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920, FAX: 714-261-7451; FSC No.: 53919; *Sls. Mgr.:* Elayne Wilson

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 45; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165; Empl.: 35

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* R. B. Vogelbach

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Nand Aggarwal ..... **A•1572-1575, 1668-1671; D•1854-1856**

Local Sales Offices & Reps

AL	Huntsville, Southeast Tech. Grp.	205-534-2376
AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Mission Viejo, Ramsey & Assocs.	714-380-7757
CA	San Diego, Ramsey & Assocs.	619-451-8865
CA	San Jose, Arnold Techn. Sls.	408-954-0400
FL	Clearwater, Sunland Assocs.	813-536-2955
FL	Goldenrod, Sunland Assocs.	305-365-9533
FL	Lauderhill, Sunland Assoc.	305-561-1303
GA	Lawrenceville, Southeast Tech. Grp.	404-979-2055
IL	Elk Grove, W.G. Brouillette	708-290-1313
MA	Sudbury, KSA of New England	508-443-5881
MN	Bloomington, Bill Deming and Assocs.	612-888-5000
MS	Meridan, Southeast Tech. Grp.	601-485-7055
NC	Zebulon, Southeast Tech. Grp.	919-269-5589
OH	Beavercreek, Electro-Com	513-427-2696
OH	Mansfield, Electro-Com	419-756-5846
OR	Beaverton, Elctrn. Comp. Sls.	503-245-2342
PA	Exton, Linear Sls.	215-524-8080
TX	Richardson, Blackburn Assocs.	214-238-8181
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Sherman Oaks, DLDI-Delay Lines Distrs.	818-986-9455
MA	Sudbury, ASK Elctrns.	508-443-5881
PA	Exton, VSH Elctrns.	215-363-2250

P.C. BOARDS, INC., 210 West Main, Chanute, KS 66720, Tel: 316-431-0406, FAX: 316-431-2013; Empl.: 73; *Sls. Mgr.:* Greg Bilyeu

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 210

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

Local Sales Offices & Reps

AL	Huntsville, REP, Inc.	205-881-9270
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	San Diego, Qualtronics, Inc.	619-695-0118
CA	San Jose, Kottmeier Assocs., Inc.	408-371-8700
CA	Woodland Hills, Precision Connector Designs, Inc.	818-884-7171
FL	Tampa, APM Assocs.	813-886-2457
GA	Tucker, REP, Inc.	404-938-4358
IL	Elk Grove Vlg., Control Sls.	708-595-2110
MA	Sharon, S & Y Elctrns., Inc.	617-784-6437
MN	Minneapolis, Electro-Tech Assocs., Inc.	612-853-0242
MO	St. Louis, Harris Hanson	314-432-3611
NC	Morrisville, REP, Inc.	919-469-9997
OH	Miamisburg, Elctrn. Comps., Inc.	513-866-3340
PA	Harrisburg, All-Tech Mktg., Inc.	717-540-1204
PA	West Chester, All-Tech Mktg., Inc.	215-344-0134
TN	Jefferson City, REP, Inc.	615-475-9012
TX	Irving, AID Elctrns.	214-790-4761
WI	Brookfield, Control Sls.	414-797-9500

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCI LTD., 1530 Parkmoor Ave.-Ste. A, San Jose, CA 95128, Tel: 408-282-0200, FAX: 408-282-0216; Empl.: 2500; *Sls. Mgr.:* Mike Clarke; *Dist. Mgr.:* Jane Campbell

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 15; *Sls. Mgr.:* Stanley L. Goldstein .... **A•2445-2453**

PDS TECHNOLOGIES, See Power-Pac

PEARL TECHNOLOGY, 2988-A Scott Blvd., Santa Clara, CA 95054, Tel: 408-996-9823, FAX: 408-253-2287

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 16; *Sls. Mgr.:* Stacey Evensen .... **A•2454**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550, FAX: 215-639-3545; Empl.: 30; *Sls. Mgr.:* Joanne Fields

THE PEDRO COMPANIES, 104 E. 10th St., St. Paul, MN 55101, Tel: 612-224-9491, FAX: 612-224-8674; Empl.: 100; *Sls. Mgr.:* Douglas Bieniek

PENBERTHY, INC., 320 Locust St., Prophetstown, IL 61277, Tel: 815-537-2311, TWX: 257-339 PMCO PRWN, FAX: 815-537-5764; Empl.: 160

PENN ENGINEERING & MANUFACTURING CORP., 5190 Old Easton Rd. PO Box 1000, Danboro, PA 18916, Tel: 215-766-8853, 800-237-4736, FAX: 215-766-0143; FSC No.: CAGE 46384; Empl.: 950; *Sls. Mgr.:* John E. O'Brien; *Dist. Mgr.:* Ed Soorikian

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537, FAX: 203-294-0361; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

PENN-TRAN CORP.,SUB. OF SPECTRUM ELCTRNS. INC., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, FAX: 814-355-1524; FSC No.: 50783; Empl.: 80; *Sls. Mgr.:* Jeffrey Krauss .... **A•1260-1261; D•1857**

Local Sales Offices & Reps

CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	909-599-4412
MA	Medfield, Nortech	508-359-6063
MN	Minneapolis, International Sls. Co.	612-831-8423
NC	Raleigh, Arthur Harris	919-460-8660
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-980-9860

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 310-393-1497, FAX: 310-393-6040; *Dist. Mgr.:* Rose Riedel Prod. Mgr.

Penny+Giles

FAX: 508-226-5208

PENNY & GILES CONTROLS, INC., 163 Pleasant St., Attleboro, MA 02703, Tel: 508-226-3008; Empl.: 10; *Sls. Mgr.:* Dean T. Bushy .... **A•2115**

PENNY & GILES DATA SYSTEMS, INC., 1250 Northmeadow Pkwy., Ste. 114, Roswell, GA 30076, Tel: 404-740-0415, FAX: 404-740-0420

PENNY TECHNOLOGIES, INC., 78 Kingsland Ave., Greenpoint, NY 11222, Tel: 718-782-4149, FAX: 718-963-2930; Empl.: 54; *Sls. Mgr.:* Jack Russell

PENRIL DATACOMM NETWORKS, 1300 Quince Orchard Blvd., Gaithersburg, MD 20878, Tel: 301-921-8600, FAX: 301-921-8376; Empl.: 240

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, 800-PENSTOCK, FAX: 408-730-4782; Empl.: 60; *Sls. Mgr.:* Ken Wadors; *Dist. Mgr.:* Ken Wadors

Local Distributors

CA	Penstock Southern CA	1-800-PENSTOCK
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CO	Penstock Rocky Mtn. Desert States	1-800-PENSTOCK
DE	Penstock Mid-Atlantic	1-800-PENSTOCK
FL	Penstock Florida	1-800-PENSTOCK
GA	Penstock South	1-800-PENSTOCK
IL	Penstock Midwest	1-800-PENSTOCK
MA	Penstock New England	1-800-PENSTOCK
NJ	Penstock East	1-800-PENSTOCK
TX	Penstock Texas	1-800-PENSTOCK
WA	Penstock Northwest	1-800-PENSTOCK
Can	Penstock Canada	1-800-736-7862

PENTA LABORATORIES, INC., 21113 Superior St., Chatsworth, CA 91311, Tel: 818-882-3872, 800-421-4213, TELEX: 95-4295 798, FAX: 818-882-3368; Empl.: 50; *Sls. Mgr.:* Richard Sanett

PENTICA SYSTEMS, INC., 19A Crosby Dr., Bedford, MA 01730, Tel: 617-275-4419, FAX: 617-275-6514; FSC No.: 04-2978461; Empl.: 6; *Sls. Mgr.:* Pete Kurpis

PERCON, INC., 1720 Willow Creek Circle, Ste. 530, Eugene, OR 97402-9153, Tel: 1-800-8-PERCON, 503-344-1189, FAX: 503-344-1399; Empl.: 32; *Sls. Mgr.:* Sls. Dept.; *Dist. Mgr.:* Doug Wilson, Dir. Mktg./Sls.

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpke, Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478, FAX: 215-674-8714; FSC No.: 61773; Empl.: 40

PERFORMANCE ELECTRONIC PACKAGING SERVICES, 6354-B Corte Del Abeto, Carlsbad, CA 92009, Tel: 619-931-7824

PERFORMANCE MOTION DEVICES, 11 Carriage Dr., Chelmsford, MA 01824, Tel: 508-256-1913, FAX: 508-256-0206; Empl.: 6; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

PERFORMANCE SEMICONDUTOR CORP., 610 E. Weddell Dr., Sunnyvale, CA 94089, Tel: 408-734-8200

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, FAX: 714-540-2026; Empl.: 20; *Sls. Mgr.:* Sandra Weller

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454, FAX: 818-566-4232; Empl.: 6; *Sls. Mgr.:* J. Ross

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Niles, IL 60714, Tel: 312-763-0763, FAX: 312-763-8330; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844, FAX: 617-734-0844; Empl.: 14; *Sls. Mgr.:* N. Geskos

PERX,INC., 525 Tamal Plaza, Corte Madera, CA 94925, Tel: 415-927-0155, FAX: 415-927-0159; Empl.: 5

PETER PARTS & ASSOCS., 82 E. Main St., Webster, NY 14580, Tel: 716-265-2540, FAX: 716-265-2542; *Sls. Mgr.:* Peter Parts

PFC, See Southern Elctrns. Co. Inc.

P.G. ELECTRONICS LTD., 800 Arrow Rd., 8, Weston, Ont., Canada M9M2Z8, Tel: 416-741-7682, FAX: 416-741-9927; FSC No.: 38243

PHASETRONICS INC./MOTORTRONICS INC., 13214-38th St. North, Clearwater, FL 34622, Tel: 813-573-1900, FAX: 813-573-1803; Empl.: 400; *Sls. Mgr.:* Karen Alberts

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-458-4444, 800-255-CLIC (2542), FAX: 219-422-1667; Empl.: 1,000; *Sls. Mgr.:* D.R. Disque, Mktg. VP

PHENIX TECHNOLOGIES, Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-746-8118, FAX: 301-895-5570; Empl.: 45; *Sls. Mgr.:* Bill Robeson

PHILADELPHIA INSULATED WIRE CO. INC., General Cable Corporation, 4 Tesseneer Drive., Highland Heights, KY 40176, Tel: 606-572-8306, 800-257-8357, FAX: 800-547-8249; Empl.: 140; *Sls. Mgr.:* Michael F. Wells

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33614-2797, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* Keith Weil

Philips Components
Discrete Products Division
A North American Philips Company

FAX: 407-881-3300

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, A North American Philips Company, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall .... **A•1144-1148, 2010-2012, 2150-2170; B•1015, 1336-1338, 1888-1889; D•1403**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Santa Clara, Technlg. Sls. Inc.	408-727-7200
CA	Signal Hill, Harper & Strong, Inc.	310-424-3030
CA	Sunnyvale, Philips Comps.	408-991-2294
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over, Inc.	407-339-5073
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Libertyville, GMR Sls., Inc.	708-367-8440
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Pk., Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, ED Glass Assocs.	201-592-0200
NJ	Parsippany, Philips Comps.	201-455-1507
NY	East Rochester, Empire Tech. Assoc., Inc.	716-381-8500
NY	Edwell, Empire Tech. Assocs., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assoc., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TN	Greenville, Philips Comps.	615-639-0251
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
PR	Caparra Hgts., M. Anderson Co. Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1033 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-247-0486,914-246-0487; FSC No.: 02114; *Sls. Mgr.:* B. Grindle

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1440 W. Indiantown Rd., Jupiter, FL 33458, Tel: 407-744-4200, FAX: 407-863-1811; *Sls. Mgr.:* Bill Winther .... **A•1144, 1147-1148; B•1015**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* Bill Cvirko .... **A•1145-1146**

DC Aluminum Electrolytic Capacitors(Computer Grade, Radial)Indl. & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, FAX: 817-325-1052; *Sls. Mgr.:* Richard Swingen .... **A•2010-2012; B•1888-1889**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., Professional Components Grp., 100 Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, FAX: 401-767-4493; FSC No.: 73445; *Dist. Mgr.:* Jeff Brooke-Stewart .... **A•2150-2170**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV,, Discrete Semiconductor Group, 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-767-4493 .... **A•2150-2170; B•1336-1338**

PhilipsECG
A North American Philips Company

FAX: 717-323-4691

PHILIPS ECG, North American Philips Co., 1025 Westminster Dr., Williamsport, PA 17701, Tel: 717-323-4691; *Sls. Mgr.:* L.R. Brophy, Gen. Mgr. Mktg.; *Dist. Mgr.:* E. H. Frost .... **A•2172-2173**

Local Sales Offices & Reps

CA	Byron, Philips ECG	510-634-9879
CA	Gardena, Bidwell Schwartz Assoc.	213-770-0300
FL	Ft. Lauderdale, Hawkins Frederickson Assoc.	305-321-6702

FL	Maitland, Hawkins Frederickson Assoc.	407-831-2474
GA	Atlanta, Millar Elctrns.	404-634-3350
MA	Woburn, Philips ECG	617-932-4748
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MO	Kansas City, Philips ECG	816-741-4019
NY	Seneca Falls, Philips ECG	315-568-5875
NC	Raleigh, Millar Elec., Inc.	919-828-8840
OH	Dayton, Philips ECG	513-436-0066
PA	Emporium, JSH Sls. Co.	814-486-1311
TX	Richardson, Philips ECG	214-231-8274
Can	Dorval, Que., ECG Canada Inc.	514-685-5800

PHILIPS SEMICONDUCTORS, Philips Electroincs, 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, CA 94088-3409, Tel: 408-991-2000, FAX: 408-991-2311; FSC No.: 1CH66; Empl.: 20,000; *Sls. Mgr.:* Jim Feijoo; *Dist. Mgr.:* Vinnie Bonanno

Philips Technologies
A Philips Electronics North America Company
PHILIPS

FAX: 203-271-6522

PHILIPS TECHNOLOGIES, North American Philips Corporation, 7 McKee Place, Cheshire, CT 06410, Tel: 203-271-6525; Empl.: 4000; *Sls. Mgr.:* R.F. Kamm

PHILIPS TECHNOLOGIES, Airpax Mechatronics Group, 604 West Johnson Ave., Cheshire, CT 06410, Tel: 203-271-6000, FAX: 203-271-6400; Empl.: 350; *Sls. Mgr.:* Ron Barbieri

PHILIPS TECHNOLOGIES, Airpax Protector Group, 807 Woods Road, Cambridge, MD 21613, Tel: 410-228-4600, FAX: 410-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* S. Monagham (CBS)/C. Tinley (MCPS) .... **B•1378**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls.	303-795-3600
GA	Lawrenceville, BCI	404-962-6826
ID	Boise, Lange Sls., Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Pittsburgh, Russell F. Clark	412-242-9500
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

PHILIPS TECHNOLOGIES, Airpax Protector Group, Husky Park, Frederick, MD 21701, Tel: 301-663-5141, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Fred Dietzel .... **B•1891**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls.	303-795-3600
GA	Lawrenceville, B.C.I.	404-962-6826
ID	Boise, Lange Sls., Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs., Inc.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

PHILIPS TECHNOLOGIES, Airpax Instruments, 150 Knotter Drive, Cheshire, CT 06410, Tel: 203-271-6000, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 200; *Sls. Mgr.:* Ron Cimino .... **D•1168**

Local Sales Offices & Reps

AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls., Inc.	303-795-3600
ID	Boise, Lange Sls, Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf, & Assocs.	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Birmingham, Dwight D. Prouty	205-988-8110
AL	Mobile, Dwight D. Prouty	205-476-5056
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Santa Clara, MANCO	408-496-6611
CO	Denver, Q.E.D., Inc.	303-825-5011
CT	Milford, Motors & Drives, Inc.	203-877-6509
FL	Ft. Lauderdale, Indl. Instrs.	305-971-0209
FL	Tampa, Wacco Inc.	813-621-6441
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Countryside, Chicago Chain & Transmission	708-482-9000
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
IA	Cedar Rapids, Van Meter Co.	319-366-5301
IA	Des Moines, Kim Controls	515-274-9194
KY	Louisville, Automatic Controls	502-426-4666
LA	Baton Rouge, D & W Sys. Sls.	504-753-0992
LA	Kenner, D & W. Sys. Sls.	504-466-1692
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Detroit, Automatic Controls	315-533-8890
MN	Minneapolis, Kim Controls	612-780-2991
MO	Fenton, Hi-Tech Elec.	314-343-6060
NH	Manchester, Industrial Control Sys.	603-625-2900
NY	Amherst, N.E. Controls of Buffalo	716-691-0081
NY	Clifton Park, N.E. Controls of Buffalo	518-371-4413
NY	New Hyde Park, I/O Corp.	516-355-0130
NY	Thompson Ridge, Vespo Mktg.	914-361-2800
NC	Charlotte, McGuire & Crawford	704-366-3454
OH	Brunswick, Automatic Controls	216-273-1117
OH	Cleves, ATR Distrs.	513-353-1800
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Ft. Washington, I/O Corp.	215-641-1870
PA	Pittsburgh, Friday Engrg.	412-341-1444
PA	Pittsburgh, Gilson Engrg. Sls.	412-369-0100
TX	Dallas, Automatic Sys.	214-688-1810
TX	Houston, The Haltom Co.	713-782-5625
VA	Richmond, Process Specialties	804-794-2511
VA	Salem, Process Specialties	703-563-0707
WA	Richland, Radar Elec, Co., Inc.	509-943-8336
WA	Seattle, Radar Elec, Co., Inc.	206-282-2511
WA	Spokane, Radar Elec, Co., Inc.	509-747-3053
WV	Charleston, Gilson Engrg Sls.	304-342-0012
WI	New Berlin, Electric Sales & Engrg.	414-782-2400
Can	Ontario, Leonard Elec., Ltd.	416-829-1200
Can	Vancouver, Southwell Controls, Ltd.	604-980-3688

PHILIPS TECHNOLOGIES, Automotive Electronics Group, Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* Jim Richford

PHILIPS TECHNOLOGIES, Philips Key Modules Group, 2001 Gateway Place, Ste. 650 West, San Jose, CA 95110, Tel: 408-453-7373, FAX: 408-453 6444; Empl.: 10; *Sls. Mgr.:* Arend Verweij

PHILMORE MANUFACTURING, 2240 15th St. P.O. Box 6386, Rockford, IL 61125-1386, Tel: 815-229-7773, FAX: 815-229-7785; Empl.: 18

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 40; *Sls. Mgr.:* Robert P. Gelernter

PHOENIX CONTACT INC., P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-922-1200, TELEX: 752592, FAX: 205-837-1256; Empl.: 100

PHOENIX MICROWAVE, 100 Emlen Way, Telford, PA 18969, Tel: 215-723-6011, FAX: 215-723-6015; Empl.: 53; *Sls. Mgr.:* Joseph Diesso, VP Sls. & Mktg.

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin .... **C•1802**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 20

PHOTON, INC., 1115 Space Park Dr., Santa Clara, CA 95054-3432, Tel: 408-492-9449, FAX: 408-492-9659; *Sls. Mgr.:* J. M. Darchuk

PHOTO RESEARCH:KOLLMORGEN, 9330 DeSoto Ave./PO Box 2192, Chatsworth, CA 91313-2192, Tel: 818-341-5151, FAX: 818-341-7070; FSC No.: 92434; Empl.: 66; *Sls. Mgr.:* M. L. Woolsey

PHYSICS INTERNATIONAL CO., Olin Defense Systems Grp., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PIC DESIGN, Remington Technologies, Inc., P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989, FAX: 203-758-8271; FSC No.: 00141; Empl.: 100; *Sls. Mgr.:* Gary Hampton

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FAX: 914-699-5565

PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney .. **A•1263-1273, 2455-2505; D•1859-1873, 2137-2185**

Local Sales Offices & Reps

CA	Santa Clara, Fisher Assocs.	408-733-7350
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665/1264
WA	Seattle, W. Spaulding Co.	206-282-9173

PICONICS, INCORPORATED, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 508-649-7501, FAX: 508-649-9643; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* Virgilius Di Biase .... **A•1274-1275, 2013**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Tempe, Semper-Fi Sls.	602-730-9553
CA	Cupertino, Alpha Inds., Inc.	408-446-5333
CA	N. Hollywood, Jewett Co.	818-789-8103
CA	North, Alpha Ind., Inc.	408-446-5628
CO	Parker, Mikro Sls. Co.	303-841-4131
FL	Lighthouse Point, R.C. Simon & Co.	305-941-2757
IL	No. IL & WI, R.H.I. Sls.	708-888-0099
IN	Huntington, Rixan Assoc.	513-278-1233
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Chelmsford, Advanced Tech. Mktg.	508-458-0200
MN	Minneapolis, Peterson Sls. Assocs.	612-835-5281
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Rochester, J.G. Welch	716-244-1100
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cincinnati, Rixan Assoc.	513-278-1233
OH	Dayton, Rixan	513-222-0011
OK	Bethany, El-Tec Sls.	405-789-5911
PA	Bedford, NJ Koebert Assocs.	215-576-1329
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
TX	Ft. Worth, El-Tec Sls.	817-268-2896
VA	Alexandria, Koebert	703-461-3655
WA	Belleview, Call Factory	508-649-7501
WV	Inwood, Koebert & Assocs., Inc.	304-229-8401

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[209] 441-1725

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PICOSECOND ATE INC., P.O. Box 1080, Beaverton, OR 97075, Tel: 503-641-3295, FAX: 503-646-3778; Empl.: 2

Local Sales Offices & Reps

OR	Beaverton, picosecond ATE Inc.	503-641-3295

PICOSECOND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, FAX: 303-447-2236; Empl.: 7; *Sls. Mgr.:* J.R. Andrews; *Dist. Mgr.:* J.R. Andrews

PIEZO CRYSTAL CO., 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, FAX: 717-249-7861; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glenn R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 908-548-2800, FAX: 908-548-3625; Empl.: 75; *Sls. Mgr.:* M.R. Scarillo

PIEZO KINETICS INC., P.O. Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, FAX: 814-355-4342; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* Harry D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, FAX: 407-293-2979; FSC No.: 25120; *Sls. Mgr.:* Paul Dechen

PIHER INTERNATIONAL CORP., NACESA, 903 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-390-6680, 800-323-6693, FAX: 708-390-9866; FSC No.: 54869; Empl.: 13; *Sls. Mgr.:* Kimberly Mack, Sls. Supp. Mgr.

PILLAR INDUSTRIES

FAX: 818-358-0398

PILLAR INDUSTRIES, INC., 1780 Evergreen Street, Duarte, CA 91010, Tel: 818-358-1337; Empl.: 3 .... **D•1874-1877**

Local Sales Offices & Reps

CA	Los Angeles, Power Partner, Inc.	310-215-0800
CA	Oxnard, Power Partner	805-659-5356
CA	Santa Clara, Foresight	408-980-9700
WA	Lynnwood, Blair Hirsh	206-775-8151

PIND TESTERS INC., 13805 Alton Parkway, Ste. B, Irvine, CA 92718, Tel: 714-457-1090, FAX: 714-457-1378; FSC No.: 66; Empl.: 15; *Sls. Mgr.:* C. Ditgen

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16127, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; FSC No.: 08676; Empl.: 310; *Sls. Mgr.:* Michael B. MacKrell .... **D•1879-1881**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Signal Hill, Thorson Co.	310-595-0361
CO	Commerce City, Williams Assocs.	303-289-5647
FL	West Palm Beach, Pen-Tech Assocs.	407-640-0800
GA	Roswell, Pen-Tech Assocs.	404-642-4110
IL	Arlington Hgts., Hill Sales	708-255-4400
MD	Columbia, Stein Instrmn.	301-596-3748
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NJ	Glen Gardner, Daner-Hayes Inc.	201-537-4534
NM	Albuquerque, Williams Assocs.	505-255-1368
NY	Vestal, D. H. Technlgs.	716-359-4652
NC	Greensboro, Pen-Tech Assocs.	919-852-6000
OH	Dublin, KRW Sls. Inc.	614-885-2598
OH	Westlake, KRW Sales	216-871-7521
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, Kruvand	214-437-3355
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Redmond, Halbar-RTS	206-882-0990

PIONEER RESEARCH, INC., 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; Empl.: 450; *Sls. Mgr.:* F. Heath

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN®

FAX: 215-256-1338

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601; FSC No.: 98938; Empl.: 180 .... **B•1304-1305**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Leucadia, Halbar Assocs.	619-942-4075
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Englewood, Integrated Motion Sys.	303-792-5516
CT	Bristol, M. L. Assocs., Inc.	203-589-2856
FL	Fort Lauderdale, Motion Controls, Inc.	305-434-4197
GA	Suwanee, Overton Assocs. Inc.	404-497-0166
IL	Mount Prospect, K-W Assocs.	708-253-6680
IN	Elkhart, Shaum Mfg., Inc.	219-264-0771
MA	Wayland, M. L. Assocs.	508-358-5540
NY	Glen Head, Marcus Sls. Assocs., Inc.	516-671-6820
NY	Rochester, Application Spec.	716-586-6226
NC	Raleigh, Overton Assocs. Inc.	919-469-5190
OH	Cleveland, Servo-Mark	216-871-2353
OK	Edmond, Motion Reps, Inc.	405-340-8100
OR	Tigard, Halbar-RTS, Inc.	503-624-5741
PA	Exton, Kiley Elect. Co., Inc.	215-363-8550
SC	Walhalla, Overton Assocs. Inc.	803-638-7101
TN	New Tazewell, Overton Assocs. Inc.	615-626-6009
TX	Austin, Motion Reps, Inc.	512-288-5758
TX	Carrollton, Motion Reps Inc.	214-492-0106
TX	Denton, Motion Reps, Inc.	817-382-4159
TX	Houston, Motion Reps, Inc.	713-981-8700
WA	Redmond, Halbar-RTS, Inc.	206-882-0990
Can	Woodbridge, Ont., Electomate Indl. Sls. Ltd.	416-850-7447

PIXELOGIC INC., 1200 N.E. Keyes Rd., Vancouver, WA 98684, Tel: 206-253-5033, FAX: 206-253-5033; Empl.: 5

PIXELWORKS, INC., 7 Park Ave., Hudson, NH 03051, Tel: 603-880-1322, FAX: 603-880-6558; Empl.: 15; *Sls. Mgr.:* Michael Jannery; *Dist. Mgr.:* A. Straume

PLAINVIEW BATTERIES, INC., 23 Newtown Rd., Plainview, NY 11803, Tel: 800-642-2354, FAX: 516-249-2876; *Sls. Mgr.:* B. Erde .... **D•1459-1461**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006-1992, Tel: 503-690-1100, FAX: 503-690-1244; FSC No.: 5Z179; Empl.: 121; *Sls. Mgr.:* Gary Baughn

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673, FAX: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, FAX: 312-489-0496; FSC No.: 99120; Empl.: 60; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 310-539-9530, FAX: 310-539-8325; Empl.: 120; *Sls. Mgr.:* Thomas Salken

PLASTIC SYSTEMS INC., 261 Cedar Hill St., Marlboro, MA 01752-3004, Tel: 508-485-7390, FAX: 508-480-0257; *Sls. Mgr.:* Jim Novak; *Dist. Mgr.:* Jim Novak

PLASTIMATIC, INC., 11 Danco Rd., Putnam, CT 06260, Tel: 203-928-7911, FAX: 201-575-8748; Empl.: 85; *Sls. Mgr.:* Christopher Brooks

PLASTRON CORP., 429 S. Evergreen St., Bensenville, IL 60106, Tel: 708-595-2212, FAX: 708-595-2599; Empl.: 245; *Sls. Mgr.:* Ian Graham

PLATO PRODUCTS, INC., 18731 Railroad St., Industry, CA 91748, Tel: 818-965-8044, 800-423-4510, FAX: 818-965-8960; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

Local Distributors

AL	Muscle Shoals, Jones Elctrns.	205-383-1241
AZ	Phoenix, Scottsdale Tool & Supply	602-273-7376

CA	Fullerton, Bertech	714-526-3700
CA	Poway, Wassco	619-679-8787
CA	Sunnyvale, COM-KYL	408-734-9660
CO	Denver, Solder Tec	303-623-5000
FL	Clearwater, Your Production Cupb'd	813-447-2581
FL	Winter Pk., Deanco, Inc.	407-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Chicago, E M F	312-889-8323
MD	Gaithersburg, Deanco	301-948-5444
MA	N. Andover, Contact East	508-682-2000
MI	Bloomfield Hills, Murray Percival Co.	313-333-1700
MN	Minneapolis, Warner Indl. Supp.	612-378-7300
NJ	Fairfield, Deanco, Inc.	201-575-7960
NY	Ithaca, Deanco, Inc.	607-257-4444
NY	W. Babylon, Irv Morse Sls.	516-491-7800
NC	Raleigh, Cameron & Barkley	919-834-6010
OR	Portland, Gen. Tool & Supp.	503-226-3411
TX	Dallas, Briggs-Weaver	214-631-3600
TX	McAllen, McAllen Bolt & Screw, Inc.	512-687-8596
TX	Pflugerville, Briggs-Weaver	512-244-3343
UT	Salt Lake City, Techn. Devices	801-972-5935
WA	Seattle, Gen. Tool & Supp.	206-762-1500
PR	E.M.F.	800-621-0080
Can	Edmonton, Alb., Cardinal Indl. Elctrns.	403-483-6266
Can	Montreal, Que., Adtool Corp.	514-482-2548

PLESSEY ELECTRIC SYSTEMS CORP., See GEC-Marconi

PLETRONICS, INC., 19015 36th Ave. West, Ste. H, Lynnwood, WA 98036, Tel: 206-776-1880, FAX: 206-776-2760; Empl.: 11; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny .... **A•1449-1455**

Local Sales Offices & Reps

AL	Huntsville, Strategic Mktg.	205-464-0490
AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Mission Viejo, Jay Mktg. Assocs.	714-768-7519
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CT	N. Haven, Radix	203-239-3611
FL	St. Petersburg, QXI	813-894-4556
IL	Downers Grove, Golten Assocs.	708-512-0093
MA	Randolph, Bengal	617-961-4120
MI	Farmington, Bergin Assoc.	313-471-7940
MN	St. Paul, Countryman	612-645-9151
NJ	Springfield, Radix	201-467-4970
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Raleigh, Strategic Mktg.	919-847-7972
OH	Centerville, Omega	513-434-5507
OH	Cleveland, Omega Sls.	216-360-9400
OR	Oregon City, Halbar PNW, Inc.	503-656-3714
TN	Nashville, Strategic Mktg.	615-883-7882
TX	Austin, Sage Mktg.	512-335-0300
TX	Dallas, Sage Mktg.	512-335-0300
WA	Redmond, Halbar	206-882-0990
Can	Mississauga, Ont., Intellatech	416-629-0082

Local Distributors

AZ	Phoenix, Arizona Comps	602-269-5655
AZ	Scottsdale, Kent	602-998-0399
CA	El Segundo, Force	213-772-1324
CA	Milpitas, Kent	408-262-5300
CA	San Diego, Kent Elctrns.	619-453-7133
CA	Santa Clara, Force	408-748-1324
CA	Sunnyvale, Capsco	408-734-3020
CA	Sunnyvale, Target	408-733-0384
CA	Torrance, All American	800-831-8300
CA	Torrance, Kent Elctrns.	310-320-2700
CA	Yoriba Linda, Target Elctrns.	714-692-1630
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Largo, Kent	813-545-0057
GA	Norcross, Century Elctrns.	404-729-2522
FL	Sunrise, All American	800-432-6838
IL	Woodridge, Golten Assocs.	708-985-5100
MD	Beltsville, PSI	301-937-4960
MD	Columbia, Kent	301-720-6200
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Chelmsford, Kent	508-250-9666
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wakefield, All American	617-246-2300
MA	Wilmington, North Star	508-657-5155
MA	Worcester, Coghlin	508-791-7861
MN	Eden Prairie, All American	612-944-2151
MN	Fridley, Voyager	612-571-7766
MN	St. Paul, Kent	612-642-2868
NJ	Edison, Dove Elctrns.	908-738-0321
NY	East Setauket, Dove Elctrns.	516-689-7733
NY	Mt. Vernon, All American	800-926-6668
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Century Elctrns.	919-596-2220
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Twinsburg, Schuster Elctrns.	216-425-8134
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MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Edison, R.E. Breuer Co. Inc.	908-561-6161
NC	Raleigh, Eastern Elctrns.	919-876-7591
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MN	Stillwater, Ned Gordon & Assoc., Inc.	612-430-1572,FAX:612-430-0027
NV	Minden, PolyPhaser Corp.	702-782-2511
NH	Manchester, Assocd. Sys.	603-472-2297, FAX:603-472-3464
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MN	St. Paul, Pulstar Dist., Inc.	612-645-3411, FAX:612-645-3511
NV	Minden, PolyPhaser Corp.	702-782-2511, FAX:702-782-4476
NJ	Clarksboro, W.R. Block & Assocs.	609-423-2255, FAX:609-423-0891
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TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179, FAX:214-475-1293
WA	Bellevue, Arpac, Ltd.	206-453-2132, FAX:206-453-1558
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CA	Newport Beach, Jones & McGeoy Sls., Inc.	714-724-8080
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CO	Littleton, Simpson Assocs.	303-794-8381
CT	Wallingford, John E. Boeing Co.	203-265-1318
FL	Apopka, Cartwright & Bean	407-889-9100
FL	Deerfield Beach, Cartwright & Bean	305-429-3400
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
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KS	Wichita, R.W. Kunz & Assocs.	316-686-3436
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MD	Burtonsville, Mechtronics Sls., Inc.	301-421-4200
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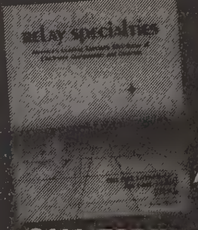

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NC	Morrisville, Rep, Inc.	919-469-9997, FAX:919-481-3879
OH	Willoughby Hills, Versatron	216-944-0082, FAX:216-944-0084
PA	Hatboro, Delta Tech Sls.	215-957-0600, FAX:215-957-0920
TN	Jefferson City, Rep, Inc.	615-475-9012, FAX:615-475-6340
TX	Dallas, Burr-Brown Corp.	214-783-4555, FAX:214-783-2717
TX	Houston, Development Tech. Sls., Inc	713-988-6546,FAX:713-988-6548
UT	Murray, Front Range Mktg.	801-288-2500, FAX:801-288-2505
WA	Federal Way, Wilson Elctrn. Sls. Team	206-946-8016,FAX:206-946-1821
Can	Mississauga, Ont., Allen Crawford Assoc.	416-890-2010,FAX:416-890-1959
Can	Ottawa, Ont., Allen Crawford Assoc.	613-596-9300, FAX:613-596-3081
Can	Pointe Claire, Que., Allen Crawford Assoc.	514-697-3333,FAX:514-697-4642
Can	Vancouver, B.C., Allen Crawford Assoc.	604-988-2195,FAX:604-980-5892

Local Distributors

CA	Brea, J.I.T. Supply	714-256-9100, FAX:714-256-9111
MA	Wilmington, North Star Elctrns.	508-657-5155, FAX:508-657-6559
TX	Carrollton, North Star Elctrns.	214-980-2999, FAX:214-980-2997

POWERCUBE CORP., Sub. Unitrode Corp., 8 Suburban Pk. Dr., Billerica, MA 01821, Tel: 508-667-9500, FAX: 508-667-6280; FSC No.: 31557; Empl.: 150; *Sls. Mgr.:* Roy Allman .... **D•2186-2197**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mfr's Agts.	205-830-4030
AZ	Scottsdale, Detomasi & Grupp, Inc.	602-947-3724
CA	Fountain Valley, Detomasi & Grupp Inc.	714-434-2988
CA	Irvine, Powercube	714-261-6137
CA	Mission Hills, Detomasi & Grupp Inc.	818-365-8285
CO	Littleton, Detomasi & Grupp, Inc.	303-972-2543
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
GA	Roswell, Elctrn. Mfr's Agts.	404-992-7240
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
ME	Bethel, Shain Assoc., Inc. (Military)	207-836-3200
MA	Billerica, Powercube Corp.	617-667-9500
MA	Norwell, Shain Assoc., Inc. (Military)	617-982-1474
MN	Bloomington, Elect. Sls. Agency	612-884-8291
NH	Nashua, Bell Controls, Inc. (Industrial)	603-882-6984
NH	Nashua, Shain Assocs., Inc. (Military)	603-881-4881
NJ	Mt. Laurel, S-J Assocs., Inc.	609-866-1234
NY	Canandaigua, S-J Assocs., Inc.	716-394-3281
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Charlotte, Elctrn. Mfr's Agts.	704-365-0547
OH	Columbus, S-J Assocs., Inc.	614-885-6700
TX	Garland, Carey, McMahill & Assocs., Inc.	214-681-1414
VA	Falls Church, S-J Assocs., Inc.	703-533-2233
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Toronto, Ont., Norgay Entprs.	416-234-8966

POWER DESIGNS, INC., 1700 Shames Dr., Westbury, NY 11590, Tel: 516-333-6200, TWX: 510-222-6561, FAX: 516-333-6512; Empl.: 48; *Sls. Mgr.:* Mary Loop

POWER DEVICES INC., 27071 Cabot Rd., Bldg. 114, Laguna Hills, CA 92653, Tel: 714-582-6712, FAX: 714-582-6722; Empl.: 10; *Sls. Mgr.:* G. E. Flynn

POWER DYNAMICS INC., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, Tel: 201-736-5722, FAX: 201-736-8930; FSC No.: 60046; *Sls. Mgr.:* James Papianni; *Dist. Mgr.:* Lyle Scott

POWER ELECTRONIC COMPONENTS, INC., PEC, Inc, 6333 Old Lagrange Rd., Crestwood, KY 40014, Tel: 502-241-5970,800-245-0193, FAX: 502-241-5970; Empl.: 4; *Dist. Mgr.:* Carl Cloud

POWEREX

FAX: 412-925-4393

POWEREX, INC., 200 Hillis St., Youngwood, PA 15697-1800, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 400; *Dist. Mgr.:* Kathy Cullen .... **A•2175**

Local Sales Offices & Reps

AZ	Scottsdale, Lindberg Co.	602-998-2944
CA	Laguna Hills, Westpower Co.	714-582-6716
CA	Santa Clara, Engineering Assocs. Corp.	408-988-5001
CO	Denver, Lindberg Co.	303-758-9033
CT	Southington, The Orion Grp.	203-621-8371
FL	Maitland, EIR, Inc.	407-660-9600
GA	Alpharetta, Southeast Power Comps.	404-587-4851
GA	Alpharetta, Southeast Power Comps.	404-664-5460
GA	Norcross, Southeast Power Comps.	404-448-2458
IL	Chicago, L&W Power Corp.	708-416-8838
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
KY	Lexington, Giesting & Assocs.	606-873-2330
MA	Peabody, The Orion Grp.	508-532-6266
MI	Detroit, L&W Power Corp.	313-451-1150
MN	Bloomington, PSI Co.	612-944-8545
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Smithtown, J&L Sls. Assocs., Inc.	516-864-1701
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Charlotte, Southeast Power Comps.	704-846-8532
NC	Greensboro, Southeast Power Comps.	919-854-9410
NC	Henderson, Southeast Power Comps.	919-438-4450
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Columbus, Giesting & Assocs.	614-459-4800
OK	Tulsa, NOVA Mktg.	918-660-5105
OR	Tigard, Vantage Corp.	503-620-3280
PA	Hatboro, Delta Tech. Sls., Inc.	215-957-0600
PA	Pittsburgh, Bear Mktg.	412-492-1150
TX	Austin, NOVA Mktg., Inc.	512-343-2321
TX	Dallas, NOVA Mktg., Inc.	214-750-6082
TX	Houston, NOVA Mktg., Inc.	713-988-6082
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Vantage Corp.	206-455-3460
WI	Milwaukee, L&W Power Corp.	414-782-0799
Can	Burnaby, B.C., Blakewood Elec. Sys., Inc.	604-444-3344
Can	Montreal, Que., GMA Assocs.	514-335-9572
Can	Ottawa, Ont., GMA Assocs.	613-820-3822
Can	Toronto, Ont., GMA Assocs	416-671-8111

Local Distributors

AL	Birmingham, Industrial Elec. Supp. Co.	205-951-4601
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Cypress, Bell Inds.	714-895-7801
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Rocklin, Bell Inds.	916-652-0414
CA	San Diego, All American	619-458-5850
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, All American	408-943-1200
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, All American	310-320-0240
CA	Torrance, Time Elctrns.	310-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CA	Walnut, ACI Elctrns.	714-594-1731
CA	West Lake Village, Semtex, Inc.	805-373-6850
CA	Woodland Hills, Time Elctrns.	818-998-7200
CO	Denver, Bell Inds.	303-691-9270
CO	Englewood, Time Elctrns.	303-721-8882
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, GRS Midan Elctrns.	203-265-2077
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Miami, All American	305-621-8282

FL	Orlando, Time Elctrns.	407-841-6565
FL	Sunrise, All American	305-572-7999
GA	Norcross, Time Elctrns.	404-448-4448
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elmhurst, Semiconductor Specialists	708-279-1000
IL	La Fox, Richardson Elctrns. Ltd.	800-348-5580
IL	Schaumberg, Time Elctrns.	708-308-3000
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Time Elctrns.	800-331-5114
IA	Cedar Rapids, Time Elctrns.	800-325-9085
KS	Lenexa, Time Elctrns.	800-325-9085
KY	Lexington, Time Elctrns.	800-331-5114
MD	Columbia, GRS Elctrns.	301-995-6744
MD	Columbia, Time Elctrns.	410-964-3090
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Peabody, Time Elctrns.	508-532-9900
MA	Woburn, ACI Elctrns.	617-935-7230
MI	Madison Heights, Galco Elctrns.	313-542-9090
MI	Novi, Time Elctrns.	800-331-5114
MN	Edina, Time Elctrns.	612-835-1250
MO	Manchester, Time Elctrns.	314-391-6444
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	East Hanover, Delburn Elctrns., Inc.	201-884-0800
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Wayne, Time Elctrns.	201-882-4611
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Harrison Equip. Co.	505-291-9951
NY	Freeport, Semtex, Inc.	516-223-0200
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Plainview, ACI Elctrns.	516-293-6630
NY	Rochester, Time Elctrns.	716-383-8853
NY	Rome, Rome Elctrns.	315-337-5400
NC	Asheville, Cameron & Barkley	800-222-3517
NC	Charlotte, Cameron & Barkley	800-532-0331
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Charlotte, Time Elctrns.	800-638-1812
NC	Fayetteville, Cameron & Barkley	800-346-0632
NC	Greensboro, Cameron & Barkley	800-632-1303
NC	Greenville, Cameron & Barkley	800-331-4620
NC	Raleigh, Cameron & Barkley	800-662-7654
NC	Wilmington, Cameron & Barkley	800-672-0435
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Cleveland, Darrah Elec.	216-631-0912
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Columbus, Hughes Peters	614-294-5351
OH	Columbus, Time Elctrns.	800-331-5114
OH	Dayton, Electronics Mktg.Corp.	513-439-4711
OH	Highland Heights, Electronics Mktg.Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Lake Oswego, Bell Inds.	503-635-6500
OR	Portland, Dunn Elctrns.	503-285-0214
OR	Portland, Time Elctrns.	503-684-3780
PA	Philadelphia, Time Elctrns.	215-337-0900
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Pittsburgh, Time Elctrns.	800-331-5114
TN	Columbia, Cameron & Barkley	615-381-8000
TX	Austin, Harrison Equip. Co.	512-258-1320
TX	Austin, Time Elctrns.	512-339-3051
TX	Brownsville, Harrison Equip. Co.	512-548-2376
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Time Elctrns.	713-530-0800
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Harrison Equip. Co.	713-879-2750
UT	Midvale, Bell Inds.	801-255-9611
UT	West Valley, Time Elctrns.	801-973-8181
VA	Charlottesville, Virginia Elec. Comps.	804-296-4184
WA	Bothell, Dunn Elctrns.	206-382-0379
WA	Redmond, Bell Inds.	206-867-5410
WA	Redmond, Time Elctrns.	206-882-1525
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Time Elctrns.	800-331-5114
WY	Gillette, WESCO	307-687-0014
Can	Brampton, Ont., Richardson Elctrns., Ltd.	416-458-5333
Can	Calgary, Alberta, Electro Sonic, Inc.	403-255-9550
Can	Mississauga, Ont., Time Elctrns.	416-601-4368
Can	Ottawa, Ont., Electro Sonic, Inc.	613-728-8333
Can	Richmond, BC, Electro Sonic, Inc,	604-273-2911
Can	Stoney Creek, Ont., Westinghouse Canada, Inc.	416-528-8811
Can	Willowdale, Ont., Electro Sonic, Inc.	416-494-1666
Can	Winnepeg, Manitoba, Electro Sonic, Inc.	204-783-3105

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER GENERAL, Nidec Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216, FAX: 617-828-3215; Empl.: 300; *Sls. Mgr.:* E.V. Lauria, VP-Sls. & Mktg.; *Dist. Mgr.:* Richard Bagg, Distbn. Sls. Mgr.

POWER INTEGRITY CORP., 1834 Pembroke Rd., Greensboro, NC 27408, Tel: 910-379-9773, 800-237-6260, FAX: 910-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE, INC., 1360 S. Clarkon St., Denver, CO 80210, Tel: 303-698-7883, FAX: 303-777-7573; Empl.: 9; *Sls. Mgr.:* Matt Breneman

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 908-826-4700, FAX: 908-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman

POWERMARK, See Square D Co. Power Protection Sys.

POWER/MATE CORPORATION, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, FAX: 619-296-8039 (sls); Empl.: 175

POWER MEASUREMENT LTD., 6703 Rajpur Place, Victoria, BC, Canada V8X 3X1, Tel: 604-652-5118, FAX: 604-652-0411; Empl.: 50; *Sls. Mgr.:* Bradford Forth, Mktg. Mgr.

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 66; *Sls. Mgr.:* Margaret A. Foggon, Export Sls. Mgr.

Power-One

D.C. Power Supplies

FAX: 805-388-0476

POWER-ONE, INC., 740 Calle Planc, Camarillo, CA 93012, Tel: 805-987-8741; FSC No.: 54407; Empl.: 320; *Dist. Mgr.:* Julius Hirsch, V.P. Sls. **D•1886-1895**

Local Sales Offices & Reps

AL	Huntsville, M-Squared, Inc.	205-830-0498
AZ	MESA, Sys. Sls. of AZ	602-464-9989
CA	Escondido, Eagle Tech. Sls.	619-743-6550
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CA	Woodland Hills, Varigon, Inc.	818-594-5080
CO	Englewood, Quorum 3	303-799-8100
CT	Hamden, Datcom	203-288-7005
FL	Boca Raton, Electrocraft	407-394-9686
FL	Largo, Electrocraft	813-544-1766
FL	Longwood, Electrocraft	407-682-7832
GA	Norcross, M-Squared,Inc.	404-447-6124
IL	Chicago, M. Gottlieb & Assocs.	312-775-1151
IN	Indianapolis, Rathsburg Assoc. Inc.	313-489-1500
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Baltimore, Eastern Comps. Sls.	410-788-7050
MA	Waltham, Datcom, Inc.	617-891-4600
MI	Farmington Hills, Rathsburg Assocs., Inc.	313-489-1500
MN	Edina, G.P. Sls., Inc.	613-831-2362
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NM	Albuquerque, Sys. Sls. of AZ	505-889-2901
NY	E.Syracuse, Nycom, Inc.	315-437-8343
NY	Fairport, Nycom, Inc.	716-425-5120
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Cary, M-Squared, Inc.	919-467-6319
NC	Raleigh, M-Squared, Inc.	919-851-0010
OH	Columbus, Rathsburg Assocs. Inc.	614-457-2242
OR	Beaverton, Pacific Mktg. Specialist	503-641-9373
PA	Norristown, Eastern Comp. Sls.	215-270-9530
VA	Redmond, Pacific Mktg. Specialist	206-882-3144
WI	Milwaukee, M. Gottlieb & Assocs.	414-546-4466

Local Distributors

AL	Huntsville, Pioneer Elctrns.-Tech.	205-837-9300
AL	Huntsville, RS Elctrns.	205-721-9999
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Bell Inds.	602-966-7800
AR	Ft. Smith, Carlton-Bates	501-646-8201
AR	Little Rock, Carlton-Bates	501-562-9100
AR	Pine Bluff, Carlton-Bates	501-535-1354
AR	Springdale, Carlton-Bates	501-756-5012
CA	Agoura, Bell Inds.	818-879-9494
CA	Carlsbad, FLW	619-434-5251
CA	Costa Mesa, FLW	714-751-7512
CA	Cypress, Bell Inds.	714-895-7801
CA	Del Mar, Compumech Elctrns.	619-792-7800
CA	Milpitas, Compumech Elctrns.	408-945-9395, 1-800-553-8558
CA	Oxnard, FLW	805-984-0167
CA	Rocklin, Bell Inds.	916-652-0418
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Sterling Elctrn.	619-560-8948
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Sunnyvale, Bell Inds.	408-734-8875
CA	Tustin, Capstone Elctrns.	714-587-0638
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Bell Inds.	303-691-2460
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Shelton, Pioneer Elctrns.-Stand.	203-929-5600
CT	Wallingford, Bell Inds.	203-269-6801
CT	Wallingford, Greene-Shaw Co.	203-265-3333
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Pioneer Elctrns.-Tech.	407-834-9090
FL	Deerfield Bch, Pioneer Elctrns.-Tech.	305-428-8877
FL	Maintland, Elctrn. Equip.	407-539-0888
FL	Maitland/Pompano Bch., Elctrn. Equip.	305-960-1200
FL	Miami, Elctrn. Equip. Co.	305-526-6000
FL	Tampa, Elctrn. Equip.	813-988-0810
GA	Duluth, Pioneer Elctrns.-Tech.	404-623-1003
GA	Norcross, Bell Inds.	404-446-7167
GA	Norcross, RS Elctrns.	404-242-0520
ID	Boise, Pioneer Elctrns.-Tech.	208-336-2227
IL	Addison, Pioneer Elctrns.	312-495-9680
IL	Arlington Hts., C.W. Elctrns.	708-439-9880
IL	Bensonville, Voyager Elctrns.	312-860-1300
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comps.	708-272-9650
IL	Schaumburg, Sterling	708-303-9900
IN	Ft. Wayne, Bell Inds.	219-422-4300
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Pioneer Elctrns.	317-573-0880
IN	Indianapolis, RS Elctrns.	317-253-9065
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Lenexa, RS Elctrns.	913-362-1923
KS	Lenexa, Sterling Elctrns.	913-492-5406
LA	Shreveport, Carlton-Bates	318-636-9975
LA	Westwego, Sterling Elctrns.	504-436-1481
MD	Columbia, Bell Inds.	410-290-5100
MD	Columbia, Sterling Elctrns.	301-290-3800
MD	Gaithersburg, Pioneer Elctrns.-Tech.	301-921-0660
MA	Andover, Bell Inds.	508-474-8880
MA	Binghamton, Pioneer Elctrns.	617-748-8211
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, Pioneer	616-698-1800
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, Pioneer Elctrns.	313-525-1800
MI	Livonia, RS Elect.	313-525-1155
MN	Eden Priarie, Pioneer	612-944-3355
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Sterling	612-831-2666
MO	Maryland Heights, RS Elctrns.	314-997-7709
MO	Springfield, Carlton-Bates	417-862-1699
MO	St. Louis, Pioneer	314-432-4350
NE	Lincoln, Scott Elctrns.	402-466-8221
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Edison, Sterling Elctrns.	908-417-1000
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Fairfield, Pioneer Elctrns.	201-575-3510
NJ	Marlton, Capstone Elctrns.	609-596-7500
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Binghamton, Pioneer Elctrns.	607-722-9300
NY	Buffalo, Zeller Elctrns.	716-873-1300
NY	Fairport, Pioneer Elctrns.	716-381-7070
NY	Hauppauge, RS Elctrns.	516-231-6372
NY	Rochester, CAM/RPC Elctrns., Inc.	716-427-9999
NY	Rochester, Zeller Elctrns.	716-254-8840
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Morrisville, Pioneer Elctrns.-Tech.	919-460-1530
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Sterling Elctrns.	919-790-8634
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Bell Inds.	513-435-5922
OH	Dayton, Bell Inds. (Military)	513-434-8231
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, CAM/RPC/First Connection	216-248-6181
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Bell Inds.	503-644-3444
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Pioneer Elctrns.-Tech.	215-674-4000
PA	Pittsburgh, CAM/RPC Elctrns.	412-963-6202
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
PA	Trevose, Bell Inds.	215-953-2899
TN	Jackson, Carlton-Bates	901-664-2714
TN	Memphis, Carlton-Bates	901-365-3539
TN	Nashville, Carlton-Bates	615-885-3232

TX	Austin, Carlton-Bates	512-837-9098
TX	Austin, Norcom, Inc.	512-451-2757
TX	Austin, Pioneer Elctrns.	512-835-4000
TX	Austin, Sterling	512-836-1341
TX	Carrollton, Capstone Elctrns.	214-380-9049, 1-800-388-6757
TX	Carrollton, Sterling Elctrns.	214-243-1600
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Ft. Worth, Carlton-Bates	817-293-5588
TX	Houston, Norcom, Inc.	713-778-0392
TX	Houston, Pioneer Elctrns.	713-495-4700
TX	Houston, Sterling Elctrns.	713-623-6600
TX	Richardson, Bell Inds.	214-690-0468
TX	San Antonio, Carlton-Bates	512-805-8300
TX	Texarkana, Carlton-Bates	214-792-6923
UT	Midvale, Bell Inds.	801-561-9691
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Redmond, Bell Inds.	206-881-2140
WA	Richardson, Radar Elec.	509-747-3053
WA	Richland, Radar Elec.	509-943-8836
WA	Seattle, Radar Electric	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Brookfield, Pioneer Elctrns.	414-784-3480
WI	New Berlin, Classic Comps.	414-786-5300
WI	Waukesha, Bell Inds.	414-547-8879
EXP	CA, Los Angeles, Hanex, Inc.	213-556-3807

POWER-PAK, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 708-966-6000, FAX: 708-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., COMPUTER PRODS./POWER PRODS., See Computer Prods. Inc., Fremont, CA.

POWER SOLUTIONS INC., 4699 N. Federal Hwy., Pompano Bch., FL 33064, Tel: 305-943-4110, FAX: 305-943-6068

POWER-SONIC, Box 5242, 3106 Spring St., Redwood City, CA 94063, Tel: 415-364-5001, FAX: 415-366-3662; Empl.: 50; *Sls. Mgr.:* Carl E. Fischetti; *Dist. Mgr.:* Carl E. Fischetti **D•1464**

Local Sales Offices & Reps

CA	Redwood City, Andrew Ryan	415-364-5001
CO	Denver, Richard Moody	303-893-3771
FL	Tampa, SRT Mktg.	813-884-4805
IL	Chicago, Rendell Sls. Co.	312-539-1820
KY	Lexington, Donald Keil	606-272-6960
MA	Norwood, Assocd. Power Prods.	617-769-7516
MI	Chelsea, Sean T Sls.	313-475-2021
MS	Jackson, Doby Assocs.	601-981-1138
NJ	Northvale, John Hart	201-767-9654
MN	Bloomington, J.L.K. Tech. Sls.	612-884-0009
OH	Willoughby, Nationwide Comps.	216-946-3226
TX	Dallas, The Power Connection	214-401-3490

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
AK	Anchorage, Frigid North	907-561-4633
AZ	Phoenix, Lynntronics	602-841-3900
AR	Little Rock, Carlton Bates	501-562-9100
CA	Costa Mesa, Battery Specialties	800-352-3706
CO	Denver, Cargo Battery	303-296-8763
CT	Waterbury, Jasco Batteries	203-597-9220
DE	National Distr., Allied Elctrns.	800-433-5700
FL	Altamonte Springs, TNR Tech.	800-346-0601
GA	Decatur, Emergency Lighting Srvc.	404-981-2288
HI	Honolulu, I.C. Supp.	808-839-1966
ID	Boise, Kimball Elctrns.	208-232-2201
IL	National Distr., Allied Elctrns.	800-433-5700
IN	Evansville, Hutch & Sons	812-425-7201
IA	Des Moines, Radio Trade Supp.	515-288-7237
KS	Kansas City, North Supply	913-791-7000
KY	Louisville, P.I. Burks	502-589-3960
LA	New Orleans, Southern Radio Supp.	800-447-0444
ME	National Distr., Allied Elctrns.	800-433-5700
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Billerica, Mayer Elctrns.	401-724-7100
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Minneapolis, Burns Sls.	800-728-4761
MO	Kansas City, Elctrn. Supp.	816-931-3383
NE	National Distr., Allied Elctrns.	800-433-5700
NV	Las Vegas, Kiesub	702-733-0024
NH	National Distr., Allied Elctrns.	800-433-5700
NJ	Randolph, Mouser Elctrns.	201-328-3322
NM	Albuquerque, Betatron	505-821-1122
NY	Ridgewood, J.A. McDermott Corp.	718-456-3606
NC	Winston Salem, Kirkman Elctrns.	919-722-9131
ND	National Distr., Allied Elctrns.	800-433-5700
OH	Millbury, Dynalite	419-837-6837
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Beaverton, Micro Power	503-626-7086
PA	National Distr., Allied Elctrns.	800-433-5700
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TN	Memphis, Carlton Bates	901-365-3539
TX	Ft. Worth, Allied Elctrns.	800-433-5700
VA	Cheseapeake, Battery Outlet	804-545-4442
WA	Redmond, Energy Sls.	206-883-2343
Can	Fort Erie, The Battery Co.	800-695-9482

POWER STAR, INC., P.O. Box 18701, Irvine, CA 92713, Tel: 714-261-5377, 800-854-9420, FAX: 714-261-5381; Empl.: 11

POWER SUPPLY CONCEPTS INC., 840 Jupiter Park Dr., Units 103-104, Jupiter, FL 33458-8947, Tel: 407-746-1800, FAX: 407-746-1805 **D•1896-1897**

power switch corp.

FAX: 201-478-8201

POWER SWITCH CORPORATION, 17 Vreeland St., Lodi, NJ 07644, Tel: 201-478-5788; Empl.: 33; *Sls. Mgr.:* Ken Schnitzer **D•1899-1905**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-9909
AZ	Tempe, Gassner & Clack	602-968-9037
CA	Camarillo, The Tricamo Co.	805-388-0039
CO	Franktown, MRC	303-660-8750
FL	Palm Bay, VM2 Mktg.	407-984-1918
GA	Atlanta, Benchmark Tech. Sls.	404-446-1711
IL	Wood Dale, BNI	708-595-9210
IN	Indianapolis, Wilson Tech Sls. Inc.	317-872-2513
IA	Cedar Rapids, Midtec Assoc., Inc.	319-395-0028
KS	Lenexa, Midtec Assoc., Inc.	913-541-0505
MA	Tyngsboro, CompTech	508-649-3030
MI	Clarkson, Bradcor Elctrns.	313-625-7644
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, Midtec Assoc., Inc.	314-275-8666
NJ	Haddonfield, M & S Assoc.	609-429-7055
NY	Endwell, Micheal Foldes, Inc.	607-786-4962
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Cleveland, Bradcor Elctrns.	216-671-1200
OH	Dayton, Bradcor Elctrns.	216-671-1200
TX	Dallas, Tycom	214-960-7368
WA	Edmonds, Power Sources Unltd.	206-743-6641
WI	Brookville, BNI	414-781-4775
Can	Mississauga, Andy Baumen Assoc.,Ltd.	416-828-2600

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, FAX: 203-726-1495; FSC No.: 50463; Empl.: 310; *Sls. Mgr.:* Kerry D. Smith

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec. Co., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC INDUSTRIAL CORP., 3958 Airway Drive, Rock Hill, SC 29732, Tel: 803-328-1888, FAX: 803-328-1870; Empl.: 110; *Sls. Mgr.:* Ed Lee; *Dist. Mgr.:* Dale Norman

POWERTEC POWER SUPPLIES, INC., DIV. OF ASTEC AMERICA, See Astec America

POWERTECH, INC., Fair Lawn Ave., Fair Lawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49

POWER TECHNOLOGY, INC., P.O. Box 191117, Little Rock, AR 72219-1117, Tel: 501-568-1995, FAX: 501-568-1994; Empl.: 85; *Sls. Mgr.:* John Webb

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio **D•1907**

Local Sales Offices & Reps

AL	Huntsville, TEQSPEC	205-883-6699
AZ	Phoenix, Jayson Co., Inc.	602-867-1964
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Diego, Power Specialists	619-726-4799
CO	Louisville, SDW	303-665-8089
CT	Guilford, HG Assocs.	203-453-5424
FL	Palm Harbor, TEQSPEC	813-942-6006
GA	Snellville, TEQSPEC	404-972-7955
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MA	Stow, HG Assocs.	508-897-3190
MI	Framington Hill, Carter, McCormic & Pierce	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Manchester, Comtel Midwest Co.	314-227-7220
NM	Albuquerque, SDW	505-883-3668
NY	Great Neck, RTI	516-829-3770
NC	Winston-Salem, TEQSPEC	919-765-5553
OH	Parma, Carter, McCormic & Pierce	216-398-0400
OK	Tulsa, Acudata	918-743-1875
PA	Pittsburgh, Carter, McCormic & Pierce	412-826-3800
TX	Austin, Acudata	512-478-1018
TX	Houston, Acudata	713-580-2451
TX	Plano, Acudata	214-424-3567
VT	Graniteville, HG Assocs.	802-476-4223
VA	Fairfax, SCI-REP	703-385-0600
WA	Bellevue, A. J. Smith Co.	206-746-6770
WI	New Berlin, Comtel Midwest Co.	414-544-6042
Can	N. Vancouver, BC, Jerome & Francis	604-986-1286
Can	Rexdale, Ont., Interfax	416-674-8970

POWERTREND, INC., 515 E. Pershing Blvd., Ste. 1001, Cheyenne, WY 82001, Tel: 307-635-9221, FAX: 307-635-8116; *Sls. Mgr.:* W. Rumsey

POWER TRENDS, INC., 1101 N. Raddant Rd., Batavia, IL 60510, Tel: 708-406-0900, FAX: 708-406-0901; Empl.: 45; *Sls. Mgr.:* Don Matthiesen

All Locations call Hamilton/Avnet 800-442-6458

Powertron

FAX: 516-883-7155

POWERTRON CORPORATION, Industrial Test Equipment Co., Inc., 21 Yennicock Ave., Port Wash., NY 11050, Tel: 516-883-1700; Empl.: 6; *Sls. Mgr.:* Barbara Assa **D•1012, 2268-2271**

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444

POWERTRONIX

FAX: 415-345-7240

POWERTRONIX CORP., 703 Cayman Ln., Foster City, CA 94404, Tel: 415-345-6800; Empl.: 94; *Sls. Mgr.:* Carl A. Svensson **A•2509-2511**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-996-5909
AR	Little Rock, Doby Assocs.	501-221-0326
CA	Foster City, Powertronix Corp.	415-345-6800
CA	Mission Viejo, Champa Assocs.	714-581-3459
CA	Sherman Oaks, Champa Assocs.	818-769-9456
CO	Littleton, Taylor Mktg.	303-850-0207
FL	Delray Beach, Phelps Assocs.	407-276-7591
IL	Arlington Hgts., MJ Petersen & Assocs.	708-577-8200
MD	Baltimore, Chesapeake Indl.	410-653-0476
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
NV	Las Vegas, Chaparral Nevada	702-433-5486
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NJ	Wayne, Apogee Mktg.	201-305-3735
NM	Albuquerque, Chaparral Elctrns.	505-271-2266
NY	Hauppauge, Sticom	516-366-4221
NY	Rochester, H.C. Johnson Agencies	716-586-0777
OH	Mainville, G.A. Barnett and Co.	513-677-0922
PA	Glenshaw, Hollern Sls. Inc.	412-487-1246
PA	Plymouth Meeting, CMS Sls. & Mktg.	215-834-6840
TN	Collierville, Doby Assocs.	901-854-5482
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9590

POWERVAR

THE ELECTRONIC SYSTEM POWER SPECIALISTS

FAX: 708-816-8988

POWERVAR, INC., 28457 N. Ballard Dr., Ste. C, Lake Forest, IL 60045, Tel: 708-816-8585, 800-369-7179; *Sls. Mgr.:* Tom Gornick; *Dist. Mgr.:* Tom Gornick .... **D•2297-2299**

Local Sales Offices & Reps

AZ	Glendale, Desert Canyon Sls.	602-938-1804, FAX:602-938-5026
CA	Concord, Competent Tech. Scvs.	510-827-9501, FAX:510-676-2904
CA	Inglewood, Ezra Mintz Assocs., Inc.	310-677-6790, FAX:310-677-7160
CA	Los Alamitos, Power Dynamics Co., Inc.	714-527-6567,FAX:714-827-7832
CA	Redondo Bch., Intelligent Power Solution	310-798-1946,FAX:310-379-1077
CA	Santa Ana, Powervar West	714-544-9940
CA	Santa Barbara, Powercom	805-963-4864, FAX:805-962-0104
CA	Woodside, Radical Two	415-363-0267, FAX:415-364-9504
CO	Boulder, Carebase Technlgs., Inc.	303-444-9399, FAX:303-444-6467
FL	Boca Raton, Business Svc. Mgt., Inc.	407-750-6802,FAX:407-750-9823
HI	Waipahu, Computer Power Specialists, Inc.	808-676-3700,FAX:808-676-5700
IL	Barrington, Integrated Power Solutions	708-991-9424,FAX:708-991-9425
IN	Zionsville, Elctrl. Powwer Protection Specs.	317-873-5027,FAX:317-873-4047
IA	Honeycreek, Integrated Elctrl. Svcs.	712-545-9394, FAX:712-545-3572
IA	Urbandale, Precision Power Sys.	515-276-4312, FAX:515-276-5058
MN	Edina, Dytec	612-831-7169,FAX:612-831-5114
MN	Lakeville, MESA Distbn.	612-469-1991, FAX:612-469-2273
MN	Minneapolis, T.G. Power Sys.	612-781-2722, FAX:612-781-7545
NY	N. Syracuse, Lachut Elctrl. Sls.	315-458-6486, FAX:315-458-6147
PA	Feasterville, Spectrum Power Prods.	215-357-6562,FAX:215-357-5871
TX	Dickinson, Power Unltd.	713-337-6804, FAX:713-337-5504
WA	Redmond, AC Power Technlg.	206-868-3632, FAX:206-868-3730
WA	Seattle, Quality Power Sys.	206-524-7016, FAX:206-524-7016
Can	Bedford, NS, Powervar Canada	902-835-0497, FAX:902-835-4530
Can	Vancouver, BC, Fisher Power Corp.	604-684-7383, FAX:604-684-0401

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR, FAX: 516-345-3106; Empl.: 50; *Sls. Mgr.:* Veronica Harney

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 407-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 75; *Sls. Mgr.:* Kathy Anderson

PPD

FAX: 919-781-4980

PPD, INC., 6001 Resco Ct, Raleigh, NC 27613, Tel: 919-781-3955; Empl.: 25 .... **A•1150-1155; B•1383**

Local Sales Offices & Reps

NC	Raleigh, Godwin Assocs.	919-878-8000

PPM, INC., 23500 Mercantile Rd., Unit I, Cleveland, OH 44122, Tel: 1-800-899-4776; FSC No.: 29504; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher .... **D•1315**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Camarillo, Brevco	805-491-2943
CO	Colorado Springs, J. Smith & Assocs.	719-597-5343
MI	Ferndale, Tiby Co.	313-547-3550
NM	Albuquerque, J. Smith & Assocs.	505-345-6501
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, FAX: 215-757-8025; FSC No.: 60197; Empl.: 50; *Sls. Mgr.:* Paul F. Ruo

PRECI-DIP, See Mill-Max Mfg. Corp.

PRECISE SENSORS, INC., 235 West Chestnut Ave., Monrovia, CA 91016, Tel: 818-358-4578, FAX: 818-358-3546; Empl.: 35

PRECISION COMPONENTS, INC., 400 W. Davy Ln., Wilmington, IL 60481, Tel: 708-543-6448, FAX: 708-543-6484

PRECISION CONTROL MANUFACTURING, INC., 1509-B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782; Empl.: 5; *Sls. Mgr.:* Steve L. Deters .... **A•2116**

Local Sales Offices & Reps

WA	Seattle, Precision Control Mfg., Inc.	206-281-9380

Local Distributors

CA	Granada Hills, Lion Elctrn., Inc.	818-363-0993

PRECISION DIGITAL CORP., 15 Mercer Road, Natick, MA 01760, Tel: 508-655-7300, FAX: 508-655-8990; *Sls. Mgr.:* Jeffrey Peters

PRECISION ELECTRONIC HARDWARE, INC., 987 Woodtick Road, Waterbury, CT 01703, Tel: 203-754-0779, FAX: 203-755-7996; Empl.: 25; *Sls. Mgr.:* Jeffrey A. Balko

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 708-678-5350, FAX: 708-678-0511; Empl.: 25; *Sls. Mgr.:* Jeff Franzen

PRECISION ELECTRONICS INC., One DiFomas Ct, Copiague, NY 11726, Tel: 516-842-4900, FAX: 516-842-4904 .... **A•2526**

PRECISION ELECTRO-OPTICS, INC., 30 Commerce St., Box 1039, Chatham, NJ 07928, Tel: 201-635-8811, FAX: 201-635-0437; FSC No.: OG1WB-Cage Code; Empl.: 8; *Sls. Mgr.:* Jim Ingram

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 708-766-0340, FAX: 708-766-0495; Empl.: 135; *Sls. Mgr.:* Richard Ziehm

PFT

FAX: 219-253-6570

PRECISION FABRICATION TECHNOLOGIES, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 100; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel .... **C•1073-1079**

Local Sales Offices & Reps

AL	Mobile, Allied Elctrns.	800-433-5700
AZ	Phoenix, Allied Elctrns.	800-433-5700
AZ	Phoenix, TeQni-Rep. Assoc.	602-242-9449
CA	Saratoga, Edward King & Assocs.	408-741-0434
CA	Sun Valley, TeQni-Rep. Assoc.	818-768-4223
CO	Englewood, Techtel Mktg.	303-721-9626
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Orlando, Aurora-Schmitt Assoc.	800-232-9005
IL	Cary, Bob Burns & Assocs.	708-516-3322
IL	Monee, C.R. Co.	708-534-7940
MA	Burlington, FJS Assocs.	617-273-5959
MI	Livonia, Amtech Rep.	313-474-8300
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Hauppauge, Schmitt Mktg. Corp.	516-434-1313
OH	Rocky Hill, Oak Hill Mktg., Inc.	216-333-0000
OR	Portland, Caruso & Co.	503-246-5439
TX	Austin, S.W. Mktg. Assoc.	512-255-8010
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Colgate, Rep One & Assocs.	414-628-4016
WI	Madison, Rep One & Assoc.	608-246-8889

Local Distributors

AL	Birmingham, ACK Radio Supply	205-322-0588
AL	Huntsville, Allied Elctrns.	800-433-5700
AL	Huntsville, Marshall Inds.	205-881-9235
AL	Mobile, Allied Elctrns.	800-433-5700
AZ	Phoenix, Allied Elctrns.	800-433-5700
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Tucson, Elctrn. City	602-622-1173
CA	Calabasas, Marshall Inds.	818-878-7021
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Chatsworth, Allied Elctrns.	800-433-5700
CA	Chatsworth, ITC Elctrns.	818-700-0900
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	El Toro, R-Vac Elctrns.	714-586-1210
CA	Fremont, Allied Elctrns.	800-433-5700
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawaiian Gardens, Dow Radio	213-421-3781
CA	Irvine, Allied Elctrns.	800-433-5700
CA	Irvine, Marshall Inds.	714-458-5394
CA	Los Angeles, ITC Elctrns.	213-388-0621
CA	Los Angeles, Pacific Radio	213-462-1393
CA	Milpitas, Marshall Inds.	408-942-4700
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	North Hollywood, Sandy's Elctrns.	818-983-2550
CA	Oxnard, Dow Radio	805-486-6353
CA	Oxnard, ITC Elctrns.	805-983-4115
CA	Pamona, DOW-Radio	818-966-8461
CA	Pasadena, DOW-Radio	818-793-1195
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Rocklin, Allied Elctrns.	800-433-5700
CA	Sacramento, Allied Elctrns.	800-433-5700
CA	Sacramento, Zack Elctrns.	916-369-1786
CA	San Diego, Allied Elctrns.	800-433-5700
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Clara, Context Engrg.	408-748-8676
CA	South San Francisco, Allied Elctrns.	800-433-5700
CA	Thousand Oaks, Pace Elctrns.	805-379-9631
CO	Denver, Gateway Elctrns.	303-458-5444
CO	Englewood, Allied Elctrns.	800-433-5700
CO	Thornton, Marshall Inds.	303-451-8444
CT	Bridgeport, Park Dists.	203-366-7200
CT	Cheshire, Allied Elctrns.	800-433-5700
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Casselbery, Allied Elctrns.	800-433-5700
FL	Fort Lauderdale, Marshall Inds.	305-977-4880
FL	Jacksonville, Allied Elctrns.	800-433-5700
FL	Largo, Allied Elctrns.	800-433-5700
FL	Miami Lakes, Allied Elctrns.	800-433-5700
FL	Pompano Beach, Allied Elctrns.	800-433-5700
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Atlanta, Allied Elctrns.	800-433-5700
GA	Atlanta, ACK Radio	404-351-6340
GA	Duluth, Allied Elctrns.	800-433-5700
GA	Norcross, Marshall Inds.	404-923-5750
ID	Boise, Radar Elc.	208-336-2227
IL	Berwin, B-B & W Inc.	708-749-1710
IL	Champaign, Klaus Radio	217-356-1896
IL	LaSalle, Klaus Radio	815-223-7400
IL	Libertyville, Allied Elctrns.	800-433-5700
IL	Mt. Prospect, Tri-State Elctrns.	708-255-0600
IL	Niles, Joseph Elctrns.	708-297-4240
IL	Oak Forest, Allied Elctrns.	800-433-5700
IL	Peoria, Klaus Radio	309-691-4840
IL	Quincy, Klaus Radio	217-223-7560
IL	Schaumburg, Marshall Inds.	708-490-0755
IL	Wood Dale, Allied Elctrns.	800-433-5700
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Evansville, Ohio Valley Sound	812-425-6173
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Allied Elctrns.	800-433-5700
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Marshall Inds.	317-297-0483
IN	Indianapolis, PEI-Genesis	317-879-0700
IN	Terre Haute, Ohio Valley Sound	812-235-6025
IA	Des Moines, Allied Elctrns.	800-433-5700
KS	Lenexa, Allied Elctrns.	800-433-5700
KS	Lenexa, Marshall Inds.	913-492-3121
KY	Louisville, Allied Elctrns.	800-433-5700
KY	Owensboro, Ohio Valley Sound	502-683-6727
LA	Metairie, Allied Elctrns.	800-433-5700
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Columbia, Allied Elctrns.	800-433-5700
MD	Gaithersburg, Capitol Radio	301-840-5700
MD	Silver Spring, Marshall Inds.	301-622-1411
MA	Billerica, Allied Elctrns.	800-433-5700
MA	Northboro, Papi Supp.	508-393-8564
MA	Norwood, Allied Elctrns.	800-433-5700
MA	Wilmington, Marshall Inds.	508-658-0810
MI	Grand Rapids, Allied Elctrns.	800-433-5700
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MI	Livonia, LWC Distributors	313-464-7700
MI	Livonia, Marshall Inds.	313-525-5850
MI	Plymouth, Allied Elctrns.	800-433-5700
MN	Bloomington, Allied Elctrns.	800-433-5700

MN	Minneapolis, Tortec Corp.	612-866-3662
MN	Plymouth, Marshall Inds.	612-559-2255
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Earth City, Allied Elctrns.	800-433-5700
NE	Omaha, Allied Elctrns.	800-433-5700
NH	Nashua, Allied Elctrns.	800-433-5700
NJ	Edison, Allied Elctrns.	800-433-5700
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Lodi, Nidisco	201-773-1771
NJ	Moorestown, Allied Elctrns.	800-433-5700
NJ	Mount Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Allied Elctrns.	800-433-5700
NJ	Pine Brook, Allied Elctrns.	800-433-5700
NM	Albuquerque, Bestech	505-298-0034
NM	Albuquerque, TMA, Inc.	505-345-8921
NY	Endicott, Marshall Inds.	607-785-2345
NY	Fairport, Allied Elctrns.	800-433-5700
NY	Hauppauge, Broadline Elctrns.	516-273-2695
NY	Hauppauge, Marshall Inds.	516-273-1515
NY	Lagrangeville, Allied Elctrns.	800-433-5700
NY	Liverpool, WEI Inc.	315-652-8111
NY	Mineola, Allied Elctrns.	800-433-5700
NY	New York City, Audiotechniques	212-586-5989
NY	Rochester, Marshall Inds.	716-235-7620
NY	Syracuse, Allied Elctrns.	800-433-5700
NC	Charlotte, United Elctrn. Supp.	704-372-2650
NC	Raleigh, Allied Elctrns.	800-433-5700
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Beachwood, Allied Elctrns.	800-433-5700
OH	Cincinnati, Allied Elctrns.	800-433-5700
OH	Columbus, Marshall Inds.	614-891-7580
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Consolidated Elctrns.	513-435-5662
OH	Dayton, Marshall Inds.	513-898-4480
OH	Solon, Marshall Inds.	216-248-1788
OH	Worthington, Allied Elctrns.	800-433-5700
OK	Tulsa, Allied Elctrns.	800-433-5700
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Portland, Allied Elctrns.	800-433-5700
OR	Portland, Radar Elec.	503-232-8353
PA	Bethlehem, P.A. Peters	215-861-4850
PA	Camp Hill, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Marshall Inds.	412-788-0441
RI	Cranston, Jabbour Elctrns.	401-944-2570
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
SC	Greenville, Allied Elctrns.	800-433-5700
TN	Memphis, Allied Elctrns.	800-433-5700
TX	Austin, Allied Elctrns.	800-433-5700
TX	Austin, Altex Elctrns.	512-832-9131
TX	Austin, Marshall Inds.	512-837-1991
TX	Brownsville, Marshall Inds.	512-542-4589
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Allied Elctrns.	800-433-5700
TX	El Paso, Allied Elctrns.	800-433-5700
TX	El Paso, Marshall Inds.	915-593-0706
TX	Fort Worth, Allied Elctrns.	800-433-5700
TX	Houston, Allied Elctrns.	800-433-5700
TX	Houston, Marshall Inds.	713-467-1666
TX	Humble, Allied Ectrns.	800-433-5700
TX	Midland, GDL Elctrns.	915-687-3876
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Marshall Inds.	801-973-2288
VA	Alexandria, Arcade Elctrns.	703-256-4610
VA	Richmond, Norfolk Wire	804-355-1100
VA	Springfield, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Norfolk Wire	804-449-1100
WA	Bothell, Marshall Inds.	206-486-5747
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Allied Elctrns.	800-433-5700
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WA	Tacoma, Allied Elctrns.	800-433-5700
WI	Madison, Satterfield Elctrns.	608-222-3400
WI	Milwaukee, Ind. Elctrns.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Waukesha, Marshall Inds.	414-797-8400
Can	Ontario, Marshall Inds.	416-458-8046
Can	Quebec, Marshall Ind.	514-694-8142

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FAX: 607-277-4466

PRECISION FILTERS, INC., 240 Cherry St, Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 80; *Sls. Mgr.:* D. F. Chandler .... **A•1616, 1673-1675; D•1018, 1200-1202**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1772
CA	Chatsworth, Technologies West	818-700-6426
IL	Matteson, Instrumentation Sls. Inc.	708-720-0705
CA	San Jose, Dugan Technlgs.	408-268-1766
CO	Denver, Hannah-Hill, Inc.	303-252-1154
FL	Orlando, Microspec	407-898-3504
GA	Lilburn, Microspec	404-921-3840
IL	Matteson, Instrumentation Sales. Inc.	708-720-0705
KS	Merriam, TECREP Corp.	913-262-9500
IN	Indianapolis, RDP Corp.	317-243-8788
MD	W. Friendship, Gans & Pugh Assocs.	410-442-2189
MA	Boston, Ellis Assocs.	617-585-6750
MI	St. Louis, TECREP Corp.	314-454-9110
MI	Farmington Hills, RDP Corp.	313-471-0685
NH	Manchester, Ellis Assocs.	603-623-0185
NM	Albequerque, Hannah-Hill, Inc.	505-268-0950
NY	Amherst, Reliable Measurement	716-862-9484
NY	Port Chester, Radiation Elctrns.	914-937-2300
OH	Dayton, RDP Corp.	513-253-6175
OH	Richfield, RDP Corp.	216-659-3138
OK	Tulsa, Abcor, Inc.	918-279-1468
PA	North Wales, Gans & Pugh Associates, Inc.	215-699-6655
PA	Pittsburg, RDP Corp.	412-487-2217
SC	Rock Hill, Microspec	803-366-3015
TN	Nashville, Microspec	615-383-4064
TX	Houston, ABCOR, Inc.	713-486-9251
UT	Salt Lake City, Hannah-Hill, Inc.	801-943-9918
VA	Herndon, Gans & Pugh Assocs.	703-709-0305
WA	Bellevue, Syntek	206-462-7700

PRECISION GRAPHICS INC., 59 La Grange St, Raritan, NJ 08869, Tel: 908-707-8880, FAX: 908-707-8884; Empl.: 39; *Sls. Mgr.:* David K. Weissman

Local Sales Offices & Reps

NJ	West Orange, Rizzo Assocs.	201-731-0974
OH	Twinsburg, Protocol Sls.	216-425-2569
PA	New Hope & Norristown, Intek, Inc.	215-723-0433

PRECISION IMAGE CORPORATION, 501 Chesapeake Dr., Redwood City, CA 94063, Tel: 415-366-8900, 1-800-338-3377, FAX: 415-366-2149; Empl.: 70; *Sls. Mgr.:* Mr. Rene Carillo; *Dist. Mgr.:* Mr. Rene Carillo

PRECISION INTERCONNECT, Subsidiary of AMP Incorporated, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400; FSC No.: 60381; Empl.: 500; *Sls. Mgr.:* Alex Guletsky

PRECISION LAMP, INC., 720 Portal St, Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 80

PRECISION MECHANISMS, 50 Bond St, Westbury, NY 11590, Tel: 516-ED3-5955, FAX: 516-333-5956; FSC No.: 08127; Empl.: 19; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01960, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert A. Degnan

PRECISION MICROCONTROL, 8122 Engineer Rd., San Diego, CA 92111, Tel: 619-565-1500, FAX: 619-565-1511; *Sls. Mgr.:* Ian M. Clark

PRECISION PAPER TUBE CO., 1033 South Noel Ave, Wheeling, IL 60090, Tel: 708-537-4250, FAX: 708-537-5777; Empl.: 250

PRECISION PRODUCTS GROUP, INC., 4903 E. State St., Rockford, IL 61108, Tel: 815-395-2155, FAX: 815-395-2151; Empl.: 500; *Sls. Mgr.:* Douglas W. Franklin

PRECISION PROTOTYPES, INC., 255 Midland Ave., Garfield, NJ 07026, Tel: 201-546-6737, FAX: 201-546-8872; *Sls. Mgr.:* Rick Caporino

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline .... **A•2014-2015**

Local Sales Offices & Reps

AZ	Tempe, Advanced Comp. S/S AZ	602-731-9711
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Seal Beach, Texel	310-596-9411
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Duluth, Dixie Tech. Mktg.	404-381-5592
IL	Arlington Heights, Russell Elctrn. Sale	708-394-5560
IN	Greenwood, Valentine & Associates	317-888-2260
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MD	Baltimore, Advanced Tech. Sls.	301-323-3140
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
NJ	Ridgewood, Ballou Inc.	201-444-6990
OH	Kettering, K.B. Smith Inc.	513-299-0033
TX	Dallas, Kay Todd Assocs.	214-458-8833
WA	Edmonds, ACDC	206-745-5445

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647-1421, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid .... **A•2016-2017**

PRECISION SPECIALTIES, INC., 8740 Shirley Ave., Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-349-4367; FSC No.: 66785; Empl.: 10

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION THIN METAL (LP), 112 Mary Ann Road, Beaver Dam, WI 53916, Tel: 414-885-9000, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

PRECISION TUBE, 287 Wissahickon Ave., N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PRECISION TUBE CO., Coaxitube Div., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 410-546-3911, FAX: 410-546-3913; FSC No.: OBV02; Empl.: 18; *Sls. Mgr.:* Douglas McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, 1-800-553-6374, FAX: 413-562-7275; Empl.: 160; *Sls. Mgr.:* Andree Buscemi

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 708-438-4000, FAX: 708-438-5522; FSC No.: 36-3193682; Empl.: 10; *Sls. Mgr.:* Pat Jones; *Dist. Mgr.:* Bob Van Orden

PREMA PRECISION ELECTRONICS, INC., 4650 Arrow Hwy. Suite E-5, Montclair, CA 91763, Tel: 714-621-7292, FAX: 714-625-2098

Premier Magnetics Inc.

FAX: 714-362-4212

PREMIER MAGNETICS INC., 27111 Aliso Creek Rd., Ste. 175, Aliso Viejo, CA 92656, Tel: 714-362-4211; Empl.: 10; *Sls. Mgr.:* Jim Earley .... **A•2508**

Local Sales Offices & Reps

CA	Northern CA, Silicon Valley Sls.	408-432-1967
FL	Tampa, APM Assocs.	813-886-2457
GA	B.T. Funderburk, Inc.	404-963-9495
MD	Artco Assocs.	410-638-1134
MA	Advanced Comp. Grp.	508-845-2023
NJ	Unirep	908-940-1851
NJ	W. Milford, Dynamic Sls. Assoc.	201-728-1044
NJ	West Milford, Dynamic Sls. Assoc.	201-728-1044
NC	B.T. Funderburk, Inc.	919-846-2373
OR	Northwest Comp. Sls.	503-620-3285
WA	Kirkland, Northwest Comp. Sls.	206-828-2104

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 718-993-9200, FAX: 718-993-9211; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza .... **C•1080**

Local Sales Offices & Reps

CA	Campbell, Shur Sls.	408-374-5577
CA	Fontana, Premier Metal	714-829-3089
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Carmel, Current Elctrns.	317-844-1770
IL	St. Charles, May Assocs.	708-293-0062
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Anoka, Tech. Solutions	612-785-9303
MO	Florissant, Delltron Co.	314-839-0033
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Rochester, MicroTech Mktg.	716-426-0806
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Penndel, Delta Mktg.	215-353-6639
TX	Richardson, Spectra Sls. Corp.	214-234-3600
WA	Redmond, Scientific Dvcs	206-885-0004
EXP	FL, Ft. Lauderdale, GM Intl.	305-434-6617

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
ID	Boise, Radar Elec.	208-336-2227
IL	Skokie, Anixter	708-677-2600
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	St. Louis, Gateway Elctrn. Supp.	314-427-6116
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Englewood, Datanet	201-569-2353
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Great Neck, Avon Datacom	516-466-1690
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Audio Techniques	212-586-5989
NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	216-248-1636
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, FAX: 914-939-9239; FSC No.: 15870; Empl.: 43; *Sls. Mgr.:* Mel Radner

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PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 180; *Sls. Mgr.:* D. Hertel .... **A•1277-1281, 2512-2525**

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625, FAX: 914-698-9456; Empl.: 25; *Sls. Mgr.:* Gilbert Bassin .... **B•1800**

PRESCO, INC., 8 Lunar Drive, Woodbridge, CT 06525, Tel: 203-397-8722, FAX: 203-389-1129; Empl.: 8

PRESIDIO COMPONENTS, INC., 7169 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, FAX: 619-578-6225; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 708-628-2255, FAX: 708-628-8025; Empl.: 25; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5002, FAX: 201-751-9653; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 98; *Sls. Mgr.:* J. S. Yakshe

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME TECHNOLOGY

FAX: 203-481-8937

PRIME TECHNOLOGY, INC., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* James L. Jamieson, Mktg. VP

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* H. Ikoma; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 908-687-1750, FAX: 908-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, 2549 U.S. Highway 1, North Brunswick, NJ 08902, Tel: 908-297-4448, FAX: 908-297-5641; Empl.: 29; *Sls. Mgr.:* H.R. Center; *Dist. Mgr.:* H.R. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-1500, FAX: 215-355-7766; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 100; *Sls. Mgr.:* Joe Grimaldi; *Dist. Mgr.:* Bruce Burgess

PRINT PRODUCTS INTL., 8931 Brookville Rd., Silver Spring, MD 20910, Tel: 301-587-7824, 800-638-2020, FAX: 800-545-0058; Empl.: 6; *Sls. Mgr.:* Scott MacDonald; *Dist. Mgr.:* Scott MacDonald

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FAX: 404-449-5457

PRO BATTERY, INC., 3941 Oakcliff Indl. Ct., Atlanta, GA 30340, Tel: 800-451-7171; Empl.: 35; *Sls. Mgr.:* Neal A. Zucker .... **B•1178; D•1465**

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; *Sls. Mgr.:* Frank J. Ardezzone

PROCESS & ANALYTICAL INSTRUMENTS DIV., A Subsidiary of Ametek Inc., 150 Freeport Rd., Pittsburgh, PA 15238, Tel: 412-828-9040, FAX: 412-828-0399; Empl.: 110; *Sls. Mgr.:* Jerry Barth

PRO-COMM, INC., 1105 Industrial Pkwy., Brick, NJ 08724, Tel: 908-206-0660, FAX: 908-458-1919; FSC No.: OUTX6; Empl.: 10; *Sls. Mgr.:* Robert L. Sepulveda

PRO COM TECHNOLOGY INC., 29 Newton Rd., Plainview, NY 11803, Tel: 516-293-4443, 800-762-3785, FAX: 516-293-4456; FSC No.: 0K887; Empl.: 11; *Sls. Mgr.:* Alan Spiegel

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 130; *Sls. Mgr.:* Dan Johnson

PRODIGIT ELECTRONICS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-527-0888; Empl.: 100; *Sls. Mgr.:* Daniel Erb

PRODUCTION AUTOMATION, INC., 2558 Seaboard Ave., San Jose, CA 95131-1026, Tel: 408-894-9064, FAX: 408-894-9083; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTRONICS INC., 7616 Disalle Blvd., Fort Wayne, IN 46825, Tel: 219-489-8201, FAX: 219-489-6573; Empl.: 4; *Sls. Mgr.:* Bernard James

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702-5131, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 30; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, FAX: 617-245-1628; Empl.: 16

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998, FAX: 714-474-1340; FSC No.: 1Z295; Empl.: 85; *Sls. Mgr.:* Diane Weston .... **C•1673**

PROFESSIONAL ENGINEERING SYSTEMS, 425 Parkway Dr., Erie, PA 16511-1051, Tel: 814-453-5452

PROGRAMMABLE DEVICES, INC., 205 Main St., North Reading, MA 01864, Tel: 508-664-6447, FAX: 508-664-9977; Empl.: 10

PTS

FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, 9 Beaver Brook Road, P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 .... **D•1316**

PROJECTIONS UNLIMITED, 14831 Myford Rd., Tustin, CA 92680, Tel: 714-544-2700, FAX: 714-544-8711; *Sls. Mgr.:* Robert C. Gau

PROJECTOR RECORDER BELT CORP., Route 3 Highway 59 P.O. Box 176, Whitewater, WI 53190, Tel: 1-800-533-9654, FAX: 1-800-635-8101; Empl.: 30; *Sls. Mgr.:* Ed Wetzel; *Dist. Mgr.:* Nancy Smith

PROJECT PRO, 1710 Enterprise Pkwy., Twinsburg, OH 44087, Tel: 216-425-8888

PROJECT RESOURCES INC., 16 Kendrick Rd., Wareham, MA 02571, Tel: 508-295-7444, FAX: 508-295-7497; FSC No.: OEF11; Empl.: 18; *Sls. Mgr.:* T.R.Egan

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, FAX: 513-890-4911; Empl.: 61; *Sls. Mgr.:* Greg Kimpton .... **D•1057**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CA	Irvine, Cal Rep Inc.	
CA	San Jose, Comtech Mktg.	408-249-3330
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Lakeland, Munday Sls. Co.	813-858-5606
GA	Alpharetta, R.A. Sls.	404-442-6749
IL	Woodridge, Golten Assocs. Inc.	708-985-5100
IN	Indianapolis, The J. C. Hofstetter Co.	317-897-7914
IA	Cedar Rapids, Thomas Dowell	319-393-7920
KS	Overland Park, Thomas L. Dowell	913-722-4242
MA	Westwood, Sturdy Corp.	617-326-8300
MN	Edina, G.P. Sls.	612-831-2362
MO	St. Louis, Thomas L. Dowell	314-849-4234
NH	Derry, Sturdy Corp.	603-434-8440
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Bohemia, Optimum Metro Sls., Inc.	516-244-5744
NY	Penn Yan, Ecco New York	315-536-5033
NC	New Bern, R A Sales	919-244-2672
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Doran Sls., Assoc.	503-640-4500
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Valley Forge, Providence Mktg.	215-935-3300
SC	Easley, R A Sales	803-859-1859
TN	Rutherford, R.A. Sls.	901-665-6301
TX	Austin, Kruvand Assocs. Inc	512-219-9443
TX	Dallas, Kruvand Assoc.	214-437-3355

WA	Bothell, Doran Sls. Assocs., Inc.	206-488-1200
Can	Islington, Ont., D.T. Shaw Co., Ltd.	416-231-3494
Can	Montreal, Que., D.T. Shaw Co. Ltd.	514-332-1163

Local Distributors

AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
AR	Pine Bluff, Carlton Bates	501-535-1354
AR	Springdale, Carlton Bates	501-756-5012
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	San Jose, Speakers Unlimited	408-453-5698
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Commerce City, Waco Elctrns.	303-289-4743
CT	Newtown, Target Elctrns.	203-426-4403
FL	Clearwater, Atlantic Elctrns.	813-531-5900
FL	Lakeland, A-A Elec.	813-665-6941
FL	Lakeland, Atlantic Elctrns.	813-687-0200
FL	West Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Lawrenceville, A-A Elec.	404-822-4960
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
LA	Shreveport, Carlton Bates	318-636-9975
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Hingham, Hingham Bay	617-740-1900
MA	Westwood, Target Elctrns.	617-329-2700
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MO	Springfield, Carlton-Bates Co.	417-862-1699
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NY	Rochester, Ray Baker Elctrns.	716-586-9164
OH	Dayton, Electro Supp.	513-299-5020
OK	Oklahoma City, Carlton Bates	405-681-4446
OK	Tulsa, Carlton Bates	918-250-1626
OR	Beaverton, Kent Elctrns.	503-626-8300
PA	Levittown, Aim Elctrns.	215-946-3900
PA	McKean, Advacom	814-476-7774
TN	Jackson, Carlton Bates	901-664-2714
TN	Memphis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-885-3232
TX	Austin, Carlton-Bates Co.	512-837-9098
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Dallas, Off The Shelf Comps.	214-247-0052
TX	Ft. Worth, Carlton Bates	817-293-5558
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Off the Shelf Comps.	214-238-0808
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	San Antonio, Carlton Bates	512-805-8300
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Texarkana, Carlton Bates	903-792-6923
WA	Redmond, Kent Elctrns.	206-883-7200
WI	Milwaukee, Electronic Expeditors	414-228-8100
Can	Willowdale, Ont., Electro Sonic	416-494-1555

PRO-LOG CORP., 2555 Garden Road, Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 120; *Sls. Mgr.:* Pat Laughlin; *Dist. Mgr.:* Pat Laughlin

PROLOGIC SYSTEMS, 557-P Burbank St., Broomfield, CO 80020, Tel: 303-460-0103, FAX: 303-469-5565; Empl.: 6

PROMAC, United Exporters Company, 1095 Market St., Ste. 701, San Francisco, CA 94013-1630, Tel: 415-255-9393, FAX: 415-255-9392; *Sls. Mgr.:* Brian Tench

PROMAX-JOHNTON ELECTRONIC CORP., 1555-B McGaw Ave., Irvine, CA 92714, Tel: 714-975-1245, FAX: 714-975-1202; Empl.: 12; *Sls. Mgr.:* Kathy De Yeso; *Dist. Mgr.:* Kathy De Yeso

PROTEK DEVICES, 2001 W. Tenth Pl., Tempe, AZ 85281, Tel: 602-968-6060, FAX: 602-921-3760; Empl.: 50

PROTO SYSTEMS, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, 800-331-1797, FAX: 404-442-9751; FSC No.: 7U 718; Empl.: 155; *Sls. Mgr.:* Keith Koehle

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Ron Nabors

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, FAX: 609-298-8235; FSC No.: 05853; Empl.: 30; *Sls. Mgr.:* C. W. Harrison

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398, FAX: 313-388-9171; Empl.: 21; *Sls. Mgr.:* J. Schultz

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FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 28 **D•2300-2304**

Local Sales Offices & Reps

CA	Anaheim, Alpha Elctrn. Sls.	714-665-6580
CA	Garden Grove, Elctrn. Packaging Solutions	714-638-4455
CA	Los Gatos, Norwest Elctrns.	408-395-1190
CA	Santa Ana, Pulizzi Engrg., Inc.	714-540-4229
CO	Golden, J.F. Hurlbut Co.	303-279-7796
FL	Oldsmar, Temco Sls. Inc.	813-855-7566
IL	Bensenville, E.S.I.	708-766-3667
MD	Columbia, L.G. White & Co., Inc.	410-290-8880
MA	Stow, H.G. Assocs.	508-897-3190
MN	St. Paul, Heyda-Hanks Assocs.	612-484-8531
NY	Babylon, The Jette Grp.	516-669-6788
NY	Fayetteville, Martin P. Andrews	315-637-5291
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
OR	Beaverton, Temper Tech. Mktg.	503-292-8201
TX	Dallas, Kruvand Assocs.	214-437-3355
PA	Valley Forge, J.E. Cuesta & Co.	215-935-0400

PULNIX AMERICA, INC., 770 Lucerne Dr., Sunnyvale, CA 94086, Tel: 408-733-1560, FAX: 408-737-2966; Empl.: 80; *Sls. Mgr.:* Richard Hofmeister

PULSE ENGINEERING, INC., 12220 World Trade Dr., San Diego, CA 92128, Tel: 619-674-8100, FAX: 619-674-8262; Empl.: 3000; *Sls. Mgr.:* Dan Jackson; *Dist. Mgr.:* Rich Backman

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 310-515-5330, FAX: 310-515-0068; Empl.: 30; *Sls. Mgr.:* Ron Perry

PUREDATA, 180 West Beaver Creek Rd., Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, FAX: 416-731-7017; Empl.: 150; *Sls. Mgr.:* Alex Kosarow, VP of Sls.; *Dist. Mgr.:* Sal Cataldo, US Sls.

PUROLATOR PRODUCTS, INC., Formerly Facet Enterprises, 3 Miracle Mile, P.O. Box 1502, Elmira, NY 14902, Tel: 607-737-8011, TELEX: 6854130, FAX: 607-737-8335; FSC No.: 72850; Empl.: 300

PYCO, INC., 600 E. Lincoln Hwy., Penndel, PA 19047, Tel: 215-757-3704, FAX: 215-757-3780; Empl.: 48; *Sls. Mgr.:* John Savage

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 375; *Sls. Mgr.:* Tom Pyle; *Dist. Mgr.:* Mark Pyle, Natl. Sls. Mgr.

PYLE-NATIONAL, 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300 x210, TELEX: 25251, TWX: 910-221-0335, FAX: 312-342-0872; FSC No.: 49367; Empl.: 400

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELECTRONICS INC., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* J. Guay

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535, FAX: 206-365-0402; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., P. O. Box 159, Toledo, IL 62468-0159, Tel: 217-849-3300, FAX: 217-849-2544; Empl.: 50; *Sls. Mgr.:* S. John Horner

PYROFILM RESISTOR CO., See KDI/Triangle Electronics

Q-CARD, INC., 2 Chellis Ct., Owings Mills, MD 21117-1634, Tel: 410-581-0112; *Sls. Mgr.:* Larry Nickel

QMI/NIEC, 12900 Rolling Oaks Rd., Twin Oaks, CA 93518, Tel: 805-867-2555, FAX: 805-867-2698; *Sls. Mgr.:* Mitchell M. Cohen; *Dist. Mgr.:* Eric A. Wesoff, W. Reg. Mgr. **A•2176-2177**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-830-4030
CA	Laguna Hills, 4-Star Elctrn. Comp. Sls.	714-583-9781
CO	Denver, Alliance Elctrns. Colorado	303-433-1648
CT	Orange, Isdale Assocs.	203-389-8583
FL	Boca Raton, Tech Sls. Specialists, Inc.	407-391-3718
GA	Roswell, EMA, Inc.	404-992-7240
IL	Glendale Hgts., Synergistic Sls., Inc.	708-858-8686
MI	Troy, C.B. Jenson & Assocs., Inc.	313-643-0506
MN	Prior Lake, Gleason Assoc., Inc.	612-447-7020
NJ	No. Fairfield, Metro Logic Corp.	201-575-5585
NJ	So. Medford, CEF Assocs.	609-953-8945
NC	Raleigh, EMA, Inc.	919-846-6888
OR	Rocky River, Oak Hill Mktg., Inc.	216-333-0000
TX	Dallas, Electra Reps., Inc.	214-248-3852

QMS CIRCUITS, INC., QMS, 40 Hill Ave., Ft. Walton Bch., FL 32548, Tel: 904-244-6191, FAX: 904-244-0270; FSC No.: 65977; Empl.: 66; *Sls. Mgr.:* Jim Kimmitt

QPS INC., 95 Stiles Rd., Salem, NH 03079, Tel: 603-893-5100, FAX: 603-890-6675; FSC No.: OR9M8

QSI CORPORATION, 2212 So. W. Temple No. 46, Salt Lake City, UT 84115, Tel: 801-466-8770, FAX: 801-466-8792; Empl.: 10; *Sls. Mgr.:* Gerri Mackey **D•1105**

Local Sales Offices & Reps

CT	Orange, Isdale Assocs.	203-389-8583
FL	Altamonte Springs, Machine Controls	407-788-6607

Q-TECH CORP., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, Tel: 310-836-7900, FAX: 310-836-2157; FSC No.: 51774; Empl.: 121; *Sls. Mgr.:* Howard Phillips **A•1456-1459**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Hermosa Beach, Quattro Sls. Assoc., Inc.	310-372-4221
CA	Moorpark, Quattro Sls. Assoc., Inc.	805-523-2978
CA	San Diego, Quattro Sls. Assoc., Inc.	619-581-3093
CA	San Jose, Blue Elctrn. Sls.	408-345-0260
CA	San Juan Capistrano, Quattro Sls. Assoc., Inc.	714-735-4510
CO	Aurora, Pipers Sls. Co.	303-340-0216
CO	Parker, Howard Assoc.	303-841-5755
CT	Canterbury, Deltech Sls. Assocs.	203-546-6322
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
IN	Fort Wayne, TX Sales Inc.	219-489-4447
IA	Cedar Rapids, WG Controls	319-373-1009
KS	Roeland Pk., Abrams & Assocs.	913-432-2303
MA	Littleton, Deltech Sls. Assocs.	508-486-8294
MN	Minneapolis, Torkelson Assocs.	612-835-2414
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	908-537-7888
NJ	Paramus, Eltech Sls.	201-967-1309
NM	Albuquerque, Piper Sls. Co.	505-828-1300
TN	Winchester, C.J. Sls.	615-967-2156
TX	Houston, Texoma Technical Sales, Inc.	713-462-1432
TX	Richardson, Texoma Tech.	214-238-8127
Can	Don Mills, Ont., R.D. Assoc.	416-444-0959

QUAD DESIGN TECHNOLOGY, INC., 1385 Del Norte Road, Camarillo, CA 93010, Tel: 805-988-8250, FAX: 805-988-8259; Empl.: 20; *Sls. Mgr.:* Ron Lee; *Dist. Mgr.:* Jack Weaver

QUADTECH, INC., Formerly GenRad Instruments, 45 Main St., Bolton, MA 01740-1107, Tel: 800-253-1230, FAX: 508-779-0247; Empl.: 80; *Sls. Mgr.:* Bob White, VP Sls.

QUALITEC TECHNOLOGIES, INC., 43064 Christy St., Fremont, CA 94538, Tel: 510-498-1046, FAX: 510-498-5938; Empl.: 130; *Sls. Mgr.:* Kevin Daniels **D•1317**

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QUALITY COMPONENTS, INC., P.O. Box 113, St. Marys, PA 15857, Tel: 814-834-2817, FAX: 814-834-9141; Empl.: 95; *Sls. Mgr.:* Michael Renaud, Mktg. Mgr.

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls.	602-957-3570
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	San Diego, Van Gott & Assocs.	619-489-0893
CT	Southington, The Orion Grp.	203-621-8371
IL	Palatine, Vine Sls., Inc.	414-279-3871
MA	Peabody, The Orion Grp.	508-532-6266
WI	Milwaukee, Vine Sls.	414-279-3871

QUALITY MICROWAVE INTERCONNECTS, INC., 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-988-9090, FAX: 508-988-9393; FSC No.: 64023; Empl.: 30; *Sls. Mgr.:* Paul M. Tusini

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Clarence Oliver

QUALITY RESEARCH COMPANY, North 11424 Judkins Lane, Spokane, WA 99207-9632, Tel: 509-924-6895; Empl.: 6; *Sls. Mgr.:* Jon Roath

QUALITY SEMICONDUCTOR, 851 Martin Ave., Santa Clara, CA 95050, Tel: 408-450-8080, FAX: 408-496-0773

QUALITY TECHNOLOGIES, 610 N. Mary Ave., Sunnyvale, CA 94086, Tel: 408-720-1440, TELEX: 6731382, FAX: 408-720-0848; Empl.: 2000; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* James Kahn

Qti

Quality Thermistor, Inc

FAX: 208-376-4754

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83709, Tel: 208-377-3373; FSC No.: 56866; Empl.: 30; *Sls. Mgr.:* John Mahoney; *Dist. Mgr.:* Todd Ketlinski .... **B•1856, 1892-1893**

Local Sales Offices & Reps

EXP	Oradell, NJ, Sylvan Ginsbury Ltd.	201-261-3200

QUALOGY INC., 109 Bonaventura Dr., San Jose, CA 95134, Tel: 408-434-5200, FAX: 408-434-5242; Empl.: 16; *Sls. Mgr.:* Mike Sills

QUALSTAR CORP., 9621 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-5822, FAX: 818-882-4081; Empl.: 50; *Sls. Mgr.:* W. J. Gervais

Qualtek ELECTRONICS CORPORATION

FAX: 216-951-7252

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319; Empl.: 75; *Sls. Mgr.:* Laura Yano/Regional Sls. Mgr.; *Dist. Mgr.:* Pat Clark/Regional Sls. Mgr. .... **A•1600; C•1638-1639**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CA	Montrose, Signal Entprs., Inc.	818-957-0640
CO	Golden, Cristec-Meade Co.	303-279-5070
FL	Tampa, Florida Comp. Sls.	813-873-3622
IN	Fishers, Connect 21	317-578-2121
IN	Valparaiso, Catalyst	219-477-4004
KS	Olathe, Rothkopf & Assocs.	913-829-8897
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Minneapolis, RK Sls. Assocs. Inc.	612-571-1001
MO	St. Louis, Rothkopf & Assocs.	314-961-4485
NJ	Lawrenceville, DVS Co.	609-896-1112
NJ	Matawan, Ashtec	908-583-6903
NY	Mendon, Tech Mark Inc.	716-624-3840
NY	Port Washington, Ashtec	516-767-0336
OH	Rocky River, Oak Hill Mtkg.	216-333-0000
OH	Westerville, Oak Hill Mktg.	614-890-5150
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
TX	Dallas, SW Mktg. Assocs.	214-341-8631
VA	Charlottesville, DVS Co.	804-973-0303
WA	Bellevue, Caruso & Assocs.	206-455-8811
Can	Ontario, Millennium Mktg.	416-798-3044

Local Distributors

CA	Gardena, Cal Switch	714-538-9830
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CT	Hartford, Wes-Garde Comps.	203-527-7705
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Wheeling, Hawk Elctrns.	708-459-4030
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Marlboro, Hardware Specialty	508-481-8622
MA	Marlboro, Now Elctrns.	508-460-0187
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Wyoming, North Coast	616-249-8910
MN	Roseville, Parts One	612-633-8079
MO	Maryland Hts., L-Comp	314-291-6200
NJ	Pennsauken, IMS Distbn.	609-662-1770
NY	Elmsford, Multimetrics	914-347-3666
OH	Highland Hgts., Major Electronix	216-442-6200
PA	Philadelphia, Sharp Elctrns.	215-969-3300
PA	Pittsburgh, CAM-RPC	412-963-6202
PA	York, ECI	717-846-5334
TX	Ft Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Tandy Elctrns.	817-870-5600
WA	Seattle, Radar Elec.	206-282-2511
WA	Vancouver, Interconnect Sls.	206-256-4085
Can	Markham, Carsten Elctrns.	416-477-7705
Can	Pickering, Ont., A.C. Simmonds & Sons	416-839-8041
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

QUALTRONICS CORP., INC., Tollgate Rd., Palm, PA 18070-0468, Tel: 215-679-0900, FAX: 215-679-5927; FSC No.: 7Z968; Empl.: 22

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns .... **D•1059**

Local Sales Offices & Reps

AZ	Mesa, Yocum Mktg.	602-834-3334
CA	Culver City, Westech Mktg.	310-842-8820
CA	Gardena, Bidwell-Schwartz Assocs.	213-770-0300
UT	Salt Lake City, Pro Tech Mktg.	801-943-8331
FL	Orlando, Cartwright & Bean of FL	407-422-4531
GA	Norcross, Cartwright & Bean of GA	404-368-0160
IL	Mt Prospect, The Dombrow Co.	312-253-3326
IL	Skokie, Specialized Mktg.	708-674-1111
IN	Carmel, Green-Wissler Sls.,Inc.	317-843-5785
KS	Prairie Village, R. W. Kunz & Assocs., Inc.	913-648-3535
MA	Chicopee, Repworks, Inc.	413-533-0845
MN	Edina, Mel Foster Techn. Sls. Inv.	612-941-9790
NJ	Rahway, R. E. Breuer CO.	201-388-5045
NY	Syracruse, The Lewis & Dunnigan Co., Inc.	315-446-5522
OH	Stow, J. W. Lehner Co.	216-686-1965
PA	Broomall, Lowery Assocs. Co.	215-356-5300
TN	Menphis, Cartwright & Bean of TN	901-362-8345
TX	Dallas, Dick Bellew Sls.	214-644-7881
WA	Seattle, Vector Manufacturers' Rep.	206-368-8400
EXP	Yonkers, NY, Roburn Agencies, Inc.	914-968-1016
Can	Waterloo, Ont., McBride Loudspeaker Source, Ltd.	519-884-3500
MI	Southfield, Robert Milsk Co.	313-354-3310

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, FAX: 201-927-8242; FSC No.: 63921; *Sls. Mgr.:* Richard A. Stansbury

QUANTEX CORPORATION, 2 Research Ct., Rockville, MD 20850, Tel: 301-258-2701, 800-992-5149 (Sls. only), FAX: 301-258-9871; Empl.: 40; *Sls. Mgr.:* Ken Charbonneau

QUANTRONIX, Excel Technology, 45 Adams Ave., Hauppauge, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 100; *Sls. Mgr.:* S. Tornegard

QUANTUM CHROMODYNAMICS, INC., 2401 208th Street Unit 9, Torrance, CA 90501, Tel: 310-320-5717, FAX: 310-320-5848; Empl.: 4; *Sls. Mgr.:* David L. Hills

QUANTUM DATA®

FAX: 708-888-2802

QUANTUM DATA INC., 2111 Big Timber Road, Elgin, IL 60123, Tel: 708-888-0450, TELEX: 206725; Empl.: 23; *Sls. Mgr.:* Bill Down .... **D•1318**

QUANTUM ELECTRONICS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-1132, FAX: 717-248-8680; Empl.: 20; *Sls. Mgr.:* Kit C. Kennedy

QUANTUM SCIENTIFIC INC., 433 Horner Ave, Unit 4, Toronto, Ont M8W 4Y4, Tel: 416-503-8555, 800-268-6000, FAX: 416-503-1322; Empl.: 14; *Sls. Mgr.:* Gary Aitchison

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-3611, FAX: 617-322-9623; Empl.: 11; *Sls. Mgr.:* D. Yanofsky

QUATECH INC., 662 Wolf Ledges Pkwy., Akron, OH 44311, Tel: 216-434-3154, TELEX: 5101012726, FAX: 216-434-1409; Empl.: 32; *Sls. Mgr.:* Michael Cenker; *Dist. Mgr.:* Michael Cenker

QUEST CONTROLS, INC., 208 9th St. Dr. West, Palmetto, FL 34221, Tel: 813-729-4799, FAX: 813-729-5480; Empl.: 32; *Sls. Mgr.:* Joe Hencoski

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996, FAX: 201-673-3997; FSC No.: 89820; Empl.: 45

RACAL-DANA INSTRS. INC., 4 Goodyear St., Irvine, CA 92718, Tel: 714-859-8999; FSC No.: 21793; Empl.: 230

RACAL-DATACOM, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-846-1601, 1-800-RACAL-55, TWX: 510-955-4145, FAX: 305-846-4942; Empl.: 2400; *Sls. Mgr.:* Dan Latham; *Dist. Mgr.:* Bill Wilson

RACAL-GUARDATA, INC., 480 Spring Pk. Pl., Ste. 900, Herndon, VA 22070, Tel: 703-471-0892, FAX: 703-437-9333; FSC No.: 56496; Empl.: 29; *Sls. Mgr.:* Thomas Mitchell, VP; *Dist. Mgr.:* Thomas Mitchell, VP

Local Distributors

Can	Mississauga, Ont., Racal Guardata Canada	416-620-3431

RADIAL CONTROLS INC., 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

RADIALL, INC., 150 Long Beach Blvd., Stratford, CT 06497, Tel: 203-386-1030, TELEX: 311796, FAX: 203-375-3808; Empl.: 40; *Sls. Mgr.:* Bill Pitcher; *Dist. Mgr.:* Peter Dionisio

RADIANT COMMUNICATIONS CORP., 5001 Hadley Rd. P.O. Box 867, South Plainfield, NJ 07080, Tel: 908-757-7444, TELEX: 908-757-8666; Empl.: 10; *Sls. Mgr.:* Gene Thaw

RADIOMETRICS MIDWEST CORP., 55 West 22nd Street, Ste. 106, Lombard, IL 60148, Tel: 708-932-7262, FAX: 708-932-7271; FSC No.: Cage Code 1Z075 SIC Code 8748 Ext. 0021; Empl.: 5

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO TELEVISION PRODUCTS CORP., 2702 Washington Ave. N., Douglas, AZ 85607, Tel: 602-364-4438, FAX: 602-364-4430; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* W. J. McGaw

RADIX MICROELECTRONICS INC., 3445 C Chelton Lp, Colorado Springs, CO 80909, Tel: 719-597-1975, FAX: 719-597-1975; Empl.: 18

RADIX WIRE CO., 26260 Lakeland Blvd., Cleveland, OH 44132, Tel: 216-731-9191, FAX: 216-731-7082; Empl.: 90; *Sls. Mgr.:* Peter B. Thurstone; *Dist. Mgr.:* Doug Kerans, Dir. Sls./Mktg.

RADSTONE TECHNOLOGY, 20 Craig Rd., Montvale, NJ 07645, Tel: 201-391-2700, 800-368-2738, FAX: 201-391-2899; *Sls. Mgr.:* Larry Abzug

RAE COMPANY INC., 1345 Brookville Way, Ste. C, Indianapolis, IN 46239, Tel: 317-351-1774, FAX: 317-351-1781; FSC No.: 07356; Empl.: 50; *Sls. Mgr.:* Tim Fraze

RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, FAX: 203-888-9860; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

RAG ELECTRONICS, INC., 21418 Parthenia St., Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457, FAX: 818-407-5559

RAGEN DATA SYSTEMS, INC., Subsidiary of Meggit U.S.A., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, FAX: 516-348-0993; FSC No.: 13068; Empl.: 180; *Sls. Mgr.:* Roberta Marino

RAGEN SYSTEMS, INC., Ragen Corp., 1 Frederick Rd., Warren, NJ 07059, Tel: 908-561-4200, FAX: 908-561-1184; Empl.: 200; *Sls. Mgr.:* Richard Grawehr

RALTRON ELECTRONICS, 2315 N.W. 107th Ave., Miami, FL 33172, Tel: 305-593-6033, TELEX: 441588, FAX: 305-594-3973; Empl.: 40; *Sls. Mgr.:* Alexander Wolloch; *Dist. Mgr.:* Alexander Wolloch .... **A•1460-1462**

Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871, FAX:205-461-7978
AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Anaheim, Raltron-California	714-974-2664, FAX:714-921-2960
CA	Los Angeles, Landa & Assocs.	213-879-0770, FAX:310-478-0190
CA	San Marcos, Falcon Sls. & Technlg.	619-591-0504, FAX:619-591-4241
CA	Santa Ana, Landa & Assocs.	714-543-7805
CA	Santa Clara, Linctronics	408-748-2970
CO	Broomfield, Summit West Mktg.	303-460-9600, FAX:303-460-9074
CT	Guilford, Data Mark	203-453-0575, FAX:203-453-5935
FL	Boca Raton, Tech. Sls. Specialists	407-391-3718, FAX:407-750-1178
FL	Clearwater, Tech. Sls. Specialists	813-535-3375, FAX:813-535-9142
GA	Atlanta, Lamons Sls.	404-242-2610, FAX:404-263-3705
ID	Boise, First Source	208-375-1561
IL	Highland Park, Bransky Sls.	708-433-2375, FAX:708-433-2377
IN	Fort Wayne, J & B Engrg. Sls.	219-483-2813
IA	Cedar Rapids, M.I.N.K. Assocs. Inc.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs. Inc.	913-341-8309, FAX:913-341-2605
KS	Wichita, M.I.N.K. Assocs. Inc.	316-838-0190, FAX:316-838-9503
MD	Baltimore, Chesapeake Ind. MK	410-653-0476
MA	Norwood, JMG Inc.	617-762-5333, FAX:617-769-8010
MN	Eden Prairie, Hanna-Lind	612-942-8554, FAX:612-942-8469
MN	Roseville, Parts '1'	612-633-8079
MO	Bridgeton, M.I.N.K. Assocs. Inc.	314-291-5454, FAX:314-291-8595
NY	Manhasset, WIN-COR	516-627-9474, FAX:516-627-2282
NY	Rochester, H.C. Johnson Agencies, Inc.	716-586-0777,FAX:716-586-6435
NC	Raleigh, Lamons Sls.	919-846-1652, FAX:919-870-7793
PA	Horsham, Nexus Technlg. Sls.	215-675-9600, FAX:215-675-9604
TN	Greenville, Lamons Sls.	615-638-4320, FAX:615-639-5160
TX	Austin, SW Mktg.	512-255-8010
TX	Dallas, SW Mktg.	214-341-8631
TX	El Paso, Alexander Entprs.	915-591-3142, FAX:915-591-3169
TX	Houston, SW Mktg.	713-699-4838
UT	Salt Lake City, Component Well	801-263-8131, FAX:801-263-8192
Can	Calgary, Alb., A.C. Simmonds & Sons Ltd. Sls.	403-256-1516,FAX:403-254-2660
Can	Lower Sackville, Nova Scotia, A.C. Simmonds & Sons Ltd. Sls.	902-865-1889,FAX:902-865-5120
Can	Pickering, Ont., A.C. Simmonds & Sons Ltd. Sls.	416-839-8041,FAX:416-839-2667
Can	Ville Lemdyne, A.C. Simmons & Sons Ltd. Sls.	514-466-5250,FAX:514-466-5252

Local Distributors

AL	Huntsville, Bell Inds.-Huntsville/HNT	205-837-1074,FAX:205-830-5598
AZ	Tempe, Bell Inds.-Sunnyvale/SUN	602-966-7800, FAX:602-967-6584
CA	Carlsbad, AEGIS Elctrn. Grp. Inc.	619-729-2026, FAX:619-729-9295
CA	Irvine, Kelex Elctrns.	714-863-1230, FAX:714-474-1231
CA	Los Angeles, Bell Inds.-Corporate	213-826-3975, FAX:310-826-1534
CA	San Jose, All American San Jose	408-943-1200, FAX:408-943-1393
CA	San Jose, Passive Technlg. Sls. Inc.	408-435-5566, FAX:408-435-3041
CA	Sunnyvale, Bell Inds.-Sunnyvale/SUN	408-734-8570,FAX:408-734-8875
CT	Wallingford, Utronics	203-265-2724, FAX:203-269-3618
FL	Altamonte Springs, Bell Inds-Ft. Lauderdale/LAU	305-421-1997,FAX:305-421-5705
FL	Boca Raton, N.R.C.	407-241-8600, FAX:407-241-3328
FL	Melbourne, Dove Elctrns.	407-242-6916
FL	Melbourne, Pridmore Corp.	407-727-2491, FAX:407-723-1213
FL	Miami, All American Miami	305-621-8282, FAX:305-620-7831
GA	Norcross, Bell Inds.-Atlanta/ATL	404-662-0923, FAX:404-449-6901
GA	Norcross, NRC-JARD Dixie Inc.	404-729-0411, FAX:404-448-2854
IL	Elk Grove Village, Bell Inds.-Chicago/CHI	708-640-1910,FAX:708-640-0474
IL	Morton Grove, Nedco Elctrns. Inc.	708-967-0500, FAX:708-967-0505
IL	Northbrook, Classic Comps. Supp. Inc.	312-272-9650
MA	Andover, Bell Inds.-Andover	508-474-8880, FAX:508-474-8902
MA	Billerica, Baldwin Comps.	508-667-6710, FAX:617-671-0034
MA	Chelmsford, Shelley-Ragon	508-250-9666, FAX:617-250-8119
MA	Newton, Greene-Shaw	617-969-8900
MA	Sudbury, ASK Elctrns.	508-443-3542, FAX:508-443-0483
MA	Winchester, Bell Inds.-Winchester/WIN	617-729-5800,FAX:617-729-6839
MN	Edina, All American MN	612-944-2151, FAX:612-944-9803
MN	Edina, Bell Inds.-Minneapolis/MIN	612-941-1493, FAX:612-941-2964
MN	Edina, Bergquist Co.	612-835-2322, FAX:612-835-4156
NH	Hudson, Bell Inds.-Hudson/HUD	617-273-4450, FAX:617-882-1275
NJ	West Berlin, G.C.I.	609-768-6767
NY	E. Setauket, Dove Elctrns.	800-232-9825
NY	E. Setauket, Dove Elctrns.	800-232-9825, FAX:516-689-7362
NY	Farmingdale, Bell Inds.-Long Island/LGI	516-752-9303,FAX:516-752-9226
NY	Ronkonkoma, All American L.I.	516-981-3935, FAX:516-981-3947
NY	Ronkonkoma, Baldwin Comps.	800-645-5608
NY	Stony Brook, Dove Elctrns.	516-689-7733, FAX:516-689-7362
PA	Exton, V.S.H. Elctrns.	215-363-2250
TX	Richardson, All American Dallas	214-231-5300, FAX:214-437-0353
TX	Richardson, Bell Inds.-Dallas/DAL	214-690-0466, FAX:214-690-0822
UT	Midvale, Bell Inds.-Salt Lake City/SLC	801-255-9611,FAX:801-255-2477
WI	Mequon, Taylor Elec.	414-241-4321
WI	New Berlin, Classic Comps. Supp. Inc.	414-786-5300
WI	Waukesha, Bell Inds.-Milwaukee/MLW	414-547-8879,FAX:414-547-6547
Can	Montreal, Ferro Technique-LTEE/Ltd.	514-341-3450,FAX:514-341-1866
Can	Montreal, Que., Elctrn. Whlsrs. Co. Ltd.	514-769-8861,FAX:514-769-9060
Can	Montreal, Que., Ferro Technique LTEE/Ltd.	514-341-3450,FAX:514-341-1866
Can	Ottawa, Ont., Wackid Radio	613-728-1821, FAX:613-722-3465
Can	St. Laurent, Que., ZEI	514-342-6211, FAX:514-342-4073

RAMCOM SYSTEMS, 3547 Voyager St. Ste. 103, Torrance, CA 90503, Tel: 310-214-8601; *Sls. Mgr.:* Ralph Tisdale

RAMTRON INTERNATIONAL CORPORATION, 1850 Ramtron Dr., Colo. Springs, CO 80921, Tel: 719-481-7000, 800-545-3726, FAX: 719-488-9095; Empl.: 135; *Sls. Mgr.:* Don Carrigan; *Dist. Mgr.:* John van Conant

RANK BRIMAR INC., 25358 Avenue Stanford, Valencia, CA 91355-1214, Tel: 805-295-5770, FAX: 805-295-5087; FSC No.: 60750; *Sls. Mgr.:* P.A. Nicholas

RANSCO INDUSTRIES, 1400 E. Statham Pkwy., Oxnard, CA 93033, Tel: 805-487-7777, FAX: 805-486-7024; Empl.: 140; *Sls. Mgr.:* Robert Briner

RANTEC MICROWAVE & ELECTRONICS, Esco Electronics, 24003 Ventura Blvd., Calabasas, CA 91302, Tel: 818-591-8189, FAX: 818-591-8489; FSC No.: 04971; Empl.: 500; *Sls. Mgr.:* Dennis Lavelle ..... **D•1908-1911**

Local Sales Offices & Reps

CA	Los Altos, Caine & White	415-948-6533
FL	Orlando, Holmes & Assocs.	407-281-0067
NH	Pelham, Rantec	603-635-3503
TX	Dallas, Kemp Engrg.	214-931-7100
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, Caine & Sweet	206-462-2118

RANTEC MICROWAVE & ELCTRNS., INC., Subsidiary of Esco Electronics Corp., 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, FAX: 805-528-8132; FSC No.: 60132; Empl.: 110; *Sls. Mgr.:* Francesca Peterson .... **D•1908-1911**

Local Sales Offices & Reps

GA	Marietta, Electro Comp Sls., Inc.	404-922-2344

RAPIDSUN, See Rapidsyn Division, American Precision Industries

RAPIDSYN DIVISION, American Precison Industries, 3229 Roymar Rd., Oceanside, CA 92054, Tel: 619-439-7500, TELEX: 18-1196; FSC No.: 32423; Empl.: 50; *Sls. Mgr.:* Mike Turner

RAPID SYSTEMS INC., 433 N. 34th St., Seattle, WA 98103, Tel: 206-547-8311, FAX: 206-548-0322; FSC No.: 91-1197314; Empl.: 13; *Sls. Mgr.:* Laurie Maltman

RASTER GRAPHICS, INC., P. O. Box 5157, Bend, OR 97701, Tel: 503-388-2584, FAX: 503-389-8249

RATELCO, Power Systems, 1260 Mercer, Dept. EEM, Seattle, WA 98109-5589, Tel: 206-624-7770, FAX: 206-382-5447; FSC No.: 14259; Empl.: 200; *Sls. Mgr.:* D. Terpstra

RAULAND-ZENITH ELECTRONICS CORP., 2407 W. North Ave., Melrose Pk., IL 60160, Tel: 708-450-8992, TELEX: 72-1488, FAX: 708-450-8393; Empl.: 2300

Raychem

FAX: 1-800-227-4866

RAYCHEM CORPORATION, 300 Constitution Dr., Menlo Park, CA 94025, Tel: 415-361-3863, 800-2-RAYCHEM/ext. 6900; Empl.: 500; *Sls. Mgr.:* Rob Palmatier; *Dist. Mgr.:* Michele Small .... **A•2179; B•1384-1385, 1894-1895; D•1466**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Pleasanton, Moulthrop Sls., Inc.	415-463-0450
CA	San Diego, Wiley Co.	619-453-9018
CO	Englewood, Thorson Rocky Mtn., Inc.	303-773-6300
FL	Altamonte Springs, Semtronics	800-432-0200
GA	Atlanta, CSR Elctrns.	404-396-3720
IL	Itasca, Micro Sls., Inc.	708-285-1000
IN	Carmel, TMC	317-844-8462
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
KY	Louisville, TMC	502-893-1377
MA	Burlington, Bob Dean, Inc.	617-229-6800
MI	Southfield, Raychem Sls. Off.	313-350-0900
MN	St. Paul, Cahill-Schmitz-Cahill	612-646-7217
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Rockville, S-J Assocs.	516-536-4242
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Parma, S-J Assocs.	216-888-7004
OH	W. Carrollton, S-J Assocs.	513-438-1700
TX	Austin, B-P Sls.	512-346-9186
TX	Dallas, B-P Sls.	214-234-8438
TX	Houston, B-P Sls.	713-782-4144
TX	Richardson, B-P Sls.	214-234-8438
UT	Salt Lake City, Thorson Rocky Mtn., Inc.	801-942-1683
VA	Falls Church, S-J Assocs.	703-533-2233
WA	Bothell, Quadra Sls. Corp.	206-489-3428
Can	Calgary, Alb., Cana-Rep Grp., Inc.	403-255-0294
Can	E. Toronto, Ont., Cana-Rep Grp., Inc.	416-930-4621
Can	Montreal, Que., Cana-Rep Grp., Inc.	514-276-4477
Can	Ottawa, Ont., Cana-Rep Grp., Inc.	613-692-4682
Can	Vancouver, B.C., Cana-Rep Grp., Inc.	604-599-1232
Can	W. Toronto, Cana-Rep Grp., Inc.	416-338-3399

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Scottsdale, Insulectro	602-991-2370
AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Costa Mesa, Insulectro	714-957-8093
CA	Gardena, Cal Switch	800-225-7924
CA	Irvine, Acacia/Deanco	714-660-0834

CA	Lake Forest, Insulectro	714-587-3200
CA	Mt. View, Insulectro	415-969-7010
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Cal Switch	619-231-6740
CA	San Diego, Insulation Supply	619-467-6890
CA	San Diego, Insulectro	714-587-3375
CA	San Jose, Insulation Supply	408-435-1244
CA	San Jose, Passive Technlg. Sls.	408-435-5566
CA	Santa Clara, Kent-Shelley Ragon	408-727-9810
CA	Torrance, Insulation Supply	310-320-9400
CO	Aurora, Insulectro	303-360-8612
CO	Commerce City, WACO Elctrns.	303-289-4743
CO	Lakewood, Acacia/Deanco	303-232-2882
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Yalesville, Schaal Assocs.	203-269-3889
CT	Yalesville, Schaal Assocs., Inc.	203-269-3889
FL	Orlando, Hammond Elctrns.	407-841-1010
FL	Winter Park, Deanco, Inc.	407-671-5100
GA	Marietta, Deanco, Inc.	404-429-0126
GA	Norcross, Hammond Elctrns.	404-449-1996
HI	Honolulu, Precision Radio	808-537-5291
IL	Elk Grove Village, Kent Elctrns.	708-364-1300
IL	Elk Grove Village, Stranco Prods., Inc.	708-952-9250
IL	Wheaton, MEGA Co., Inc.	708-665-6214
IN	Indianapolis, Custom Service Elctrns.	317-879-9119
IA	Cedar Rapids, Kent-Shelley Ragon	319-373-0525
KS	Wichita, MEGA Co., Inc.	316-636-5020
MD	Columbia, Sager Elctrns.	410-995-4900
MD	Gaithersburg, Deanco, Inc.	301-948-5444
MA	Burlington, Schaal Assocs., Inc.	617-272-7940
MA	Hingham, Sager Elctrns.	617-749-6700
MN	St. Paul, Kent-Shelley Ragon	612-642-2823
MO	Hazelwood, Kent-Shelley Ragon	314-895-1515
MO	Independence, Kent-Shelley Ragon	816-254-3410
MO	St. Peters, MEGA Co., Inc.	314-939-9129
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Fairfield, Deanco, Inc.	201-575-7960
NM	Albuquerque, WACO Elctrns.	505-255-1638
NY	Hauppauge, Deanco, Inc.	516-434-7100
NY	Hauppauge, Sager Elctrns.	516-348-1300
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OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Highland Heights, Elctrns. Mktg. Corp.	216-442-3441
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Insulectro	503-626-4289
OR	Beaverton, Kent	503-626-8300
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Irving, Bunker Inds., Inc.	214-438-3300
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WA	Redmond, Insulectro	206-885-3800
WA	Redmond, Kent Elctrns.	206-883-7200
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Can	Scarborough, Ont., Paisley Prods. of Canada	416-751-3700
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Can	Vancouver, B.C., E.B. Peerless, Ltd.	604-327-1181

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FL	Largo, Electrocraft	813-544-1766
IL	Elk Grove, Oasis Sls.	708-640-1850
IN	Carmel, Technlg. Mktg.	317-844-8462
IN	Fort Wayne, Technlg. Mktg.	219-432-5553
IA	Cedar Rapids, Oasis Sls.	319-377-8738
KS	Olathe, G.M. Brown & Assoc.	913-829-3086
MA	Waltham, Datcom	617-891-4600
MN	Bloomington, Oasis Sls.	612-941-1917
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Mt. Laurel, S J Mid-Lantic	609-866-1234
NY	Huntington, CDB Entprs.	516-692-5200
OH	West Carrolton, S-J Ohio	513-438-1700
OR	Beaverton, Westmark Elctrns.	503-641-8780
TX	Richardson, Barry Sls.	214-234-0255
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Brookfield, Oasis Sls.	414-782-6660

RAYTHEON CO., Electronic Components Division, 190 Willow St., Waltham, MA 02254, Tel: 617-899-8400, TWX: 710-324-8400, FAX: 617-899-5451; *Sls. Mgr.:* L. Ron Lewis

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CA	Laguna Hills, 4-Star	714-583-9781
CO	Denver, Purdy Co.	303-790-2211
IL	Des Plaines, Electron Mktg.	708-298-2330
MA	Needham, Ray Perron Co.	617-449-6162
MI	Brighton, A/P Assoc.	313-229-6650
MN	Eden Prairie, Hanna Lind	612-942-8554
MO	Bridgton, AEM	314-298-9900
NJ	Leonia, Peter E. Schmitt	201-944-1096
NY	Rochester, Micro Tech	716-426-0806
OH	Cleveland, RK Comp. Sls.	216-642-9312
PA	Erdenheim, Omni Sls.	215-233-4600
PA	Freedom, RK Comp. Sls.	412-775-0747
TX	Dallas, Allied Comps.	214-238-0408
VA	Manassas, FBD	703-369-7212
WI	Colgate, Rep One	414-628-4016

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FL	W. Palm Beach, Atlantic Elctrns.	813-531-5900
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IL	Wood Dale, NEP Elctrns.	708-595-8500
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MD	Gaithersburg, MS Elctrns.	301-921-0200
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NJ	E. Brunswick, Brohters Elctrns.	908-238-2200
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TX	Ft. Worth, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP	414-785-9100

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RC ELECTRONICS, 43002 Christy St., Fremont, CA 94538-3164, Tel: 510-656-8490, FAX: 510-656-4759; *Sls. Mgr.:* Joe Butler

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 708-432-7915, FAX: 708-432-9181; Empl.: 20

RDF CORPORATION, 23 Elm Ave., P.O. Box 490, Hudson, NH 03051-0490, Tel: 603-882-5195,800-445-8367, FAX: 603-882-6925; FSC No.: 02009; Empl.: 97; *Sls. Mgr.:* Randal A. Gauthier; *Dist. Mgr.:* Irwin Bluestein

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CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, M & H Assocs.	407-332-7912
GA	Marietta, E-Squared Mktg.	404-565-2088
MD	Germantown, Bresson Assocs.	301-540-0110
MN	Minneapolis, OEM Elctrl. Sls., Inc.	612-884-7509
NY	Hicksville, J. Square Mktg., Inc.	516-935-3200
OH	Dayton, John Stephenson Assoc.	513-435-0745
OK	Tulsa, Nova Mktg.	918-660-5105
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TX	Dallas, Nova Mktg.	214-265-4600
TX	Houston, Nova Mktg.	713-988-6082
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NJ	Flanders, K&R Engrg. Corp.	201-584-5235
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Cincinnati, Tri-State Mktg.	513-761-7993
TX	Irving, Kite Elctrns. Sls.	214-986-0321
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EXP	London, England, Reeves-Hoffman U.K.	44-844-275929
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REGULUS SYSTEMS, 11901 Forest View Dr., Nevada City, CA 95959, Tel: 415-593-4197

REICH ASSOCIATES, INC., Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 210-751-3220, FAX: 210-751-3054; FSC No.: 55916; Empl.: 20; *Sls. Mgr.:* W. Reich

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RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

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TX	Farmers Branch, Keats & Assocs.	214-243-5905

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RELIANCE MOTION CONTROL, Reliance Electric, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Harry Webber; *Dist. Mgr.:* Brad Nelson

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CT	East Hampton, Apex Assocs.	203-268-8401
GA	Marietta, Solutions Mfrs. Reps.	404-951-5683
IN	Indianapolis, Schark Mktg. Inc.	317-842-6204
MA	Needham, Apex Assocs.	617-444-8070
MS	Meridian, Solutions Mfrs. Reps.	601-482-4647
MO	St. Louis, Rush & West Assoc.	314-965-3322
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, Border States Tech. Svc.	505-884-9100
NY	Skaneateles, NRM Mktg. Grp. Inc.	315-685-8991
NC	Raleigh, Solutions Mfrs. Reps.	919-790-7606
UT	Sandy, Moss Mktg.	801-562-9000
FL	Indian Harbor Bch., Solutions Inc.	407-777-0994
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Mt. Airy, Eltron Sls. Ltd.	410-875-0362
MI	Grosse Point Pk., Greiner Assocs.	313-499-0188
OH	Rocky River, Oak Hill Mktg. Inc.	216-333-0000
OR	Hillsboro, Temco Northwest	503-645-2030
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VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
WA	Bothell, Temco Nortwest	206-481-6150
WI	Brookfield, Bert Wartchow Assocs.	414-821-2993
Can	Montreal, Que, Eli Manis, Inc.	514-484-2923

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REPUBLIC ELECTRONICS CO., Esterline Technologies, 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, FAX: 516-273-9820; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman, Mktg. Mgr.

RESEARCH DEVICES, INC., 121 Ethel Rd. West, Piscataway, NJ 08854, Tel: 908-572-4800, TELEX: 467058, FAX: 908-572-4808; Empl.: 30; *Sls. Mgr.:* Michael Schneider

RESEARCH INC., P.O. Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, TELEX: 29-0502, FAX: 612-941-3628; Empl.: 140; *Sls. Mgr.:* JD Strand, Al Day, Marianne Walmsley

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* Roger H. Falde, Dir. Sls.

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 708-652-7555, FAX: 708-863-4272; Empl.: 35; *Sls. Mgr.:* Theresa McGraw

FAX: 408-441-7224

RESONANT POWER TECHNOLOGY, 1926 Junction Ave., San Jose, CA 95131-2102, Tel: 408-441-0800; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon .... **D•1914-1915**

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RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, FAX: 516-231-6465; FSC No.: 13619; Empl.: 140; *Sls. Mgr.:* Dave Radford .... **A•1157-1158, 1601, 1676, 2315, 2532**

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AZ	The James Gerry Co.	602-893-3543
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CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
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FL	Ft. Lauderdale, Tech Rep Assocs.	305-791-2708
FL	Merritt Island, Tech-Rep Assocs.	407-453-3313
FL	Winter Springs, Tech-Rep Assocs.	407-699-4010
IL	Compucon West	708-513-7706
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MD	Kensington, Koebert Assoc.	301-493-8924
MO	Ballwin, Gillam Entrprs., Inc.	314-458-1896
MA	Burlington, Tritek, Inc.	617-272-4550
NM	Albuquerque, M.G. Elctrns.	505-255-1638
NY	Buffalo, Foster & Wager, Inc.	716-385-7744
NY	Great Neck, Trionic Assocs.	516-466-2319
NY	Ronkonkoma, Compucon Distrs., Inc.	516-981-8810
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Glenside, Koebert Assocs.,Inc.	215-887-2310
TX	Garland, McBride Sci. Sls.	214-494-5000
VA	Alexandria, koebert Assocs.	703-461-3655
WA	Bellevue, Olson Technical Sls. Corp.	206-883-7792
Can	Bedford, N.S., Norgay Entprs. Ltd.	902-864-2504
Can	Delta, B.C., Norgay Entprs. Ltd.	604-940-8988
Can	Ottowa, Ont., Norgay Entprs. Ltd.	613-745-4051
Can	Toronto, Ontario, Norgay Entprs. Ltd.	416-234-8966
Can	Westmount, Quebec, Norgay Entprs. Ltd.	514-932-3233

Local Distributors

IL	Des Plaines, Compucon Distrs., Inc.	708-513-7706
MA	Reading, Tritek, Inc.	617-272-4550
NY	Ronkonkoma, Compucon Distributors, Inc.	516-981-8810

RF INDUSTRIES LTD. (NUELINK), 7620 Miramar Rd., San Diego, CA 92126, Tel: 619-549-6340, 800-233-1728, FAX: 619-549-6340; Empl.: 25; *Sls. Mgr.:* Les Perlman

RFL ELECTRONICS INC., Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, FAX: 201-334-3863; FSC No.: 49673; Empl.: 300

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 200; *Sls. Mgr.:* C. Baker

R.F. POWER LABS., INC., Kalmus Engineering Inc., 21820 -87th S.E., Woodinville, WA 98072, Tel: 206-481-8833, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Jeannie Olson

RGB SPECTRUM, 950 Marina Village Parkway, Alameda, CA 94501, Tel: 510-814-7000, FAX: 510-814-7026; Empl.: 30; *Sls. Mgr.:* Lucien E. Long; *Dist. Mgr.:* Lucien E. Long

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RHG ELECTRONICS LABORATORY, INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, FAX: 516-242-1222; Empl.: 205; *Sls. Mgr.:* David E. Krautheimer

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RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, FAX: 714-896-0971; FSC No.: 16714; Empl.: 60; *Sls. Mgr.:* Mary Manandik; *Dist. Mgr.:* Sheryl Lane .... **A•1579, 2533**

Local Sales Offices & Reps

AL	Huntsville, CMR Cross Assocs.	205-533-1320
CA	San Diego, Canusa Technlg.	619-729-8662
CO	Parker, A-5 Co.	303-841-3651
CT	Canterbury, Deltech Sls.	203-546-6322
FL	Altamonte Springs, Electramark	407-830-0844
FL	Boca Raton, Electramark	305-424-2872
FL	Tampa, Electramark	813-962-1882
MA	Littleton, Deltech Sls.	508-486-8294
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
OR	Lake Oswego, Joe Blanchard Sls.	503-620-6888
TX	Austin, Component Technlg.	512-288-7328
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-690-3011
VT	S. Burlington, Deltech Sls.	802-865-4454
WA	Redmond, Joe Blanchard Sls.	206-778-9622

Local Distributors

CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642
CA	San Jose, Eric Elctrns.	408-432-1111
MA	Wakefield, Nu Horizons Elctrns. Corp.	617-246-4442
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000
NY	E. Rochester, Nu Horizons Elctrns. Corp.	716-292-0777
WI	McQuon, Taylor Elec. Co.	414-241-4321

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FAX: 908-389-9066

RIA ELECTRONICS, 15 Meridan Rd., P.O. Box 447, Eatontown, NJ 07724, Tel: 908-389-1300; Empl.: 7 .... **C•1442-1449**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns., Inc.	602-996-5909
CA	Orange, Dobson Mktg.	714-639-3278
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8718
CO	Evergreen, Mid/West Co.	303-674-4829
CT	Milford, High Tech Sls.	203-874-6595
GA	Alpharetta, R A Sls.	404-442-6749
IL	Arlington Hgts., MJ Peterson & Assocs.	708-577-8200
IN	Ft. Wayne, M/S Sls.	219-436-3023
IN	Greenwood, M/S Sls.	317-881-0110
KS	Wichita, Mid/West Co.	316-264-0440
MD	Baltimore, Stitzer Co., Inc.	301-494-9100
MI	Livonia, Electro Mktg. Grp., Inc.	800-338-6856
MN	Roseville, TLC Elctrns.	612-483-2226
MO	Florissant, Mid/West Co.	314-837-3361
NE	Lincoln, Mid/West Co.	402-423-1386
NJ	Woodbridge, Jade Mktg.	908-750-2998
NM	Albuquerque, Chaparral Elctrns., Inc.	502-271-2266
NC	New Bern, R A Sls.	919-244-2672
OH	Dayton, Electro Mktg. Grp., Inc.	800-338-6856
OH	N. Royalton, Electro Mktg. Grp., Inc.	800-338-6865
PA	Allison Park, Electro Mktg. Grp., Inc.	800-338-6856
PA	Malvern, Stitzer Co., Inc.	215-644-5500
SC	Easley, R A Sls.	803-859-1859
TN	Rutherford, R A Sls.	901-655-6301
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assoc.	206-573-5161
Can	Markham, Ont., Birde Mktg.	416-477-7722

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, Control Des. Supp.	602-829-7981
AR	Maumelle, Control Des. Supp.	501-851-3171
CA	Anaheim, Control Des. Supp.	714-821-1516
CA	Buena Pk., SEL Sls., Inc.	714-521-8673
CA	S. Francisco, Steven Engrg.	415-588-9200
CA	San Carlos, Control Des. Supp.	415-592-4806
CA	San Carlos, Logan Elctrns.	415-592-4806
CA	Santa Monica, Master Distrs.	310-452-1229
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, Control Des. Supp.	303-296-1922
CT	Wallingford, Control Des. Supp.	203-269-9955
FL	Davie, Arco Distrs. Inc.	305-473-2550
FL	Pompano Bch., Control Des. Supp.	305-783-1311
FL	Sanford, Control Design Supp.	407-328-8011
GA	Stone Mountain, Control Des. Supp.	404-479-3906
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Schaumburg, Control Des. Supp.	708-307-8900
IL	Wood Dale, Electro-Kinetics	708-595-6700
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Control Des. Supp.	317-788-4559
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
IA	Marion, Control Des. Supp.	319-373-2923
KS	Kansas City, Control Des. Supp.	913-362-4248
MA	Walpole, Richey-Impact Elctrns.	508-668-8200
MA	Woburn, Control Des. Supp.	617-932-9404
MI	Farmington Hills, Control Des. Supp.	313-473-0220
MI	Rose Mount, Advent Elctrns., Inc.	708-297-6200
MN	Minneapolis, Control Des. Supp.	612-721-1628
MO	Kansas City, Barr-Thorp Elec. Co.	816-531-8840
MO	Maryland Heights, Control Design Supp.	314-432-1116
NH	Goffstown, Key Comps.	603-626-1717
NJ	Bellmawr, Mid Atlantic Comps.	609-931-5303
NJ	Union, Lectron Inds.	908-687-2626
NY	Bohemia, EBL Svcs., Inc.	516-567-7577
NY	Ronkonkoma, Spectrum Comps.	516-737-6900
NC	Charlotte, Control Des. Supp.	704-588-4410
NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, Roberts Elctrns.	216-230-1711
OH	Columbus, Aesco Elctrns., Inc.	614-882-6762
OH	Dayton, Related Comps.	513-253-6116
OR	Portland, Tek-Elec. Control, Inc.	503-246-5451
PA	Malvern, Control Des. Supp.	215-296-0150
PA	Pittsburgh, Aesco Elctrns.	412-344-1550
TX	Dallas, Control Des. Supp.	713-868-4018
TX	Houston, Control Des. Supp.	713-868-4018
UT	Nephi, Control Des. Supp.	801-623-2908
WA	Kent, Control Des. Supp.	206-251-6323
WA	Seattle, Tek-Electric Control	206-243-6007
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	New Berlin, Control Des. Supp.	414-784-1015
Can	Markham, Ont., Birde Mktg., Inc.	416-477-7722

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RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147, Tel: 708-208-2200, 800-348-5500, FAX: 708-208-2550; FSC No.: 5L804; Empl.: 625; *Sls. Mgr.:* Robert L. Prince; *Dist. Mgr.:* Robert L. Prince

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, FAX: 312-539-6770; FSC No.: 06915; Empl.: 400; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

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RIFOCS CORP., 474 Constitution Ave., Camarillo, CA 93012, Tel: 805-389-9800, FAX: 805-389-9808; Empl.: 12; *Sls. Mgr.:* Dennis N. Horwitz

RITTAL CORP., One Rittal Place, Springfield, OH 45504-9807, Tel: 800-477-4000, TELEX: 513-390-5599; Empl.: 270

RITTER COIL, INC., 720 Sheridan Dr., P.O. Box 3130, Easton, PA 18043-3130, Tel: 215-258-6780, FAX: 215-258-6783; Empl.: 20; *Sls. Mgr.:* Jackie Berhel

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada NOB 2EO, Tel: 519-696-2616, FAX: 519-696-2670; Empl.: 30; *Sls. Mgr.:* Gary Ritz; *Dist. Mgr.:* Leonard Snow .... **C•1081; D•1913**

Local Sales Offices & Reps

CA	Torrance, U.S. Power Converting Co.	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Electronics Ltd.	519-696-2616

Local Distributors

CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Electronics Ltd.	519-696-2616

RIVERHEAD CIRCUITS, AMP ò AKZO Corporation, P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-284-2352; Empl.: 500; *Sls. Mgr.:* Dennis Marek

RJF INTERANTIONAL CORP., 3875 Embassy Pkwy., Fairlawn, OH 44333, Tel: 216-668-7689, FAX: 216-668-7701

R-K ELECTRONICS, 11560 Goldcoast Dr., Cincinnati, OH 45249, Tel: 513-489-4060; Empl.: 25

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, FAX: 914-241-1753; FSC No.: 12598; Empl.: 56; *Sls. Mgr.:* Walter Crofut; *Dist. Mgr.:* Walter Crofut

RME FILTERS, INC., PO Box 838, Amherst, NH 03031, Tel: 603-595-4573, FAX: 603-881-7649; FSC No.: 0S2B1

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 708-879-0020, FAX: 708-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders .... **C•1533**

RMS, Electrical Connector Division, 8600 Evergreen Blvd., Minneapolis, MN 55433, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Connie Laumeyer

RMS INSTRUMENTS, 1415-2 Bonhill Rd., Mississauga, Ont., Can L5T 1R2, Tel: 416-564-5533, FAX: 416-670-0053; Empl.: 15; *Sls. Mgr.:* Edward A. McGovern

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23606, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre

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FAX: 408-744-1521

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Local Sales Offices & Reps

AL	Huntsville, JSI, Inc.	205-883-4163
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Los Angeles, West Coast Reps.	310-690-9960
CA	San Diego, W. Coast Rep	619-581-2406
CA	San Jose, P & M Elctrns.	408-287-0402
CO	Denver, F.G. Mktg.	303-795-9176
CT	Redding, Power Factor	203-938-7013
DC	Washington, Gans & Pugh	703-709-0305
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Orlando, Panamtech	407-679-5506
IL	Chicago, Mar-con Assocs. Inc.	708-675-6450
KS	Kansas City, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	410-442-2189
MA	Boston, Power Factor	508-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
MO	St. Louis, Midtec	314-275-8666
NV	Henderson, Chaparral	702-433-5486
NM	Albuquerque, Chaparral	505-292-0007
NY	Buffalo, NRM Mktg.	716-634-4300
NY	Great Neck, M.O.S. Mktg.	516-487-3966
NY	Rochester, NRM Mktg.	716-352-9166
NY	Syracuse, NRM Mktg.	315-685-8991
OH	Centerville, Omega Sls., Inc.	513-434-5507
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Redmond, Pacific Mktg.	206-882-3144

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-948-0564, FAX: 812-945-0804; Empl.: 400; *Sls. Mgr.:* Bill Gruhn; *Dist. Mgr.:* Carl Pearcy

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 65

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, P.O. Box 3135, Princeton, NJ 08543, Tel: 609-844-0800, FAX: 609-895-9726; Empl.: 15; *Sls. Mgr.:* S.N. Thanos

ROCKWELL INTERNATIONAL, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 COLLINS CSMA , FAX: 714-641-5320; Empl.: 60; *Sls. Mgr.:* Robert A. Johnson

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Ernie Raper, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

ROCOM CORPORATION, 5957 Engineer Dr., Huntington Beach, CA 92649, Tel: 1-800-952-3539, 714-891-9922, FAX: 714-891-2121; FSC No.: 67361; Empl.: 21; *Sls. Mgr.:* Robert Jewell; *Dist. Mgr.:* Robert Jewell

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FAX: 516-277-8375

RODALE TECHNICAL SALES INC., 577 Main Street, Islip, NY 11751, Tel: 516-277-5454, TELEX: 5106007812, ESYLNK: T8003254112; Empl.: 10; *Sls. Mgr.:* Gene Lipman .... **C•1640-1641, 1804-1805; D•1063**

Local Sales Offices & Reps

CA	Yorba Linda, Rodale Tech. Sls., Inc.	714-283-3140
IL	Bensenville, Connecting Technlg.	708-238-0509
IN	Carmel, Current Elctrns. Mktg.	317-844-1770
KS	Prairie Village, Crosslink Elctrl./Elctrns.	913-432-6100
NY	Islip, Rodale Tech. Sls., Inc.	516-277-5454
OH	Bedford Hgts., P.H.P.	515-472-5984

Local Distributors

AZ	Phoenix, Storm Prods.	602-269-3485
CA	Inglewood, Storm Prods.	213-776-8141
CA	Sacramento, AVAC Sunset	1-800-AVAC-DIV
CO	Broomfield, Storm Prods.	303-466-1991
MN	Bloomington, KL Tannehill	612-881-6700
MN	St. Paul, AVAC Mid-America	1-800-AVAC-DIV
NJ	Edison, AVAC National	1-800-AVAC-DIV
TN	Nashville, AVAC Pioneer Tenn.	1-800-AVAC-DIV
TX	Dallas, Storm Prods.	214-330-1381
UT	Salt Lake City, Standard Supp.	801-486-3371
WA	Woodinville, Storm Prods.	206-488-7400

RODANN ELECTRONICS MFG. CO., 3100 Airway Ave. 128, Costa Mesa, CA 92626, Tel: 714-662-3232, 800-366-7010, FAX: 714-662-3171; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct., Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L
ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, 1-800-548-6305, TWX: 296210; *Sls. Mgr.:* Tom Cooke .... **D•1320-1321**

Local Sales Offices & Reps

AZ	Mesa, Scientific Dvcs. W.	602-839-6628
CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Louisville, Scientific Dvcs. W.	303-665-8089
FL	Boca Raton, Electromark	407-852-2259
GA	Helen, Electromark Sys.	706-865-3120
IL	Elk Grove, Loren Green Assocs.	312-593-0282
KS	Merriam, Tec Rep	913-262-9500
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MN	Plymouth, Hei-Lite	612-550-0506
MO	St. Louis, Tec Rep	314-454-9100
NJ	Laurel Springs, Donald Williams	609-346-2876
NY	Liverpool, Northern Tech. Sls.	314-451-1091
NC	Winston-Salem, Nelson Assocs.	919-765-5520
OH	N. Olmsted, AM Sls.	216-779-5033
OK	Tulsa, Spectra Sls	918-665-8899
OR	Aloha, Core II Mktg.	503-649-0871
OR	Beaverton, Core II Mktg	503-641-0877
RI	Narragansett, Pat Assocs.	401-783-9598
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Alexandria, Dyna Rep	703-354-1222
Can	Scarborough, MultiTest Elctrns.	416-609-8399

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Scarborough, MultiTest Elctrns.	416-609-8396

ROEDERSTEIN ELECTRONICS, INC., Vishay Electronic Components, 2100 W. Front St., Statesville, NC 28677, Tel: 704-872-8101, FAX: 704-872-8023; Empl.: 98; *Dist. Mgr.:* Teresa Alexander

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 708-498-2300, FAX: 708-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave & Circuit Matls. Div., 100 S. Roosevelt Ave., Chandler, AZ 85226, Tel: 602-961-1382, FAX: 602-961-4533

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Power Distribution Div., 5750 E. McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-396-6401

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500

ROH, Portland Instrument, 6120 San Fernando Rd., Glendale, CA 91201, Tel: 818-500-0137, FAX: 818-240-1828; Empl.: 10; *Sls. Mgr.:* Dick Herbert

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65

ROHM CORPORATION, Rohm Electronics Division, 3034 Owen Drive, Antioch, TN 37013, Tel: 615-641-2020, FAX: 615-641-2022; Empl.: 115; *Sls. Mgr.:* Mike DelGrippo; *Dist. Mgr.:* Steve Bishop

ROLLS BATTERY ENGINEERING, 8 Proctor St., Salem, MA 01970, Tel: 508-745-3333, FAX: 508-741-8956; FSC No.: 6140 6135; Empl.: 4-5; *Dist. Mgr.:* John J. Surrette

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ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9800, FAX: 301-696-9494; FSC No.: 4Y520/C0242; Empl.: 45; *Sls. Mgr.:* Warren Hudacek

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEMOUNT ANALYTICAL INC., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 800-222-2600 ext. 400, FAX: 201-857-9403

ROSS ENGINEERING CORP.

FAX: 408-377-5182

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Jim Ross; *Dist. Mgr.:* Jim Ross .... **B•1228, 1592-1594, 1802; D•1319**

ROTEK INSTRUMENT CORP., 390 Main St, Waltham, MA 02254, Tel: 617-899-4611, FAX: 617-894-7273; FSC No.: 06678; *Sls. Mgr.:* Paul Lualdi

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
FL	Palm Harbor, Teqspec	813-942-6006
MA	Randolph, EML Assocs.	617-341-0781
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NC	Winston-Salem, Teqspec	919-765-5553
PA	Lansdale, Techn. Instr. Sls.	215-361-7850
PA	Pittsburgh, Meas. Instr. East	412-459-8090
TX	Dallas, Kemp Instrs.	214-931-7100
VA	Dumfries, Electra-Tech Inc.	703-670-6962
WA	Seattle, Branom Instr. Co.	206-762-6050

ROTORK CONTROLS, INC., 19 Jetview Drive, Rochester, NY 14624, Tel: 716-328-1550, FAX: 716-328-5848; Empl.: 75; *Sls. Mgr.:* Chris Warnett; *Dist. Mgr.:* Chris Warnett

ROWE INDUSTRIES, INC. | Talley Industries

FAX: 419-729-1794

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761; FSC No.: 82878; Empl.: 89 .... **C•1807**

Local Sales Offices & Reps

AL	Huntsville, Giestings & Assoc.	205-830-4550
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CA	Tustin, R.T.S. Assocs.	714-730-9561
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CT	New England, R.F. Assocs.	203-458-3674
FL	Clearwater, R.F. Assocs., Inc.	813-442-8500
FL	Longwood, R.F. Assocs., Inc.	407-657-7332
GA	Duluth, Giestings & Assocs.	404-476-0025
IL	Naperville, Connect Plus	708-355-6363
IL	Rolling Meadows, Rowe Inds.	708-670-0913
IN	Carmel, Giestings & Assoc.	317-844-5222
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Topsfield, R.F. Assocs., Inc.	508-887-9762
MI	Livonia, Giestings & Assoc.	313-478-8106
MN	Stillwater, Kits Co.	612-439-8088
NY	Pittsford, Franklin Sls.	716-248-8251
NY	Smithtown, Koebert Assocs.	516-979-6683
OH	Cinicinnati, Makin Assocs.	513-871-2424
OH	Toledo, Rowe Inds.	419-729-9761
RI	Cranston, Rowe Inds., Inc.	401-946-0210
TX	Austin, Kruvand Assocs., Inc.	512-219-9441
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
UT	Ogden, Spectrum	801-972-8552
VA	Alexandria, Koebert Assocs.	703-461-3655
WA	Bellevue, Advanced Power Comp.	206-747-9127
WA	Vancouver, Advanced Power Comp.	206-896-4239
WI	Hartland, Connect-Plus	414-367-2094
Can	Barnaby, B.C., Cartwright	416-528-0294
Can	Burnaby, B.C., Advanced Power Comp.	604-299-7330

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2310
TX	Ft. Worth, Ft. Worth Wire & Cable	817-232-4100

ROYAL ENTERPRISES CO., 4260 Valley Fair St., Simi Valley, CA 93063, Tel: 805-522-8730, 818-998-2455, FAX: 805-522-9055; Empl.: 5; *Sls. Mgr.:* Robert E. Burks

MILTON ROY CO, Process & Environ., 1238 W. Grove Ave., Orange, CA 92665-4134, Tel: 714-974-5560, FAX: 714-921-2531; Empl.: 60; *Sls. Mgr.:* Harold Peper

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 7; *Sls. Mgr.:* Terry Josselyn

R-THETA INC.

FAX: 1-800-567-7115

R-THETA INC., 290 Larkin St., P.O. Box 1089, Buffalo, NY 14220-8089, Tel: 1-800-388-5428; Empl.: 75; *Sls. Mgr.:* Barry Butwell; *Dist. Mgr.:* Mike Taverner .... **C•1643**

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MA	Brookline, Harman Assocs., Inc.	617-232-6687
MN	Eden Prairie, Hanna Lind Ltd.	612-942-8554
OH	Cleveland, Staffco	216-331-5100

Local Distributors

NJ	Darien, C.W. Assocs.	203-656-2339
NY	Syracuse, Leonard D. Allen Inc.	315-437-8387

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-679-7180, FAX: 708-675-3709; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, TELEX COMMUNICATIONS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-566-6700, TELEX: 194855, FAX: 818-843-7953; FSC No.: 60572; Empl.: 45; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-472-1081; FSC No.: 01EG24; *Sls. Mgr.:* David Zoscak

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Local Distributors

AZ	Tempe, CMI Metermaster	602-431-0015
CA	Fullerton, Rustrak	714-879-6384
CA	Hayward, Coast Inst.	510-786-9300
CA	San Marcos, Mitchell Inst.	619-744-2690
CO	Commerce City, WACO Elctrns.	303-289-4743
FL	Palm Bay, EIL Instrs.	407-725-8300
GA	Forest Park, Brownell Electro	404-362-9009
MD	Hunt Valley, EIL Instrs.	410-584-7400
MA	Burlington, EIL Instrs.	617-272-9450
MI	Grand Rapids, Smith Inst.	616-245-1195
MI	Royal Oak, George Inst.	313-280-1111
MO	St. Louis, Indl. Svc. Labs	314-423-3141
NJ	Newark, Norman Bragar Prods.	201-344-1100
NC	Charlotte, Inotek Corp.	704-527-5000
OH	Cincinnati, Schlemmer Assocs.	513-522-8340
OH	Cleveland, M.A. Blankenberg	216-251-7010
PA	Philadelphia, Sunshine Scientific	215-673-5600
RI	E. Greenwich, Rustrak	800-332-3202
TX	Dallas, Inotek Corp.	214-243-8370
TX	Houston, American Analog	713-941-7265
WA	Seattle, Branom Inst.	206-762-6050
WI	Waukesha, Wisconsin Control Corp.	414-542-1588

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

R X D INC., Relm Communications, 806 Custer Ave., Norfolk, NE 68701, Tel: 402-379-0112, 800-228-8108, FAX: 402-379-3074 .... **A•1470-1473**

Local Sales Offices & Reps

AL	Huntsville, BITS, Inc.	205-881-2900
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CA	Cupertino, Prism Tech. Sls.	408-435-7377
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Diego, Solutech, Inc.	619-581-2741
GA	Norcross, BITS, Inc.	404-564-5599
IL	Hoffman Estates, Astrotech Elctrns.	708-934-1538
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IN	Leo, Mohrfield Mktg.	219-627-5355
MN	Oakland, Complete Sls.	612-731-2923
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	Canandaigua, S-J Assocs.	716-394-3281
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Roslyn Heights, Michel Assocs.	516-621-6378
NC	Raleigh, BITS, Inc.	919-676-1880
OH	Columbus, S-J Assocs.	614-885-6700
UT	Salt Lake City, Wind River Mktg., Inc.	801-972-1151
VA	Falls Church, S-J Assocs.	703-533-2233
WI	Watertown, Astrotech	414-261-7600
Can	Mississauga, Source Elctrns.	416-676-0830
Can	Mont. Gabriel, Source Elctrns.	514-369-0321
Can	Orleans, Source Elctrns.	613-837-0220

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Scottsdale, Added Value Elec. Dist.	602-951-9788
CA	Chatsworth, E/W Elctrns.	818-718-2500
CA	Garden Grove, Ewing Elctrns.	714-891-9163
CA	Milpitas, California Capacitor	408-262-6000
CA	San Diego, Added Value Elec. Dist.	619-558-8890
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Inductive Comps.	408-971-0688
CA	Stanton, Inductive Comps.	714-828-3420
CA	Tustin, Added Value Elec. Dist.	714-259-8258
CA	Visalia, Added Value Elec. Dist.	209-734-8861
CO	Wheat Ridge, Added Value Elec. Dist.	303-422-1701
IN	Indianapolis, Custom Svc.	317-879-9119
MA	Methuen, AVED Elctrns., Inc.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
MO	St. Louis, RIC-Tronics	314-997-4707
NH	Merrimack, Brevan Elctrns.	603-429-1900
NH	Salem, Diamond Elctrns.	603-894-4420
NC	Charlotte, E.M.C. (Elec. Mktg. Corp.)	704-394-6195
OH	Columbus, E.M.C. (Elec. Mktg. Corp.)	614-299-4161
OH	Highland Height, E.M.C. (Elec. Mktg. Corp.)	216-442-3441
TX	Austin, LCD Elctrns.	512-388-0900
TX	Carrollton, LCD Elctrns.	214-245-0600
TX	Richardson, Ewing Elctrns. Inc.	214-231-6725
UT	West Valley, Added Value Elec. Dist.	801-975-9500

RYE INDUSTRIES, INC., 3337 Air Park Rd., Fuquay-Varina, NC 27526, Tel: 919-557-0511, 800-626-1511, FAX: 919-557-0510; Empl.: 5

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* James D. Mack; *Dist. Mgr.:* Dick Fry

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-250-1244, FAX: 714-250-1009; FSC No.: 58795; Empl.: 49

SACO CONTROLS INC., 9700 Trans Canada Hwy., Montreal,Qc., Canada H4S 1V9, Tel: 514-745-0310, TELEX: 055-62171, FAX: 514-745-0315; Empl.: 36; *Sls. Mgr.:* Pat Argento

SAE POWER, INC., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-988-0700, FAX: 408-986-8529; *Sls. Mgr.:* Nick Markoff; *Dist. Mgr.:* Debbie Thomas

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, FAX: 912-247-6680; Empl.: 200; *Sls. Mgr.:* Syd Reames .... **D•1418, 1467-1471**

Local Distributors

CT	Stamford, AeroQuality Sls.	203-351-8500
TN	Nashville, Ryder Aviall	615-754-7700

SAFT AMERICA INC., Research & Development Center, 109 Beaver Ct., Cockeysville, MD 21030, Tel: 410-771-3200, FAX: 410-771-1144 .... **D•1418, 1467-1471**

SAFT AMERICA INC., Lithium Battery Div., 313 Crescent St., Valdese, NC 28690, Tel: 704-874-4111, FAX: 704-874-2431; Empl.: 150; *Sls. Mgr.:* Glen Bowling .... **D•1418, 1467-1471**

FAX: 912-247-6680

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 600; *Sls. Mgr.:* Michael Marcoux; *Dist. Mgr.:* George Lupul .... **D•1418, 1467-1471**

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CA	Camarillo, SAFT America, Inc.	805-491-2821
CA	Redwood City, SAFT America, Inc.	415-365-4539
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Oak Forest, SAFT America, Inc.	708-687-6690
IN	Indianapolis, SAFT America, Inc.	317-594-0443
TX	Dallas, SAFT America, Inc.	214-239-3935
MN	Inver Grove Hgts., SAFT America, Inc.	612-552-0121
NY	Plainview, SAFT America, Inc.	516-931-5902
NY	Stoney Point, SAFT America, Inc.	914-786-0213
PA	Bensalem, SAFT America, Inc.	215-744-8044

Local Distributors

AK	Fairbanks, Cold Spot	907-457-8555
AZ	Phoenix, Lynntronics	602-841-3900
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Huntington Beach, House of Batteries	800-432-3385
CA	Mountain View, Energy Sls.	415-969-0800
CA	San Diego, Tauber Elctrns.	619-274-7242
CO	Littleton, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech.	407-682-4311
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	800-334-5066
HI	Honolulu, Battery Factory	808-537-6797
IL	Downers Grove, TDI	708-971-3460
IL	Lisle, Jabro Batteries	708-964-9358
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Andover, Generation Elctrns.	508-683-1177
MA	Middleboro, Glynn Elctrns.	508-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	St. Paul, D. C. Battery Prods. Inc,	612-646-7478
NY	Pen Yan, Advacom	315-536-2221
NY	Plainview, Plainview Batteries	516-249-2873
PA	Bensalem, Avex Elctrns. Corp.	215-638-3300
PA	McKean, Advacom	814-476-7774
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctrns.	713-783-2288
TX	Houston, Lone Star Mktg.	713-589-0853
TX	Spring, Jabro Batteries, S.W.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Redmond, Energy Sls.	206-883-2343
Can	Brampton, Ont., Innovative	416-791-2132
Can	Burnaby, B.C., Polar	604-294-1891
Can	Edmonton, D.C. Solutions	403-486-3636
Can	Mississauga, Ont., Advance	416-670-7159
Can	Mississauga, Ont., Alexander	416-568-9877
Can	Montreal, Que., Universal	514-722-3311
Can	Pointe-Claire, A.R. Grey	514-694-6378
Can	Regina, Regina	306-522-2221

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 708-377-3779, FAX: 708-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 26 Beaver St., Ansonia, CT 06401, Tel: 203-736-9805, FAX: 203-736-9835; FSC No.: 18065; Empl.: 25; *Sls. Mgr.:* Joseph Mezei

SAMATIC WINDING MACHINE, Jenlor Ltd., 200 Highbridge St., Fayetteville, NY 13066, Tel: 315-637-9080, FAX: 315-637-9149; Empl.: 15; *Sls. Mgr.:* Jim Philips; *Dist. Mgr.:* Jim Phillips

SAMHWA U.S.A. INC., 9330 Eton Ave., Chatsworth, CA 91311, Tel: 818-727-0512, FAX: 818-727-0700/0800/0900; Empl.: 8; *Sls. Mgr.:* Joseph Buckle; *Dist. Mgr.:* Diane Lawrence

SAMSUNG ELECTRON DEVICES, See Samtron Displays, Inc.

SAMSUNG SEMICONDUCTOR, INC., 3655 North First Street, San Jose, CA 95134, Tel: 408-954-7000,1-800-423-7364, TELEX: 339544, FAX: 408-954-7883

FAX: 812-948-5047

SAMTEC, INC., P.O. Box 1147, New Albany, IN 47151-1147, Tel: 1-800-672-6832; FSC No.: 55322; Empl.: 200; *Sls. Mgr.:* Mike Hynes .... **C•1548-1553**

Local Sales Offices & Reps

AZ	Tempe, Westrep/AZ	602-820-9932
CA	Anaheim, Westrep/CA	213-404-3881
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	San Jose, Kottmeier	408-371-8700
CO	Boulder, Front Range Mktg.	303-447-4780
FL	Margate, EPM Corp.	305-977-0331
IL	Lisle, W.G. Controls	312-963-5954
IN	Indianapolis, Needler Sls.	317-255-8056
IA	Cedar Rapids, W.G. Controls	319-373-1009
KS	Parker, S. W. Assocs.	913-898-6552
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MI	Holland, Com-Tek Sls.	616-399-7273
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MO	St. Louis, S.W. Assoc./Saunders	800-821-6344
NJ	Hackensack, CBA/Metro	201-440-4114
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, B. T. Funderburk	919-846-2373
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Huntington Valley, Inacker Sls.	215-947-5660
RI	Warwick, Schumacher & Yarrington	401-884-5671
TX	Plano, High Tech Sls.	214-612-0216
WA	Lynnwood, Quadra Sls.	206-743-2633
WI	Mequon, Badgerep	414-241-9200
PR	Caguas, K. D. Tronics	809-746-0275
Can	Oakville, Ont., Haltronics	416-844-2121
Can	Surrey, B.C., Cana Comm Mktg.	604-589-3822

Local Distributors

AL	Birmingham, Forbes	205-251-4104
AL	Huntsville, Hammond Elect.	205-830-4764
AZ	Tempe, Cypress	602-966-2256
CA	Agoura Hills, Cypress Elect.	818-597-9491
CA	Buena Pk., Cypress	714-521-5230
CA	Chatsworth, Milcomm	818-998-3111
CA	Manhattan Bch., Prime Electro	310-379-3642
CA	Milpitas, Sierra West	408-945-1050
CA	Riverside, Elec. Supp.	714-683-7300
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Neumann Elect.	619-695-3005
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Abacus	408-732-2000
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Indelco	303-694-9444
CT	East Haven, J.V. Elec.	203-469-2321
CT	Milford, Fleet Elect.	203-877-2577
CT	Yatesville, Schaal, Inc.	203-269-3779
FL	Ft. Lauderdale, KSM Elect.	800-327-8914
FL	Orlando, Hammond Elect.	407-841-1010
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
GA	Norcross, Hammond Elect.	404-449-1996
IL	Addison, Belford Elec.	312-691-1100
IL	Wheaton, Mega/Deanco	708-665-6214
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, Dee Elect.	319-365-7551
KS	Wichita, Mega/Deanco	316-636-5020
MD	Gaithersburg, Deanco	301-948-5444
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Middletown, Current Comps.	301-473-5333
MA	Burlington, Schaal, Inc.	617-272-1506
MA	Walpole, Richey/Impact	508-668-8200
MA	Wilmington, North Star	508-657-5155
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Grand Rapids, RM Elect.	616-531-9300
MN	Eden Prairie, Cypress Elect.	612-934-2104
MN	New Brighton, Parts 1	612-633-8079
MN	St. Peters, Mega/Deanco	314-939-9129
MO	Kansas City, Elec. Supp.	800-669-3752
MO	St. Louis, Franklin Elec.	314-993-5333
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Walker Elec.	505-883-2992
NY	Hauppauge, Broadline Elec.	516-231-4100
NY	Ithaca, Deanco	607-257-4444
NY	Penn Yan, Advacom Tech'y	315-536-2221
NC	Raleigh, Century Elec.	919-782-2116
NC	Raleigh, Deanco	919-851-2065
NC	Winston-Salem, Kirkman Elec.	919-722-9131
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Beaverton, Cypress	503-641-2233
OR	Tualatin, Moore	503-692-5333
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elec.	215-631-5400
TX	Carrollton, North Star	214-980-2999
TX	Dallas, Cypress	214-869-1435
TX	Stafford, Southwest	713-240-4000
WA	Bothell, Cypress	206-483-1144
WA	Redmond, Priebe Elec.	800-426-9911
WA	Seattle, Radar Elect.	206-282-2511
WI	Milwaukee, Marsh	414-475-6000
Can	Burnaby, B.C., Intek	604-294-8100
Can	Calgary, Alberta, Intek	403-243-8035
Can	Dartmouth, Nova Scotia, Arcom	902-464-1600
Can	Gloucester, Ont., Elctrn. Whslr.	613-746-4413
Can	Mississauga, Ont., Rush Elect.	416-677-7280
Can	Montreal, Que., Elctrn. Whslr.	514-769-8851
Can	Montreal, Que., Ferro Technique Ltd.	514-341-3450
Can	Scarborough, Ont., UTech Elect.	416-609-2900
Can	Ste Foy, Que., Elctrn. Whslr.	418-657-5020
Can	Surrey, BC, Memco	604-590-1553
Can	Toronto, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Victoria, B.C., Pacific Coast Elect.	604-385-5111

SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, 14251 E. Firestone Bl. No. 101, La Mirada, CA 90638, Tel: 310-802-8425, TWX: 183423 SEDLA; *Sls. Mgr.:* Myung Bang .... **B•1110-1111**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
AZ	Phoenix, Moss Mktg.	602-433-9349
CA	Aliso Viejo, Pro Assocs.	714-588-2700
CO	Aurora, Moss Mktg.	303-340-8535
CT	Torrington, Phoenix Sls. Co.	203-934-7135
IL	Hoffman Estates, Astro/Tech. Elctrns.	708-934-1538
IN	Ft. Wayne, Gen II Mktg.	219-436-4485
IA	Marion, A.E.M., Inc.	319-377-1129
KS	Lenexa, A.E.M., Inc.	913-888-0022
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Peabody, Orion Grp.	508-532-6266
MN	Eden Prairie, Comprehensive Tech. Sls.	612-941-7181
MO	Bridgeton, A.E.M., Inc.	314-298-9900
NJ	Allendale, Eastec Assocs.	201-934-7135
NM	Albuquerque, Moss Mktg.	505-292-7505
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Lyndhurst, Gallant III Elctrns.	216-291-1185
OK	Locust Grove, IMPAQ Sls. Co.	918-479-6493
OR	Beaverton, A.T.M.I., Inc.	503-643-8307
PA	Erdenheim, Omni Sls.	215-233-4600
TX	Irving, IMPAQ Sls. Co.	214-650-0000
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Redmond, A.T.M.I., Inc.	206-869-7636
WI	Watertown, Deaken Tech. Sls. Co.	414-261-7600

Local Distributors

AZ	Scottsdale, Added Value	602-951-9788
CA	Laguna Hills, Jaco/Distel, Inc.	714-837-8966
CA	San Diego, Added Value	619-558-8890
CA	San Jose, JACO/DISTEL INC.	408-432-9290
CA	Sunnyvale, LCD Sys.	408-747-0277
CA	Tustin, Added Value	714-259-8258
CA	Visalia, Added Value	209-734-8861
CA	Westlake, JACO/DISTEL	805-495-9998
CA	Westlake Village, Added Value	818-889-2861
CO	Wheat Ridge, Added Value	303-422-1701
CT	Meriden, JACO Elctrns, Inc.	203-235-1422
FL	Tampa, JACO/Q.C.	813-628-4665
MA	Tewksbury, Jaco Elctrn. Inc.	508-640-0010
MI	Farmington Hills, Key Elctrns.	313-489-5455
NY	Hauppauge, Jaco Elctrns.,Inc.	516-273-5500
NC	Raleigh, Jaco/Q.C.	919-876-7767
OK	Tusla, Jaco/Q.C.	918-664-8515
OR	Beaverton, IEC	503-641-1690
TX	Addison, Jaco/Q.C.	214-733-4300
TX	Austin, Added Value	512-454-8845
TX	Austin, Jaco/Q.C.	512-835-0220
TX	Sugar Land, Jaco/Q.C.	713-240-2255

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VA	Charlottesville, Virginia Elctrns.	804-296-4184
WA	Redmond, Jaco/Distel, Inc.	206-881-9700

S & EI MANUFACTURING, 18800 Parthenia St., Northridge, CA 91324, Tel: 818-349-4111, FAX: 818-349-4651; FSC No.: 24152; Empl.: 35; *Sls. Mgr.:* Howard Johnson, VP Mktg. Sls.

SANDMAN ELECTRIC CO., INC., 530 West St., Braintree, MA 02184, Tel: 617-848-2111, FAX: 617-848-2129; Empl.: 30

S&S ASSOCIATES, INC

FAX: 805-544-3109

S & S ASSOCIATES, INC., 863 Via Esteban, San Luis Obispo, CA 93401, Tel: 805-544-2500; *Sls. Mgr.:* Bob Priest; *Dist. Mgr.:* Bob Priest ...... **C•1082-1085, 1534**

SAN FERNANDO ELEC. MFG., See SFE Technlgs.

SANFORD-MILLER CORP., 1800 A Access Road, Oceanside, NY 11572, Tel: 516-763-0926, 800-645-5900, FAX: 516-678-1355; Empl.: 10

SANGAMO COMPONENTS DIV., See Cornell Dubilier Electronics

SANKEN ELECTRIC USA CORP., 2500 W. Higgins Rd. Ste. 730, Hoffman Estates, IL 60195, Tel: 708-519-1717, FAX: 708-884-1511; Empl.: 9; *Sls. Mgr.:* Lanny C. Anderson

SANLAR, INC. T/A, Harbison Industrial Products, 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, FAX: 215-949-1518; Empl.: 40

SAN-O INDUSTRIAL CORP., 91-3 Colin Dr., Holbrook, NY 11741, Tel: 516-472-6666, FAX: 516-472-6777; Empl.: 50; *Sls. Mgr.:* N. Sato; *Dist. Mgr.:* P. Wernick

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SANWA COMPONENTS USA INC., 50 Brigham St., Marlboro, MA 01752, Tel: 508-480-9555, FAX: 508-481-2042; Empl.: 8; *Sls. Mgr.:* Mark Johnson

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SANYO ENERGY (U.S.A.) CORPORATION, 2001 Sanyo Avenue, San Diego, CA 92173, Tel: 619-661-6620; Empl.: 500; *Sls. Mgr.:* Joseph A. Carcone ...... **D•1472**

Local Sales Offices & Reps

AZ	Phoenix, Lynntronics	602-841-3900
CA	Mountain View, Energy Sls.	415-969-0800
CO	Denver, Car-Go Battery	303-296-8763
NJ	Teterboro, Engrd. Assembilies	201-288-4477
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NC	Winston-Salem, Progressive Techngs.	919-368-1375
OR	Aloha, Elctrn. Concepts	503-642-9715
TX	Houston, K-Power	713-785-1300
WA	Redmond, Energy Sls.	206-883-2343
WA	Seattle, Rep West	206-283-8351

Local Distributors

CA	Costa Mesa, Battery Specialties	714-755-0888
CA	Escondido, Alexander Batteries	619-480-4445
CA	Santa Clara, Cypress Elctrns.	408-980-8400
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Tampa, Reptron Elctrns. (Lithium Only)	800-800-5441
MI	Livonia, LWC Distrs.	313-464-7700
MN	Eden Prairie, Imtron Corp.	612-942-8554
TX	Stafford, Southwest Elctrns.	713-240-4000
UT	Salt Lake City, Standard Supp.	801-486-3371

SANYO SEMICONDUCTOR CORPORATION, 453 Ravendale Dr., Ste. G, Mountain View, CA 94043, Tel: 415-960-8591, FAX: 415-960-8591

SANYO SEMICONDUCTOR CORP., 80 Commerce Dr., Allendale, NJ 07401, Tel: 201-825-8080, FAX: 201-825-0163; Empl.: 50; *Sls. Mgr.:* Yoshi Paulovich

SAPHIKON, INC., 33 Powers St., Milford, NH 03055, Tel: 603-673-5831, FAX: 603-673-1256; Empl.: 75; *Sls. Mgr.:* Linda Berthiaume

SaRonix

FAX: 415-856-4732

SARONIX, 151 Laura Lane, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465; FSC No.: 61441; Empl.: 44; *Sls. Mgr.:* Mike Nusbaum; *Dist. Mgr.:* Mike Nusbaum ...... **A•1474-1479**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs. Inc.	205-881-1096
CO	Parker, Parker Webster Co.	303-841-4888
CT	Torrington, Phoenix Sales	203-496-7709
FL	Altamonte Springs, Sls. Engrg. Concepts	305-830-8444
FL	Deerfield Beach, Sls. Engrg. Concepts	305-426-4601
GA	Norcross, Interep	404-449-8680
IL	Rolling Meadows, Phase II	708-806-1330
IN	Indianapolis, EMCI	317-921-3450
MA	Norwell, Norris Assocs. Inc.	617-659-7988
MI	Jenisen, R. C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Innovate	612-225-9772
NV	Reno, Galena Technlg. Grp.	702-746-0642
NJ	Kenvil, Harold Gray Assocs.	201-927-6662
NY	Buffalo, Lynn Assocs.	716-631-0054
NC	Raleigh, J & B Sls.	919-783-9440
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
TN	Greenville, Interep	615-639-3491
TX	Austin, Strategic Mktg.	512-335-4535
UT	Murray, Parker Webster Co.	801-266-9939
WI	Wauwatosa, Phase II	414-771-9986
EXP	CA, Palo Alto, SaRonix	415-856-6900

Local Distributors

CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	San Diego, Deco Elctrns.	619-693-1595
CA	Sherman Oaks, Delay Line Dists., Inc.	818-986-9455
CA	Sunnyvale, Target Elctrns.	408-733-0384
CO	Englewood, Indelco	303-795-3431
FL	Melbourne, Genl. Radio Supp. Co.	407-242-8151
FL	Miami, All American	305-621-8282
IL	Palantine, Technlg. Sls. Inc.	708-991-6600
MD	Columbia, Genl. Radio Supp.	301-995-6744
MD	Rockville, All American	301-251-1205
MA	Wakefield, All American	617-246-2300
MA	Wilmington, Northstar Elctrns.	508-657-5155
MN	Eden Prairie, All American	612-944-2151
NJ	Camden, General Radio Supp. Co.	609-621-8098
NY	Mt. Vernon, All American	914-699-2224
NY	Stonybrook, Dove Elctrn. Comps.	516-689-7733
OR	Portland, Radar Elec. Co.	503-232-3404
TX	Richardson, All American	214-231-5300
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Technlg. Sls. Inc.	414-964-5015

SAS INDUSTRIES INC., Wading River Manor Rd., Manorville, NY 11949, Tel: 516-727-1441, 1-800-544-5238, FAX: 516-727-1387; FSC No.: 4L975; Empl.: 35; *Sls. Mgr.:* Steve Steckis

SAVOY ELECTRONICS, INC., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-359-5400, FAX: 305-563-1378; FSC No.: 13075; Empl.: 20; *Sls. Mgr.:* June Harris

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SAYLOR ELECTRONICS INT'L, INC., 3680 Research Way, Carson City, NV 89706, Tel: 702-883-4184; Empl.: 7

SBE, INC., 4550 Norris Canyon Rd., San Ramon, CA 94583-1389, Tel: 510-355-2000, 800-925-2666, FAX: 510-355-2020; Empl.: 120; *Sls. Mgr.:* Bill Allen VP Sls.; *Dist. Mgr.:* Bill Allen VP Sls.

SB ELECTRONICS, INC., 131 South Main St., Barre, VT 05641, Tel: 802-476-4146, FAX: 802-476-4149; FSC No.: 49588; Empl.: 100; *Sls. Mgr.:* Mark Browning, Sr.

SCANBE, See Zero Enclosures, Zero Corp.

SCANNING DEVICES, INC., 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991, FAX: 617-899-2235; Empl.: 16; *Sls. Mgr.:* David Chanoux

SCHAEFER, INC., Schaefer GmBH, 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-879-8658, ESYLNK: 510-100-3630, FAX: 508-879-8669; Empl.: 60; *Sls. Mgr.:* Richard Sakakeeny

SCHAFFNER EMC, INC. COMPONENTS DIVISION, 9 Fadem Road, Springfield, NJ 07081, Tel: 201-379-7778, 800-367-5566, FAX: 201-379-1151; *Sls. Mgr.:* Steve Cogger, VP of Sls. ... **A•1602-1605; D•1322**

Local Sales Offices & Reps

AL	Huntsville, SACS	205-533-4229
AZ	Phoenix, C.T. Carlberg & Assoc.	602-468-0750
CA	Auburn, Ewing-Foley, Inc.	916-885-6591
CA	Fallbrook, Gary Chilcote Assoc.	619-728-7678
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CO	Englewood, Delltron Co.	303-741-2122
FL	Ft. Lauderdale, Hawkins-Frederickson Assoc. Inc.	305-321-6702
FL	Maitland, Hawkins-Frederickson Assoc. Inc.	407-831-2474
GA	Norcross, SACS	404-447-6154
IL	Arlington Heights, Brainard-Nielsen Mktg.	708-437-2700
IA	Marion, A.E.M. Inc.	319-377-1129
KS	Lenexa, A.E.M. Inc.	913-888-0022
MD	Randallstown, Beacon North	703-478-2480
MI	Livonia, Electro Mktg. Grp.	313-421-7590
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, A.E.M. Inc.	314-298-9900
NM	Albuquerque, C.T. Carlberg	505-899-2155
NY	Kings Park, Mil-Com Sls.	516-366-2156
NY	Rochester, H. C. Johnson Agys.	716-586-0777
NC	Raleigh, SACS	919-859-9970

OH	Dayton, Electro Mktg. Grp.	513-890-8322
OH	N. Royalton, Electro Mktg. Grp.	216-582-0075
OK	Broken Arrow, D.J. Sls.	918-258-1445
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Allison Park, Electro Mktg. Grp.	412-492-0688
SC	Irmo, SACS	803-732-0816
TN	Knoxville, Beacon Electronics	615-588-4168
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
VA	Sterling, Beacon North	703-478-2480
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Manitowa, Brainard-Nielsen Mktg.	414-682-1201
PR	Bayamon, Selmark Assoc.	809-797-2096
Can	Ontario, Avotronics Ltd.	416-475-2024
Can	Quebec, Avontronics Ltd.	514-697-2135

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800
AZ	Mesa, Richey Impact Sls.	602-641-2313
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Cypress	602-966-2256
CA	Agora Hills, Cypress	818-597-9491
CA	Costa Mesa, Cypress	714-549-2424
CA	Fremont, Acacia/Deanco	415-623-7500
CA	Garden Grove, Richey Impact Sls.	714-895-0060
CA	Gardena, Cal Switch	213-770-2330
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Acacia	619-597-0577
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Richey Impact Sls.	619-271-4511
CA	San Jose, Richey Impact Sls.	408-956-8010
CA	San Jose, Rose Elctrns.	408-943-0255
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sun Valley, Richey Impact Sls.	818-768-0403
CO	Denver, IEC	303-292-6121
CO	Englewood, Cypress	303-792-5829
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Orlando, Sager Elctrns.	407-240-3114
GA	Norcross, Component Distrs.	404-441-3320
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Hoffman Estates, IEC	708-843-2040
IL	Schaumburg, QPS Elctrns.	708-884-6620
MD	Columbia, D.K. Elctrns.	301-995-1950
MD	Columbia, Sager Elctrns.	410-995-4900
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Walpole, Richey Impact Sls.	508-668-8200
MI	Farmington Hills, Key Elctrns.	313-489-5455
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Roseville, Chris Elctrns.	612-631-2647
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MO	St. Charles, Heartland	314-928-6010
NH	Salem, Sager Electrns.	603-898-1348
NJ	Moorestown, Marlac	609-234-4200
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Sager Elctrns.	919-850-9550
OR	Portland, Cypress	503-223-8900
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Dallas, Comp. Distrs.	214-644-0373
TX	Irving, Cypress	214-255-0065
UT	Salt Lake City, IEC	801-977-9750
WA	Blaine, Memco	604-590-1553
WA	Bothell, Cypress	206-483-1144
WA	Redmond, Acacia/Deanco	206-881-5566
WA	Seattle, Kam Elctrns.	206-382-1300
WA	Seattle, Richey Impact Sls.	206-575-1910
WV	McKean, Advacom	814-476-7774
Can	Burlington, Ont., Sanbek Sls.	519-746-5801

SCHAFFNER EMC, INC. INSTR. DIV., 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778, FAX: 201-379-1151; *Sls. Mgr.:* Michael O'Connor, VP Sls. ..... **D•1322**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Redondo Beach, Ward/Davis Assoc.	310-643-6977
CA	San Diego, Ward/Davis Assoc.	619-292-1000
CA	Santa Clara, Ward/Davis Assoc.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Longwood, Southern Mktg. Assoc.	407-682-7317
FL	Satelite Beach, Southern Mktg. Assoc.	407-777-3587
GA	Alpharetta, Southern Mktg. Assoc.	404-664-9797
IL	Willowbrook, PVA Corp.	708-655-3355
IN	Fishers, Carter Technlg.	317-842-9277
KS	Lenexa, Midtec	913-541-0505
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter Technlg.	313-477-7700
MN	Apple Valley, Alliance Tech. Prod.	612-432-2111
MO	St. Louis, Midtec	314-275-8666
NM	Albuquerque, Tech. Mktg. Spec.	505-291-1363
NY	Rochester, Eastern Sys.	716-292-1460
NC	Greensboro, Southern Mktg. Assoc.	919-632-9370
OH	Englewood, Carter Technlg.	513-836-0951
OH	Parma, Carter Technlg.	216-398-0400
OR	Wilsonville, Syntek	503-682-2750
PA	Huntington Valley, Sci-Rep	215-322-6500
PA	Pittsburgh, Carter Technlg.	412-826-3800
TX	Austin, Barnhill Assocs.	512-472-2398
TX	Houston, Barnhill Assocs.	713-266-2666
TX	Richardson, Barnhill Assocs.	214-917-6777
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
Can	St.Laurent, Que., Interfax Sys.	514-336-0392

SCHAFFNER EMC, INC., Intepro, 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778; *Sls. Mgr.:* Mike O'Connor

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, FAX: 513-791-7192; Empl.: 195; *Sls. Mgr.:* Dave Blice, VP Mktg.; *Dist. Mgr.:* Dan Shaw

SCHELL INC., P.O. Box 12689, St. Petersburg, FL 33733, Tel: 813-822-2600, 800-237-2600, FAX: 813-822-8800; Empl.: 50; *Dist. Mgr.:* Steve Hahn

SCHENCK PEGASUS CORPORATION, 2890 John R Road, Troy, MI 48083, Tel: 313-689-9000, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 800-828-6237, ext. 2126, TELEX: 6854121, FAX: 716-427-9993; Empl.: 500; *Sls. Mgr.:* Duncan Tyrrel

SCHLEICHER GMBH & CO., c/o Progressive Automation Controls Co., 8300 Parkview Rd., Greendale, WI 53129-2161, Tel: 414-421-4380, 1-800-803-0444, FAX: 414-421-5964; FSC No.: 39-1749933; Empl.: 5; *Sls. Mgr.:* Robert J. Yoblin; *Dist. Mgr.:* Robert J. Yoblin

SCHLEUNIGER, INC., 150 Dow St. Tower Four, Manchester, NH 03101, Tel: 603-668-8117, FAX: 603-668-8119; Empl.: 20; *Sls. Mgr.:* Marc Amiet

SCHLUMBERGER INDUSTRIES, Tranducers Div., 11321 Richmond, M-102, Houston, TX 77082, Tel: 713-558-2587, TELEX: 791209, FAX: 713-558-8954; *Sls. Mgr.:* Mike Masso

SCHLUMBERGER INSTRUMENTS, Schlumberger Technlgs., 829 Middlesex Turnpike, Billerica, MA 01821, Tel: 508-671-9700, 1-800-225-5765, FAX: 508-671-9704; Empl.: 70

SCHNEIDER CORP. OF AMERICA, 400 Crossways Park Drive, Woodbury, NY 11797, Tel: 516-496-8500, FAX: 516-496-8524; Empl.: 13; *Sls. Mgr.:* Dwight Lindsey; *Dist. Mgr.:* Dwight Lindsey

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, FAX: 703-471-1795; Empl.: 45; *Sls. Mgr.:* O. K. Davis

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, FAX: 612-475-1786; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* K. Nicholls

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* J. Nimmerfroh

SCHOTT HIGH VOLTAGE, 1161 W. 2320 So., Salt Lake City, UT 84119, Tel: 801-972-3690, FAX: 801-972-3699; Empl.: 35; *Sls. Mgr.:* Jeff Dalebout

SCHRACK COMPONENTS, INC., 5305 NW 35th Terrace, Ft. Lauderdale, FL 33309, Tel: 305-733-3330, FAX: 305-733-7373; Empl.: 10; *Sls. Mgr.:* R. Biddle, T. DiLeonardo, C. Gilliland; *Dist. Mgr.:* Christopher Meza

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Phoenix/Scottsdale, Vikeland Sls.	602-948-7921
CA	Montrose, Signal Entprs.	818-957-0640
CO	Boulder, Stratford Grp.	303-530-3194
FL	Longwood, M & H Assoc.	407-332-7912
IL	Arlington Hgts., Thermek Inc.	708-577-6900
IN	Mishawaka, Power Comps.	219-256-6630
MD	Baltimore, Micro-Comp	410-644-5700
MA	Swansea, Poisson	508-677-3655
MN	Roseville, T.L.C.	612-483-2226
MO	Bridgeton/St. Louis, Dy-Tronix	314-291-4777
NJ	Lawrenceville, D.V.S.	609-896-1112
NJ	Totowa, R.D.I. Sls.	201-812-9606
NY	Buffalo, Lynn Assoc.	716-631-0054
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770
TX	Dallas, Rem Comps.	214-234-1069
WA	Seattle, Caruso & Camellieri Assoc.	206-455-8811
WI	Wauwatosa, Larsen & Assoc.	414-258-0529

Local Distributors

AZ	Mesa, Consolidated Elctrn. Distr.	602-962-9141
AZ	Tempe, L Comp	602-730-1633
CA	City of Industry, ITAL Elctrns. Sls.	818-968-8515
CA	Irvine, Kelex Controls	714-863-1230
CA	Martinez, GE Supp. Co.	513-229-6425
CA	Sacramento, GE Supp. Co.	916-648-3144
CA	San Jose, GE Supply Co.	408-534-0600
CA	Tustin, Western Switches & Controls	714-259-8144
CO	Denver, Control Des. Supp.	303-296-1922
CO	Denver, CSID	303-292-9594
FL	Coral Springs, G.R.E.	305-341-1103
FL	Miami, All American	305-621-8282
GA	Stone Mountain, Control Des. Supp.	404-979-3500
ID	Boise, Bolen's Control House	208-362-5280
IL	Addison, L Comp	708-628-1400
IL	Carol Stream, Lectro Comps.	708-690-0520
IN	Indianapolis, Control Des. Supp.	317-788-4559
KS	Kansas City, Control Des. Supp.	913-362-4248
ME	Gray, Longhill Electro. Tech.	207-657-2183
MD	Gaithersburg, Axis Elec.	301-840-9640
MA	Cambridge, Hi-Tek	617-491-0442
MA	Methuen, Aved	508-688-3800
MA	Norwood, Emtel	617-769-9500
MI	Brighton, H.H. Barnum	313-229-2961
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Plymouth, Leeds	612-557-1277
MN	Roseville, Chris Elctrns.	612-631-2647
MO	Kansas City, L Comp	816-241-0111
MO	St. Louis, Elctrn. Controls Supp.	314-645-2400
MO	St. Louis, L Comp	314-298-7231
NJ	E. Rutherford, A.A. Elec.	201-777-5477
NJ	Oakland, Relay Spec.	201-337-1000
NJ	Pennsauken, I.M.S.	609-662-1770
NJ	S. Hackensack, Nassor	201-641-3737
NY	Newburgh, Electrol Control Supp.	914-561-5330
NY	Orchard Park, Park Elctrn.	716-662-7070
NC	Charlotte, Control Des. Supp.	704-588-4410
OH	Cincinnati, Cincinnati Controls	513-530-0044
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Malvern, Control Des. Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
TX	Houston, Wofford Elctrns.	713-351-2722
UT	Nephi (Salt Lake City), Control Des. Supp.	801-623-2906
WA	Spokane, Consolidated Elctrn. Distr.	509-535-8891
WI	New Berlin, Control Des. Supp.	414-784-1015

SCHROFF, INC., 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, FAX: 401-738-7988; Empl.: 120; *Sls. Mgr.:* William Bottis ..... **C•1088-1089**

Local Sales Offices & Reps

AL	Huntsville, W.L.A. & Assoc.	205-721-1788
AZ	Phoenix, JBS Assocs.	602-244-1212
CA	Downey, Buffa Inc.	310-923-4618
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CO	Longmont, Luscombe Engrg.	303-772-3342
FL	Melbourne, R-Rep. Co.	407-722-1900
GA	Lawrenceville, W.L.A. Assoc.	404-339-9443
IL	Hillside, Cadre Tech. Rep.	708-449-3900
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MD	Baltimore, Leading Edge Sls.	301-644-0016
MI	Troy, C. B. Jensen	313-643-0506
MN	Minneapolis, D. A. Case Assoc.	612-831-6777
MO	St. Louis, Tech. Sls. Assoc.	314-521-2044
NH	Salem, Sales Engr.	603-893-5521
NJ	Englewood, Sprung & Rea, Inc.	201-569-5666
NY	E. Syracuse, Bastian Sls.	315-437-1482
NY	Fairport, Bastian Sls.	716-223-0237
NC	Raleigh, W.L.A. Assoc.	919-231-9939
OH	Aurora, EMA	216-562-6104
OH	Centerville, EMA	513-433-2800
TX	Garland, C.M.A.	214-681-1414
TX	Houston, C.M.A.	713-771-1500
UT	Salt Lake City, Luscombe Eng.	801-268-3434
WA	Woodinville, T.E.A.M.	206-485-1111
WI	Brookfield, Mc Mahon Sls. Inc.	414-782-3335

Local Distributors

CT	Wallingford, Sager	203-265-4600
FL	Orlando, Sager	407-354-1130
GA	Norcross, Sager	404-446-0085
IL	Chicago, Leeds Elctrns.	312-625-3800
MD	Columbia, Sager	410-995-4900
MA	Hingham, Sager	617-749-6700
MI	Madison Heights, Tracer Control Co.	313-545-7140

MN	Minneapolis, Leeds Elctms.	612-557-1277
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, Sager	919-850-9550
PA	Philadelphia, Sager	215-464-4336
WI	Milwaukee, Leeds Elctms.	414-789-6994

SCHUMACHER ELECT. CORP., 7474 N. Rogers Ave., Chicago, IL 60626, Tel: 312-973-1600, FAX: 312-973-7781; Empl.: 700; *Sls. Mgr.:* Norman Patinka

SCHURTER

FAX: 707-778-6401

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94954, Tel: 800-848-2600 ext.62; FSC No.: 61935; *Sls. Mgr.:* Janet Barrett .... **A•1606-1608; B•1386-1388, 1803; C•1450-1455**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls. Inc.	205-464-0033
AZ	Scottsdale, JK & Assos.	602-990-8804
AR	Little Rock, Doby Assoc.	501-221-0326
CA	Chatsworth, Cygnus Sls. Engrg. Corp.	818-727-0312
CA	San Diego, Cygnus Sls. Engrg. Co.	619-268-7771
CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CO	Broomfield, Summit West Mktg., Inc.	303-460-9600
FL	Pompano Bch., IMR, Inc.	305-942-2449
GA	Norcross, Benchmark Tech. Sls. Inc.	404-446-1711
IL	Arlington Hgts., MJ Petersen & Assoc., Ltd.	708-577-8200
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Baltimore, Chesapeake Indl. Mktg.	410-653-0476
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, Acorn Elctrns. Inc.	314-421-1751
NH	Nashua, Bell Controls	603-882-6984
NJ	Ho-Ho-Kus, D. J. Fisher Co.	201-652-0090
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Fairport, TAC Sls, Inc.	716-223-7610
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Hillsboro, Doran Sls.	503-640-4500
TX	Dallas, Reese & Assocs.	214-224-1000
UT	Salt Lake City, Luscombe Engrg. Co.	801-268-3434
WA	Bothell, Doran Sls.	206-488-1200

Local Distributors

AZ	Phoenix, BeSwitched	602-275-4805
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Irvine, Kensington Elctrns., Inc.	714-588-0575
CA	Livermore, Quail Elctrns.	510-373-6700
CO	Aurora, Jet Elctrns.	303-364-1000
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Orlando, Sager	407-354-1130
GA	Norcross, NRC Elctrns.	404-729-0411
ID	Boise, Radar Elec. Co.	208-336-2227
IL	Chicago, Leeds Electro Cmpnts.	312-625-3800
IL	Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc.	708-437-7120
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Sager Elctrns.	301-995-4900
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Livonia, RS Elctrns.	313-525-1155
MN	Plymouth, Leeds Electro Comps., Inc.	612-557-1277
NH	Salem, Sager Elctrns.	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Strongsville, Fuse World	216-238-1330
OR	Portland, Radar Elctrns. Co.	503-232-3404
OR	Tualatin, Moore Elctrns., Inc.	503-692-5333
PA	Harrisburg, Ad-Tech Elctrns., Inc.	717-561-9905
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Dallas, Fuses Unlimited	214-907-8600
WA	Kent, Moore Elctrns.	206-251-8090
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Oconomowoc, GW Elctrns. Ltd.	414-567-9445
Can	Markham, Ont., Birde Mktg.	416-477-7722

SCHUSTER ELECTRONICS, 54 Cove Rd., Huntington, NY 11743, Tel: 516-271-0590; *Sls. Mgr.:* Norman Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd., Stratford, CT 06497, Tel: 203-386-9978, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 11800 Sunrise Valley Dr., Ste. A, Reston, VA 22091-5302, Tel: 703-471-1600, FAX: 703-620-1561; Empl.: 2; *Sls. Mgr.:* Mr. Kevin B. Deasy

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994, FAX: 303-444-9229; Empl.: 35

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

Esterline SCIENTIFIC COLUMBUS

FAX: 614-272-2288

SCIENTIFIC COLUMBUS CO., 1900 Arlingate Lane, Columbus, OH 43228-4105, Tel: 614-274-0400; Empl.: 150 .... **B•2007-2012**

Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-979-5500
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
OH	Grove City, Leidy Engrg. Sls.	614-875-1524
PA	Collegeville, GEE Co., Inc.	215-489-8860
TN	Chattanooga, Spader & Assocs.	615-899-3823
AZ	Scottsdale, Young Power Equip. Co.	602-991-9191
AR	Little Rock, BFCO, Inc.	501-753-9977
CA	Glendale, Young & Co.	818-242-2171
CA	San Francisco, Wrathall & Krusi, Inc.	415-777-0226
CO	Littleton, The Beabout Co., Inc.	303-795-1000
FL	Gainesville, RJC Assocs.	904-372-4635
FL	Orlando, RJC Assocs.	407-894-7371
GA	Decatur, Spader & Assocs.	404-296-3024
HI	Honolulu, Berkley Engrg. & Equip. Co.	808-845-9377
IL	Naperville, O'Conner, Serra & Assoc., Inc.	708-420-7812
IN	Nobelsville, C.D. Arnold Co.	317-773-5821
IA	Cedar Rapids, Harry Ferris Co.	319-377-1226
KS	Kansas City, Power Equip. Sls. Co., Inc.	913-384-3848
LA	Kenner, John J. Aertker Jr. Co., Inc.	504-469-0136
MA	Quincy, Fantasia Assocs., Inc.	617-479-0800
MI	Brighton, Dale P. Seyfried Co., Inc.	313-227-5353
MI	Grand Rapids, Dale P. Seyfried Co., Inc.	616-453-8603
MN	Minneapolis, Arjay Automation, Inc.	612-861-1749
MO	Springfield, Power Equip. Sls. Co. Inc.	417-833-3056
MO	St. Louis, Ken Way Co.	314-469-9998
NE	Lincoln, Harry Ferris Co.	402-464-6148
NM	Albuquerque, Young Power Equip. Co.	505-843-9450
NY	Albany, Expert Industrial Sys., Inc.	518-869-3355
NY	N. Tonawanda, Expert Industrial Sys. Inc.	716-694-3935
NY	North Chili, Expert Industrial Sys. Inc.	716-594-5755
NY	Syracuse, Expert Industrial Sys. Inc.	315-455-2469
NC	Raleigh, Robert W. Chapman & Co.	919-782-2624
OH	N. Canton, Leidy Engrg. Sls.	216-497-9585
OK	Tulsa, C. B. Anderson Elec. Co.	918-836-4661
OR	Portland, McLaren Inc.	503-627-0757
PA	Pittsburgh, Russell F. Clark Co., Inc.	412-242-9500
SC	Greenville, Robert W. Chapman & Co.	803-288-8821
SC	W. Columbia, Robert W. Chapman & Co.	803-739-0220
TX	Arlington, Ev Smith Sls. Co.	817-572-2911
TX	Houston, Ev Smith Sls. Co.	713-931-0403
VA	Alexandria, The Hildenbrand Co., Inc.	703-998-0445
VA	Midlothian, Robert W. Chapman & Co.	804-323-6088
WA	Kirkland, McLaren Inc.	206-827-9400
WI	Milwaukee, Reynolds & Co.	414-351-1100
Can	Calgary, Alb., Landel Controls Ltd.	403-254-8900
Can	Mississauga, Ont., Sircon Controls, Ltd.	416-238-9505
Can	Richmond, B.C., Landel Controls Ltd.	604-244-7331
Can	St. Laurent, Que., Le Groupe Rotalec	514-341-3685

SCIENTIFIC CONVERSION, INC., 42 Truman Dr., Novato, CA 94947, Tel: 415-892-2323, FAX: 415-892-2321; Empl.: 15; *Sls. Mgr.:* Maura Vrydaghs

SCIENTIFIC INSTRUMENTS, 4400 W. Tiffany Dr., West Palm Beach, FL 33407, Tel: 407-881-8500, FAX: 407-881-8556; FSC No.: 591197614; Empl.: 52; *Sls. Mgr.:* Mike Capers; *Dist. Mgr.:* Mike Capers

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

FAX: 510-471-9752

SCIENTIFIC TECHNOLOGIES INC., Control Components Div., 31069 Genstar Rd., Hayward, CA 94544-7831, Tel: 510-471-9717, 800-221-7060; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun .... **B•1595-1596**

SCIENTIFIC TECHNOLOGIES INC., Optical Sensor Div., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 120

SCI TECHNOLOGY, INC., PO Box 1000, 8600 So. Memorial Pkwy., Huntsville, AL 35807, Tel: 205-882-4569, FAX: 205-882-4659

SCITEQ ELECTRONICS, INC., 4775 Viewridge Ave., San Diego, CA 92123, Tel: 619-292-0500, FAX: 619-292-9120; FSC No.: 70561; Empl.: 40; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, FAX: 703-471-6750; Empl.: 95; *Sls. Mgr.:* T. Titcomb

SCORPION SEMICONDUCTOR, 2360 Qume Dr., Ste. B, San Jose, CA 95131, Tel: 408-944-6270, FAX: 408-944-6272

SCOTT SPECIALTY GASES, INC., 6141 Easton Rd., P.O. Box 310, Plumsteadville, PA 18949-0130, Tel: 215-766-8861, FAX: 215-766-0320; FSC No.: SIC 2818; *Sls. Mgr.:* James Wallis

SC TECHNOLOGY, INC., 368 Earhart Way, Livermore, CA 94550, Tel: 510-373-9230, FAX: 510-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, FAX: 914-235-8369; FSC No.: 63,58,Y,Z; Empl.: 30; *Sls. Mgr.:* Jerrold Hacker; *Dist. Mgr.:* Subhash Grandhi

SEACOR INC.

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 20; *Sls. Mgr.:* D. Calamaras .... **A•1160-1162**

Local Sales Offices & Reps

AL	Huntsville, Summit Mktg.	205-721-1701
AZ	Tempe, FP Sls.	602-894-5303

CA	Alhambra, James Gerry Co., Inc.	213-283-7694, FAX:818-282-3836
CA	San Jose, H. W. Assocs.	408-996-9940, FAX:408-996-0885
CO	Denver, English/Damco Sls. Co.	303-782-0683, FAX:303-782-0670
FL	Palm Harbor, Francois & Assocs., Inc.	813-784-4812,FAX:813-784-4854
GA	Norcross, Summit Mktg. Assoc.	404-498-4530
IN	Indianapolis, Schank Elctrn. Mktg., Inc.	317-842-6204,FAX:317-842-6205
MD	Bel Air, Freedman/Malta Assoc.	410-879-3148, FAX:410-838-0789
MA	Sudbury, KSA of New England	508-443-5881, FAX:508-443-0483
MI	Troy, Schank Elctrn. Mktg., Inc.	313-588-2040
MN	Plymouth, Highland Elctrns. Sls. Co.	612-557-7002, FAX:612-557-7014
NJ	Budd Lake, T & K Sls.	201-347-1856, FAX:201-691-1468
NM	Albuquerque, FP Sls.	505-345-5553, FAX:505-345-5555
NY	Skaneateles, NRM Mktg. Grp., Inc.	315-685-8991, FAX:315-685-6199
NY	Smithtown, T & K Sls.	516-724-3456, FAX:516-724-3485
NC	Chapel Hill, Summit Mktg. Assoc.	919-968-7808
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932, FAX:513-574-2854
OH	Miamitown, Bob Gilbert & Assocs.	513-353-4889, FAX:513-353-4689
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211,FAX:215-265-8764
TX	Richardson, Barry Sls., Inc.	214-234-0255, FAX:214-235-0271
Can	Markham, Ont., Kellock Sls. & Mktg.	416-471-0202, FAX:416-472-4519

Local Distributors

CT	Bridgeport, Park Distrs.	203-366-7200
CT	Wallingford, Mid-State Elctrns.	203-265-9900, FAX:203-269-2374
FL	Boca Raton, NRC Elctrns.	407-241-8600, FAX:407-241-3328
FL	Ft. Lauderdale, Brothers Elec.	305-561-6700, FAX:305-564-8080
GA	Norcross, NRC Elctrns.	404-729-0411, FAX:404-448-2854
IN	Carmel, Altex Elctrns.	800-783-2589, FAX:317-848-1323
MA	Marlboro, NOW Elctrns.	508-460-0187, FAX:508-460-0467
MA	Sudbury, ASK Elctrns.	508-443-5881, FAX:508-443-0483
MN	Eitzen, Capacitor Assocs.	507-495-3306, FAX:507-495-3454
MN	Fridley, Voyager Elctrns.	612-571-7766, FAX:612-571-9519
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200, FAX:201-238-2218
NJ	Rockaway, Tonar Inds.	201-586-9000, FAX:201-586-2075
NY	Ronkonkoma, Spectrum Comp. Supp.	516-737-6900,FAX:516-737-6642
WA	Seattle, Vesco Elctrns.	206-575-3607

SEACOR PIEZO CERAMICS, 8 Huntington St. Ste. 300, Huntington, CT 06484, Tel: 203-925-1320, FAX: 203-925-1320

SEAFAB, INC., 14648 N.E. 95th St., Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALING DEVICES, INC., 4400 Walden Ave., Lancaster, NY 14086, Tel: 716-684-7600, FAX: 716-684-0760; Empl.: 95; *Sls. Mgr.:* Wayne K. Carrig

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; FSC No.: 3678; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 800-634-2356, FAX: 818-246-6803; FSC No.: 86928; Empl.: 80; *Sls. Mgr.:* Dave Buddecke

secma inc.

A MEMBER OF SECME GROUP

FAX: 714-261-8390

SECMA, INC., Secme, 17752 Skypark Circle No. 200, Irvine, CA 92714, Tel: 714-261-0610; Empl.: 250 .... **B•1804-1807, 1850-1851**

Local Sales Offices & Reps

AL	Huntsville, Progressive Technlg.	205-551-7770
CA	Alameda, Liaison, Inc.	510-769-1991
CA	Chula Vista, PCA Mktg. & Sls. Eng.	714-493-3434
CA	Dana Point, PCA Mktg. & Sls. Engrg.	714-493-9822
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
IL	Elk Grove Vlg., Tristar Grp.	708-593-0200
IL	Elk Grove Vlge., Tristar Grp.	708-364-6507
IN	Greenwood, Liberty Sls.	317-888-8396
IN	Lafayette, Liberty Sls.	317-474-5058
MA	Scituate, Olsen Tech. Sls.	617-545-5101
NY	Bohemia, Optimum Metro Sls.	516-244-5744
OH	Mentor, Sls. Plus	216-942-7811
OR	Lake Oswego, SPS Elctrns.	503-697-7768
TX	Lewisville, Elctrn. Prod. Rep.	817-467-0377
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Mountlake Perris, SPS Elctrns.	503-697-7768
Can	Brossard, Que., D B Lectro	514-923-4525
Can	Brossard, Que., DB Lectro	514-923-4525
Can	Markham, Ont., Avotronics	416-475-1858
Can	Ontario, Avotronics	416-475-2024

Local Distributors

CA	Covina, SelectaSwitch	818-697-4119
MA	Woburn, Control Des. Supp.	617-932-9404
Can	Markham, Ont., ARMA	416-475-1858

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TELEX: 673-2151, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 45; *Sls. Mgr.:* Thomas Nelson

SECTOR SYSTEMS CO., INC., 416 Ocean Ave., Marblehead, MA 01945, Tel: 617-639-2625; Empl.: 10

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-333-7706, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 370; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Pat Bringuel

SII

Seiko Instruments

FAX: 310-517-7792

SEIKO INSTRUMENTS U.S.A., INC. ELECTRONIC COMPONENTS, 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-517-7770; *Sls. Mgr.:* A. Kishida; *Dist. Mgr.:* T. Touji .... **A•1480; B•1113; D•1106, 1473**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Phoenix, C.T. Carlberg & Assocs.	602-468-0750
AZ	Scottsdale, C.T. Carlberg & Assocs.	602-994-9388
AZ	Tucson, C.T. Carlberg & Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871
CA	Newbury Park, Groh Assocs.	805-498-8410
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, H-Technical Sls.	408-453-2111
CO	Aurora, Electrodyne	303-695-8903
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Elk Grove Village, TriStar Grp., Inc.	708-593-0200
IN	Ft. Wayne, Electro Rep Inc.	219-489-8205
IN	Indianapolis, Electro Rep Inc.	317-842-7202
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Electri-Rep	913-649-2168
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MA	Taunton, Focus Elctrns. Sls.	508-824-3840
MI	Farmington Hills, Rathsburg Assoc., Inc.	313-489-1500
MN	Bloomington, Matrix Mktg. Grp.	612-835-6977
MO	St. Louis, Electri-Rep	314-993-4421
NJ	E. Brunswick, Shepard & Assoc.	908-254-5757
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J.N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Earl & Brown Co. Inc.	503-639-2100
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
Can	Markham, Ont., Birde Mktg.	416-477-7722
TX	Austin, TI Mktg. Inc.	512-371-7272
TX	Dallas, TL Mktg. Inc.	214-490-9300
TX	Houston, TL Mktg. Inc.	713-587-8100
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Menomonee, TriStar Grp., Inc.	800-654-4105
Can	Kanata, Ontario, Birde Mktg.	613-592-5411
Can	St. Laurent, Quebec, Birde Mktg.	514-335-4050
Can	Vancouver, B.C., Birde Mktg.	604-431-0426

Local Distributors

AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Agoura Hills, Cypress Elctrns.	818-597-9491
CA	Chatsworth, Sterling Elctrns.	818-407-8850
MD	Columbia, Sterling Elctrns.	301-290-3800
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Jose, All American	408-943-1200
CA	San Jose, Electro Alliance, Inc.	408-280-0221
CA	San Jose, Sterling Elctrns.	408-435-0835
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Sunrise, All American	305-572-7999
CA	Tustin, OBI	714-258-1411
CA	Tustin, Sterling Elctrns.	714-259-0900
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Miami, All American	305-621-8282
GA	Norcross, Applied Power Inc. (printers only)	404-263-0421
IL	Rosemont, Advent Elctrns., Inc.(printers only)	708-297-6200
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IL	Schaumburg, Sterling Elctrns.	708-303-9900
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elctrns., Inc.(printers only)	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.(printers only)	319-363-0221
IA	Cedar Rapids, Dee Elctrns., Inc. (LCD only)	319-365-7551
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Middletown, Current Comps.	301-473-5333
MD	Raynham, Current Comps.	508-824-7900
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns., Inc.(printers only)	313-477-1650
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Edison, Sterling Elctrns.	908-417-1000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NC	Raleigh, Century Elctrns.	919-782-2116
NY	Ronkonkoma, All American	516-981-3935
NC	Raleigh, Sterling Elctrns.	919-596-2220
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Tualatin, Moore Elctrns.	503-692-5333
OR	Beaverton, Micropower (Batteries Only)	503-626-7086
PA	Norristown, Century Elctrns.	215-631-5404
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Irving, Cypress Elctrns.	214-255-0065
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-323-5510
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Kent, Moore Elctrns., Inc.	206-251-8090
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, B.C., Semad/DGW Elctrns.	604-420-9889
Can	Calgary, Alb., Semad/DGW Elctrns.	403-252-5664
Can	Markham, Ont., Carsten Elctrns. Ltd.	416-477-7705
Can	Markham, Ont., Semad/DGW Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad/DGW Elctrns.	613-727-8325
Can	Pointe Claire, Que., Semad/DGW Elctrns.	514-694-0860
Can	St. Laurent, Que., Carsten Elctrns. Ltd.	514-334-8321

SEIKO INSTS. USA, INC., Graphic Devices & Systems Div., 1130 Ringwood Ct., San Jose, CA 95131, Tel: 408-922-5800, FAX: 408-922-5840; *Sls. Mgr.:* Steve Dodds; *Dist. Mgr.:* Ralph Kosoff

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7793; Empl.: 250; *Sls. Mgr.:* K. Curtis; *Dist. Mgr.:* P. Simpson

SEKAI ELECTRONICS OF AMERICA, INC., 14535H Valley View Ave., Santa Fe Springs, CA 90670-5234, Tel: 310-921-7775, FAX: 310-921-7875; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski; *Dist. Mgr.:* Ron Burnett selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673; Empl.: 18; *Sls. Mgr.:* Ray Anton; *Dist. Mgr.:* Ray Anton .... **B•1896-1897; C•1535; D•1368-1370**

Local Sales Offices & Reps

CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mission Viejo, Summit Sls.	714-830-5545
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Littleton, Summit Sls.	303-973-9681
FL	Sarasota, Rep-USA	813-923-2897
IL	Woodridge, Golten Assocs.	708-985-5100
IN	Indianapolis, S & M Sls. & Mktgs.	317-843-5519
MA	Andover, Crawford Assocs.	508-470-2122
NY	Hauppauge, Sticom	516-366-4221
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Valley Forge, J.E. Cuesta & Co.	215-935-0400
TX	Dallas, H.H. & Assoc.	214-247-8308
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
NY	Hauppauge, A J Elctrns.	516-361-9780

SELECO, INC., P.O. Box 68809, Indianapolis, IN 46268, Tel: 317-872-4148, FAX: 317-875-3276; Empl.: 30

SELECT CONTROLS INC., 350 I Central Ave., Bohemia, NY 11716, Tel: 516-467-8577, FAX: 516-567-9013; Empl.: 14

SEMICON COMPONENTS, INC., A Subsidiary of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, FAX: 617-272-9109

SEMICONDUCTOR CIRCUITS, INC., Astec America, Inc., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 52; *Sls. Mgr.:* Douglas E. Hemingway, VP/Sls. .... **D•2207-2209**

Local Sales Offices & Reps

AZ	Chandler, Technisource Corp.	602-497-0711
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Los Gatos, Luscombe Engr. Co. of San Francisco	408-370-2020
CO	Lakewood, Frontier Mktg.	303-980-5888
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Plainfield, Rathsburg Assoc.	317-838-0360
MD	Pasadena, Elctrn. Engr. & Sls., Inc.	410-255-9686
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Edina, Ohms Technlg., Inc.	612-932-2920
MO	Florissant, Delltron Co., Inc.	314-839-0033
NH	Nashua, Bennetron	603-880-7008
NJ	Morrestown, TAI Corp.	609-778-5353
NM	Albuquerque, Technisource Corp.	505-268-4232
NY	Melville, Parallax	516-351-1000
NY	Syracuse, L.D. Allen Co.	315-437-8387
OH	Columbus, Rathsburg Assocs.	614-457-2242
OR	Lake Oswego, Luscombe Engr. N/W	503-636-6664
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WA	Bellevue, Luscombe Engr. N/W	206-223-1541
Can	Ottawa, Ont., Cantec Reps., Inc.	613-725-3704

Local Distributors

CA	Santa Clara, Foresight Elctrns.	408-980-9700
CT	Seymore, Target Elctrns.	203-888-1480
GA	Norcross, Applied Power Inc.	404-263-0421
IN	Carmel, Altex Elctrns.	317-848-1323
MA	Wellsley Hills, Target Elctrns.	617-235-2545
MA	Westwood, Target Elctrns.	617-329-2700
MI	Brighton, Applied Power Inc.	313-227-3604
NH	Derry, Target Elctrns.	603-434-8440
NJ	Lodi, TRC Elctrns.	201-779-8282
TX	Stafford, Southwest Elctrns.	713-240-4000

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, FAX: 914-698-5386; Empl.: 57; *Sls. Mgr.:* Dolores Bankose

Local Sales Offices & Reps

AZ	Chandler, Mission Mktg.	602-786-0804
CA	Anaheim, Chalman Technlgs.	714-632-1724
CA	San Ramon, California Tech. Svcs.	510-743-8544
CO	Fort Collins, Rep Sls., Inc.	303-226-1504
CT	Southington, Libby Assoc.	203-747-5601
CT	Southington, Libby Assocs.	203-747-5601
CT	Washington Depot, Gemair Inc.	203-868-1390
IL	Palatine, M & S Sls.	708-934-1200
MD	Walkerville, KH Sls.	301-898-0758
MN	Minneapolis, Ferrian Sls.	612-721-8915
PA	Franconia, Scharas Assocs.	215-582-0450
TX	Dallas, Dallas Indl. Sls.	214-669-2608
TX	Richardson, PSI	214-644-5090
WA	Bellevue, Mars	206-747-3292
WA	Redmond, Advanced Elec. Resources	206-881-5207

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Englewood, Component Sls.	303-779-8060
FL	Longwood, Delmac Sls.	407-831-0040
IL	Downers Grove, Frank Mendell Assoc.	708-719-0099
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Lorenz Sls.	913-469-1312
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-474-7094
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q.A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Paoli, Stitzer Co. Inc.	215-644-5500
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Austin, M-Rep	512-250-0828
TX	Dallas, M-Rep	214-484-5711
UT	Midvale, Utah/CSI	801-561-5099
WA	Bellevue, Westmark Elctrns.	206-454-1944
Can	Montreal, Que., Solid State Engrg.	514-481-3313

SEMIKRON, INC., 11 Executive Dr., Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, FAX: 603-883-8021; FSC No.: 58687; Empl.: 12; *Sls. Mgr.:* Arthur Connolly

SEMTECH CORPORATION

FAX: 805-498-3804

SEMTECH CORPORATION, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111; FSC No.: 14099; Empl.: 350; *Sls. Mgr.:* Jack Poe; *Dist. Mgr.:* Shawn O'Grady .... **A•2180-2218; D•1845**

Local Sales Offices & Reps

AL	Huntsville, Giesting & Assocs.	205-830-4554
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Anaheim, First Rep of S. CA	805-373-0887
CA	La Jolla, Coastal Elctrns.	619-459-4148
CA	Newbury Pk., Semtech Western Reg. Sls.	805-498-2111
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CA	Westlake Village, First Rep of S. CA	805-373-0887
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Deerfield Beach, Delmac Sls., Inc.	305-427-7788
FL	Longwood, Delmac Sls., Inc.	407-831-0040
GA	Duluth, Giesting & Assocs.	404-476-0025
IL	Glendale Hgts., Synergistics Sls., Inc.	708-858-8686
IN	Carmel, Giesting & Assocs.	317-844-5222
KY	Versailles, Giesting & Assocs.	606-873-2330
MD	Glen Burnie, Logical Technlg., Inc.	410-766-7444
MA	Chelmsford, Semtech Eastern Reg. Sls.	508-256-0506
MA	Framingham, Stone Comp. Sls.	508-875-3266
MI	Comstock Park, Giesting & Assocs.	616-784-9437
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	New Brighton, Design Technlg. Comps., Inc.	612-631-3738
MO	Florissant, Central Tech. Sls.	314-831-4069
NJ	Fairfield, Metro Logic Corp.	201-575-5585
NY	Bellmore, Compar New York, Inc.	516-221-7300
NY	Rochester, Ontec Elctrn. Mktg.	716-464-8636
NY	Wappingers Falls, Ontec Elctrn. Mktg.	914-462-7188
OH	Cincinnati, Giesting & Assocs. (Home Off.)	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Dublin, Giesting & Assocs.	614-792-5900
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Horsham, Nexus Technlg. Sls., Inc.	215-675-9600
PA	Pittsburgh, Giesting & Assocs.	412-828-3553
TX	Richardson, Semtech Central Reg. Sls.	214-783-9903
WA	Renton, Quest Mktg.	206-228-2660
WI	Brookfield, Synergistics Sls., Inc.	414-821-1516
EXP	Shijuku-Tokyo, Japan, Jepico-Shinjuku	03-348-0611
Can	Hamilton, Ont., Cartwright Southall Assoc., Inc.	416-528-0294

SEMTECH CORPUS CHRISTI, Semtech Corporation, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, FAX: 512-289-0472; Empl.: 200 .... **A•2180-2218; D•1845**

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Bradford Jubin

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 1-800-736-2673, 605-339-0100, FAX: 605-339-0317; FSC No.: 33347; Empl.: 230; *Sls. Mgr.:* George Gonos

SENSIDYNE, INC., 16333 Bay Vista Drive, Clearwater, FL 34620, Tel: 813-530-3602, 1-800-451-9444; Empl.: 70; *Sls. Mgr.:* Bob Duff; *Dist. Mgr.:* John Lavezzorio

SENSITEK CORPORATION, See Biddle Instruments

SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35

SENSITRON SEMICONDUCTOR, RSM Electron Power Div., 221 W. Industry Ct., Deer Park, NY 11729, Tel: 516-586-7600, FAX: 516-242-9798; FSC No.: 13409; Empl.: 150; *Sls. Mgr.:* Bryan Rogers; *Dist. Mgr.:* Bryan Rogers

SENSORAY

FAX: 503-684-8164

SENSORAY, 15800 Upper Boones Ferry Rd., # 150, Lake Oswego, OR 97035, Tel: 503-684-8005

SENSOR CORP., 303 Scottdale Ave., Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

SENSOR DEVELOPMENTS INC., PO Box 290, Lake Orion, MI 48361, Tel: 313-391-3000, FAX: 313-391-0107; Empl.: 80; *Sls. Mgr.:* Bill Wood

SENSOR PRODUCTS, INC., 171 Castle Ridge Park, E. Hanover, NJ 07936, Tel: 201-884-1755, FAX: 201-884-1699; Empl.: 5

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07004, Tel: 201-227-7790, 800-524-1610, FAX: 201-227-8063; FSC No.: 0AES7; Empl.: 125; *Sls. Mgr.:* Robert Gliniecki .... **B•1898-1901**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
MA	Lexington, Jodan Technlg.	617-863-8898

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583, FAX: 818-341-9059; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188, FAX: 614-486-0506; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTECH, INC., 518 Ryers Ave., Cheltenham, PA 19012, Tel: 215-663-0422, FAX: 215-663-0461; Empl.: 5

SENTRY MANUFACTURING COMPANY, P.O. Box 250, Chickasha, OK 73023, Tel: 405-224-6780, FAX: 405-224-8808; FSC No.: 5955; Empl.: 26; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 70; *Sls. Mgr.:* Neil Reckon .... **C•1090-1091**

Local Sales Offices & Reps

CA	Covina, Serco Prods.	818-331-0517
CA	Los Gatos, Shur Sls.	408-399-7487
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Atlanta, Beacon Elec.	404-256-9640
KY	Louiseville, O.H. Bromberg	502-456-1498
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MN	S. lMinneapolis, R.J., Inc	612-866-3661
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Latham, L-Tron Corp.	518-785-5032
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
OR	Portland, Brown Co.	503-293-1683
PA	Ft. Washington, Simon Mktg. Consultants	215-628-3394
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Cucamonga, Abletronics	714-944-4952
CA	Culver City, DOW Elctrns.	213-391-6763
CA	El Monte, Marshall Ind.	800-522-0084
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Palo Alto, Fry's Elctrns.	415-496-6100
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CO	Aurora, Jet Elec. Supp.	303-364-1000
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Tampa, Sunex Elctrn. Supp. Inc.	813-885-4074
FL	West Palm Beach, Dolphin Elctrn. Supp. Inc.	305-659-7166
MA	Burlington, Atlantic Comps.	617-270-0051
MA	Lynn, Land Elctrns. Inc.	617-592-2220
MN	S. Minneapolis, Tortec Corp.	612-866-3662
MN	Thief River Falls, Digi-Key	218-681-6674
NV	Las Vegas, Sandy's Elctrns.	702-383-8353
NJ	Lodi, Nidisco Inc.	201-773-1771
NJ	Rockaway, Tonar Ind.	201-586-9000
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Southeastern Elctrns.	919-638-8204
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Hudson, Hamshire	216-425-8888
TN	Clarksville, Randolph, Hale & Matthews Inc.	615-647-2325
TX	Austin, Electrotex, Inc.	512-454-0318
TX	Dallas, Electrotex, Inc.	214-234-0433
TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Houston, Electrotex, Inc.	713-526-3456
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
Can	Kingston, Ont., Electronic Packaging Sys. Ltd.	613-384-1142
Can	Markham, Ont., Arna Elctrns.	416-475-1858
Can	Montreal, Future Elctrns.	800-388-8731

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SERVOMEX COMPANY, INC., 90 Kerry Pl., Norwood, MA 02062, Tel: 617-769-7710, TELEX: 4430161, FAX: 617-769-2834; *Sls. Mgr.:* Michael Hammond

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SESCOM, INC., 2100 Ward Dr., Henderson, NV 89015-4249, Tel: 702-565-3400, FAX: 702-565-4828; FSC No.: 7Z174; Empl.: 12; *Sls. Mgr.:* Franklin J. Miller ... **C•1093**

setra

FAX: 508-264-0292

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243; FSC No.: 53367; Empl.: 110 .... **B•2014-2015**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-522-1010
CA	Concord, QCon, Inc.	510-682-2020
CA	Downey, Dynasales Co.	310-806-1400
CO	Westminster, RMS Sls.	303-429-1111
FL	Tampa, Quantum Measurements Corp.	813-933-8078
GA	Atlanta, Craft Assocs.	404-256-0420
IL	W. Dundee, Precision Meas. Prods.	708-426-4446
IN	Ft. Wayne, Domino, Inc.	219-456-5512
IN	Indianapolis, Domino, Inc.	317-841-6159
KY	Louisville, Domino, Inc.	502-425-2848
MD	Columbia, Stein Instrs.	301-596-3748
MA	Wilbraham, NEDT, Inc.	413-596-8853
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	St. Louis, Adelphi, Inc.	314-821-1232
NJ	Little Falls, KLS Assocs.	201-785-4450
NY	Cazenovia, Ritec Entprs., Inc.	315-655-4158
NY	Rochester, Ritec Entprs., Inc.	716-271-3170
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, ADI Instrs.	214-340-3445
WA	Seattle, EMRA Controls, Inc.	206-244-4341
WI	Waukesha, Ray Knitter Assocs.	414-544-1976
Can	Ontario, Alpha Controls & Instr.	416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559, FAX: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 800; *Sls. Mgr.:* Michael Rosenberg

SGS-THOMSON MICROELCTRONICS, INC., 1000 Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100

SGS-THOMSON MICROELECTRONICS, INC., 1310 Electronics, Carrollton, TX 75006, Tel: 214-466-6000, FAX: 214-466-7602; FSC No.: 7X328; Empl.: 1700; *Sls. Mgr.:* Carlo Bozotti; *Dist. Mgr.:* Jack Dauber

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, 1-800-876-3135, FAX: 919-934-3298; Empl.: 30; *Sls. Mgr.:* M. D. Sutton .... **B•1808; D•1323**

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346, FAX: 919-965-6620; FSC No.: 58258; *Sls. Mgr.:* Joe Deans .... **D•1324**

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAMROCK PLASTICS & RUBBER, INC., 5330 E. 25th St., Indianapolis, IN 46218, Tel: 317-543-3540, 800-382-4635, FAX: 317-543-3553; Empl.: 25; *Sls. Mgr.:* Bill Crispen

SHAPE ELECTRONICS, INC., The Wiremold Co., 901 DuPage Ave., Lombard, IL 60148, Tel: 708-620-8394, 1-800-367-5811, FAX: 708-620-0784; Empl.: 110; *Sls. Mgr.:* Jim Piantanida; *Dist. Mgr.:* Jim Piantanida

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024, FAX: 714-675-9063; Empl.: 7

SHARP ELECTRONICS CORP., Microelectronics Grp., 5700 NW Pacific Rim Blvd., M/S. 20, Camas, WA 98607, Tel: 206-834-2500, FAX: 206-834-8903; *Sls. Mgr.:* Doug Goodyear; *Dist. Mgr.:* George Campot

SHATTUCK INDUSTRIES, 117 Fern St., Santa Cruz, CA 95060, Tel: 408-427-3122, FAX: 408-427-3134; *Sls. Mgr.:* Bruce Shattuck; *Dist. Mgr.:* Julie Murray

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELDON INSTRUMENTS, 1021 North University Ave., Ste. 204, Provo, UT 84604, Tel: 801-376-7861, FAX: 801-374-8022; Empl.: 6; *Sls. Mgr.:* Robert Gaurie

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AZ	Mesa, Spectrum Assocs., S.W.	602-966-1788
CA	Pleasanton, Leddy Assocs., Inc.	510-417-1033
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CO	Westminster, Wsetern Reg. Mktg.	303-428-8088
FL	Satellite Beach, Curtis Mktg.	407-779-3912
GA	Marietta, Intronics	404-973-6605
IL	Glen Ellyn, Lincoln Hoages, Inc.	708-469-6750
MN	Hopkins, Steve Forsythe & Assocs.	612-933-8267
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Port Washington, TMA	516-883-2432
RI	Lincoln, Global Tech. Sls.	401-334-3830
TX	Dallas, de Forest Sls. Co.	214-349-3290
UT	Salt Lake City, Western Reg. Mktg.	801-268-9768
WA	Bellevue, AIE	206-455-4697
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AR	Ft. Smith, Radio, Inc.	501-646-5200
CA	Anaheim, Bisco Inds. Inc.	714-635-0380
CA	San Jose, Bisco Inds. Inc.	408-435-8980
IL	Franklin Park, Bisco Inds. Inc.	708-451-1230
MA	Woburn, Bisco Inds.	617-938-8590
MO	Kansas City, Elctrns. Supp.	816-931-0250
NY	Elmsford, White Plains Elctrl.	914-592-9555
OH	Dayton, Advacom	513-272-5900
OH	Middleburg, Advacom	216-826-3300
OH	Strongsville, Roberts Elctrns. Co., Inc.	216-238-1711
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Arlington, Bisco Inds.	817-640-7046
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-1294
TX	Houston, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Bisco	801-972-3525

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Local Sales Offices & Reps

AL	Madison, Benchmark Sls.	205-464-0033
CA	Culver City, Shinano Kenshi Corp.	310-915-7300
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
CO	Denver, Tech Rep Sls. Co.	303-758-7031
CO	Englewood, Tech. Rep. Sls.	303-799-8877
CT	Bloomfield, SIR/DSA Assocs.	203-243-9343
FL	Lighthouse Pt., Krutek & Assocs.	305-783-2501
GA	Norcross, Benchmark Sls.	404-446-1711
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
MA	Westford, SIR/DSA Assocs.	508-692-2500
MI	Royal Oak, Elctrl. Sys. Co.	313-542-1747
MN	Minneapolis, HMR, Inc.	612-888-2122
NJ	Mt. Laurel, Paragon Sls.	609-778-1190
NY	Clark Mills, KLM Garner	315-853-6126
NY	Mineola, DOL Engrg.	516-747-3944
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, Benchmark Sls.	919-850-0633
OH	Dayton, Elctrl. Sys. Co.	513-545-9822
OH	Orville, Elctrl. Sys. Co.	216-682-5530
OR	Portland, Intertech Sls.	503-775-7885
PA	Blue Bell, Deltronics	215-641-9930
TX	Austin, Capitol Sls.	512-250-0201
TX	Dallas, Theodore Borek Assoc.	214-985-7702
WA	Redmond, Halbar	206-882-0990

Local Distributors

CA	Culver City, Digilog Devices Inc.	310-915-7346

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2985 E. Hillcrest Dr., Westlake Vl., CA 91362, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski **D•1918-1919, 2210-2211**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Murrieta, Mil-Com Sls., Inc.	714-677-2097
CA	San Diego, Power Assocs.	619-275-0641
CA	Santa Clara, Integrated Tech. Sls.	408-727-3408
CO	Bloomfield, Summitwest Mktg., Inc.	303-460-9600
FL	Land O' Lakes, A.J.'s Power Source, Inc.	813-996-2583
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	312-991-0700
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, Chesapeake Indl. Mktg.	301-653-0476
MI	Lathrup Vl., R. C. Nordstrom & Co.	313-559-7373
MN	Mancato, E. I. Sls.	507-345-5786
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Hampton, Primary Source	603-926-8044
NY	Hauppauge, Aurora-Schmitt	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
PA	Blue Bell, Deltatronics Inc.	215-641-9930
TX	Richardson, Jim Gray & Assocs.	214-699-9976
TX	Richmond, Jim Gray & Assocs.	713-342-1710
UT	Midvale, Arrowhead/CSI	801-561-5688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792
WI	Waukesha, Eagle Tech. Sls.	414-549-3622

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supply	602-275-2626
AZ	Tucson, Dalis Elctrn Supply	602-294-2628
CO	Littleton, Displays Plus, Inc.	303-730-7333
CT	Danbury, Aved Elctrn. Dist., Inc.	203-744-7838
IL	Schaumburg, QPS Elctrns.	312-884-6620
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Andover, Aved Elctrn. Dist., Inc.	508-688-3800
MA	Tewksbury, Armor Elctrns.	508-640-1499
MI	St. Clair Shores, Spemco	313-771-2700
NJ	Pennsauken, Alta Elctrns.	609-488-1442
NM	Albuquerque, Summit Elec. Supp. Co.	505-884-4400
NM	Albuquerque, Walker Elctrn. Supply	505-883-2992
NY	Glen Head, Livera Polk Assocs.	516-759-9300
NY	Rochester, Masline ELctrns.	716-546-5373
OH	Cleveland, Major Elctrns.	216-442-6200
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	El Paso, Midland Wintronic Co.	915-779-8391
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Stafford, Southwest Elctrns.	713-240-4000

SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 510-475-9000, TWX: 910-338-2229, FAX: 510-475-0613; *Sls. Mgr.:* Doug Hall

Local Sales Offices & Reps

CA	Newbury Park, Interconn Tech. Mktg.	714-589-4655
IL	Crystal Lake, Mid America Reps.	815-455-5310
IN	Carmel, Technology Mktg. Corp.	317-844-8462
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, J.L.Montgomery	313-489-0099
TN	Greenville, Lamons Sls. Co.	615-639-8711
TX	Dallas, THT Sls.	214-783-1501

SHIPLEY COMPANY, INC., 2300 Washington St., Newton, MA 02162, Tel: 617-969-5500, FAX: 508-234-4055; *Sls. Mgr.:* Timothy S. Tubergen

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FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021-4799, Tel: 516-466-0911, TELEX: 4758024 **A•2534; B•1180, 1809; C•1457-1459, 1808-1809; D•1064-1065, 1474, 1921**

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SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 708-866-2200, TELEX: 4330191, FAX: 708-886-2279; *Sls. Mgr.:* A.G. Hershner, Dir. of Sls.

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 82239; Empl.: 15; *Sls. Mgr.:* James L. Jamieson, Mktg. VP **D•1371**

Local Sales Offices & Reps

AK	Please Consult Factory, Please Consult Factory	203-481-5721
CA	Burbank, Modco Co.	818-848-2215
CA	San Diego, Qualtronics	619-873-0118
CA	So. San Francisco, Carelli-EMA	415-873-3365
CO	Denver, Nelson Co. Inc.	303-295-1017
CT	Gilman, Adams McGregor Inc.	203-537-3033
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Cary, Bob Burns Assocs.	708-516-3322
IN	Indianapolis, John Sukup Inc.	317-253-5501
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Franklin, D. F. Tobias & Co.	201-751-8680
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Rochester, D. F. Tobias	201-751-8680
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, John Olsen Co.	216-838-0510
PA	Glenshaw, DVS Co.	609-896-1112
SC	Landrum, B.T. Funderburk Inc.	919-846-2373
TX	Dallas, The Crockett Sls. Co.	214-350-3377
Can	Thornhill, Ont., R. C. Kahnert Sls. Ltd.	416-764-2596
Can	Winnipeg, Manitoba, Smith-Patterson & Assocs.	204-885-1376

Local Distributors

AL	Birmingham, ACK Radio Supply	205-322-0588
AZ	Phoenix, Capital Elctrns. Supp.	602-252-5897
AR	Little Rock, Carlton-Bates	501-562-9100
CA	San Francisco, Zack Elctrns.	415-624-1444
CA	San Jose, Quements Elctrns.	408-998-5900
CA	San Rafael, Electronics Plus	415-457-0466
CO	Denver, Fistells Elec. Supp.	303-629-1312
CT	New Haven, Hatry Elctrns.	203-787-5921
IN	East Chicago, Acro Elctrns.	219-397-8681
IA	Des Moines, Radio Trade Supp.	515-288-7237
KY	Louisville, Peerless Elctrn.Eqpt.	502-637-7677
LA	Baton Rouge, Ralph's Elctrn. Supp.	504-344-3761
MO	Kansas City, Elctrn. Supp. Co.	816-931-0250
MO	Kansas City, Walters Indl. Elect. Inc.	1-800-821-5248
NM	Los Cruces, Elctrn. Parts Co.	505-523-4578
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Lima, Hutch & Sons	419-229-8751
OK	Tulsa, Radio Inc.	918-587-9123
PA	Reading, Barbey Elctrns. Corp.	215-376-7451
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
TX	Fort Worth, Allied Elctrns.	1-800-433-5700
TX	Houston, City Elctrns. Supp.	713-621-1060
TX	Houston, Elctrn. Prts. Outlet	713-784-0140
WI	Milwaukee, E.M. Instrs. Inc.	414-272-7799
Can	Willowdale, Ontario, Electro Sonic Inc.	416-494-1666

SIEMENS-B C L MAGNETICS, Siemens Automotive Ltd., 5045 North Service Rd., Burlington, Ont., Canada L7L 5H6, Tel: 416-335-2530, FAX: 416-335-8474; Empl.: 180; *Sls. Mgr.:* Dave Dore

SIEMENS COMPONENTS, INC., 2191 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-980-4568, TELEX: 84-4491

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529, FAX: 201-321-3961; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert

SIENNA TECHNOLOGIES INC., 2535 Pilot Knob Road, St. Paul, MN 55120, Tel: 612-688-6106, FAX: 612-688-2417; Empl.: 18; *Sls. Mgr.:* Deborah L. Bernard; *Dist. Mgr.:* George Doerfler

SIERRA AUTOMATED SYSTEMS & ENGINEERING CORP., 2112 N. Glenoaks Blvd., Burbank, CA 91504, Tel: 818-840-6749, FAX: 818-840-6751; *Sls. Mgr.:* Al Salci

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Valor Electronics

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 30; *Sls. Mgr.:* Stephen R. Ferree; *Dist. Mgr.:* Stephen R. Ferree

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SIERRA SEMICONDUCTOR CORP., 2075 N. Capitol Ave., San Jose, CA 95132, Tel: 408-263-9300, FAX: 408-263-3337

SIERRA WEST POWER SYSTEMS, 2615 Missouri Ave., Bldg. No. 5, Las Cruces, NM 88001, Tel: 505-522-8828, FAX: 505-522-8828; Empl.: 12

SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700, 800-874-7121, FAX: 713-933-9067; FSC No.: 60767; Empl.: 87; *Sls. Mgr.:* K. Johnson

SIGMA PLASTRONICS, INC., P.O. Box 649, Whitmore Lake, MI 48189, Tel: 810-231-2871, FAX: 810-231-2960; Empl.: 3

SIGMAPOWER, INC, FPBSM Industries, Inc., 19060 S. Dominguez Hills Dr., Rancho Dominguez, CA 90220-6404, Tel: 310-884-5200, FAX: 310-635-1956; FSC No.: 55196; Empl.: 150

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193, FAX: 619-283-6526; Empl.: 21; *Sls. Mgr.:* David L. Russell **D•1211**

Local Sales Offices & Reps

AZ	Scottsdale, Allen Sls. Assocs.	602-443-1820
CA	San Carlos, Electronic Engrg. Assoc.	415-593-2189
IL	Elgin, R.K. Elctrns., Inc.	312-695-8552
MA	Wilbraham, N.E.D.T.	413-596-8853
NJ	Parsippany, Creative Tech. Sls.	201-335-7881
EXP	Bristol, England, Wesser Elctrns.	272-571-404
Intl	Palaiseau, France, Salies S.A.	920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 4755 Forge Rd., Colorado Springs, CO 80907, Tel: 719-528-2300, FAX: 719-528-2370; Empl.: 57; *Sls. Mgr.:* Rick Mintle; *Dist. Mgr.:* Sharon McDaniel

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917

SIGNAL SWITCH COMPANY, 1791 Capital St., Ste. F, Corona, CA 91720, Tel: 909-736-5404, FAX: 909-736-5406; FSC No.: 58468; Empl.: 10; *Sls. Mgr.:* Stan Adams .... **B•1479**

Local Sales Offices & Reps

CA	Redlands, Esco Elctrns.	909-335-1444, FAX:909-335-2996
FL	Orlando, E.G. Holmes & Assocs.	407-281-0067
IL	Berkley, ESA Tech. Mktg.	708-544-0120, FAX:708-544-0266
MD	Silver Springs, Instrucom Inc.	301-384-0700, FAX:301-984-6202
MA	Holliston, E.S.I.	508-429-2493,FAX:508-881-4577
NM	Albuquerque, C.T. Carlsberg & Assocs.	505-899-2155,FAX:505-899-2160
NY	Kings Park, E Square Mktg. Assocs.	Voice, FAX:516-544-4788
OH	Cleveland, Leading Edge Elctrn. Sls.	216-232-4946, FAX:216-232-9510
PA	Holland, W.A. Drobile, Inc.	215-364-2501, FAX:215-364-2051
Can	Halifax, N.S., Gates Engrg. Ltd.	902-457-0805

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 908-793-4668, FAX: 908-793-4679; Empl.: 7; *Sls. Mgr.:* W. Kinney

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TRANSFORMER

FAX: 516-239-7208

SIGNAL TRANSFORMER CO., INC., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, Tel: 516-239-5777; FSC No.: 08779; Empl.: 450; *Sls. Mgr.:* John Marino .... **A•2536-2556**

Direct sales only. Inwood, NY 516-239-5777

Local Sales Offices & Reps

Can	Toronto, Ont., Calbrooke Mktg.	416-346-2551

SIGNATRON, A Subsidiary of Meteor Communications Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 25; *Sls. Mgr.:* Joseph T. McNamara

SIGNUM, INC., 80 Hovey Street, Watertown, MA 02172-3356, Tel: 617-926-3566, FAX: 617-926-0333; *Sls. Mgr.:* Thomas DiGennaro

SIGNUM SYSTEMS CORP., 171 E. Thousand Oaks Blvd. No. 202, Thousand Oaks, CA 91360, Tel: 805-371-4608, ESYLNK: ATTMAIL!SIGNUM, FAX: 805-371-4610; Empl.: 15; *Sls. Mgr.:* Don Mull; *Dist. Mgr.:* J. Pennese

SIKAMA INTERNATIONAL, INC., 301 B Donaldson Place, Santa Barbara, CA 93117, Tel: 805-683-6379, FAX: 805-683-6740; Empl.: 10; *Sls. Mgr.:* Len Cardoza; *Dist. Mgr.:* Len Cardoza

SILICONES UNLIMITED, INC., 3939 Roswell Rd., Ste. 250, Marietta, GA 30062, Tel: 404-578-1274, FAX: 404-578-8209

SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804, FAX: 714-893-2570; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Roger Holliday; *Dist. Mgr.:* Louise Toussaint

SILICON POWER CUBE, See Crydom Company

SILICON SENSORS, Old Hwy. 18 East, Dodgeville, WI 53533, Tel: 608-935-2707, TWX: 910-997-0072, FAX: 608-935-2775; FSC No.: 54822; Empl.: 30; *Sls. Mgr.:* Phil Lulewicz

SILICON SYSTEMS INC., 14351 Myford Rd., Tustin, CA 92680, Tel: 714-731-7110, TWX: 910-595-2809

SILICON TRANSISTOR CORP., Katrina Rd., Chelmsford, MA 01824, Tel: 508-256-3321, FAX: 508-250-1046; FSC No.: 07256; Empl.: 200; *Sls. Mgr.:* John J. Flynn; *Dist. Mgr.:* Fred Wheaton

SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, FAX: 514-747-3906; Empl.: 110; *Sls. Mgr.:* Carol Larsen .... **B•1339**

Local Sales Offices & Reps

FL	Tampa, Standard Mktg. Inc.	813-933-5833
IL	Crystal Lake, Komac Entprs. Inc.	815-459-7456
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MD	Ellicott City, Nelson Elctrns. Inc.	410-747-7887
MA	Topsfield, RFC-Elctrns. SLs., Inc.	508-887-8545
MI	Livonia, Amtech Reps.	313-474-8300
NJ	Denville, T. J. Sls., Inc.	201-361-5352
TX	Lewisville, Silonex Inc.	214-317-7585

SILTRONICS LTD., P.O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 110; *Sls. Mgr.:* G. Urban

SIMCO

FAX: 305-233-1990

SIMCO, 21401 SW 127 Ave., Miami, FL 33177, Tel: 305-233-9900, 800-780-9090; Empl.: 15 .... **C•1094-1096**

Local Sales Offices & Reps

CA	San Diego, Qualtronics, Inc.	619-695-0118
CT	Bethel, Instr. Dynamics	203-743-5045
GA	Atlanta, Electro Sls. Inc.	404-394-1122
IL	Cary, Bob Burns & Assocs.	708-516-3322
MD	Baltimore, Muncy Sls. Assocs.	301-484-6376
MA	Wakefield, Instr. Dynamics Inc.	617-245-5100
MN	St. Paul, Heyda-Hanks Assoc.	612-484-8531
NY	Great Neck, F & F Metro Inc.	516-482-4080
OR	Beaverton, Luscombe Eng./NW	206-223-1541
TX	Dallas, Southwest Elctrn. Ind. Inc.	214-690-9881
WA	Bellevue, Luscombe Eng./NW	206-223-1541
WI	Wauwatosa, Larsen Assocs. Inc.	414-258-0529
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, FAX: 215-822-3795; Empl.: 150; *Sls. Mgr.:* Bob Heacock

SIMMONDS PRECISION ENGINE SYSTEMS, BF Goodrich Aerospace, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, FAX: 607-335-5440; Empl.: 650; *Sls. Mgr.:* G. D. Cummings

SIMPSON ELECTRIC CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, FAX: 708-697-2272; Empl.: 550; *Sls. Mgr.:* Brian Gieler/Jack Femmel

SIMTEK CORP., 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920, Tel: 719-531-9444, FAX: 719-531-9481; Empl.: 25; *Sls. Mgr.:* L.D. Hockaday; *Dist. Mgr.:* David Bowers

SIMULEX CORPORATION, 2832-C Walnut Avenue, Tustin, CA 92680, Tel: 714-730-1500, FAX: 714-730-7176; *Sls. Mgr.:* Dave Guss

SINCLAIR RADIO LABORATORIES LTD., 85 Mary St., Aurora, Ont., Canada L4G 3G9, Tel: 416-727-0165, FAX: 416-727-0861; Empl.: 130; *Sls. Mgr.:* J.C. Stratt

SINGER DATA PRODUCTS, INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6500, FAX: 708-860-3672; Empl.: 54; *Sls. Mgr.:* Shelly Kroan .... **D•1107**

Local Sales Offices & Reps

NJ	Haddonfield, Singer Data	609-429-6927

SINOTECH MADE IN CHINA, INC., Technology Communications Group, Inc., 23590 Stafford Hill Drive, West Linn, OR 97068, Tel: 503-638-1000, FAX: 503-638-1002; Empl.: 45; *Sls. Mgr.:* John Vezmar

SIPEX CORP., 22 Linnell Circle, Billerica, MA 01821, Tel: 508-667-8700, FAX: 508-667-8310; FSC No.: 33256; Empl.: 300; *Sls. Mgr.:* Emil Verano, Jack Worthen; *Dist. Mgr.:* Beth Tebbetts

SITCO ANTENNAS DIV.OF SIMPLICITY TOOL CORP., 10330 N.E. Marx St., Portland, OR 97220, Tel: 503-253-2000, FAX: 503-253-2009; Empl.: 18; *Sls. Mgr.:* M. Bureker

S.I. TECH, 901 N. Batavia Ave., Batavia, IL 60510, Tel: 708-232-8640, FAX: 708-232-8677; Empl.: 17; *Sls. Mgr.:* Ramesh Sheth; *Dist. Mgr.:* George Hain .... **B•1229**

Local Sales Offices & Reps

AL	Saraland, Coastal Computer Comm.	205-679-8657
FL	Melbourne, Raynolds & Raynolds	407-259-7000
MA	Holliston, Olson Mktg.	508-429-8066
MN	Hibbing, Minntech Ec.	218-262-5228
NM	Albuquerque, S & S Technlg.	505-298-7177
PA	Canonsburg, Performance Metrics	412-942-3035
TN	Memphis, Professional Technlg.	901-458-1228
WA	Bellevue, Interconnect Tech.	206-462-9508

Local Distributors

AL	Birmingham, Newark Ec.	205-942-4044
AK	Anchorage, Potelcom Supp.	907-274-8525
AR	Little Rock, Carlton Bates	817-293-5558
CA	Los Angeles, Anixter	213-625-7828
CA	San Francisco, Anixter	415-543-6070
CO	Denver, Newark Ec.	303-373-4540
FL	Miami, Newark Ec.	800-631-4608
IL	Chicago, Newark	312-792-8233
IL	Skokie, Anixter	800-243-8344
LA	Baton Rouge, Anixter	504-922-7755
MA	Boston, Anixter	508-682-8870
MI	Detroit, Anixter	313-478-3900
MO	St. Louis, Newark Ec.	314-821-7466
NY	Hauppauge, Manchester Equip. Co.	516-294-5351
OH	Columbus, Hughes-Peters	614-294-6215
PA	Pittsburgh, South-Hills Ec.	800-245-6215
TN	Chattanooga, Horizon Ec.	615-899-8585
TN	Clarksville, Randolph, Hale, Matthews	615-647-2325
TX	Houston, Anixter	713-460-9473
VA	Chantilly, Newark Ec.	703-471-7447
WA	Bellevue, Newark Ec.	206-641-9800
WI	Milwaukee, Anixter	414-355-0222
Can	London, Newark Ec.	519-685-4280
Can	Toronto, Anixter	416-568-8999

SITRONIC GMBH, Weissenwolffstr.14, 4221 Steyregg, Steyregg, Austria, Tel: 732-640-591-0, FAX: 732-640-592-5; Empl.: 8; *Sls. Mgr.:* Ing. Franz Peter Kogl; *Dist. Mgr.:* Mrs. Michaela Eibl

SIVERS IMA AB, 11520 Jefferson Blvd., Culver City, CA 90230, Tel: 213-306-4248, FAX: 213-390-4350; Empl.: 300; *Sls. Mgr.:* Marshall Cleland

SJOBERG, C., & SON, INC., 415 Station St., P.O. Box 3583, Cranston, RI 02910, Tel: 401-461-8220, FAX: 401-467-5446; Empl.: 20

SKB COPORATION, 434 W. Levers Place, Orange, CA 92667, Tel: 714-637-1252, FAX: 714-637-0491; FSC No.: 61302; Empl.: 170; *Sls. Mgr.:* Allan Evavold

SKF CONDITION MONITORING, 4141 Ruffin Rd., San Diego, CA 92123-1841, Tel: 619-496-3400, FAX: 619-496-3546; Empl.: 150

SKO-DIE, INC., 8050 Austin Ave., Morton Grove, IL 60053, Tel: 708-965-1130, FAX: 708-966-0322; FSC No.: 7P145; Empl.: 50; *Sls. Mgr.:* Richard J. Steininger

SKY COMPUTERS, INC., Subsidiary of Analogic Corporation, 27 Industrial Ave., Chelmsford, MA 01824, Tel: 508-250-1920, TELEX: 499-1331, FAX: 508-250-0036; Empl.: 75

SKYDYNE DIV., AAR MFG., 21 River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, 800-428-CASE, FAX: 914-856-8378; Empl.: 110; *Sls. Mgr.:* M. Timney

SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086-9714, Tel: 619-782-3342; FSC No.: 3612,5950,3677,7584,3670,3820; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO, R.E. Phelon Co., 801 Hailey St., Ardmore, OK 73401, Tel: 405-223-4773, TELEX: 697-5577, FAX: 405-226-5757; FSC No.: 05611; *Sls. Mgr.:* T. Medrick .... **D•1325**

SL CORPORATION, 240 Tamal Vista Blvd. No. 110, Corte Madera, CA 94925, Tel: 415-927-1724, FAX: 415-927-2931; Empl.: 40; *Sls. Mgr.:* Christopher Wilson; *Dist. Mgr.:* Christopher Wilson

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FAX: 818-768-8326

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; FSC No.: 08717; Empl.: 25 .... **B•1182-1187**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Montrose, Signal Entprs. Inc.	818-957-0640
CA	Mtn. View, Francisco & Assocs.	415-962-1717
RI	Warwick, Schumacher & Yarrington	401-884-5671

IL	Wheaton, CS Tech Sls.	708-653-8126
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	Shawnee Mission, Microtronics	913-262-1444
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-232-4946
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson Tech Sls.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Canoga Park, AMC Radio Hardware	818-998-2584
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Powell Elctrns.	408-943-9020
CT	W. Hartford, Signal Ctr. Inc.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
CA	Los Angeles, Trebor Elctrns.	213-641-8304
FL	Pompano Beach, Peerless Radio	305-973-4141

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[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

KS	Wichita, Lee Prods.	316-264-2172
MD	Annapolis, Powell Elctrns.	301-880-3355
IL	Arlington, Mar'Lyn Elctrns.	312-364-7880
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-568-5600
OH	Dayton, D & D Packaging Co., Inc.	513-233-8585
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
TX	Austin, The Altair Co.	512-837-4490
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

SLOAN TECHNOLOGY, 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, FAX: 805-965-0522; Empl.: 75; *Sls. Mgr.:* Drew Osterman

SL WABER, INC., 520 Fellowship Rd. Ste. 306, Mt. Laurel, NJ 08054, Tel: 609-866-8888, 800-257-8384, FAX: 609-866-1945; Empl.: 370; *Sls. Mgr.:* Edward Brown

SMART RELAY TECHNOLOGY, INC., 97 Gannet Dr., Commack, NY 11725, Tel: 516-543-7161, FAX: 516-543-7162; *Sls. Mgr.:* Ron Colino

H H SMITH, NT-T Inc., 632 Arch St., Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-1912; Empl.: 300; *Sls. Mgr.:* Larry Zeiser; *Dist. Mgr.:* Larry Zeiser

SMK CORPORATION

FAX: 714-779-2790

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960; FSC No.: 637-7400; Empl.: 219; *Sls. Mgr.:* Gary Redman/ T. Klymenko .... **C•1461**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls. Co.	303-455-1719
GA	Norcross, Electro-Mech.	404-447-6478
IL	Parkridge, Metcom Assocs.	708-696-1490
IN	Indianapolis, John H. Weaver Co.	317-849-1659
IN	Indianapolis, Lat-Tronics	317-846-5788
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	Eden Prairie, PWC Inc.	612-934-1409
NY	Dewitt, Interactive Comp. Sls.	315-445-9600
NC	Raleigh, Electro-Mech	919-790-9300
PA	Flourtown, C.G.M. Inc.	215-233-0333
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Plano, Ram Elctrns.	214-578-5400
WA	Bothel, Quadra Sls. Corp.	206-489-3428
Can	Ottawa, Elctrn. Sls. Profs.	613-567-8547

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Agoura Hills, Cypress Elctrns.	818-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CO	Englewood, Cypress Elctrns.	303-792-5829
CT	Danbury, Pilgrim Elctrns.	203-792-7274
FL	Ft. Lauderdale, Comp. Assocs.	305-733-4100
GA	Smyrna, ERC Parts, Inc.	404-984-0276
IN	Carmel, Altex Elctrns.	317-848-1323
MI	Grand Rapids, EC Elctrns.	616-530-0576
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aero-Space Computer Supps. Inc.	612-884-4725
PA	Essington, Tri-Com, Inc.	215-259-7400
TX	Irving, Cypress Elctrns.	214-255-0065
WA	Bothel, Cypress Elctrns.	206-483-1144
Can	Markham, Ont., Carsten Elctrns.	416-477-7705
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321

S-MOS SYSTEMS, INC., 2460 North First St., San Jose, CA 95131, Tel: 408-922-0200, FAX: 408-922-0238

SMT EAST CORPORATION, 200 Foxborough Blvd., Foxborough, MA 02035, Tel: 800-888-SMT1, FAX: 508-543-3515; Empl.: 55; *Sls. Mgr.:* Steven E. Dutton; *Dist. Mgr.:* Kanan Technologies

SNAPTITE/ALLIED, 6424 W. Ridge Rd., Erie, PA 16506, Tel: 814-838-3190, FAX: 814-833-5439; Empl.: 75; *Sls. Mgr.:* Ed Kindlin

SOFTAID, INC., 8300 Guilford Rd., Columbia, MD 21046, Tel: 410-290-7760, FAX: 410-381-3253; Empl.: 9; *Sls. Mgr.:* Al Saxon

SOLA, 1717 Busse Rd., Elk Grove Village, IL 60007-5666, Tel: 708-439-2800, FAX: 800-626-6269; *Sls. Mgr.:* James Kimball; *Dist. Mgr.:* Brian Crowe

SOLAOYNE DIVISION, Rogers Corporation, 7447 Convoy Ct, San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; Empl.: 76; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 800-952-5302, TWX: 910-997-1921, FAX: 2*3-462-3721; FSC No.: 13222; Empl.: 17; *Sls. Mgr.:* Roy Talley

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981, FAX: 213-678-0103; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 3; *Sls. Mgr.:* Joyce White

SoLiCo/mec
Sorenson Lighted Controls, Inc

FAX: 1-800-275-7092

SOLICO/MEC, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092 .... **B•1812**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Denver, Advent Comps.	303-455-1985
IL	Shiller Park, WRB Inc.	708-678-7888
IN	Fort Wayne, Menze Sls.	219-747-5616
MD	Gaithersburg, Naudin Assoc., Southern, Inc.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Minneapolis, Technical Comps. Grp.	612-561-5556
NJ	Burlington, VDE Elctrns.	609-387-9331
NY	Great Neck, Pacent Engrg.	516-482-4678
NC	Siler City, Crossroads Elctrns.	919-742-2372
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WI	Mequon, WM Bolles Inc.	414-241-3320

Local Distributors

CA	Anaheim, Electro Comps. Distr.	213-628-2844
CA	Covina, Selecta-Switch Inc.	818-967-4123
CA	Freemont, Kea Elctrns.	415-651-2600
CA	Gardena, California Switch & Signal	213-538-9830
CA	Hayward, Electro Comps. Distr.	415-783-5800
CA	Los Angeles, Electric Switchs	213-660-1310
CA	Sunnyvale, Target Elctrncs.	408-733-0384
CA	Tustin, Western Switches & Controls	714-259-8144
CA	Van Nuys, Wes-Garde Compts.	818-786-3724
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Lakeland, Wes-Garde Comps.	813-644-7564
GA	Tucker, CID Inc.	404-491-3143
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Spemco Inc.	313-771-2700
MN	Minneapolis, Carl Berquist Co.	612-835-2322
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
SC	Columbia, Dixie Elctrns. Inc.	803-779-5332
TX	Dallas, Wes-Garde Comps.	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image	414-321-4722

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003-2596, Tel: 201-429-8700, FAX: 201-429-8683; Empl.: 110; *Sls. Mgr.:* Tom Smith, Gen. Sls. Mgr.

SOLID STATE DEVICES, 14849 Firestone Blvd., La Mirada, CA 90638, Tel: 714-670-7734; FSC No.: 30043; Empl.: 200; *Sls. Mgr.:* Sharon Pfifer

Local Sales Offices & Reps

AZ	Parker, Howard Assoc.	303-841-5755
IN	Ft. Wayne, M/S Sls. & Assoc., Inc.	219-436-3023
CA	Los Angeles, Varigon	818-594-5080
CO	Parker, Howard Assoc.	303-841-5755

FL	St. Petersburg, Bolton Assoc., Inc.	813-864-2294
FL	Pompano Bch, Bolton Assocs.	305-975-7245
IN	Greenwood, M/S Sls. And Assocs., Inc.	317-881-0110
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
OH	Dublin, M/S Sls. & Assoc., Inc.	201-288-7400
NJ	Hasbrouck Heights, Comp. Tech. Sls.	201-288-7400
WA	Seattle, J.J. Backer	206-285-1300
Can	Oakville , Ont., Haltronics	800-387-7949

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

Solid State
Optronics, Inc.

FAX: 408-436-1392

SOLID STATE OPTRONICS, 2 North First St., San Jose, CA 95113-1201, Tel: 408-436-1390 ...... **B•1597-1601**

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 708-932-1660, FAX: 708-887-9522

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-863-5946; FSC No.: 21845; Empl.: 275; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Joanne Crumbley ...... **A•2219**

SOLITRON/MICROWAVE, Solitron Devices, Inc., 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-848-4311, Ext.116; FSC No.: 95077; Empl.: 175; *Sls. Mgr.:* Brian Jackson; *Dist. Mgr.:* Brian Jackson ...... **A•2219**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CO	Longmount, Piper Sls. Co.	303-443-5337
CT	Danbury, Phase One	203-791-9042
CT	Washington, Tri-Com Assocs.	203-868-7027
IL	Elgin, R.H.I. Sls. Corp.	708-888-0099
MA	Burlington, Tri-Com Assocs.	617-272-8163
MN	Edina, Gibb Tech. Sls.	612-835-3370
MO	Grandview, R.R. Burton & Assocs., Inc.	816-763-5385
NJ	Marlton, Solitron Dvs., Inc.	609-988-5470
NM	Albuquerque, Piper Sls. Co.	505-828-1300
NY	tappan, Solitron Dvs., Inc.	914-359-5050
NY	Syracuse, PiTronics, Inc.	315-455-7346
OH	Centerville, Solitron Dvs., Inc.	513-438-3308
OR	Beaverton, Quest Mktg., Inc.	503-641-7377
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Plano, Zeus Engnr.	214-423-2027
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Piper Sls. Co.	801-466-9336
WA	Renton, Quest Mktg., Inc.	206-228-2916
Can	Montreal, Que., Cana-Rep Grp., Inc.	514-576-4477

Local Distributors

CA	Burbank, Elmo Semicond.	818-768-7400
CA	Centerville, Koehike Comps., Inc.	513-435-5435
CA	San Jose, All American Semicond., Inc.	408-943-1200
CA	Torrance, All American Semicond., Inc.	213-320-0240
CA	Walnut, 3893004trns. Corp.	714-594-1731
CT	Killingworth, ACI Elctrns. Corp.	203-663-3311
FL	Miami, All American Semicond.	305-621-8282
FL	Sunrise, All American Semicond., Inc.	305-572-7999
MD	Rockville, All American Semicond., Inc.	301-251-1205
MA	Wakefield, All American Semicond.	617-246-2300
MA	Woburn, ACI Elctrns. Corp.	617-935-7230
MN	Eden Prairie, All American Semicond., Inc.	612-944-2151
NJ	Totowa, ACI Elctrns. Corp.	201-812-0507
NY	Mt. Vernon, All American Semicond., Inc.	914-699-2224
NY	Plainview, ACI Elctrns. Corp.	516-293-6630
NY	Ronkonkoma, All American Semicond., Inc.	214-231-5300
TX	Richardson, All American Semicond., Inc.	214-231-5300

SOLTEC CORP., 12977 Arroyo Street, San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, FAX: 818-365-7839; Empl.: 40; *Sls. Mgr.:* Byron G. McIntire

SONICALL, INC., 3288 E. Willow Street, Signal Hill, CA 90806, Tel: 213-490-2143, FAX: 213-490-2145; *Sls. Mgr.:* Frank Handler

SONICOR INSTRUMENT CORP., 100 Wartburg Ave., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494, FAX: 516-842-3389; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., See East Penn Manufacturing

SONOBOND ULTRASONICS INC., Inductotherm Industries, 887 S. Matlack St., West Chester, PA 19382, Tel: 610-696-4710, 800-323-1269, FAX: 610-692-0674; FSC No.: 15882; Empl.: 21; *Sls. Mgr.:* Thomas Walraven; *Dist. Mgr.:* Kyle Kimbro

SONY COMPONENT PRODUCTS CO, Semiconductor Division, 108333 Valley View St., Cypress, CA 90630, Tel: 714-229-4197, FAX: 714-229-4271; Empl.: 120; *Sls. Mgr.:* Chuck Schouw, V.P.; *Dist. Mgr.:* Mark Marrietta

SOPHIA SYSTEMS & TECHNOLOGY, 777 California Avenue, Palo Alto, CA 94304, Tel: 415-493-6700, 800-824-9294, FAX: 415-493-4648

SORENSEN COMPANY, 615 N. Railroad Ave., Paxton, IL 60957, Tel: 800-525-2024, FAX: 217-379-9216; Empl.: 115; *Sls. Mgr.:* Gerald J. Demirjian

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-275-7089, FAX: 1-800-275-7092; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ...... **B•1812**

Local Sales Offices & Reps

CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
CA	San Rafael, Wright Assocs.	415-457-9940
CO	Denver, Advent Comps.	303-455-1985
FL	Tampa, Florida Comp. Sls.	813-873-3622
IL	Schiller Park, W.R.B. Inc.	708-678-7888
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Shawnee Mission, The Mertens Co.	913-432-9323
MD	Gaithersburg, Naudian Assoc. Southern, Inc.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin, Inc.	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-561-5556
MO	Clayton, Mertens Co.	314-993-6600
NJ	Burlington, VDE Elctrns.	609-387-9331
NJ	Hazlet, Pacent Engrg.	908-264-2202
NY	Great Neck, Pacent Eng. Co.	516-482-4678
NC	Siler City, Crossroads Elctrns.	919-742-2372
TX	Dallas, Glidden Electro Equip.	214-341-0610
WI	Mequon, WM Bolles Assoc., Inc.	414-241-3320

Local Distributors

AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Anaheim, Electro Comps. Dist.	213-628-2844
CA	Covina, Selecta Switch	818-967-4123
CA	Freemont, KEA Elctrns.	510-651-2600
CA	Gardena, California Switch & Signal	310-538-9830
CA	Glendale, Minarik Elec. Co.	818-507-6445
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps. Grp.	818-786-3724
CO	Commerce City, Minarik Elec. Co.	303-289-5800
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Wes-Garde Comp. Grp.	813-644-7564
GA	Tucker, CID, Inc.	404-491-3143
IL	Carol Stream, Wes-Garde Comp. Grp.	708-653-1460
KS	Overland Pk., Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Specialities Mfg.	313-771-2700
MN	Minneapolis, Carl Bergquist	612-835-2322
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Nashua, Wes-Garde Comp. Grp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comp. Grp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Valley City, Roberts Elctrns.	216-225-4646
OH	Westerville, Wes-Garde Comps. Grp.	614-885-0319
OR	Portland, Minarik Elec.	503-253-3402
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	San Antonio, Minarik Elec.	512-822-7097
WI	Grafton, Lake-View Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image	414-321-4722

Can	Edmonton, Deskin Sls.	403-466-2106
Can	Montreal, Deskin Sls.	514-331-2860
Can	Ottawa, Deskin Sls.	613-228-1201
Can	Toronto, Deskin Sls.	416-475-1412
Can	Vancouver, Deskin Sls.	604-324-8343
Can	Winnipeg, Deskin Sls.	403-466-2106

SOR, INC., 14685 W. 105th St., Lenexa, KS 66215, Tel: 913-888-2630, TELEX: 4992783, FAX: 913-888-0767; Empl.: 200; *Sls. Mgr.:* Steve Highberger

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 3775-9119, TELEX: 246-6377, FAX: (03) 3775-7092; Empl.: 1150; *Sls. Mgr.:* M. Chiba, Overseas Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Anthony Fischetti

SOUTH AMERICAN DEVELOPMENT CORP., 29 Noxon Rd., Poughkeepsie, NY 12590, Tel: 914-452-1305, FAX: 914-452-2526; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONIC, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 50; *Sls. Mgr.:* John Levyssohn

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000; *Sls. Mgr.:* David Coleman

SOUTHWALL TECHNOLOGIES INC., 1029 Corporation Way, Palo Alto, CA 94303. Tel: 415-962-9111, FAX: 415-967-8713; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.;* Terri Harris, Prod. Mgr.

SOUTHWESTERN NAMEPLATE & MFG. CO., INC., P.O. Box 35, Fourth St., Anna, TX 75003, Tel: 214-231-6663, 214-924-3289, 1-800-331-6600, FAX: 214-924-3090; Empl.: 14

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPECIAL ELECTRIC CO., INC., 3628 W. Pierce St., Milwaukee, WI 53215, Tel: 414-383-6370, TELEX: 910-262-3106, FAX: 414-383-6725; Empl.: 40; *Sls. Mgr.:* F. James Heider

SPECIALIZED PRODUCTS COMPANY, 3131 Premier Dr., Irving, TX 75063, Tel: 214-550-1923, TELEX: 732764, FAX: 214-550-1386; Empl.: 39; *Sls. Mgr.:* Paul Jones

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, FAX: 203-269-5293; Empl.: 72

SPECIALTY COATING SYSTEMS, INC., 5707 W. Minnesota St., Indianapolis, IN 46241, Tel: 317-244-1200, FAX: 317-240-2073; Empl.: 135; *Sls. Mgr.:* Bill Yager

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SPECIALITY ELECTRONICS, INC., 19200 Asheville Hwy., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 80; *Sls. Mgr.:* Tim Smith; *Dist. Mgr.:* Frank Pellatt .... **C•1462-1467; D•1475**

Local Sales Offices & Reps

PA	Lewisberry, Specialty Elctrns., Inc.	717-938-6171, FAX:717-938-5910

SPECO DIV., Components Specialties, Inc., 1172 Rte. 109, P.O. Box 624, Lindenhurst, NY 11757-0624, Tel: 516-957-8700, 800-645-5516, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman/Angela Carolan; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998; *Sls. Mgr.:* Edward F. O'Connor

SPECTRAL INNOVATIONS, 4633 Old Ironsides Dr., Ste. 401, Santa Clara, CA 95054-1807, Tel: 408-727-1314, FAX: 408-727-1423

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-823-6857, FAX: 206-821-3193; FSC No.: 51896; Empl.: 120; *Sls. Mgr.:* Woody Hertzog

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2261, FAX: 508-347-1211; FSC No.: 6V569; Empl.: 150

SPECTRA-PHYSICS LASERS INC., 1330 Terra Bella Ave.,P.O. Box 7013, Mountain View, CA 94039-7013, Tel: 415-961-2550, 800-456-2552, TELEX: 348-488, FAX: 415-969-4084; *Sls. Mgr.:* Bob Turcotte

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Don Trutwin

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

Spectrol®

FAX: 909-923-6765

SPECTROL ELECTRONICS CORP., 4051 Greystone Dr., Ontario, CA 91761, Tel: 909-923-3313; FSC No.: 02111; Empl.: 200; *Sls. Mgr.:* Rob Taflinger; *Dist. Mgr.:* Rob Taflinger .... **A•2119-2121; B•2016-2017**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-536-9775
AZ	Scottsdale, JK Assocs.	602-990-8804
CA	Huntington Beach, West Elctrns. Sls.	714-375-5500
CA	San Diego, Hadden & Assoc.	619-565-9444
CA	San Jose, Silicon Valley	408-432-1967
CO	Denver, West, Inc.	303-477-8180
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, DHR Mktg.	407-331-1199
IL	Naperville, Lancastle Sls.	708-527-1142
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
GA	Duluth, DHR Mktg.	404-564-0529
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NM	Scottsdale, AZ, J.K. Assocs.	602-990-8804
NY	Commack, E.R.A.	516-543-0510
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg.	919-829-1970
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Dayton, Luebbe Sls.	513-438-0490
OH	Westlake, Luebbe Sls.	216-899-0071
OR	Beaverton, Westmark Elctrn., Inc.	503-641-8780
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TN	Nashville, DHR Mktg.	205-722-0440
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Lancastle, Lancastle	414-569-9084
Can	Markham, Deskin Sls.	416-475-1412

Local Distributors

AL	Mobile, Newark Elctrns.	205-471-6500
AZ	Phoenix, Newark Elctrs.	602-864-9905
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Scottsdale, Kent/Shelley-Ragon	602-998-0399
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Fountain Valley, Component Center	714-979-0433
CA	Orange, Newark Elctrs.	714-634-8224
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Largo, Kent/Shelley-Ragon	813-545-0057
GA	Norcross, Newark Elctrns.	404-448-8500
ID	Boise, Newark Elctrns.	208-342-4311
IL	Bensenville, Voyager	312-860-1300
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Rosemont, Advent	708-297-6200
IN	Ft. Wayne, Newark Elctrns.	219-484-0766
IN	Indianapolis, Olive Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Tewksbury, Armor Elctrns.	508-640-1499
MA	Waltham, Newark Elctrns.	617-894-8050
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oakpark, Newark Elctrns.	313-967-0600
MN	Bloomington, Sterling Elctrns.	612-831-2666
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
MN	St.Paul, Gopher Elctrns.	612-483-3322
MO	Independence, Kent/Shelley-Ragon	816-254-3410
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Union, Newark Elctrns	908-851-2290
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Medford, Kent/Shelley-Ragon	516-447-2000
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Akron, Akron Elctrns. Supp.	216-762-8818
OH	Cincinnati, Newark Elctrns.	513-722-8181
OH	Columbus, Electronics Mktg.	614-299-4161
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Altair	918-252-5781
OR	Portland, Radar Elec.	503-232-3401
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	N. Versailles, CMD	412-678-6020
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Newark Elctrns.	615-588-6493
TN	Nashville, Randolph & Rice	615-255-5601
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Houston, Sterling Elctrns.	713-623-3900
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Redmond, Kent/Shelley-Ragon	206-883-7200
WA	Seattle, Radar Electrns.	206-282-2511
WV	Charleston, Newark Elctrns.	304-744-9022
WI	Milwaukee, Newark Elctrns.	414-453-9100

SPECTRON ENGINEERING INC., 255 Yuma Ct., Denver, CO 80223, Tel: 303-733-1060, FAX: 303-733-2432; Empl.: 9; *Sls. Mgr.:* Zdzislav Krzystek

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; Empl.: 70; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840/1-800-274-8888, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 150; *Sls. Mgr.:* David Ross

SPECTRUM CONTROL, INC.

FAX: 814-835-9000

SPECTRUM CONTROL, INC., 6000 West Ridge Rd., Erie, PA 16506, Tel: 814-835-4000; FSC No.: 33095;5733; Empl.: 604; *Sls. Mgr.:* D. Reynolds; *Dist. Mgr.:* D. Zaday .... **A•1677-1679; C•1468**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-880-8050
AZ	Tempe, Westrep	602-820-9932
CA	Huntington Bch., West Elctrn. Sls.	714-375-6500
CA	Mountain View, RF Assocs. North	415-694-4972
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Margate, EPM Corp.	305-977-0331
GA	Atlanta, EMA, Inc.	404-448-1215
IL	Crystal Lake, Spectrum Control, Inc.	815-477-2600
IA	Cedar Rapids, T. L. Dowell & Assoc.	319-393-7920
KS	Overland Park, T. L. Dowell & Assoc.	913-722-4242
MD	Centerville, EMC Technlgsts.	410-758-3510
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, T. L. Dowell & Assoc.	314-849-4234
NJ	Brielle, EMC Technlgsts.	908-223-6699
NY	Victor, EMC Technlgsts.	716-924-1844
NC	Raleigh, EMA, Inc.	919-847-8800
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
TX	Dallas, J.Y. Schoonmaker Co.	214-349-1650
UT	Salt Lake City, Lindberg Co.	801-484-8689
VA	Sterling, EMC Technlgsts.	703-450-7988
WA	Redmond, EMG, Inc.	206-882-0962
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

SPECTRUM CORP., 10048 Easthaven, Houston, TX 77075, Tel: 713-944-6200, 1-800-392-5050(Sls), FAX: 713-944-1290; Empl.: 35; *Sls. Mgr.:* Gary W. Liddell; *Dist. Mgr.:* Jim B. Bishop

SPECTRUM DEVICES, P.O. Box 1586, Sugar Land, TX 77487-1586, Tel: 713-242-6417, FAX: 713-242-6415; FSC No.: 0RNT4; Empl.: 7; *Sls. Mgr.:* Sajid Rafique

SPECTRUM SIGNAL PROC., 250 H st., P.O. Box 8110-25, Blaine, WA 98231-0025, Tel: 1-800-663-8986 (US), 604-421-5422, FAX: 604-421-1764; Empl.: 48; *Sls. Mgr.:* Brian Lowe; *Dist. Mgr.:* Rod Jensen

Local Sales Offices & Reps

CA	Mountain View, Spectrum Signal Processing	415-903-7355
MA	Westborough, Spectrum Signal Processing	800-323-1842,508-366-7355
Can	Burnaby, B.C., Spectrum Signal Processing	800-663-8986,604-421-5422

Local Distributors

CA	Mountainview, Thorson West	415-964-9300

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 749 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-7791, TWX: 910-334-1163, FAX: 805-683-3481; FSC No.: 32464; Empl.: 70; *Sls. Mgr.:* R.L. Waguespack

SPEEDY CIRCUITS, PJC Technologies, Inc., 5332 Commerical Dr., Huntington Bch., CA 92649, Tel: 714-898-4901, FAX: 714-891-0607; Empl.: 36; *Sls. Mgr.:* Jon P. Herkins

Spellman
High Voltage Electronics Corp

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 180; *Sls. Mgr.:* Eric Marko; *Dist. Mgr.:* Eric Marko .... **D•1922-1935**

Local Sales Offices & Reps

Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12; *Sls. Mgr.:* Andrew Richardson

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Ed Danahy

SPRAGUE, 70 Pembroke Rd., Concord, NH 03301, Tel: 603-224-1961, FAX: 603-224-1430 .... **A•1166-1167**

SPRAGUE, Solid Tantalum Capacitors, 678 Main Street, Sanford, ME 04073-0231, Tel: 207-324-4140, FAX: 207-324-7223; *Sls. Mgr.:* Bob Marlowe ... **A•1166-1167**

SPRAGUE, Wet & Foil Tantalum Capacitors, 1600 Curran Hwy., North Adams, MA 01247-3987, Tel: 413-664-4431, FAX: 413-663-5079; *Sls. Mgr.:* Mike Duffy .... **A•1166-1167**

SPRAGUE, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200, 603-883-9774 (Mktg), FAX: 603-880-1910; *Sls. Mgr.:* Phil Brucato

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Martin D. Markson .... **A•1164-1165**

Local Sales Offices & Reps

AL	Huntsville, TMA	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Dana Point, Quattro Sls. Assocs.	714-493-1720
CA	Hermosa Bch., Quattro Sls. Assocs.	310-372-4221
CA	Moorpark, Quattro Sls. Assocs.	805-523-2978
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CO	Englewood, Cain Technlg.	303-220-8118
CT	KSA Connecticut	203-524-5849
FL	Deerfield, TMA	305-427-1090
FL	Largo, TMA	813-531-4405
FL	Winter Park, TMA	407-671-2245
GA	Norcross, TMA	404-446-3565
IL	Wood Dale, B.N.I. Elctrns.	708-595-9210
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Roeland Park, M.S.B. Assocs.	913-432-2131
MD	Manchester, Imagitron Sls.	410-374-5600
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Imagitron Sls. Co., Inc.	800-638-3592
NM	Albuquerque, SSA of New Mexico	505-889-2901
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Johnson City, Upstate Engrg. Sls.	607-729-0827
NY	Melville, R F Elctrns. Sls. Co. Inc.	516-420-8890
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Raleigh, TMA	919-872-5104
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-582-0003
OH	Stow, Stegman Blaine Mktg.	216-688-6421
OH	Vandalia, Stegman Blaine Mktg.	513-890-7975
OK	Tulsa, Delta Comps.	918-592-7711
OR	Beaverton, Harry Levinson Co.	503-690-1312
TX	Seagoville, Delta Comps.	214-287-6333
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Waukesha, BNI Elctrns.	414-784-3544
PR	Caroline, Elctrn. Sls. Assocs.	809-762-6459
Can	Halifax, Norgay Entprs.	902-864-4321
Can	Montreal, Norgay Entrps.	514-932-3233
Can	Ottawa, Norgay Entprs.	613-745-4051
Can	Toronto, Ont., Norgay Entprs.	416-234-8966
Can	Vancouver, Norgay Entprs.	604-940-8988

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-891-8885
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	San Diego, TTI, Inc.	619-748-2025
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, TTI, Inc.	303-429-6806
CT	Wallingford, TTI, Inc.	203-284-7474
FL	Ft. Lauderdale, Bros. Elctrns. of FL	305-561-6700
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Schaumberg, TTI Inc.	708-884-6500
IN	Indianapolis, Meunier Elctrns., Supp.	317-635-3511
MD	Columbia, TTI, Inc.	301-995-1331
MA	Wilmington, TTI, Inc.	508-658-4700
MN	Minnetonka, TTI, Inc.	612-933-8555
NJ	Fairfield, Tri Start Elctrns.	201-227-3500
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NY	Ronkonkoma, TTI, Inc.	516-737-2000
OH	Dayton, TTI Inc.	513-898-8330
OH	Independence, TTI Inc.	216-328-9755
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Garland, J & S Elctrns. Inc.	214-487-8808
WA	Redmond, TTI, Inc.	206-882-0291
WA	Seattle, Kam Elctrns.	206-382-1300
Can	Toronto, Ont., Norgay Entprs. Ltd.	416-234-8966

S-PRODUCTS INC., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-331-9546, FAX: 203-335-2723; Empl.: 4

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 708-397-2600, FAX: 708-397-8814; Empl.: 17,000; *Sls. Mgr.:* D. Pugh, Sls. VP; *Dist. Mgr.:* K. Fairleigh, Distbn. Mktg. & Sls. VP

SQUARE D COMPANY, 1700 Sunshine Drive, Clearwater, FL 34625, Tel: 813-447-2511, FAX: 813-447-4662; Empl.: 175; *Sls. Mgr.:* Nick Powers

SQUARE D. COMPANY, Control Products, Hwy 64 East, Knightdale, NC 27545, Tel: 919-266-3671, FAX: 919-266-8393; Empl.: 900

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-265-0856; FSC No.: 21441

SRT ELECTRO-OPTICS, INC., 756 Tom Martin Drive, Birmingham, AL 35211, Tel: 205-916-2929, FAX: 205-916-2903; Empl.: 35

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, FAX: 315-638-0333; Empl.: 250; *Sls. Mgr.:* D. Carroll

S SQUARED ELECTRONICS, formerly ComTech Systems, Inc., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

STACKBIN CORP., 29 Powder Hill Rd., PO Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 50; *Sls. Mgr.:* Lisa Porazzo; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-0272, FAX: 814-837-0277; *Sls. Mgr.:* G.A. Olson, Mgr. Sls. & Mktg.

STACO, INC., See Staco Transpower Components Corp. of America

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Don Ruther .... **A•2535; D•1936**

Local Sales Offices & Reps

CA	Mtn. View, Westech	415-961-1422
CO	Denver, EDS	303-871-8865
FL	Maitland, Hawkins Frederickson	407-831-2474
GA	Atlanta, Millar	404-634-3350
IL	Chicago, Saffro	708-299-7680
MA	Lexington, Hathaway	617-861-7010
MI	Detroit, R.C. Nordstrom	313-559-7373
MO	St. Louis, Dowell	314-849-4234
NY	Clarence, R.W. Mitscher	716-759-2350
NY	Northport, LSC	516-266-5020
NC	Raleigh, Millar	919-828-8840
OH	Cleveland, Depco	216-442-6200
OR	Hillsboro, Turn-A-Round	503-640-4661
PA	Philadelphia, ECSC	215-825-8610
Can	Scarborough, Decade	416-439-9921

Local Distributors

AL	Birmingham, JLS	205-322-2486
CA	San Francisco, Stevens Engrg.	415-588-9200
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Wallingford, Sager Elctrn. Supp.	203-265-4600
FL	Miami, Elctrn. Equip.	305-526-6060
FL	Tampa, EMSCO	813-253-2684
GA	Atlanta, Cleveland Elec.	404-696-4550
HI	Honolulu, Victor Kim	808-841-6266
IL	Chicago, Newark Elctrns.	312-792-8233
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
KY	Louisville, Peerless	502-637-7674
LA	Lafayette, Ralph's	318-234-4507
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Somerville, Electro Sls.	617-666-0500
MI	Madison Hgts., Galco	313-542-9090
MN	Minneapolis, Elctrn. Center	612-378-2442
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	St. Louis, Van Sickle Ind.	314-621-5000
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Dayton, Stotts Friedman Elctrns.	513-298-5555
PA	Drexel Hill, Kass Elctrns.	215-449-2300
SC	Charleston, Wholesale Elctrns.	803-722-2634
TN	Knoxville, Indl. Elctrns.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5602
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	San Antonio, Sherman Elctrns.	210-224-1001
VA	Charlottesville, VA Elctrns.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Decade Elctrns.	416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 80; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, Components Corp. of America, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, FAX: 618-263-3150; FSC No.: 83008; Empl.: 75; *Sls. Mgr.:* Lori Jeffries

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAG MICROSYSTEMS INC., 1600 Wyatt Drive, Santa Clara, CA 95054, Tel: 408-988-1118, 1-800-227-8836, FAX: 408-988-1232; Empl.: 120; *Sls. Mgr.:* Bob Herriford; *Dist. Mgr.:* Bob Herriford

STAINLESS, INC., 210 S. 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Owen F. Ulmer

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Local Sales Offices & Reps

AL	Athens, E.M.F.	205-233-2947
AZ	Scottsdale, Suntech Sls.	602-860-8262
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
CT	Waterbury, Cannon Assocs.	203-597-0240
FL	Tampa, Uni-Rep	813-681-3477
GA	Atlanta, E.M.F.	404-948-6023
IL	Chicago, Joel Wasserman Assocs.	708-256-3566
IN	Indianapolis, Century Tech. Sls.	219-329-0447
IA	Cedar Rapids, Lowell Kangas	319-362-9290
KS	Shawnee, Lowell Kangas	913-631-3515
MD	Sykesville, D.J.C.	301-795-7020
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell Kangas	314-821-4050
NH	Nashua, Cannon Assoc.	603-598-4766
NM	Albuquerque, Marino Elec.	505-292-0007
NY	Rochester, Senntec	716-425-3954
NC	Lillington, E.M.F.	919-867-6221
OH	Beachwood, Elctrn. SalesMasters	216-831-9555
OR	Beaverton, Temper Tech.	503-292-8201
PA	Philadelphia, D.J.C.	215-334-4533
RI	Barrington, Cannon Assocs.	401-245-0850
TX	Richardson, Pro-Comp Sls.	214-669-1500

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-675-3133, FAX: 708-675-3709; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, FAX: 818-443-9049; FSC No.: 30149; Empl.: 45; *Sls. Mgr.:* Kathy Allee; *Dist. Mgr.:* Kathy Allee .... **A•1481**

Local Sales Offices & Reps

AZ	Phoenix, Suntech	602-860-8262
CA	Fallbrook, Chilcote Assoc.	619-728-7678
CA	Huntington Beach, Force 1 Sls.	714-963-3949
CA	Sunnyvale, ESCO Assoc.	408-745-1410
FL	Winter Pk., HHP Assoc.	407-740-0320
IN	Ft. Wayne, M/S Sls.	219-436-3023
MI	Grand Rapids, R.P. Urban & Assocs.	616-245-0511
MN	Afton, Real Elctrns.	612-436-1950

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	Carlsbad, Aegis Elctrn. Grp.	619-729-2026
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, Sierra West	408-945-1050
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Largo, Elctrn. Precepts of Fl.	813-544-3636
FL	Melbourne, Dove Elctrns.	407-242-6916
GA	Norcross, NRC Elctrns.	404-729-0411
IN	Indianapolis, Mar	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Wyoming, EC Elctrns.	616-530-0576
NV	Las Vegas, Kiesub Elctrns.	702-733-0024
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Fairfield, Tri Start	201-229-3500
NY	E. Setauket, Dove Elctrns.	800-232-9825
NY	Ronkonkoma, TRI Start	516-737-2200
TX	Richardson, Ewing Elctrns.	214-231-6725
VA	Vienna, Dove Elctrns.	703-893-1821

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, FAX: 201-256-2820; Empl.: 26

STANDARD GRIGSBY, INC., FLINT INDUSTRIES, See OakGrigsby, Inc.

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 5190 Old Easton Rd., Danboro, PA 18916, Tel: 215-766-0960, FAX: 215-766-0962; Empl.: 7; *Sls. Mgr.:* Ed Soorikian

STANDARD MAGNETIC CORP., 7231 Garden Grove Blvd., Ste. D, Garden Grove, CA 92641, Tel: 714-379-5671, FAX: 714-379-5673; FSC No.: 51103; Empl.: 20; *Sls. Mgr.:* Satish Jain

STANDARD MICROSYSTEMS, 80 Arkay Dr., Hauppauge, NY 11788, Tel: 516-273-3100, FAX: 516-273-3123; FSC No.: 53848; Empl.: 500

STANDARD REFERENCE LABS, INC.,, See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St., Rancho Dominguez, CA 90220, Tel: 310-609-1811, 800-326-0006, TELEX: 65-3423, ESYLNK: 62931655, FAX: 310-609-1862; Empl.: 50; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

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STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. .... **A•1290-1295; B•1605, 1810-1811**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-464-0745
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
FL	Lutz, R.W. Mitscher Co.	813-948-2351
FL	Tequesta, R.W. Mitscher Co.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Nielson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
KS	Olathe, G.M. Brown & Assoc.	913-829-3086
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MN	Bloomington, Jay Borman Sls. Co.	612-922-7909
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Woodbridge, Jade Mktg.	201-750-2998
NY	Binghamton, R.W. Mitscher Co., Inc.	607-724-6561
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NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Jade Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-222-5425
WI	Manitowoc, Brainard-Wilson Mktg.	414-682-1201

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STANDISH INDUSTRIES, Standish LCD Div., W7514 Hwy V, Lake Mills, WI 53551, Tel: 414-648-1000; FSC No.: OS145; Empl.: 250; *Sls. Mgr.:* Richard D. Barbieri .... **B•1118**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Boulder, Design Technlg. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Tampa, Bob Dean, Inc.	813-969-2875
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Skokie, Indl. Rep.	708-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, TMC	502-245-7411
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	St. Louis, Rush & West	314-965-3322
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Procomp Sls. Co.	512-331-0800
TX	Hurst, Procomp Sls. Co.	817-589-0336
TX	Richardson, Procomp Sls. Co.	214-669-1500
WI	Brookfield, Indl. Rep.	414-789-9393
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Displays Plus	303-730-7333
CT	Danbury, Heilind Elctrns.	203-797-8600
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Saginaw, Shand Elctrns.	517-753-9900
MN	Minneapolis, Voyager Elctrns.	612-571-7766
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-887-2800
NY	Rome, Rome Elctrns.	315-337-5400
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom	814-476-7774
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Stafford, Harrison Equip.	713-879-2700
TX	Stafford, Southwest Elctrns.	713-240-4000
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Mequon, Taylor Elec.	414-241-4321
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad Elctrns.	613-727-8325
WA	Bellevue, Testco, Inc.	206-454-7422

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95056, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 900; *Sls. Mgr.:* Chuck Frank

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 61; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12

STANLEY

FAX: 714-222-0555

I I STANLEY CO., INC., 2660 Barranca Pkwy., Irvine, CA 92714, Tel: 1-800-LED-LCD1; Empl.: 450; *Sls. Mgr.:* Bill Roth .... **B•1130, 1188-1189**

Local Sales Offices & Reps

AZ	Scottsdale, B.S.E.	602-483-0373
CA	Irvine, Gravley & Assoc., Inc.	714-852-9994
CA	San Jose, Signet	408-453-0611
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Pt., Jack Krutek Assoc.	305-783-2501
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, EMCI	317-921-3450
KS	Overland Park, Mink Assoc.	913-341-8309
MD	Highland, Penn Star Elctrns.	301-854-2308
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MO	Bridgeton, Mink Assoc.	314-291-5454
NJ	Long Valley, Paul Sweeney Co., Inc.	908-852-1434
NY	N. Syracuse, Entec Grp. Inc.	315-458-7936
NC	Greensboro, Arthur, Harris & Assoc., Inc.	919-275-3030
OH	Lexington, EMCI	414-884-3639
PA	Penn Star Elctrns.	301-854-2308

TX	Dallas, Norcom	214-386-4888
UT	Sandy, First Source	801-943-6894

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Hartford, Wesgarde Comps. Grp.	203-527-7705
FL	Lakeland, Wesgarde Comps. Grp.	813-644-7564
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Woodale, NEP Elctrns.	708-595-8500
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, DEE Elctrns. Inc.	319-365-7551
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Future Elctrns.	410-290-0600
MA	Bolton, Future Elctrns.	508-779-3000
MI	Livonia, Future Elctrns.	313-261-5270
MN	Roseville, Chris Elctrns.	612-631-2647
MO	St. Louis, Wesgarde Comps. Grp.	314-567-7776
NH	Nashua, Wesgarde Comps. Grp.	603-880-1971
NJ	Mt. Laurel, Wesgarde Comps. Grp.	609-778-8190
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Concord, Future	704-455-9030
OH	Westerville, Wes Garde Comps.	614-885-0319
OR	Portland, Cypress Elctrns.	503-223-8900
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Houston, Kent Elctrns.	713-789-7770
UT	Murray, Milgray Elctrns.	801-261-2999
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Waukesha, Future Elctrns.	414-786-1884

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 100 Goldstein Drive, Woonsocket, RI 02895, Tel: 401-766-8400, FAX: 401-767-0244; Empl.: 35; *Sls. Mgr.:* John Howley

STANTON MAGNETICS, INC., 101 Sunnyside Blvd., Plainview, NY 11803-1511, Tel: 516-349-0235, FAX: 516-349-0230; Empl.: 300; *Sls. Mgr.:* Ed Maidel; *Dist. Mgr.:* Ed Maidel

STAR CASE MANUFACTURING CO., INC., 648 Superior Avenue, Munster, IN 46321, Tel: 219-922-4440, 800-822-STAR (outside IN), 800-782-CASE (inside IN), FAX: 219-922-4442; Empl.: 75; *Sls. Mgr.:* Veronica Stadden

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OEM DIVISION

FAX: 908-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 908-572-9512; Empl.: 120; *Sls. Mgr.:* Georgia Lombardi; *Dist. Mgr.:* Chris Duffy **D•1068-1071, 1108-1111**

Local Sales Offices & Reps

CA	Burbank, Star Micronics	818-972-1877
IL	Arlington Hgts., Star Micronics	708-670-7222

Local Distributors

CA	Los Angeles, Elec. Switches, Inc.	213-660-1310
CA	Pasadena, MS Cash Drawer	818-792-2111
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Sunnyvale, Penstock Inc.	408-730-0300
CA	Tustin, OBI Dists.	714-258-1411
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Oldsmar, Applied Power	813-854-4004
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Wood Dale, NEP Elctrns.	708-595-8500
IL	Wheeling, Hawk Elctrns. Inc.	708-459-4030
KY	Florence, U R I Elctrns. Inc.	606-371-4423
MD	Middletown, Current Comps.	301-473-5333
MA	Mansfield, Current Comps. Inc.	508-824-7900
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
NJ	Sparta, Instrument & Equip. Co.	201-579-0009
OH	Cincinnati, U R I Elctrns.	513-723-8800
OH	Columbus, Applied Power	614-882-1110
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Dallas, Foxfire Inc.	214-353-9543
WA	Bellevue, Penstock Inc.	206-454-2371
WI	New Berlin, NEP Elctrns. Inc.	414-785-9100
WI	Waukesha, Hawk Elctrns. Inc.	414-547-4457
EXP	Markham, Ont., Birde Mktg. Inc.	416-477-7722
EXP	Vancouver, B.C., Birde Mktg. Inc.	604-431-0426

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR-TRON CORPORATION, 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, FAX: 401-274-3936; Empl.: 27; *Sls. Mgr.:* Joyce D'Orsi

STATEK

FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394; FSC No.: 51791; Empl.: 130; *Sls. Mgr.:* Suzanne Ray; *Dist. Mgr.:* Suzanne Ray **A•1482-1483**

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Phoenix, Eltron	602-266-2164
CA	Long Beach, RD & D Sls.	310-988-1116
CA	Mtn. View, Disman-Bakner	415-969-3010
CO	Englewood, Comp. Sls.	303-779-8060
FL	Palm Habor, Sigma Tech	813-789-5522
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Kokomo, Skyline Sls.	317-452-6500
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MA	Woburn, Radian Assocs.	617-933-7386
MI	Brighton, AP Assoc.	313-229-6550
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NJ	Bellmawr, TAI Corp.	609-778-5353
NY	Endwel, Reagan/Compar	607-754-2171
NY	Rye Brook, Tekmar	914-632-2828
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Cleveland, Omega Sls. Inc.	216-360-9400
OR	Oregon City, Halbar Assoc.	503-656-3714
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Midvale, Comp. Sls.	801-561-5099
WA	Redmond, Halbar Assocs.	206-882-0990

Local Distributors

AL	Huntsville, Reptron Elect.	205-722-9500
CA	Orange, Western Micro	714-637-0200
CA	San Diego, Western Micro	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Miami, All American	305-621-8232
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	708-359-5500
IL	Schaumberg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Mt. Vernon, All American	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Redmond, Kent Elect.	206-883-7200

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Thomas S. Hufnagel **A•2020-2027**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Melbourne, Graham Assoc., Inc.	407-773-6631
FL	Palm Bch. Gdns., Graham Assoc., Inc.	407-662-4049
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MA	Newton, NormellAssocs.,Inc.	617-969-5478
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Bellmore, Compar NY, Inc.	516-221-7300
NY	Lewiston, Watmet, Inc.	716-285-3595
PA	Lansdale, E.L. Assocs.	215-368-8000
TX	Dallas, Merino Sls. Co.	214-233-6002
WA	Bellevue, Mars	206-747-3292
Can	Niagara Falls, Waters Metal Prods., Ltd.	416-374-3050

Local Distributors

CA	Los Alamitos, Semi Dice, Inc.	213-594-4631
MD	Baltimore, RESCO	410-931-8200
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	Red Bank, CHPS, Inc.	908-758-1200
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Port Chester, Zeus Comps.	914-937-7400

THE STAVER COMPANY INCORPORATED

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STAVER CO., INC., 41 Saxon Ave./P.O. Box 220M, Bay Shore, NY 11706-9998, Tel: 516-666-8000; Empl.: 80; *Sls. Mgr.:* Pat Sullivan **B•1119-1123**

Local Sales Offices & Reps

CA	Cathedral City, R D Sls. Corp.	619-324-5044
IL	Wheaton, RMP McBride Corp.	708-462-2500
IN	Sugar Grove, The Manx Co.	708-466-4200
MN	St. Paul, Proud Inds.	612-646-9428
NH	Hancock, Eisenbeis Sls.	603-525-4417
NY	East Northport, Levison Sls. Co.	516-266-5020
NC	New Hill, Tom G. Santel	919-362-4091
OR	Beaverton, Quest Mkgt.	503-641-7377
PA	Montgomeryville, Eastern Scientific Mktg.	215-368-4570
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Dallas, Innovative Tech. Sls.	214-669-3485
TX	Houston, Innovative Tech. Sls.	713-443-0331
WA	Renton, Quest Mkgt.	206-228-2660
WI	Colgate, RMP McBride Sls. Corp.	414-628-4016

STEINEL AMERICA, INC., 15317 Minnetonka Ind. Rd., Minnetonka, MN 55345, Tel: 800-852-4343, FAX: 612-931-3026; *Sls. Mgr.:* Nat Reidel; *Dist. Mgr.:* Jim Stangl

Local Distributors

IL	Addison, Len's Ace Hardware	708-543-8882
MA	N. Andover, Contact East	508-682-9844
MN	Bloomington, K.L. Tannehill, Inc.	612-881-6700
ND	Grand Forks, Acme Elctrc.	701-746-6481
OH	Akron, Philcap Elctrns.	216-253-2109
TX	Ft. Worth, Connector Micro Tooling	817-283-4882
WA	Seattle, Radar Elctrc.	206-282-2511

STEINWALL, INC., 7895 Ranchers Rd. NE, Minneapolis, MN 55432, Tel: 612-571-8202, FAX: 612-572-2031; Empl.: 61; *Sls. Mgr.:* Maureen Steinwall

STENNING INSTRUMENTS, INC., 604 Via Del Oerro, Camarillo, CA 93010, Tel: 805-484-4996, FAX: 805-484-5337; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Darrell Wilburn

STEPHENS ANALYTICAL, INC., 2750 Brabant-Marineau, Montreal, Que., CA H4S 1L1, Tel: 514-332-1230, FAX: 514-335-6566; Empl.: 12; *Sls. Mgr.:* Mr. Alan Lee

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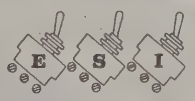

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Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7671
CA	Chatsworth, Western Component Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls.-N.	415-594-1222
CO	Denver, Manufacturers Marketing Corp.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sales Co.	301-374-5600
MA	Lowell, Underwood Sales	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, (Metropolitan) Sterling	516-328-3300
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	208-524-5170

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 708-671-4208, FAX: 708-671-5270; FSC No.: 52763; Empl.: 45; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, FAX: 716-854-3448; Empl.: 70

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140, FAX: 201-672-2837; Empl.: 50; *Sls. Mgr.:* Robert Cantilina

STEWARD, INC., E 36th st., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 250; *Sls. Mgr.:* Don Lepard; *Dist. Mgr.:* Steve Woods

STEWART CONNECTOR SYS., INC., R.D. No. 2 Box 2020, Glen Rock, PA 17327, Tel: 717-235-7512, TELEX: 4977105, FAX: 717-235-7954; Empl.: 196; *Dist. Mgr.:* T. Meighen, Dir. Mktg.(USA) A. McDonald, Dir. Mktg.(Europe) .... **C•1469**

Local Sales Offices & Reps

AL	Huntsville, Comps. Mktg. Svc.	205-881-6699
CA	Dana-Point, PCA	714-493-9822
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Component Prod. Sls. Co., Inc.	303-530-2800
IL	Prospect Hgts., Comms. Equip.	708-506-9000
IL	St. Charles, XYZ Mktg.	708-584-3001
IN	Carmel, Valentine Assocs.	317-846-0008
KS	Parker, S.W. Assocs., Inc.	913-898-6552
MA	Tauton, Focus	508-824-3840
MI	Southfield, Carl H. Schmidt	313-353-6000
MN	Brooklin Center, Combined Sls.	612-566-2724
NJ	Franklin Lakes, Atlantic Tech. Comps., Inc.	201-337-2477
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, D.P. Riggins	704-375-7550
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-6422
PA	Boswell, B.E. Gibson	814-629-6772
PA	Glen Rock, SCS	717-235-7512
TX	Dallas, JYSCO	214-349-1650
VA	Ashland, Glassock Assocs.	804-798-2125
WA	Issquah, Elctrns. Northwest, Inc.	206-557-0851
Can	Campden, Ont., Magden	416-563-5408

Local Distributors

CA	Irvine, Kensington Elctrns.	714-588-0575
CA	Milpitas, Sierra West	408-945-1050
CA	San Jose, Spectra Elctrns.	408-452-1590
IL	Lisle, Comps., Inc.	708-852-7707
MA	Ashland, Quality Comps.	508-881-6504
NH	Atkinson, AEI Astrum	603-898-3399

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Local Sales Offices & Reps

NY	Bayport, Stimpson Co., Inc.	516-472-2000
RI	Cranston, Stimpson Co., Inc.	401-461-7720

Local Distributors

NY	Bayport, Stimpson Co.,Inc.	516-472-2000
RI	Cranston, Stimpson Co.,Inc.	401-461-7720

ST KELTEC CORP., Subsidiary of Signal Technology Corp., 84 Hill Ave., Ft. Walton Beach, FL 32548, Tel: 904-244-0043, FAX: 904-664-0546; FSC No.: 09062; Empl.: 410; *Sls. Mgr.:* Alex Coronis

ST MICROSONICS CORP., Subsidiary of Signal Technology Corporation, 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200, FAX: 617-337-4208; FSC No.: 11869; Empl.: 80; *Sls. Mgr.:* Ken Lambert

ST MICROWAVE CORP., Sub. of Signal Technlg. Corp., 955 Benecia Ave., Sunnyvale, CA 94086, Tel: 408-730-6300, FAX: 408-245-3396,408-733-0254; FSC No.: 27338; Empl.: 208; *Sls. Mgr.:* Paul Thesing

STN INTERNATIONAL C/O CHEMICAL ABSTRACTS SERVICE, 2540 Olentangy River Road, Columbus, OH 43202-1505, Tel: 614-447-3600, TELEX: 810-482-1608, ESYLNK: 614-447-3713; Empl.: 1500; *Sls. Mgr.:* Tom Gornick

STOCK DRIVE PRODUCTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores

Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7071
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Denver, Manufacturer's Mktg.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170

STOCK MODEL PARTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-3300, FAX: 516-326-8827

STOCKO CONNECTORS, Stocko Corporation, 495 Industrial Road, Carlstadt, NJ 07072, Tel: 201-933-4452, FAX: 201-933-4522; Empl.: 34; *Sls. Mgr.:* Rudolf Schindler .... **C•1470-1471**

Local Sales Offices & Reps

AL	Huntsville, E-Squared Mktg.	205-430-3000
CA	San Diego, Cetinske Sls. Co.	619-487-3335, FAX:619-673-0612
CA	Santa Clara, Nova-Tronix	408-729-9530
GA	Lawrenceville, E-Squared Mktg.	404-995-7206
GA	Marietta, E-Squared Mktg.	404-565-2088
KS	Olathe, G.M. Brown & Assocs.	913-829-3086, FAX:913-829-3274
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339, FAX:617-769-8662
MI	Grand Rapids, J.M.J. & Assocs., Inc.	616-285-8887, FAX:616-285-7633
MO	Florissant, G.M. Brown & Assocs.	314-839-3600, FAX:314-839-3601
PA	Pittsburgh, KT Mktg.	412-367-1011, FAX:412-367-2153
TX	Burleson, Bounty Elctrns., Inc.	817-447-9775, FAX:817-447-9706

Local Distributors

MI	Wyoming, EC Elctrns.	616-530-0576, FAX:616-530-8598
MO	St. Charles, Heartland Elctrns.	314-928-6010, FAX:314-447-3416
NJ	Carlstadt, Stocko Connectors	201-933-4452, FAX:201-933-4522
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

ST OLEKTRON CORPORATION, Subsidiary of Signal Technology Corp., 28 Tozer Rd., Beverly, MA 01915, Tel: 508-922-0019, FAX: 508-927-9328; FSC No.: ON8W8; Empl.: 105; *Sls. Mgr.:* Chuck Davis

All Locations for Compucon Distrs. Call 800-426-7746

ST OLEKTRON SYSTEMS, Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, FAX: 508-949-1804; FSC No.: 32252; Empl.: 35; *Sls. Mgr.:* Bill Uffelman

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790-3305, Tel: 516-751-4277, 800-568-4634, FAX: 516-689-6671; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 708-323-9121, FAX: 708-323-9398; FSC No.: 57500; Empl.: 72; *Sls. Mgr.:* Brian J. Holland

STRATOS PRODUCT DEVELOPMENT GROUP, 2025 First Ave., Ste PH-B, Seattle, WA 98121, Tel: 206-448-1388, FAX: 206-448-7830; Empl.: 28

STRAWBERRY TREE, INC., 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-8800, TELEX: 650 3172834 MCI, FAX: 408-736-1041; Empl.: 25

STRONGBOX, P.O. Box 2726, Culver City, CA 90231-2726, Tel: 310-305-8288, FAX: 310-305-1905; FSC No.: 2T043; Empl.: 5; *Sls. Mgr.:* Larry Martinek .... **C•1098-1099**

STRUTHERS-DUNN, INC. AND HI-G CO., INC., Lambs Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, ESYLNK: 622-87939, FAX: 609-589-2619,609-589-2094; FSC No.: 78290; Empl.: 467; *Sls. Mgr.:* Bruce E. Armstrong, V.P. .... **B•1606-1614**

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AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Los Angeles, RD&D	213-666-1611
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	W. Parker, W. Howard Assoc., Inc.	303-841-5755
CT	Bloomfield, Friedman	203-242-7781
FL	Orlando, Comp. Design Mktg.	407-352-5480
GA	E. Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Downers Grove, Bob Burns & Assoc.	312-960-2046
IN	Ft. Wayne, TX Sls.	219-423-3422
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, Advanced Tech. Sls.	913-782-8702
LA	Lafayette, Fralia	318-269-9452
MD	Monkton, Imagitron Sls.	410-374-5600
MI	Southfield, TX Sls.	313-353-8210
MN	Minneapolis, Jay Borman	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, B.S.E.	505-293-2582
NY	Buffalo, Tri-Tech	716-877-3677
OH	Cincinnati, Elctrn Comps.	513-729-1969
OH	Miamisburg, Elctrn. Comps.	513-866-3340
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Bellevue, Eltech, Inc.	206-643-4330

Local Distributors

CA	Santa Ana, Norstan Elctrns., Inc.	714-540-4165
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Associated Aircraft	214-331-4381

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SUBMARINE SIGNAL DIVISION, Raytheon Company, 1847 W. Main Road, Portsmouth, RI 02871, Tel: 401-847-8000, TELEX: 71-6817111, FAX: 401-847-2364; Empl.: 2,300

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FAX: 619-744-6081

SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92079, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413; Empl.: 75 .... **C•1472-1473**

Local Sales Offices & Reps

AZ	Phoenix, TM Entprs.	602-759-9650
AL	Athens, Effective Mktg. Force	205-233-2947
CA	Lacanada, KCP	818-790-1365
CA	Newport Beach, Qual Conn	714-851-6465
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-425-6604
FL	Palm Harbor, Bob Dean, Inc.	813-789-1233
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Randallstown, Chesapeake Inds. Mktg.	410-653-0476
MA	Harvard, Cycle Sls.	508-456-6868
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Louis, M-S-B Assocs., Inc.	314-772-2166
NY	Peconic, HLJ Comp-Tech	516-734-7784
NC	Lillington, Effective Mktg. Force	919-867-6221
OH	Dublin, Sls. Plus	216-942-7811
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Richardson, Comp. Partners	214-644-1288
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Oconomowoc, Artmor Ltd.	414-367-8789

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AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Cypress Elctrns.	602-966-2256
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CA	City of Industry, Ital Elect Sls. Inc.	818-968-8515
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	San Diego, Cypress/RPS Elect.	619-535-0011
CA	San Jose, Sierra W. Elctrns.	408-945-1050
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Engelwood, Cypress Elctrns.	303-792-5829
CO	Littleton, Indelco Inc.	303-795-3431
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Davie, Arco Distrs., Inc.	305-473-2550
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elctrns.	708-691-1100
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, DEE Electrns.	319-365-7551
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M X 4 Elctrns., Inc.	301-252-1192
MA	Canton, Richey/Impact Elect.	508-668-8200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	St. Claire Shore, Spemco	313-771-2700
MN	Bloomington, Bergquist Co.	612-835-2322
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	St. Paul, Kent/Shelley Ragon, Inc.	612-642-2828
MN	Thief River Fls., Digi-Key Corp.	218-681-6674
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NH	Atkinson, Astrum Elctrns.	603-898-3399
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NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Electronic Parts	505-293-6161
NM	Las Cruces, Electronic Parts	505-523-4578
NY	Ithaca, Deanco	607-257-4444
NY	Peconic, Forejay Assocs.	516-734-7760
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Fayetteville, Southeastern Elctrns.	704-523-1122
NC	Hickory, Southeastern Elctrns., Inc.	919-828-2311
OH	Cincinnati, Schuster Elec. Co.	513-489-1400
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elctrns.	215-293-9000
RI	Warwick, Cal-Greg Comps., Inc.	401-738-6170
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5601
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TX	Dallas, Tactic Elctrns.	214-702-6111
TX	Garland, J & S Elctrns.	214-487-8808
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Pflugerville, RSI	512-251-1161
TX	Richardson, Off The Shelf	214-238-0808
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UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annandale, Arcade Elect. Inc.	703-256-4610
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
VA	Virginia Bch., Deanco	804-499-3322
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SUMMAGRAPHICS CORP., 60 Silvermine Rd., Seymour, CT 06483, Tel: 203-881-5400, TELEX: 964348, FAX: 203-881-5367; Empl.: 185; *Sls. Mgr.:* Jim Whitney; *Dist. Mgr.:* George Poland

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SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, FAX: 805-238-0241; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Patrick Banakis

SUNDSTRAND DATA CONTROL, 15001 N.E. 36th St., Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 1500; *Sls. Mgr.:* C. Friesen

SUN ELECTRONIC SYSTEMS, INC., 5307 NW 35th Terr., Ft. Lauderdale, FL 33309, Tel: 305-739-7004, FAX: 305-739-7006; Empl.: 12; *Sls. Mgr.:* Veronica L. Pasqua .... **D•1212-1213**

Local Sales Offices & Reps

CA	San Jose, Woodell Assocs.	408-732-4327

SUNON, 23362 Madero Rd. C , Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Frank Buday

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, FAX: 818-914-1583; FSC No.: 64908; Empl.: 10; *Sls. Mgr.:* Joseph F. Petralia; *Dist. Mgr.:* Joseph F. Petralia

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SUNX SENSORS/IMPORTED BY RAMCO ELECT., 1207 Maple St., West Des Moines, IA 50265, Tel: 515-225-6933, FAX: 515-225-0063; Empl.: 25; *Sls. Mgr.:* Mike Reelitz; *Dist. Mgr.:* Mike Reelitz

SUPERCOMIX INC., 261 Fifth St. East, St. Paul, MN 55101, Tel: 612-222-0046, FAX: 612-222-0049; Empl.: 15; *Sls. Mgr.:* C. Gallo; *Dist. Mgr.:* C. Gallo

SUPERIOR CARBON PRODUCTS, INC., 101 HWY 35, Superior Pl., Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; FSC No.: 68256; Empl.: 71

SUPERIOR ELECTRIC, Warner Electric, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, FAX: 203-584-1483; FSC No.: 58474; Empl.: 500; *Sls. Mgr.:* John Hegel/James Hayden; *Dist. Mgr.:* Michael Miga/Michael Bonney .... **A•2557; B•1308-1309; C•1475**

Local Sales Offices & Reps

MS	Jackson, Doby Assocs.	601-981-1138

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SUPERTEX, INC., 1225 Bourdeaux Drive, Sunnyvale, CA 94088, Tel: 408-744-0100, TWX: 910-339-9388

SUPPORT ELECTRONICS, INC., 52 Roosevelt Ave., Butler, NJ 07405-1367, Tel: 1-201-838-2755, FAX: 1-201-838-2755

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 510-234-9090, TWX: 910-382-8130, FAX: 510-233-8888; Empl.: 30; *Sls. Mgr.:* Nola Sanders; *Dist. Mgr.:* Nola Sanders

SURGEONICS LIMITED, One Sullivan Parkway, Fort Edward, NY 12828, Tel: 518-747-2156, FAX: 518-747-2607; Empl.: 20; *Sls. Mgr.:* R. Thomas

SURON MAAGAN MICHAEL, Kibbutz Maagan-Michael, D.N. Menashe 37805, Israel, Tel: 06-394211, TELEX: 471468 SURON IL, FAX: 063-90296; Empl.: 38; *Sls. Mgr.:* Gershon Peleg

SUSCO ELCTRNS., 61A Carolyn Blvd., Farmingdale, NY 11735, Tel: 516-249-4848, FAX: 516-249-4865

SUTTON DESIGNS, INC., 215 N. Cayuga Street, Ithaca, NY 14850, Tel: 800-326-8119, FAX: 607-277-6983; FSC No.: 6625; Empl.: 24; *Sls. Mgr.:* Mark Miller

SWAN ASSOCIATES, P.O. Box 9424, New Haven, CT 06534, Tel: 203-387-3917, FAX: 203-397-5306; Empl.: 2

SWISS JEWEL COMPANY, 613 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, FAX: 215-922-3055; Empl.: 8; *Sls. Mgr.:* P. N. Steel, Jr.

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SWITCHCRAFT, INC., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389;multiple; Empl.: 600 .... **B•1813; C•1476-1482, 1810-1811**

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CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-340-8535
MA	Merrimac, Switchcraft, Inc. New England Sls.	603-424-4423
FL	Clearwater, Sunland Assoc.	813-536-2955
FL	Lauderhill, Sunland Assoc.	305-748-1303
FL	Oviedo, Sunland Assoc.	407-365-9533
GA	Duluth, New Age Electr.	404-476-0079
IL	Chicago, Switchcraft Inc.	312-792-2700

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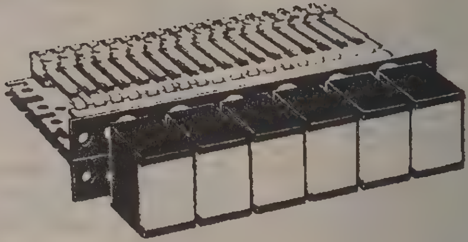

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MN	Minnetonka, Switchcraft, Inc. Minnesota Sls.	612-544-7123
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NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Centereach, Jade Mktg.	516-696-3331
NY	Rochester, Apex Assocs.	716-272-7040
NC	Raleigh, New Age Electr.	919-954-1552
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
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TX	Houston, J. Y. Schoonmaker Co.	713-738-2427
UT	Salt Lake City, Moss Mktg.	801-562-9000
WA	Bellevue, Comtec	206-443-1188
WI	Burlington, Switchcraft	414-763-2100
Can	Toronto, A.C. Simmonds & Sons Ltd.	416-839-8041

SWITCHES UNLIMITED, INC., 34-11 56th St, Woodside, NY 11377, Tel: 718-478-5000, 800-221-0487, FAX: 718-672-6370; Empl.: 20; *Sls. Mgr.:* Douglas King

SWITCHING POWER INC., 3601 Veterans Hwy, Ronkonkoma, NY 11779, Tel: 516-981-7231, TWX: 510-220-1528, FAX: 516-981-7266; Empl.: 200

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FAX: 714-996-2753

SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909, 800-992-7740; Empl.: 85; *Sls. Mgr.:* Guy Lacerte .... **D•1938-1941**

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AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Holder Hauer	602-242-4025
CA	Los Alamitos, Power Specialists	213-594-9418
CA	Placentia, Switching Sys. Intl.	714-996-0909
CA	San Diego, Power Specs.	619-586-1160
CA	San Jose, Nelson Elctrns. Sls.	408-437-9300
CO	Denver, Holder Hauer	303-427-3443
CT	Meriden, Power Conversion Sys.	203-235-4886
FL	Orlando, Hughes Assocs.	305-629-5933
GA	Atlanta, Hughes Assocs.	404-662-1587
IL	Chicago, Utronix	312-834-1100
IL	Elmhurst, Utronix	312-834-1100
MD	Randallstown, Beacon North Inc.	800-877-3747
VA	Sterling, Beacon North, Inc.	703-478-2480
MI	Ann Arbor, Lintott & Assoc.	313-662-1611
MN	Minneapolis, Electro-Serv	612-338-3475
NH	Londonderry, Power Conversion Sys.	603-434-2371
NM	Albuquerque, Holder Hauer	505-888-9614
NY	Rochester, Power Conversion Assocs.	716-426-3598
NY	Spring Valley, Powertronics	914-735-3775
NC	Raleigh, Hughes Assocs.	919-467-7029
PA	Collegeville, Beacon North	215-287-5479
TN	Nashville, Hughes Assocs.	615-871-0908
TX	Garland, Carey, McMahill & Assoc.	214-681-1414
UT	Salt Lake City, Holder Hauer	801-532-2111

Local Distributors

CA	Milpitas, Compumech	408-945-9100

SYGENEX INC., 15446 Bel-Red Rd. Ste. 450, Redmond, WA 98052, Tel: 206-881-5500, FAX: 206-869-2837; Empl.: 8; *Sls. Mgr.:* Mary J. Grubic, Business Mgr.

SYLVANIA AUTOMOTIVE AND MINIATURE LIGHTING, Osram Sylvania, 275 W. Main St, Hillsboro, NH 03244, Tel: 603-464-5533, FAX: 603-464-0259; FSC No.: 88204; Empl.: 850; *Dist. Mgr.:* Tom Izbicki, Sls. Mgr. .... **B•1190-1194**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AR	Little Rock, Cartwright & Bean	901-362-8345
CA	Irvine, English/Damco Sls. Assocs.	714-837-3801
CO	Wheatridge, Cluff & Assocs.	303-425-6604
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Apopka, Cartwright & Bean	407-889-9100
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Skokie, I.R.I	708-967-8430
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R. O. Whitesell	317-457-9127
IA	Cedar Rapids, R. W. Kunz	319-396-5386
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Versailles, R.O. Whitesell & Assocs.	606-873-1182
LA	Covington, Cartwright & Bean	504-892-1780
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NJ	Long Valley, Paul A. Sweeney	908-852-1434
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Electronic Sources Inc.	503-627-0838
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Dallas, Erickson Sales	214-739-5833
TX	Round Rock, Erickson Sls.	512-244-3068
TX	Stafford, Erickson Sales	713-261-5031
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYLVANIA, Emissive Products/Process Heat, Portsmouth Ave., Exeter, NH 03833, Tel: 603-772-4331, FAX: 603-772-9710; Empl.: 200; *Sls. Mgr.:* Joe Stark

SYLVANIA LIGHTING, Sylvania Lighting Center, 100 Endicott St, Danvers, MA 01923, Tel: 1-800-544-4828, 508-777-1900

SYNEKTRON
A TDK GROUP COMPANY

FAX: 503-639-5453

SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090; Empl.: 100 .... **B•1310**

SYNERGY MICROWAVE CORPORATION, 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-8800, FAX: 201-881-8361; FSC No.: 63155; Empl.: 48; *Sls. Mgr.:* Antonio Almeida

SYNERGY SEMICONDUCTOR CORPORATION, 3450 Central Expressway, Santa Clara, CA 95051, Tel: 408-730-1313, FAX: 408-737-0831

SYNETCOM DIGITAL INCORPORATED, 1426 Aviation Blvd. Ste. 101, Redondo Bch., CA 90278, Tel: 310-379-2000; Empl.: 5; *Sls. Mgr.:* Donald Laufer

SYNOPTICS, LTD., Paragon Towers, 233 Needham St, Newton, MA 02164, Tel: 617-527-4461, FAX: 617-527-4084; Empl.: 25; *Sls. Mgr.:* Barbara Finer; *Dist. Mgr.:* Barbara Finer

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Mitchell Corrigan .... **D•1112**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968, Fx:408-356-7249
CA	Murrieta, Mil-Com Sales, Inc.	714-677-2097, Fx:714-677-2096
CA	San Diego, Mil-Com Sales, Inc.	619-275-0641, Fx:619-275-0641
FL	Winter Pk., Carter Assocs.	407-678-5133, Fx:407-678-5251
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810,Fx:708-593-1746
NJ	Butler, General Technlgs.	201-492-1292, Fx:201-492-0051
OH	Aurora, EMA, Inc.	216-562-6104
OH	Aurora, Meta Tech. Sls., Inc.	216-562-8772, Fx:216-562-7129
OH	Centerville, EMA, Inc.	513-433-2800, Fx:513-433-3147
OH	Cleveland, EMA Inc.	216-562-7498
TX	Missouri City, C & L Assocs.	713-499-5541, Fx:713-499-5473
WI	Milwaukee, Coombs Assocs.	414-351-6123, Fx:414-351-6154

Local Distributors

WV	Ravenswood, Valtronics, Inc.	304-273-5356

SYSCON INTL., INC., 1108 So. High St, So. Bend, IN 46601-3796, Tel: 219-232-3900, FAX: 219-287-5916; Empl.: 80; *Sls. Mgr:* Ed Hansen

SYSTEC, INC., 3816 Chandler Dr., Minneapolis, MN 55421, Tel: 612-788-9701, FAX: 612-788-9502; Empl.: 15; *Sls. Mgr.:* Tom Thielen

SYSTEM
GENERAL

FAX: 408-262-9220

SYSTEM GENERAL CORPORATION, 510 South Park Victoria Dr., Milpitas, CA 95035, Tel: 408-263-6667; Empl.: 52; *Sls. Mgr.:* Gary Delucchi; *Dist. Mgr.:* Gary Delucchi .... **A•1717**

Local Sales Offices & Reps

CA	Pleasanton, IFM, Inc.	510-846-0762
NH	Merrimack, Wilson/Reilly Assoc.	603-673-9504
PA	Philadelphia, Austek	215-924-6228
TX	Denton, System General Corp.	817-565-9944

SYSTEMS ALTERNATIVES, 1705 Indian Wood Circle, Maumee, OH 43537, Tel: 419-891-1100, FAX: 419-891-1045; *Sls. Mgr.:* Mark Weihs

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085, FAX: 216-666-7183; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, FAX: 513-426-1984; FSC No.: 14590; Empl.: 1000; *Sls. Mgr.:* Frank Balogh, Jr.

SYSTEMS TESTING, INC., PO Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Ardezzone

SYSTRAN CORP., 4126 Linden Ave., Dayton, OH 45432-3068, Tel: 1-800-252-5601, FAX: 513-258-2729; Empl.: 70; *Sls. Mgr.:* Susan Chicoine

SYSTRON-DONNER INERTIAL DIV., A BEI Electronics Company, 2700 Systron Dr., Concord, CA 94518, Tel: 510-671-6400, TWX: 910-481-9478, FAX: 510-671-6590; Empl.: 370

SYSTRON-DONNER MICROWAVE DIV., 13100 Telfair Ave., Sylmar, CA 91342, Tel: 818-362-9900, FAX: 818-367-4709; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

SYSTRONIX INC., 555 S. 300 East, PO Box 526398, Salt Lake City, UT 84152-6398, Tel: 801-534-1017, FAX: 801-534-1019; Empl.: 4; *Sls. Mgr.:* Bruce Boyes

TABER INDUSTRIES, 455 Bryant St, N. Tonawanda, NY 14120, Tel: 716-694-4000, 800-333-5300, FAX: 716-694-1450; Empl.: 100; *Sls. Mgr.:* Bernie W. Daube

3-D VISIONS, 2780 Skypark Dr., Torrance, CA 90505, Tel: 310-325-1339, FAX: 310-325-1505; Empl.: 8

TAB/MCGRAW-HILL, McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, FAX: 717-794-2080; Empl.: 400; *Sls. Mgr.:* Tim Higgins

TACC INTERNATIONAL CORPORATION, Formulated Resins Grp., Air Station Inds. Pk, Rockland, MA 02370, Tel: 617-878-7015, TELEX: 952123, ESYLNK: 5106015650(TACC INTL CORP), FAX: 617-871-6727; Empl.: 70; *Sls. Mgr.:* Norman G. Harrington

TADIRAN

FAX: 516-621-4517

TADIRAN ELECTRONIC INDUSTRIES, INC., 2 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980; Empl.: 6300; *Dist. Mgr.:* Effie Shoval, Sls. Mgr. .... **D•1477**

Local Sales Offices & Reps

AL	Huntsville, M Squared I (M2I)	205-830-0498
AZ	Reptronix	602-230-2630
AZ	Tempe, Reptronix Ltd.	602-345-4580
CA	Nexus	415-691-1100
CA	Cameron Pk., Parsons Tech. Mktg.	916-676-2025
CA	Los Angeles, Tech. Solutions	818-704-1693
CA	Orange County, Tech. Solutions	714-707-4565
CA	San Jose, Tritech Sls.	408-925-9409
CA	Santa Ana, Technlg. Solutions	714-558-9562
CT	Bloomfield, Friedman Sls. Inc.	203-243-3122
CT	Farmington, SBX Sls. (FSI)	203-676-1880
FL	Melbourne, Photon Sls. Inc.	407-259-8999
GA	Norcross, M Squared I (M2I)	404-447-6124
IL	Palatine, Technology Sls.	708-991-6600
IA	AEM, Inc.	319-377-1129
KS	AEM, Inc.	913-888-0022
MI	Grand Rapids, Urban Assocs., Inc.	616-245-0511
MI	Livonia, Urban Assocs., Inc.	313-421-9150
MN	Tech. Solutions	612-785-9341
MN	St. Louis Pk., Elctrn. Innovators	612-922-2945
MO	AEM, Inc.	314-298-9900
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Mt. Laurel, Paragon Sls. & Mktg.	609-778-1990
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NC	Raleigh, M Squared I (M2I)	919-851-0010
OH	Cleveland, Arthur H. Baier Co.	216-292-7500
OK	T-Tec Sls.	918-747-0522
OK	Broken Arrow, G.M. Brown & Assoc.	918-251-2084
OR	EE Sls.	503-639-3978
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
TX	T-Tec Sls.	817-274-9662
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	El Paso, T-Tec Sls.	915-581-7920
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Houston, T-Tec Sls.	713-578-9666
TX	Richardson, Mil-Rep Assocs.	214-644-6731
VA	Sterling, Beacon North	800-336-3747
WA	EE Sls.	206-883-3374
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374
WI	Milwaukee, Technlg. Sls.	414-964-5015
Can	Mil	403-236-2431
Can	Markham, Ont., Designtronics	416-513-8760
Can	Pt. Claire, Que., Designtronics	514-695-3124
Can	Richmond, B.C., Blakewood Elctrns.	604-273-9910

Local Distributors

AZ	Phoenix, Lynntronics	602-841-3900
CA	Canoga Pk., Powerline	818-887-3337
CA	Costa Mesa, Battery Specialties	714-755-0888
CA	Costa Mesa, House of Batteries	714-548-3968
CA	Huntington Bch., House of Batteries	714-375-0222
CA	Los Angeles, Bell Inds.(Corporate Ofc.)	213-826-3975
CA	Mountain View, Power Source	415-960-0700
CA	Palo Alto, Power Source	415-856-0700
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, JDR MicroDevices	408-559-1200
CA	San Jose, Pioneer Technlgs.	408-954-9100
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Tarzana, Battery Biz	818-774-1678
CA	Van Nuys, Cresta Corp.	818-787-3919
CO	Littleton, AVT	800-537-9602
CT	Oxford, Periphex, Inc.	203-264-3985
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Hialeah, Pro Battery Specs.	305-884-4040
FL	Jacksonville, Sunn Battery	904-353-6452
FL	Tampa, Micro Precision, Inc.	813-854-2816
GA	Decatur, ELS	800-334-5066
GA	Marietta, Synergistics	404-973-2200
IL	Chicago, Newark Elctrns.(Corporate Ofc.)	312-784-5100
IL	Downers Grove, Telecomm. Dvcs.	708-971-3460
IL	Lisle, Jabro House of Batteries	708-964-9358
LA	Lafayette, Mark Avant Sls.	301-232-6609
MD	Gaithersburg, Pioneer Technlgs.(Corporate Ofc.)	301-921-0660
MA	Andover, Generation Elctrns.	508-683-1177
MA	Methuen, Generation Elctrns.	508-683-1177
MI	Grand Rapids, North Coast Comps.	616-452-0800
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Unipower Corp.	612-884-2933
MN	St. Paul, D C Battery Prods.	612-646-7478
MN	St. Paul, Shelly Ragon(Corporate Ofc.)	612-642-2820
NY	Bohemia, Battery Assemblers	516-567-8855
NY	Commack, Bren-Tronics	516-499-5155
NY	Lynbrook, Dantona Inds., Inc.	800-326-8662
NY	Plainview, Micro Connections	516-993-1400
NY	Staten Island, Yakar Sys.	800-783-8181
NC	Pilot Mountain, Progressive Tech., Inc.	919-368-1375
NC	Winston Salem, Progressive Technlgs.	919-761-1375
OH	Cleveland, Pioneer Standard(Corporate Ofc.)	216-587-3600
OH	Columbus, Promark Elctrns.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	Levittown, Aim Elctrns.	215-785-3500
PA	Richboro, Power Comps.	800-628-7029
TX	Ft. Worth, Tandy Consumer Mail	817-390-8273
TX	Houston, Bar-Tec	713-957-4717
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Elect-A-Van	214-231-5351
TX	Spring, Jabro	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
Can	Alberta, Edmonton, Cardinal Elec., Ltd.	403-484-8926
Can	Burnaby, BC, Enercell	604-435-3666
Can	Calgary, AB, Cardinal Elctrns., Ltd.	403-259-6817
Can	Markham, Ont., Semad	416-475-8500
Can	Richmond, BC, Enermax Batteries	604-270-0812
Can	Surrey, BC, Excell Battery Co.	604-591-6588

TA ENGINEERING CO., INC., 1605 School St., Moraga, CA 94556, Tel: 415-376-8500, FAX: 415-376-4977; Empl.: 12

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 708-364-6104, FAX: 708-870-7828; Empl.: 63; *Sls. Mgr.:* Ken Keim

talema

FAX: 314-265-3350

TALEMA ELECTRONIC, INC., P.O. Box 306, Saint James, MO 65559, Tel: 314-265-5500; Empl.: 44; *Sls. Mgr.:* Jeff Goff .... **A•2566-2570**

Local Sales Offices & Reps

AL	Huntsville, Progressive Technlg.	205-551-7770
CA	Campbell, King-Way Assocs. Inc.	408-866-5010
CA	Tarzana, King-Way Assocs., Inc.	818-609-1974
CO	Grand Junction, Krebill Comp. Sls.	303-293-8220
IL	Wheaton, EMTronics, Inc.	312-665-6222
KS	Shawnee, Buckman & Assocs.	913-268-6917
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NH	Hampton, Primary Source	603-926-8044
NY	Commack, R.C. Engrg. Sls.	516-543-3325
OR	Beaverton, Luscombe Engrg.	503-636-6664
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
WA	Bellevue, Luscombe Engrg.	206-643-1463
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

TALIQ CORP., 1277 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-745-0750, FAX: 408-745-1820; Empl.: 100; *Sls. Mgr.:* Bob Simpson

TALTRONICS, Dimetrics, Inc., 404 Armour St., P.O. Box 339, Davidson, NC 28036, Tel: 704-892-8872, FAX: 704-892-4713; Empl.: 3000; *Sls. Mgr.:* Gene Sokolowski; *Dist. Mgr.:* Gene Sokolowski ...... **D•1942-1943, 2313**

Local Sales Offices & Reps

CA	Sunnyvale, Peartech Ind.	408-732-1500
FL	Largo, Electrocraft	813-544-1766
NH	Nashua, Bennetron	603-880-7008
NJ	Medford, The McCoy Grp.	609-953-0770
NY	Jericho, J Squared Mktg.	516-935-3200
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Dallas, Advance Tech. Sls.	214-340-1300

TAMA ELECTRIC CO., LTD., See Raltron Electronics Corp.

tamura

FAX: 909-676-9482

TAMURA CORPORATION OF AMERICA, 43352 Business Park Dr., P.O. Box 892230, Temecula, CA 92589-2230, Tel: 909-699-1270; Empl.: 6000; *Sls. Mgr.:* Steve Fisher; *Dist. Mgr.:* Steve Fisher .... **A•1297-1299, 1610-1611, 2571-2579; D•1479, 1945-1955**

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Avtec/Earl & Assoc.	602-994-3813
CA	Marina Del Rey, Macro Rep Inc.	310-827-5120
CA	San Diego, Varigon San Diego, Inc.	619-576-0100
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Marlborough, Precision Sls., Inc.	203-295-0580
FL	Deerfield Bch., Micro-Elec. Comps. Corp.	305-426-8944
FL	Largo, Micro-Elec. Comps. Corp.	813-393-5011
FL	Winter Springs, Micro-Elctrn. Comps.	407-366-1379
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IL	Park Ridge, Metcom Assoc., Corp.	708-696-1490
IN	Huntington, Elctrn. Reps Inc.	219-356-3513
IN	Indianapolis, Elctrn. Reps Inc.	317-894-1414
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Lexington, Elctrn. Reps Inc.	606-277-0436
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg. Co.	616-791-7370
MN	Edina, Grayden & Flemmer	612-941-1120
MO	St. Louis, Rush & West	314-965-3322
NJ	Lodi, TRC Elctrns.	201-779-8282
NC	Raleigh, Elctrn. Mktg. Assoc.	919-847-8800
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
PA	Allentown, TRC Elctrns.	215-264-4995
TX	Dallas, Marathon Assocs.	214-234-5686
TX	Freeport, Marathon Assocs.	409-233-7026
TX	Houston, Marathon Assocs.	713-495-6495
WA	Redmond, S.E.A. (Sls. & Engrg. Assoc.)	206-883-4999
WA	Vancouver, S.E.A. (Sls. & Engrg. Assoc.)	206-573-5161
WI	West Allis, Metcom Assocs. Corp.	414-476-1300
Can	Pointe Claire, Que., A.R. Gray & Assocs.	514-694-6378

Local Distributors

AL	Birmingham, American Elctrn. Supply	205-942-4656
CA	Manhattan Beach, Prime Electro Prods. Co.	213-379-3642
CA	Santa Clara, Foresight Elctrns.	408-980-9700
CA	Yorba Linda, Target Elctrns., Inc.	714-733-0384
CO	Littleton, Deltex, Inc.	303-779-1611
CO	Littleton, Displays Plus, Inc.	303-730-7333
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Glendale Hgts., Mac Gregor & Co., Inc.	708-469-4080
IL	Grove Vlg., Nu-Way Elctrns., Inc.	708-437-7120
IN	Indianapolis, Meunier Elctrns.	317-635-3511
LA	Houma, Control Genl.	504-872-9002
MD	Burtonsville, U.S. Elctrns., Inc.	301-384-3300
MD	Columbia, Vantage Comps.	410-720-5100
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Acme Elctrns.	612-338-1016
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MN	St. Paul, Power Mation	612-645-0781
MN	St. Paul, Power Motion	612-645-0781
MS	Jackson, Ellington Elctrn. Supp., Inc.	601-355-0561
NJ	Lodi, TRC Elctrns.	201-779-8282
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NY	Syracuse, ADR Technlgs. Inc.	315-437-7087
OH	Centerville, Indl. Prods. Distbg., Inc.	513-435-2086
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
TX	Richardson, The Altair Co.	214-231-5166
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns.	713-351-2255
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Progressive Image, Inc.	414-321-4722

T&W SYSTEMS, INC., See Versacad Computervision Personal CAD/CAM

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Floral Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125; Empl.: 10; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

K.L. TANNEHILL INC., 1210 W. 96th St., Bloomington, MN 55431, Tel: 612-881-6700, FAX: 612-881-0743; Empl.: 21; *Sls. Mgr.:* James Falcone

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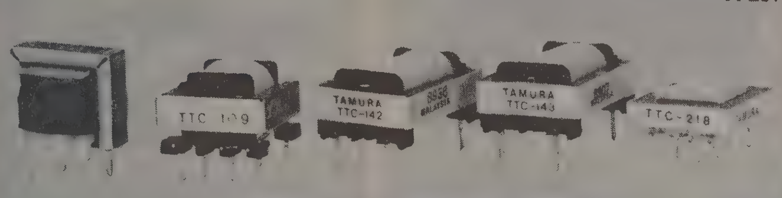
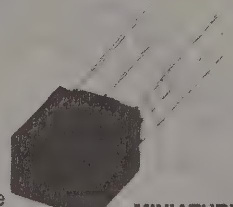
A•2575



TELECOMMUNICATIONS TRANSFORMERS MEET FCC PART 68



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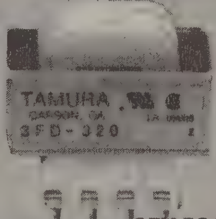
MINIATURE AUDIO & FCC PART 68 COUPLING

A•1299
A•1610

COMMON MODE COILS

See Page
A•2578

SCR/TRIAC TRIGGER TRANSFORMERS



See Page **A**•2576

OEM PC BOARD POWER TRANSFORMERS

See Page **A**•1297

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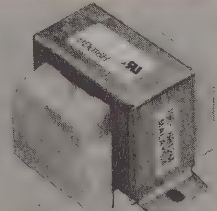

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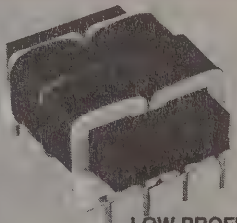

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See Page **A**•2574

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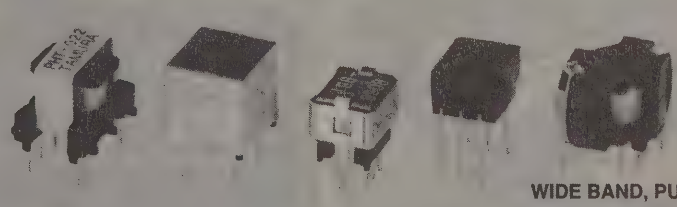

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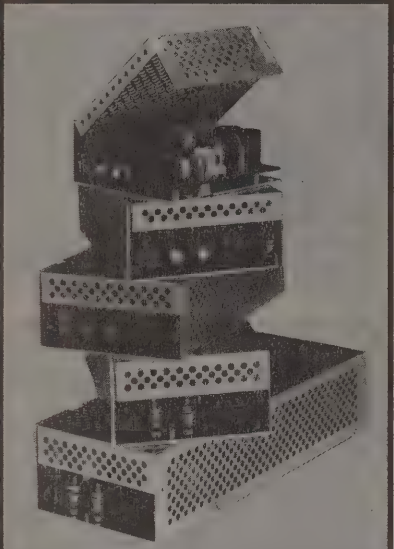
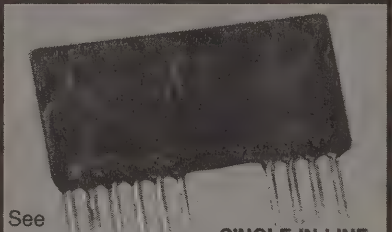


See Page D•1948

SWITCHING POWER SUPPLIES TO 400W



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SINGLE-IN-LINE DC/DC CONVERTERS

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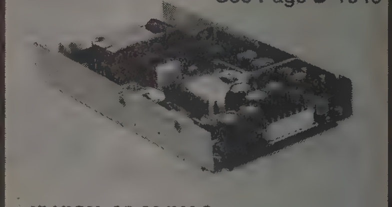

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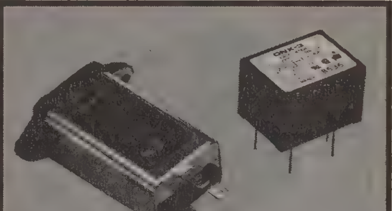

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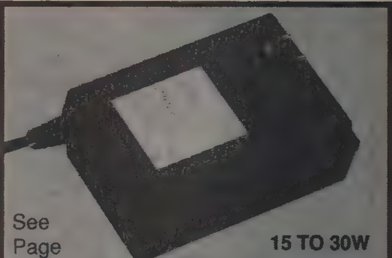


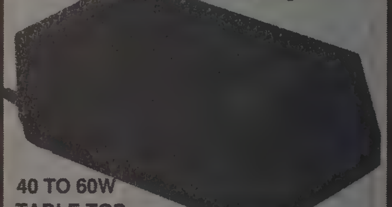
See Page D•1954

15 TO 30W SWITCH-MODE POWER

See Page D•1950, D•1951

SINGLE & MULTI-OUTPUT LINEAR POWER SUPPLIES

See Page D•1954



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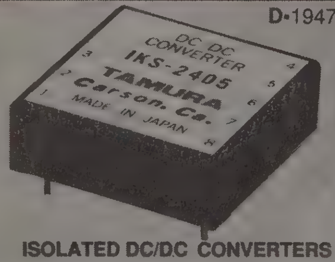
D•1947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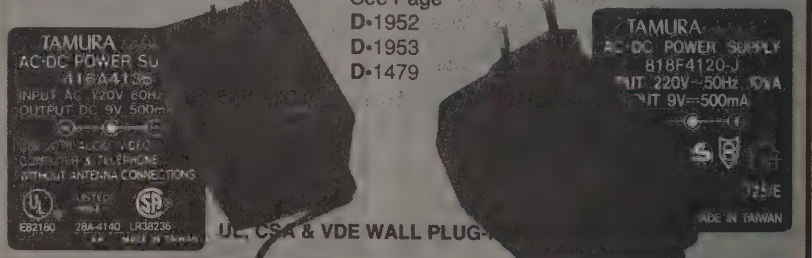
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CA	La Habra, Cygnus Sls. Engrg. Corp.	213-691-2993
CO	Parker, Technlg. Mktg. Assoc.	303-841-3435
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MN	Minneapolis, Intertec Assocs.	612-921-8443
MO	St. Louis, AEM Inc.	314-298-9900
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Irving, Kite Elctrn.	214-986-0321
WA	Kirkland, NorthWest Comp. Sls.	206-828-2104
Can	Guelph, Ont., Victrix, Ltd.	518-836-1480
Can	Ontario, Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

CA	Los Angeles, Cal-State Elctrns.	213-933-8187
CA	Oakland, N. A. D'Arcy	415-638-7773
CT	Bristol, M.L. Assocs., Inc.	203-589-2856
GA	Atlanta, Motion Elctrns.	404-455-8262
IL	Des Plaines, Delta Tech.Prods.	708-803-6070
IN	South Bend, PEI/Genesis	800-523-0727
MD	Baltimore, PEI/Genesis	301-529-2200
MA	Woburn, Abbott Elctrns. Co.	617-935-2040
MI	Dearborn, Industrial Temp. & Control	313-278-2210
MN	St. Paul, Gopher Elctrns. Co.	612-494-4900
NY	Albany, Adirondack Elctrns., Inc.	518-456-0203
NC	Charlotte, Jenkins Elec. Co.	704-392-7371
OH	Dayton, Wright Source	513-293-1341
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-4494
Can	Guelph, Ont., Victrix Ltd.	519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900, FAX: 201-569-5615; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

Local Sales Offices & Reps

AZ	Mesa, Techni-Tool West	602-345-2700
CA	W. Covina, Electra-Tec	818-964-9772
FL	Ft. Pierce, Hyber-Sem	305-464-0461
NJ	Butler, Genl. Techn.	201-492-1292

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, FAX: 215-426-2836; FSC No.: 90095; Empl.: 900; *Sls. Mgr.:* G. Shilling ... **A•1580-1583**

Local Sales Offices & Reps

CA	Livermore, United Techn. Mktg.	415-449-7644
AZ	Phoenix, Detomasi & Grupp	602-947-3724
CA	Mission Hills, Detomasi & Grupp	818-365-8285
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CO	Grand Juction, Krebill Comp. Sls.	303-243-8220
AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
GA	Norcross, Advanced Comps.Mktg.	404-448-7025
IL	Wauconda, Cudahy Sls.	708-526-2484
KS	Parker, S.W. Assocs.	913-898-6552
MD	Baltimore, Callas Elctrns.	301-744-7711
MO	St. Louis, S.W. Assocs., Inc.	314-576-4650
NM	Albuquerque, Quatra Assocs., Inc.	505-296-6781
NY	Jericho, J. Square Mktg.	516-935-3200
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OH	Dayton, The Lyons Corp.	513-278-0714
FL	Seminole, Q-Rep	813-397-8431
OR	Tigard, Vantage Corp.	503-684-0422
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Vantage Corp.	206-455-3460

TECHNO DIVISION, DALE ELECTRONICS, 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Pete Huber; *Dist. Mgr.:* Jon Trabert .... **A•1916, 1925**

TECHNO-ISEL USA DIVISION, Designatronics, 2101 Jericho Tpke. - Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85; *Sls. Mgr.:* Dr. George Klein; *Dist. Mgr.:* Dr. George Klein

TECHNOLOGY DESIGN INC., 10838 Main St., Bellevue, WA 98006, Tel: 206-455-9822, FAX: 206-455-3449; Empl.: 16; *Sls. Mgr.:* Larry Stapleton

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70; *Sls. Mgr.:* Mark S.Jacobus .... **D•1574-1578, 2056-2057, 2070**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	San Diego, Cirolia Elctrns. Sls.	619-743-3015
CA	Santa Clara, W. J. Elect Sls.	408-982-9222
FL	Clearwater, Tech-Rep Assoc.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Heights, Greenslade	708-593-3450
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Topsfield, Whitehead Assoc.	508-887-8050
MN	Minneapolis, Tec Teams Sls.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
NY	Fayetteville, Tri-Tech	315-446-2881
OH	Chagrin, J. J. Bair	216-543-8617
TX	Dallas, Tesco	214-553-1200
UT	Midvale, Christee	801-566-3694
WI	Wauwatosa, Greenslade Sls.	414-258-2727

TECHNOLOGY 80, INC., 658 Mendelssohn Ave. N., Minneapolis, MN 55427, Tel: 612-542-9545, FAX: 612-542-9785; Empl.: 25; *Sls. Mgr.:* Dennis Sherwood

TECHNO SCIENTIFIC INC., 60 Caster Ave., Woodbridge, Ont., Canada L4L 5Y9, Tel: 905-851-9958, FAX: 905-851-6314; FSC No.: 6635; Empl.: 20; *Sls. Mgr.:* Victoria McDonald

TECHRAND CORP. OF AMERICA, 6520 Schamber Dr., Muskegon, MI 49444, Tel: 616-798-2930, FAX: 616-798-2934; Empl.: 40; *Sls. Mgr.:* James Arter

TECHRON.

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 600 .... **D•1019-1021**

Local Sales Offices & Reps

CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Pleasanton, IFM Inc.	510-846-0762
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
IL	Arlington Hgts., Berndt Assocs., Inc.	708-632-0900
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montgomeryville, Eastern Sci-Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 70; *Sls. Mgr.:* Gerald Winters

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 15; *Sls. Mgr.:* James M. Griffith

TECKNIT, 129 Dermody St., Cranford, NJ 07016, Tel: 908-272-5500, TELEX: 6853079 TCKNT, FAX: 908-272-2741; FSC No.: 07700; Empl.: 225; *Sls. Mgr.:* Joseph Barbuto

TECLAB, Kalamazoo Technical Furniture, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-372-6000, 800-832-5227, FAX: 616-372-6116; Empl.: 35; *Sls. Mgr.:* B. Smith .... **C•1105**

TECNETICS, See Computer Products, Inc.

TECNETICS INC., 6287 Arapahoe Ave., Boulder, CO 80303, Tel: 303-442-3837, FAX: 303-444-9437; Empl.: 120; *Sls. Mgr.:* Paula Guadiana

Refer to Tecnetics Inc. 6287 Arapaho Ave. Boulder, CO 80303

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 30; *Sls. Mgr.:* Sandra Murphy

TECTROL INC

SWITCHING POWER PRODUCTS

FAX: 416-638-0553

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 450; *Sls. Mgr.:* Paul Carroll .... **D•1960-1964**

Local Sales Offices & Reps

CA	Granada Hills, Plustronics	818-995-8908
CA	Newport Beach, Plustronics	714-476-8009
CA	San Diego, Mesa Comps.	619-278-8021
CO	Denver, Seale & Assoc., Inc.	303-695-1980
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
IN	Columbus, High-Tech Assocs.	812-378-4835
CT	Bloomfield, Zaslow Sls.	203-242-7781
MA	Natick, Zaslow Sls.	508-393-8150
MN	S.St. Paul, Northport Engrg., Inc.	612-457-8000

NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NY	Ronkonkoma, PMR	516-467-8200
NC	Raleigh, VMI	919-870-7123
OH	Dayton, Tech. Dvcs.	513-890-6811
OK	Tulsa, Tectrol Inc.	918-234-2440
OR	Tigard, Rep-West	503-639-0325
PA	Pittsburgh, Lynn Assocs.	412-443-3670
TX	Arlington, T-Tech Sls.	817-274-0505
WA	Seattle, Rep-West	206-283-8351
Can	Downsview, Ont., Tectrol Inc.	416-630-8108

Local Distributors

CA	Santa Clara, Foresight Elctrns.	408-980-9700

TEGAM, INC., 7230 North Ridge Rd., Madison, OH 44057, Tel: 800-666-1010, FAX: 216-428-1068; Empl.: 50; *Sls. Mgr.:* Terry Gambill

TEKA

an Interplex Industries company

FAX: 401-461-2310

TEKA INTERCONNECTION SYSTEMS, Interplex Industries, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester .... **C•1484-1489**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assocs. S.W. Inc.	602-966-1788
CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	Fullerton, Kent Elctrns.	714-773-0781
CA	Pleasanton, Leddy Assocs., Inc.	510-417-1033
CA	San Diego, Kent Elctrns.	619-271-5404
CA	San Diego, Qualtronics	619-695-0118
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
FL	Orlando, Werndli & Assocs.	407-851-1923
GA	Marietta, Quality Mktg.	404-565-5578
IL	Barrington, Bill Walthall & Assocs.	708-381-3177
MN	Wayzata, Cardinal Sls.	612-475-0041
NY	Hauppauge, Sticom Sls. & Mktg.	516-366-4221
NJ	Mt. Laurel, WYCK Mktg.	609-727-1070
OH	Cincinnati, Century Tech. Sls.	513-677-5088
OR	Beaverton, Norwest Inteconnect Sys.	503-690-7120
RI	Lincoln, Global Technical Sls. Inc.	401-334-3830
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731
EXP	Huntington Beach, Intercation Inc.	714-636-3722
Can	St. Laurent, Que., HHR Electro	514-739-7054

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	San Diego, Deco	619-693-1595
CA	San Jose, Compass Comp.	408-432-7575
CA	San Jose, Spectra Elec.	1-800-252-1590
CA	San Jose, Turbo Elctrns.	408-441-6616
CA	Santa Ana, Norstan Elctrns.	714-540-4165
CA	Santa Clara, Kent Elec.	408-727-9810
CA	Sunnyvale, PSC Elctrns.	408-737-1333
FL	Largo, Elctrn. Precepts of FL	1-800-367-4649, 813-544-3636
MA	Methuen, Aved Elctrns.	508-688-3800
MI	Fraser, Madison Elctrns.	313-294-8300
MN	St. Paul, Kent Elctrns.	612-642-2844
NJ	Cherry Hill, Jetta Corp.	609-663-7272
NJ	Whippany, American Distrs. Inc.	201-428-0510
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, I.P.D., Inc.	513-435-2086
RI	Warwick, Cal-Greg-Comps.	401-738-6170
TX	Allen, Prime Distbn.	214-231-0170
WA	Redmond, Kent Elctrns.	206-241-1980
Can	Burlington, Ont., Alternate Source Comp.	416-335-6385

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKNOR MICROSYSTEMS INC., 31 Blvd. de la Seigneurie Est, Ste. 107, Blainville, Que., CAN J7G 4G6, Tel: 514-437-5682, 800-387-4222, FAX: 514-437-8053; Empl.: 32; *Sls. Mgr.:* Pierre McMaster

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* David Duelfer; *Dist. Mgr.:* David Duelfer

TEKTRONIX, INC., P.O. Box 1000, Wilsonville, OR 97070, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 12,500

TEKTRONIX, INC., Display Products, P.O. Box 500 M/S 46-943, Beaverton, OR 97077, Tel: 503-627-5000, FAX: 503-627-1070

TEKTRONIX-SIGNAL ANALYSIS UNIT, 3003 Bunker Hill Ln, PO Box 58086, Santa Clara, CA 95052-8086, Tel: 408-496-0960, FAX: 408-496-6108

TELCO

TELCO INTERCONTINENTAL CORPORATION

FAX: 713-859-8825

TELCO INTERCONTINENTAL CORP., TECO, 9812 Whithorn Dr., Houston, TX 77095, Tel: 713-855-2218; Empl.: 13; *Sls. Mgr.:* Ruth Haber .... **B•1311; C•1490-1491**

Local Sales Offices & Reps

CA	Lomita, Tech Rep Comps.	310-539-9070, FAX:310-539-0434
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	San Jose, Mc Farland Assoc.	408-993-0200, FAX:408-993-0123
CA	Santa Clara, Suneical Mktg. Co.	408-244-9900
CA	Solana Bch., Carco	619-792-5555
CO	Denver, Motion Technlg.	303-757-3003, FAX:303-757-0616
CO	Erie, ROKC Comps.	303-828-3872
FL	Ft. Lauderdale, Motion Controls	305-434-4197, FAX:305-434-5682
GA	Atlanta, Industrial Apparatus	404-875-8086, FAX:404-875-1506
GA	Kernersville, Wallace Elctrns., Sls.	919-996-2742
IL	Addison, Vikeland Sls.	708-832-8425, FAX:708-832-7251
IL	Chicago, Rendell Sls.	312-539-1820
KS	Overland Pk., Singer Inds. Sls.	913-897-2008
MA	Northborough, Easterly Sls.	508-393-7399
NH	Dover, Pfall Assoc.	603-742-0966, FAX:603-743-3347
NJ	Sussex, Carbone Assoc.	201-875-1882, FAX:201-875-2685
NY	Glen Cove, DynoRep	516-676-1598
OH	Worthington, R J Mktg.	614-888-7638
PA	Willow Grove, Tech Sls. Assocs.	215-784-0170
TX	Austin, Sunbelt Comps.	512-335-0499, FAX:512-331-1351
TX	Burleson, Bounty Elctrns.	817-447-9775
TX	Dallas, Sunbelt Comps.	214-248-8000, FAX:214-248-8100

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20876, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* Harry Sussman

TELE-DENKEN RESOURCES, INC., 7702 FM 1960 East, Humble, TX 77346, Tel: 713-852-5366, TELEX: 4949653, FAX: 713-852-3869; *Sls. Mgr.:* Gary Killian; *Dist. Mgr.:* Gary Killian

TELEDYNE COMPONENTS, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200; *Sls. Mgr.:* Robbie Izat; *Dist. Mgr.:* Nancye R. Beck, Worldwide Distr. Sls. Mgr.

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, 800-759-1844, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

TELEDYNE KINETICS, Div. of Teledyne, Inc., 8650 Balboa Ave., San Diego, CA 92123-1502, Tel: 619-576-1005, FAX: 619-576-0607; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* Peter Kurbikoff

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 310-822-8229, 310-305-0248, TWX: 910-343-7436, FAX: 213-305-0248; FSC No.: 16170; Empl.: 912; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, FAX: 415-966-1521; FSC No.: 24022; Empl.: 200; *Sls. Mgr.:* M. Lee

TELEDYNE PENN-UNION, Solderless Connector Div., One Riverside Dr., Ansonia, CT 06401, Tel: 203-732-7025, TELEX: 963408, ESYLNK: 62877180, FAX: 203-732-0831; FSC No.: 19724; *Sls. Mgr.:* Bob O'Keefe

TELEDYNE PENN-UNION, 229 Waterford St., Edinboro, PA 16412, Tel: 814-734-1631 Ext. 382, FAX: 814-734-4946; *Sls. Mgr.:* Chuck Malay

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 11532; *Sls. Mgr.:* Tom Garland .... **B•1616-1623**

Local Sales Offices & Reps

AL	Huntsville, Elcom	205-830-4001, FAX:205-830-4058
AZ	Scottsdale, Arcom Sls.	602-947-5745, FAX:602-990-1765
CA	Anaheim, Westrep	714-527-2822, FAX:714-527-3868
CA	San Diego, Westrep	619-674-1880, FAX:619-674-1878
CA	San Jose, Meridian-West	408-927-6377, FAX:408-927-6378
CO	Englewood, Thorson Rocky Mtn., Inc.	303-773-6300,FAX:303-773-6302
CT	Stratford, VISTAssociates, Inc.	203-375-5456, FAX:203-375-6907
FL	Longwood, Teledyne Relays	407-682-9044, FAX:407-682-7644
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320, FAX:407-740-0319
GA	Norcross, Elcom	404-447-8200,FAX:404-447-8340
IL	Bloomingdale, Teledyne Relays	708-529-1060, FAX:708-529-1120
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245, FAX:317-845-8440
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576, FAX:319-393-7317
KS	Olathe, C-Tron	913-780-3796,FAX:913-780-3007
MD	Towson, Arbotek Assocs., Inc.	410-825-0775,. FAX:410-337-2781
MA	Marlborough, VISTAssociates, Inc.	508-481-9277, FAX:508-460-1869
MN	Eden Prairie, Stan Clothier Co.	612-944-3456, FAX:612-944-6904
MO	St. Louis, Rothkopf & Assocs., Inc.	314-961-4485, FAX:314-961-4736
NJ	Cherry Hill, Vantage Sls.	609-424-6777, FAX:609-424-8909
NJ	Montville, Teledyne Relays	201-299-7667, FAX:201-299-6998
NM	Albuquerque, Reptronix	505-292-1718, FAX:505-299-1611
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866,FAX:914-664-4928
NY	Syracuse, Hotze & Murcan Assocs.	315-455-8807, FAX:315-455-8810
NC	Asheville, Elcom	704-298-8709,FAX:404-447-834
OH	Dayton, J.C. Hofstetter Co.	513-296-1010, FAX:513-296-1274
OH	Medina, J.C. Hofstetter Co.	216-241-4880, FAX:216-725-4471
OR	Beaverton, Tekrep Inc.	503-626-3759, FAX:503-626-3759
PA	Hickory, J. C. Hofstetter Co.	412-356-2305, FAX:412-356-7303
TX	Austin, Kruvand Assocs., Inc.	512-219-9441, FAX:512-219-1932
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355, FAX:214-680-8854
UT	Salt Lake City, Thorson Rocky Mtn.	801-942-1683, FAX:801-942-1694
VA	Hawthorne, Teledyne Relays	213-777-0077, FAX:213-779-9161
WA	Gig Harbor, Tekrep, Inc.	206-884-5050, FAX:206-884-3170
Can	Mississauga, Ont., G.M.A.	416-671-8111, FAX:416-671-2422

Local Distributors

AL	Huntsville, Pioneer/Alabama	205-837-9300, FAX:205-837-9358
AL	Huntsville, Time Elctrns.	205-721-1133

AZ Tempe, Time Elctrns. 602-967-2000, FAX:602-967-5923
CA Camarillo, Milgray/Los Angeles 805-484-4055, FAX:805-388-8169
CA Hawthorne, Teledyne Relays 213-777-0077, FAX:213-779-9161
CA Irvine, Milgray/Orange County 714-753-1282, FAX:714-753-1682
CA San Diego, Time Elctrns. 619-586-0129, FAX:714-544-2526
CA San Jose, Milgray/San Jose 408-456-0900, FAX:408-456-0300
CA Sunnyvale, Time Elctrns. 408-734-9888, FAX:408-734-1719
CA Tustin, Time Elctrns. 714-669-0100, FAX:714-544-2526
CA Woodland Hills, Time Elctrns. 818-593-8400, FAX:818-593-8484
CO Englewood, Time Elctrns. 303-721-8882, FAX:303-796-0324
CT Milford, Milgray/Conn. 203-878-5538, FAX:203-878-6970
CT Norwalk, Pioneer/Connecticut 203-853-1515, FAX:203-838-9901
FL Altamonte Springs, Pioneer/Altamonte Spgs. 407-834-9090,FAX:407-834-0865
FL Clearwater, Pioneer/Clearwater 813-536-0445, FAX:813-531-5037
FL Deerfield Beach, Pioneer/Deerfield Beach 305-428-8877,FAX:305-481-2950
FL Ft. Lauderdale, Time Elctrns. 305-484-7778, FAX:305-484-7880
FL Orlando, Time Elctrns. 407-841-6565, FAX:407-648-0814
FL Winter Pk., Milgray/Fla. 407-647-5747, FAX:407-629-0757
GA Atlanta, Electro-Air Corp. 404-351-3545, FAX:404-351-9081
GA Duluth, Pioneer/Duluth 404-623-1003, FAX:404-623-0665
GA Norcross, Milgray/Atlanta 404-446-9777, FAX:404-446-1186
GA Norcross, Time Elctrns. 404-368-0969, FAX:404-368-0970
IL Addison, Pioneer/Chicago 708-495-9680, FAX:708-495-9831
IL Bloomingdale, Teledyne Relays 708-529-1060, FAX:708-529-1120
IL Palatine, Milgray/Chicago 708-202-1900, FAX:708-202-1985
IL Schaumburg, Time Elctrns. 708-303-3000, FAX:708-303-3030
IN Indianapolis, Pioneer/Indiana 317-573-0880, FAX:317-573-0979
KS Overland Pk., Milgray/Kansas City 913-236-8800, FAX:913-384-6825
MD Columbia, Milgray/Wash. 301-621-8169, FAX:301-381-3066
MD Columbia, Time Elctrns. 301-964-3090, FAX:301-964-9274
MD Gaithersburg, Pioneer/Gaithersburg 301-921-0660,FAX:301-921-4255
MA Lexington, Pioneer/Mass. 617-861-9200, FAX:617-863-1547
MA Peabody, Time Elctrns. 508-532-9900, FAX:508-532-9989
MA Wilmington, Milgray/New England 508-657-5900, FAX:508-658-7989
MI Grand Rapids, Pioneer Western Mich. 616-698-1800,FAX:616-698-1831
MI Livonia, Pioneer/Mich. 313-525-1800, FAX:313-427-3720
MN Eden Prairie, Pioneer/Twin Cities 612-944-3355, FAX:612-944-3794
MN Edina, Time Elctrns. 612-830-1252, FAX:708-303-3030
MO Manchester, Time Elctrns. 314-230-7500, FAX:314-391-8603
MO St. Louis, Pioneer/St. Louis 314-432-4350, FAX:314-432-4854
NJ Fairfield, Pioneer/NJ 201-575-3510, FAX:201-575-3454
NJ Marlton, Milgray/Delaware Valley 609-983-5010, FAX:609-985-1607
NJ Marlton, Time Elctrns. 609-596-6700, FAX:609-596-4555
NJ Montville, Teledyne Relays 201-299-7667, FAX:201-299-6998
NJ Parsippany, Milgray/New Jersey 201-335-1766, FAX:201-335-2110
NY Binghamton, Pioneer/Binghamton 607-722-9300, FAX:607-722-9562
NY Buffalo, Summit Distrs. Inc. 716-887-2800, FAX:716-887-2866
NY E. Syracuse, Time Elctrns. 315-432-0355, FAX:315-432-8147
NY Fairport, Pioneer/Rochester 716-381-7070, FAX:716-381-5955
NY Farmingdale, Milgray/NY 516-391-3000, FAX:516-420-0685
NY Hauppauge, Time Elctrns. 516-273-0100, FAX:516-273-0037
NY Pittsford, Milgray/Upstate NY 716-381-9700, FAX:716-381-9495
NY Rochester, Summit Distrs. Inc. 716-334-8110
NY Woodbury, Pioneer/Woodbury 516-921-8700, FAX:516-921-2143
NC Charlotte, Pioneer/Charlotte 704-527-8188, FAX:704-522-8564
NC Durham, Pioneer/Durham 919-544-5400, FAX:919-544-5885
NC Raleigh, Milgray/Raleigh 919-790-8094, FAX:919-872-8851
OH Cleveland, Milgray/Cleveland 216-447-1520, FAX:216-447-1761
OH Cleveland, Pioneer/Cleveland 216-587-3600, FAX:216-663-1004
OH Columbus, Time Elctrns. 614-794-3301, FAX:708-303-3030
OH Dayton, Pioneer/Dayton 513-236-9900, FAX:513-236-8133
OR Beaverton, Time Elctrns. 503-626-2979, FAX:206-820-1088
PA Horsham, Pioneer/Horsham 215-674-4000, FAX:215-674-3107
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300, FAX:412-963-8255
TX Austin, Pioneer/Austin 512-835-4000, FAX:512-835-9829
TX Austin, Time Elctrns. 512-346-7346, FAX:512-346-7527
TX Dallas, Milgray/Dallas 214-248-1603, FAX:214-248-0218
TX Dallas, Pioneer/Dallas 214-386-7300, FAX:214-490-6419
TX Houston, Pioneer/Houston 713-495-4700, FAX:713-495-5642
TX Richardson, Time Elctrns. 214-644-4644, FAX:214-644-6668
TX Stafford, Milgray/Houston 713-240-5360, FAX:713-240-5404
UT Murray, Milgray/Utah 801-261-2999, FAX:801-261-0880
UT W. Valley, Time Elctrns. 801-973-8494, FAX:801-973-7418
WA Kirkland, Time Elctrns. 206-820-1525, FAX:206-820-1088
WI Brookfield, Pioneer/Wisconsin 414-784-3480, FAX:414-784-8207
Can Mississauga, Ont., Milgray/Toronto 416-678-0958, FAX:416-678-1213
Can Mississauga, Ont., Time Elctrns. 416-672-5300, FAX:416-672-5304
Can Pointe Claire, Milgray/Montreal 514-426-5900, FAX:514-426-5836

TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, FAX: 715-229-2124; *Sls. Mgr.:* Harry Brebaugh

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174, FAX: 619-560-1147; Empl.: 250; *Sls. Mgr.:* J.E. Wallin

TELEDYNE SOLID STATE

FAX: 213-779-9161

TELEDYNE SOLID STATE, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 63745; *Sls. Mgr.:* Tom Garland **B•1616-1623**

Local Sales Offices & Reps
AL Huntsville, Elcom 205-830-4001, FAX:205-830-4058
AZ Scottsdale, Arcom Sls. 602-947-5745, FAX:602-990-1765
CA Anaheim, Westrep 714-527-2822, FAX:714-527-3868
CA Hawthorne, Teledyne Solid State 213-777-0077, FAX:213-779-9161
CA San Diego, Westrep 619-674-1880, FAX:619-674-1878
CA San Jose, Meridian-West 408-927-6377, FAX:408-927-6378
CT Stratford, VISTAssociates, Inc. 203-375-5456, FAX:203-375-6907
FL Winter Pk., HHP Assocs., Inc. 407-740-0320, FAX:407-740-0319
GA Norcross, Elcom 404-447-8200,FAX:404-447-8340
IL Bloomingdale, Teledyne Solid State 708-529-1060, FAX:708-529-1120
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245, FAX:317-845-8440
IA Cedar Rapids, Stan Clothier Co. 319-393-1576, FAX:319-393-7317
KS Olathe, C-Tron 913-780-3796,FAX:913-780-3007
MD Towson, Arbotek Assocs., Inc. 410-825-0775, FAX:410-337-2781
MA Marlborough, VISTAssociates, Inc. 508-481-9277, FAX:508-460-1869
MN Eden Prairie, Stan Clothier Co. 612-944-3456:FAX:612-944-6904
MO St. Louis, Rothkopf & Assocs. 314-961-4485, FAX:314-961-4736
NJ Cherry Hill, Vantage Sls. Co. 609-424-6777, FAX:609-424-8909
NJ Montville, Teledyne Solid State 201-299-7667, FAX:201-299-6998
NM Albuquerque, Reptronix 505-292-1718, FAX:505-299-1611
NY Mount Vernon, Friedman-Smith Elctrns. 914-664-4866,FAX:914-664-4928
NY Syracuse, Hotze & Murcan Associates 315-455-8807,FAX:315-455-8810
NC Asheville, Elcom 704-298-8709,FAX:404-447-8340
OH Dayton, J. C. Hofstetter Co. 513-296-1010, FAX:513-296-1274
OH Medina, J. C. Hofstetter Co. 216-241-4880, FAX:216-725-4471
OR Beaverton, Tekrep, Inc. 503-626-3759, FAX:503-626-3759
PA Hickory, J. C. Hofstetter Co. 412-356-2305, FAX:412-356-7303
TX Austin, Kruvand Assocs., Inc. 512-219-9441, FAX:512-219-1932
TX Dallas, Kruvand Assocs., Inc. 214-437-3355,FX, 214-680-8854
WA Gig Harbor, Tekrep Inc. 206-884-5050, FAX:206-884-3170

Local Distributors
AL Huntsville, Pioneer/Alabama 205-837-9300, FAX:205-837-9358
AL Huntsville, Time Elctrns. 205-721-1133
AZ Tempe, Time Elctrns. 602-967-2000, FAX:602-967-5923
CA Camarillo, Milgray/Los Angeles 805-484-4055, FAX:805-388-8169
CA Hawthrone, Teledyne Solid State 213-777-0077, FAX:213-779-9161
CA Irvine, Milgray/Orange Ctny 714-753-1282, FAX:714-753-1682
CA San Diego, Time Elctrns. 619-586-0129, FAX:714-544-2526
CA San Jose, Milgray/San Jose 408-456-0900, FAX:408-456-0300
CA Sunnyvale, Time Elctrns. 408-734-9888, FAX:408-734-1719
CA Tustin, Time Elctrns. 714-669-0100, FAX:714-544-2526
CA Woodland Hills, Time Electronics 818-593-8400, FAX:818-593-8484
CO Englewood, Time Elctrns. 303-721-8882, FAX:303-796-0324
CT Milford, Milgray/Conn. 203-878-5538, FAX:203-878-6970
CT Norwalk, Pioneer/CT 203-853-1515, FAX:203-838-9901
FL Altamonte Spgs., Pioneer/Altamonte Spgs. 407-834-9090,FAX:407-834-0865
FL Clearwater, Pioneer/Clearwater 813-536-0445, FAX:813-531-5037
FL Deerfield Bch., Pioneer/Deerfield Bch. 305-428-8877,FAX:305-481-2950
FL Ft. Lauderdale, Time Elctrns. 305-484-7778, FAX:305-484-7880
FL Orlando, Time Elctrns. 407-841-6565, FAX:407-648-0814
FL Winter Pk., Milgray/Fla. 407-647-5747, FAX:407-629-0757
GA Atlanta, Electro-Air Corp. 404-351-3545, FAX:404-351-9081
GA Duluth, Pioneer/Duluth 404-623-1003, FAX:404-623-0665
GA Norcross, Milgray/Atlanta 404-446-9777, FAX:404-446-1186
GA Norcross, Time Elctrns. 404-368-0969, FAX:404-368-0970
IL Addison, Pioneer/Chicago 708-495-9680, FAX:708-495-9831
IL Bloomingdale, Teledyne Solid State 708-529-1060, FAX:708-529-1120
IL Palatine, Milgray/Chicago 708-202-1900, FAX:708-202-1985
IL Schaumburg, Time Elctrns. 708-303-3000, FAX:708-303-3030

IN	Indianapolis, Pioneer/Indiana	317-573-0880, FAX:317-573-0979
KS	Overland Pk., Milgray/Kansas City	913-236-8800, FAX:913-384-6825
MD	Columbia, Milgray/Wash.	301-621-8169, FAX:301-381-3066
MD	Columbia, Time Elctrns.	301-964-3090, FAX:301-964-9274
MD	Gaithersburg, Pioneer/Gaithersburg	301-921-0660,FAX:301-921-4255
MA	Lexington, Pioneer/Mass.	617-861-9200, FAX:617-863-1547
MA	Peabody, Time Elctrns.	508-532-9900, FAX:508-532-9989
MA	Wilmington, Milgray/New England	508-657-5900, FAX:508-658-7989
MI	Grand Rapids, Pioneer/Western Michigan	616-698-1800,FAX:616-698-1831
MI	Livonia, Pioneer/Mich.	313-525-1800, FAX:313-427-3720
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355, FAX:612-944-3794
MN	Edina, Time Elctrns.	612-830-1252, FAX:708-303-3030
MO	Manchester, Time Elctrns.	314-230-7500, FAX:314-391-8603
MO	St.Louis, Pioneer/St. Louis	314-432-4350, FAX:314-432-4854
NJ	Fairfield, Pioneer/New Jersey	201-575-3510, FAX:201-575-3454
NJ	Marlton, Milgray/Delaware Valley	609-983-5010, FAX:609-985-1607
NJ	Marlton, Time Elctrns.	609-596-6700, FAX:609-596-4555
NJ	Montville, Teledyne Solid State	201-299-7667, FAX:201-299-6998
NJ	Parsippany, Milgray/New Jersey	201-335-1766, FAX:201-335-2110
NY	Binghamton, Pioneer/Binghamton	607-722-9300, FAX:607-722-9562
NY	Buffalo, Summit Distrs. Inc.	716-887-2800, FAX:716-887-2866
NY	E. Syracuse, Time Elctrns,	315-432-0355, FAX:315-432-8147
NY	Fairport, Pioneer/Rochester	716-381-7070, FAX:716-381-5955
NY	Farmingdale, Milgray/New York	516-391-3000, FAX:516-420-0685
NY	Haupauge, Time Elctrns.	516-273-0100, FAX:516-273-0037
NY	Pittsford, Milgray/Upstate New York	716-381-9700,FAX:716-381-9495
NY	Rochester, Summit Distrs. Inc.	716-334-8110
NY	Woodbury, Pioneer/Woodbury	516-921-8700, FAX:516-921-2143
NC	Charlotte, Pioneer/Charlotte	704-527-8188, FAX:704-522-8564
NC	Durham, Pioneer/Durham	919-544-5400, FAX:919-544-5885
NC	Raleigh, Milgray/Raleigh	919-790-8094, FAX:919-872-8851
OH	Cleveland, Milgray/Cleveland	216-447-1520, FAX:216-447-1761
OH	Cleveland, Pioneer/Cleveland	216-587-3600, FAX:216-663-1004
OH	Columbus, Time Elctrns.	614-794-3301, FAX:708-303-3030
OH	Dayton, Pioneer/Dayton	513-236-9900, FAX:513-236-8133
OR	Beaverton, Time Elctrns.	503-626-2979, FAX:206-820-1088
PA	Horsham, Pioneer/Horsham	215-674-4000, FAX:215-674-3107
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300, FAX:412-963-8255
TX	Austin, Pioneer/Austin	512-835-4000, FAX:512-835-9829
TX	Austin, Time Elctrns.	512-346-7346, FAX:512-346-7527
TX	Dallas, Milgray/Dallas	214-248-1603, FAX:214-248-0218
TX	Dallas, Pioneer/Dallas	214-386-7300, FAX:214-490-6419
TX	Houston, Pioneer/Houston	713-495-4700, FAX:713-495-5642
TX	Richardson, Time Elctrns.	214-644-4644, FAX:214-644-6668
TX	Stafford, Milgray/Houston	713-240-5360, FAX:713-240-5404
UT	Murray, Milgray/Utah	801-261-2999, FAX:801-261-0880
UT	West Valley, Time Elctrns.	801-973-8494, FAX:801-973-7418
WA	Kirkland, Time Elctrns.	206-820-1525, FAX:206-820-1088
WI	Brookfield, Pioneer/Wisconsin	414-784-3480, FAX:414-784-8207
Can	Mississauga, Ont., Milgray/Toronto	416-678-0958, FAX:416-678-1213
Can	Mississauga, Ont., Time Elctrns.	416-672-5300, FAX:416-672-5304
Can	Pointe Claire, Que., Milgray/Montreal	514-426-5900,FAX:514-426-5836

TELEDYNE THERMATICS, Teledyne Inds., Inc., P O Box 909, Elm City, NC 27822, Tel: 919-236-4311, ESYLNK: 62877220, FAX: 919-236-3613; FSC No.: 12515; Empl.: 400; *Sls. Mgr.:* Harry Helmer; *Dist. Mgr.:* Ed Rattie

TELEFUNKEN, See AEG Corp.

TELEGENIX/GRIM
AN INDUCTOTHERM COMPANY

FAX: 609-424-2022

TELEGENIX/GRIM CORP., P.O. Box 5550, Cherry Hill, NJ 08034, Tel: 609-424-5220; Empl.: 125; *Dist. Mgr.:* Ray Madonna .... **D•1074-1075**

Local Sales Offices & Reps

VA	Fairfax, GRIM Corp., Govt. Sls.	703-934-4615

Local Distributors

NJ	Cherry Hill, Telegenix/GRIM Corp.	800-933-4746

TELEMET, Geotel, Inc., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-436-7260, TWX: 510-227-9850, FAX: 516-436-7257; Empl.: 35; *Sls. Mgr.:* Paul H. Paulson III

TELENEX CORPORATION, A Unit of General Signal Corp., 13000 Midlantic Dr., Mt. Laurel, NJ 08054, Tel: 609-234-7900, FAX: 609-778-8700; Empl.: 400; *Sls. Mgr.:* Kirby Holmes, EVP-Mktg. & Sls.

TELEPHONICS CORPORATION/PRD INSTRUMENTS, 770 Park Avenue, Huntington, NY 11743, Tel: 516-549-6415/6428, TELEX: 510-222-4494, FAX: 516-549-6100; FSC No.: 78711, 9N770; Empl.: 22; *Sls. Mgr.:* Jacob Levy

TELEPLEX, INC., Alford Division, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, FAX: 617-933-4512; FSC No.: OL1H4; Empl.: 20; *Sls. Mgr.:* Lois Clark, V.P.

TELE QUARZ, USA, 2427 Twilight Rd., P.O. Box 240392, Charlotte, NC 28224-0392, Tel: 704-553-0300, FAX: 704-552-6044

TELEQUARZ-GMBH, See Raltron Electronics Corp.

TELESIS MARKING SYSTEMS, INC., Box 5000, Chillocothe, OH 45601, Tel: 614-642-3200, FAX: 614-642-2037; Empl.: 75; *Sls. Mgr.:* Larry Holt; *Dist. Mgr.:* Larry Holt

TELE-TECH CORPORATION, P.O. Box 790, Bozeman, MT 59715, Tel: 406-586-0291, FAX: 406-587-0653; FSC No.: 62759; Empl.: 75; *Sls. Mgr.:* Al Zoller

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELEVISION EQUIPMENT ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, FAX: 914-763-9158; Empl.: 10

TELLUREX CORP., 1248 Hastings, Traverse City, MI 49684, Tel: 616-947-0110, FAX: 616-947-5821; Empl.: 16; *Sls. Mgr.:* Gregg Smith

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Richard Aaron

TELPAR, INC., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001, Tel: 214-233-6631, TELEX: 73-2561, FAX: 214-233-8947; Empl.: 28; *Sls. Mgr.:* Bob Reynolds .... **D•1113-1115**

TELTEC, INC., 7890 12th Ave. S., Minneapolis, MN 55425, Tel: 612-854-9177, FAX: 612-854-8601; FSC No.: 57856; Empl.: 7; *Sls. Mgr.:* Victor Vachhani; *Dist. Mgr.:* Victor Vachhani

TELTRON, INC., 2 Riga Lane, Birdsboro, PA 19508, Tel: 610-582-2711, TELEX: 4990805, FAX: 610-582-0851; FSC No.: 28287; Empl.: 35; *Sls. Mgr.:* Clyde Mock

TEMESCAL/AIRCO COATING TECHNOLOGY, The BOC Group, Inc., 2700 Maxwell Way, PO Box 2529, Fairfield, CA 94533-0252, Tel: 707-423-2100, FAX: 707-425-1706; *Sls. Mgr.:* Brian Kaemmer

TEMP-FLEX CABLE, INC., 11 Depot Street, S. Grafton, MA 01560, Tel: 508-839-5987, FAX: 508-839-4128; FSC No.: 0CGL7; Empl.: 48; *Sls. Mgr.:* Warren Persak

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 908-757-8300, TELEX: 138-662, FAX: 908-757-9273; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-864-3700, TWX: 510-226-3787, FAX: 516-864-4972; FSC No.: 07031; Empl.: 205; *Sls. Mgr.:* Steven Waite

TEMPOSONICS SENSORS DIVISION, MTS Sys. Corp., PO Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200; *Sls. Mgr.:* David Miller

TEMPTRONIC CORPORATION, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, FAX: 617-969-2475; Empl.: 750; *Sls. Mgr.:* R. Himmel, R. DiFilippo, E. Lowerre

TEMPUSTECH, INC., 295 Airport Rd., Naples, FL 33942, Tel: 813-643-2424, FAX: 813-643-4981; Empl.: 13 .... **D•1144**

TENNEY ENGINEERING, 109 Springfield Rd., Union, NJ 07083, Tel: 908-686-7870, TWX: 710-985-4725, FAX: 908-686-7971; Empl.: 175; *Sls. Mgr.:* Jerome A. Perlstein, Mgr. Application Engr.

TENOR CONTROLS COMP, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, FAX: 414-782-0005; Empl.: 30; *Sls. Mgr.:* Ted James

TENSOLITE COMPANY, Subsidiary of Carlisle Corp., 100 Tensolite Drive, St. Augustine, FL 32092, Tel: 904-829-5600, FAX: 904-829-3447; Empl.: 210; *Sls. Mgr.:* William Dungan; *Dist. Mgr.:* John Berlin

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131, TELEX: ITT 4940124, FAX: 512-251-5798; Empl.: 36

TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, FAX: 615-428-4483; Empl.: 100

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 34623, Tel: 813-796-1044, FAX: 813-791-7425; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Pat Tesi .... **A•2028-2035**

Local Sales Offices & Reps

CA	Bridge Mktg.	415-965-8045
FL	APM Assocs.	813-886-2457
MA	Berkshire Elctrns.	508-435-9356
NY	R.P. Luce	516-754-5064
OH	Comps. Inc.	216-243-9200
TX	Miles J. Cooley Co.	214-262-5893
VA	Absco	804-674-8939

Local Distributors

FL	NRC	407-241-8600
NY	Sherburn Elctrns.	516-231-4300
NY	Tri-Start Elctrns.	516-737-2200

TERADYNE CONNECTION SYS., Teradyne, Inc., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, FAX: 603-889-2128; FSC No.: 31413; Empl.: 1000; *Sls. Mgr.:* D. Murphy

Local Sales Offices & Reps

CA	Irvine, Teradyne Connection Sys.	714-757-2600
CA	Sunnyvale, Teradyne Connection Sys.	408-732-8770
CO	Longmont, Teradyne Connection Sys.	303-651-3737
CT	Cromwell, Teradyne Connection Sys.	203-635-3360
FL	Altamonte Springs, Teradyne Connection Sys.	407-332-6555
NC	Raleigh, Teradyne Connection Sys.	919-872-0392
MD	Columbia, Teradyne Connection Sys.	410-290-9189
MN	Columbia Heights, Teradyne Connection Sys.	612-636-1770
NH	Nashua, Teradyne Connection Sys.	603-889-5156
PA	Trevose, Teradyne Connection Sys.	215-638-2829
TX	Richardson, Teradyne Connection Sys.	214-231-5384

Can	Mississauga, Ont, Teradyne Canada, Ltd.	416-602-6999

TERADYNE INC., Assembly Test Group, 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 510-932-6900, FAX: 510-934-0540; Empl.: 350; *Sls. Mgr.:* David Bernstein

TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282, FAX: 301-921-8353; Empl.: 18; *Sls. Mgr.:* Mark Teitelbaum

TERRA TECHNLG. CORP., 3854 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, FAX: 206-882-1412; *Sls. Mgr.:* Greg Hoyle, Sls. Mgr.

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TESTONE INC., Rt. 113 & Mensch Rd., P.O. Box 1589, Skippack, PA 19474-1589, Tel: 215-584-9658, FAX: 215-584-9166; Empl.: 36; *Sls. Mgr.:* Harold Schweriner; *Dist. Mgr.:* Harold Schweriner

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TESTRONICS, 1320 Millwood Rd., McKinney, TX 75069, Tel: 214-542-3111, FAX: 214-542-2131; FSC No.: 62236; Empl.: 30

TEST SYSTEMS, INC., 217 W. Palmaire, Phoenix, AZ 85021, Tel: 602-861-1010; FSC No.: 6625; *Sls. Mgr.:* Mike Milburn

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FAX: 508-699-5200

TEXAS INSTRUMENTS, Connector Systems, 34 Forest St., MS 14-01, Attleboro, MA 02703, Tel: 508-699-5269, 508-699-3450, TELEX: 92-7708, TWX: 710-346-0566; FSC No.: 59350; *Sls. Mgr.:* Dom Archino, Sls. Mgr.-; *Dist. Mgr.:* Dom Archino, Distr. Sls. Mgr. ... **C•1493-1498**

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Intl	Brighton, UK, Texmate/Amplicon Live Line	(0273)-570220
Intl	Taiwan/Taipei, Texmate (Taiwan Branch)	886-2-591-7865

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CA	Duarte, Pathfinder	818-357-1890
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IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MN	New Brighton, J & W Instrs.	612-784-5708
MT	Billings, Kirst Engrg.	406-656-9570
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NC	Statesville, Statesville Process Instr.	704-873-1835
OR	Portland, HIS Elctrns.	503-643-5648
PA	Bridgeville, Norton Equip.	412-221-3131
PA	Wayne, Mainline Instrs.	215-687-5307
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TX	Lewisville, KSE-Texas	800-594-2121
TX	Odessa, Whitlock Instrs.	915-337-3412
UT	Sandy, Indl. Instrs.	801-566-2980
WA	Belleville, Eustis Corp.	206-451-0700
WI	Milwaukee, Gordon Hatch Co.	414-671-6550
EXP	San Juan, PR, Tomas Cuerda, Inc.	809-758-7830
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Intl	New Zealand, Auckland, Metermaster NZ Ltd.	(649) 579-5120
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Can	Ottawa, R.H.Nichols Co. Ltd.	613-727-3974
Can	Toronto, R. H. Nichols Co. Ltd.	416-851-8871

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NH	Salem, Sales Engrg. Co., Inc.	603-893-5521
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NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
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TX	Austin, Ion Assocs.	512-794-9006
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WA	Spokane, UniComp, Inc.	509-922-4883
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THERMIK CORP., Thermik Sensor Technics, GmbH, 100 Industrial Drive, New Bern, NC 28562, Tel: 919-636-5720, FAX: 919-636-5737; Empl.: 13

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FAX: 419-525-8344

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MO	Lake St. Louis, Therm-O-Disc	314-625-3632
NY	Youngstown, Therm-O-Disc	716-745-3550
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TX	The Colony, Therm-O-Disc	214-370-2744

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OH	Mansfield, Therm-O-Disc	419-525-8500

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CT	Shelton, Therm-O-Disc	203-929-4268
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GA	Norcross, Glen White Assoc.	404-441-1447
IL	Arlington Heights, Therm-O-Disc	708-394-8858
IL	Chicago, Dolin Sales Co.	312-498-6770
IN	Floyd Knobs, Therm-O-Disc	812-923-5974
IN	Indianapolis, Wilson Tech. Sls.	317-872-2513
MA	Waltham, Gerber Sls.	800-843-7377
MI	Grand Rapids, William Moses	616-795-9958
MI	Wayland, Therm-O-Disc	616-795-9958
MN	Eagan, Relcomp	612-688-8006
MO	Lake Saint Louis, Therm-O-Disc	314-625-3632
MO	St. Louis, Smith-Bollinger & Co.	314-343-2221
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, Trembly Assocs.	505-266-8616
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NC	Huntersville, Glen White Assocs.	704-875-3737
OH	Dayton, Jay Engrg.	513-253-2151
OH	Mansfield, Therm-O-Disc	419-525-8315
TN	Gray, Glen White Assocs.	615-477-8850
TN	Nashville, Therm-O-Disc	615-646-6542
TX	Dallas, Norcom	214-386-4888
TX	The Colony, Therm-O-Disc	214-370-2744
UT	Salt Lake City, Trembly Assocs.	801-295-4703
VA	Lynchburg, Glen White Assoc.	804-385-6110
WI	Milwaukee, D. Dolin Sls.	414-482-1111
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THERMONICS, INC., 3350 Scott Blvd., Bldg. 32, Santa Clara, CA 95054, Tel: 408-496-6838, FAX: 408-496-6918

THERMOSEN, INC., Allied Controls, Inc., 150 E. Aurora St., Waterbury, CT 06708, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 00428; Empl.: 10

THERMOSET PLASTICS INC., 5101 East 65th St., Indianapolis, IN 46220, Tel: 317-259-4161, TELEX: 910-250-5447, ESYLNK: 62045624, FAX: 317-252-8402; Empl.: 65; *Sls. Mgr.:* Bob Meyer

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TX	El Paso, T-Tec Sls.	915-581-7920
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MA	Natick, Wayland Engrg. Sls., Inc.	508-655-6080
NJ	Lakewood, Atek Inc.	908-905-4443
NC	Raleigh, Benchmark Tech. Sls., Inc.	919-850-0633
WA	Federal Way, Wilson Elctrn. Sls. Team	206-946-8016
CA	San Clemente, A.T.A. Assocs.	714-661-9700

TNR TECHNICAL INC., 279 Douglas Ave. No.1112, Altamonte Springs, FL 32714, Tel: 407-682-4311, FAX: 407-682-4469; Empl.: 9; *Sls. Mgr.:* Jerrold Lazarus

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, FAX: 617-828-3048; FSC No.: 21966; Empl.: 25; *Sls. Mgr.:* T. Deutschmann, Jr.

TOCOS AMERICA, INC., Tokyo Cosmos Electric Co., Ltd., 1177 E. Tower Road, Schaumburg, IL 60173, Tel: 708-884-6664, FAX: 708-884-6665; Empl.: 2,000; *Sls. Mgr.:* Robert W. Kruse .... **A•2122-2123**

Local Sales Offices & Reps

AL	Huntsville, WLA & Assocs.	205-721-1788, FX-205-721-1789
AZ	Scottsdale, Pinnancle Comp. Sls.	602-994-0441, FAX:602-994-3638
AZ	Tucson, Pinnacle Comp. Sls.	602-886-1726, FAX:602-749-5539
CA	Colton, Inland Empire Elec. Sls.	714-872-0988, FAX:714-872-0988
CA	Pleasanton, Leddy Assocs.	510-417-1033, FAX:510-417-1458
CO	Denver, English-Damco Sls. Co.	303-782-0683, FAX:303-782-0670
FL	Altamonte Springs, TSS, Inc.	407-332-0067
FL	Boca Raton, TSS, Inc.	407-391-3718
FL	Clearwater, TSS, Inc.	813-530-5739
GA	Lawrenceville, WLA & Assocs.	404-339-9443, FAX:404-513-9148
IL	Deerfield, Mid-Tek Mktg. Co.	708-808-8822, FAX:708-808-8869
IN	Columbus, A E Sls.	812-378-4361, FAX:812-372-8216
IN	Fishers, AE Sls.	317-578-2121,FAX:317-842-7703
IN	Leesburg, AE Sls.	219-834-1232, FAX:219-834-1234
MD	Randallstown, Chesapeake Indl. Mktg.	410-653-0476,FAX:410-653-4675
MA	Woburn, Radian Assocs., Inc.	617-933-7386, FAX:617-933-3516
MI	Kentwood, Miltimore Sls., Inc.	616-554-9292, FAX:616-554-9210
MI	Novi, Miltimore Sls., Inc.	313-349-0260, FAX:313-349-0756
MN	Roseville, Vector Comp. Sls.	612-631-1334, FAX:612-631-1329
NM	Albuquerque, Zia Tech. Sls.	505-296-4255, FAX:505-296-4255
NY	Pittsford, Franklin Sls. Corp.	716-248-8251, FAX:716-248-3866
PA	Philadelphia, Check Assocs., Inc.	215-487-3007, FAX:215-483-1096
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255, FAX:214-235-0271
WA	Seattle, Northmar, Inc.	206-524-5170, FAX:206-524-0402
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121, FAX:416-844-0129

Local Distributors

CA	Chatsworth, EW Elctrns.	818-718-2500, FAX:818-718-9007
CA	Chatsworth, Passive Comps. Inc.	818-700-8838, FAX:818-700-9389
CA	Fremont, KEA Elctrns.	415-651-2600, FAX:415-651-2691
CA	Industry, ITAL Elctrns. Sls., Inc.	818-968-8515, FAX:818-336-1725
CA	Irvine, Kelex Elctrns.	800-4-CAPACI, FAX:714-474-1231
CA	Lake Elsinore, Dave Vest	FAX:714-245-3835
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Surface Mount Ctr.	408-453-2023, FAX:408-453-5699
CA	Santa Maria, Garrett Inst. & Comps.	805-922-0594, FAX:805-922-3643
CA	Tustin, H.T.S.	714-259-7733,FAX:714-544-4871
CA	Yorba Linda, Corona Elctrns.	714-283-8185, FAX:714-283-8191
CO	Aurora, QPS Elctrns. Inc. (CO)	303-343-9260, FAX:303-343-3051
FL	Boca Raton, N.R.C. Elctrns.	407-241-8600, FAX:407-241-3328
FL	Clearwater, Atlantic Elctrns.	813-531-5900, FAX:813-535-6354
FL	Ft Lauderdale, Stock Elctrns.	305-978-9875
FL	Lakeland, Atlantic Elctrns.	813-687-0200, FAX:813-687-0300
FL	Orlando, Atlantic Elctrns.	800-354-2505, FAX:407-352-9528
FL	W. Palm Bch., Atlantic Elctrns.	407-686-8553, FAX:407-686-6964
IL	Addison, Belford Elctrns., Inc.	708-691-1100, FAX:708-691-1118
IL	Bensenville, Voyager Elctrns.	708-860-1300, FAX:708-860-1573
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620, FAX:708-884-7573
IN	Indianapolis, Meunier Elctrns. Supp.	317-635-3511, FAX:317-631-4707
IN	Indianapolis, MAR Elctrns.	317-633-6699, FAX:317-633-6687
IN	Indianapolis, R.M. Elctrns. Co. Inc.	317-291-7110, FAX:317-291-1675
MD	Beltsville, Petricko Sls., Inc.	301-937-4960, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	301-840-9640, FAX:301-840-9299
MA	Andover, Aved Elctrns., Inc.	800-441-AVED, FAX:508-794-0159
MA	Billerica, Baldwin Comps. Ctr. Inc.	508-667-6710, FAX:508-671-0034
MN	Fridley, Voyager Elctrns.	612-571-7766, FAX:612-571-9519
MN	Plymouth, Leeds	612-557-1277,FAX:612-557-1499
NH	Salem, Diamond Elctrns.	603-894-4420, FAX:603-894-5897
NJ	Whippany, A.D.I.	201-428-0510,FAX:201-887-0923
NM	Albuquerque, Betatron	505-821-1122, FAX:505-828-0450
NY	Ronkonkoma, Baldwin Comps. Ctr. Inc.	800-645-5608,FAX:516-588-5441
NY	Syracuse, A.D.R. Technlgs.	315-437-7087, FAX:315-437-7794
PA	Wayne, Peak Elctrns.	215-293-9000, FAX:215-687-4579
TX	Austin, Tinkertronics, Inc.	512-926-4420, FAX:512-926-9590
TX	Dallas, Off the Shelf Comps.	214-247-0052, FAX:214-247-2332
TX	Richardson, All American	214-231-5300
TX	Richardson, Comp. Technlg. Corp.	214-437-2211, FAX:214-437-2265
TX	Richardson, Off the Shelf Comps.	214-238-0808, FAX:214-669-0560
WA	Seattle, KAM	206-382-1300
WI	Brookfield, Leeds	414-789-6995, FAX:414-789-6994
Can	Burlington, Alternate Source Comp.	800-661-9536
Can	Calgary,Alb., Memco	403-258-3399, FAX:403-259-3459
Can	Surrey, B.C., Memco	604-590-1553, FAX:604-590-5008

TODD

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FAX: 516-231-3473

TODD PRODUCTS CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366; Empl.: 250 .... **D•1488, 1967-1996**

Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-882-6751
CA	Livermore, Todd Prods. Corp.	510-449-6186
CA	San Clemente, Todd Prods. Corp.	714-496-1155
CA	San Diego, Todd Prods. Corp.	619-672-9062
CO	Englewood, Thorson Rocky Mtn. Inc.	303-773-6300
FL	Altamonte Springs, Glen White Assocs.	407-322-4875
FL	Baco Raton, Glen White Assocs.	407-393-0776
FL	Palm Harbor, Glen White Assocs.	813-787-8503
GA	Duluth, Glen White Assocs.	404-418-1500
IL	Hoffman Estates, Todd Prods. Corp.	708-882-3325
MD	Glen Arms, Glen White Assocs.	410-592-9105
MA	Hingham, Northeast Reps.	617-749-8700
MI	Jenison, ELectro MKtg.	616-667-2983
MI	Livonia, Electro Mktg.	313-421-7590
MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Fairfield, T.A.M.	201-575-4130
NY	Syracuse, Labtronics	315-455-7314
NC	Raleigh, Glen White Assocs.	919-848-1931
OH	Dayton, Electro Mktg.	513-890-8322
OH	No. Royalton, Electro Mktg.	215-582-0075
OR	Bothell, Temco Northwest	206-481-6150
PA	Allison Park, Electro Mktg.	412-492-0688
PA	Glenside, Koebert Assocs.	215-887-2310
TN	Gray, Glen White Assocs.	615-477-8850
TX	Houston, AID Elctrns. Inc.	713-575-7959
TX	Irving, AID Elctrs. Inc.	214-790-4761
UT	Salt Lake City, Thorson Rocky Mtn. Inc.	801-942-1683
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bothell, Temco Northwest	206-481-6150

TODD SYSTEMS, INC., 50 Ash St., Yonkers, NY 10701, Tel: 914-963-3400, FAX: 914-963-3506; Empl.: 45; *Sls. Mgr.:* S. Edwards .... **A•2582-2585**

Local Distributors

AL	Mobile, Kretzer's Inc.	205-438-5611
CA	Berkley, Roma Elctrns.	410-644-0661
CA	San Francisco, Aris Corp.	415-550-8605
CT	Stamford, Elm Elctrns.	203-348-6278
FL	Miami, Electronic Equip.	305-526-6000
FL	Miami Bch., B. Frank Inc.	305-861-8227
GA	Macon, Giga Corp.	912-745-2897
IL	Aurora, Bwy. Appliance	708-897-8688
LA	New Orleans, Gulf Marine Supp.	504-525-6252
MD	Brookeville, Albee Sls.	301-924-5538
MA	Boston, Astro Int.	617-323-6993
NJ	Newark, Cotrapex, Inc.	201-589-1416
NJ	Newark, Pinto Trading	201-344-7748
NY	New York, ABC Trading Co.	212-228-5080
NY	New York, Taft Elctrns.	212-575-5194
OH	Dayton, K. Elctrns.	513-426-1877
TX	Houston, Cross & Co.	713-673-3100
TX	Houston, Western Sls.	713-869-6671
VA	Fairfax, Atlantic Export	703-573-8383
WA	Seattle, ForeigN Elctrns.	206-682-2761
WA	Seattle, Pearl Elctrns.	206-622-6200
EXP	NY, New York, Able Intl., Ltd.	212-696-5300

TOKIN AMERICA, INC., 155 Nicholson Ln., San Jose, CA 95134, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 20; *Sls. Mgr.:* William English; *Dist. Mgr.:* William English

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-297-0070, FAX: 708-699-7864; Empl.: 75; *Sls. Mgr.:* Frank Migliarese; *Dist. Mgr.:* Tom Quinlan

TOLTEC INDUSTRIES, INC., 7024 Manya Circle, San Diego, CA 92154, Tel: 619-423-0700, FAX: 619-423-6647; Empl.: 1000; *Sls. Mgr.:* Joseph F. Harrison

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TOPLINE COMPONENTS, P.O. Box 5100, Garden Grove, CA 92645, Tel: 714-898-3830, FAX: 714-891-0321; Empl.: 50

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TOP-LINK COMPUTER INC., 1585 Mc Candless Drive., Milpitas, CA 95035-8001, Tel: 408-946-7888; Empl.: 420; *Sls. Mgr.:* Alan Richards .... **D•1998-2001**

Local Sales Offices & Reps

CA	Calabassas, Centaur Corp.	818-591-1655
CA	Irvine, Centaur Corp.	714-261-2123
CA	Mountain View, Taarcom Inc.	415-960-1550
CA	Sacramento, Taarcom Inc.	916-782-1781
CA	San Diego, Centaur Corp.	619-278-4950
CO	Denver, Electrophase	303-237-3739
IL	Chicago, Heartland Technical	708-358-6622
KS	Olathe, C-Tron Inc.	913-780-3796
MA	Boston, Mac Allister & Assoc.	617-631-7556
MI	Detroit, Greiner Assocs.	313-499-0188
MN	Minneapolis, Technical Comps.	612-561-5556
NJ	Lodi, TRC Elctrns.	201-779-8282
OH	Dayton, J.C. Hofstetter	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-4477
OR	Portland, Power Factor	503-233-6969
PA	Allentown, TRC Elctrncs.	215-264-4995
TX	Austin, Kruvand Assoc.	214-437-3355
TX	Austin, Kruvano Assoc.	512-219-9441
TX	Dallas, Kruvand Assoc.	512-219-9441
TX	Dallas, Kruvano Assoc.	214-437-3355
WI	Milwaukee, Heartland Tech.	414-789-6860

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800, 800-888-0331
CA	Santa Ana, Foresight Elctrns.	714-833-2134, 800-253-0490
CA	Santa Clara, Foresight	408-980-9700,800-253-0490
CO	Englewood, Comp. Distrs.	303-770-6214, 800-551-7357
CO	Littleton, Displays Plus	713-240-4000,800-231-3612
FL	Clearwater, Comp. Distrs.	813-796-0466
FL	Palm Bay, Comp. Distrs.	407-724-9910, 800-558-2351
GA	Norcross, Comp. Distrs.	404-441-3320, 800-874-7209
IL	Roselle, Foresight Elctrns.	708-980-9890
NJ	Lodi, TRC Elctrns.	201-779-8282
PA	Allentown, TRC Elctrns.	215-264-4995
TX	Dallas, Comp. Distrs.	214-644-0373,800-848-4234
TX	Houston, Southwest Elctrns.	713-240-4000, 800-231-3612

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641, 800-867-3526, FAX: 201-374-7611; Empl.: 20; *Sls. Mgr.:* Harold Tischler .... **A•2581**

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(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
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TOREMA U.S.A., INC., 10401 West Office Drive, Houston, TX 77042, Tel: 713-977-2500, FAX: 713-977-5031; FSC No.: QB2R8; Empl.: 40; *Sls. Mgr.:* David P. Snelling

Toroid
SUPERIOR TRANSFORMERS

FAX: 410-860-0302

TOROID CORP. OF MARYLAND, 608 Naylor Mill Rd., Salisbury, MD 21801, Tel: 410-860-0300; Empl.: 48; *Sls. Mgr.:* Lennart Elmlund .... **A•2586-2592**

Local Sales Offices & Reps

AZ	Phoenix, Tech Rep	602-991-6646
CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-560-1050
CA	San Jose, Marketing Co.	408-272-6836
CA	Seal Beach, Texel	213-596-9411
CA	Simi Valley, Texel	805-582-1223
FL	Boca Raton, Electro-Craft	407-394-9686
FL	Largo, Electro-Craft	813-544-1766
GA	Atlanta, Overton Assocs.	404-497-0166
IL	Wheeling, Ed Joyner & Co.	708-520-1200
MD	Salisbury, Toroid Corp. of Maryland	410-860-0300
MA	Southboro, Sullivan Tech. Sls.	508-881-2215
MN	Osseo, Gaffney Sls.	612-425-5484
MO	Salisbury, Toroid Corp. of Mo.	410-860-0300
NJ	Budd Lake, T & K Sls.	201-347-1856
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsford, KLM Garner	716-381-8350
NY	Smithtown, T & K Sales.	516-724-3456
NC	Raleigh, Overton Assocs.	919-469-5190
OH	Vandalia, Whit-Com Sls.	513-898-5433
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Huntingdon Valley, Ed Leiby & Assoc.	215-659-8938
SC	Walhalla, Overton Assocs.	803-638-7101
TN	New Tazewell, Overton Assocs.	615-626-6009
VT	Ludlow, Verro & Assoc.	802-228-5240
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039
WA	Seattle, Harry Levinson Co.	206-382-1300

TOROID TECHNOLOGIES, INC., 8-70 Hanlan Rd., Woodbridge, Ont., Can L4L 3P6, Tel: 905-850-5122, FAX: 905-850-5129; Empl.: 11; *Sls. Mgr.:* Saverio Panetta; *Dist. Mgr.:* Saverio Panetta

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FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Norem .... **A•1301-1307, 2594-2596**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	San Jose, Tech Rep Inc.	408-261-8287
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Altamonte Springs, Semtronics Inc.	407-831-8233
KS	Overland Pk., QDC Inds.	913-642-2214
MD	Baltimore, Dickison Sls. Co.	301-823-0923
MA	Lowell, Underwood Sls.	508-256-8191
MI	Livonia, Electro-Mktg. Inc.	313-421-7590
NY	Northport, R. P. Luce & Co., Inc.	516-754-5064
NY	Pittsford, James E. Zimmerman Sls., Inc.	716-381-3186
OH	Dayton, Electro-Mktg. Inc.	513-890-8322
PA	Langhorne, R.P. Luce & Co.	215-757-3518
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger .... **D•1326**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORTRAN INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-367-5188, FAX: 203-384-8120; Empl.: 6 .... **A•2593**

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 908-364-1800, FAX: 908-363-6234; Empl.: 200

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC., 9775 Toledo Way, Irvine, CA 92718, Tel: 714-455-2000, FAX: 714-859-3963

TOSHIBA INSTRUMENTATION DIV., Toshiba Intl. Corp., 5354 S. 129th E. Ave., Tulsa, OK 74134, Tel: 918-252-3548, FAX: 918-250-9023; Empl.: 20; *Sls. Mgr.:* Lewis E. Smith

TOSHIN KOGYO CO., R.G. Allen Co., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300

TOTAL CONCEPT SALES, 501 W. Glenoaks Blvd., Ste 343, Glendale, CA 91202-2896, Tel: 818-547-9476, FAX: 818-547-9473; Empl.: 3; *Sls. Mgr.:* Robert J. Cunningham; *Dist. Mgr.:* Robert J. Cunningham

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 508-453-7272, FAX: 508-453-7395; Empl.: 15; *Sls. Mgr.:* Patrick Letendre .... **D•2002**

All states not listed call T.P.I. direct 508-453-7272

Local Sales Offices & Reps

AZ	Tempe, Trembly	602-431-9417
CA	San Diego, Amasco	619-292-7666
CA	San Jose, Amasco	408-262-1500
CA	Torrance, Amasco	310-781-9494
CT	Weston, Paquette Elctrns.	203-544-8424
CO	Golden, Trembly Assoc.	303-279-3019
IL	Palatine, Vine Sls., Inc.	708-934-5476
IN	Carmel, Giesting & Assoc.	317-844-5222
KY	Versailles, Giesting & Assoc.	606-873-2330
MD	Ellicott City, Technology Sls.	301-461-7802
MA	Marlboro, JDS Reps.	508-460-0187
MI	Livonia, Giesting & Assoc.	313-478-8106
MN	Oakdale, Complete Sls.	612-731-2923
NV	Las Vegas, Trembly Assoc.	702-739-9770
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Buffalo, Lynn Assocs.	716-631-0054
OH	Cincinnati, Giesting & Assoc.	513-385-1105
OR	Portland, Index, Inc.	503-297-3364
PA	Gibsonia, Lynn Assocs.	412-443-3670
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Pittsburg, Giesting & Assoc.	412-828-6160
TX	Dallas, Rem Components	214-234-1069
UT	N. Salt Lake City, Trembly Assoc.	801-295-4703
WA	Bellevue, Inex, Inc.	206-271-2979
WI	Genoa City, Vine Sls. Inc.	414-279-3871

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	San Jose, Power and Data	408-629-3550
MA	Marlboro, Now Electronics	508-460-0187
MN	Roseville, Parts 1	612-633-8079
TX	Houston, Wofford	713-847-3583

TOTAL TEMPERATURE INSTRUMENTATION, INC., PO Box 1073, 30 Krupp Dr., Williston, VT 05495, Tel: 802-863-0085, FAX: 802-863-1193; Empl.: 10; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

TOUCH TECHNOLOGY, 5524 Bee Caves Rd. Building L, Austin, TX 78746, Tel: 512-328-9284, FAX: 512-328-9285; Empl.: 65; *Sls. Mgr.:* Sue Ellen Smith

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605; Empl.: 75; *Sls. Mgr.:* Gary Schmitz

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FAX: 708-593-5678

TOYOCOM USA INC., 617 E. Golf Rd., Ste. 112, Arlington Heights, IL 60005, Tel: 708-593-8780/1-800-TOYOCOM; Empl.: 16; *Sls. Mgr.:* Dennis Reifel .... **A•1484-1495**

Local Sales Offices & Reps

AL	Huntsville, Electramark	205-830-4400
AZ	Tempe, Cantec Sls.	602-968-9021
CA	El Toro (Southern), English/Damco	714-753-1950
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Colorado Spgs., Pinnacle Rocky Mtn.	719-570-0180
FL	Maitland, EIR	407-660-9600
GA	Norcross, Electramark	404-446-7915
IL	Arlington Hgts., Toyocom U.S.A., (Corp. Hdqtrs.)	708-593-8785
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, ATS	319-393-8280
MD	Rockville, Cetech	301-590-0111
MD	Timonium, Cetech	410-666-0315

MA	Randolph, Hatch Assocs.	617-963-3306
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Scott Elctrns.	612-929-2985
NJ	Mountainside, Henry G. Richter	908-233-4615
NY	Fairport, Henry G. Richter	716-223-6010
NC	Raleigh, C-Tech Sls.	919-954-7000
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Phoenixville (E.PA), Henry G. Richter	215-495-6176
PA	Pittsburgh (W.PA), Giesting & Assocs.	412-828-3553
TX	Ft. Worth (xtal), Rice Entpr.	214-436-6062
UT	Salt Lake City, Pinnacle Rocky Mtn.	801-264-8366
WA	Renton, Quest Mktg.	206-228-2660
Intl	San German, Digit-Tech Sls.	809-892-4317
Can	Kanata, Ont. (East), C.M.T.	613-591-9555
Can	Mississauga, Ont. (East), C.M.T.	416-612-0900

TRACER ELECTRONICS, INC., 200 Broadacres Drive, Bloomfield, NJ 07003, Tel: 201-338-1234, FAX: 201-338-1125; Empl.: 10

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Westerville, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 50; *Sls. Mgr.:* Fred Meyer .... **C•1106-1113**

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts; *Dist. Mgr.:* Sharon Altimari .... **A•1852-1857; D•1077, 1207**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Dana Point, S&S Technlgy., Inc.	714-661-4619
CA	Folsom, Disman-Bakner	916-983-1029
CA	Granada Hills, S & S Technlg., Inc.	818-366-2866
CA	Mountain View, Disman Bakner	415-969-3010
CA	San Diego, S & S Technlg. Inc.	619-484-2996
CO	Parker, Howard Assocs.	303-841-5755
FL	Harbour Bch, M. Lader Co.	800-442-3177
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
FL	Tampa, M. Lader Co.	813-264-1444
GA	Stockbridge, M. Lader Co.	800-442-3177
GA	Warner Robbins, JC Coefield	912-922-5555
IL	Northbrook, CJ Sls.	708-559-0660
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	410-381-1550
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Amherst, TMR Assocs.	603-672-9336
NJ	Clarksboro, M Lader Co.	609-423-4213
NJ	Denville, Ascor Elctrns., Inc.	201-627-1863
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Seaford, Ascor Elctrns., Inc.	516-826-7204
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Conshohocken, M. Lader Co.	215-825-3177
PA	East Greenville, M Lader Co.	215-679-8485
TX	Austin, Thorson Co.	512-467-2737
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
VA	Strasburg, M. Lader Co.	703-465-9180
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga Tron Assocs. Ltd.	613-225-4090

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-2444
CA	Mtn. View, Comstock Distrs., Inc.	415-969-3010
NY	Ronkonkoma, Compucon Distr., Inc.	516-981-8810
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, FAX: 44-382-562643; Empl.: 30

FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts .... **D•1077, 1207**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs., Inc.	205-776-9481
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Laguna Hills, Elotek Sys.	714-830-4856
CA	Mountain View, Disman Bakner	415-969-3010
CO	Parker, Howard Assocs.	303-841-5755
FL	Ft. Walton Bch., Mktg. & Consulting	904-863-3017
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Lawrenceville, Saber Assocs., Inc.	404-962-8740
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MA	Andover, Saret Assocs.	508-475-9332
MO	Maryland Hgts., KJS Mktg., Inc.	314-770-1412
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Clayton, Saber Assocs., Inc.	919-553-5009
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Austin, Thorson	512-467-2737
TX	Dallas, Thorson	214-233-5744
TX	Houston, Thorson	713-558-8205
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga-Tron Assocs., Ltd.	613-225-4090

TRANSAMERICA DELAVAL, INC., See CEC Instruments, IMO Inds. Inc.

TRANSAMERICA DELAVAL, See Gems Sensors, IMO Inds. Inc.

Trans American Transformer, Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd., E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 .... **A•2597**

TRANSCHEM, Jetronics Industries, Inc., P.O. Box 667, 1521 Pomona Rd., Corona, CA 91718, Tel: 909-371-5751, FAX: 909-371-9602; FSC No.: 03526; Empl.: 60; *Sls. Mgr.:* Ernie Aiu, Genl. Mgr.

TRANSCO PRODUCTS, INC., Subsidiary of Datron Systems Inc., Vard Newport, Camarillo, CA 93012, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 300; *Sls. Mgr.:* Larry Neeley, Sls. Mgr.

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 60; *Sls. Mgr.:* J.L. Jamieson, Mktg. VP

All states not listed consult factory, N. Branford, CT

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN , MTE Corporation, W147 N9525 Held Drive, Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; Empl.: 120; *Sls. Mgr.:* John A. Houdek

TRANSFORMER ENGINEERING CORPORATION, 2550 Brookpark Rd., Cleveland, OH 44134, Tel: 216-741-5282, FAX: 216-741-4860; Empl.: 85; *Sls. Mgr.:* William M. Dick

TRANSFORMER TECHNOLOGIES, INC., 402 Locust St., Mt. Vernon, NY 10552, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 15; *Sls. Mgr.:* Thomas Quaglieri .... **A•2598**

Local Sales Offices & Reps

IL	Highland Pk., Mid-Tek Mktg.	708-831-1130
VA	Ashland, Glasscock Assocs.	804-798-2125

TRANSICOIL INC, Eagle-Picher Inc., 2560 General Armistead Blvd., Trooper, PA 19403, Tel: 215-539-4400, FAX: 215-539-3400; FSC No.: 82686; Empl.: 215; *Sls. Mgr.:* John Stalber; *Dist. Mgr.:* Fran Mashintonio

TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622, FAX: 201-361-7665; FSC No.: 09004; Empl.: 650; *Sls. Mgr.:* Martin M. O'Donnell .... **D•2003**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	205-539-1485
AZ	Phoenix, Trembley Assocs.	602-431-9417
AZ	Tucson, Trembley Assoc.	602-790-9945
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW, Inc.	714-751-7512
CO	Colorado Springs, Trembley Assocs.	719-475-0072
CO	Denver, Trembley Assocs.	303-279-3019
CT	Scientific Dvcs., Inc.	203-248-9361
FL	Melbourne, Reynolds Assocs., Inc.	407-259-7000
GA	Duluth, Reynolds Assocs., Inc.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Lexington, E. F. Delfino, Inc.	617-862-1118
MI	Ann Arbor, Ashby Assocs., Inc.	313-995-4082
MN	Anoka, Tech. Solutions, Inc.	612-785-9303
MO	Earth City, Midwest Tech. Sls. Inc.	314-298-8787
NV	Las Vegas, Trembley Assocs., Inc.	702-739-9770
NJ	Comp-Tech Sls.	201-935-2152
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NM	Alburquerque, Trembley Assocs. Inc.	505-266-8616
NM	Las Cruces, Trembley Assocs. Inc.	505-526-1615
NY	Commack, Comp-Tech Sls.	516-499-9189
NY	New Hyde Park, Comp-Tech Sls.	516-488-4520
NC	Raleigh, Reynolds & Assocs., Inc.	919-876-0282
OH	Arcanum, Ashby Assocs., Inc.	513-692-8713
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
PA	Southampton, Campbell Assoc.	215-322-6630
TX	Austin, Jim Hughes Co.	512-467-8896
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	N. Salt Lake City, Trembley	801-295-4703
VA	Alexandria, Dyna-Rep Co.	703-354-1222
Can	Weston Ont., Duncan Instrs. Canada Ltd.	416-742-4448

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ... **D•1208-1210**

Local Sales Offices & Reps

NY	Saugerties, Beckrep	914-246-3031
OR	Beaverton, Seltech Elctrns. Mfg. Rep. Inc.	503-629-9254
TX	Richardson, Scientific Sls. Co.	214-231-6541
WA	Bellevue, Seltech Elctrns. Mfg. Rep. Inc.	206-746-7970
Can	St. Laurent, Que., Testforce Sys. Inc.	514-856-0970

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E, Solon, OH 44139, Tel: 216-248-2229, FAX: 216-248-7780; FSC No.: 6685; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSONIC SYSTEMS INC., 34 Dutch Mill Rd., Ithaca, NY 14850, Tel: 607-257-5300, TELEX: 413523, ESYLNK: 62050974; Empl.: 40

TRANSPARENT DEVICES, INC., 853 Lawrence Drive, Newbury Park, CA 91320, Tel: 805-499-5000, FAX: 805-499-5888; Empl.: 26; *Sls. Mgr.:* C. Estiandan ... **B•1126**

Local Sales Offices & Reps

CA	Irvine, Cal Rep, Inc.	714-509-7707
CO	Aurora, Electrodyne	303-695-8903
GA	Acworth, EAB, Inc.	404-975-3660
IL	Glendale Heights, Synergistic Sls.	708-858-8686
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Towson, ATS, Inc.	410-296-9360
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	E. Brunswick, Shepard Assocs.	908-254-5757
NY	E. Syracuse, Nycom, Inc.	315-437-8343
OH	Solon, Five Star Elctrns.	216-349-1611
OK	Tulsa, Delta Comps., Inc.	918-592-7711
PA	Frazer, Indl. Comps.	215-889-0650
PA	Pittsburgh, Marktech	412-367-2327
TX	Seagoville, Delta Comps., Inc.	214-287-6333
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Seattle, J.J. Assocs.	206-246-6619

WI	Brookfield, Synergistic Sls.	414-821-1516
MA	Westford, Elctrn. Microtech Assoc.	508-692-0070

TRANSTECHNOLOGY ELECTRONICS, Transtechnology Corporation, 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 309-693-3308; FSC No.: 30463; Empl.: 105; *Sls. Mgr.:* Ignas Budrys; *Dist. Mgr.:* Ignas Budrys

TRANSTECTOR SYSTEMS, INC., P.O. Box 300, Hayden Lake, ID 83835, Tel: 800-829-2901, TELEX: 150-077TRANSTECPFLS, FAX: 208-772-9016; FSC No.: 30992; Empl.: 150; *Sls. Mgr.:* Mary Mohr

TRAN-TEC CORP., Box 1044, Columbus, NE 68601, Tel: 402-564-2748, FAX: 402-564-4946; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

TRATEC OF CALIFORNIA, INC., 3648 Main St., Chula Vista, CA 91911, Tel: 619-476-1155, ESYLNK: 619-476-1176; Empl.: 250; *Sls. Mgr.:* Dale Fox

TREE TECHNOLOGIES CORPORATION, Baird Research Pk., 1576 Sweet Home Rd., Buffalo, NY 14228, Tel: 716-688-4640, FAX: 716-636-3630; Empl.: 8; *Sls. Mgr.:* Victor Demjanenko, PH.D.

TREK, INCORPORATED, 3932 Salt Works Road, Medina, NY 14103-0728, Tel: 716-798-3140, FAX: 716-798-3106; Empl.: 119; *Sls. Mgr.:* Donald L. Pritchard; *Dist. Mgr.:* Donald L. Pritchard

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94538-6148, Tel: 510-651-1150, FAX: 510-651-5763; Empl.: 142; *Sls. Mgr.:* Colleen Frisz

TREND DLC, INC., 3D Great Meadow Lane, East Hanover, NJ 07936, Tel: 201-515-4935, FAX: 201-515-4938; Empl.: 20; *Sls. Mgr.:* Joseph R. La Manna

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000, FAX: 215-482-9389; Empl.: 55

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TRICONEX CORP., 15091 Bake Parkway, Irvine, CA 92718, Tel: 714-768-3709, 800-325-2128 (outside Ca), FAX: 714-768-6601; Empl.: 115; *Sls. Mgr.:* Paul Hamilton; *Dist. Mgr.:* Paul Hamilton

TRICON INDUSTRIES, INC., Brazing Alloys & Chemical Products Div., 5000 Chase St., Downers Grove, IL 60515-4012, Tel: 708-963-0220, FAX: 708-963-0269; Empl.: 19; *Sls. Mgr.:* T. R. Boedeker

TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 708-964-2330, FAX: 708-964-5179; Empl.: 289; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05403, Tel: 802-863-6873, FAX: 800-325-2654; Empl.: 35; *Sls. Mgr.:* Charlie Goetz

TRIGON/ADCOTECH, Dynatech, 100 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-946-4300, FAX: 408-263-9217; Empl.: 50

TRILITHIC, INC., 9202 E. 33rd St., Indianapolis, IN 46236, Tel: 800-344-2412, FAX: 317-895-3613; FSC No.: 23042; Empl.: 120; *Sls. Mgr.:* D. Distler

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FAX: 209-651-0188

TRI-MAG, INC., 1601 N. Clancy Ct., Visalia, CA 93291, Tel: 209-651-2222, TELEX: (ITT) 4994462; FSC No.: 64771; Empl.: 80 ..... **A•1612-1614; D•2004-2006, 2212-2214**

Local Sales Offices & Reps

AL	Huntsville, Stelmack Comps.	404-441-7927
CA	Burlingame, William J. Purdy Co.	415-347-7701
CA	Dana Point, Electro-Venture	714-496-5225
FL	Land O'Lakes, AJ's Power Source, Inc.	813-996-2583
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810
KS	Kansas City, EPI, Inc.	816-523-8911
MD	Ambler, W.R. Hartmaier Assoc., Inc.	215-643-6691
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
MO	St. Louis, EPI, Inc.	314-962-1411
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, R.M. Scanlon & Assoc., Inc.	716-359-0773
NY	Syracuse, R.M. Scanlon & Assoc., Inc.	315-463-7682
OH	Mentor, Sales Plus, Inc.	216-942-7811
OK	Tulsa, Innovative Tech. Sls.	214-699-3485
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
PA	Ambler, W.R. Hartmaier Assoc. Inc.	215-643-6691
PA	Ambler, W.R. Hartmaier Assocs., Inc.	215-643-6691
TX	Austin, Innovative Tech. Sls.	512-255-1510
TX	Dallas, Innovative Tech. Sls.	214-699-3485
TX	Houston, Innovative Tech. Sls.	214-699-3485
WA	Redmond, Pacific Mktg. Spec.	206-882-3144
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

Local Distributors

CA	Santa Ana, El-Com/Cabletek	714-432-6630
MA	Needman, Power Electro Supp. Co.	718-767-1447

TRIMM INC., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 708-362-3700, FAX: 708-680-3888; FSC No.: 81812; Empl.: 50; *Sls. Mgr.:* Richard Neidl

TRIM-TRONICS, INC., 2763 Route 20 East, Cazenovia, NY 13035, Tel: 315-655-9528, FAX: 315-655-2149; Empl.: 20; *Sls. Mgr.:* James E. Dowd

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535, FAX: 219-259-8552; FSC No.: 3677; Empl.: 50; *Sls. Mgr.:* AJ Reinke

TRIONICS, INC., P.O. Box 225, St. Charles, IL 60174, Tel: 708-365-6570, FAX: 708-365-6575; Empl.: 80

TRIO-TECH INTERNATIONAL, 355 Parkside Dr., San Fernando, CA 91340, Tel: 818-365-9200, TELEX: 194811(TTI INTL SFDO), FAX: 818-365-8210; Empl.: 266; *Sls. Mgr.:* Jon Easterson

TRIPLE I, See PHI Technologies, Inc.

TRIPLETT CORPORATION, One Triplett Dr., Bluffton, OH 45817-9987, Tel: 419-358-5015, FAX: 419-358-7956; *Sls. Mgr.:* Joel Weldy; *Dist. Mgr.:* Tony Augsburger

TRIPP LITE, 500 No. Orleans, Chicago, IL 60610-4188, Tel: 312-329-1777, FAX: 312-644-6505; Empl.: 200; *Sls. Mgr.:* Ray Foster

TRI QUINT SEMICONDUCTOR, 3625 S.W. Murray Blvd., Beaverton, OR 97005, Tel: 503-644-3535, FAX: 503-644-3198

TRIRIDGE

FAX: 412-899-2284

TRIRIDGE CORP., P.O. Box 12420, Pittsburgh, PA 15231, Tel: 412-899-2288, 800-537-3529; FSC No.: 31951; Empl.: 48; *Sls. Mgr.:* Michael Minich .... **B•1625**

Local Sales Offices & Reps

CA	Seal Beach, Texel	213-596-9411
MA	Chelmsford, Interstate Sls. Assocs.	508-256-2287
MN	Stillwater, Kits Co.	612-439-8088
NY	Manhasset, Win-Cor Elctrn.Sls.	516-627-9474
PA	Horsham, Jacobsen Assoc.	215-674-2937

Local Distributors

CA	Los Angeles, Masters Distrs.	213-452-1229
OH	Warren, Rem Elctrn. Supp. Co.	216-373-1300
PA	McKean, Advacom Inc.	814-476-7774

TRI-SOURCE INC., 415 Howe Ave., Shelton, CT 06484, Tel: 203-924-7030, FAX: 203-924-7045; Empl.: 45; *Sls. Mgr.:* Lloyd Schiller .... **D•2008-2011**

Local Sales Offices & Reps

CT	Hartford, E.M.I.	800-443-4506
FL	Ft. Lauderdale, CBC Elctrns.	305-755-1111
FL	Orlando, CBC Elctrns.	407-831-5380
FL	Tampa, CBC Elctrns.	813-969-1901
MA	Marlborough, E.M.I.	800-424-4506
NJ	Mt. Laurel, Power Square	609-424-0064
NY	Great Neck, Mos Assocs.	516-487-3966
TX	Dallas, MT Associates	214-380-9090

Local Distributors

MA	Marlboro, E.M.I.	1-800-443-4506

TRI-STAR ELCTRNS., 11020 Audelia Rd., Dallas, TX 75243, Tel: 214-553-8011, FAX: 214-553-8009

TRI-TECH ELECTRONICS, INC., 9480 E. Colonial Dr., Orlando, FL 32817, Tel: 407-277-2131, FAX: 407-282-1202; Empl.: 115

TRM, INC., 280 S. River Rd., Manchester, NH 03110, Tel: 603-627-6000, FAX: 603-627-6025; Empl.: 40; *Sls. Mgr.:* D. Crocker

TROMPETER ELECTRONICS, INC., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91362-4047, Tel: 818-707-2020, FAX: 818-706-1040; FSC No.: 14949; Empl.: 180; *Sls. Mgr.:* Dick Coleman; *Dist. Mgr.:* Raymond Calvin .... **C•1499-1505**

Local Sales Offices & Reps

AL	Huntsville, CP&F (Dixie)	205-536-1506
AZ	Tempe, Aztec Entprs.	602-649-9155
CA	Los Angeles, Knight Co.	310-670-2833
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CA	Temecula, Knight Co.	714-699-2495
CO	Denver, Aztec Entprs.	303-779-5285
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Orlando, CP&F Florida, Inc.	407-855-0843
FL	Tampa, CP&F Florida, Inc.	813-854-5116
FL	W.Melbourne, CP&F Florida, Inc.	407-724-6795
GA	Duluth, CP&F (Dixie)	404-497-9404
IL	Arlington Heights, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Pk., BAKA Corp.-Kansas City	913-432-5252
KS	Wichita, BAKA Corp.-Wichita	316-682-8411
MD	Landover, Sel-Tronics, Inc.	301-341-2700
MA	Lowell, Underwood Sls.	508-256-8191
MI	Rochester Hills, Geotronix	313-373-4334

MN	Minneapolis, Engrg. Prods. Assoc., Inc.	612-835-9002
MO	St. Johns, BAKA Corp.	314-429-2252
NJ	Elmwood Park, L & M Assoc.	800-722-0441
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Clifton Park, TAE REP Inc.	518-371-3117
NY	Rochester, TAE REP Inc.	716-586-8710
NY	Waverly, TAE REP Inc.	607-565-3485
NY	Whitney Point, TAE REP Inc.	607-692-3705
NC	Charlotte, CPF Atlantic, Inc.	704-846-1702
NC	Greensboro, CP&F Atlantic, Inc.	919-218-0800
OH	Cincinnati, Geisting & Assoc.	513-385-1105
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix	513-854-5939
OR	Portland, Evergreen Mktg. Grp.	503-598-7667
PA	Allison Park, Geotronix	412-487-1770
PA	Southampton, WA Drobile, Inc.	215-364-2501
TX	Arlington, Ion Assocs.	817-695-8000
TX	Austin, Ion Assocs.	512-794-9006
TX	Houston, ION Assocs.	713-537-7717
UT	Salt Lake City, Aztec Entprs.	801-467-4675
WA	Edmonds, Evergreen Mktg.	206-771-3593
WI	Milwaukee, Berndt Assocs.	414-545-8400
Can	Burlington, Ont., Promark Elctrns.	416-332-1145
Can	St. Laurent, PQ, Promark Elctrns. (Canada)	800-363-8855

TRONTECH, INC., 38 Industrial Way E., Eatontown, NJ 07724, Tel: 908-542-1133; Empl.: 70; *Sls. Mgr.:* Albert E. Arbuckle

TRU

FAX: 508-531-6993

TRU-CONNECTOR CORP., 245 Lynnfield St., Peabody, MA 01960, Tel: 508-532-0775, 1-800-262-9787, 1-800-COAXTRU; FSC No.: 92180; Empl.: 46; *Sls. Mgr.:* Robert F. Hoff .... **C•1507**

Local Sales Offices & Reps

CA	Irvine, Calrep	714-509-7707,FAX:714-509-7708
FL	Clearwater, Brennan Assocs.	813-446-5006, FAX:813-443-6035
MD	Rockville, KMA Sls.	301-460-8876, FAX:301-460-9530
MA	Lexington, O'Sullivan & Murphy	617-862-6570, FAX:617-862-7252
NY	East Syracuse, R.D. Sherman Corp.	315-433-1165, FAX:315-437-8283
OH	Wilmington, R.N. Smith Co.	513-382-4048
PA	Fawn Grove, Chesapeake Tech. Sls.	717-382-4944,FAX:717-382-4149
Intl	Israel, Tel Aviv, STG Intl. Ltd.	011-972-3-265231
Can	Oakville, Ont., Paltronics Ltd.	416-844-2233, FAX:416-844-0129

TRUETIME, INC., 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687(TRUETIME SARO), FAX: 707-527-6640; Empl.: 50; *Sls. Mgr.:* Rick Dielman

TRUEVISION, 7340 Shadeland Station, Indpls., IN 46256, Tel: 317-841-0332, FAX: 317-576-7700; Empl.: 103; *Sls. Mgr.:* Brian Donahue

TRULINE CORPORATION, 909 W. Visalia Rd., Farmersville, CA 93223, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRUMETER COMPANY, INC., 38 West 32nd St., New York, NY 10001, Tel: 212-564-0666, 800-537-2261, FAX: 212-268-0432; Empl.: 9; *Sls. Mgr.:* Rene Jacobus

TRW MICROWAVE, See FEI Microwave

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 750; *Sls. Mgr.:* George R. Downs

TSCHUDIN & HEID, INC, Tschudin & Heid AG, 2 North Plains Industrial Rd., Wallingford, CT 06492, Tel: 203-269-3337, FAX: 203-269-4448; Empl.: 6; *Sls. Mgr.:* Thomas M. D'Allesantro; *Dist. Mgr.:* Michael E. Losi

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331-3429, Tel: 818-896-6676, FAX: 818-896-2816; Empl.: 5; *Sls. Mgr.:* James T. Thomasson; *Dist. Mgr.:* James T. Thomasson .... **D•2317**

Local Sales Offices & Reps

CA	Corona Del Mar, Motion Control, Inc.	714-675-0211
CA	Los Angeles, TS Products, Inc.	818-896-6676
CA	Montebello, TUCUL Engrg.	818-791-1364

TSSI, 8205 S.W. Creekside Place, Beaverton, OR 97005, Tel: 503-643-9281, FAX: 503-646-4954; Empl.: 65; *Sls. Mgr.:* Dean Turnbaugh, V.P., N.A. Sls.; *Dist. Mgr.:* David Flaningam, V.P., Intl. Sls.

TAITIEN

FAX: 516-589-7793

TTE FREQUENCY DEVICES, LTD., 351 Knickerbocker Ave., Bohemia, NY 11716, Tel: 516-589-7789; Empl.: 800 (Worldwide); *Sls. Mgr.:* Paul Huron; *Dist. Mgr.:* Lloyd Kittlesen .... **A•1496-1501**

Local Sales Offices & Reps

CA	Irvine, Balzerwolf Assoc.	714-261-6977
IL	Arlington Hgt., Davix	708-577-4475
MI	Grand Rapid, JMJ Assoc.	616-774-9480
NY	Bohemia, High Energy Prods.	516-589-7789
WI	Menomonee Falls, Davix	414-255-1600

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FAX: 310-445-2791

TTE, INCORPORATED, 2251 Barry Ave., W. Los Angeles, CA 90064-1400, Tel: 310-478-8224, 800-776-7614; FSC No.: 07766; Empl.: 30; *Sls. Mgr.:* S. J. Sodaro .... **A•1680-1683**

T T I TESTRON INC., 41 Century Drive, Woonsocket, RI 02895, Tel: 401-766-9100, FAX: 401-766-9017; Empl.: 250; *Sls. Mgr.:* Barry Ross

TUCKER ELECTRONICS, Box 551419, Dallas, TX 75355-1419, Tel: 214-348-8800, 800-527-4642, FAX: 214-348-0367; Empl.: 65; *Sls. Mgr.:* Bill Chapman

TUMBLER CORP. CABLE DIV., 175 Kootenai Drive, Fremont, CA 94539, Tel: 510-657-3002, FAX: 510-770-1933; Empl.: 86; *Sls. Mgr.:* Vincent P. Lin

TUMBLER TECHNOLOGIES, 1340 Fulton Place, Fremont, CA 94539, Tel: 510-651-7724, FAX: 510-651-7840; Empl.: 5 Local/120 Overseas; *Sls. Mgr.:* Alex T. Hung

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, FAX: 617-784-5563; Empl.: 23; *Sls. Mgr.:* William O'Connell

TURCK INC., 3000 Campus Drive, Minneapolis, MN 55441-2656, Tel: 612-553-9224, 1-800-328-0580, FAX: 612-553-0708; FSC No.: SIC 3625; Empl.: 98; *Sls. Mgr.:* Jeffrey C. Ursell, Dir. of Sls.; *Dist. Mgr.:* B. Nielson (West)/ R. Black (East)

TURTLE MOUNTAIN CORPORATION, 1st St. So., Dunseith, ND 58329, Tel: 701-244-5242, FAX: 701-244-5582; Empl.: 190; *Sls. Mgr.:* Van Barkus

TUS
ELECTRONICS

FAX: 714-458-1166

TUS ELECTRONICS, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-458-1155 .... **C•1649-1651**

TUSONIX

FAX: 602-744-6155

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, TELEX: 102-299640, TWX: 310-299640; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* Patrick K. Gougeon .... **A•1168-1169, 1684-1685**

Local Sales Offices & Reps

AZ	Tucson, Tusonix, Inc.	602-744-0400
CA	San Diego, DJM Elctrns.	619-488-9166
CA	San Fransisco, Tusonix, Inc.	510-793-3785
CA	Valencia, DJM Elctrns.	805-254-2677
NY	Webster, Tusonix, Inc.	716-671-7870
NC	Greensboro, Tusonix, Inc.	919-292-4286
TX	Dallas, Tusonix, Inc.	214-985-9335

Local Distributors

AZ	Tempe, TTI	602-431-1191
CA	Agoura Hills, Penstock	818-879-8374
CA	Milpitas, TTI	408-946-5577
CA	Mission Hills, TTI	818-891-8885
CA	San Diego, Penstock	619-535-3015
CA	San Diego, TTI	619-748-2025
CA	Santa Ana, TTI	714-641-9393
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CA	Westwood, Penstock	310-208-2877
CO	Denver, TTI	303-429-6806
CO	Englewood, Penstock, Inc.	303-421-7161
CT	Wallingford, TTI	203-284-7474
FL	Orlando, TTI	407-859-1000
FL	Palm Bay, Penstock	407-724-5300
GA	Atlanta, Penstock	404-951-0300

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1026 6th. AVENUE
OAKLAND, CA 94606

GA	Norcross, TTI	404-662-0911
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Penstock, Inc.	312-934-3700
IL	Schaumburg, TTI	708-884-6500
IN	Ft. Wayne, Penstock, Inc.	219-447-6526
IN	Richmound, Penstock	317-935-0141
KS	Olathe, Penstock	913-829-9330
MD	Columbia, Penstock	410-290-3746
MD	Columbia, TTI	301-995-1331
MA	Marlborough, Penstock	508-624-7300
MA	Tewsbury, TTI	508-851-2000
MN	Eden Prairie, TTI	612-933-8555
NJ	Fairfield, Penstock, Inc.	201-808-1414
NJ	Mt. Laurel, TTI	609-234-6400
NY	E. Northport, Penstock	516-368-2773
NY	Ronkonkoma, TTI	516-737-2000
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
PA	Coatesville, Penstock	215-383-9536
TX	Dallas, TTI	214-701-9555
TX	Fort Worth, TTI	817-595-3100
WA	Bellevue, Penstock, Inc.	206-454-2371
WA	Redmond, TTI	206-882-0291

TUSTIN ELECTRONICS CO., 1580 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-5800, FAX: 714-777-5814; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

2M SALES COMPANY, 1601 E. Hwy. 13, Ste. 202, Burnsville, MN 55337, Tel: 612-890-7774, FAX: 612-894-9352

TWO TECHNOLOGIES,INC., 419 Sargon Way, Horsham, PA 19044, Tel: 215-441-5305, FAX: 215-441-0423; Empl.: 13; *Sls. Mgr.:* Joan Rickards

TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 510-548-4434, FAX: 510-548-3073; Empl.: 10; *Sls. Mgr.:* Colleen Heffley

TYCO INSTR. DIV., See Data Instrs.

TYCOR INTERNATIONAL INC., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, FAX: 403-253-0663; Empl.: 32

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, 800-535-5552, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.; *Dist. Mgr.:* Terry Tuttle

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* C. Rob Wilcox; *Dist. Mgr.:* Greg Borstelmann

UDS/MOTOROLA, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1993, Tel: 205-430-8000, TELEX: 752602 UDS HTV, FAX: 205-830-5657; Empl.: 1000; *Sls. Mgr.:* Tony Zalenski

U. E. SYSTEMS, INC., 12 West Main St., Elmsford, NY 10523, Tel: 914-592-1220, 800-223-1325, TELEX: 229676, FAX: 914-347-2181; Empl.: 20

ULTRAN LABORATORIES, 1020 East Boal Ave., Boalsburg, PA 16827, Tel: 814-466-6200, FAX: 814-466-6847; FSC No.: 6635,AJ14,H266,5999; Empl.: 13; *Sls. Mgr.:* Julie L. Rhodes

ULTRAVOLT, INC., CS9002, Ronkonkoma, NY 11779, Tel: 800-876-POWER, FAX: 516-363-2423; Empl.: 15; *Sls. Mgr.:* Jim Morrison .... **D•2013-2015**

ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Ulveco

FAX: 713-977-5031

ULVECO, INC., 10401 West Office Dr., Houston, TX 77042, Tel: 1-800-527-7042; Empl.: 50; *Sls. Mgr.:* Dave Snelling .... **A•2600-2601**

Local Sales Offices & Reps

AZ	Chandler, Techni-Source Corp.	602-497-0711
AR	Van Buren, Hightower Indl. Sls.	501-471-8116
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Murrieta, Van Gott & Assocs.	909-698-7774
CA	San Jose, Carmen Elctrns.	408-275-3775
CO	Franktown, MRC	303-660-8750
CT	Avon, Tom Maguire Assocs.	203-673-3019
FL	Maitland, E I R, Inc.	407-660-9600
GA	Duluth, PCI	404-623-8604
IL	Arlington Heights, Hill Sales Corp.	708-255-4400
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Ann Arbor, Lintott Assocs., Inc.	313-665-8457
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NH	Windham, Tom Maguire Assocs.	603-437-1245
NM	Albuquerque, Techni-Source Corp.	505-268-4232
OH	Lexington, North Central Mktg.	419-884-9804
PA	Exton, Linear Sls.	215-524-8080

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

UNDERWATER KINETICS, 1020 Linda Vista Dr., San Marcos, CA 92069, Tel: 619-744-7560, FAX: 619-744-7320; Empl.: 85; *Sls. Mgr.:* Greg Sippel

UNDERWOOD INDUSTRIES OF N.Y., INC., d/b/a Viking Products, 456 Broad St., P.O. Box 269, Waverly, NY 14892, Tel: 607-565-4551, FAX: 607-565-9650; Empl.: 7; *Sls. Mgr.:* Robert Pichette

UNGAR, Rubbermaid Office Products Group, 5620 Knott Ave., Buena Park, CA 90621, Tel: 714-994-2510, TELEX: 4720750 Eldon, FAX: 714-523-7790; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers; *Dist. Mgr.:* Dianna Paul

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, FAX: 203-265-2690; Empl.: 45

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700, 800-526-1389, FAX: 201-674-3803; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* Steven Mercadante

UNIMAX, A Divison of C & K, Ives Rd., P.O. Box 152, Wallingford, CT 06492, Tel: 203-269-8701, FAX: 203-265-5398; FSC No.: 80207; Empl.: 250; *Sls. Mgr.:* B. D'Amico

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158, FAX: 503-757-0858

UNION CARBIDE CHEMICALS & PLASTICS COMPANY INC., Industrial Chemicals Div., Crystal, 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, FAX: 619-565-8926; Empl.: 125; *Sls. Mgr.:* L. R Rothrock

UNIPLEX CORP., 2905 Country Dr., St. Paul, MN 55117, Tel: 612-490-1936, FAX: 612-490-0495; Empl.: 8; *Sls. Mgr.:* M. Bryan

UNIPOWER
CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 260; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. .... **D•2016-2035**

Local Sales Offices & Reps

AL	Huntsville, Marco Mktg.	205-883-9630
AZ	Phoenix, Comp. Sls.	602-263-6022
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	San Jose, The JSYS Grp.	408-928-1411
CO	Denver, AKI Enterprises	303-756-0700
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
IL	Itasca, Beta Technlgy.	708-250-9586
MD	Gaithersburg, Deltatronics	301-253-0615
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg.	616-791-7370
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Great Neck, F & F Metro	516-482-4080
NY	Rochester, Elcom Sls. Inc.	716-385-1400
NY	Skaneateles, Elcom Sls. Inc.	315-685-8967
OH	Columbus, McFadden Sls.	614-761-3177
OR	Tigard, Northwest Comp. Sls.	503-620-3285
PA	Blue Bell, Deltatronics	215-641-9930
TX	Richardson, Jim D. Gray Assocs.	214-699-9976
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WI	Milwaukee, Beta Technlg.	414-543-6609
Can	Mississauga, Andy Bauman Assocs.	416-828-2600
Can	W. Vancouver, Leister Blake Entprs.	604-926-6127

Local Distributors

CA	N. Hollywood, B.J. Wolfe	213-877-5518
CA	San Jose, B.J. Wolfe	408-371-3443
CA	San Jose, ForeSight Elctrns.	408-980-9700
CA	Santa Ana, ForeSight Elctrns.	714-833-2134
FL	Land-O-Lakes, AJ'S Power Source.	813-996-2583
IL	Roselle, ForeSight Elctrns.	708-980-9890
NH	Salem, Diamond Elctrns.	603-894-4420
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Houston, Wofford Elctrns.	713-351-2255

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd.

UNIT DESIGN, 1811 N. Case St., Orange, CA 92665, Tel: 714-282-8100, FAX: 714-282-8188; Empl.: 20; *Sls. Mgr.:* Nanette Janes

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FAX: 708-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 708-696-2000; Empl.: 65 .... **A•1171-1173**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell	205-883-5110
CA	Los Altos, Recht Assoc.	415-964-6321
CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
CO	Englewood, Purdy & Assocs.	303-790-2211
GA	Norcross, R. O. Whitesell	404-449-9190
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IN	Indianapolis, R. O. Whitesell	317-876-9000
IA	Cedar Rapids, J.R. Sls., Inc.	319-393-2232
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, R. O. Whitesell	606-873-1182
MI	Grand Rapids, R. O. Whitesell	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R. O. Whitesell	616-983-7337
MN	Plymouth, Twist Co.	612-550-0922
NY	Hauppauge, Aurora Mktg.	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Beaverton, Elctrn. Source, Inc.	503-627-0838
PA	Ambler, W.R. Hartmaier	215-643-6691
PA	Pittsburgh, R. O. Whitesell	412-963-6161
PA	Spring House, Hartmaier, Assoc.	215-643-6691
TN	Knoxville, R. O. Whitesell	615-694-9476
TX	Austin, RAM Elctrn Sls.	512-250-5082
TX	Houston, RAM Elctrn. Sls.	713-580-7394
TX	Plano, RAM Elctrn. Sls.	214-578-5400
Can	Scarborough, Ont., JRL/Franklin	416-756-9862

Local Distributors

AL	Huntsville, Hammond Elctrns	205-830-4764
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Bell Inds.	818-706-2608
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Camarillo, Milgray Elctrns.	800-635-7812, 805-484-4055
CA	Chatsworth, Passive Comps.	818-700-8838
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Tustin, Capstone Elctrns.	713-730-0349
CA	Tustin, Projections Unltd.	714-544-2700
CA	Tustin, Time Elctrns.	714-669-0100
CO	Denver, Capstone Elctrns.	303-375-1300
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Milford, Milgray	800-922-6911
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Winter Pk., Milgray Elctrns.	800-241-5523
GA	Atlanta, Time Elctrns.	404-984-0923
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Milgray Elctrns.	800-241-5523
IL	Chicago, Newark Elctrns.	312-907-5211

IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Palatine, Milgray Elctrns.	800-322-6271
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wood Dale, Nep Elctrns.	708-595-8500
KS	Overland Pk., Milgray Elctrns.	800-255-6576, 913-236-8800
MD	Columbia, Milgray Elctrns.	800-638-6656
MD	Columbia, Time Elctrns.	301-964-3090
MA	Hopkinton, Interface Elctrns.	508-435-6858
MA	Peabody, Time Elctrns.	508-532-9756
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Milgray Elctrns.	800-334-6941
MA	Wilmington, North Star Elctrns.	508-657-5155
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Marlton, Capstone Elctrns.	609-727-7800
NJ	Marlton, Milgray Elctrns.	800-257-7111
NJ	Parsippany, Milgray Elctrns.	800-622-0291
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Teterboro, EAC	201-288-4477
NY	Farmingdale, Milgray Elctrns.	800-645-4729
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Milgray Elctrns.	800-562-3118
OH	Cleveland, Milgray Elctrns.	800-321-0006
OH	Dublin, Time Elctrns.	614-761-1100
OR	Beaverton, Future Elctrns.	503-645-9454
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Interface Elctrns.	215-889-2060
SC	Greensville, Hammond Elctrns.	803-233-4121
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Dallas, Milgray Elctrns.	800-637-7227
TX	Fort Worth, TTI, Inc.	817-740-9000
TX	Houston, Time Elctrns.	713-530-0800
UT	Salt Lake City, Milgray Elctrns.	800-537-9739
UT	W. Valley, Time Elctrns.	801-973-8181
WA	Bothell, Projections Unltd.	206-485-2147
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Marsh Electronics	414-786-5300
WI	New Berlin, Nep Elctrns.	414-785-9100
Can	Mississauga, Ont., Capstone	416-495-7705
Can	Mississauga, Ont., Time Elctrns.	416-672-5300
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Richmond, B.C., Electrosonics, Inc.	604-273-2911
Can	Vancouver, B.C., Future	604-438-5545
Can	Willowdale, Ont., Electronics	416-494-1666
Can	Willowdale, Ont., Milgray Elctrns.	800-268-3315, 416-756-4481
Can	Winnipeg, Sas., Zentronics	204-694-1957

(UEC) UNITED ELECTRIC CONTROLS, P. O. Box 9143, Watertown, MA 02272-9143, Tel: 617-926-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St., Georgetown, MA 01833, Tel: 508-352-2200, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* R.L. Bailly

UNITED MOTION TECHNOLOGY, 2954 Scott Blvd., Santa Clara, CA 95054, Tel: 408-970-9742, 1-800-424-STEP, FAX: 408-986-8009; Empl.: 4

Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CT	Essex, Winslow Elec. Co.	203-767-8229
FL	Pampano Bch., Motion Prods.	305-783-9003
NY	Cazenovia, Delen Assocs.	315-655-8602
PA	Pittsburgh, Precision Dvcs.	412-941-7662
Can	Ottawa, Graham Dewar & Assoc.	613-744-8463

UNITED PRICING REPORTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

UNITED SOLDER WRAP INC., See Vector Elctrns. Co., Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St., Fort Worth, TX 76110, Tel: 817-921-3014, 800-433-7140, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES ELECTRONICS, 60 Brown Ave., Springfield, NJ 07081, Tel: 201-912-0111, FAX: 201-912-0015; Empl.: 20

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 55; *Sls. Mgr.:* Roger Meade

UNITED SWITCH COMPANY, 3214 W. McGraw, Seattle, WA 98199, Tel: 206-282-8823, FAX: 206-282-9173; Empl.: 3; *Sls. Mgr.:* John Spaulding

UNITED TECHNICAL PRODUCTS, 6 Headley Pl., Fallsington, PA 19054, Tel: 800-553-5300, FAX: 215-736-8515; Empl.: 50; *Sls. Mgr.:* Bob Harbison, Jr.

UNITED TECHNOLOGIES MICROELECTRONICS CENTER, United Technologies Corp., 1575 Garden of The Gods Rd., Colorado Springs, CO 80907, Tel: 719-594-8000, 1-800-MIL-UTMC, FAX: 719-594-8032; Empl.: 308; *Sls. Mgr.:* Dwight Deem

UNITED WIRE & CABLE CORP., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-757-3872, FAX: 508-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161, FAX: 714-871-4164; FSC No.: 0AMM9; Empl.: 40; *Sls. Mgr.:* D. Molby

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Local Sales Offices & Reps

AZ	Paradise Valley, Techrep-Arizona	602-991-6646
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Cindel/Penmark	408-988-8331
CO	Highlands Ranch, Valcomp Elctrns., Inc.	303-791-0330
FL	Clearwater, Brennan Assocs.	813-446-5006
IA	Des Moines, The Beams Co.	515-255-1148
IL	Glen Ellyn, Lincoln, Hodges & Assocs.	708-469-6750
IN	Ft. Wayne, Outman Sls.	219-489-7699
MD	Ellicott City, Callas Elctrns., Inc.	410-465-0044
MA	Northboro, Easterly Sls. Assocs.	508-393-7399
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	St. Paul, Countryman Assocs.	612-645-9151
NJ	Hampton, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Rochester, Nortek	716-387-0640
NC	Greensboro, Loki Data Prods., Inc.	919-234-5066
OH	Akron, Augnat Assocs.	216-239-2499
PA	Souderton, Intek, Inc.	215-723-0433
TX	Richardson, Barry Sls.	214-234-0255

Local Distributors

CA	Milpitas, M.S. Inserts & Fasteners	408-946-6565
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Context Engrg.	408-748-8676
CO	Denver, Integrated Elctrns., Inc.	303-393-6121
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Coral Springs, HAI Elctrns., Inc.	305-752-7520
GA	Norcross, Applied Power, Inc.	404-263-0421
MA	Billerica, M.S. Inserts & Fasteners	508-670-5600
MA	Northboro, Papi Supp. Co.	508-393-3127
MA	Winchester, Webb Distbn.	617-729-5800
MI	Grand Rapids, S-F Elctrns. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Warren, Rem Elctrns. Supp. Co., Inc.	216-373-1300
TX	Houston, Tristar Elctrns.	713-667-7200
TX	Wylie, Air Quip/Robleyco	214-442-3573

UNITREK CORPORATION, 3000 Lewis & Clark Hwy., Ste.2, Vancouver, WA 98661, Tel: 206-699-7277, FAX: 206-694-9230; Empl.: 80; *Sls. Mgr.:* John Sailer

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, FAX: 617-924-1235; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE INTEGRATED CIRCUITS CORP., 7 Continental Blvd., Merrimack, NH 03054-0399, Tel: 603-424-2410, TWX: 95-3040

UNIVERSAL AD-YU/D-F INC., 2517 E. Norwich St., St. Francis, WI 53235, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

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UNIVERSAL SEMICONDUCTOR INC., 1925 Zanker Rd., San Jose, CA 95112, Tel: 408-436-1906, FAX: 408-436-1125; FSC No.: 62305; Empl.: 30; *Sls. Mgr.:* Uday B. Koppikar

Universal Voltronics

FAX: 914-241-3129

UNIVERSAL VOLTRONICS DIV., Thermo Voltek Corp., 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; FSC No.: 14225; Empl.: 85 .... **D•2037-2039**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Alamitos, Tritek Sci. Dvcs.	714-362-3592
CO	Wheat Ridge, Trembly Assocs.	303-921-8900
IN	Ossian, Science Sls. Inc.	219-622-7383
NV	Las Vegas, Trembly Assoc., Inc.	702-739-9770
NJ	Roseland, Tech. Mktg. Assoc.	201-228-7800
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
PA	Audubon, Holmes Assocs., Inc.	215-666-0637
TX	El Paso, Trembly Assoc.	915-533-9380
UT	No. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
WA	Bellevue, The Western Rep.	206-637-0947
Can	Nepean, Ont., Datacomp Elctrns.	613-723-8825
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

Local Distributors

AZ	Phoenix, Trembly Assoc. Inc.	602-967-2058
CO	Wheat Ridge, Trembly Assoc. Inc.	303-421-8900
NV	Las Vegas, Trembly Assoc. Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc. Inc.	505-266-8616
UT	North Salt Lake, Trembly Assoc. Inc.	801-295-4703
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

UNIVERSITY SOUND, INC., Mark IV Industries, 13278 Ralston, Sylmar, CA 91342, Tel: 818-362-9516, FAX: 818-367-5292; Empl.: 72; *Sls. Mgr.:* Greg McLagan

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

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United Research and Development

FAX: 714-831-6371

U.R.D. AMERICA, P.O. Box 6006, Laguna Nigel, CA 92607, Tel: 714-831-0111; *Sls. Mgr.:* Lawrence Sultan .... **D•1169**

Local Sales Offices & Reps

CA	Canoga Pk., C & W Comp. Sls.	818-700-2684
IL	Lena, BB & J Sls., Inc.	815-369-2066
MA	Brookline, Reliable Sls.	617-738-8305
NY	Franklin Sq., Cooper Simon Emtec	516-489-0404

USAPEX CORP., 2378 Walsh Ave., Ste B, Santa Clara, CA 95051, Tel: 408-982-9063, FAX: 408-982-0223; FSC No.: 77-0326422; Empl.: 15

USAR SYSTEMS, INC., 568 Broadway Ste. 405, New York, NY 10012, Tel: 212-226-2042, FAX: 212-226-3215; Empl.: Less than 10; *Sls. Mgr.:* Tony D'Amato

US DIGITAL

FAX: 206-260-7452

U. S. DIGITAL CORP., 17401 N.E. Stoney Meadows Dr., Vancouver, WA 98682, Tel: 206-260-7451; *Sls. Mgr.:* David Madore .... **B•2019-2023; D•1327**

Local Sales Offices & Reps

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

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USD PRODUCTS, Div. of Bussmann, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-4600, FAX: 708-867-2211; Empl.: 200; *Sls. Mgr.:* Mr. Chris Osmun

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-6381, FAX: 818-786-9162; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Ed Wallen

U.S. ELCO, INC., See Cosel USA Inc.(Formerly US Elco)

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200, FAX: 201-848-9006; Empl.: 25; *Sls. Mgr.:* James F. Golden

U.S. POWER/RELCO MIDWEST, U.S. Power Converting Co., 8830 West 61st North, Wichita, KS 67205, Tel: 316-722-6440; Empl.: 12; *Dist. Mgr.:* Jonathan P. Snow .... **C•1081; D•1913**

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 310-316-9984, FAX: 310-316-9050; Empl.: 8; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark .... **C•1081; D•1913**

Local Sales Offices & Reps

KS	Wichita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616
Can	Torrance, U.S. Power Conv. Co.	310-316-9984

Local Distributors

CA	Torrance, U.S. Power Converting/L. Snow & Assocs.	310-316-9984
KS	Witchita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

U.S. RESISTOR, INC., P.O. Box 1059, St. Marys, PA 15857-1059, Tel: 814-781-7679, FAX: 814-834-9201

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. TERMINALS INC., 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297; Empl.: 20; *Sls. Mgr.:* Bill Jacobs; *Dist. Mgr.:* Bill Jacobs .... **C•1652-1653**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Scottsdale, Western High Tech. Mktg.	602-860-2702
CA	Oceanside, Noo Rep Tech Sls.	619-941-0558
CA	San Gabriel, U.S. Toyo Fan Corp.	818-287-5297
CA	Sunnyvale, U.S. Toyo Fan Corp.	408-737-0123
CO	Boulder, Comp. Prod. Sls.	303-530-2800
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Woodridge, Golten Assoc.	708-985-5100
IA	Blue Grass, Rothkopf & Assocs.	319-381-4396
KS	Olathe, Rothkopf & Assocs.	913-829-8897
MD	Towson, Dalbrook Corp.	410-296-3165
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Brighton, W. R. Hummon	313-486-5333
MN	New Brighton, Boerger & Assoc.	612-636-4339
MO	St. Louis, Rothkopf & Assocs.	314-961-4485
NJ	Fort Lee, Nepture Elec.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elec.	516-349-1600
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Richfield, Geotronix	216-659-6100
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Allison Pk., Geotronix Inc.	412-487-1770
PA	Lansdale, Dalbrook Corp.	215-362-8033
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Richardson, Zonk & Assoc.	214-238-7651
VA	Fredericksburg, Dalbrook Corp.	703-786-1873
WA	Snohomish, Unicomp, Inc.	206-568-0511
PR	Santruce, SISCO	809-726-3137
Can	Montreal, Dynatech Elctrns.	514-276-4477

Local Distributors

AZ	Scottsdale, Added Value Elctrns.	602-951-9788
CA	Fremont, Connex Elctrns.	510-656-7722
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Tustin, Added Value Elctrns. Distr.	714-259-8258
CO	Wheatridge, Added Value Elctrns.	303-422-2529
CT	Hamden, Astrex, Inc.	203-288-0044
UT	Salt Lake City, Added Value Elect.	801-975-9500
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Haverhill, Cord Elctrns.	617-374-0100
MA	W. Springfield, Astrex, Inc.	413-788-7341
MN	Fridley, Voyager Elec.	612-571-9519
MN	Minneapolis, Aerospace Computer Supp.	612-884-4725
NY	Elmsford, Multimeterics	914-347-3666
NY	Endwell, Astrex, Inc.	607-754-3823
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
PA	Willow Grove, Astrex, Inc.	215-784-9934
TX	Richardson, Zec Sls.	214-669-0895
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UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 908-922-1009, FAX: 908-922-1848; FSC No.: 23261; Empl.: 35

UTICOR TECHNOLOGY, 4140 Utica Ridge Rd., Bettendorf, IA 52722, Tel: 319-359-7501, FAX: 319-359-9094; Empl.: 110; *Sls. Mgr.:* Tom Howard

UTI INSTRUMENTS CO., 2030-C Fortune Dr., San Jose, CA 95131, Tel: 408-428-9400, FAX: 408-428-0823; Empl.: 80; *Sls. Mgr.:* Tom Strahl

UVP, INC., 5100 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-285-3123, 800-452-6788, FAX: 818-285-2940; Empl.: 100; *Sls. Mgr.:* Phil Spillane

VAIL SILICON TOOLS, 692 A S. Military Trail, Deerfield Beach, FL 33442, Tel: 305-570-5580, FAX: 305-428-1811; Empl.: 4; *Sls. Mgr.:* Jim Prince; *Dist. Mgr.:* Doug Beard

VALHALLA SCIENTIFIC

FAX: 619-457-0127

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576; Empl.: 75; *Sls. Mgr.:* Kerry Clark .... **D•1328-1331**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
CA	Costa Mesa, Cutlass Elctrns.	714-549-9358
CA	San Diego, Amasco	619-292-7666
CA	San Jose, ARC Tech. Resources	408-263-6486
CA	Sunnyvale, ARC Technical Resources	408-773-8871
CA	Torrance, Cutlass Elctrns.	213-324-7360
FL	Orlando, Currie, Peak & Frazier	407-855-0843
FL	Pace, Currie, Peak & Frazier	904-994-0599
FL	Tampa, Currie, Peak & Frazier	813-854-5116
FL	W. Melbourne, Currie, Peak & Frazier	407-724-6795
GA	Dulth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MD	Landover, Sel-Tronics	301-341-2700
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter, McCormic & Peirce (CMP)	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Kansas City, Comtel Midwest	913-268-0762
NY	Rochester, Eastern Systems	716-292-1460
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Englewood, Carter, McCormic & Peirce (CMP)	513-836-0951
OH	Parma, Carter, McCormic & Peirce (CMP)	216-398-0400
OR	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Robert Meyers Assocs.	215-224-1663
PA	Pittsburg, Carter, McCormic & Peirce (CMP)	412-826-3800
TX	Dallas, Entest	214-980-9876
TX	Houston, Entest	713-686-7306
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest Co.	414-544-6042

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

VALLEY ELECTROMAGNETICS, ECM Motor Co., 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-7373; Empl.: 100; *Sls. Mgr.:* R. Forschler

VALOR ELECTRONICS, 9715 Business Park Avenue, San Diego, CA 92131-1642, Tel: 619-537-2500, TELEX: 653406 VALORSD, FAX: 619-458-0875; FSC No.: 15003; Empl.: 5000; *Sls. Mgr.:* Brad Rogers .... **A•1686-1687, 2602-2603; D•2215**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech.	205-464-0033, FAX:205-464-9909
AZ	Scottsdale, American Mktg., Inc.	602-948-2778, FAX:602-860-4455
CA	Garden Grove, Elsco Elctrns.	714-891-4621, FAX:714-891-1251
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800, FAX:408-496-6952
CO	Englewood, Comp. Sls., Inc.	303-779-8060, FAX:303-779-8357
FL	Boca Raton, So. Atlantic Comp. Sls.	417-391-1034
FL	Orlando, So. Atlantic Comp., Sls.	407-857-3650, FAX:407-857-3298
FL	Seminole, So. Atlantic Comp., Sls.	813-595-6397, FAX:813-595-6397
GA	Norcross, Benchmark Technlg.	404-446-1711, FAX:404-448-2854
ID	Meridian, Utah CSI	208-888-3554
IL	Arlington Hgts., KMA Sls., Co.	708-398-5300, FAX:708-398-5708
IN	Carmel, Valentine Assoc., Inc.	317-846-0008
MA	Topsfield, Whitehead Assocs. Inc.	508-887-8050, FAX:508-887-5434
MI	Canton, Techrep Inc.	313-981-1950, FAX:313-981-2006
MN	Minneapolis, DeBeck-Hays Assocs. Inc.	612-835-3610,FAX:612-835-0515
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NJ	Matawan, Ashtec, Inc.	908-583-6903, FAX:908-583-0379
NY	Apalachin, T-Squared Elctrns. Co.	607-625-3983
NY	Cicero, T-Squared Elctrns. Co.	315-699-1559
NY	Port Washington, Ashtec Inc.	516-767-0336, FAX:516-767-0981
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Raleigh, Benchmark Technlg.	919-850-0633, FAX:919-850-0725
OH	Dayton, KW Elctrn. Sls.	513-890-2150, FAX:513-890-5408
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177, FAX:216-491-9102
PA	Pittsburgh, KW Elctrn. Sls.	412-492-0777, FAX:412-492-0780
TX	Austin, Kruvand	512-219-9441,FAX:512-219-1932
TX	Dallas, Kruvand	214-437-3355,FAX:214-680-8854
UT	Midvale, Utah CSI	801-561-5099
WA	Seattle, Northmar Inc.	206-524-5170, FAX:206-524-0402
WI	Milwaukee, KMA Sls. Co.	414-259-1771, FAX:414-259-0246
PR	Rio Piedras, D.K. Marketing	809-765-5380, FAX:809-758-5380
Can	Rexdale,Ont., Electro-Source, Inc.	416-675-4490

Local Distributors

AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-437-1200

CA	Chatsworth, Hall-Mark Elctrns. Corp.	818-773-4560
CA	Irvine, Hall-Mark Elctrns. Corp.	714-727-6000
CA	Milpitas, Sierra West	408-945-1050
CA	Riverside, Electronic Supply	714-683-7300
CA	Rocklin, Hall-Mark Elctrns. Corp.	916-624-9781
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Jose, Elctrn. Supp.	408-453-3770
CA	San Jose, Hall-Mark Elctrns. Corp.	408-432-4000
CO	Englewood, Hall-Mark Elctrns. Corp.	303-790-1662
CT	Cheshire, Hall-Mark Elctrns. Corp.	203-271-2844
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Casselberry, Hall-Mark Elctrns. Corp.	407-830-5855
FL	Largo, Hall-Mark Elctrns. Corp.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns. Corp.	305-971-9280
GA	Duluth, Hall-Mark Elctrns. Corp.	404-623-4400
IL	Wood Dale, Hall-Mark Elctrns. Corp.	708-860-3800
IN	Indianapolis, Hall-Mark Elctrns. Corp.	317-872-8875
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
MD	Columbia, Hall-Mark Elctrns. Corp.	301-988-9800
MA	Billerica, Hall-Mark Elctrns. Corp.	508-667-0902
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Plymouth, Hall-Mark Elctrns. Corp.	313-416-5800
MN	Bloomington, Hall-Mark Elctrns. Corp.	612-881-2600
MO	Earth City, Hall-Mark Elctrns. Corp.	314-291-5350
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Moorsetown, Hall-Mark Elctrns. Corp.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns. Corp.	201-515-3000
NJ	Rockaway, Tonar Inds. Inc.	201-586-9000
NY	Fairport, Hall-Mark Elctrns. Corp.	716-425-3300
NY	Ronkonkoma, Hall-Mark Elctrns. Corp.	516-737-0600
NC	Raleigh, Hall-Mark Elctrns. Corp.	919-872-0712
OH	Solon, Hall-Mark Elctrns. Corp.	216-349-4632
OH	Worthington, Hall-Mark Elctrns. Corp.	614-888-3313
OK	Tulsa, Hall-Mark Elctrns. Corp.	918-254-6110
TX	Austin, Hall-Mark Elctrns. Corp.	512-258-8848
TX	Dallas, Hall-Mark Elctrns. Corp.	214-343-5822
TX	Houston, Hall-Mark Elctrns. Corp.	713-781-6100
UT	Salt Lake City, Hall-Mark Elctrns., Inc.	801-269-0416
WA	Seattle, Hall-Mark Elctrns. Corp.	206-547-0415
WI	New Berlin, Hall-Mark Elctrns. Corp.	414-797-7844
Can	Pointe Claire, Tonar Inds., Inc.	514-694-3057

VALPEY-FISHER:MATEC CORP, 75 South St, Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Mark Freyermuth, Mktg. Mgr.; *Dist. Mgr.:* John Pimentel

VALPEY-OPT COMPANY, Valpey-Fisher Corp./Opt Inds., 75 South St., Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; Empl.: 7; *Sls. Mgr.:* Wim Van Den Akker

VAMISTOR CORP., 144 River Bend Drive, Sevierville, TN 37862, Tel: 615-453-0001, FAX: 615-453-0003; FSC No.: 56856, OEBU2; Empl.: 53; *Sls. Mgr.:* Pat Healy; *Dist. Mgr.:* Pat Healy

VANGUARD ELECTRONICS CO., 1480 W. 178th St., Gardena, CA 90248, Tel: 310-323-4100, FAX: 310-329-8427; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* Kenneth R. Finley (Intl.); *Dist. Mgr.:* John Hoenig (Domestic)

VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498, FAX: 505-268-9722; *Sls. Mgr.:* Michael E. Vann

VAN WATERS & ROGERS INC., Univar Corp., PO Box 64004, St. Paul, MN 55164-0004, Tel: 612-774-9400, FAX: 612-774-0850; Empl.: 30000; *Sls. Mgr.:* George Coyle

VARIAN ASSOCIATES, Electron Device Business, 3100 Hansen Way, Palo Alto, CA 94304, Tel: 415-493-4000, 800-544-4636, TELEX: 34 8476, FAX: 415-424-6276; FSC No.: 02845; Empl.: 10,700; *Sls. Mgr.:* John Beighley

VARIAN MICROWAVE EQUIPMENT PRODUCTS, Varian Assocs., Inc., 3200 Patrick Henry, Santa Clara, CA 95054, Tel: 408-496-6273, TELEX: 510-601-5674 MEDSC, TWX: 348476, FAX: 408-496-6235; FSC No.: 59782; Empl.: 300; *Sls. Mgr.:* Don Crumm

VARITRONIX, See VL Electronics

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, 800-431-2154, FAX: 914-592-2667; Empl.: 33

VASAK INDS., INC., 211 Eucalyptus Drive, El Segundo, CA 90245, Tel: 1-800-67-VASAK; Empl.: 10; *Sls. Mgr.:* John Vasak

VA-TRAN SYSTEMS INC., 677 Anita St. Ste. A, Chula Vista, CA 91911, Tel: 619-423-4555, FAX: 619-423-4604; Empl.: 10; *Sls. Mgr.:* J.E. Sloan

VEAM, Litton Systems, 100 New Wood Rd., Watertown, CT 06795, Tel: 203-274-9681, TELEX: 710-477-0039, FAX: 203-274-4963; FSC No.: 55561; Empl.: 80; *Sls. Mgr.:* Maryellen Myers

VECTOR
ELECTRONIC COMPANY

FAX: 818-365-5718

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, 800-423-5659; FSC No.: 82893; Empl.: 95; *Dist. Mgr.:* J. Forman .... **C•1025, 1674-1675, 1678-1681**

For Vector Elctrns.' sales offices and reps. in all other states- 800-423-5659.

Local Sales Offices & Reps

CA	Carlsbad, QPI Sls.	714-431-8859
CA	Santa Ana, Mike Roth	714-647-0606
FL	Melbourne, Saber Assocs.	407-724-0920
IL	Inverness, Carvel Eng.	708-934-9600
MA	Needham Hgts., Todino	617-444-7925
NJ	Newark, Rical Assocs.	201-643-0880
NM	Albuquerque, Odyssey1	505-345-9695
OH	Solon, Five Star	216-349-1161
OR	Beaverton, Luscombe, Eng.	503-636-6664
PA	King of Prussia, KSI, Inc.	215-783-6400
TX	Dallas, Technlg. Reps.	214-713-9027
VA	Alexandria, Dyna-Rep	703-354-1222

National Distributors

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
MN	Thief River Falls, Digi-Key	800-344-4539
OH	Cleveland, Pioneer Stand. Elec.	216-587-3600
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Ft. Worth, Allied	800-433-5700
TX	Ft. Worth, Allied Elctrns.	800-433-5700

THE VECTOR GROUP, INC., 189 Horsham Rd., Horsham, PA 19044, Tel: 1-800-523-3696, FAX: 215-672-3411; Empl.: 10; *Sls. Mgr.:* Frank Menichello

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-356-2377, FAX: 908-356-6782; FSC No.: 32846; Empl.: 30; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., P.O. Box 5160, Norwalk, CT 06856-5160, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 340; *Sls. Mgr.:* Larry Jawitz .... **A•1502-1509**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Mountain View, Schoenduve Corp.	415-962-8330
CA	San Diego, Midwin & Olifson, Inc.	800-275-8765
CA	Tarzana, Midwin & Olifson, Inc.	800-275-8765
CO	Parker, Techn. Mktg. Assocs.	303-841-3435
CT	Watertown, May Tech.	203-274-3777
FL	Melbourne, Saber Assocs.	800-432-6288
GA	Lawrenceville, Saber Assocs.	800-327-0853
IL	Libertyville, GMR Sls., Inc.	708-367-8440
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	Kokomo, Valentine & Assocs.	317-453-3799
IN	South Bend, Valentine & Assocs.	219-288-7070
MO	St. Louis, Rush & West Assocs.	314-965-3322
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Burtonsville, Eastern Instrumentation	301-384-8500
MA	Reading, May Tech.	617-942-7135
MI	Grand Rapids, R. P. Urban Assocs.	616-245-0511
MN	Burnsville, Allied Comp. Reps.	612-435-7876
NY	Great Neck, F & F Metro	516-482-4080
NM	Albuquerque, J. Smith & Assocs.	505-345-6501
NY	Rochester, T–Squared Elctrns.	716-924-9101
NC	Clayton, Saber Assocs.	800-327-0853
OH	Englewood, A. Nace Co.	513-836-0931
OH	Hudson, A. Nace Co.	216-656-3273
PA	Havertown, SWR Tech., Inc.	215-353-6639
TX	Dallas, Texas Avionics	214-437-5677
UT	Salt Lake City, Techn. Mktg. Assocs.	801-483-1009
WA	Seattle, Datacom	206-285-2525
Can	Quebec, Microvolt Elctrns.	514-421-4164

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300, FAX: 516-349-8321; *Sls. Mgr.:* Gary DiBiase

FAX: 308-324-4985

VEETRONIX, INC., Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter .... **B•1816-1817**

VEGA PRECISION LABS., 800 Follin La, Vienna, VA 22180, Tel: 703-938-6300, FAX: 703-938-6311; FSC No.: 23115; Empl.: 160; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., 8675 Miralani Dr., Ste. 150, San Diego, CA 92126, Tel: 619-578-6787; FSC No.: 0BV42; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-0389; Empl.: 25; *Sls. Mgr.:* Sam Link .... **D•1388**

VEMALINE PRODUCTS DIV., See Handles Unlimited

VENABLE INDUSTRIES, INC., 2120-M Braker Ln., Austin, TX 78758, Tel: 512-837-2888,800-262-2522, TELEX: 752421, FAX: 512-837-3209; Empl.: 20; *Sls. Mgr.:* Shelley Kelly

VENT RAK, See General Devices

VERDURE INDUSTRIES INC., PO Box 24886, Omaha, NE 68124, Tel: 402-691-8300, FAX: 402-691-8400; Empl.: 7; *Sls. Mgr.:* Larry Johnson

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, P.O. Box 1207, Stowe, VT 05672-1207, Tel: 802-253-8567, 802-253-7649, FAX: 802-253-8019; Empl.: 8 .... **A•2036-2037**

Local Sales Offices & Reps

MA	Framingham, Gallagher Assosc.	508-626-2346
VT	Burlington, Twin State Sls.	802-658-7868

VERMONT RESEARCH CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, FAX: 802-886-2682; Empl.: 50; *Sls. Mgr.:* John Dimitruk

VERNITECH:VERNITRON CORP., 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 170

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VERNITRON CORP., Precision Comps. Group, 2800 Anvil St. N., St. Petersburg, FL 33710, Tel: 813-347-2181; FSC No.: 84048; Empl.: 350; *Sls. Mgr.:* Dennis Snavely/Roger Millheim; *Dist. Mgr.:* K. Hansen .... **A•1308, 2124-2126, 2599**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AK	Factory Direct	813-347-2181
AZ	Phoenix, Shefler-Kahn	602-257-9015
AR	Little Rock, Doby Assoc.	501-221-0326
CA	Los Angeles, Factory Direct	813-347-2181
CA	Santa Clara, West Rep	408-988-3188
CO	Denver, J.F. Hurlbut Co.	303-279-7796
NH	Amherst, D.A. Crowley & Assoc.	603-673-7050
FL	Largo, Electrocraft	813-544-1766
IL	Downers Grove, Golten Assocs.	708-985-5100
IN	Indianpolis, Elctrns. Reps.	317-894-1414
KS	Lenexa, MTS	913-888-5100
MD	Manchester, Imagitron Sls.	410-374-5600
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MI	St. Joseph, R.C. Merchant & Co.	616-983-7378
MN	Minneapolis, PSI	612-944-8545
MS	Jackson, Doby Assocs.	601-981-1138
NM	Albuquerque, Shefler-Kahn	505-345-3591
NY	Great Neck, Mos Assocs.	516-487-3966
NY	Syracuse, Pi'tronics	315-435-7346
OH	Cleveland, Baehr Greenleaf	216-892-1770
OH	Dayton, Baehr Greenleaf	513-439-0724
PA	Warrendale, Baehr Greenleaf	412-934-3088
TX	Dallas, Erickson Sls.	214-739-5833
Can	Scarbourough, Ont., JRL Assocs.	416-756-9862
Can	W. Vancouver, Leister Blake	604-926-6127

Local Distributors

AZ	Phoenix, Future	602-968-7410
AZ	Scottsdale, Kent	602-998-0399
AZ	Tempe, TTI	602-431-1191
CA	Agoura Hills, Zeus	818-889-3838
CA	Los Angeles, Bell	310-826-3975
CA	Los Angeles, TTI	818-891-8885
CA	San Diego, Kent	619-453-7133
CA	San Diego, TTI	619-748-2025
CA	San Jose, Future	408-434-1122
CA	San Jose, TTI	408-946-5577
CA	San Jose, Zeus	408-629-4789
CA	Santa Ana, TTI	714-641-9393
CA	Santa Clara, Kent	408-727-9830
CA	Torrance, Kent	310-320-2700
CO	Denver, TTI	303-429-6806
CT	Bethel, Future	203-743-9594
CT	Wallingford, TTI	203-284-7474
FL	Baco Raton, Jaco	407-241-7943
FL	Clearwater, Future	813-530-1222
FL	Orlando, TTI Inc.	407-849-1000
GA	Norcross, Jaco	404-449-9508
GA	Norcross, RS	404-242-0520
GA	Norcross, TTI	404-662-0911
IL	Elk Grove, Kent	708-364-1300
MA	Wilmington, TTI Inc.	508-658-4700
MD	Columbia, TTI	410-995-1331
MD	Columbia, Zeus	410-997-1118
MA	Bolton, Future	508-779-3000
MA	Lexington, Zeus	617-246-8200
MA	Tewksbury, JACO	508-640-0010
MN	Eden Prarie, TTI	612-933-8555
MN	St. Pauls, Kent	612-642-2828
MO	St. Louis, Olive	314-997-7709
MD	Columbia, Jaco	301-995-6620
NJ	Marlton, Future	609-596-4080
NJ	Mt. Carmel, TTI	609-234-6400
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Future	315-451-2371
NY	Mamaronneck, New Yorker	914-698-7800
NY	Port Chester, Zeus	914-937-7400
NY	Port Jefferson Station, Unique	516-474-4320
NY	Ronkonkoma, TTI Inc.	516-737-2000
OH	Columbus, Elctrns. Mktg.	614-299-4161
OH	Dayton, Bell Micro-Mil	513-434-8231
OH	Dayton, Zeus	513-293-6162
OH	Independence, TTI	216-328-9755
PA	Philadelphia, P.E.I. Genisus	215-673-0400
TX	Addison, JACO	214-733-4300
TX	Ft. Worth, Allied	817-595-3500
TX	Ft. Worth, TTI Inc.	817-595-3100
TX	Richardson, Zeus	214-783-7010
UT	Salt Lake City, Future	801-972-8489
WA	Bothell, Future	206-489-3400
WA	Redmond, TTI	206-882-0291
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERN KIEBLER ELECTRONICS, INC., 201 N. Gables, Wheaton, IL 60187, Tel: 708-668-5407, FAX: 708-462-7590; Empl.: 150; *Sls. Mgr.:* Vern Kiebler

VERSALOGIC CORP., 3888 Stewart Rd., Eugene, OR 97402, Tel: 800-824-3163, FAX: 503-485-5712

VERTEK INTL. INC., 9465 Customhouse Plaza, Ste. D, San Diego, CA 92173, Tel: 619-661-6868, FAX: 706-686-3444(Mexico); Empl.: 150

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Carlo Pastore

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, FAX: 714-530-0143; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 12; *Sls. Mgr.:* Cyndi Reish

VETRA SYSTEMS CORP., 27 Newtown Rd., Plainview, NY 11803, Tel: 516-454-6469, FAX: 516-454-1648; Empl.: 10; *Sls. Mgr.:* Jim Del Rossi .... **B•1852**

VG CONTROLS, INC., 34 Jenkins Road, Hewitt, NJ 07421, Tel: 201-853-4600, TELEX: 201-853-7913; Empl.: 3 .... **B•1855**

VGI, INC., Vikay Industrial Pte. Ltd., 1800 Vernon St., Roseville, CA 95661, Tel: 916-783-7878, FAX: 916-783-7845; Empl.: 14; *Sls. Mgr.:* Gary Johnson

VIABLE SYSTEMS INC., Box 369, Sherborn, MA 01770, Tel: 508-653-7665, TELEX: 922 495 VIABLEUS, FAX: 508-653-6645; Empl.: 30

VIATRAN CORPORATION, 300 Industrial Drive, Grand Island, New York 14072, Tel: 716-773-1700, TELEX: 710-260-1353, ESYLNK: 716-773-2488; Empl.: 110

VIA WEST INTERFACE, INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, 1-800-266-5716, FAX: 1-602-623-5718; Empl.: 4; *Sls. Mgr.:* Robert S. Bos

VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

Vibra•Metrics INC.

FAX: 203-288-4937

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-U-SENS-IT; Empl.: 25; *Sls. Mgr.:* William McClain .... **B•2024**

Local Sales Offices & Reps

AZ	Tempe, Rusler Tech.	602-897-2877
CA	Huntington Bch., Transducer Sys. Co.	714-969-7690
CO	Longmont, Weaver & Assocs.	303-772-1999
GA	Tunnel Hill, Pump & Vibration Consits.	404-935-5851
MI	Troy, Satullo Assoc., Inc.	313-585-4811
LA	Greenwell Springs, Vibratronics	504-261-7580
MI	Troy, Satullo Assocs., Inc.	313-585-4811
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
NY	E. Berne, Northeast Rsch. Assoc.	518-872-2062
OH	Cleveland, Abitec	216-531-9122
OR	Portland, R & T Factors, Inc.	503-287-6114
PA	New Hope, NOVA Pennsylvania Inc.	215-297-0950
RI	Narragansett, Pat Assocs.	800-628-8860
SC	Spartanburg, Pat Assocs.	803-591-4284
TN	Chattanooga, Pump & Vibation Consits.	404-935-5851
TX	Friendswood, Parameter Meas.	713-482-8470
TX	Webster, Parameter Meas.	214-907-6300
UT	W. American Fork, Highland Tech. Mktg.	801-756-2634
VA	Powhatan, IHN Mntc & Eng. Svcs.	804-598-7625
WA	Issaquah, Avantech	206-392-4033
WI	Mequon, James L. Griffin Co. Inc.	414-241-4451
EXP	Hamden, CT, Vibra-Metrics, Inc.	203-288-6158
Can	Burnaby, BC, Machinery Condition Monitoring	506-738-8675

Can	Montreal, Que., Silentec, Ltd.	514-731-3397
Can	St. John, NB, Dynamic Signal Analysis Corp.	604-433-8515

Local Distributors

CT	Ledyard, Emprise Corp.	203-464-8555
MA	Action, Lindskog Balancing Co.	508-263-2040

VIBRO-METER CORP., P.O. Box 5058, Billerica, MA 01822-5058, Tel: 508-663-7322, TELEX: 948145, TWX: 710-320-1872, FAX: 508-667-1944; FSC No.: 62587; Empl.: 50; *Sls. Mgr.:* John Strich

VICOM SYSTEMS, INC., 46107 Landing Pkwy., Fremont, CA 94538, Tel: 415-498-3200, FAX: 415-498-3325; Empl.: 45; *Sls. Mgr.:* Michael Piltoff, Sls. VP

VICOR CORP., 23 Frontage Rd., Andover, MA 01810, Tel: 508-470-2900, TELEX: 910-380-5144, ESYLNK: 508-475-6715; Empl.: 400; *Sls. Mgr.:* D. Nesbitt; *Dist. Mgr.:* L. Cavanaugh

V.I. CORPORATION, 47 Pleasant St., Northampton, MA 01060, Tel: 413-586-4144, FAX: 413-586-3805; Empl.: 75; *Sls. Mgr.:* Paul Maguire, VP Nat. Sls.

VICTOREEN, INC., 6000 Cochran Rd., Solon, OH 44139-3395, Tel: 216-248-9300, 216-248-9043, FAX: 216-248-9301; Empl.: 350; *Sls. Mgr.:* Glenn Whiteley .... **A•2038-2040**

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 500; *Sls. Mgr.:* E. M. Colasanto

VICTOR ENGINEERING, 1000 Calle Cordillera, San Clemente, CA 92673, Tel: 714-366-2931, FAX: 714-366-2385

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933, FAX: 213-559-4167; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, FAX: 201-379-5982; Empl.: 98

VIDCO, INC., 6175 S.W. 112th Ave., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, 10 Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613, FAX: 914-764-4613; Empl.: 5

VIDEO DISPLAY CORP., 1868 Tucker Industrial Dr., Tucker, GA 30084, Tel: 404-938-2080,800241-5005, FAX: 404-493-3903; Empl.: 300; *Sls. Mgr.:* Robert (Bob) Liss; *Dist. Mgr.:* Randy Russell

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 120; *Sls. Mgr.:* J. Jenson

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33716, Tel: 813-577-1216, FAX: 813-577-2082; *Sls. Mgr.:* Bill Strickland

VIKING ELECTRONICS, INC., 1531 Ind. St. PO Box 448, Hudson, WI 54016, Tel: 715-386-8861, FAX: 715-386-7423; Empl.: 40; *Sls. Mgr.:* Roy Crist

VIKING ELECTRONICS, INC., 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, FAX: 818-882-5713; FSC No.: 05574; Empl.: 150; *Sls. Mgr.:* William Vockerath; *Dist. Mgr.:* William Vockerath

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 508-481-4600, FAX: 508-481-4602; Empl.: 25; *Sls. Mgr.:* Aubrey Elms

VIRGINA PANEL CORPORATION, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; FSC No.: 18117; Empl.: 130; *Sls. Mgr.:* Norman D. Wood

FAX: 703-375-0135

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-375-0100; FSC No.: 59608; Empl.: 110; *Sls. Mgr.:* Barry D. Lee .... **C•1508-1509, 1814-1817**

Local Sales Offices & Reps

AL	Huntsville, Solutions, Inc.	205-539-3152
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Arcadia, H M C Inc.	818-447-0958
CA	San Diego, HMC, Inc.	619-484-8921
CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
FL	Apopka, Dan-Tech Sls.	407-884-0252
FL	Clearwater, Dan-Tech Sls.	813-441-2609
FL	Davie, Dan-Tech Sls.	305-581-2884
GA	Marietta, Solutions, Inc.	404-951-5683
IL	Wheaton, CS Tech. Sls., Inc.	708-653-8126
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Norwood, MacInnis Co.	617-762-8090
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MS	Meridian, Solutions, Inc.	601-482-4647
MO	Lake St. Louis, Markline Technlgs.	314-625-6222
NJ	Englewood, Sprung & Rea Inc.	201-569-5666
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Buffalo, Empire Tech.	716-381-8500
NY	Skaneateles, Empire Tech.	315-685-5703
NC	Raleigh, Solutions, Inc.	919-790-7606
OH	Rocky River, Oak Hill Mktg.	216-333-0000
OH	Westerville, Oak Hill Mktg.	614-890-5150
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Harrisburg, All-Tech. Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg., Inc.	215-344-0134
KS	Overlook Pk., Markline Technlgs.	913-681-8880
TX	Austin, M-Rep	512-250-0828
TX	Dallas, M-Rep	214-484-5711
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Mountlake Terrace, SPS Elctrns.	206-323-4140
Can	Downsview, Ont., Tienkay, Inc.	416-736-1221
Can	Montreal, Que., XLR8 Inc.	514-481-6566

Local Distributors

CA	Canoga Park, Acort Inds.	818-700-2991
NH	Manchester, Yankee Elctrn. Supp. Co.	800-365-9720
Can	Downsview, Ont., P.S. Comps.	416-665-9546

VISHAY-MANN SYSTEM, See Vishay Resistive Systems

VISHAY RESISTORS, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl.: 500; *Sls. Mgr.:* William Brennan ... **A•2041-2048, 2127**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, VEC	619-535-9080
CA	Tustin, VEC	714-544-7024
CO	Loveland, VEC	303-667-7500
GA	Atlanta, JWL Assocs.	404-518-8500
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IL	Skokie, IRI-Illinois	708-967-8430
IN	Indianapolis, Scott Elctrns.	317-841-0010
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Bloomington, IRI of Minnesota	612-854-8027
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NY	Fairport, L-Mar Assocs.	716-425-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OR	Beaverton, Uni Comp, Inc.	503-643-1645
PA	Horsham, TMI	215-441-4300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Austin, BPA, Inc.	512-346-9186
TX	Richardson, BPA, Inc.	214-234-8438
WA	Snohomish, Uni Comp, Inc.	206-568-0511
WI	Brookfield, IRI-Wisconsin	414-789-9393
Can	Burnaby, B.C., Kaytronics, Inc.	604-294-2000
Can	Calgary, Alberta, Kaytronics	403-275-7000
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Mississauga, Ont., Kaytronics, Inc.	416-507-6400
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

Local Distributors

AZ	Scottsdale, Kent Elec./Shelley-Ragon	602-998-0399
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Chatsworth, Kent Elec./Shelley-Ragon	818-998-3333
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Milpitas, Kent Elec./Shelley-Ragon	408-262-5300
CA	Mission Hill, TTI, Inc.	818-891-8885
CA	San Diego, Kent Elec./Shelley-Ragon	619-453-7133
CA	San Diego, TTI, Inc.	619-748-2025
CA	San Jose, Passive Comps.	408-441-1441
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Sunnyvale, TTI, Inc.	408-946-5577
CA	Torrance, Kent/Shelley-Ragon	310-321-2700
CO	Englewood, Kent Elec./Shelley-Ragon	303-762-0670
CO	Westminister, TTI, Inc.	303-429-6806
CT	Berlin, Kent Elec./Shelley-Ragon	203-829-2100
FL	Largo, Kent Elec./Shelley-Ragon	813-545-0057
FL	Orlando, TTI, Inc.	407-859-1000
FL	St. Petersburg, MMG Elec./L&S	813-521-2966
CT	Wallingford, TTI, Inc.	203-284-7474
GA	Norcross, TTI, Inc.	404-662-0911
IL	Elk Grove, Kent Elec./Shelley-Ragon	708-364-1300
IL	Schaumburg, TTI, Inc.	708-884-6500
IA	Cedar Rapids, Kent Elec./Shelley-Ragon	319-373-0525
KS	Overland, Kent Elec./Shelley-Ragon	816-254-3410
MD	Baltimore, RESCO/Baltimore	410-931-8200
MD	Beltsville, RESCO/Washington	301-937-9100
MA	Chelmsford, Kent Elec./Shelley-Ragon	508-250-9666
MA	Tewksbury, TTI, Inc.	508-851-2000
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	St. Paul, Kent Elec./Shelley-Ragon	612-642-2828
MS	Columbia, TTI, Inc.	410-995-1331
MO	Hazlewood, Kent Elec./Shelley-Ragon	314-895-1515
MO	Independence, Kent Elec./Shelley-Ragon	816-254-3410
NJ	Denville, Kent Elec./Shelley-Ragon	201-625-5500
NJ	Mt. Laurel, TTI Inc.	609-234-6400
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Ronkonkoma, Mast Distrs., Inc.	516-471-4422
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Charlotte, TTI, Inc.	704-522-0277
SC	Charleston, L & S	803-720-4242
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Dayton, TTI, Inc.	513-898-8330
OH	Independence, TTI, Inc.	216-328-9755
OR	Beaverton, Kent Elec./Shelley-Ragon	503-626-8300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Austin, Kent Elec./Shelley-Ragon	512-834-1900
TX	Fort Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Houston, Kent Elec./Shelley-Ragon	713-780-7770
TX	Houston, Texas Comp. Corp.	713-468-3882
TX	Houston, TTI, Inc.	713-879-5800
TX	Richardson, Kent Elec./Shelley-Ragon	214-669-2600
WA	Redmond, Kent Elec./Shelley-Ragon	206-883-7200
WA	Redmond, TTI, Inc.	206-882-0291
Can	Burnaby, B.C., Kaytronics	604-294-2000
Can	Kanata, Ont., Kaytronics	613-564-0080
Can	Mississauga, Ont., Kaytronics	416-507-6400
Can	Que., Kaytronics, Inc.	514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, FAX: 203-355-0712; Empl.: 15; *Sls. Mgr.:* Richard Jones

VISION ENGINEERING LABORATORIES, Amglo Kemlite Laboratories Inc., 8787 Enterprise Blvd., Largo, FL 34643, Tel: 813-539-0448, FAX: 813-539-8535

VISTA SYSTEMS, INC., 2 Centennial Drive, Peabody, MA 01960, Tel: 508-532-1971, FAX: 508-532-2068; Empl.: 4; *Sls. Mgr.:* Jim Atwood

VISUAL COMMUNICATIONS CO., INC., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, Tel: 619-549-6900, FAX: 619-549-3520; Empl.: 9; *Sls. Mgr.:* P. Loudon ... **B•1196-1199**

Local Sales Offices & Reps

CT	Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Dist. Inc.	800-888-0331
CA	Costa Mesa, Orange County Comp.	714-979-3597
CA	Los Angeles, Electric Switch Inc.	213-660-1310
CA	San Diego, Orange County Comps.	619-549-2511
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CO	Englewood, Component Dist. Inc.	800-551-7357
FL	Clearwater, Component Distrs.	800-558-2351
FL	Ft. Lauderdale, Component Distrs.	813-796-0466
FL	Palm Bay, Component Dist. Inc.	407-724-9910
GA	Norcross, Component Dist. Inc.	404-441-3320
IL	Palatine, OHM Elctrns.	800-624-8490
MA	Lynn, Land Elctrns.	617-581-9060
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MN	New Brighton, Chris Elctrns.	612-631-2647
NJ	Bellmawr, Mid Atlantic	609-931-5303
OH	Aurora, Industrial Prods.	216-562-8113
OH	Centerville, Industrial Prod. Dist.	513-435-2086
OH	Columbus, Spectra Elctrns.	614-265-2250
TX	Dallas, Component Dist. Inc.	800-848-4234

VISUAL INFORMATION TECHNOLOGIES, INC.(UITEC), 3460 Lotus Dr., Plano, TX 75075, Tel: 214-596-5600, 800-325-6467, FAX: 214-867-4489; Empl.: 40; *Sls. Mgr.:* Ken Hilton, VP Sls., Mktg.; *Dist. Mgr.:* Winston Guillory

VITEC ELECTRONICS CORP., 8530 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1535, FAX: 209-651-1538; *Sls. Mgr.:* Ed Green

VITEC, INC., 236000 Mercantile Rd., Cleveland, OH 44122, Tel: 1-800-321-6384, FAX: 216-464-5324; Empl.: 300; *Dist. Mgr.:* Ernie Hopp

VITEQ CORP., 1000 Aerospace Rd., Lanham, MD 20706, Tel: 301-731-0400, F^X: 301-731-5995; Empl.: 120; *Sls. Mgr.:* Edward Bone

VITREK CORPORATION, 7576 Trade Street, San Diego, CA 92121, Tel: 619-586-1695, FAX: 619-586-0802; Empl.: 42; *Sls. Mgr.:* Kevin Clark ... **D•1333**

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 325; *Sls. Mgr.:* Tom Curran; *Dist. Mgr.:* Tom Curran

VL ELECTRONICS, INC., 3250 Wilshire Blvd., Ste. 1301, Los Angeles, CA 90010-1603, Tel: 213-738-8700, FAX: 213-738-5340; FSC No.: 95-3896380; Empl.: 10; *Sls. Mgr.:* C. Kreslake; *Dist. Mgr.:* C. Kreslake ... **B•1127**

Local Sales Offices & Reps

AL	Huntsville, Giesting & Assocs.	205-830-4554
CA	San Diego, Varitronix	213-738-8700
CO	Denver, MRC	303-660-8750
DC	D.C./Baltimore, Eastern Elctrns.	919-876-7591
GA	Norcross, Giesting & Assocs.	404-242-9320
IL	Des Plaines, ESCO Assocs.	708-298-5310
IN	Indianapolis, J. C. Hofstetter Co.	317-897-7914
IA	Marion, A.E.M. Assocs.	319-377-1129
KS	Olathe, A.E.M. Assocs.	913-888-0022
MA	Canton, New England Elctrn. Sls.	617-828-4835
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TX	Dallas, Altech	214-418-0850
MN	St. Paul, Proud Inds.	612-646-9428
WI	Colgate, Rep One	414-628-4016
WI	Madison, Rep 1 & Assocs.	608-835-7365
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-234-8966
Can	Vancouver, Norgay Ltd.	604-275-1121

Local Distributors

CA	Los Angeles, VL Elctrns Inc.	213-738-8700
MN	Minnesota, Digi Key	800-344-4539
NC	Raleigh, Eastern Elctrns.	919-876-7591

VLSI TECHNOLOGY, INC., 1109 McKay Dr., San Jose, CA 95131, Tel: 408-434-3000, FAX: 408-434-7926; Empl.: 2000; *Dist. Mgr.:* John Levers

VME MICROSYSTEMS INTL. CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; FSC No.: OBPH5; Empl.: 137; *Sls. Mgr.:* Al Casteleyn

VMETRO, INC., VMETRO as, 16010 Barker's Point Ln., Ste. 575, Houston, TX 77079, Tel: 713-584-0728, FAX: 713-584-9034; Empl.: 6; *Sls. Mgr.:* Jennifer Kaufmann

VOICE CONNEXION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366, FAX: 714-261-8563; *Sls. Mgr.:* Shirley Dworak

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 908-526-3408, FAX: 908-526-5714; Empl.: 7

VOICE PROCESSING CORP., 1 Main St., Cambridge, MA 02142, Tel: 617-494-0100, FAX: 617-494-4970; Empl.: 19

VOLGEN AMERICA, INC., Tokyo Keidenki Co., Ltd., 32980 Alvarado-Niles Rd., Ste.854, Union City, CA 94587, Tel: 510-429-7170, FAX: 510-429-7173; Empl.: 5; *Sls. Mgr.:* Ron Wild; *Dist. Mgr.:* Robert Staub

Local Sales Offices & Reps

AZ	Scottsdale, Jackson Mtkg.	602-998-0831
CA	Santa Clara, Elctro-Venture	415-727-1553
CO	Parker, TMA Colorado	303-841-3435
FL	Lighthouse Point, Warren Peters Assocs.	305-974-2442
IL	Roselle, Rainbow Entprs.	708-980-2155
MA	Milford, AFM Grp.	508-634-3092
MN	Richfield, Clay Rep. Co.	612-861-2191
NY	Eastchester, WD. Sls.	914-779-8840
NY	Rochester, Micro-Tech. Mktg.	716-426-0806
NC	Raleigh, Tingen Tech. Sls.	919-870-6670
OH	Westlake, KRW Sls.	216-871-7521
OR	Portland, Power Factor Assocs.	503-657-6969
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
TX	Dallas, AID Elctrns.	214-790-4781
Can	Mississauga, Ont., BBD Elctrns.	416-821-7800

Local Distributors

CA	Milpitas, Compumech Elctrns.	408-945-9100
FL	Ft. Lauderdale, Panamtech	305-792-7220
GA	Norcross, Satori Elctrns.	404-242-0606
IL	Chicago, Dalec Distrs.	312-283-0300
IL	Roselle, Foresight Elctrns.	708-980-2155
MA	Burlington, Atlantic Comps.	617-270-0051
MI	Livonia, LWC Distrs.	313-464-7700
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VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, TELEX: 530484, FAX: 209-651-0740; FSC No.: 60211; Empl.: 85; *Sls. Mgr.:* Karen Spano

VOLTARC TECHNOLOGIES, INC., 186 Linwood Ave., P.O. Box 688, Fairfield, CT 06430, Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 500; *Sls. Mgr.:* Gino J. Ciancanelli

Voltech

FAX: 508-879-8669

VOLTECH, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329; Empl.: 10; *Sls. Mgr.:* Louise Hall .... D•1332

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs., Inc.	800-327-0853
CA	Dana Point, Electro Venture-South	714-496-5225
CA	Santa Clara, Electro Venture-North	408-727-1553
FL	Melbourne, Saber Assocs., Inc.	800-327-0853
GA	Lawrenceville, Saber Assocs., Inc.	800-327-0853
IL	Arlington Hgts., Berndt Assoc., Inc.	708-632-0900
IN	Carmel, Berndt Assoc., Inc.	317-844-0114
MI	Plymouth, E Q S Sys.	313-455-7920
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, Quality Technig.	505-889-4565
NY	Fayetteville, M.P. Andrews Mfg's. Rep.	315-637-5291
NY	Wantagh, Bytec	516-781-7400
NC	Clayton, Saber Assocs.,Inc.	800-327-0853
OH	Chesterland, E Q S Sys.	216-729-2222
OH	Dayton, E Q S Sys.	513-236-7676
MN	Minneapolis, Berndt Assoc., Inc.	612-546-2021
OR	Portland, Power Factor & Assoc.	503-233-6969
PA	Huntington Valley, Sci Rep, Inc.	215-322-6500
PA	Wexford, E Q S Sys.	412-935-0678
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Fairfax, SCI Rep, Inc.	703-385-0600
WA	Seattle, Datacom	206-285-2525
WI	Milwaukee, Berndt Assoc., Inc.	414-545-8400

VOLTEX

FAX: 516-842-2991

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ... D•2217

Local Sales Offices & Reps

CA	Santa Clara, W-J Elctrns. Sls.	408-982-9222

VOLTRONICS CORPORATION, 100-10 Ford Rd., Denville, NJ 07834, Tel: 201-586-8585, FAX: 201-586-3404; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Nicholas J. Perrella

Local Sales Offices & Reps

CA	Mtn. View, Schoenduve Corp.	415-962-8330
CA	Tarzana, Midwin & Olifson	800-275-8765
CO	Parker, W. Howard Assocs., Inc.	303-841-5755
FL	Lighthouse Pt., R. C. Simon & Co.	305-941-2757
IL	Chicago, CSJ Inc.	708-559-0660
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Columbia, M. Lader Co.	800-442-3177
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
PA	Camphill, Quick Response Tech. Sls.	215-362-9225
TX	Richardson, Vector Sls. Co.	214-234-4291
Can	St. Laurent,Que., RF Microwave Ltd.	514-335-2335
WA	Seattle, Datacom Assocs., Inc.	206-285-2525

VORNE INDUSTRIES, INC., 5831 Northwest Highway, Chicago, IL 60631, Tel: 312-775-9440, FAX: 312-775-3854; *Sls. Mgr.:* Ramon Vorne

VORTEC CORPORATION ILLINOIS TOOL WORKS, 10125 Carver Rd., Cincinnati, OH 45242, Tel: 800-441-7475, FAX: 513-891-4092; FSC No.: 51313; Empl.: 45; *Sls. Mgr.:* Karen S. Brown

VORTEX, INC., 990 Highland Dr., Ste. 212, Solana Bch., CA 92075, Tel: 619-259-5549, FAX: 619-259-5588; Empl.: 30; *Sls. Mgr.:* Paul J. Jester

V R INDUSTRIES, INC., 333 Strawberry Field Rd., Warwick, RI 02886, Tel: 401-732-6800, FAX: 401-738-7910; *Sls. Mgr.:* Fred Pestana

V-TRON ELECTRONICS CORP., 10 Venus Way, P.O. Box 3297, S. Attleboro, MA 02703, Tel: 508-761-9100, FAX: 508-761-4727; Empl.: 150; *Sls. Mgr.:* Richard E. French

Local Sales Offices & Reps

MA	Needham, Com-Sale	617-444-8071
NC	Raleigh, Avalon Entprs.	919-821-5777
TX	Ft. Worth, Diversified Comps.	817-244-7704

VU-DATA CORPORATION, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, FAX: 619-452-2543; FSC No.: 34160; Empl.: 20; *Sls. Mgr.:* M. Knapp

VYNCKIER, INC., 4 Skyline Dr., Hawthorne, NY 10532, Tel: 714-896-0772, FAX: 714-891-0749; Empl.: 50

WABASH MAGNETICS, CONTROL PRODS. GRP., First & Webster Streets, Wabash, IN 46992, Tel: 219-563-2191, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Stanley P. Bickhart

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-354-1268; FSC No.: 65996; *Sls. Mgr.:* Thomas J. Artmann

WALDMANN LIGHTING CO., 9 W. Century Dr., Wheeling, IL 60090, Tel: 708-520-1060, 800-634-0007, FAX: 708-520-1730; *Sls. Mgr.:* Gary Cardoza

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 508-852-3674, 508-853-3232, 800-962-4638, FAX: 508-856-9931; Empl.: 83; *Sls. Mgr.:* B. Langley .... D•1334

Local Sales Offices & Reps

AL	Birmingham, Levand Sci. Co.	800-222-2595
CA	San Marcos, Mitchell Instrs.	619-744-2690
CA	Santa Barbara, Abbeon Cal, Inc.	805-966-0810
CT	Westport, A.J. Abrams Co.	203-226-3010
IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
MA	Gardner, MR Resources	508-632-7000
MD	Baltimore, Davis Instrs.	301-243-4301
NY	Rochester, Transcat	716-458-4801
TX	Garland, Tucker Elctrns.	214-348-8800

Local Distributors

CA	San Marcos, Mitchell Instrs.	619-744-2690
CT	Westport, A.J. Abrams	203-226-3010
IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
MA	Gardner, MR Resources	508-632-7000
MD	Baltimore, Davis Instrs.	301-243-4301
TX	Garland, Tucker Elctrns.	214-348-8800
NY	Rochester, Transcat	716-458-4801

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535, FAX: 401-732-5784; Empl.: 75; *Sls. Mgr.:* Rick Sorensen; *Dist. Mgr.:* R. Huntsman

WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 603-778-2300, FAX: 603-778-9797; Empl.: 50

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; FSC No.: 79165; Empl.: 60; *Sls. Mgr.:* William Goettche

WALTHER ELECTRIC CORPORATION, WALTHER WERKE, Ferdinand Walther, 10 Alvin Ct, E. Brunswick, NJ 08816, Tel: 908-238-1166, FAX: 908-238-0764; Empl.: 220; *Sls. Mgr.:* Craig J. Nimick

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, FAX: 714-545-6093; FSC No.: 58774; Empl.: 20; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Greg Winchell .... **B•1176-1177**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
IN	Kokomo, (SAI)Schillinger Assoc. Inc.	317-455-2708
MI	Southfield, Turner Assocs.	313-353-7660
NY	Bayshore, Richard McGrath Inc.	516-968-8448
WA	Seattle, Repwest	206-283-8351

WANDEL & GOLTERMANN INC., 2200 Gateway Centre Bvld., Morrisville, NC 27560-9228, Tel: 919-460-3300, FAX: 919-481-4372; Empl.: 40; *Sls. Mgr.:* Calvin Church

WARREN G-V, General Signal Corp., 1 Apollo Drive, Whippany, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9331; FSC No.: 93929; Empl.: 140; *Sls. Mgr.:* William J. Vandertulip; *Dist. Mgr.:* William J. Vandertulip ... **B•1908**

Local Sales Offices & Reps

AZ	Phoenix, Dorton Entprs. Inc.	602-944-2957
CA	Brea, Masco Inc.	714-529-0866
CA	Saratoga, Testco	408-253-1900
CO	Golden, James Hurlburt Co.	303-279-7796
IL	S. Elgin, R.K. Elctrns.	708-695-8552
KS	Lenexa, Midtech Inc.	913-541-0505
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339
MN	Eden Praire, PWC Inc.	612-934-1409
NY	Hauppauge, Sticom	516-366-4221
NY	Rochester, Lamb Comps. Inc.	716-328-6350
PA	Hatboro, AQS Inc.	215-674-3562
TX	Carrollton, Seaton Corp.	214-980-9860

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WATERS INSTRUMENTS INC., 2411 7th St. N.W., Rochester, MN 55903, Tel: 507-252-3700, FAX: 507-288-7218; Empl.: 135; *Sls. Mgr.:* Peter D. Kozachok

WATERS MANUFACTURING, INC. | Talley Industries

FAX: 508-358-5649

WATERS MANUFACTURING, INC., Talley Industries, Longfellow Ctr., Wayland, MA 01778, Tel: 508-358-2777; FSC No.: ;Multiple; Empl.: 90; *Sls. Mgr.:* Gary Briggs .... **A•2128-2129**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs., Inc.	205-533-9108
AZ	Paradise Valley, Techrep Comps., Inc.	602-991-6646
AZ	Paradise Valley, Techrep-Don Epand	602-443-8288
CA	Alameda, Liaison, Inc.	501-769-1991
CA	Lomita, Techrep	310-539-9070
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	Melbourne, R-Rep Co.	407-242-9800
IL	Palatine, Vine Sls., Inc.	708-934-5476
KS	Overland Park, Acorn Elctrns.	913-649-6402
MA	Lowell, Underwood Sls. Corp.	508-256-8191
MO	St. Louis, Acorn Electronics	314-421-1751
OH	Dayton, INH Comp. Sls.	513-434-8808
PA	Blairsville, Meas. Instrs. East	412-459-8092
PA	Newtown, Indl. Sls. Assoc.	215-860-2076
TX	Dallas, Allied Comps.	214-238-0408
TX	Dallas, Circom, Inc.	214-690-0400

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 2600

WAVETEK CORP., 9145 Balboa Ave., San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-450-0325; Empl.: 260; *Sls. Mgr.:* Joe Gomula; *Dist. Mgr.:* Michael Latham

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK COMMUNICATIONS DIV., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203-6109, Tel: 317-788-9351, ESYLNK: 317-782-4607; FSC No.: 34280; Empl.: 303; *Sls. Mgr.:* Gary Culbertson; *Dist. Mgr.:* Ben Constantini

For Sls. Ofcs. & Reps. 9145 Balboa Ave, San Diego, CA 92123

WAVETEK INSTRUMENTS DIVISION, Wavetek Corp., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-565-9558; *Sls. Mgr.:* Joe Gomula

WAYNE KERR INC., Farnell Electronics plc, 11 Sixth Rd., Woburn, MA 01801, Tel: 617-938-8390, 1-800-933-9319, FAX: 617-933-9523; Empl.: 7; *Sls. Mgr.:* Ken Harrison

WEARNES HOLLINGSWORTH CORP., 4 Chrysler, Irvine, CA 92718, Tel: 714-855-6404, FAX: 714-855-8264; Empl.: 30; *Sls. Mgr.:* Jim Hunter

WEARNES HOLLINGSWORTH, Electrical Products Division, 1601 N. Powerline Rd., Pompano Bch., FL 33069, Tel: 305-979-2050, FAX: 305-960-1431; Empl.: 117; *Sls. Mgr.:* Jack Kelly

WEBER PROTECTION, INC., 291 Great Valley Parkway, Malvern, PA 19355, Tel: 610-651-0770, 800-WEBERPA, FAX: 610-651-0775; *Sls. Mgr.:* Theo Notaras .... **B•1391-1393**

Local Sales Offices & Reps

AZ	Hartland Sls.	602-492-0012
CA	Lighthorse Technlgs.	619-270-7399
CA	Signal Entprs.	818-957-0640
CA	Trademark Assocs.	408-997-1216
CO	Donohue Sls. Co.	303-455-1719
CT	C.W. Assocs.	203-656-2339
FL	EAB, Inc.	407-339-4986
GA	EAB, Inc.	404-975-3660
IL	Production Comps.	312-774-3434
MI	Urban Assocs.	616-245-0511
MN	Engr. Prods.	612-835-9022
MO	M.I.N.K. Assocs.	314-291-5454
NH	Bell Controls	603-882-6984
NY	L-Tron	716-383-0050
NY	Sticom Sls. & Mktg.	516-366-4221
OH	R.K. Comp. Sls.	216-642-9312
OR	Controltek	503-641-0876
PA	Freedman-Malta Assocs.	215-337-9211
TX	D.J. Sls. & Assocs.	214-783-8876
WI	Bert Wartchow Assocs.	414-821-2993

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FAX: 518-298-5938

WECO ELECTRICAL CONNECTORS, INC., Trimex Bldg., Rte. 11, Mooers, NY 12958, Tel: 518-298-4810; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* John T. Meikle; *Dist. Mgr.:* John T. Meikle .... **C•1510-1521**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean Inc.	205-830-1540
AZ	Mesa, Hartland Sls. Inc.	602-834-7042
CA	Newport Bch., SPA Inc.	714-863-1193
CA	San Diego, SPA Inc.	619-530-0209
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Boulder, Stratford Grp.	303-530-3194
FL	Apopka, Cartwright & Bean Inc.	407-889-9100
FL	Deerfield, Cartwright & Bean Inc.	305-429-3400
GA	Norcross, Cartwright & Bean Inc.	404-368-0160
IL	Palatine, Key Entprs. Inc.	708-991-2144
IN	Indianapolis, MEI (Mktg. Engrs.)	317-872-5665
IA	Davenport, Rush & West Assocs. Inc.	319-388-9494
KS	Olathe, Rush & West Assocs.,Inc.	913-764-2700
KY	Lexington, Mktg. Engrs. Inc.	606-275-4103
LA	Covington, Cartwright & Bean Inc.	504-892-1700
MD	Randalls Town, Chesapeake Indl. Mktg.	410-653-0476
MA	Scituate, Olsen Tech Sls. Inc.	617-545-5101
MI	Farmington, Marlow Assocs. Inc.	313-478-2240
MI	Novi, Marlow Assocs., Inc.	313-348-5791
MN	Eden Prairie, PWC Inc.	612-934-1409
MS	Jackson, Cartwright & Bean Inc.	601-981-1170
MO	St. Louis, Rush & West Assocs.,Inc.	314-965-3322
NH	Nashua, Olsen Tech. Sls. Inc.	603-888-3619
NJ	Woodbridge, Riser Sls.Inc.	908-634-0954
NY	Buffalo, NRM Mktg. Inc.	716-634-4300
NY	Skaneateles, NRM Mktg. Inc.	315-685-8991
NY	Spencerport, NRM Mktg. Inc.	716-352-9166
NC	Charlotte, Cartwright & Bean Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean Inc.	919-876-4130
OH	Dayton, Marlow Assocs., Inc.	513-274-9666
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Allison Pk., Marlow Assocs., Inc.	412-487-0664
PA	Spring Grove, Select Sls. Assocs.	717-229-2977
TN	Germantown, Cartwright & Bean Inc.	901-758-8113
TN	Knoxville, Cartwright & Bean Inc.	605-693-7450
TX	Austin, Electra Reps. Inc.	512-339-1163
TX	Dallas, Electra Reps. Inc.	214-248-3852
TX	Houston, Aid Elctrns., Inc.	713-575-7959
WA	Snohomish, SPS Elctrns.	206-323-4140
WI	Milwaukee, Key Entprs. Inc.	414-762-2323

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Scottsdale, Evolution Technlg.	602-991-0223
AZ	Tempe, Control Design Supp. Inc.	602-829-7981
AR	N. Little Rock, Control Design Supp. Inc.	501-851-3137
CA	Anaheim, Control Design Supp. Inc.	714-821-1516
CA	Brea, Interconnect Specialties Inc.	714-961-7955
CA	Fountain Valley, Comp. Ctr.	714-979-0433
CA	Fremont, Connex Elctrns. Corp.	510-656-7722
CA	San Carlos, Control Design Supp. Inc.	415-592-4806
CA	San Diego, Control Design Supp.	619-457-9822
CA	San Diego, DECO ELctrns.Inc.	619-693-1595
CA	Santa Ana, BDS Elctrns. Inc.	714-662-1050
CA	Santa Clara, Component Ctr.	408-988-3751
CA	Van Nuys, Wes-Garde Comps. Grp.	818-786-3724
CO	Denver, Control Design Supply Inc.	303-296-1922
CT	Wallingford, Control Design Supp. Inc.	203-269-9955
CT	Yalesville, Glynn Elctrns.	203-265-2498
FL	Davie, ARCO Dists. Inc.	305-473-2550
FL	Largo, Electronic Precepts of FL Inc.	813-544-3636
FL	Pompano Bch., Control Design Supp. Inc.	305-782-1311
FL	Sanford, Control Design Supp. Inc.	407-328-8011
GA	Fayetteville, Frankland Inc.	404-461-4026
GA	Stone Mtn., Control Design Supp. Inc.	404-979-3500
IL	Carol Stream, Lectro Comps. Inc.	708-690-0520
IL	Glendale Heights, Mac Gregor & Co. Inc.	708-469-4080
IL	Schaumburg, Control Design Supp. Inc.	708-307-8900
IN	Evansville, Ohio Valley Sound	812-425-6173

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IN	Terre Haute, Ohio Valley Sound	812-235-6025
IA	Marion, Control Design Supp. Inc.	319-373-2923
KS	Kansas City, Control Design Supp. Inc.	913-362-4248
KS	Wichita, RSC Elctrns. Inc.	316-267-5213
KY	Owensboro, Ohio Valley Sound	502-683-6727
MD	Gaithersburg, Axis Elctrns. Inc.	301-840-9640
MA	Middleboro, Glynn Elctrns. Inc.	508-947-4262
MA	Woburn, Control Design Supp. Inc.	617-932-9404
MI	Farmington Hills, Control Design Supp., Inc.	313-473-0220
MN	Minneapolis, Control Design Supp. Inc.	612-721-1628
MO	St. Louis, Control Design	314-432-1116
MO	St. Louis, Franklin Elctrns.	314-429-3111
NH	Manchester, Glynn Elctrns.	603-622-8131
NJ	Cliffwood, Federated Purchaser Inc.	908-290-2900
NY	Henrietta, Control Design Supp. Inc.	716-334-1120
NY	Rome, Rome Elctrn.	315-337-5400
NY	Syracuse, ADR Tech.	315-437-7087
NC	Charlotte, Control Design	704-588-4410
NC	Raleigh, Century Elctrn. Co.	919-596-2220
OH	Akron, Aesco Elctrns. Inc.	216-762-8818
OH	Cincinnati, Hughes Peters Inc.	513-351-2000
OH	Columbus, Aesco Elctrns. Inc.	614-882-6762
OH	Columbus, Hughes Peters Inc.	614-294-5351
OH	Columbus, Thompson Elctrn. Supp.	614-228-6191
OH	Dayton, Scotts-Friedman Co. Inc.	513-298-5555
OH	Valley City, Roberts Elctrn. Co. Inc.	216-225-4646
OK	Oklahoma City, RSC Elctrns. Inc.	405-631-7729
OR	Portland, Dunn Elctrns. Inc.	503-285-0214
PA	Allentown, Lighting Fixture & Supply Co. Inc.	215-435-9691
PA	Malvern, Control Design Supp. Inc.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elctrn. Co. Ltd.	215-631-5404
PA	York, Elctrn. Comp. for Inds.	717-846-5334
TN	Nashville, Randolph & Rice, Inc.	615-255-5601
TX	Austin, Wofford Elctrns., Inc.	512-339-1131
TX	Dallas, Control Design	214-358-1441
TX	Dallas, Wofford Elctrns. Inc.	214-340-8555
TX	Ft. Worth, Allied Elctrns. Inc.	817-595-3500
TX	Richardson, RSC Elctrns., Inc.	214-644-3444
TX	Tomball, Wofford Elctrns. Inc.	713-351-2255
UT	Nephi, Control Design Supply Inc.	801-623-2908
WA	Bothell, Dunn Elctrns. Inc.	206-382-0379
WA	Kent, Control Design Supp. Inc.	206-251-6323
WA	Richmond, Murphy Elctrns., Inc.	206-881-1234
WA	Seattle, H.D. Campbell	206-433-1900
WI	New Berlin, Control Design	414-784-1016

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Local Sales Offices & Reps

Can	Calgary, Alb., Deskin Sls.	403-270-4440
Can	Dorval, Que., Weiss Co.	514-685-6644
Can	Edmondton, Sas., Deskin Sls.	403-466-2106
Can	Mississauga, Ont., Weiss Co.	416-673-0011
Can	Nepean, Ont., Weiss Co.	613-225-1810
Can	Transcona,Man., Deskin Sls.	204-224-1321
Can	Vancouver, B.C., Deskin Sls.	604-324-8343

Local Distributors

Can	Calgary,Alb., Deskin Sls.	403-270-4440
Can	Dartmouth, N.S., Arcom Elctrns.	902-464-1600
Can	Dorval, Que., Bentin Elctrl.	514-631-2061
Can	Dorval, Que., Elkon	514-636-0510
Can	Drummondville, Que., Marnel Intl., Inc.	819-478-3128
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Islington, Ont., D.T. Shaw Co. Ltd.	416-231-2706
Can	Markham, Ont., Carsten Elctrns. Ltd.	416-477-7705
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Mississauga, Ont., Rush Elctrns Ltd.	416-677-7280
Can	Mississauga, Ont., Sayal Elctrns.	416-238-8640
Can	Montreal, Que., Cite Electronique	514-526-9184
Can	Montreal, Que., Crobel Electronique Ltee	514-493-8818
Can	Montreal, Que., D.T. Shaw Co. Ltd.	514-332-1163
Can	Montreal, Que., Versatech Elctrns. Inc.	514-335-3833
Can	Nepean, Ont., Deskin Sls.	613-228-1201
Can	Oakville, Ont., Cantwell Cullen & Co.	416-842-8470
Can	Point Viau Laval, Que., Montcalm Electronique	514-663-3102
Can	Quebec, Que., Pro Technique Que. Inc.	418-529-5774
Can	Scarborough, Ont., Elkon	416-398-4014
Can	Scarborough, Ont., Sayal Elctrns.	416-494-8999
Can	Sherbrooke, Que., Cite Electronique	819-822-9908
Can	St Laurent, Que., Carsten Elctrns. Ltd.	514-334-8321
Can	St. Laurent, Que., Access-O-Tronik	514-335-6000
Can	St. Laurent, Que., Deskin	514-331-2860
Can	St. Laurent, Que., Ferrotronics Components Inc.	514-333-7288
Can	Ste. Foy, Que., Access-O-Tronik	418-683-5979
Can	Ste. Foy, Que., Crobel Electronique Ltee	418-687-1171
Can	Stittsville, Ont., Carsten Elctrns. Ltd.	613-831-1620
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Vancouver,B.C., Deskin Sls.	604-324-8343
Can	Winnipeg, Man., WES Elctrns. Ltd.	204-632-1260

WEED FIBER OPTICS INC., Weed Instrument Co., 800 Paloma Dr., Ste. 240, Round Rock, TX 78664, Tel: 512-388-2522, FAX: 512-388-4711; Empl.: 14; *Sls. Mgr.:* Chuck Landis; *Dist. Mgr.:* Chuck Landis

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FAX: 516-254-2099

WEICO WIRE & CABLE, INC., 161 Rodeo Dr., Edgewood, NY 11717, Tel: 516-254-2970; FSC No.: 7R617; *Sls. Mgr.:* Theodore Weill **C•1818-1855**

WEIDMULLER INC., 821 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-2877, FAX: 804-794-0252; Empl.: 110; *Sls. Mgr.:* Peter Anest

WEIDMULLER INC., Paladin Tools, 3543 Old Conejo Rd., No. 101, Newbury Park, CA 91320, Tel: 805-499-0318, FAX: 805-499-4006; Empl.: 20; *Sls. Mgr.:* Lee Sachs, Label Sls. Mgr.; *Dist. Mgr.:* Shannon Burke, Distr. Mgr.

WEIR ELCTRNS. LTD., Durban Rd., Bognor Regis, West Sussex, ENG PO 22 9RW, Tel: 0243-865991, TELEX: 86543, FAX: 0243-868613; Empl.: 500; *Sls. Mgr.:* Peter Cole (Exp.)

WEITZ ELECTRONICS/MARVWA USA, 1040 1st. Ave., Ste. 361, New York, NY 10022, Tel: 718-523-3688, FAX: 718-657-6938; Empl.: 49; *Sls. Mgr.:* Greg Weitz

WELCH ALLYN, INC., Data Collection Div., 4619 Jordan Rd., Skaneateles Falls, NY 13153-0187, Tel: 315-685-8945, FAX: 315-685-3172; *Sls. Mgr.:* Richard Kraetz; *Dist. Mgr.:* Andy Adams

WELLEX CORPORATION, 44141 S. Grimmer Blvd., Fremont, CA 94538, Tel: 510-490-3263, FAX: 510-490-5531; Empl.: 356; *Sls. Mgr.:* John E. Soares

WELLS ELECTRONICS, INC., 1701 S. Main St., South Bend, IN 46613, Tel: 219-287-5941, TELEX: 4937960, FAX: 219-287-0356; FSC No.: 219-287-0356; Empl.: 200; *Sls. Mgr.:* Mike Myers

WELLS-GARDNER ELCTRNS. CORP., 2701 N. Kildare Ave., Chicago, IL 60639, Tel: 312-252-8220, FAX: 312-252-8072; Empl.: 282; *Sls. Mgr.:* Lawrence J. Brady

WENZEL ASSOCIATES, INC., 1005 La Posada Dr., Austin, TX 78752, Tel: 512-450-1400, FAX: 512-450-1490; FSC No.: 62821; Empl.: 45; *Sls. Mgr.:* Liz Ronchetti **A•1510**

Local Sales Offices & Reps

CA	Milpitas, Allis Northwest	206-828-0444
CA	Sunnyvale, Esco Assocs.	408-745-0533
NH	Hollis, RF Elctrns. New England	603-465-3211
NY	Melville, RF Elctrns.	516-420-8890
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
Can	Ottawa, Ont., Gigatron	613-225-4090

WERLATONE, INC., P. O. Box 47, Rte. 22, Brewster, NY 10509, Tel: 914-279-6187, FAX: 914-279-7404; FSC No.: 28812; Empl.: 13; *Sls. Mgr.:* G. Werlau

WESCHLER INSTRUMENTS

FAX: 216-238-0660

WESCHLER INSTRUMENTS, Hughes Corp., 16900 Foltz Parkway, Cleveland, OH 44136, Tel: 216-238-2550; Empl.: 125; *Sls. Mgr.:* Gary Gonzales **D•1389-1401**

Local Sales Offices & Reps

AL	Regal-Brown	205-626-1929
AZ	Kachina Controls	602-886-4984
CA	Northern CA, Seco Controls	510-798-8300
CA	Southern CA, RDX Corp.	714-599-0985
CO	Anderson Controls	303-692-0290
FL	Datarep Inc.	407-843-5224
IL	Ray Knitter Assoc.	708-690-6363
IN	IN North, Jack Margis Assoc.	219-374-5905
IN	IN South, Ray Knitter Assoc.	317-862-2788
IA	Simone Engrg.	319-364-2378
LA	Weschler	216-238-2550
MA	Eastern Systems	508-435-2151
MI	G&D Assoc.	313-684-5233
MN	Waltam Sales	612-781-2778
MO	Controls Midwest	816-842-4290
NE	Simone Engrg.	402-592-0098
NV	Vegas, Kachina Ctrls.	702-791-5666
NJ	RJM Sales	908-322-7880
NM	Kachina Controls	505-345-1045
NY	NY, Eastern Sys.	508-435-2151
NC	J.H. Instruments	704-889-5600
OH	OH (North), Advanced Technlg.	216-835-5050
OH	OH (South), CKM Indl.	513-871-1413
OK	Wallace & Schoeffler	918-742-5331
OR	McLaren Inc.	503-627-0757
PA	PA (East), RJM Sales	215-643-6610
TX	Wilsher Co.	713-683-6826
UT	Anderson Controls	801-566-5864
VA	Martin Control Equip.	804-321-7143
WA	McLaren Inc.	206-827-9400

WV	Cavcon Sys., Inc.	304-342-0385
WI	WI (East), Ray Knitter Assoc.	414-544-1976

WESCO ELECTRICAL CO., 201 Munson St, Greenfield, MA 01301, Tel: 413-774-4358, FAX: 413-774-4562; FSC No.: 12673; Empl.: 150; *Sls. Mgr.:* James R. DeSanty .... **A•1174-1175**

Local Sales Offices & Reps

AZ	Tempe, ACS of AZ	602-731-9711
CA	Mission Viejo, Jay Mktg. Assoc.	714-768-7519
CA	San Jose, Westron Assoc.	408-264-4070
CT	Milford, Cuming Assoc.	203-878-3946
FL	Maitland, EIR, Inc.	305-660-9600
IN	Indianapolis, John H. Weaver Co.	317-257-7661
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
MI	Madison Hgts., DEM Sls., Inc.	313-583-1500
MN	Minneapolis, Furber Sls. Co.	612-881-3620
NY	Shirley, Tri-Tek Mktg.	516-395-3391
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Willoughby Hills, Versatron	216-944-0082
PA	Montgomeryville, Quick Response Tech Sls.	215-362-9225
TN	McMinnville, B & D Mktg.	615-473-7155
Can	Oakville, Ontario, Haltronics Ltd.	416-844-2233

WESCORP STATIC CONTROL PRODUCTS, 144 S. Whisman Rd., Mountain View, CA 94041, Tel: 415-969-7717, FAX: 415-969-6130; Empl.: 15; *Sls. Mgr.:* Thelma Paxton; *Dist. Mgr.:* Sue McCray

Local Sales Offices & Reps

CA	Newport Bch., Innotech	714-722-8767
IN	Indianapolis, Emmtronics	317-845-0668
MA	Hopedale, DMA Mktg.	508-473-9994
MN	New Brighton, Pragmatic Technlg., Inc.	612-631-1981
NY	Jericho, B & D Assocs.	516-937-3593
OR	Beaverton, Browand, Potter & Assts.	503-644-5233
TX	El Paso, Alexander Entprs.	915-591-3142
TX	Rowlett, Campion Sls. Co., Inc.	214-475-8313

WES-GARDE COMPONENTS GROUP, INC., 190 Elliott St, Hartford, CT 06114, Tel: 203-525-6907

WESTAMP, 1542 15th St, Santa Monica, CA 90404, Tel: 310-393-0401, FAX: 310-451-1058; FSC No.: 12745; Empl.: 40; *Sls. Mgr.:* Bradley A. Landseadel

WESTBERG MANUFACTURING INC. (WESTACH), 3400 Westach Way, Sonoma, CA 95476, Tel: 707-938-2121; Empl.: 20; *Sls. Mgr.:* R. R. Westberg

WEST COAST ELEC. MFG., 1399 Charlotte Hwy., Fairview, NC 28730, Tel: 704-628-1711, FAX: 704-628-1439; FSC No.: 81823; Empl.: 25; *Sls. Mgr.:* W. E. Seal

WESTCON, 959 Cheney Ave., Marion, OH 43302, Tel: 614-382-5771, TELEX: 3775688; Empl.: 50

WESTCON, INC., 5101 N. Interstate Ave., Portland, OR 97217, Tel: 503-283-0132, FAX: 503-283-0137; Empl.: 15; *Sls. Mgr.:* Jan M. Rundquist; *Dist. Mgr.:* Jan M. Rundquist

WESTCOR CORPORATION, 485-100 Alberto Way, Los Gatos, CA 95032, Tel: 408-395-7050, FAX: 408-395-1518; *Sls. Mgr.:* Nancy Pepper

WEST ELECTRONIC SALES TEAM, 16512 Burke Lane, Ste. A, Huntington Beach, CA 92647, Tel: 714-375-6500, 310-495-5569, FAX: 714-375-6507; Empl.: 15; *Sls. Mgr.:* Mark Wickham; *Dist. Mgr.:* Jack Carrigan

WESTERN CASE, INC., 14351 Chambers Rd., Tustin, CA 92680, Tel: 714-838-8460, FAX: 714-838-3039; *Sls. Mgr.:* David B. Horne

WESTERN DATACOM CO., INC., 959 Bassett Rd., Westlake, OH 44145, Tel: 216-835-1510, 800-262-3311, FAX: 216-835-9146; Empl.: 15; *Sls. Mgr.:* Philip Ardire; *Dist. Mgr.:* Linda Naughton

THE WESTERN DESIGN CENTER, INC., 2166 East Brown Rd., Mesa, AZ 85213, Tel: 602-962-4545, FAX: 602-835-6442

WESTERN DIGITAL CORP., 8105 Irvine Center Drive, Irvine, CA 92718, Tel: 714-932-6000, FAX: 714-932-6498; Empl.: 6500; *Sls. Mgr.:* Tom DeMarchi

WESTERN ELECTRO-MECHANICAL CO., INC., 300 Broadway, Oakland, CA 94607, Tel: 415-452-1936, FAX: 415-452-1939; Empl.: 9; *Sls. Mgr.:* Hal Johnson

WESTERN ELCTRN. COMPS. CORP., 1250-A Avenida Acaso, Camarillo, CA 93012, Tel: 805-482-8002, FAX: 805-482-8675; Empl.: 25; *Sls. Mgr.:* Diane Ziese

WESTERN ELECTRONIC PRODUCTS CO., 915-G Calle Amanecer, San Clemente, CA 92673, Tel: 714-492-4677, FAX: 714-492-5952; Empl.: 6; *Sls. Mgr.:* Tony English

GRAPHTEC

FAX: 714-855-0895

WESTERN GRAPHTEC, INC., 11 Vanderbilt, Irvine, CA 92718-2067, Tel: 714-770-6010, 800-854-8385; FSC No.: 6625; Empl.: 850; *Sls. Mgr.:* Larry Roberson; *Dist. Mgr.:* Grant Smith .... **D•1417**

Local Sales Offices & Reps

AZ	Chandler, Vic Myers Assocs.	602-241-9324
CA	Irvine, Western Graphtec	714-770-6010
CO	Aurora, Vic Myers Assocs.	303-629-9676
FL	Boca Raton, Western Graphtec	407-392-4550
IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Indiannapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
MA	Andover, Western Graphtec	508-470-1806
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Milford, T.M.S.	313-360-1514
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Peters, Western Graphtec	314-279-3915
NM	Albuquerque, Vic Myers Assocs.	505-294-1791
NY	Cedar Grove, K.L.S.	201-785-4450
NY	Kings Pk., K.L.S.	516-724-3155
OH	Beavercreek, T.M.S.	513-429-1142
OH	Westlake, T.M.S.	216-327-3527
PA	Bridgeville, T.M.S.	412-221-2338
UT	Salt Lake City, Vic Myers	801-581-1760
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest	414-544-6042

WESTERN MULTIPLEX CORP., 310 Harbor Blvd., Belmont, CA 94002, Tel: 415-592-8832, TELEX: 295114 VIA RCA, FAX: 415-592-4249; FSC No.: 94-2620670; Empl.: 52; *Sls. Mgr.:* Graham Barnes

WESTERN RESERVE ELECTRONICS, 2150 Highland Rd., Twinsburg, OH 44087, Tel: 216-425-4951, FAX: 216-425-4956; Empl.: 100; *Sls. Mgr.:* Robert Rhodes

WESTINGHOUSE ELECTRIC CORP., Control Division, P.O. Box 819, Oldsmar, FL 34667, Tel: 813-855-4621, TELEX: 358713; Empl.: 330; *Sls. Mgr.:* E.M. Tempest

WEST INSTRUMENT, A Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-4188, FAX: 401-884-4872; Empl.: 150; *Sls. Mgr.:* Warden Hunt; *Dist. Mgr.:* Warden Hunt

WESTLAKE COMPONENTS INTERNATIONAL, 30961 Agoura Rd. Ste.311, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-707-1754; *Sls. Mgr.:* Rick Odorfer

WESTON INSTRUMENTS, Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35; *Sls. Mgr.:* Gerald D. Frank; *Dist. Mgr.:* Gerald D. Frank

WESTREX PRODUCTS, 25 Denby Rd., Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Joe Grimaldi

WESTRONICS INC. OF TEXAS, A Baker Hughes Co., 5001 Blue Mound Rd., Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 130; *Sls. Mgr.:* Jim Bittikoffer

WESTVACO-STATIC CONTROL, 311 Industry Ave., P.O. Box 1675, Springfield, MA 01101-1675, Tel: 413-787-9783, FAX: 413-787-9626; *Sls. Mgr.:* Arthur Semle

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 908-222-6880, FAX: 908-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

WHITE-RODGERS LOGANSPORT DIV., See Stancor/ White Rodgers

S.S WHITE TECHNOLOGIES INC., 151 Old New Brunswick Rd, Piscataway, NJ 08854-3761, Tel: 908-752-8300, FAX: 908-752-3750; FSC No.: 0KZS2; Empl.: 100; *Sls. Mgr.:* Craig Griffin; *Dist. Mgr.:* Pam Barnhard

WHITE TECHNOLOGY, INC., Bowmar Instrument Corp., 4246 E. Wood St., Phoenix, AZ 85040, Tel: 602-437-1520, FAX: 602-437-9120; FSC No.: 54230; Empl.: 93; *Sls. Mgr.:* Steve McComb, Bob Faris

WHITMOR WIRE & CABLE CORP., 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

A mark of safety

Wickmann USA, Inc.

FAX: 404-699-9176

WICKMANN USA, INC., 4100 Shirley Drive, Atlanta, GA 30336, Tel: 404-699-7820; Empl.: 600-650; *Sls. Mgr.:* Michael V. Nagle; *Dist. Mgr.:* Joyce Bullard .... **B•1394-1398**

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Atlanta, JWL Assoc.	404-518-8500
IL	Crystal Lake, Golbeck Milota Assoc.	815-459-0504
IN	Indianapolis, J.C. Hofstetter Co.	317-897-7914
MD	Baltimore, Muncy Sls. Assocs.	410-484-6376
MA	Needham Hgts., Rosen & Assocs.	617-449-4700
MI	Grand Rapids, R.P.Urban & Assocs.	616-245-0511
MN	Minneapolis, RK Sls.	612-571-1001
NJ	Monmouth Junction, S.E.A. Co., Inc.	908-821-4100
NC	Charlotte, JWL Assoc.	704-541-5750
OH	Medina, J.C. Hofstetter Co.	216-725-4477
OR	Beaverton, Temper Tech. Mktg.	503-292-8201
TX	Dallas, Rem Comps.	214-234-1069

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Fuses Unlimited	818-786-8111
CA	Yorba Linda, Target Elctrns.	714-692-1630
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Crystal Lake, Right Distrs.	815-459-0645
MA	Sharon, Adcour Inc.	617-784-8123
MN	Roseville, Parts 1	612-633-8079
NJ	Orange, Actionfuse Co.	800-232-3873
OH	Cincinnati, Schuster Elctrns.	800-521-1358
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OR	Beaverton, Comp. Resources Inc.	800-537-5494
TX	Dallas, Fuses Unltd.	214-907-8600
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Intermountain Fuse	801-265-8333
WA	Kent, Comp. Resources Inc.	800-547-6523
WI	Milwaukee, Progressive Image, Inc.	800-686-7764
Can	Downsview, Ont., PS Comps., Inc.	416-665-9546

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570, FAX: 602-254-1570; FSC No.: 58907; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 174 Chesterfield Indl. Blvd., Chesterfield, Missouri 63005, Tel: 314-532-5887, FAX: 314-532-5492; Empl.: 11; *Sls. Mgr.:* Donald Toone

WIELAND INC., 49 International Rd., Burgaw, NC 28425, Tel: 919-259-5050, FAX: 919-259-3691; FSC No.: 06229; Empl.: 100; *Sls. Mgr.:* Carl Gruenberg, V.P. Sls. & Mktg.; *Dist. Mgr.:* Steve Vineis

WIKO, LTD., 10490 West 164th Place, Orlando Park, IL 60462, Tel: 1-800-323-1107, FAX: 1-800-241-9928; Empl.: 40; *Sls. Mgr.:* Jerry Francis

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; Empl.: 150; *Sls. Mgr.:* R. Vermilyea

WILCO

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ... **A•1309-1313, 2604-2605**

Local Sales Offices & Reps

IL	Arlington Heights, M.B. Sls.	708-392-9499

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880, FAX: 408-251-0508; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Sylvia Neal

WILCOXON RESEARCH, INC., 21 Firstfield Rd., Gaithersburg, MD 20878, Tel: 301-330-8811, FAX: 301-330-8873 .... **B•2025**

WILKERSON INSTRUMENT COMPANY INC., 2915 Parkway St., Lakeland, FL 33811, Tel: 813-646-3909, FAX: 813-644-5318; Empl.: 56; *Sls. Mgr.:* Julie Unger

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, FAX: 818-889-3810; Empl.: 28; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

W.L. WILLIAMSON & ASSOC., LTD., 528 S. Extension Rd., Mesa, AZ 85210, Tel: 602-833-5202, FAX: 602-833-5529; Empl.: 3

WILLIAMSON CORPORATION, 70 Domino Dr., Concord, MA 01742, Tel: 508-369-9607, FAX: 508-369-5485; FSC No.: 92-3343 WILIAMSON WCRD; Empl.: 25; *Sls. Mgr.:* William R. Barron

WILMAR ELECTRONICS, INC., 2430 Amsler St., Torrance, CA 90505, Tel: 310-326-6668, FAX: 310-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

Local Sales Offices & Reps

CA	Emeryville, Davis Gregory & Doll	415-428-9103
CA	Fountain Valley, J.S.B. Engrg.	714-546-5402
GA	Atlanta, Sls. of Georgia, Inc.	404-875-7726
NJ	Flanders, Guido Assocs.	201-347-4643

WILMORE ELECTRONICS CO., INC., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617, FAX: 919-732-9359; Empl.: 48; *Sls. Mgr.:* J. L. Harris .... **D•2041, 2218-2220, 2306-2307**

WILSON COMPANY-SYSTEMS DIVISION, 16301 Addison Road, Dallas, TX 75248, Tel: 214-931-8666, 800-580-1212, FAX: 214-248-1177; Empl.: 65; *Sls. Mgr.:* Jerry Herrin; *Dist. Mgr.:* Jerry Herrin

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 708-469-7473, FAX: 708-469-8663; Empl.: 21; *Sls. Mgr.:* Robert W. Carroll; *Dist. Mgr.:* Howard Wilson

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 800

THE WINATIC CORP., Electro-Technik Industries, Inc., 409 Commerce Rd., Vestal, NY 13850, Tel: 607-729-6318, FAX: 607-729-6446; Empl.: 125; *Sls. Mgr.:* Ted Zaparzynski

WINEGARD CO., 3000 Kirkwood St., Burlington, IA 52601-2000, Tel: 319-754-0600, FAX: 319-754-0787; Empl.: 300; *Sls. Mgr.:* James Riffel, Sls. Dir.

WINSYSTEMS, INC., 715 Stadium Dr., Arlington, TX 76011, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 1AU87

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-448-1903, 800-742-6809, FAX: 317-448-4823; Empl.: 10 .... **D•1146**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021-2824, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 22

WIRE GRAPHICS, INC., 95 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-293-1525, FAX: 516-293-1607; Empl.: 23; *Sls. Mgr.:* Nat Stettin

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-232-2062; Empl.: 900; *Sls. Mgr.:* Scott Bartosch

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; FSC No.: FSCN 50738; Empl.: 225; *Sls. Mgr.:* Russell Morgan, Sls. & Svc. Mgr.; *Dist. Mgr.:* Phil Negrin, Mktg. Mgr.

WOLFRAM RESEARCH, INC., 100 Trade Center Drive, Champaign, IL 61820-7237, Tel: 217-398-0700, FAX: 217-398-0747; Empl.: 1000; *Sls. Mgr.:* Zoe Miolier; *Dist. Mgr.:* Roy Chumko

WONDERWARE, 16 Technology, Ste 154, Irvine, CA 92718, Tel: 714-727-3200; Empl.: 45; *Sls. Mgr.:* Jerry Brooks; *Dist. Mgr.:* Rick Mellor

WONTRONICS, 3048 N. Coolidge Ave., Los Angeles, CA 90039, Tel: 213-660-6230, FAX: 213-913-2299; *Sls. Mgr.:* Frank Phillips

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon .. **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

Local Sales Offices & Reps

AZ	Scottsdale, American Mktg.	602-948-2778, FAX:602-860-4455
AZ	Tempe, Spectrum Assocs., Inc.	602-966-1788, FAX:602-966-1726
CA	Anaheim (North), Jay Mktg. Assocs.	714-768-7519, FAX:714-581-1211
CA	Anaheim (South), Jay Mktg. Assocs.	714-974-7182, FAX:714-283-2915
CA	Fullerton, Jay Mktg. Assocs.	714-870-9573, FAX:714-870-1448
CA	Mission Viejo, Jay Mktg. Assocs.	714-768-7519, FAX:714-581-1211
CA	Mt. View, Straube Assocs. Inc.	415-969-6060, FAX:415-964-6526
CA	Newport Bch. (NEC only), S.P.A. Elctrn. Sls.	714-863-1193,FAX:714-863-1250
CA	Northridge, Jay Mktg. Assocs.	818-363-6308, FAX:818-363-6790
CA	San Jose (NEC only), Signet Tech. Sls.	408-453-0611,FAX:408-453-0633
CO	Englewood, Purdy Co. Assocs.	303-790-2211, FAX:303-790-2230
CT	Bloomfield, Zaslow Sls. Co., Inc.	203-242-7781, FAX:203-243-9442
FL	Boca Raton, Aurora-Schmitt Assocs.	407-392-9497,FAX:407-392-9497
FL	Orlando, Aurora-Schmitt Assocs.	407-297-6039, FAX:407-297-6039
GA	Alpharetta, Pinnacle Mktg.	404-410-9980, FAX:404-410-9980
IL	Arlington Hgts., Davix Intl. Ltd.	708-259-5300, FAX:708-259-5428
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260, FAX:317-841-0231
IA	Marion, Associated Elctrn. Mktg., Inc.	319-377-1129,FAX:319-377-1539
MD	Towson, Arbotek Assocs., Inc.	410-825-0775, FAX:410-337-2781
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722, FAX:313-464-3123
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616, FAX:612-854-8031
MO	St. Louis, AEM, Inc.	314-298-9900, FAX:314-298-8660
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NM	Albuquerque, Syntech	505-266-7951, FAX:505-292-4411
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313,FAX:516-434-1572
NY	New Hartford, Franklin Sls.	315-793-3161, FAX:315-793-3139
NY	Pittsford, Franklin Sls.	716-248-8251, FAX:716-248-3866
NC	Raleigh, Pinnacle Mktg.	919-848-0404, FAX:919-848-0101
NC	Wilmington, Pinnacle Mktg.	919-686-4696, FAX:919-686-4697
OH	Dayton, Baehr Greenleaf & Assocs. (BGA)	513-439-0724,FAX:513-439-0387
OH	Dayton, John Stephenson & Assoc.	513-435-0745, FAX:513-435-7902
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770,FAX:216-892-1771
OR	Beaverton, Luscombe Engrg.	503-636-6664, FAX:503-697-7611
PA	Pittsburgh, Baehr Greenleaf & Assoc.	412-934-3088,FAX:412-934-3990
TX	Austin, Comp. Technlg.	512-288-7328, FAX:512-288-7372
TX	Dallas, Comp. Technlg.	214-783-8831, FAX:214-783-4801
TX	Houston, Comp. Technlg.	713-690-3011, FAX:713-462-9906
WA	Bellevue, Luscombe Engrg.	206-643-1463, FAX:206-649-9120
WI	Menomonee Falls, Davix Intl. Ltd.	414-255-1600, FAX:414-255-1863

Local Distributors

AL	Huntsville, All American	205-837-1555, FAX:205-837-7732
AL	Huntsville, Reptron Elctrns. Inc.	205-722-9500, FAX:205-722-9565
CA	Corona, Compumech Elctrns.	714-278-4761, FAX:714-278-4761
CA	Milpitas, Compumech Elctrns.	408-945-9100, FAX:408-945-9395
CA	San Diego, All American	619-458-5850
CA	San Diego, All American	619-458-5850, FAX:619-458-5866
CA	San Diego, Neumann	619-695-3005, FAX:619-695-0935
CA	San Jose, All American Semiconductor Inc.	408-943-1200,FAX:408-943-1393
CA	Santa Clara, Trinity Elctrns.	408-980-9011, FAX:408-980-9014
CA	Sunnyvale, Target Elctrns.	408-733-0384, FAX:408-733-0397
CA	Thousand Oaks, Compumech Elctrns.	805-492-6299,FAX:805-492-8429
CA	Torrance, All American Semiconductor Inc.	310-320-0240,FAX:310-320-7207
CA	Yorba Linda, Target Elctrns.	714-692-1630, FAX:714-692-1547
CO	Aurora, QPS	303-373-2766,FAX:303-373-4029
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112, FAX:305-735-1121
FL	Melbourne, Pridmore	407-727-2491, FAX:407-723-1213
FL	Miami, All American Semiconductor Inc.	305-621-8282,FAX:305-620-7831
FL	Sunrise, All American Semiconductor Inc.	305-572-7999,FAX:305-749-9229
FL	Tampa, Reptron Elctrns.	813-854-2351, FAX:813-855-0942
GA	Athens, Resource Elctrns.	706-613-7755, FAX:706-613-7856
GA	Norcross, Reptron Elctrns.	404-446-1300, FAX:404-446-2991
ID	Boise, Radar Elctrn.	208-337-2227, FAX:208-337-2322
IL	Chicago, All American	312-659-9075, FAX:312-477-9962
IL	Lisle, Components Inc.	708-852-7707, FAX:708-852-0263
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620, FAX:708-884-7573
IL	Schaumburg, Reptron Elctrns.	708-882-1700, FAX:708-882-8904
IL	Wheeling, All American	708-970-8976, FAX:708-537-5631
IA	Des Moines, Midstate	515-244-7231, FAX:515-244-0828
MD	Rockville, All American Semiconductor Inc.	800-426-0420,FAX:301-251-8574
MA	Norwood, Emtel	617-769-9500,FAX:617-769-8329
MA	Wakefield, All American Semiconductor Inc.	617-246-2300,FAX:617-246-2305
MI	Livonia, Reptron Elctrns.	313-525-2700, FAX:313-525-3209
MN	Eden Prairie, All American Semiconductor Inc.	612-944-2151,FAX:612-944-9803
MN	Minnetonka, Reptron Elctrns.	612-938-0000, FAX:612-938-3995
MO	Fenton, Beckwith Elctrns.	314-343-6463, FAX:314-343-7026
MO	St. Charles, Finnigan Elctrns.	314-946-6201, FAX:314-724-8956
NE	Omaha, Mid-State Distbn. Co.	402-592-5965, FAX:402-331-7382
NE	Omaha, Midstate	402-592-5965
NJ	West Berlin, GCI	609-768-6767,FAX:609-768-3649
NM	Albuquerque, Betatron	505-821-1122, FAX:505-828-0450
NY	Penn Yan, Advacom	315-536-2221
NY	Ronkonkoma, All American Semiconductor	516-981-3935,FAX:516-981-3947
NC	Charlotte, Resource Elctrns.	704-521-8682, FAX:704-558-4696
NC	Hickory, Resource Elctrns.	704-328-1130, FAX:704-328-8318
NC	Raleigh, Reptron Elctrns.	919-870-5189, FAX:919-870-5210
NC	Raleigh, Resource Elctrns.	919-829-0704, FAX:919-527-9647
NC	Winston-Salem, Resource Elctrns.	919-724-5961, FAX:919-723-7024
OH	Dayton, Advacom, Inc.	513-274-5900, FAX:513-274-9124
OH	Middleburg, Advacom, Inc.	216-826-3300, FAX:216-826-1669
OH	Solon, Reptron Elctrns.	216-349-1415, FAX:216-349-1634
OR	Portland, Radar Elctrns.	503-232-3404, FAX:503-235-0428
PA	Harrisburg, Cumberland Elctrns.	717-232-5999, FAX:717-238-5379
PA	McKean, Advacom Inc.	814-476-7774, FAX:814-476-7724
PA	York, Advacom, Inc.	717-741-9277, FAX:717-741-9462
SC	Columbia, Resource Elctrns.	803-779-5332, FAX:803-765-9276
SC	Greensville, Resource Elctrns.	803-297-1430, FAX:803-297-1439

SC	No. Charleston, Resource Elctrns.	803-552-2671,	FAX:803-552-2676
TN	Gray, Resource Elctrns.	615-477-2131,	FAX:615-477-4407
TN	Oakridge, Resource Elctrns.	615-481-3393,	FAX:615-481-3397
TX	Austin, Omni Pro Elctrns.	512-794-9200,	FAX:512-338-9576
TX	Carrollton, Omni Pro Elctrns.	214-713-9000,	FAX:214-732-8743
TX	Houston, Omni Pro Elctrns.	713-270-1700,	FAX:713-270-8020
TX	Richardson, All American Semiconductor	214-231-5300,	FAX:214-437-0353
UT	Salt Lake City, All American	801-682-8313,	FAX:801-261-3885
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184,	FAX:804-971-8411
WA	Edmonds, Oman & Assocs.	206-774-1887,	FAX:206-771-2296
WA	Richland, Radar Elctrns.	509-943-8336,	FAX:509-943-6790
WA	Seattle, Radar Elctrns.	206-282-2511,	FAX:206-282-1598
WA	Spokane, Radar Elctrns.	509-747-3053,	FAX:509-456-8069
WI	Lisle, Comps. Inc.	414-529-4106,	FAX:708-852-0263
WI	Milwaukee, QPS Elctrns.	414-789-7577,	FAX:708-884-7573
Can	Calgary, Alb., Memco	403-258-3399,	FAX:403-258-3459
Can	Ontario, Sanbek Sls.	519-746-5801,	FAX:519-746-6561
Can	Ontario, Utech	416-609-2900,	FAX:416-609-2588
Can	St. Laurent, Que., C.I.E. Elctrns.	514-342-2447,	FAX:514-342-4073
Can	St. Laurent, Que., Versatech Elctrns.	514-335-3833,	FAX:514-355-0307
Can	Surrey, B.C., Memco	604-590-1553,	FAX:604-590-5008
KS	Lenexa, Associated Elctrn. Mktg., Inc.	913-888-0022,	FAX:913-888-4848

WORLD PRODUCTS INC.

FAX: 707-996-3380

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201; Empl.: 50 ..... **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assocs.	602-966-1788
CA	Los Angeles, SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls., Co.	303-455-1719
FL	Melbourne, R-Rep Co., Inc.	407-242-9800
IL	Arlington, KMA Sls. Co.	312-398-5300
IN	Fort Wayne, Berberich Assoc.	219-486-0673
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Livingston, Avemark Tech. Mktg.	201-992-5331
OH	Dayton, Berberich Assocs. Inc.	513-433-0342
OR	Beaverton, Luscombe Engrg./N.W.	503-636-6664
PA	Hatboro, AQS Electro	215-674-4421
TX	Dallas, Southwestern Tech. Sls.	214-369-0977
VA	Herndon, Stinson Assocs.	703-620-1332
WA	Bellevue, Luscombe Engrg./N.E.	206-643-1463
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Montreal, ELI Manis Inc.	514-484-2923

Local Distributors

AL	Huntsville, Reptron Elctrns. Inc.	205-722-9500,	FAX:205-722-9565
CA	Anaheim, Compumech Elctrns.	714-939-9100,	FAX:714-939-9113
CA	Milpitas, Compumech Elctrns.	408-945-9100,	FAX:408-945-9395
CA	San Diego, All American	619-458-5850	
CA	San Diego, Neumann	619-695-3005,	FAX:619-695-0935
CA	San Jose, All American Semiconductor	408-943-1200,	FAX:408-943-1393
CA	Santa Clara, Trinity Elctrns.	408-980-9011,	FAX:408-980-9014
CA	Sunnyvale, Target Elctrns.	408-733-0384,	FAX:408-733-0391
CA	Torrance, All American Semiconductor	800-831-8300,	FAX:310-320-7207
CA	Yorba Linda, Target Elctrns.	714-692-1630,	FAX:714-692-1547
CT	Yalesville, Schaal	203-269-3779,	FAX:203-284-2159
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112,	FAX:305-735-1121
FL	Melbourne, Pridmore	407-727-2491,	FAX:407-723-1213
FL	Miami, All American Semiconductor	305-621-8282,	FAX:305-620-7831
FL	Sunrise, All American Semiconductor	305-572-7999,	FAX:305-749-9229
FL	Tampa, Reptron Elctrns.	813-854-2351,	FAX:813-855-0942
FL	Winter Park, Deanco	407-671-5100,	FAX:407-679-0361
GA	Augusta, Dixie Elctrns.	404-722-2055,	FAX:404-722-0388
GA	Marietta, Deanco	404-429-0126,	FAX:404-429-0333
GA	Norcross, Reptron Elctrns.	404-446-1300,	FAX:404-446-2991
ID	Boise, Radar Elctrns.	208-336-2227,	FAX:208-336-2322
IL	Lisle, Components Inc.	708-852-7707,	FAX:708-852-0263
IL	Schaumburg, Reptron Elctrns.	708-882-1700,	FAX:708-882-8904
IA	Cedar Rapids, Mid-State Distbg. Co.	800-798-9411,	FAX:319-365-9411
IA	Des Moines, Mid-State Distbrg. Co.	515-244-7231,	FAX:515-244-0828
IA	Mason City, Mid-State Distbg. Co.	800-798-8012,	FAX:515-423-8012
IA	Ottowa, Mid-State Distbg. Co.	800-937-5407,	FAX:515-682-5407
MD	Gaithersburg, Deanco	301-948-5444,	FAX:301-963-6469
MA	Burlington, Schaal	617-272-7940,	FAX:617-272-3343
MA	Norwood, Emtel	617-769-9500,	FAX:617-769-8329
MA	Wakefield, All American Semiconductor	617-246-2300,	FAX:617-246-2305
MI	Livonia, Reptron Elctrns.	313-525-2700,	FAX:313-525-3209
MN	Eden Prairie, All American Seminconductor	612-944-2151,	FAX:612-944-9803
MN	Minnetonka, Reptron Elctrns.	612-938-0000,	FAX:612-938-3995
MO	Fenton, Beckwith Elctrns.	314-343-6463,	FAX:314-343-7026
NE	Omaha, Mid-State Distbg. Co.	402-592-5965,	FAX:402-331-7382
NJ	Fairfield, Deanco	201-575-7960,	FAX:201-575-3606
NM	Albuquerque, Betatron	505-821-1122,	FAX:505-828-0450
NY	Hauppauge, Schaal	516-434-7700,	FAX:516-434-7111
NY	Ithaca, Deanco	607-257-4444,	FAX:607-257-3678
NY	Penn Yan, Advacom Technlg.	315-536-2221,	FAX:315-536-0828
NY	Ronkonkoma, All American Semiconductor	800-874-2830,	FAX:516-981-3947
NC	Charlotte, Dixie Elctrns.	704-377-4348,	FAX:704-377-2561
NC	Raleigh, Deanco	919-851-2065,	FAX:919-859-4806
NC	Raleigh, Reptron Elctrns.	919-870-5189,	FAX:919-870-5210
NC	Winston-Salem, Dixie Elctrns.	919-724-5961,	FAX:919-723-7024
OH	Cleveland, Advacom, Inc.	216-826-3300,	FAX:216-688-5914
OH	Solon, Reptron Elctrns.	216-349-1415,	FAX:216-349-1634
OH	Worthington, Reptron Elctrns.	614-436-6675,	FAX:614-436-4285
OR	Portland, Radar Elctrns.	503-232-3404,	FAX:503-235-0428
PA	Harrisburg, Cumberland Elctrns.	717-232-5999,	FAX:717-238-5379
PA	McKean, Advacom, Inc.	814-476-7774,	FAX:814-476-7724
PA	Philadelphia, Deanco	215-735-3678	
SC	Columbia, Dixie Elctrns.	803-779-5332,	FAX:803-765-9276
SC	Greensville, Dixie Elctrns.	800-868-2260,	FAX:803-297-1439
SC	No. Charleston, Dixie Elctrns.	803-868-3336,	FAX:803-552-2676
TN	Gray, Dixie Elctrns.	615-477-3838,	FAX:615-477-4407
TN	Oakridge, Dixie Elctrns.	615-481-3393,	FAX:615-938-4133
TX	Austin, Omni Pro Elctrns.	512-794-9200,	FAX:512-338-9576
TX	Dallas, Omni Pro Elctrns.	214-233-0500,	FAX:214-385-7508
TX	Houston, Omni Pro Elctrns.	713-270-1700,	FAX:713-270-8020
TX	Richardson, All American Semiconductor	214-231-5300,	FAX:214-437-0353
VA	Charlottesville, Virginia Elctrns. Comps.	804-296-4184,	FAX:804-971-8411
VA	Virginia Beach, Deanco	804-499-3322,	FAX:804-499-1038
WA	Richland, Radar Elctrns.	509-943-8336,	FAX:509-943-6790
WA	Seattle, Radar Elctrns.	206-282-2511,	FAX:206-282-1598
WA	Spokane, Radar Elctrns.	509-747-3053,	FAX:509-456-8069
Can	Nepean, Ont., Zanin Elctrns.	613-596-2911,	FAX:613-596-2915
Can	St. Foy, Que., Zanin Elctrns.	418-681-1262,	FAX:418-681-1264
Can	St. Laurent, Que., Zanin Elctrns.	514-342-6211,	FAX:514-342-4071
Can	Toronto, Ont., Zanin Elctrns.	416-674-7220,	FAX:416-674-7836

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, 1001 Old Stage Rd., Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Tommy Little

WPI GROUP, INC., 18 Mill St., Warner, NH 03278, Tel: 603-456-3111, FAX: 603-456-2498; Empl.: 115; *Sls. Mgr.:* Paul D. Iverson

WSI, 47280 Kato Rd., Fremont, CA 94538, Tel: 510-656-5400, 800-451-5970 (USA), FAX: 510-657-5916; Empl.: 150; *Sls. Mgr.:* Bob Hoard; *Dist. Mgr.:* Mike Speckman

WYLE LABS, See Electronic Enclosures

XANTREX TECHNOLOGY INC., 3873 Airport Way, Bellingham, WA 98227-9754, Tel: 206-671-2966, FAX: 206-671-3095; *Sls. Mgr.:* Michael Rodger; *Dist. Mgr.:* Michael Rodger

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCEL CONTROLS, INC., 1600 W. 6th St., Mishawaka, IN 46544, Tel: 219-259-7804, FAX: 219-259-5769; Empl.: 40; *Sls. Mgr.:* Bruce Shepard

XCP, INC., 40 Elm St., P.O. Box 819, Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 757 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-524-1935, FAX: 408-245-7084; Empl.: 19; *Sls. Mgr.:* Andrew Rao; *Dist. Mgr.:* Brian Lee

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, FAX: 617-933-8804; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Dist. Mgr.:* L. Geery, T. Dos Santos, M. Mitchner

Xentek

FAX: 619-471-4021

XENTEK, INC., Taiyo Yuden USA, Inc., 1770 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-4001; FSC No.: 53279; Empl.: 220; *Sls. Mgr.:* Chuck Henry ..... **D•2042-2047, 2308-2309**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7886
CA	Huntington Bch., Regan/Munro Sls., Inc.	714-841-1411
CA	San Jose, Ruppert Sls. & Eng.	408-998-8717
CO	Denver, AC Mktg.	303-433-1648
FL	Ft. Lauderdale, Post Mktg.	305-989-2931
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assoc.	913-541-0505
MA	Chelmsford, Waterstate Sls.	508-256-2287

MI	Farmington Hills, Carter, McCormic & Pierce	313-477-7700
NJ	Medford, Mech-Elec. Sls.	609-654-8209
MN	Richfield, Clay Rep Co.	612-861-2191
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Bell Controls	603-882-6984
NC	Raleigh, Lamons Sls. Co.	919-846-1652
NJ	Fairfield, Astrorep	201-808-0025
NY	Babylon, Astrorep	516-422-2500
NY	Dewitt, ICS	315-445-9600
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Portland, E-Square	503-292-8204
PA	Pittsburgh, Carter, McCormic & Pierce	412-826-3800
TN	Greenville, Lamins Sls. Co.	615-639-8711
TX	Austin, Pro Comp	512-331-0800
TX	Houston, Pro Comp	713-977-8550
TX	Hurst, Pro Comp	817-589-0336
TX	Richardson, Pro Comp	214-669-1500
VA	Richmond, Mech-Elec Sls.	804-231-4006
WA	Bellevue, E-Square	206-637-0302
WI	Milwaukee, LTD Technlgs.	414-774-1000

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, United States Customer Operations, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,900

XETEL CORPORATION, 2525 Brockton Dr., Austin, TX 78758, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 395; *Sls. Mgr.:* Mark Trutna

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, FAX: 818-709-5235; Empl.: 21; *Sls. Mgr.:* Robert Browning

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 800-628-0544, FAX: 817-473-1808; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Buck Johnson

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 1010; *Sls. Mgr.:* Bruce Mattern,VP Sls.; *Dist. Mgr.:* Bruce Mattern

XILINX CORP., 2100 Logic Drive, San Jose, CA 95124, Tel: 408-559-7778, FAX: 408-559-7114

XITRON
TECHNOLOGIES

FAX: 619-458-9213

XITRON TECHNOLOGIES, 10225 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-458-9852; Empl.: 10; *Sls. Mgr.:* Stephen Merrill **D•1335**

XKD CORPORATION, Dynatech, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

XL MICROWAVE, 5811 Racine St., Oakland, CA 94609, Tel: 510-428-9488, FAX: 510-428-9469; Empl.: 7; *Sls. Mgr.:* William J. Artz

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HEADQUARTERS: 380 North St., Teterboro, NJ 07608

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, FAX: 913-631-1170; FSC No.: 57051; Empl.: 12; *Sls. Mgr.:* Jerry Dehnert **A•1511**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
FL	Ocalia, Florida Electro Comps.	904-351-4125
IL	Schaumberg, Sieger Assocs.	708-381-7403
KS	MidTech Assoc., Inc.	913-541-0505
KS	Lenexa, Midtec Assoc. Inc.	913-541-0505
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	410-461-2525
MA	Amesbury, Carl Sheys Assoc. Ltd.	508-388-3616
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
NJ	Hasbrouck Heights, Comp. Tech. Sls.	201-288-7400
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6263
EXP	NY, Great Neck, Techcomp Intl.	516-466-2167
OH	Ft. Mitchell, G.W. Thelien Co.	606-341-8181

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank

XYLOGICS, INC., 53 Third Ave., Burlington, MA 01803, Tel: 800-225-3317, FAX: 617-273-5392; Empl.: 165; *Sls. Mgr.:* Bernard D. Olmsted; *Dist. Mgr.:* Joe Twardy

XYZ ELECTRONICS, 4700 N. 600 W, McCordsville, IN 46055, Tel: 317-335-2128, FAX: 317-335-2128; Empl.: 5

YAMAICHI ELECTRONICS, INC., Yamaichi Electronics Co., Ltd., 1420 Koll Circle, Ste.B, San Jose, CA 95112, Tel: 408-452-0797, FAX: 408-452-0799; Empl.: 24; *Sls. Mgr.:* Bob Million; *Dist. Mgr.:* Jim Bennett

YARDNEY TECHNICAL PRODUCTS, INC., 82 Mechanic St., Pawcatuck, CT 06379, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Louis R. Magnarella, VP

YELLOW SPRINGS INSTRUMENTS CO., Box 279, Yellow Springs, OH 45387, Tel: 800-765-4974, TELEX: 205437, FAX: 513-767-9353; Empl.: 359; *Sls. Mgr.:* Michael Flora **B•1909-1910**

Local Sales Offices & Reps

AZ	Chandler, Elec-Com Assocs.	602-893-2930
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IL	Lombard, Patrick & Douglas	708-268-1900
KS	Shawnee, Comtel Midwest	913-268-0762
MA	Natick, Andruss-Peskin	800-878-3919
MI	Canton, Tech-Rep, Inc.	313-981-1950
MN	Minneapolis, Automation Sensors, Inc.	612-537-6416
MO	Chesterfield, Advanced Indl. Sys.	314-532-2477
NJ	Scotch Plains, RJM Sls.	908-322-7880
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterfield, EQS Assoc.	216-729-2222
PA	Chadds Ford, RJM Sls.	215-358-4014
VA	Richmond, Advanced Control	804-282-9499
Can	Scarborough, Ont., Finnan Engr. Prod.	416-438-6070

Local Distributors

CA	Foster City, Therm-X	415-571-1166
MA	Natick, Andruss-Peskin	508-653-3919
NJ	Scotch Plains, RJM Sls.	201-322-7880
OH	Dayton, RDP Corp.	513-253-6175
Can	Scarborough, Ont., Finnan Engrd.	416-438-6070

YOUNG TECHNOLOGY, 48012 Fremont Blvd., Fremont, CA 94538, Tel: 510-490-6373, FAX: 510-490-3214; Empl.: 30; *Sls. Mgr.:* Ian McLean; *Dist. Mgr.:* Ian McLean

YSI INCORPORATED, See Yellow Springs Instrument Co.

YUASA
EXIDE, INC.

FAX: 215-378-0345

YUASA-EXIDE, INC., 645 Penn St., Reading, PA 19601, Tel: 215-378-0333; Empl.: 2000; *Sls. Mgr.:* Ronn Alonso, Francis Taylor, Bill McKenty; *Dist. Mgr.:* Greg Rapp **D•1485**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Westrep	602-820-9932
CA	Huntington Beach, West Elctrns.	310-493-5569
CA	San Diego, West Elctrns.	619-233-0236
CA	Santa Clara, Novatronix	408-727-9530
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Over & Over	407-332-1222
FL	Coral Springs, Over & Over	305-753-7050
FL	Tampa, Over & Over	813-626-9100
GA	Norcross, Over & Over	404-449-6205
IL	Arlington Heights, Brainard-Nielsen	708-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
KS	Wichita, R. W. Kunz & Assocs.	316-686-3436
MD	Hunt Valley, Samual K. MacDonald	410-584-8631
MA	Burlington, Kitchen & Kutchen	617-229-2660
MN	Anoka, Tech. Solutions	612-750-6122
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4799
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	908-464-0203
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Columbus, McFadden Sls.	614-761-3177
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Monroeville, Samuel K. MacDonald	412-373-1723
TX	Richardson, Krone & Assocs.	214-437-1892
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Manitowoc, Brainard-Nielsen	414-797-7940
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-225-5161
Can	Richmond, B.C., Tech-Trek Ltd.	604-276-8735
Can	St. Laurent, Que., Tech-Trek Ltd.	514-337-7540

Local Distributors

AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Downers Grove, Jarbo Battery	312-964-9358
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
TX	Allen, Prime Distrbg.	214-231-0170
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	National & Canada, Newark Elctrns.	800-367-3573
Can	Brampton, Ont., Zentronics	416-451-8445

ZAKI CORPORATION, 420 Maple St., Marlboro, MA 01752, Tel: 508-480-0201, FAX: 508-481-0595; *Sls. Mgr.:* Steven Sotsky

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176, FAX: 415-968-4851; FSC No.: 58758; 5950; Empl.: 20 Average

ZAXTEK, 42 Corporate Pk. Ste. 100, Irvine, CA 92714, Tel: 714-474-1170, 800-421-0982, FAX: 714-474-0159; Empl.: 15; *Sls. Mgr.:* Robert J. Parente, Dir. of Sls. & Mktg.

Z COMMUNICATIONS, INC., 9939 Via Pasar, San Diego, CA 92126, Tel: 619-621-2700, FAX: 619-621-2722; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Devang Patel

ZEBRA TECHNOLOGIES CORPORATION, 333 Corporate Woods Pkwy., Vernon Hills, IL 60061-3109, Tel: 708-634-6700, TELEX: 206230, FAX: 708-913-8766; *Sls. Mgr.:* Kevin O'Donnell

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 800-233-2343, FAX: 914-681-7446

ZENDEX CORP., 6780 Sierra Court, Ste. A, Dublin, CA 94568, Tel: 510-828-3000, TWX: 910-389-4009, FAX: 510-828-1574; Empl.: 20; *Sls. Mgr.:* Russ Gamble

ZENITH MAGNETICS, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025-2493, Tel: 708-391-8700; *Sls. Mgr.:* Bob Cunningham; *Dist. Mgr.:* Allan Parker

Local Sales Offices & Reps

AZ	Scottsdale, Vikeland Sls., Inc.	602-948-7921
CA	Dana Point, Electro Venture	909-496-5225

CA	Laguna Hills, Electro Venture-s	714-581-9244
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Tech Rep Sls.	303-758-7031
CO	Englewood, Tech. Rep. Sls.	303-799-8877
CT	Franklin, OEM Mktg. & Sls.	313-572-0516
FL	Clearwater, Tech. Rep. Assocs.	813-572-9900
IL	Arlington Hts., Hill Sls. Corp.	708-255-4400
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Farmington Hills, Carter Technlg. Inc.	313-477-7700
MN	Minneapolis, Comstrand, Inc.	612-574-9480
NH	Salem, OEM Mktg. & Sls.	603-893-1197
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
OH	Cleveland, S-Tek	216-468-0413
OR	Portland, Jos. V. Belusko Co.	503-222-4279
PA	Willow Grove, Tech Sls. Assoc.	215-784-0170
TX	Dallas, MGR Elctrns.	214-238-5246
VA	Alexandria, Mid-States Mktg., Inc.	703-370-2600

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; Empl.: 160; *Sls. Mgr.:* Jeff Zernov

ZERO CABINETS (STANTRON), 12224 Montague St., Pacoima, CA 91331-2226, Tel: 818-890-3445, FAX: 818-890-4460; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier .... **C•1118-1123**

Local Sales Offices & Reps

AL	Huntsville, Esneault Assocs.- BJR	205-881-3569
AZ	Phoenix, Shefler/Kahn	602-581-0884
CA	Camarillo, Luscombe Engrg.	805-388-2058
CA	Long Bch., Luscombe Engrg.	310-594-5994
CA	Mission Viejo, Luscombe Engrg.	714-855-8954
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Pleasanton, Moulthrop Sls.	510-463-0450
CA	San Diego, Qualtronics	619-695-0118
CA	Thousand Oaks, Luscombe Engrg.	805-377-8415
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Indiana Rocks Bch., P & M Tech. Sls. Co.	813-593-3248
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Palmer, Benoit & Co.	413-283-8348
MN	Bloomington, Elctrn. Sls. Agcy.	612-884-8291
MO	Raytown, Cadon Tech. Sls.	816-356-7685
MO	St. Louis, Cadon Tech. Sls.	314-645-8670
NH	Hudson, Benoit & Co.	603-598-3291
NM	Albuquerque, S & S Technlgs.	505-298-7177
NY	Commack, MTR Inc.	516-462-9580
NY	New Hyde Pk., MTR Inc.	516-326-8138
NY	Syracuse, Fountain, Young & Co., Inc.	315-437-7733
OH	Cincinnati, KCH Co.	513-931-1686
OR	Tigar, Halbar-R.T.S. Inc.	503-624-5741
PA	Boswell, B.E. Gibson, Co.	814-629-6772
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Effective Sls.	801-266-9617
VA	Martinsville, Engrg. Reps Assocs.	703-632-2365
WA	Redmond, Halbar-R.T.S. Inc.	206-882-0990
WA	Vashon, Halbar-R.T.S. Inc.	206-285-1363
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

ZERO EAST, Zero Corporation, 288 Main St., Monson, MA 01057-0128, Tel: 413-267-5561, FAX: 413-267-5569; FSC No.: 1400; Empl.: 235; *Sls. Mgr.:* John S. Dryjowicz, (Cabinets) .... **C•1124-1127**

Local Sales Offices & Reps

AL	Huntsville, BJR Mfrs. Reps.	205-881-3569
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Montrose, Luscombe Eng. Co.	818-249-9000, FAX:818-248-8536
CA	Pleasanton, Moulthrop Sls., Inc.	510-463-0450, FAX:510-463-1756
CA	San Diego, Qualtronics	619-695-0118, FAX:619-695-0119
CO	Golden, J.F. Hurlburt	303-279-7796, FAX:303-278-0092
FL	Indian Rocks Bch., P & M Tech. Sls.	813-593-3248
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Monson, Zero East (House Acct.)	413-267-5561
MA	Palmer, Benoit & Co.	413-283-8348
MN	Bloomington, Elctrn. Sls. Agency	612-884-8291
MO	St. Louis, Cadont Tech. Sls.	314-645-8670
NM	Albuquerque, S & S Technlgs.	505-298-7177
NY	Commack, MTR, Inc.	516-462-9580, FAX:516-462-1056
NY	E. Syracuse, Fountain, Young Co.	315-437-7733
OH	Cincinnati, Kenneth C. Hoffman Co.	513-931-1686
OR	Portland, Halbar-RTS, Inc.	503-244-4123, FAX:503-684-1803
PA	Boswell, B.E. Gibson Co.	814-629-6772, FAX:814-629-7169
PA	Huntingdon Valley, Inacker Sls., Inc.	215-947-5660, FAX:215-947-0948
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Effective Sls.	801-266-9617
VA	Martinsville, Enrgr. Reps.	703-632-2365
WA	Redmond, Halbar-RTS, Inc.	206-882-0990, FAX:206-881-3323
WA	Vashon, Halbar-RTS, Inc.	206-285-1363, FAX:206-463-2009
Can	Montreal, Jelco	514-522-6038

ZERO ENCLOSURES, Zero Corp., 200 North 500 West, North Salt Lake, Utah 84054-0310, Tel: 801-298-5900, FAX: 801-292-9450; Empl.: 285; *Sls. Mgr.:* Doug Griffith, V.P.

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057-0128, Tel: 413-267-5561, FAX: 413-267-5569; FSC No.: 19178; Empl.: 380; *Sls. Mgr.:* Roger St. Martin

ZERO PLASTICS, Zero Corp., 288 Main St., Monson, MA 01092, Tel: 413-267-5561, FAX: 413-267-3179; FSC No.: 03663; Empl.: 110; *Sls. Mgr.:* Kathy Odiorne

ZETA GRAPHICS CORP., 737 E. Arnold Dr., Martinez, CA 94553, Tel: 510-313-5900, FAX: 510-372-7431; Empl.: 70; *Sls. Mgr.:* Gary Hasenfus, VP Sls. Mktg.

ZETEX

FAX: 516-864-7630

ZETEX, INC., Zetex plc., 87 Modular Avenue, Commack, NY 11725, Tel: 516-543-7100; *Sls. Mgr.:* Joseph M. DeBlasio .... **A•2227**

Local Sales Offices & Reps

AL	Huntsville, ACM, Inc.	205-881-5493
AZ	Phoenix, Reptronix, Ltd.	602-230-2630
CA	Milpitas, Ward Elctrns.	408-945-0420
CA	San Diego, Cerco	619-693-7500
CA	Westlake Village, First Rep of Southern CA	805-373-0887
CT	Clinton, Stone Comp. Sls.	203-669-4344
FL	Casselberry, American Micro Sls.	407-831-2505
FL	Tarpon Springs, American Micro Sls.	813-938-3073
FL	West Palm Beach, American Micro Sls.	407-689-3860
GA	Norcross, ACM,Inc.	404-448-7025
IL	Park Ridge, Metcom Assocs.	708-696-1490
IN	Fort Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
IA	Cedar Rapids, M.I.N.K. Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs.	913-341-8309
MA	Framingham, Stone Comp. Sls., Inc.	508-875-3266
MI	Grand Rapids, Urban Assocs., Inc.	616-245-0511
MI	Livonia, Urban Assocs., Inc.	313-421-9150
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	Brighton, M.I.N.K. Assocs.	314-291-5454
NJ	Fairfield, Metro Logic	201-575-5585
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	Binghamton, Micro-Tech	607-771-8867
NY	New Platz, Micro-Tech	914-255-7019
NY	Rochester, Micro-Tech	716-426-0806
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Portland, General Elctrns.	503-297-8500
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TX	The Woodlands, Oeler & Menelaides	713-894-5021
WA	Stanwood, Gen. Elctrns.	206-246-8096
WI	West Allis, Metcom Assocs.	414-476-1300
Can	Mississauga, GMA	416-671-8111
Can	Nepean, Ont., GMA	613-820-3822
Can	St. Laurent, GMA	514-336-9572
Can	Vancouver, GMA	604-439-3383

Local Distributors

AL	Huntsville, All American Semiconductor	205-837-1555
CA	San Diego, All American Semiconductor	619-458-5850
CA	San Jose, All American	408-943-1200
CA	San Jose, Jaco	408-432-9290
CA	Torrance, All American	310-320-0240
CA	Tustin, Jaco	714-258-9003
CA	Westlake, Jaco	805-495-9998
FL	Boca Raton, Jaco	407-241-7943
FL	Miami, All American	305-621-8282
FL	Sunrise, All American	305-572-7999
ID	Boise, Radar Elec.	208-336-2227
IL	Rosemont, Advent	708-297-6200
IN	Indianapolis, Advent	317-872-4910
IA	Cedar Rapids, Advent	319-363-0221
MD	Columbia, Jaco	410-995-6620
MD	Rockville, All American	301-251-1205
MA	Tewksbury, Jaco	508-640-0010
MA	Wakefield, All American	617-246-2300
MI	Farmington Hills, Advent	313-477-1650
MN	Eden Prairie, All American	612-944-2151
MN	Fridley, Voyager	612-571-7766
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MO	St. Louis, Ric-Tronics	314-997-4707
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	West Berlin, Gen. Comps.	609-768-6767
NY	Hauppauge, Jaco	516-273-5500
NY	Penn Yan, Advacom Technlg	315-536-2221
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Mast Distrs.	516-471-4422
NY	Spring Valley, Sota-Tech Inc.	914-425-5900
NC	Raleigh, Jaco	919-876-7767
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Schuster	216-425-8134
PA	Mc Kean, Advacom Inc.	814-476-7774
TX	Austin, Jaco	512-835-0220
TX	Richardson, All American	214-231-5300
TX	Richardson, Jaco	214-234-5565
UT	Salt Lake City, All American Semiconductor	801-261-4210
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	West Allis, Advent Elctrns.	414-475-6860
Can	Surrey, BC, Martin Elctrn. Mktg. Corp.	604-590-1553

ZEUS INDL. PRODS. INC., P.O. Box 2167, Orangeburg, SC 29116, Tel: 803-531-2174, 800-526-3842, FAX: 803-533-5694; FSC No.: 32039; Empl.: 350; *Sls. Mgr.:* Jamie McLean, OEM Sls. Mgr.; *Dist. Mgr.:* Heather Bernardo, Distr. Sls. Mgr.

ZEVATECH, INC., 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-460-0111, FAX: 919-469-0480; Empl.: 29; *Dist. Mgr.:* Bob Black

ZEXCO, 5526 Murietta Ave., Van Nuys, CA 91401, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, FAX: 805-541-5088; Empl.: 65; *Sls. Mgr.:* Ron Giovannelli

ZILOG, INC., 210 East Hacienda Avenue, Campbell, CA 95008-6600, Tel: 408-370-8000, TWX: 910-338-7621

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 310-527-0488, FAX: 310-767-1714; Empl.: 60; *Sls. Mgr.:* Mike Sullivan

ZI-TECH INSTRUMENT CORP., P.O Box 51845, Palo Alto, CA 94303-0725, Tel: (415) 326-2151, FAX: 415-325-1276; Empl.: 7; *Sls. Mgr.:* J. Ziman

ZITEL CORPORATION, 630 Alder Drive, Milpitas, CA 95035, Tel: 408-321-9600, 800-622-5020, FAX: 408-321-9696; Empl.: 160; *Sls. Mgr.:* Don Olker; *Dist. Mgr.:* Don Olker

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZMAN MAGNETICS, 7633 South 180th, Kent, WA 98032, Tel: 206-251-8064, FAX: 206-251-6264; Empl.: 40; *Sls. Mgr.:* Mark Mennella .... **A•1315, 2606**

Local Sales Offices & Reps

CA	Mountain View, Bridge Mktg.	415-965-9045
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991

Z-WORLD ENGINEERING, 1724 Picasso Ave., Davis, CA 95616, Tel: 916-757-3737, FAX: 916-753-5141; Empl.: 18; *Sls. Mgr.:* Carrie Maha; *Dist. Mgr.:* Kelli Binsky

ZYLAB CORPORATION, 100 Lexington Dr., Buffalo Grove, IL 60089, Tel: 708-459-8000, FAX: 708-459-8054; Empl.: 21; *Sls. Mgr.:* Beth Harvey

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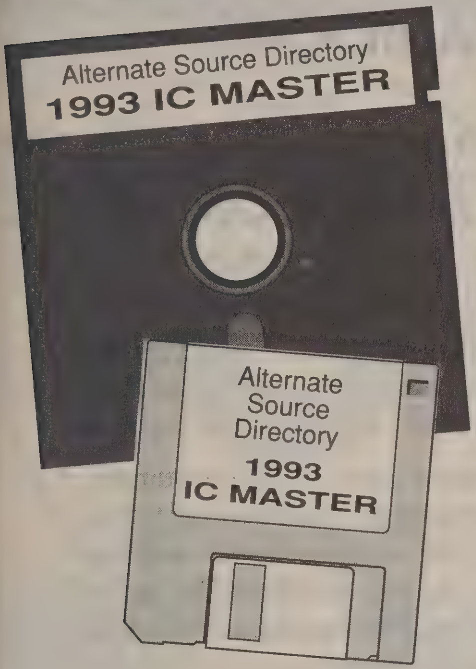

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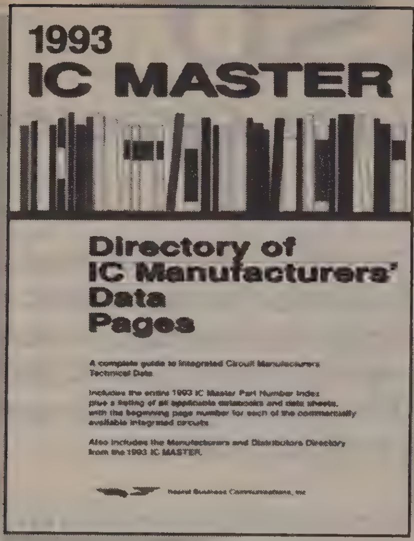

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1993
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ROMWARE

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

[j] Solid $RbAg_4I_5$ electrolyte.

[k] Several different cathode materials used.

[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

MINIGLOSSARY
CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (µF) 1 microfarad (µF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

eem

MINIGLOSSARY

BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = ½\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta$ (loss angle) $= \frac{ESR}{X_c} =$
$(2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = $ Cotan δ (loss angle) $= \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (½\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \text{ x } 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \text{ x } 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \text{ x } 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{ --- } + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area of electrode overlap
t_D = Dielectric thickness
V = Voltage (volts)
t = time (hours)
R_S = Series Resistance (ohms)
f = frequency (Hertz)
L = Inductance (henries)
δ = Loss angle
ø = Phase angle
x+y = Exponent effect of voltage and temperature
L_O = Operating life (hours)
L_t = Test life (hours)
V_t = Test voltage (volts)
V_o = Operating voltage (volts)
T_t = Test temperature (°C)
T_o = Operating temperature (°C)

eem

MINIGLOSSARY
CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY— CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

cem

MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

eem

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

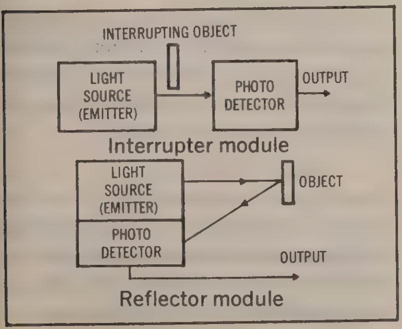
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

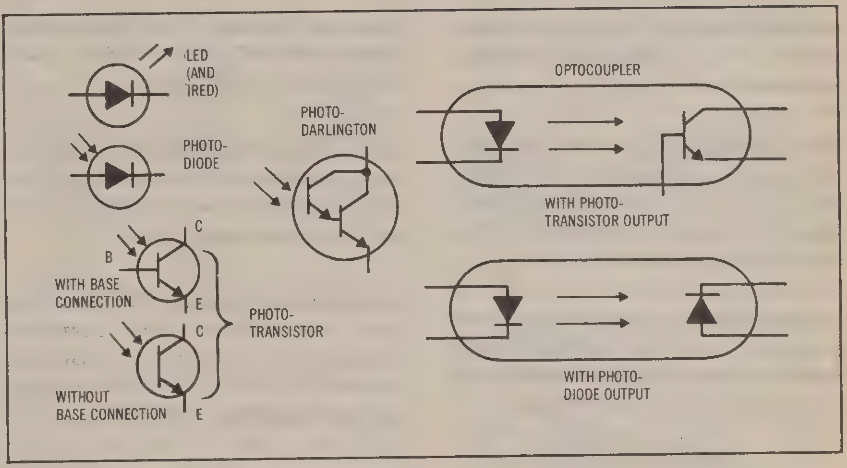
Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.



Interrupter module

Reflector module



IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

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MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

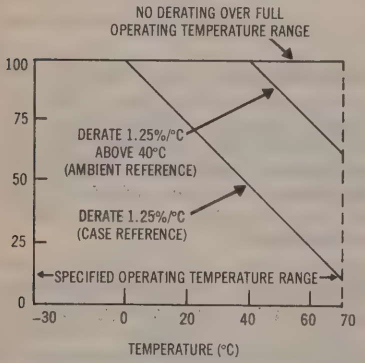

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

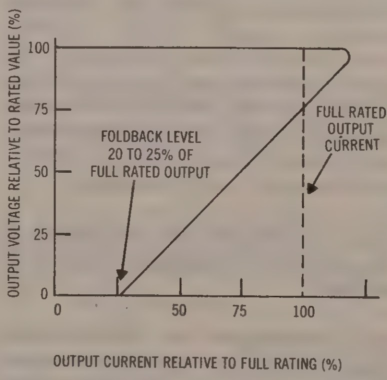

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

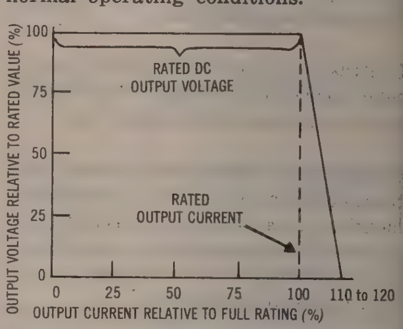

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

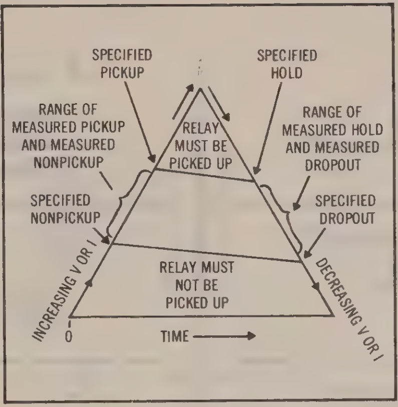
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively air-tight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

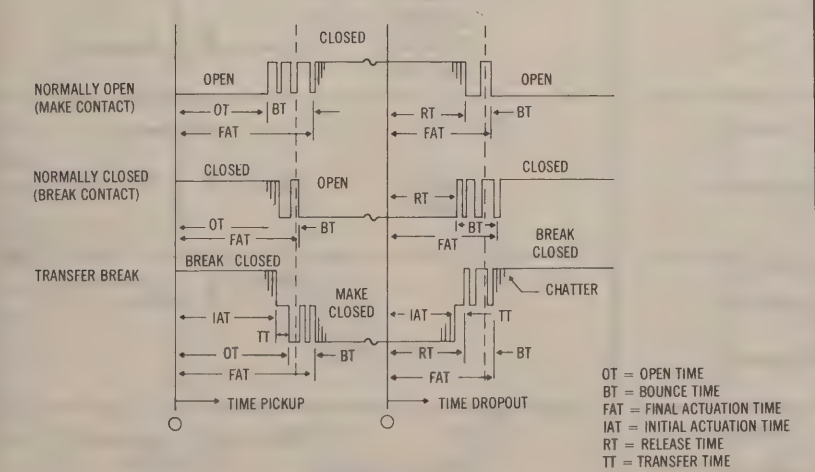
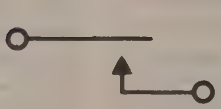

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OT
BT
FAT
RT
OPEN
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
CLOSED
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
TIME PICKUP
TIME DROPOUT
O
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

Fig. 2. Typical time vs. current (non-inductive load)

MINIGLOSSARY
RELAY CONTACT FORMS

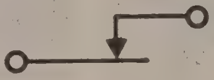
A

Make
SPST-NO



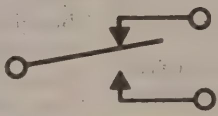
B

Break
SPST-NC



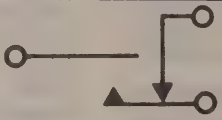
C

Break, Make
(Transfer)
SPDT



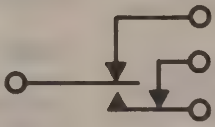
D

Make, Break
(Continuity
Transfer)



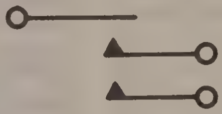
E

Break,
Make,
Break



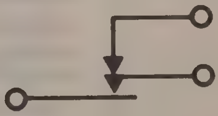
F

Make,
Make



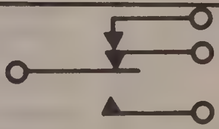
G

Break,
Make



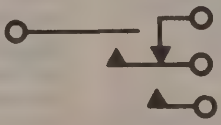
H

Break,
Break,
Make



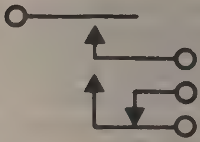
I

Make,
Break,
Make



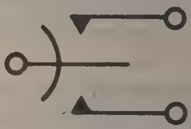
J

Make,
Make,
Break



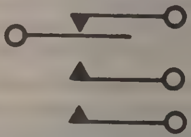
K

Center off
SPDT



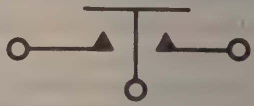
L

Break,
Make,
Make



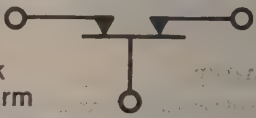
U

Double
make
Contact
on arm



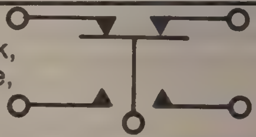
V

Double break
Contact on arm



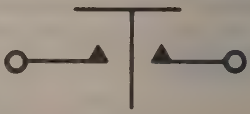
W

Double break,
Double make,
Contact
on arm



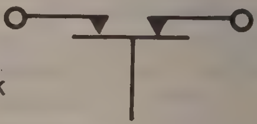
X

Double
make



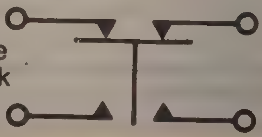
Y

Double break



Z

Double make
Double break
SPDT-DB



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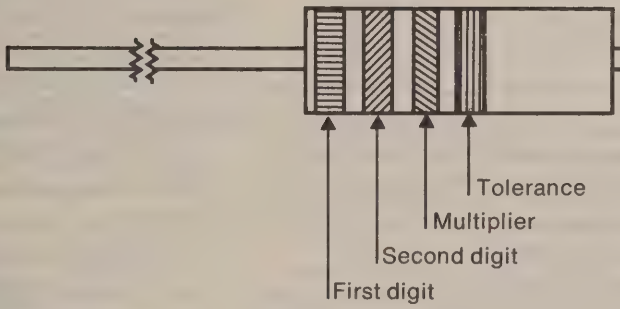
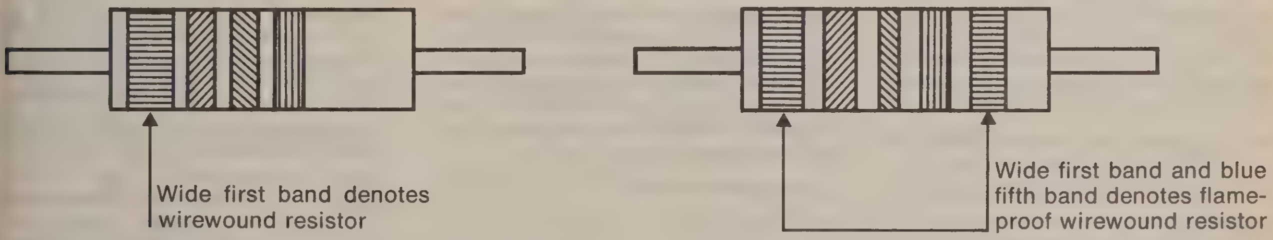
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes


Tolerance
Multiplier
Second digit
First digit

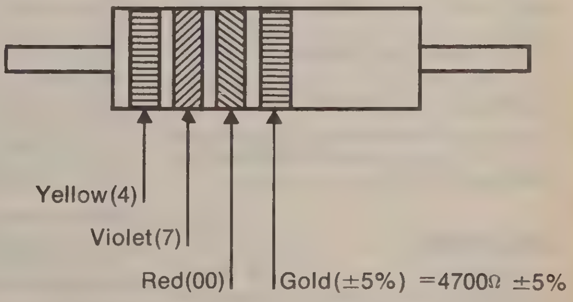
Color code for general-purpose industrial resistors


Wide first band denotes wirewound resistor
Wide first band and blue fifth band denotes flame-proof wirewound resistor

Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:


Yellow(4)
Violet(7)
Red(00)
Gold(±5%) =4700Ω ±5%

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MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

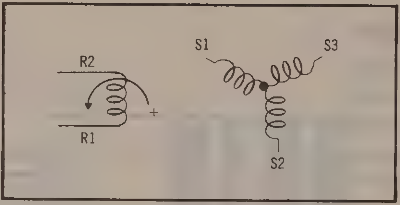
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

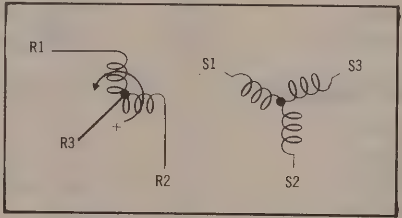
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

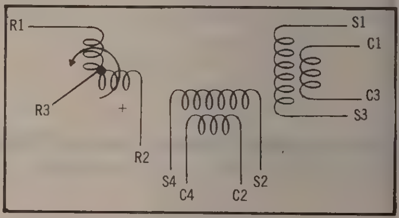
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
Instruments, Test & Measuring, Product Selection Guide	D•1215
Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

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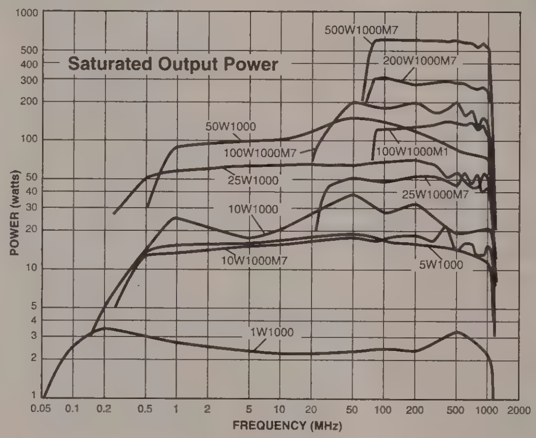
1 watt to 10,000 watts, 10 kHz to 1,000 MHz

For rf susceptibility testing, NMR spectroscopy, plasma physics, rf heating, and general rf lab requirements, Amplifier Research offers the depth of design experience and the breadth of line to fulfill even the most unusual demands. If the rf power amplifier you wish *you* had designed—with instantly available bandwidth, total immunity to load mismatch, pulse and blanking capability—is not already in these pages, the chances are very good that it can be designed and meticulously built for you at Amplifier Research, singly or in OEM quantities.

Series W • 1 to 500 watts, 100 kHz to 1000 MHz

These versatile, ultra-broadband, solid-state linear amplifiers provide rf power over four decades of bandwidth from 100 kHz to 1 GHz. Our newest line, Series W includes standard models rated up to 500 watts. Special or modified units are available to provide even higher useful power.

Solid State		
Model	**RF Power (watts)**	**Frequency**
1W1000	1	100kHz-1000MHz
5W1000	5	500kHz-1000MHz
10W1000	10	1-1000MHz
25W1000	25	1-1000MHz
50W1000	50	1-1000MHz
10W1000M7	10	1-1000MHz
25W1000M7	25	25-1000MHz
100W1000M1	100	100-1000MHz
100W1000M7	100	25-1000MHz
200W1000M7	200	80-1000MHz
500W1000M7	500	100-1000MHz



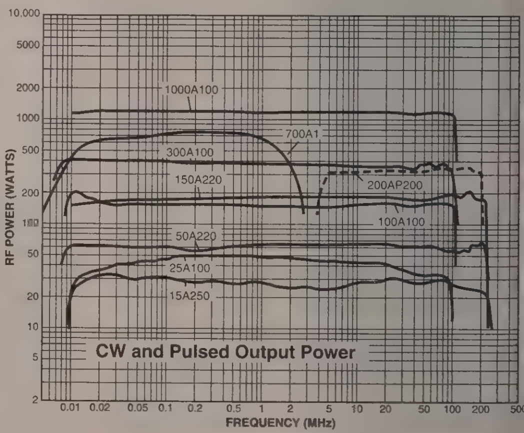
MODEL 500W1000M7

Series A • 15 to 1000 watts, 10 kHz to 250 MHz

If it's low to moderately high rf power and solid-state reliability over four decades of bandwidth that you need, turn to Series A, where standard models deliver up to 1000 watts. Frequencies for these all-solid-state amplifiers range from 10 kHz to 250 MHz.

Solid State		
Model	**RF Power (watts)**	**Frequency**
15A250	15	10kHz-250MHz
50A220	50	10kHz-220MHz
150A220	150	10kHz-220MHz
200AP200	300 pulse	5-200MHz
25A100	25	10kHz-100MHz
100A100	100	10kHz-100MHz
300A100	300	10kHz-100MHz
1000A100	1000	10kHz-100MHz
700A1	700	10kHz-1MHz

MODEL 50A220



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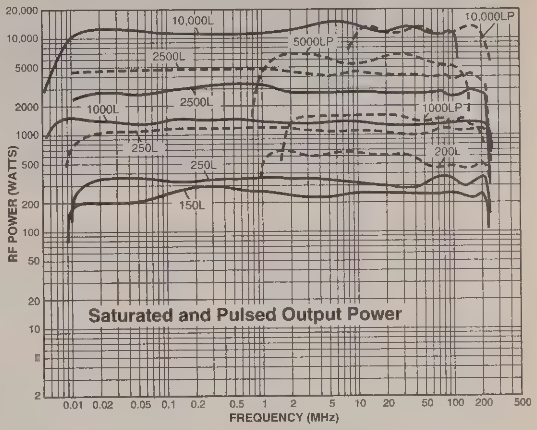
Call toll-free direct to applications engineering: 1-800-933-8181
160 School House Road, Souderton, PA 18964-9990 USA • TEL 215-723-8181 • FAX 215-723-5688
In Europe, call EMV: Munich, 89-612-8054; London, 908-566-556; Paris, 1-64-61-63-29.

Series L • 150 to 10,000 watts, 10 kHz to 220 MHz

Our highest-power series, these broadband Class A linear amplifiers are designed with modern solid-state low-power stages skillfully combined with highly reliable tube output stages to deliver moderate to very high power over four decades of bandwidth—150 to 10,000 watts over the frequency range of 10 kHz to 220 MHz.

Solid State/Tubes		
Model	RF Power (watts) cw/pulse	Frequency
150L	150	10kHz-220MHz
200L	200/400	1-200MHz
250L	250/750	10kHz-220MHz
1000L	1000/2500	10kHz-220MHz
1000LP	200/1000	2-200MHz
2500L	2500/3500	10kHz-220MHz
5000LP	400/5000	1-150MHz
10,000L	10,000	10kHz-100MHz
10,000LP	2000/10,000	9-180MHz



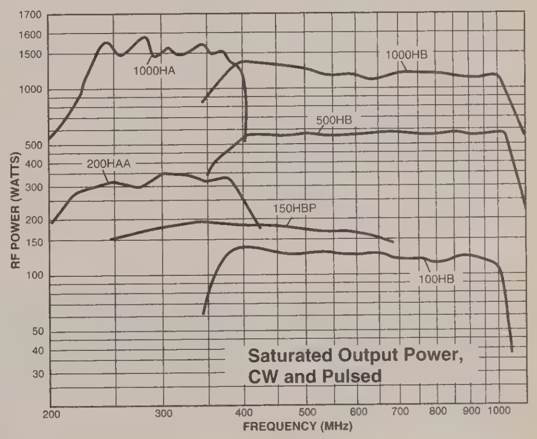
MODEL 250L

See our antenna pages elsewhere in this volume.

Series H • 100 to 1250 watts, 220 to 1000 MHz

Series H amplifiers are an economical solution where a narrower bandwidth will provide adequate performance. They cover the bandwidth from 220 MHz to 1000 MHz. Up to 1250 watts, and higher-power units are available.

Solid State		
Model	RF Power (watts)	Frequency
200HAA	200	220-400MHz
100HB	100	400-1000MHz
500HB	500	400-1000MHz
1000HB	1000	400-1000MHz
150HBP	150 pulse	300-600MHz
Solid State/Tubes		
1000HA	1250	220-400MHz



MODEL 100HB

Accessories for rf testing

Ultra-broadband control preamplifier • 10kHz to 1 GHz, 30 dB gain control, pedestal and blanking outputs, front-panel rf level control, rf delay, threshold control.

PCB emissions scanner • Locates low-to-high emissions, displays color image, stores data for design corrections at development stage.

Dual-directional couplers • Seven models up to 15 kW, matched to AR amplifiers and antennas.

High-power broadband antennas • A full line, matched to the frequency and power output of AR broadband amplifiers, and delivering field levels as high as 1,000 volts per meter. See complete antenna catalog elsewhere in this volume.

Ultra-broadband E-field monitor • Four-channel capability, 1 to 300 V/m, isotropic probes cover 10 kHz to 1000 MHz or 80 MHz to 40 GHz.

Power combiner/dividers • Combine signals from four amplifiers, or divide one signal into four outputs.

Broadband fiberoptic data links • Modular plug-in analog systems for acquiring and measuring interference data, stimulating EUT, displaying results in color or monochrome, 10 kHz to 1 GHz.

Fiberoptic CCTV systems • Watch performance of EUT under hostile EMI and/or EMP shielded-room conditions, in color or monochrome.

TEM cells • Half again the bandwidth of comparable-size chambers: To 750 MHz for 15-cm EUT, 375 MHz for 30-cm EUT.

Computer bus interfaces • Two models, for isolated GPIB connection or isolated TTL connection, permit remote operation of amplifiers.

RF connection kit • Things you'd search for around the lab: Cables, coax adapters, connectors, fuses, lamps, fabricated cables.

High-power rf matching transformers • Match 50-ohm input to 12.5- or 200-ohm output. Up to 2 kW cw.

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In Europe, call EMV: Munich, 89-612-8054; London, 908-566-556; Paris, 1-64-61-63-29.

6455

MAXIMUM CURRENT CAPACITY— CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

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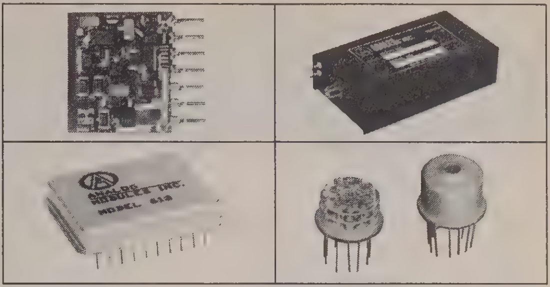

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- PHOTODETECTOR—AMPLIFIER MODULES
- FAST PEAK PULSE STRETCHERS
- LASER RANGEFINDER RECEIVERS
- CUSTOM MODULES AND HYBRIDS (MIL)

AMPLIFIERS

Model	Type	Input (Ω)	Frequency Response	Gain	Lowest Noise (A or V/√Hz)	Output Load Ω	Output Swing (V)	Supply Voltage (V)	Pkg. Dim. (Inches)	Special Features
110	Current	Bipolar	AC-105MHz	1 to 80KV/A	1pA	50 (AC)	+5	+9	0.7 x 0.62 x 0.3	>60dB Dynamic Range (Voltage)
311		Bipolar	100Hz-1.5MHz	1 to 1000MV/A	7fA	50	+/-6	+/-15	3.12 x 1.5 x 1.09	Trimpot Variable Gain
312A		GaAs	200Hz-200MHz	0.1 to 1MV/A	0.6pA	50	+/-3	+15	3.5 x 2.03 x 0.92	Ideal with <10pF Input capacitance
313A		Bipolar	1KHz-350MHz	20KV/A	6.5pA	50	+2, -1.2	+15	3.5 x 2.03 x 0.92	Will accept higher capacitive inputs
341		Bipolar	DC-1.5MHz	1 to 1000MV/A	7fA	50	+/-6	+/-15	3.12 x 1.5 x 1.09	Variable gain, offset, drift 2pA/°C
342A		GaAs	DC-100MHz	100 KV/A	2.5pA	50	+2, -1	+/-12	3.5 x 2.03 x 0.92	DC offset adjust, drift 20nA/°C
343A		Bipolar	DC-300MHz	20KV/A	8.0pA	50	+/-1.5	+/-12	3.5 x 2.03 x 0.92	DC offset adjust, drift 50nA/°C
321	Voltage	50/100K	100Hz-4MHz	20 to 80dB	5nV	50	+/-6	+/-15	3.12 x 1.5 x 1.09	Trimpot variable gain
322A		50/250	100Hz-100MHz	20 to 60dB	280pV	50	+/-3	+15	3.12 x 1.5 x 1.09	Lowest voltage noise
324A		≥1M	200Hz-60MHz	40 to 60dB	500pV	50	+/-3	+/-15	3.5 x 2.03 x 0.92	Low Noise, high input impedance
351		50/100K	DC-4MHz	20 to 80dB	7nV	50	+/-6	+/-15	3.12 x 1.5 x 1.09	Variable gain, offset adjust, drift 0.2μV/°C
352A		50/50K	DC-100MHz	40dB	7.5nV	50	+3, -1	+/-12	3.5 x 2.03 x 0.92	DC offset adjust, drift 3μV/°C
353A		50	DC-350MHz	30dB	3nV	50	+/-1.5	+/-12	3.5 x 2.03 x 0.92	DC offset adjust, drift 15μV/°C
354	Video	50/5K	DC-20MHz	0-18dB	SNR>50dB	50	+/-15	105-125VAC	3.25 x 8.0 x 9.0	30Vpk-pk swing, gain/offset adjust
362	Prog. Gain	>3K	50KHz-40MHz	0-40dB	20nV	≥2K	+/-3.5	+/-12	3.85 x 2.5 x 0.47	0-10V linear gain control
381	Logarithmic	50	DC-30MHz	10mV/dB	5μVrms	50	+/-0.5	+/-12	2.56 x 1.31 x 0.86	90dB Dynamic range, +/-0.5dB Linearity
382		50	DC-115MHz	6mV/dB	16μVrms	50	+0.6, -0.5	+/-5	3.95 x 2.6 x 0.94	80dB Dynamic range, +/-0.5dB Linearity
383		50	100Hz-40MHz	8mV/dB	5μVrms	50	+1	+/-15	4 x 2.25 x 0.95	90dB Dynamic range, +/-0.5dB Linearity

PHOTODETECTOR—AMPLIFIER MODULES

Model	Input Photo-detector	Amplifier Type	Frequency 1. Response	Gain (V/W)	Noise (W√Hz)	Output Load Ω	Dynamic Range (Voltage)	Supply Voltage (V)	Pkg. Dim. (Inches)	Special Features 2.
711	Si, InGaAs	311	DC-1.5MHz	77V/nW to 0.5V/μW	0.1fW	50	> 45db	+/-15	3.12 x 1.5 x 1.09	Choice of various pin and APD detectors
712A	Si, InGaAs	312A	200Hz-80MHz	.05-7V/μW	9fW	50	> 45db	+15	3.5 x 2.03 x 0.92	Choice of various pin and APD detectors
713A	Si, InGaAs	313A	200Hz-300MHz	7.4-1500V/mW	0.1pW	50	> 45db	+15	3.5 x 2.03 x 0.92	Choice of various pin and APD detectors

1. DC response also available. 2. **Model 521** HV Power Supply and **Model 522** temperature compensated HV power supply available for APD photobiasing.

FAST PEAK PULSE STRETCHERS

Model	Input (Ω)	Frequency Response	Accuracy (20nS)	Resets	Output Load (Ω)	Output Swing (V)	Supply Voltage (V)	Pkg. Dim.	Special Features
610	0-4V (50/10K)	Pulse down to 20nS FWHM	+/-3%, +/-20mV	TTL	>400	0-4	+/-15V	3.12 x 1.5 x 1.09	10nS TTL Input Gate
613	0-4V (50)	Pulse down to 5nS FWHM	+/-1%, +/-20mV	TTL	>400	0-4.3	+/-15V	1.24 x 1.14 x 0.21	DC Coupled Hermetic Hybrid

LASER RANGEFINDER RECEIVERS

Model	Input Photo-detector	Input Wave-length	Time Program Gain	Sensitivity, 50% P_D 0.1% FAR	Output Type	Supply Voltage .(V)	Pkg. Dim.	Special Features 1.
751	Si APD	0.4 - 1.1μm	$1/R^2$ to 2.5Km	10nW @ 1.06μm w/20nS pulse	TTL/CMOS or ECL	8-16V, > +550	4.57 x 1.53 x 0.625	APD Gain and Threshold adjust
752	InGaAs	1.06 - 1.7μm	$1/R^2$ to 2Km	60nW @ 1.54μm w/30nS pulse	TTL/CMOS or ECL	8-16V	4.93 x 1.42 x 0.531	Internal threshold adjust
753	InGaAs	1.06 - 1.7μm	$1/R^2$ to 2.5.Km	60nW @ 1.5μm w/30nS pulse	TTL/CMOS	+8	1.0 x 0.75 x 0.375	2 Surface-mount PCB
754	InGaAs	1.06 - 1.7μm	$1/R^2$ to 2Km	50nW @ 1.54μm w/28nS pulse	TTL/CMOS	+12	0.6 diameter x 0.425	Hermetic TO-8 Hybrid
755	InGaAs APD	1.06 - 1.7μm	$1/R^2$ to 2Km	8nW @ 1.54μm w/28nS pulse	TTL/CMOS	+12, >+80	0.6 diameter x 0.425	Hermetic TO-8 Hybrid
756	Si APD	0.4 - 1.1μm	$1/R^2$ to 2Km	3nW @ 1.06μm w/20nS pulse	TTL/CMOS	+12, >+450	0.6 diameter x 0.425	Hermetic TO-8 Hybrid

1. AMI also offers **Models 902 and 908** High Speed Range Counting Boards and **Model 900-20** Complete Rangefinder.

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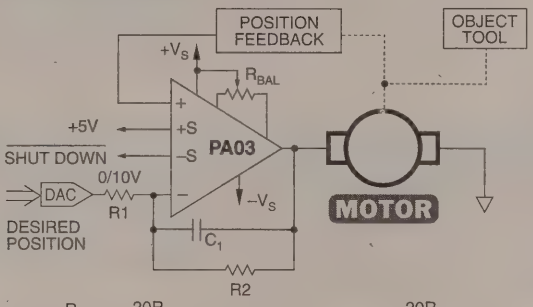
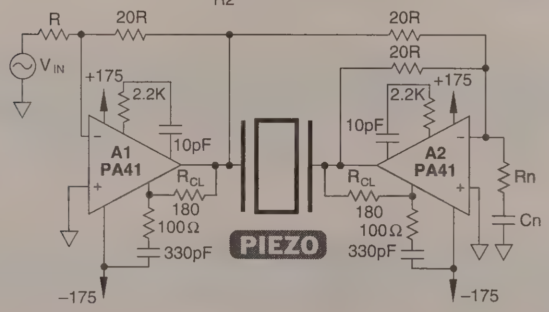
TYPICAL APPLICATIONS

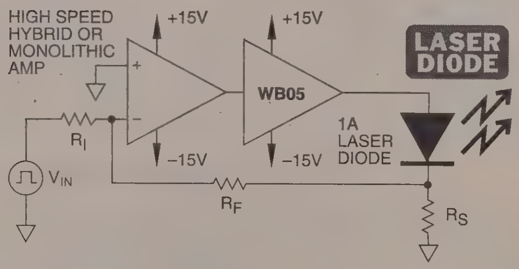
HIGH POWER


POSITION FEEDBACK
OBJECT TOOL
+V_S
R_BAL
+5V
SHUT DOWN
+S
–S
PA03
0/10V
DAC
R1
DESIRED POSITION
–V_S
C1
R2
MOTOR

HIGH VOLTAGE

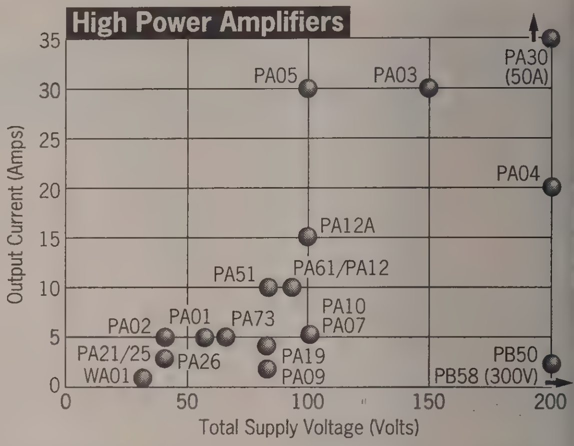

R
20R
20R
20R
V_IN
+175
2.2K
10pF
A1 PA41
R_CL
180
100Ω
330pF
–175
PIEZO
10pF
2.2K
+175
A2 PA41
R_CL
180
100Ω
330pF
–175
Rn
Cn

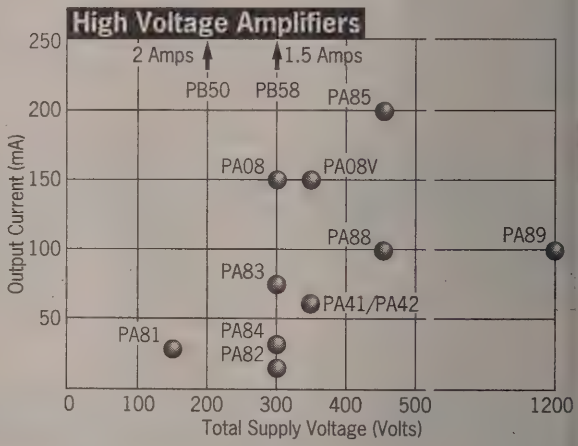
HIGH SPEED

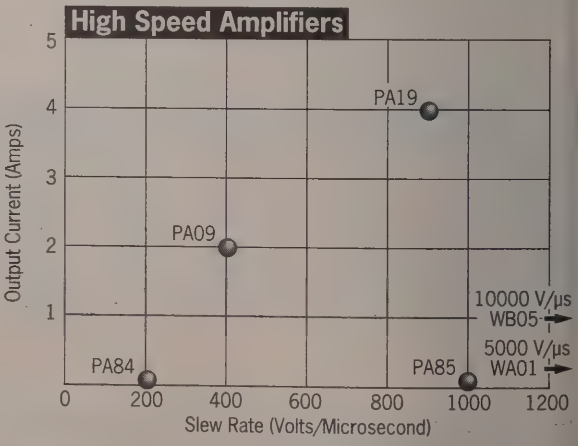

HIGH SPEED HYBRID OR MONOLITHIC AMP
+15V
+15V
WB05
LASER DIODE
R_I
–15V
–15V
1A LASER DIODE
V_IN
R_F
R_S

PRODUCT DEFINITIONS

HIGH POWER AMPLIFIER: **$I_{OUT} > \pm 1.0A$**
HIGH VOLTAGE AMPLIFER: **$V_S > \pm 50V$**
HIGH SPEED AMPLIFIER: **Slew Rate > 400V/μs**







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HIGH VOLTAGE

Model	±Supply Range Volts Min/Max	Output Current (Cont.) mA, Min	Saturation @I_OMax (V_S-V_O) Volts, Max	Internal Power Watts Max	Slew Rate V/µs Typ	V_{OS} Initial mV Max	V_{OS} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max	Packaging Type
PA89	50/600	75	30	40	16	2	30	.05	6	10	Ext Adj	No	–25/85	MO-127
PA89A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA85	15/225	200	10	35	1000	2	30	.05	25	100	Ext Adj	No	–25/85	TO-3
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA85M	*	*	*	*	400	4	30	.05	*	*	*	*	–55/125	*
PA88	15/225	100	10	15	30	2	30	.05	2	2	Ext Adj	No	–25/85	TO-3
PA88A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA88M	*	*	*	*	15	4	30	.05	*	*	*	*	–55/125	*
PA41	50/175	60	12	12	40	60	130	.05	2	1.6	Ext Adj	No	–25/85	TO-3
PA41A	*	*	10	*	*	30	65	*	1.8	*	*	*	*	*
PA41M	*	*	12	*	*	60	130	*	2	*	*	*	–55/125	*
PA42	50/175	60	12	9	40	60	130	2000	2	1.6	Ext Adj	No	–25/85	SIP10
PA42A	*	*	10	*	*	30	*	*	1.8	*	*	*	*	*
PA08V	15/175	150	15	17.5	30	2	30	.05	8.5	5	Ext Adj	Yes	–25/85	TO-3
PA08	15/150	*	*	*	*	*	*	*	*	*	*	*	*	*
PA08A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA08M/883	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125	*
PB58	15/150	1500	11	80	100	1750	7000	—	12	2.5	Ext Adj	No	–25/85	TO-3
PB58A	*	2000	*	*	*	1000	*	—	*	*	*	*	*	*
PA83	15/150	75	10	17.5	30	3	25	.05	8.5	5	(.1)	Yes	–25/85	TO-3
PA83A	*	*	*	*	*	1	10	.01	*	*	*	*	*	*
PA83M/883	*	*	*	*	*	3	25	.05	*	*	*	*	–55/125	*
PA84	15/150	40	7	17.5	200	3	25	.05	7.5	76	(.05)	Yes	–25/85	TO-3
PA84A	*	*	*	*	*	1	10	.01	*	*	*	*	*	*
PA84M/883	*	*	*	*	*	3	25	.05	*	*	*	*	–55/125	*
PA84S	*	*	*	*	*	*	*	*	*	*	*	*	–25/85	*
PA82J	70/150	15	5	11.5	20	3	25	.05	8.5	5	(.025)	Yes	0/70	TO-3
PB50	30/100	2000	11	35	100	1750	7000	—	18	2.5	Ext Adj	No	–25/85	TO-3
PA81J	32/75	30	5	11.5	20	3	25	.05	8.5	5	(.05)	Yes	0/70	TO-3

†Specifications apply for T_C = 25°C, unless otherwise stated. *Specification is same as above.

HIGH SPEED

Model	Slew Rate V/µs Typ	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I_OMax (V_S-V_O) Volts, Max	Internal Power Watts Max	V_{OS} Initial mV Max	V_{OS} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max	Packaging Type
WA01	5000	.4	12/16	4	10.5	10	50	20000	30	—	(.6)	No	–25/85	TO-3
WA01A	*	*	*	*	*	5	25	10000	*	*	*	*	*	*
WB05	10000	1	5/15	6.5	15	100	500	30000	30	250	(1.5)	No	–25/85	TO-3
PA85	1000	.2	15/225	10	35	2	30	.05	25	100	Ext Adj	No	–25/85	TO-3
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA85M	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125	*
PA19	900	4	15/40	5	78	3	30	.2	120	100	Ext Adj	Yes	–25/85	TO-3
PA19A	*	*	*	*	*	.5	10	.05	*	*	*	*	*	*
PA09	400	2	12/40	8	78	3	30	.1	85	150	(4.5)	Yes	–25/85	TO-3
PA09A	*	*	*	*	*	.5	10	.02	*	*	*	*	*	*
PA09M/883	*	*	*	*	*	3	30	.1	*	*	*	*	–55/125	*

†Specifications apply for T_C = 25°C, unless otherwise stated. *Specification is same as above.

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HIGH POWER

Model	Internal Power Watts Max	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I_OMax (V_S-V_O) Volts, Max	Slew Rate V/µs Typ	V_{OS} Initial mV Max	V_{OS} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max	Packaging Type
PA30	1000	50	15/100	7.5/9.5(1)	45	10	50	.05	40	1	Ext Adj	Yes	–25/85	SL15
PA03	500	30	15/75	7	8	2	30	.05	300	1	Thermal	Yes	–25/85	MO-127
PA03A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA05	250	30	15/50	5.8/9.5(1)	100	10	50	.05	120	3	Ext Adj	Yes	-25/85	MO-127
PA05A	*	*	*	*	*	5	30	.02	*	*	*	*	*	*
PA04	200	20	15/100	5.3/8.8(1)	50	10	50	.05	90	2	Ext Adj	No	–25/85	MO-127
PA04A	*	*	*	*	*	5	30	.02	*	*	*	*	*	*
PA12	125	10	10/45	6	4	6	65	30	50	4	Ext Adj	No	–25/85	TO-3
PA12A	*	15	10/50	7	*	3	40	20	*	*	*	*	–55/125	*
PA12M/883	*	*	10/45	6	*	6	65	30	*	*	*	*	*	*
PA12H		1	*	4		6		30	100		*	*	–25/200	*
PA61(2)	97	10	10/45	7	2.8	6	65	30	10	1	Ext Adj	No	–25/85	TO-3
PA61A(2)	*	*	*	6	*	3	40	20	*	*	*	*	*	*
PA61M/883(2)	*	*	*	7	*	6	65	30	*	*	*	*	–55/125	*
PA51(2)	97	10	10/36	8	2.6	10	65	40	10	1	Ext Adj	No	–25/85	TO-3
PA51A(2)	*	*	10/40	*	*	5	40	20	*	*	*	*	*	*
PA51M/883(2)	*	*	10/36	*	*	10	65	40	*	*	*	*	–55/125	*
PB58	80	1.5	15/150	11	100	1500	7000	—	12	2.5	Ext Adj	No	–25/85	TO-3
PB58A	*	2.0	*	*	*	1000	*	—	*	*	*	*	*	*
PA07	67	5	12/50	5	5	2	30	.05	30	1.3	Ext Adj	Yes	–25/85	TO-3
PA07A	*	*	*	*	*	.5	10	.01	*	*	*	*	*	*
PA07M/883	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125	*
PA10	67	5	10/45	8	3	6	65	30	30	4	Ext Adj	No	–25/85	TO-3
PA10A	*	*	10/50	6	*	3	40	20	*	*	*	*	–55/125	*
PA10M/883	*	*	10/45	8	*	6	65	30	*	*	*	*	*	*
PA73(2)	67	5	10/30	8	2.6	10	65	40	5	1	Ext Adj	No	–25/85	TO-3
PA73M/883(2)	*	*	*	*	*	*	*	*	*	*	*	*	–55/125	*
PA01	67	5	10/28	10	2.6	12	65	50	50	1	Ext Adj	No	–25/85	TO-3
PA02	48	5	7/19	4	20	10	50	.2	40	4.5	Ext Adj	No	–25/85	TO-3
PA02A	*	*	*	*	*	3	25	.1	*	*	*	*	–55/125	*
PA02D	48	5	7/19	4	20	10	50	.2	110	4.5	Ext adj	No	–25/85	TO-3
PA02M/883	*	*	*	*	*	*	50	.2	40	*	*	*	–55/125	*
PA21	36	2.5	2.5/20	3.0	1.2	10	15 typ	1000	90	.6	(3)	No	–25/85	TO-3
PA21A	*	3.0	*	3.5	*	4	10 typ	250	*	*	(4)	*	*	*
PA21M	*	2.5	*	3.0	*	10	15typ	1000	*	*	(3)	*	–55/125	*
PA25	36	2.5	2.5/20	3.0	1.2	10	15 typ	1000	90	.6	(3)	No	–25/85	TO-3
PA25A	*	3.0	*	3.5	*	4	10typ	250	*	*	(4)	*	*	*
PA26	36	2.5	2.5/20	3.0	1.2	10	15 typ	1000	90	.6	(3)	No	–25/85	SIP12
PB50	35	2	30/100	11	100	1750	7000	—	18	2.5	Ext Adj	No	–25/85	TO-3

†Specifications apply for T_C = 25°C, unless otherwise stated. *Specification is same as above.

(1) 1st number with Boost Voltage = V_S + 5V; 2nd number without Boost Voltage (2) Class "C" output—optimized for low cost—not recommended above 1KHz

DESC SMD AVAILABILITY

Apex Model Number	SMD Part #
High Power	
PA02M/883	5962-9067901HXX
PA07M/883	5962-9063801HXX
PA10M/883	5962-9082801HXX
PA12M/883	5962-9065901HXX
PA51M/883	5962-8762002YC

Apex Model Number	SMD Part #
High Voltage	
PA08M/883	5962-9072301HXX
PA83M/883	5962-9162101HXX
PA84M/883	5962-9073601HXX
High Speed	
PA09M/883	5962-9170001HXX

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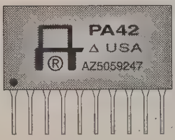
PA41/PA42

Industry's First Monolithic High Voltage Op Amp, 350V Output SIP Packaging



Features:

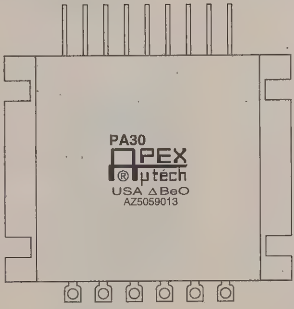
- Monolithic MOS Technology
- $29.85 in 100s*; $20.90 IN 5K*
- High output current—60mA
- Low quiescent current—2mA
- Slew Rate—40V/μs
- PA42 in low weight, 10-pin SIP package for board space efficiency
- PA41 in TO-3
- PA41M hi-rel grade

Applications:

- Piezoelectric positioning
- Electrostatic transducer & deflection
- Deformable mirror focusing
- Biochemistry stimulators
- Telecommunications
- ATE

PA30

2.68 Horsepower or 2000W RMS Output



Features:

- 2000W RMS output power continuous (8000W pulse)
- High peak current—100A
- No second breakdown
- On-chip thermal protection
- Kelvin sensing
- Voltage supply range—±15V to ±100V
- 1000W internal power dissipation
- 2.80" x 2.20" x .422" Package

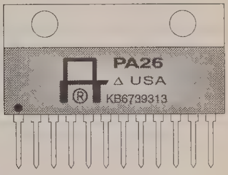
Applications:

- Sonar
- Magnetic coil drive
- Power source simulation
- Welding
- Motor drive

* Prices subject to change without notice

PA21/PA25/PA26

Low Cost, Dual Op Amp 5V to 40V Operation



Features:

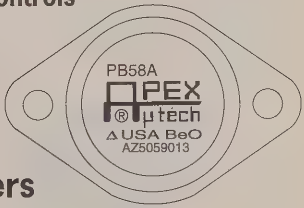
- Dual Amplifier
- Prices start $5.75 in 100s*
- Wide Supply Range
  - single supply: 5V to 40V
  - split supply: ±2.5V to ±20V
- Wide common mode range includes negative rail
- Optional V_{BOOST} inputs for higher efficiency
- High ouput current—3A x 2
- PA26 in 12-pin SIP package
- PA21/25 in TO-3
- PA21M hi-rel grade

Applications:

- Audio power amplifier
  - stereo—30W RMS per channel
  - bridge—60W RMS per package
- Single supply systems
  - 5V—peripherals
  - 12V—automotive
  - 24V—airborne
- Brush type dc motor drive uni/bi-directional
- Valve control
- Industrial/automotive controls

PB50/58

Low Cost High Voltage Boosters



Features:

- Voltage and current booster for small signal op amp
- <$65 in 100s*
- High output current—2A
- High slew rate—100V/μs
- Voltage supplies up to ±150V

Applications:

- High voltage instrumentation
- Programmable power supplies up to 280Vpp
- Line drivers
- Data acquisition systems
- Magnetic deflection

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Instrumentation Amplifiers and Transducer Signal Conditioners

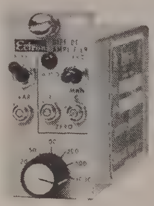
- **Thermocouple/MV Calibrators**
- **Thermocouple Signal Conditioners**
- **Strain Gage Signal Conditioners**
- **Transducer Amplifiers**
- **Computer Controlled Signal Conditioning Systems**
- **Differential DC Amplifiers**

VEHICLE TESTING

THE AUTO INDUSTRY STANDARD for on-board vehicle test, these Ectron conditioner amplifiers are small, rugged, and very stable under poor environmental conditions.

MODEL 418

- 100 g Shock, 20g Vibration
- −25 °C to +71 °C Operation
- Bridge or Thermocouple Conditioning
- 12 or 28V Power
- Isolated Diff. Amplifier
- Integral Excitation Supply

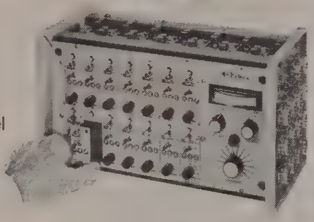


MODEL 352

- 20kHz Bandwidth
- 8 oz Weight
- RFI Protection
- Variable Excitation
- 20M Ω Input impedance
- Bridge Conditioning

4000 SERIES ENCLOSURES

Rugged 14 and 22 channel signal conditioning systems accept Model 418 or 352 amplifiers.



SEVERE ENVIRONMENT

These conditioner amplifiers are for use in missile, aircraft and other severe applications.

MODEL 414

- 100g Shock
- 1″ x 2″ x 3″ Size, 8 Oz Wt.
- Bridge Excitation, Balance
- Thermocouple Conditioning
- RFI Protection
- 12 or 28V Power

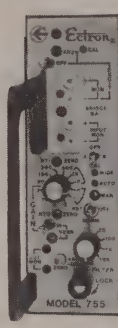
MODEL 314B

- 2500g Shock
- −25 °C to +71 °C Operation
- 1.2 Cu. In. Vol, 1.7 oz Wt.
- Isolated Excitation Supply
- Gain Variable to 1000

TRANSDUCER CONDITIONER AMPLIFIERS

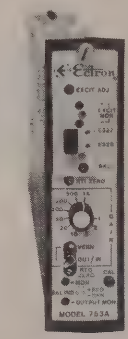
MODEL 755

- Dual Range Auto Zero
- Selectable 4 Pole Filters
- 100KHz Bandwidth
- 300V Common Mode
- Constant Voltage/ Current Excitation
- Ten Wire Input
- Ten Units per Rack



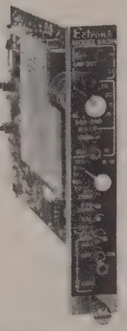
MODEL 753A

- 300V Common Mode
- 140KHz Bandwidth
- Constant Voltage/ Current Excitation
- Remote CAL
- Bridge Completion
- Ten Wire Transducer Input
- Plug-in Conditioner Assembly
- 12 Units per Rack



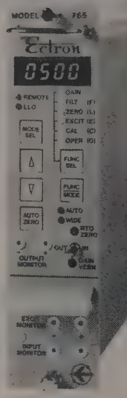
MODEL 563H

- Gains x .01 to x 2500
- Bandwidth to 200KHz
- Variable excitation
- Bridge Completion
- Selectable Filter
- Dual Outputs
- 16 Units per rack



MODEL 765 PROGRAMMABLE CONDITIONER AMPLIFIER

- Manual or IEEE-488
- Gain, Filter, Excitation Zero, CAL
- 100KHz Bandwidth
- 300V Common Mode
- Constant Voltage/ Current
- Ten Wire Input/Dual Output
- DC or AC Coupling
- Ten Units per Rack



MODEL 778 WIDEBAND AMPLIFIER

- Bandwidth dc to 3 MHz
- Transducer Conditioning
- Selectable Gains and Filter
- 300 Volt Common Mode
- 120 dB CMR dc to100kHz, 80 dB to 5 MHz
- 10 Units per Rack

SERIES 680

- Multifunction Amplifiers
- Auto Zero
- Strain Gage Conditioning
- Thermocouple Linearization
- Bridge Excitation and Bipolar Cal.
- 120 dB CMR and 300V CMV
- 12V dc, 28V dc or 115V ac power

THERMOCOUPLE SIMULATOR / CALIBRATOR

MODEL 1120

- 10 TC Types
- 0.005% of Reading Accuracy
- IEEE-488 or RS-232 Interface
- Key Temperature Directly in C or F
- Microprocessor Based
- DC Calibrator Mode

Calibrates any instrument that uses a thermocouple for its input:

Calibrates: Temperature Recorders, Digital Thermometers, Thermocouple Transmitters

PRECISION DIFFERENTIAL DC AMPLIFIER

MODEL 751

- 0.01% Gain Accuracy
- 140dB CM Rejection
- 300V CM Voltage
- 0.4 μV/ °C Zero Stability
- 100 KHz Bandwidth
- Selectable 3 Pole Filter
- Dual Outputs
- 12 Units per Rack

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Model 6100L
100W
400-1000MHz

✓	MODEL	CLASS	FREQ. RANGE	POWER	GAIN
	LF/MF				
	1040L	B	10kHz -500kHz	400W	55dB (±1dB)
	1140LA	B	9kHz -250kHz	1100W	55dB (±1dB)
	AP-400B	B	80kHz - 2.7MHz	400W	55dB (±1.5dB)
	240L	A	20kHz -10MHz	40W	50dB (±1.5dB)
	2100L	A	10kHz -12MHz	100W	50dB (±1.5dB)
	HF				
	A-150	A	300kHz -35MHz	150W	55dB (±1dB)
	A-300	A	300kHz -35MHz	300W	55dB (±1dB)
	A-500	A	300kHz -35MHz	500W	60dB (±1dB)
	A-1000	A	300kHz -35MHz	1000W	60dB (±1.5dB)
	VHF				
	325LA	A	250kHz -150MHz	25W	50dB (±1.5dB)
	3100LA	A	250kHz -150MHz	100W	55dB (±1.5dB)
	3200L	A	250kHz -120MHz	200W	55dB (±1.5dB)
	UHF				
	400AP	A	150kHz -300MHz	3W	37dB (±1dB)
	403LA	A	150kHz -300MHz	3W	37dB (±1dB)
	411LA	A	150kHz -300MHz	10W	40dB (±1.5dB)
	525LA	A	1MHz -500MHz	25W	50dB (±1.5dB)
	550L	A	1.5MHz-400MHz	50W	50dB (±1.5dB)
	5100L	A	1.5MHz-400MHz	100W	50dB (±1.5dB)
	603L	A	800kHz -1GHz	3W	40dB (±1.5dB)
	630L	A	400MHz-1GHz	30W	51dB (±2dB)
	6100L	AB	400MHz-1GHz	100W	51dB (±2dB)

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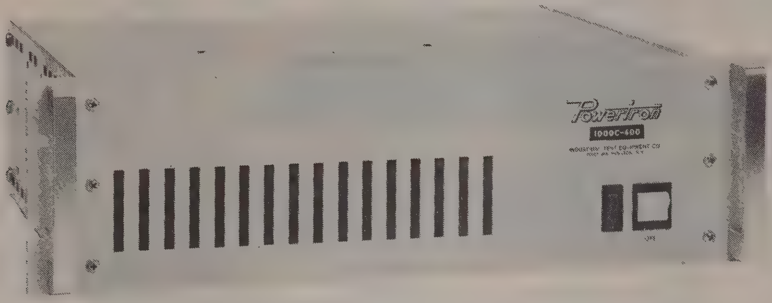

GENERAL SPECIFICATIONS

All models operate from 50/60Hz, 120/220 VAC power except model 2700A which operates on three phase 208, 380, or 480 volts 50/60 Hz.

All models (except 250A) contain a built-in output transformer with taps to 300 volts RMS.

All models produce full output voltages of 25 volts RMS with 1 volt RMS inputs when used without the built-in output transformer. Alternate voltage and current output transformers with ranges to 15kV and 1500A are available on order.

All models (except 250A) are available in a transconductance configuration in which the output is a current directly proportional to the input signal.

MODEL NO. & MAX PWR. IN WATTS	3 dB FREQUENCIES STRAIGHT - W/O USING OUTPUT Xfrmr	PHYSICAL
20A	10Hz to 100kHz	3.5 rack, 17 lbs
80A	10Hz to 20kHz	5.0" rack, 50 lbs
250A	10Hz to 1.2 MHz	5.25" rack, 65 lbs
500A	10Hz to 40kHz	5.25" rack, 83 lbs
1000A	10Hz to 30kHz	12.5" rack, 172 lbs
2700A	10Hz to 25kHz	17" rack, 235 lbs

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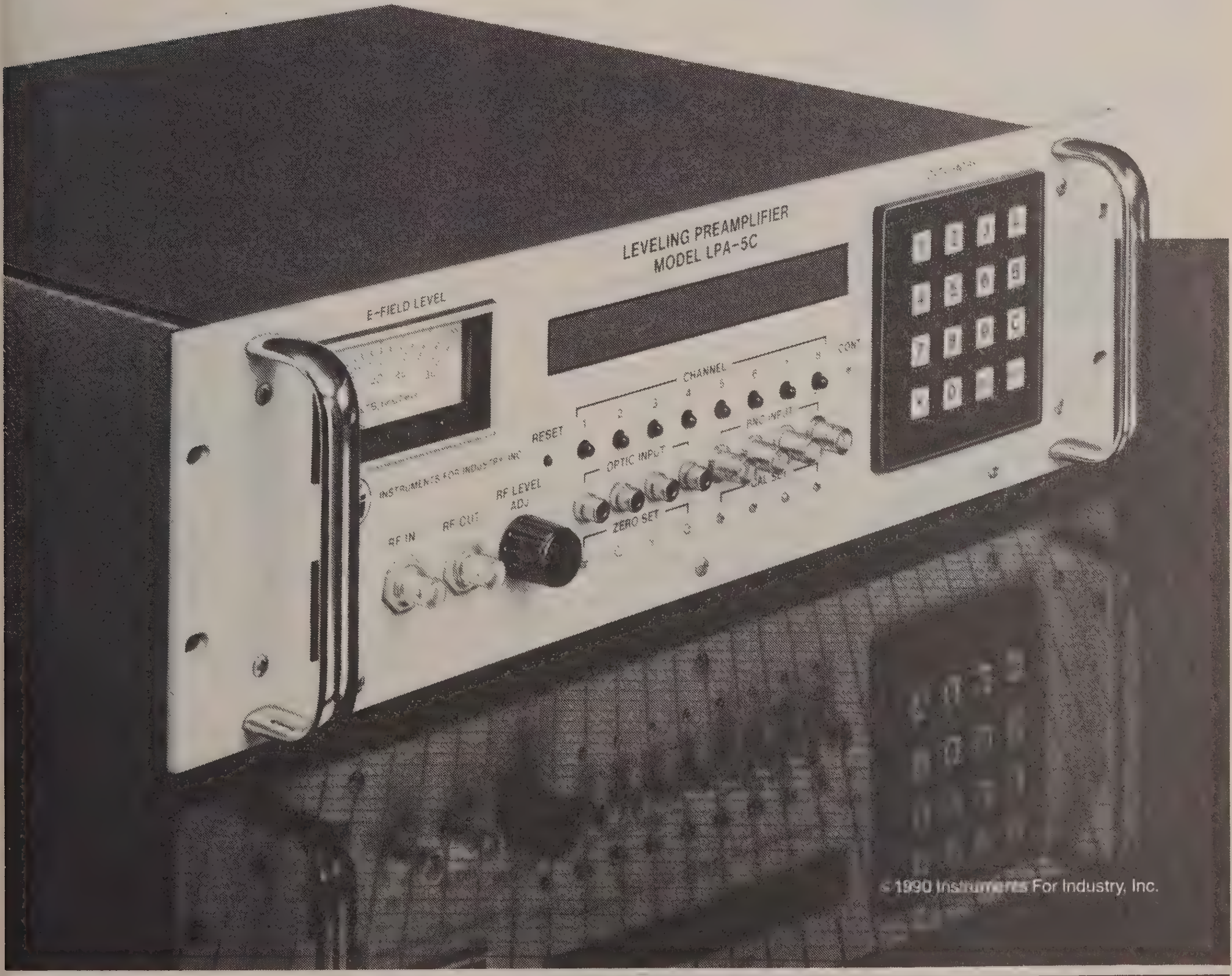
LEVELING PREAMPLIFIER
MODEL LPA-5C
E-FIELD LEVEL
CHANNEL
RESET
OPTIC INPUT
BNC INPUT
CAL SET
ZERO SET
RF LEVEL ADJ
RF IN
RF OUT
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- Isolated Power Output
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- Synchronization
- Wide Bandwidth/Fast Setting Time
- Programmable Gain

IA175 ULTRA-LINEAR ISOLATION AMPLIFIER WITH EXTERNAL SYNC CAPABILITY

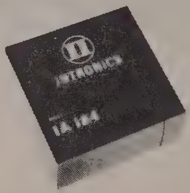
Fully Compatible with 12-Bit Acquisition Systems

CASE DIMENSIONS: 3.5" X 2.5" X .62"

FEATURES:
- UL Component Recognized
- Provision for External Synchronization
- High Linearity: 0.005% Peak, Typical
- High Input/Output Isolation: 5000 VDC continuous, 3000 VAC RMS
- 1000:1 Programmable Gain
- Input Voltage Noise: 1uV RMS, 10Hz-1KHz
- 126 dB CMRR
- Low Drift: ±0.01%/°C Maximum
- Common Mode Input Voltage: 5000 VDC
- Isolated Power: ±14 VDC, ±15mA

IA184 LOW-COST, HIGH LINEARITY ISOLATION AMPLIFIER WITH EXTERNAL SYNC CAPABILITY

Fully Compatible with 10-Bit Data Acquisition Systems

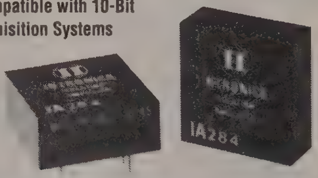


CASE DIMENSIONS: 1.5" X 1.5" X 0.62"

FEATURES:
- UL Component Recognized
- Provision for External Synchronization
- High Linearity: 0.025 Peak, Typical
- Input/Output Isolation: 2500 VDC or VAC, Continuous
- 1000:1 Programmable Gain
- Input Voltage Noise: 1uV RMS, 10Hz-1KHz
- 126 dB CMRR
- Isolated Power: ±15 VDC, ±15mA

IA284 LOW COST, HIGH-LINEARITY ISOLATION AMPLIFIER

Fully Compatible with 10-Bit Data Acquisition Systems

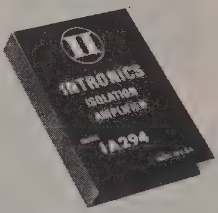


CASE DIMENSIONS: 1.5" X 1.5" X 0.62"

FEATURES:
- UL Component Recognized
- High Linearity: 0.025% Peak, Typical
- Input/Output Isolation: 2500 VDC or VAC, Continuous
- 10:1 Programmable Gain
- 100:1 Programmable Gain (Optional)
- Input Voltage Noise: 10uV RMS, 10Hz-1KHz
- 126 dB CMRR
- Isolated Power: ±15 VDC, ±15mA

IA294 MEDICAL ISOLATION AMPLIFIER

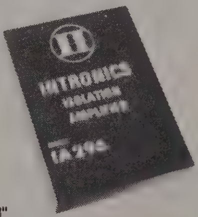
LOW NOISE, WITH ACTIVE INPUT REFERENCE AND SHIELD DRIVES



CASE DIMENSIONS: 3.0" x 2.0" x .62"

FEATURES:
- UL Component Recognized
- Provision for External Synchronization
- High Linearity: 0.1% Peak, Typical
- High Input/Output Isolation: 5000 VDC, Continuous
- 10:1 Fixed Gain
- Input Voltage Noise: 5uV RMS, 10Hz-1KHz
- 126 dB CMRR
- True Instrumentation Front-End
- Active Input Reference
- Active Shield Drives
- Differential Input Protection for Defibrillators: 6500 VDC
- Input to Output Leakage Current: < 10uV
- Isolated Power: ±15 VDC, ±15mA

IA296 ULTRA LOW NOISE TRUE INSTRUMENTATION MEDICAL ISOLATION AMPLIFIER



CASE DIMENSIONS: 3.5" x 2.5" .63"

FEATURES:
- UL Component Recognized
- Provision for External Synchronization
- High Linearity: 0.1% Peak, Typical
- High Input/Output Isolation: 5000 VDC, Continuous
- 10:1 Fixed Gain
- Input Voltage Noise: < .3uV, 10Hz-1KHz
- 170 dB CMRR
- Failure of any internal component results in < 10uA bias current
- Isolated Power: ±12 VDC, ±10mA

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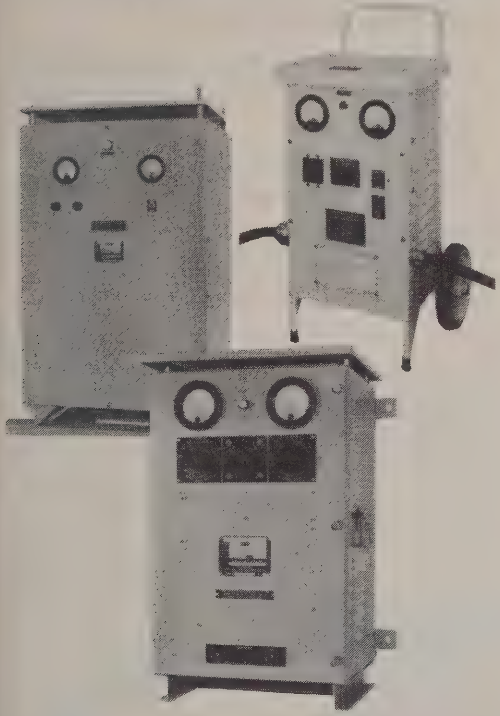
POWER SUPPLIES AND BATTERY CHARGERS



CML MACARR Mobile and Stationary DC Power Supplies Ground support, aircraft starting and convenient low voltage power

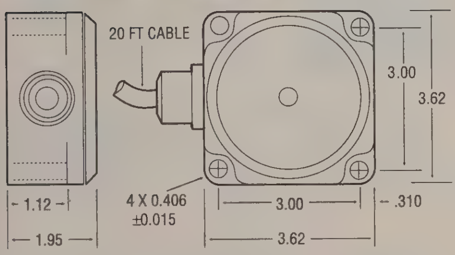
Both our stationary and mobile DC power supply units are built to deliver dependable long term performance. They meet RF interference requirements and demonstrate good inherent load regulation and low ripple. Each unit features heavy intermittent load capability and weatherproof construction suitable for outdoor duty. Mobile models feature large pneumatic tires for easy maneuverability. CML MACARR DC power supplies are capable of operating in parallel with other units of the same model with no paralleling interconnection required. Each unit includes 2% accurate output voltmeter and ammeters.

CML MACARR Battery Chargers

Lightweight, compact and versatile, CML MACARR chargers from Marine Electric Systems are typically used in military and high performance commercial applications. Model 40-30 BCN, for example, is a versatile unit which meets the requirements for small multi-purpose battery chargers. It can charge a wide variety of batteries up to 36 volts nominal (18 cells) and 300 ampere hours. The charger is a fully regulated, current limited stable source for float charging, utilizing SCR's with magnetic gating. A fully discharged battery can be safely recharged with this model. As an example of efficiency, a 130 AH battery can be recharged in 7 hours. The unit is designed for easy maintenance. All electronic components and adjustments are readily accessible behind the front access door.

CML MACARR is a product line of Marine Electric Systems

PROXIMITY SENSORS



Marine Electric Systems Models 8-559, 8-560, 8-562, 8-563 Proximity Sensors
(All Metal Sensing Two Wire AC) 0.5" to 1.00" Sensing Range

Marine Electric Models 8-559, 8-560, 8-562 and 8-563 are two wire AC, solid state, self-contained electronic proximity switches designed for hostile shipboard environments. Stainless steel construction, as well as watertight integrity, makes these switches ideal for applications where reliable, accurate position sensing is required. The wide range of operating voltages allows multiple units in series. High EMI immunify enables units to be used topside in the presence of high power radio or radar transmitters. Simple two wire configuration allows direct replacement of mechanical.

These rugged and reliable sensors offer the following features:

- Operating voltage 24 to 124 VAC for series switch application
- 1.25 amp rms switch load rating
- High EMI resistance (high immunity to radio or radar interference)
- Two wire operation (direct replacement of mechanical switches)
- Over-current protection in case of shorted load
- DC Sensors also available

Other Product Lines and Products of Marine Electric Systems:

Galbraith Pilot Marine; Salinity Monitoring and Alarm Systems
Temperature Monitoring and Alarm Systems
Public Address Systems, Speakers and Accessories
MESYS; Engine Monitoring and Alarm

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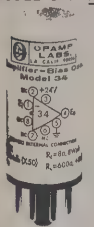
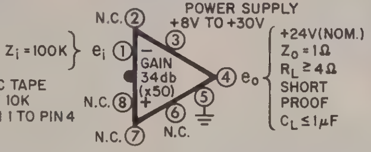
MODEL 34 AMPLIFIER-BIAS OSCILLATOR


OPAMP LABS. LA CALIF
Amplifier-Bias Osc
Model 34

20CY TO 20KC(±1db) 0.25% T.H.D. (+18dbm)
50CY TO 10KC(±3db) 1% T.H.D. (8W PK) SINGLE POLARITY POWER SUPPLY

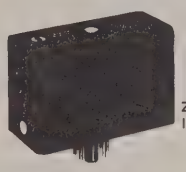

N.C. ②
+8V TO +30V
③
Z_i = 100K
e_i ①
–
GAIN 34db (x50)
+
N.C. ⑧
④ e_o
⑤
⑥
N.C. ⑦
N.C.
+24V(NOM.)
Z_O = 1Ω
R_L ≥ 4Ω
SHORT PROOF
C_L ≤ 1μF

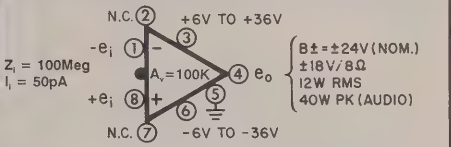
AS 100KC MAGNETIC TAPE BIAS OSC. CONNECT 10K RESISTOR FROM PIN 1 TO PIN 4
e_o = 20V/1K LOAD

OCTAL PLUG-IN SIZE: 1"DIAx2"H WT: 2 OZ PRICE: **$30**

MODEL 423 D.C. OPERATIONAL AMPLIFIER (REPAIRABLE)

- ●D.C. TO 150KC
- ● ± 20mV OFFSET
- ● ±10μV/°C DRIFT
- ●2μV(-115dbm) NOISE
- ●0.1% T.H.D.



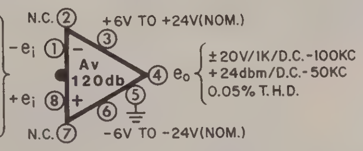

Z_i = 100Meg
I_i = 50pA
N.C. ②
+6V TO +36V
③
-e_i ①
–
A_v = 100K
+e_i ⑧
+
④ e_o
⑤
⑥
N.C. ⑦
-6V TO -36V
B± = ±24V (NOM.)
±18V/8Ω
12W RMS
40W PK (AUDIO)

OCTAL PLUG-IN
SIZE: 1-1/2" x 3-1/4" x 2-1/2" H. WT: 7 OZ. PRICE: **$45**

MODEL 425 D.C. OPERATIONAL AMPLIFIER

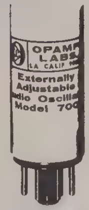
OPAMP LABS. LA CALIF
D.C. Operational Amplifier
Model 425

Z_i=200Meg(c.m.)
=20K(Diff)
Offset = ±20μv
I_i=20na
Drift = 1μv/°c
CM = ±20V
Noise:
1nv√HZ @1KHZ

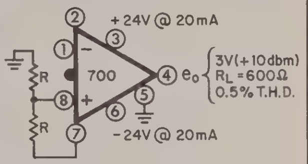

N.C. ②
+6V TO +24V(NOM.)
③
-e_i ①
–
Av 120db
+e_i ⑧
+
④ e_o
⑤
⑥
N.C. ⑦
-6V TO -24V(NOM.)
±20V/1K/D.C.-100KC
+24dbm/D.C.-50KC
0.05% T.H.D.

OCTAL PLUG-IN
SIZE: 1" DIA x 1-5/8" H WT: 2 OZ PRICE: **$35**

MODEL 700 AUDIO OSCILLATOR (EXTERNALLY ADJUSTABLE)

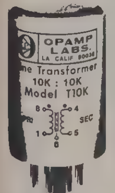

OPAMP LABS LA CALIF
Externally Adjustable Audio Oscillator
Model 700

FREQ	R(±5%)	FREQ	R(±5%)
16CY	NONE	1KC	1.6K
50CY	43K	2KC	800Ω
100CY	20K	5KC	320Ω
200CY	9.1K	10KC	160Ω
440CY	3.6K	12KC	130Ω
500CY	3.2K	15KC	100Ω


②
+24V @ 20mA
③
①
–
R
700
⑧
+
R
④ e_o
⑤
⑥
⑦
-24V @ 20mA
3V(+10dbm)
R_L = 600Ω
0.5% T.H.D.

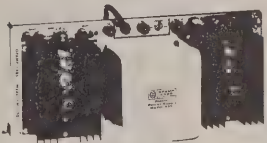
OCTAL PLUG-IN SIZE: 1"DIAx2"H WT: 2 OZ PRICE: **$40**

AUDIO TRANSFORMERS


OPAMP LABS. LA CALIF 90038
Line Transformer
10K : 10K
Model T10K
8
4
SEC
1
5
6

MODEL	DESCRIPTION	SIZE	PRICE
T-10K	10K/10K INPUT	1-3/8"D x 2"H	$30
T-18	600Ω/600 Ω +18dbm	1"D x 2"H	$15
T-25	600Ω/600 Ω +24dbm	1-5/8" x 2"H	$25
T-26	150Ω/600 Ω +24dbm	1-5/8" x 2"H	$25
T-28	150Ω/600 Ω +24dbm	1-5/8" x 1-5/8" x 2-1/2"H	$30
T-30	150Ω/150 Ω/600 Ω +30dbm	1-5/8" x 1-5/8" x 2-1/2"H	$35
T-39	16Ω/150 Ω +39dbm	2" x 2-3/8" x 3"H	$50
422	Electronic Trans +24dbm	1"D x 2"H	$40

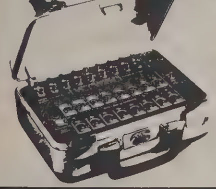
MODEL SM-100 DUAL 50W. OR MONO 100W. D.C. THRU AUDIO OPERATIONAL POWER AMPLIFIER



Description: Rack-Mounted Power Amplifier; consists of two 440 Power Amplifiers, one 536 power supply. Available in either Stereo (50W/Channel) or Mono(100W) configuration.

SIZE: 7"Hx19"Wx7"D
WT: 15 LBS PRICE: **$350 / WIRED**

Model VA-16 1-in/16-out Video/Audio Distribution System



Specifications
Video: BNC Connectors
DC to 8 MHZ(-1db)
Unity gain (in-phase)

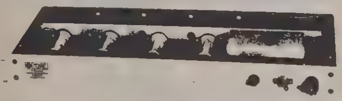
Audio: XLR-type connectors
Bal-in(10k),Bal-out(600 ohms)
30 HZ to 15 KHZ(-1db)
Output level: +18dbm
THD: 0.05%
Signal/Noise: >70db
Size: 10" x 12" x 5" Deep "Halliburton" case
WT: 8 lbs. Price: $795

MODEL A-24/2ML 2-in/24-out(mic/line) Audio Press Box
MODEL A-24/2ML/B Internal Rechargeable Battery

Specifications
Inputs: Two balanced microphone
(switchable to line inputs at 10K ohms)
Gain controls
VU Meter
Outputs-24 seperate outputs each one:
"XLR", 1/4"Phone Jack, RCA and 3.5mm Jack
Ground floating (Does not require ground lift)
+18dbm output capability
Transformer isolated
Mic/Line switchable
50HZ to 15KHZ (-2db)
50db Channel isolation

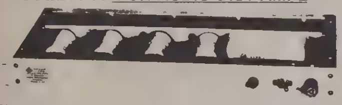
WT: 16 lbs	A-24/2ML	Price: $1595
Size: 13" x 18" x 6" Deep "Halliburton" Case	A-24/2ML/B	Price: $1795

MODEL V-44 4-CH VIDEO DIST AMPL



Specifications (per channel):
DC to 8 MHZ (±1DB)
Diff gain: 0.1%
Diff phase: 0.2 deg.
Tilt & overshoot: <1%
Hum & noise: -60 db
Isolation: >40 db @ 3.58mc
Size: 1 R.U. x 19"W x 6"D
WT: 5 lbs. Price: $400

MODEL A-44 4-CH AUDIO DIST AMPL



Specifications (per channel):
Bal(elec) input imp: 20k ohms
Freq. Resp: 20cy to 20kc (±1db)
Gain: Unity (0dbm)/THD: 0.05%
Output imp: 600 ohm
Output level: +24dbm
Size: 1 R.U. x 19"W x 6"D
WT: 5 lbs. Price: $440

Model V-44/RGBS/G HIGH DEFINITION RGBS SYSTEM

RGB
*DC to 70 MHZ
*2 v p-p
*Output Imp 75 ohm
*6db gain (gain pot)
*BNC connector
SYNC
*DC to 200 KC
*8 v p-p
*Output Imp 75 ohm
*6db gain (gain pot)

Size: 1-3/4"H x 19"W x 6"D Wt: 5 lbs Price: $700

Monitoring "Type" Routing Switchers

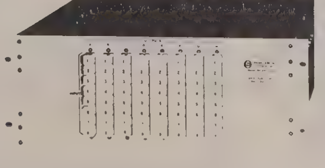
8-in/1-out	RSP-8 Mono-Aud/Video	$175
	RSP-8S St-Aud/Video	$250
12-in/1-out	RSP-12 Mono-Aud/Video	$250
	RSP-12s ST-Aud/Video	$325
16-in/1-out	RSP-16 Mono-Aud/Video	$300
	RSP-16S St-Aud/Video	$375
24-in/1-out	RSP-24S St-Aud/Video	$450

Specifications
Interlock push-buttons
Audio(RCA) follow Video(BNC)
DC to 8 MHZ
Size: 1-3/4" x 19" x 6-1/2"D
Wt: 3 lbs.
Also Assigning "Types" Available

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Model MS/8X8/VSA Stereo Audio / Video Matrix Switcher

Any input can be assigned to one, two, or more, or all outputs. All outputs are buffered. For instructional, commercial, and post production



Specifications
8-in/8-out Stereo Audio / Video
Interlock push-button switches lighted
Video DC to 8 MHZ
Audio DC to 20 KHZ

Price:

MS/8X8/VSA	Video-Stereo Audio	$2950
MS/8X8/VMA	Video-Mono Audio	$2750
MS/8X8/V	Video only	$2550
MS/8X8/VSA/B	12v DC operation	$2950

Size: 7" H x 19" W x 14" D Weight: 16 lbs.

PRECISION FILTERS, INC.

Signal Conditioning Amplifier/Filters

Versatile

For any combination of strain gages, voltage sources, resistor bridges, piezoelectric devices, thermocouples, RTD, and potentiometers. Easy front panel operation or input setups with a graphical user interface.

Calibration

Go/no-go test with diagnostics. Programmable source for end-to-end calibration through the A/D.

27000—Amplified Performance at an Attenuated Price

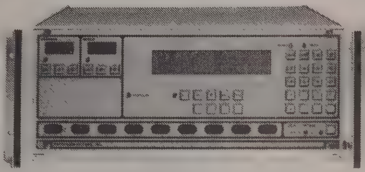
- Up to 64 channels/mainframe, 1024 channels per system controller
- Low cost per channel
- Resistive bridge: 2- to 10-wire input, differential amp with 120 dB CMRR, 300 VCM, 100 kHz BW
- Filter/amps: 4 to 8 pole LP, HP, BP, BR
- Thermocouple: cold junction isolation, 1500 VCM, 130 dB CMRR
- RTD: Prog. current excitation, 120 dB CMRR, Tempco 1 µV/°C
- Potentiometer: Prog. voltage excitation, 120 dB CMRR, Tempco 1 µV/°C
- Charge: Isolated charge converter
- Current: 10 µA to 10 mA FS. 100 kHz

6310—Sharper Performance

- 32 channels in a 7" case
- 1, 2, and 4 arms; 2- to 10-wire
- ±10 V or ±300 V common mode
- Voltage and current excitation
- Automatic bridge balance and zero
- 80 dB/oct. anti-alias elliptic filters
- Frequencies to 204.7 kHz; 2046 cutoff settings for fine resolution
- Binary gain: 1, 2, 4, 8, 16,... 1024
- 1° and 0.1 dB match

Programmable Amplifiers

A selection of amplifiers for the System 6000.



Low-level, Wide-band, AC

6104 quad low-noise AC differential preamplifier. –10 to 60 dB gain. Low-noise FET input with rolloff and filter.

Low-cost, Wide-band, DC

6114A quad DC post-amp. Provides additional gain after other signal conditioning modules. –9.9 to 60 dB gain.

Low-level, Low Frequency, DC

6124 quad DC preamplifier for low-Z source signals. 0 to 70 dB gain. Employs low-drift, low-noise, bi-polar input stage for measuring low-level low impedance sources.

Amplifier Options

- Programmable gain
- Calibration input
- Output monitor
- Rolloff, pre-whitening
- Current sources for ICP transducers
- Computer remote control via GPIB or RS-232C serial interface

Gain-Rangers

For acoustic signals with wide dynamic range.

Automatic Gain Ranging Amplifiers.
That's Precision 6201.

6201-1-AMP

Dual automatic gain ranging AC amplifier. Employs a low-noise differential input stage, band-limiting, and pre-whitening to condition wide-band, wide dynamic range AC signals. Up to 30 channels in a mainframe.

Record data of extremely wide dynamic range within the limits of magnetic recording tape.

6201-2-AMP

Dual programmable AC amplifier. 32 channels in the Precision 6000 mainframe.

Gain Ranger Options

- Rolloff, pre-whitening, equalization
- Current sources for remote integrated circuit piezoelectric transducers (ICP)
- Overload detectors
- Calibration signal injection
- Output monitors
- System status, Mux/demux
- Calibration subsystem

- See Precision Filter/Amp systems in Section 2750.
- See other data acquisition systems and additional information about the Precision 27000 in Section 2325.

Precision Filters, Inc., 240 Cherry Street, Ithaca, New York 14850 607-277-3550 Fax: 607-277-4466

TECHRON

The Source of Power

Industrial Power Amplifier Specifications

Techron® Power Sources

Low-Noise Linear Single-Level and Bi-Level® Power Amplifiers

MODEL	OUTPUT LOAD (Ω)	MAXIMUM OUTPUT VOLTAGE (VOLTS RMS)	MAXIMUM OUTPUT CURRENT (AMPS RMS)	MAXIMUM OUTPUT POWER (WATTS RMS)	MAXIMUM OUTPUT VOLTAGE (PEAK VOLTS)	MAXIMUM OUTPUT CURRENT (PEAK AMPS)	NUMBER OF CHANNELS	OUTPUT BANDWIDTH	CV/CC (See Note)	SLEW RATE (VOLTS / μS)
7700 family	2	77.5	38.7	3000	109.5	54.8	1	DC – 40 kHz	CV / CC	40
7571	4	63.2	15.8	1000	89.4	22.4	1	DC – 20 kHz	CV / CC	32
7560	4	63.2	15.8	1000	89.4	22.4	1	DC – 20 kHz	CV	32
7550	4	37.4	9.4	350	52.9	13.2	2	DC – 20 kHz	CV, CC optional	30
7541	2	31.6	15.8	500	44.7	22.4	1	DC – 20 kHz	CV / CC	11
7540	4	32.6	8.1	265	46.0	11.5	2	DC – 20 kHz	CV, CC optional	16
7521	2	24.1	12.0	290	34.1	17.0	1	DC – 20 kHz	CV / CC	10
7520	4	23.2	5.8	135	32.9	8.2	2	DC – 20 kHz	CV, CC optional	12
5530	4	33.5	8.4	280	47.3	11.8	2	DC – 20 kHz	CV	8
5515	4	22.8	5.7	130	32.2	8.1	2	DC – 20 kHz	CV	6
5507	4	13.4	3.4	45	19.0	4.7	2	20Hz – 20kHz	CV	6

For all amplifiers:

- Harmonic distortion is less than 0.1% from 20 Hz to 20kHz.
- The amplifier output is short, mismatch, and open circuit protected in voltage mode.
- Limiting is instantaneous with no flyback pulses, thumps or cutouts.
- The phase shift between input and output from DC to 20 kHz is less than –20 degrees.
- All amplifiers have a standard voltage gain of 20.
- CC= controlled current output; CV= controlled voltage output.
- Output specifications in above chart are per channel.

TECHRON®

1718 W. Mishawaka Road • Elkhart, IN 46517
Techron is a division of Crown® International, Inc.

OUTPUT IMPEDANCE (LESS THAN)	OPTIMUM LOAD IMPEDANCE FOR MAXIMUM POWER TRANSFER	INPUT IMPEDANCE	RESIDUAL NOISE 20 – 20kHz (LESS THAN)	AC POWER REQUIREMENTS 47–63Hz AC VOLTS (RMS)	TYPE OF COOLING	WEIGHT	DIMENSIONS	PRICE* (US DOLLARS)
0.005Ω	1.0Ω	10kΩ	0.400mV	3 phase 208, 240, 380, 415	Forced Air	128 lbs.	19" wide 18 3/8" deep 10 1/2" high	$6,999
0.005Ω	2.7Ω	25kΩ	0.690mV	100, 120 200, 220, 240	Forced Air	92 lbs.	19" wide 16 1/2" deep 8 3/4" high	$3,730
0.005Ω	2.7Ω	25kΩ	0.690mV	100, 120 200, 220, 240	Forced Air	92 lbs.	19" wide 16 1/2" deep 8 3/4" high	$3,250
0.012Ω	2.7Ω	10kΩ	0.130mV	100, 120, 200, 220, 240	Forced Air	57 lbs.	19" wide 14 3/4" deep 7" high	$2,645
0.030Ω	1.4Ω	10kΩ	0.350mV	100, 120, 200, 220, 240	Convection/ Forced Air	55 lbs.	19" wide 10 1/8" deep 7" high	$2,095
0.007Ω	2.7Ω	30kΩ	0.090mV	100, 120, 200, 220, 240	Convection F/A Optional	55 lbs.	19" wide 10 1/8" deep 7" high	$1,795
0.030Ω	1.4Ω	10kΩ	0.350mV	100, 120, 200, 220, 240	Convection/ Forced Air	28 lbs.	19" wide 10 1/8" deep 5 1/4" high	$1,695
0.015Ω	2.7Ω	30kΩ	0.069mV	100, 120, 200, 220, 240	Convection F/A Optional	25 lbs.	19" wide 10 1/8" deep 5 1/4" high	$1,395
0.015Ω	2.7Ω	25kΩ	0.080mV	100, 120, 200, 220, 240	Convection F/A Optional	45 lbs.	19" wide 9 3/4" deep 7" high	$1,345
0.015Ω	2.7Ω	25kΩ	0.082mV	100, 120, 200, 220, 240	Convection F/A Optional	24 lbs.	19" wide 8 3/4" deep 5 1/4" high	$995
0.030Ω	2.7Ω	25kΩ	0.084mV	100, 120, 200, 220, 240	Convection	10 lbs.	19" wide 8 1/2" deep 1 3/4" high	$675

Techron gives you power you can trust. Not just because we say so, but because we've been in the controlled power source business for over thirty years. And in that time, we've learned how to build the best industrial grade, high efficiency linear power amplifiers.

Our amps are ideal for applications where clean, reliable, DC to 50kHz, high-current power is required.

In fact, one of modern medicine's most important diagnostic tools, the Magnetic Resonance Imaging gradient subsystem, is powered by Techron. Our gradient amplifiers are the choice of major MRI manufacturers—because Techron's advanced engineering combines the efficiency you might expect from switchers with the clean signal of linears.

Techron amplifiers serve as the signal source for testing aerospace electronic systems, and are even used to power tables in vibration analysis systems. In addition, they can be configured as a line voltage generator system for computers or automated test equipment.

If you see the specifications you're looking for, call us. If you don't, call us anyway. Our engineers will be happy to discuss your application requirements, be they off-the-shelf or custom.

Call: (219) 294-8300
Fax: (219) 294-8329

*Prices subject to change without notice.

More V/m than ever. From Amplifier Research.

Log-periodic antennas

	AT1000	AT1080
FREQUENCY RANGE	150 to 1000 MHz	80 to 1000 MHz
POWER INPUT (maximum)	2000 watts	2000 watts
POWER GAIN (over isotropic)	6.5 dB min, 7.5 dB avg.	6.0 dB min., 7.0 dB avg.
GAIN FLATNESS	± 1.0 dB	± 1.0 dB
IMPEDANCE	50 ohms nominal	50 ohms nominal
VSWR	Max. 1.8:1, avg. 1.5:1	Max. 2.0:1, avg. 1.5:1
BEAMWIDTH (average)	E plane 60°, H plane 105°	E plane 60°, H plane 105°
FRONT TO BACK RATIO (minimum)	15 dB	15 dB
CONNECTOR	Type C female	Type C female
SIZE (w × h × d)	102 × 13 × 91 cm (40 × 5 × 36 in.)	160 × 13 × 193 cm (63 × 5 × 76 in.)
WEIGHT (maximum)	7 kg (15 lb)	7.7 kg (17 lb)
MOUNTING	Wall bracket included; optional tripod available.	Wall bracket included; optional tripod available.

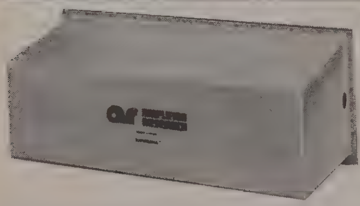
Low-MHz arrays

	AT1225	AT1250
FREQUENCY RANGE	25 to 50 MHz	50 to 100 MHz
POWER INPUT (maximum)	10,000 watts	10,000 watts
POWER GAIN		
(average)	4.5 dB	5.0 dB
(minimum)	4.0 dB	4.0 dB
GAIN FLATNESS	± 1.5 dB	± 1.5 dB
IMPEDANCE	50 ohms nominal	50 ohms nominal
FIELD STRENGTH at 8 meters with 10 kW input	100 V/m	100 V/m
VSWR		
(average)	2.5:1	2.0:1
(maximum)	3.5:1	3.0:1
BEAMWIDTH	60°	60°
FRONT TO BACK RATIO	10 dB typical	10 dB typical
CONNECTOR	Type LC female	Type LC female
SIZE (w × h × d)	528 × 21.5 × 244 cm (208 × 8.5 × 96 in.)	264 × 21.5 × 122 cm (104 × 8.5 × 48 in.)
WEIGHT (maximum)	34 kg (75 lb)	16 kg (35 lb)

High-gain horn antennas

	AT4000	AT4001
FREQUENCY RANGE	200 to 1000 MHz	400 to 1000 MHz
POWER INPUT (maximum)	1500 watts	1000 watts
POWER GAIN	10 dB min., typically increasing to 18 dB at 1000 MHz	10 dB min., typically increasing to 15 dB at 1000 MHz
IMPEDANCE	50 ohms nominal	50 ohms nominal
VSWR	2.5:1 max., 1.5:1 avg.	2.5:1 max., 1.5:1 avg.
BEAMWIDTH	Typical curves available on request	Typical curves available on request
FRONT-TO-BACK RATIO	Typical curves available on request	Typical curves available on request
CONNECTOR	Type C female	Type C female
MOUNTING	Heavy-duty tripod included. Pads with 5/8-11 thread for stand mounting vertically or horizontally	Rear flange for wall mount. Pads with 1/4-20 thread for optional tripod mount.
WEIGHT (approximate)	46 kg (100 lb)	9.1 kg (20 lb)
SIZE (w × h × d)	109.2 × 145.8 × 175.3 cm (43 × 57 × 69 in.)	56.4 × 79.3 × 73.7 cm (22.2 × 31.2 × 39.0 in.)

AT2000 CAVITENNA®



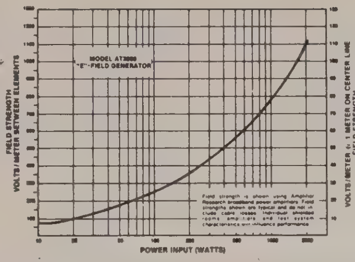
A top-loaded monopole radiating on ground, the Cavitenna utilizes the entire shielded room as a reverberating chamber. It mounts easily on a wall or ceiling with magnetic clamps. Only four feet wide, the Cavitenna rivals the frequency response, power-handling capability, and gain of antennas four times its size.

FREQUENCY RANGE	30-1000 MHz
INPUT POWER (cw max.)	
30–250 MHz	3500 watts
30–500 MHz	2000 watts
30–1000 MHz	1250 watts
IMPEDANCE	50 ohms nominal
CONNECTOR	Type C female
ELECTRIC FIELD INTENSITY	Curves available, calculated using AR amplifier performance data.
SIZE (w × h × d)	117 × 61 × 51 cm (46 × 24 × 20 in.)
WEIGHT (max.)	14 kg (30 lb)
MOUNTING PROVISIONS	Magnetic clamps included.

ar AMPLIFIER RESEARCH

Call toll-free direct to applications engineering: 1-800-933-8181
160 School House Road, Souderton, PA 18964-9990 USA • TEL 215-723-8181 • FAX 215-723-5688
In Europe, call EMV: Munich, 89-612-8054; London, 908-566-556; Paris, 1-64-61-63-29.

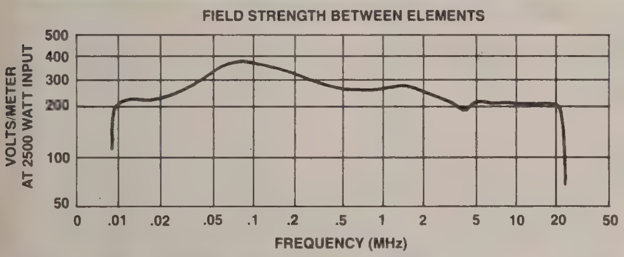
AT3000 E-field generator


MODEL AT3000 "E"-FIELD GENERATOR
FIELD STRENGTH VOLTS/METER BETWEEN ELEMENTS
VOLTS/METER @ 1 METER ON CENTER LINE FIELD STRENGTH
POWER INPUT (WATTS)
Field strength is shown using Amplifier Research broadband power amplifiers. Field strengths shown are typical and do not include cable losses. Individual shielded rooms, amplifiers and test system characteristics will influence performance.

OPERATING RANGE (max.)				
	Without forced-air cooling		With forced-air cooling	
POWER (watts)	DUTY CYCLE (percent)	ON TIME (minutes)	DUTY CYCLE (percent)	ON TIME (minutes)
1000	100	continuous	100	continuous
1600	50	7	100	continuous
2000	25	3	100	continuous
3000	DO NOT USE		50	5

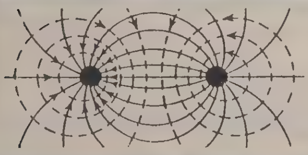
FREQUENCY RANGE	10 kHz–30 MHz
IMPEDANCE	50 ohms, VSWR 2.5:1 max.
ELECTRIC FIELD INTENSITY	Up to 1000 volts/meter, see graph.
CONNECTOR	Type C female
SIZE (w × h × d)	188 × 72 × 7 cm (74 × 28 × 2.5 in.)
WEIGHT (max.)	16 kg (35 lb)
MOUNTING	Optional tripod available.

AT3001 E-field generator



POWER INPUT, CW max.	3000 watts
FREQUENCY RANGE	10 KHz–20 MHz
IMPEDANCE	50 ohms, VSWR 2.5:1 max, 1.5:1 avg.
ELECTRIC FIELD INTENSITY (at 2500-watt input)	200 volts/meter min. between elements
RF INPUT CONNECTOR	Type C female
COOLING	Natural convection to 40°C ambient
WEIGHT, approximate	113 kg (250 lb)
SIZE (w × h × d)	102 × 222 × 304 cm (40 × 87.5 × 119.5 in.)

AT5000 E/H-field generator



Simulates free space

- **Over 500 volts per meter over 10 kHz to 100 MHz bandwidth with 2500-watt input power.**

A 2.4 × 1-meter open area between parallel conductors permits testing of large assemblies such as computers inside a shielded room, under 377-ohm impedance conditions usually associated only with free space. Simultaneous electric field (solid lines in diagram) and magnetic field (dashed lines) are propagated orthogonally.

POWER INPUT, CW	3000 watts maximum
FREQUENCY RANGE	10 kHz–100 MHz
INPUT IMPEDANCE	50 ohms
VSWR	2.0:1 max. 10kHz–100 MHz 6:1 max. 10–20 kHz above 1kW input power
ELECTRIC FIELD INTENSITY	100 V/m (at one meter) @ 2500 watts input 500 V/m center @ 2500 watts input
RF INPUT CONNECTOR	Type C female
COOLING	Natural convection to 40°C ambient temperature
WEIGHT	95 kg (210 lb)
SIZE (w × h × d)	2.65 × 2.4 × 1.2 m (105 × 96 × 49 inches)

Ultra-broadband field monitor system

- **Two isotropic probes cover over 6 decades (10 kHz to 1 GHz, 80 MHz to 40 GHz)**
- **1- to 300-V/m sensitivity**
- **Up to four independent inputs**

The first electric-field monitoring system to cover the entire rf spectrum to 1 GHz without bandbreaks or pauses for changing sensors, it now extends its coverage to 40 GHz with a second sensor, Model FP2080. Compact, advanced two-component system—sensor probe/transceiver inside the shielded room, master control outside.

Model FM2000 provides two digital (IEEE-488 and RS-232) outputs, two switch-selectable 0–4 Vdc analog outputs, high-field and power-loss alarm, LED display—all controlled at front panel.

Models FP2000 and FP2080 isotropic sensor probes communicate with control panel through 2-way fiberoptic cable. Up to four probes may feed field level information to the monitor from various points in the shielded room. Operator enjoys complete flexibility in choice of signal input for automated EMC testing.

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Radian™ ANTENNAS

35 YEARS OF MANUFACTURING AUDIO COMPONENTS

Radian RF Products

Rubber Duck Industrial & Telescopic Antenna

Specializing in Spread Spectrum Applications (902-928MHz)

Radian Spread Spectrum Antennas lead the way providing designers with the latest innovation for Radio Frequency /Data Communication applications. Our Spread Spectrum RF Antennas are used on products requiring dependable (cost effective) transmissions of data. Radian antennas also meet critical performance guidelines for **Marine, Aircraft, Cellular** and many industrial and consumer products.

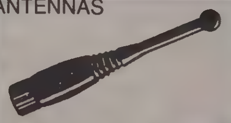
Japan Electronic is a leader in antenna design and manufacture for this important industrial market. For requirements demanding stringent specifications, Japan Electronic will assist the customer in defining parameters that meet the design criteria of the application. Antennas can be provided with any standard or custom RF connector and our factory can tool and mold to your custom design. Antenna are available in full, half and quarter wave models, in all popular styles, including rubber duck and telescopic.

Model Number	Design	Construction	Connector	Frequency	Height
JA-27B-AD	Helical/Base loading coil	Rubber	PL-259	27MHz	34cm
JA-27C-SB	Helical/Center loading coil	Polyolefin Rubber	BNC	27MHz	27cm
JA-27C-SM	Helical/Center loading coil	Polyolefin Rubber	PL-259	27MHz	27cm
JA-27C-SS	Helical/Center loading coil	Polyolefin Rubber	Stud	27MHz	27cm
JA-27T-ST	Helical/Top loading Coil	Polyolefin Rubber	TNC	27MHz	24cm
JA-40-PS	Helical	ABS	Stud	46-49MHz	24cm
JA-40-SR	Helical	Polyolefin Rubber	Stud(M3x0.5P)	46-49MHz	21.8cm
JA-40-SS	Helical	Polyolefin Rubber	Stud	46-49MHz	24cm
JA-40-SS1	Helical	Polyolefin Rubber	Stud	46-49MHz	13.8cm
139-174MHz					
JA-150-DB	Helical	Rubber	BNC	139-174MHz	18CM
JA-150-DS1	Helical	Rubber	Threaded (5/16-32x1/2")	139-174MHz	18CM
JA-150-DS4	Helical	Mold type	Threaded (5/16-32x1/2")	139-174MHz	18CM
JA-150-MB	Helical	Mold type	BNC	139-174MHz	18CM
JA-150-MB	Helical	Elastomer	BNC	139-174MHz	18cm
JA-150-MS	Helical	Mold type	Threaded (5/16-32x1/2")	139-174MHz	18CM
JA-150-MS	Helical	Elastomer	Stud(¼x32)	139-174MHz	17cm
JA-150-SB	Helical	Polyolefin Rubber	BNC	139-174MHz	18CM
JA-220-MS	Helical	Elastomer	Stud(¼x32)	222MHz	14cm
JA-220-MT	Helical	Elastomer	TNC	222MHz	15.4cm
238-381MHz					
JA-250B-SS	Speed Wire Element	Polyolefin Rubber	Stud	253-381MHz	11.5cm
JA-250B-SS1	Speed Wire Element	Polyolefin Rubber	Stud	253-381MHz	11.1cm
JA-250G-SS	Speed Wire Element	Polyolefin Rubber	Stud	253-381MHz	15.5
430-460MHz					
JA-450-MB	Helical	Mold type	BNC	430-460MHz	8cm
JA-450-HDB	Helical	Rubber	BNC	430-460MHz	7cm
JA-450-MS3	Speed wire element	Mold type	Threaded (1/4-32x3/16")	430-460MHz	17cm
JA-450-DS4	Speed wire element	Rubber	Threaded (1/4-32x3/16")	430-460MHz	17cm
JA-450-SB	Speed wire element	Polyolefin Rubber	BNC	430-460MHz	17cm
JA-450-DB	Speed wire element	Rubber	BNC, TNC	430-460MHz	17cm

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS

HEADPHONES / SETS

ANTENNAS



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MICROPHONES

BUZZERS

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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

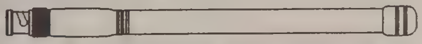
Radian™ ANTENNAS

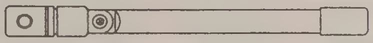
35 YEARS OF MANUFACTURING AUDIO COMPONENTS

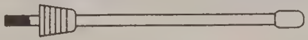
806-950MHz

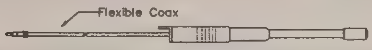
Model Number	Design	Construction	Connector	Frequency	Height
JASP-1	Speed Wire Element	Rubber Coated	Mini Pin Plug	920-950MHz	10cm
JASP-2 (3dB gain)	Speed Wire Element	Rubber Coated	Mini Pin Plug	920-950MHz	20cm
JASP-3 (3dB gain)	Spike Antenna	Rubber Coated	TNC	806-896MHz	21cm
JASP-4 (3dB gain)	Spike Antenna	Stainless Wire Element	SMA	806-896MHz	21cm
JASP-5 (3dB gain)	Spike Antenna	Rubber Coated	TNC	806-896MHz	19cm
JA-900-SS	Speed Wire Element	Polyolefin Rubber	Stud(M5x0.5P)	902-928MHz	14.5cm
JA-900-SS1	Speed Wire Element	Polyolefin Rubber	Stud	902-928MHz	8.1cm
JA-900-RS1	Stranded Copper Wire	Polyolefin Rubber	Stud	902-928MHz	11.2cm
590 (3dB gain)	Spike Antenna	Rubber Coated	90°TNC	806-896MHz	20cm
TB-1(3dB gain)	Spike Antenna	Rubber Coated	90°TNC	806-896MHz	20cm
JA-900-RS	Brass Pipe	Black Chrome Plate	Stud	902-928MHz	16cm
JA-900-RS1	Stranded Copper Wire	Polyolefin Rubber	Stud	902-928MHz	11.2cm

Typical Styles

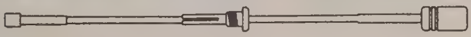

Rubber Duck w/BNC Connector

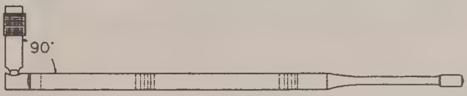

Single Section Brass Rod


JA900SS W/Threaded Stud



JASP1 λ/4 wave Speed Wire Element

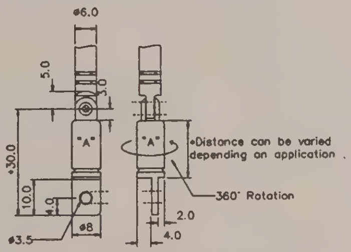

Whip Antenna for Portable applications



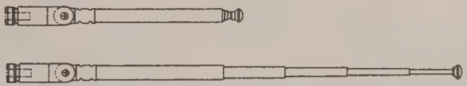
90°Swievel mount

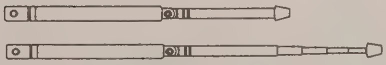
Telescopic Antennas

Telescopic Antennas are a unique product offered by Japan Electronics. Telescopic Antennas are custom manufactured to offer unsurpassed flexibility in your product design.



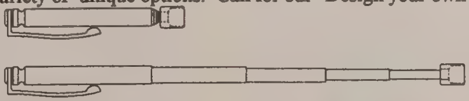
Universal Swivel Mount


Telescopic Antenna with Swivel Mount

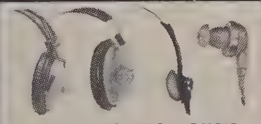

Telescopic Antenna with Stud Mount

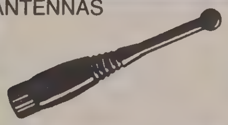
Telescopic Tools

Telescopic tools are manufactured utilizing the same tooling as our telescopic antennas but are customized for non RF applications with a variety of unique options. Call for our "Design your own" worksheet.



OTHER QUALITY JEMA AUDIO AND RF COMPONENTS


HEADPHONES / SETS

ANTENNAS


EOM DYNAMIC

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SIRENS • HORNS

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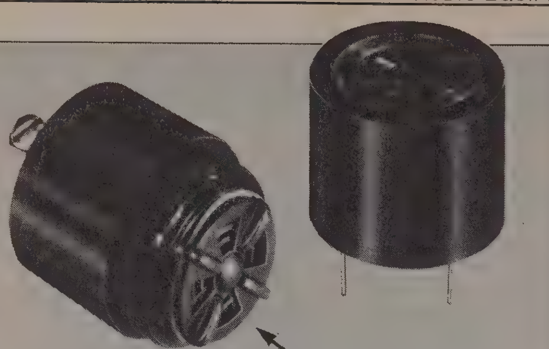
JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091



PIEZO ALARMS

from Floyd Bell Inc.

Optional rotary shutter for volume control is available for all models with case style 07, 09 and 19. When ordering add "V" to case style number. Example: MC-V09-301-Q.

Now, built-in shutter-type volume control lets your customer adjust the sound level to suit his needs. This simple manual shutter provides variable attenuation up to 20 dBa typical.

CONTINUOUS TONE

CASE STYLE	MODEL NUMBER	OPERATING VOLTAGE VDC *VAC	TYPICAL SOUND PRESSURE dBa AT 2 FEET		TYPICAL OPERATING CURRENT (mA)		Terminations
			At min. V	At max. V	At min. V	At max. V	
EXTRA LOUD CONTINUOUS TONE—FREQUENCY 2900±500Hz							
04	XC-04-212-W	2-12	82	103	8	65	W
04	XC-04-212-T	2-12	82	103	8	65	T
•04	XC-04-330-W	3-30	82	103	6	70	W
•04	XC-04-330-T	3-30	82	103	6	70	T
05	XC-05-212-P	2-12	82	103	8	65	P
•05	XC-05-330-P	3-30	82	103	6	70	P
09	XC-09-212-W	2-12	82	103	8	65	W
09	XC-09-212-Q	2-12	82	103	8	65	Q
09	XC-09-212-S	2-12	82	102	8	65	S
•09	XC-09-330-W	3-30	82	103	6	70	W
•09	XC-09-330-Q	3-30	82	103	6	70	Q
•09	XC-09-330-S	3-30	82	103	6	70	S
•19	XC-19-201-Q	*30-120	82	103		40	Q
•19	XC-19-301-Q	*130-220	82	103		40	Q
LOUD CONTINUOUS TONE—FREQUENCY 2900±500Hz							
04	LC-04-212-W	2-12	76	97	8	65	W
04	LC-04-212-T	2-12	76	97	8	65	T
05	LC-05-212-P	2-12	76	97	8	65	P
09	LC-09-212-W	2-12	76	97	8	65	W
09	LC-09-212-Q	2-12	76	97	8	65	Q
09	LC-09-212-S	2-12	76	97	8	65	S
MEDIUM CONTINUOUS TONE—FREQUENCY 2900±500Hz							
01	MC-01-116-W	1-16	68	93	1	18	W
01	MC-01-116-T	1-16	68	93	1	18	T
02	MC-02-116-P	1-16	68	93	1	18	P
07	MC-07-116-W	1-16	68	93	1	18	W
07	MC-07-116-T	1-16	68	93	1	18	T
07	MC-07-116-Q	1-16	68	93	1	18	Q
07	MC-07-116-S	1-16	68	93	1	18	S
•09	MC-09-516-Q	5-16	85	95	2	20	Q
•09	MC-09-516-S	5-16	85	95	2	20	S
•09	MC-09-516-L	5-16	85	95	2	20	L
01	MC-01-130-W	1-30	68	95	1	13	W
01	MC-01-130-T	1-30	68	95	1	13	T
02	MC-02-130-P	1-30	68	95	1	13	P
07	MC-07-130-W	1-30	68	95	1	13	W
07	MC-07-130-T	1-30	68	95	1	13	T
07	MC-07-130-Q	1-30	68	95	1	13	Q
07	MC-07-130-S	1-30	68	95	1	13	S
•09	MC-09-530-Q	5-30	75	95	2	20	Q
•09	MC-09-530-S	5-30	75	95	2	20	S
•09	MC-09-201-Q	*30-120	68	95		40	Q
•09	MC-09-301-Q	*130-220	68	95		40	Q

INTERMITTENT TONE

When Ordering: Specify Fast, Medium or Slow Beep Rate.
Fast: 3 Beeps Per Second, **Medium:** 2 Beeps Per Second, **Slow:** 1 Beep Per Second

CASE STYLE	MODEL NUMBER	OPERATING VOLTAGE VDC *VAC	TYPICAL SOUND PRESSURE dBa AT 2 FEET		TYPICAL OPERATING CURRENT (mA)		Terminations
			At min. V	At max. V	At min. V	At max. V	
EXTRA LOUD BEEP—FREQUENCY 2900±500Hz							
04	XB-04-312-W	5-12	90	104	20	60	W
04	XB-04-312-T	5-12	90	104	20	60	T
•04	XB-04-630-W	6-30	90	104	12	100	W
•04	XB-04-630-T	6-30	90	104	12	100	T
05	XB-05-312-P	5-12	90	104	20	60	P
•05	XB-05-630-P	6-30	90	104	12	100	P
09	XB-09-312-W	5-12	90	104	20	60	W
09	XB-09-312-Q	5-12	90	104	20	60	Q
09	XB-09-312-S	5-12	90	104	20	60	S
•09	XB-09-630-W	6-30	90	104	12	100	W
•09	XB-09-630-Q	6-30	90	104	12	100	Q
•09	XB-09-630-S	6-30	90	104	12	100	S
•19	XB-19-201-Q	*30-120	90	104		50	Q
•19	XB-19-301-Q	*130-220	90	104		50	Q
LOUD BEEP—FREQUENCY 2900±500Hz							
04	LB-04-312-W	5-12	84	97	20	60	W
04	LB-04-312-T	5-12	84	97	20	60	T
05	LB-05-312-P	5-12	84	97	20	60	P
09	LB-09-312-W	5-12	84	97	20	60	W
09	LB-09-312-Q	5-12	84	97	20	60	Q
09	LB-09-312-S	5-12	84	97	20	60	S
MEDIUM BEEP TONE—FREQUENCY 2900±500Hz							
•04	MB-04-516-W	5-16	85	95	2	24	W
•04	MB-04-516-Q	5-16	85	95	2	24	Q
•05	MB-05-516-P	5-16	85	95	2	24	P
•09	MB-09-516-Q	5-16	85	95	2	24	Q
•09	MB-09-516-S	5-16	85	95	2	24	S
•09	MB-09-516-L	5-16	85	95	2	24	L
•04	MB-04-530-W	5-30	75	95	2	18	W
•04	MB-04-530-T	5-30	75	95	2	18	T
•05	MB-05-530-P	5-30	75	95	2	18	P
•09	MB-09-530-W	5-30	75	95	2	18	W
•09	MB-09-530-Q	5-30	75	95	2	18	Q
•09	MB-09-530-S	5-30	75	95	2	18	S
•19	MB-19-201-Q	*30-120	75	95		40	Q
•19	MB-19-301-Q	*130-220	75	95		40	Q
LOUD INTERRUPTED BEEP TONE—FREQUENCY 2900±500Hz							
05	LP-05-516-P	5-16	85	97	15	45	P
09	LP-09-516-Q	5-16	85	97	15	45	Q
09	LP-09-516-S	5-16	85	97	15	45	S
MEDIUM INTERUPTED BEEP TONE—FREQUENCY 2900±500Hz							
05	MP-05-516-P	5-16	78	90	10	20	P
09	MP-09-516-Q	5-16	78	90	10	20	Q
09	MP-09-516-S	5-16	78	90	10	20	S

•Indicates Recognized Component,
Underwriters Laboratory

FLOYD BELL, INC.

MANUFACTURER OF QUALITY PIEZOELECTRIC ALARMS SINCE 1972

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® Most Audio II alarms are UL recognized components

PIEZO ALARMS

CHIME TONE

When Ordering: Specify Chime Rate
Fast: 2 Chimes Per Second, **Moderate:** 1 Chime Per Second

CASE STYLE	MODEL NUMBER	OPERATING VOLTAGE VDC *VAC	TYPICAL SOUND PRESSURE dBa AT 2 FEET		TYPICAL OPERATING CURRENT (mA)		Terminations
			At min. V	At max. V	At min. V	At max. V	
CHIME TONE—FREQUENCY 2700±500Hz							
04	CH-04-525-W	5-25	70	90	6	66	W
04	CH-04-525-T	5-25	70	90	6	66	T
05	CH-05-525-P	5-25	70	90	6	66	P
09	CH-09-525-W	5-25	70	90	6	66	W
09	CH-09-525-Q	5-25	70	90	6	66	Q
09	CH-09-525-S	5-25	70	90	6	66	S
•19	CH-19-201-Q	*120	70	90		40	Q
•19	CH-19-301-Q	*220	70	90		40	Q

WARBLE TONE

WARBLE TONE—CENTER FREQUENCY 2700±500Hz							
•04	MW-04-616-W	6-16	80	95	8	18	W
•04	MW-04-550-W	15-36†	75	95	3	8	W
•04	MW-04-201-W	*40-120	75	95	3	8	W
•05	MW-05-616-P	5-16	80	95	8	18	P
•05	MW-05-550-P	15-36†	75	95	3	8	P
•09	MW-09-616-L	5-16	80	95	8	18	L
•09	MW-09-616-W	6-16	80	95	8	18	W
•09	MW-09-616-Q	6-16	80	95	8	18	Q
•09	MW-09-616-S	6-16	80	95	8	18	S
•09	MW-09-550-W	15-36†	75	95	3	8	W
•09	MW-09-550-S	15-36†	75	95	3	8	S
•09	MW-09-201-W	*40-120	75	95	3	8	W
•09	MW-09-201-S	*40-120	75	95	3	8	S
•09	MW-09-301-W	*140-220	75	95	3	8	W
•09	MW-09-301-S	*140-220	75	95	3	8	S

•Indicates Recognized Component, Underwriters Laboratory †Vac-Vdc

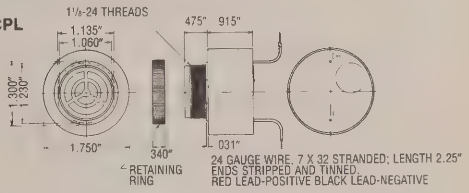
WARNING SIREN TONE

The Model AL-612 Audiolarm® is a miniature panel or PC mounted alarm that emits a very loud siren-like tone when power is applied. The output tone varies from approximately 2500 to 3500 Hz at a 2.5 Hz rate. The audible output level peaks at about 106 dB(a) when operated from a 12 VDC source; the unit also works well from a heavy-duty alkaline 9V transistor radio battery. Our most attention-getting alarm!!

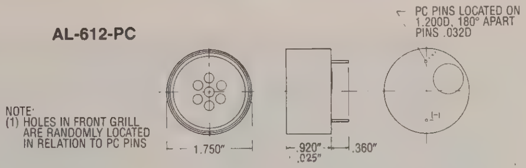
SPECIFICATIONS

Operating Voltage: 6 to 12 VDC
Operating Current: Up to 100 mA (Voltage Dependent)
Sound Output: Up to 106 dB(a) @ 2 ft with 12 VDC supply; strongly harmonic police-like siren tone.
Operating Frequency: Sweeps from 2500 to 3500 Hz @2.5 Hz rate.
Operating Temperature: -20°C to +65°C
Storage Temperature: -40°C to +80°C
Terminals: Wire or PC pins (see drawings)
Material: Black ABS—KJB thermoplastic case
Mounting: PC—Printed Circuit board mount (see drawing) CPL—Rear panel mount in 1⅛" dia. hole, panel thickness .250" max.
Weight: Two (2) ounces

AL-612-CPL


1⅛-24 THREADS
1.135"
1.060"
1.300"
1.230"
1.750"
340"
RETAINING RING
475"
915"
031"
24 GAUGE WIRE, 7 X 32 STRANDED; LENGTH 2.25" ENDS STRIPPED AND TINNED.
RED LEAD-POSITIVE BLACK LEAD-NEGATIVE

AL-612-PC


PC PINS LOCATED ON 1.200D, 180° APART PINS .032D
NOTE:
(1) HOLES IN FRONT GRILL ARE RANDOMLY LOCATED IN RELATION TO PC PINS
1.750"
.920"
.025"
.360"

AudioLarm® II Series

Engineered alarms/exclusive design features

Cases molded from flame retardant engineering grade thermoplastic. Water-proof and shock-resistant solid-state electronics sealed in epoxy resin...100% inspected to ensure premium quality. Quality-made in U.S.A.

GENERAL SPECIFICATIONS

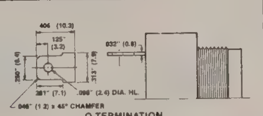
OPERATING TEMPERATURE: -30°C to +65°C.
STORAGE TEMPERATURE: -40°C to +85°C.
REVERSE VOLTAGE: Protected to the maximum operating voltage (some models may sound softly when connected to reverse polarity).
SURGE VOLTAGE: 20% over maximum rated voltage for less than 5 minutes.
LIFE EXPECTANCY: 10 years under normal operating conditions.

TERMINATIONS

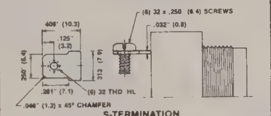
W—Leads: 2 wires 24AWG (7 x 32) tinned copper vinyl insulated, 2" long, ¼" end stripped, color coded.
P—PC Pins: 3 PC pins 90° apart on a .500" R from center, .032" diameter.
T—.110 quick connect terminals: .110" width, .020 thickness, brass solder plated for push on attachment or direct solder.
Q—.250 quick connect terminals: .250" width, .033" thickness, brass electro-tin plated for push-on attachment or direct solder.
S—Screw terminals: 6/32 ¼" long stainless steel screw for wires with lug attachments.
L—.250" quick connect terminals oriented at right angles: .250" width, .033" thickness, brass electro-tin plated for push-on (quick connect) attachment.

TO ORDER—Arrange information into the format of the following Sample Model Number.

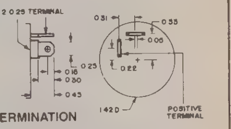
TERMINATION
X B - 09 - 630 - Q (F)
CASE STYLE
RATE (for Chime and Intermittent Tones only)


406 (10.3)
125" (3.2)
032" (0.8)
250" (6.4)
313" (7.9)
281" (7.1)
.096" (2.4) DIA. HL.
046" (1.2) x 45° CHAMFER

Q-TERMINATION

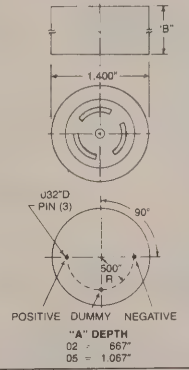

(6) 32 x .250 (6.4) SCREWS
406" (10.3)
.125" (3.2)
.032" (0.8)
250" (6.4)
313 (7.9)
.281" (7.1)
(6) 32 THD HL
.046" (1.2) x 45° CHAMFER

S-TERMINATION

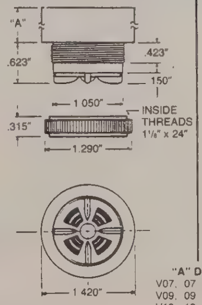

2 0 25 TERMINAL
0 31
0 55
0 06
0 25
0 22
0 16
0 30
0 45
1 42 D
POSITIVE TERMINAL

L-TERMINATION

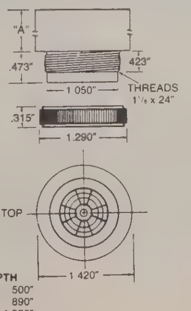
CASE STYLE - 02, 05"


"B"
1.400"
032"D PIN (3)
90°
500" R
POSITIVE
DUMMY
NEGATIVE
"A" DEPTH
02 = 667"
05 = 1.067"

NEW ROTARY VOLUME CONTROL
CASE STYLE - V07, V09, V19

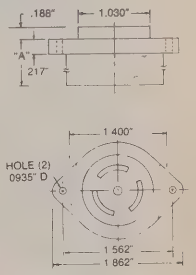

"A"
.623"
.423"
150"
1 050"
.315"
INSIDE THREADS 1⅛" x 24"
1.290"
1 420"

CASE STYLE 07, 09, 19


"A"
.473"
423"
1 050"
THREADS 1⅛ x 24"
.315"
1.290"
TOP
1 420"

"A" DEPTH
V07, 07 500"
V09, 09 890"
V19, 19 = 1.390"

CASE STYLE 01, 04, 14


.188"
1.030"
"A"
217"
1 400"
HOLE (2) 0935" D
1 562"
1 862"

"A" DEPTH
01 667"
04 1 067"
14 1 567"

PC MOUNT	SCREW CAP PANEL MOUNT		FLANGED PANEL MOUNT WITH RAISED GRILL
	With Rotary Shutter Vol. Control	Without Rotary Volume Control	

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Most Audio II alarms are UL recognized components

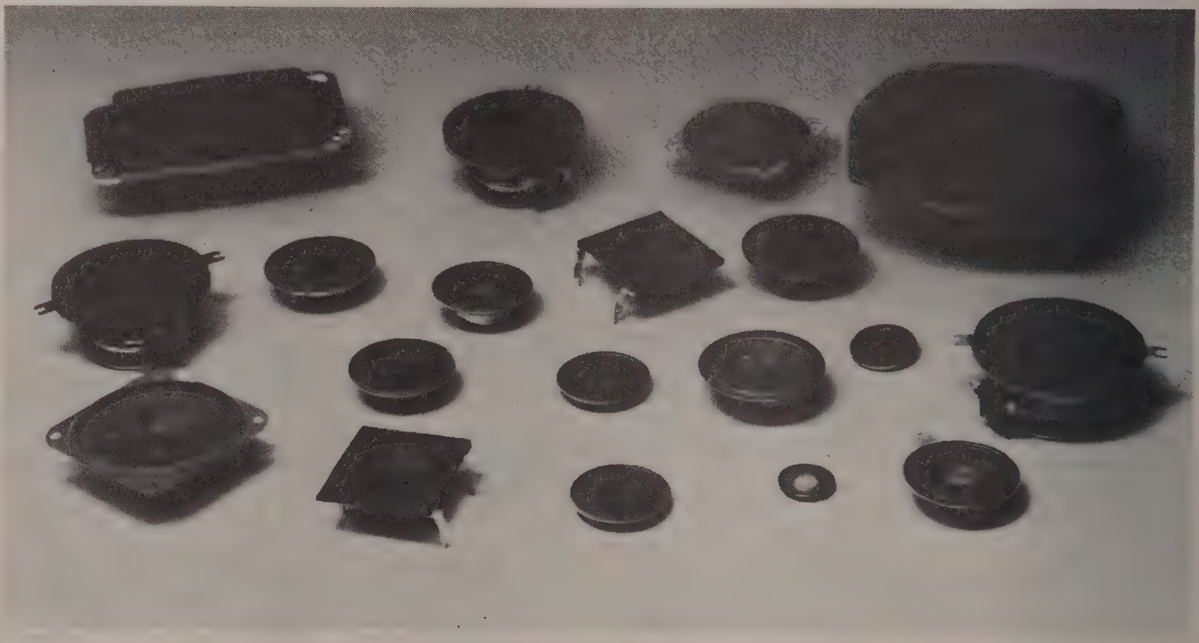
CTS SPEAKERS

APPLICATIONS

- Automotive
- Communications
- Data Processing
- Intercom
- Industrial Sound
- Security & Alarm
- Stereo
- General Purpose

PRODUCT FEATURES

- Wide Selection, Round & Oval
- Ultra Thin Micro Speakers
- PCB Mount Speakers
- Low Flux Leakage Speakers
- Ferrite, ALNICO, and Rare Earth Magnets



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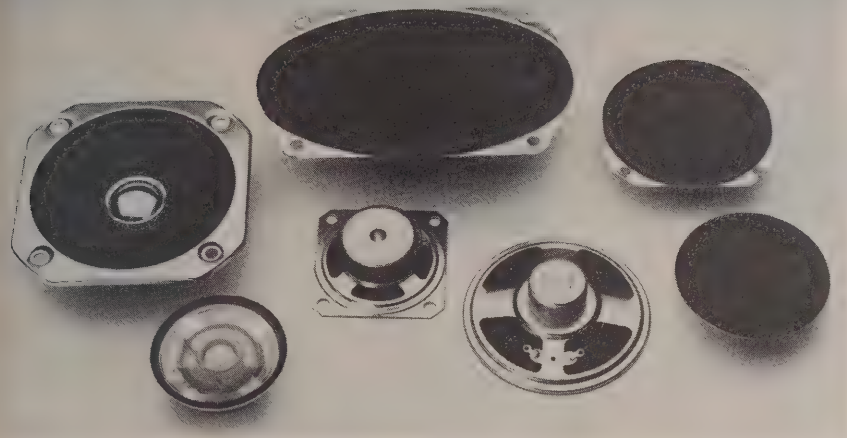
SPEAKERS/BUZZERS
(LOW & REGULAR PROFILE)



A WIDE VARIETY OF QUALITY (LOW AND REGULAR PROFILE) SPEAKERS AND BUZZERS

PIEZO SPEAKERS
- Low frequency and broad band
- High frequency compared with conventional electro-magnetic type speaker
- Ultra thin and lightweight

SOUND TRANSDUCER
- P.C. Board Mounting
- Very small size and lightweight
- Electro-magnetic type

SPEAKER TRANSDUCER
- P.C. Board mounting type
- Wide frequency ranges
- Small and lightweight

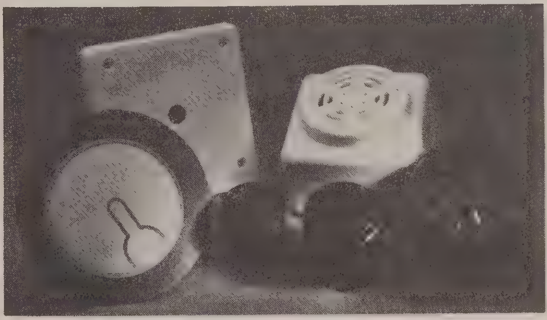
PIEZO CERAMIC AUDIO TRANSDUCER (external drive type)
- Small size, lightweight
- Low power consumption
- SEP-1162 Wave Solderable and washable
- P.C. Board mounting
- High efficiency

PIEZO ELEMENTS AND BUZZERS
- Lowest cost solution for audio signaling applications.
- Buzzers either round or square with wire or pin
- Buzzers size range .47 to 1.75″
- dB ratings up to 90dB min.

MINIATURE SPEAKERS
- Speaker: 13mm Mylar cone Cobalt Magnet
- Frequency: 32HMS
- Max Input Power: 100mw

PIEZO AUDIO INDICATOR (panel mounting type)
- Fits 1.125 inch (28.57mm) opening in panels up to 0.25 inch (6.35mm) thick
- 3 different tones and combinations are available
- Supplied with philips-head screws

ELECTRONIC SOLID STATE AUDIO INDICATOR
- Small size and lightweight
- 400HZ
- No RF noise and long life
- Wide operating voltage



CUI STACK also carries adaptors, transformers, switches, oscilloscope probes, din connectors, molded cable assemblies, jacks and plugs, and rotary encoders. **YOUR BEST SOURCE FOR ELECTROMECHANICAL COMPONENTS.**

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CUI STACK

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Beaverton, OR 97005

FAX: (503) 643-6129

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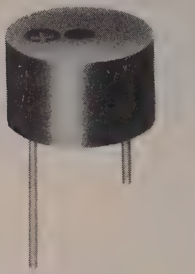
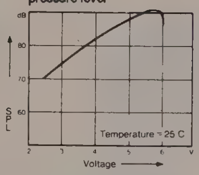
GOLDEN PACIFIC ELECTRONIC, INC. (714) 993-6970 FAX: (714) 993-6023
560 S. MELROSE ST., PLACENTIA, CA. 92670

MICRO BUZZERS—MEB SERIES

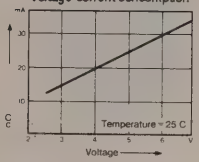
MEB-12C-5



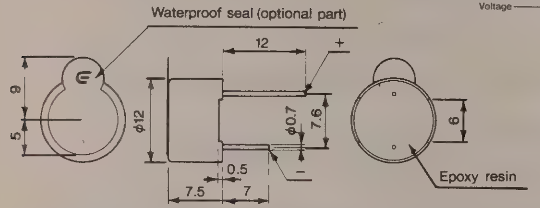
Voltage-sound pressure level



Voltage-current consumption



■ OUTLINE DRAWING

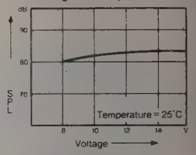


■ SPECIFICATIONS *3V Available

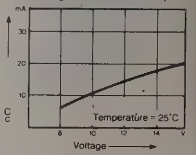
Rated voltage (VDC)	5 *	**Operating temperature**		−20°C ~ +80°C
Rated current (mA)	25 (at 5V)	**Pin polarity**	(+)	Long pin
Sound pressure level (dB)	min.80 typ. 87 (at 5V DC at 10cm)		(−)	Short pin
Operating voltage range (VDC)	3~6	**Net weight (grs.)**		1.6

MEB-12B-12

Voltage-sound pressure level



Voltage-current consumption



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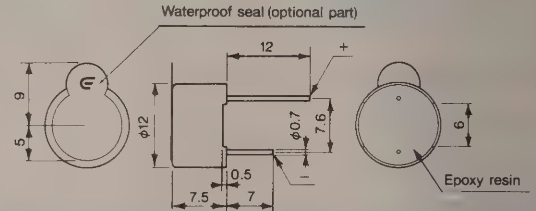


■ SPECIFICATIONS

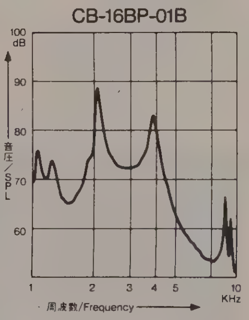
Rated voltage (VDC)	12	**Operating temperature**		−10°C ~ +60°C
Rated current (mA)	15 (at 12V)	**Pin polarity**	(+)	Long pin
Sound pressure level (dB)	min. 75 typ. 85 (at 12V DC at 10m)		(−)	Short pin
Operating voltage range (VDC)	8~16	**Net weight (grs.)**		1.6

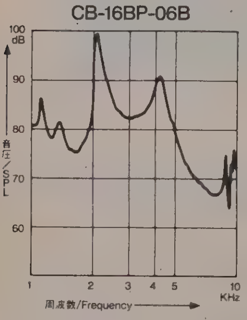
SMALL SIZE MAGNETIC SOUND GENERATORS—CB SERIES

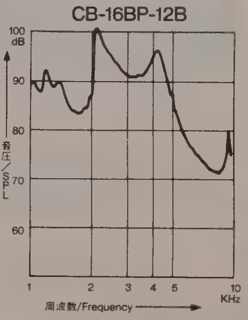
CB-16BP-01B
CB-16BP-06B
CB-16BP-12B

Washable Connection Leads: P

■ FREQUENCY CHARACTERISTICS


CB-16BP-01B


CB-16BP-06B


CB-16BP-12B

■ SPECIFICATIONS

Rated voltage (VDC)	1.5	**Direct current resistance (Ω)**	30
Average current consumption (mA)	max. 6.8	**Inductance (mH)**	6.4
Sound pressure (dB)	min.80 typ. 87 (at 10cm)	**Operating voltage range (VDC)**	1.0~3.0
Resonance frequency (Hz)	2,048	**Net weight (grs.)**	5.0

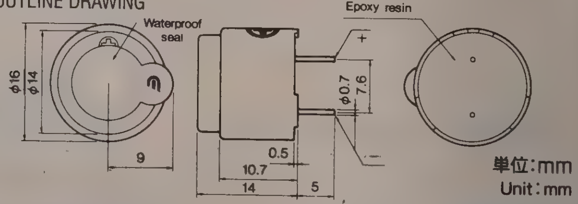
■ SPECIFICATIONS

Rated voltage (VDC)	6.0	**Direct current resistance (Ω)**	50
Average current consumption (mA)	max. 24	**Inductance (mH)**	8.6
Sound pressure (dB)	min.85 typ. 96 (at 10cm)	**Operating voltage range (VDC)**	4.0~9.0
Resonance frequency (Hz)	2,048	**Net weight (grs.)**	5.0

■ SPECIFICATIONS

Rated voltage (VDC)	12	**Direct current resistance (Ω)**	115
Average current consumption (mA)	max. 24	**Inductance (mH)**	15
Sound pressure (dB)	min.85 typ. 96 (at 10cm)	**Operating voltage range (VDC)**	6.0~18.0
Resonance frequency (Hz)	2,048	**Net weight (grs.)**	5.0

■ OUTLINE DRAWING



単位:mm
Unit:mm

CITIZEN ELECTRONICS CO., LTD.

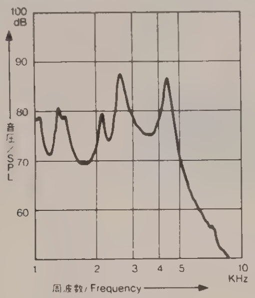
SOUND GENERATORS CITISOUND™

GOLDEN PACIFIC ELECTRONIC, INC. (714) 993-6970 FAX: (714) 993-6023
560 S. MELROSE ST., PLACENTIA, CA. 92670

SMALL SIZE MAGNETIC SOUND GENERATORS—CB SERIES

CB-12C

■ FREQUENCY CHARACTERISTICS



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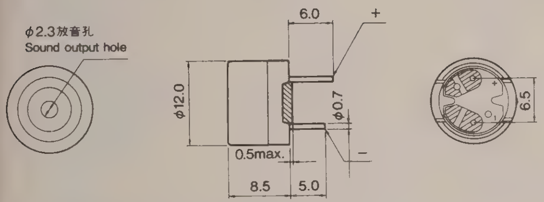
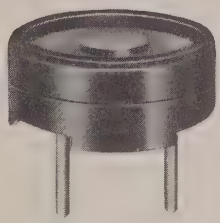

φ2.3放音孔
Sound output hole
6.0
+
φ12.0
φ0.7
0.5max.
–
8.5
5.0
6.5

■ SPECIFICATIONS * 2048 Hz AVAILABLE

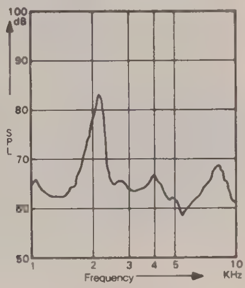
Rated voltage (VDC)	1.5	**DC resistance (Ω)**	42
Average current consumption (mA)	max. 10	**Inductance (mH)**	6.2
Sound pressure level (dB)	min.80 typ. 83 (at 10cm)	**Operating voltage range (VDC)**	1.1～1.7
Resonance frequency (Hz)	4,096*	**Net weight (grs.)**	2

CB-12E

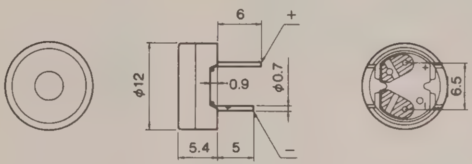


Connection Leads: P, W, N

■ FREQUENCY CHARACTERISTICS



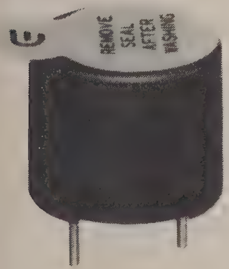
■ OUTLINE DRAWING


6
+
φ12
0.9
φ0.7
5.4
5
–
6.5

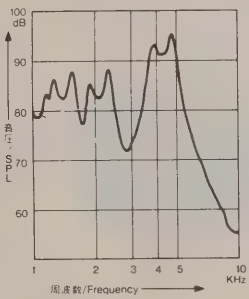
■ SPECIFICATIONS

Rated voltage (VDC)	1.5	**DC resistance (Ω)**	42
Average current consumption (mA)	max. 10	**Inductance (mH)**	6.2
Sound pressure level (dB)	min. 70 typ. 77 (at 10cm)	**Operating voltage range (VDC)**	1.1～1.7
Resonance frequency (Hz)	2,048	**Net weight (grs.)**	1.8

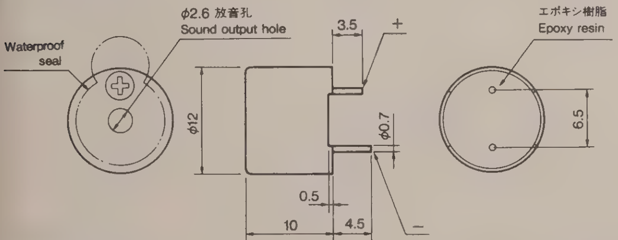
CB-12TP


REMOVE SEAL AFTER WASHING

■ FREQUENCY CHARACTERISTICS



■ OUTLINE DRAWING

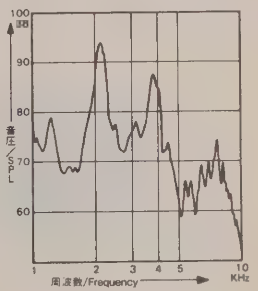

Waterproof seal
φ2.6 放音孔
Sound output hole
3.5
+
φ12
φ0.7
0.5
10
4.5
–
エポキシ樹脂
Epoxy resin
6.5

■ SPECIFICATIONS

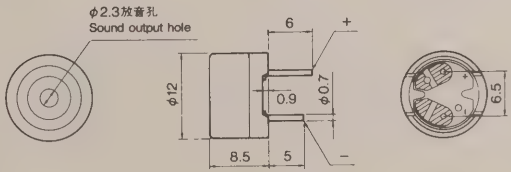
Rated voltage (VDC)	1.5	**DC resistance (Ω)**	51
Average current consumption (mA)	max. 8.5	**Inductance (mH)**	3.8
Sound pressure level (dB)	min. 85 typ. 89 (at 10cm)	**Operating voltage range (VDC)**	1.1～1.7
Resonance frequency (Hz)	4,096	**Net weight (grs.)**	2

CB-12G

■ FREQUENCY CHARACTERISTICS



■ OUTLINE DRAWING


φ2.3放音孔
Sound output hole
6
+
φ12
0.9
φ0.7
8.5
5
–
6.5

■ SPECIFICATIONS

Rated voltage (VDC)	1.5	**DC resistance (Ω)**	17
Average current consumption (mA)	max. 24	**Inductance (mH)**	1.8
Sound pressure level (dB)	min. 85 typ. 90 (at 10cm)	**Operating voltage range (VDC)**	1.1~1.7
Resonance frequency (Hz)	2,048	**Net weight (grs.)**	2

CITIZEN ELECTRONICS CO., LTD.

SOUND GENERATORS CITISOUND™

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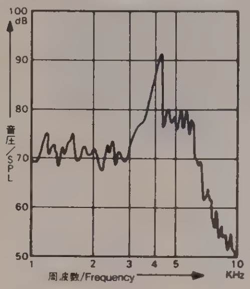
SMALL SIZE MAGNETIC SOUND GENERATORS—CB SERIES

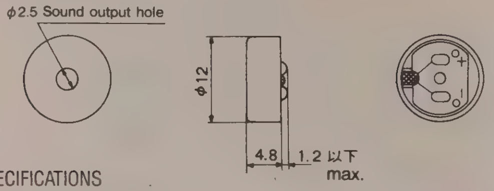
CB-12H

Connection Leads: N

■ FREQUENCY CHARACTERISTICS



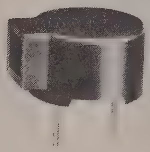
■ OUTLINE DRAWING


φ2.5 Sound output hole
φ12
4.8
1.2 以下 max.
+
−

■ SPECIFICATIONS

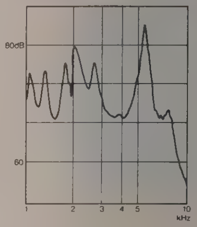
Rated voltage (VDC)	1.5	Direct current resistance (Ω)	51
Average current consumption (mA)	max. 7.5	Inductance (mH)	3.8
Sound pressure (dB)	min.75 typ. 86 (at 10cm)	Operating voltage range (VDC)	1.1～1.7
Resonance frequency (Hz)	4,096	Net weight (grs.)	1.5

CB-12QP-1/3*

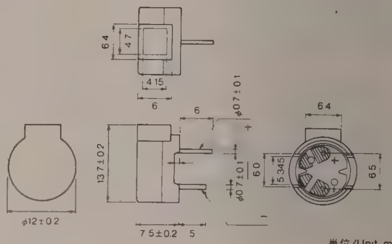


Connection Leads: P

■ FREQUENCY CHARACTERISTICS



■ OUTLINE DRAWING


6.4
4.7
4.15
6
6
φ0.7±0.1
+
13.7±0.2
φ0.7±0.1
6.0
5.345
−
φ12±0.2
7.5±0.2
5
6.4
6.5

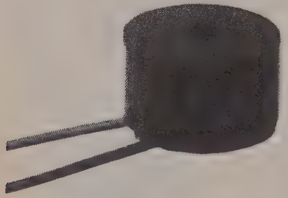
単位/Unit. mm

■ SPECIFICATIONS

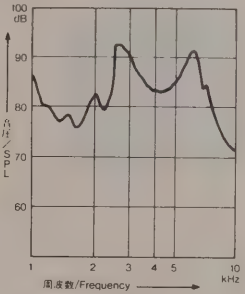
Rated voltage (VDC)	1.5	Direct current resistance (Ω)	42
Average current consumption (mA)	max. 10	Inductance (mH)	6.2
Sound pressure (dB)	min 70 typ 76 (at 10cm)	Operating voltage range (VDC)	1.0～2.0
Resonance frequency (Hz)	2,048	Net weight (grs.)	2

*For CB-12QP-3 Spec. Please Call GPE

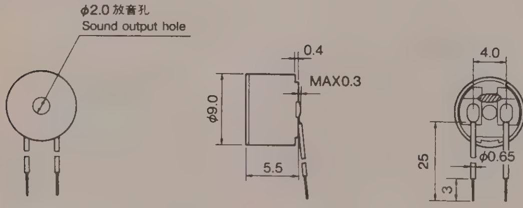
CB-09A



■ FREQUENCY CHARACTERISTICS



■ OUTLINE DRAWING

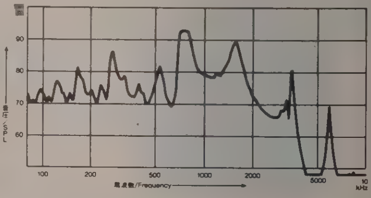

φ2.0 放音孔
Sound output hole
0.4
MAX0.3
φ9.0
5.5
4.0
25
3
φ0.65

■ SPECIFICATIONS

Rated voltage (VDC)	5	DC resistance (Ω)	25
Average current consumption (mA)	max. 70	Inductance (mH)	1.2
Sound pressure level (dB)	min.85 typ. 90 (at 10cm)	Operating voltage range (VDC)	1.1~6.0
Resonance frequency (Hz)	2,700	Net weight (grs.)	0.7

CB-25AP

■ FREQUENCY CHARACTERISTICS



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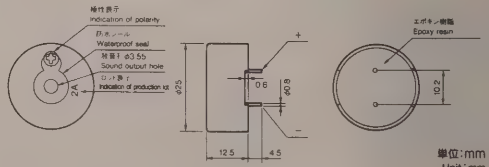
極性表示
Indication of polarity
防水シール
Waterproof seal
放音孔 φ3.55
Sound output hole
ロット表示
Indication of production lot
2A
φ25
0.6
φ0.8
+
−
12.5
4.5
エポキシ樹脂
Epoxy resin
10.2

単位:mm
Unit:mm

■ SPECIFICATIONS

Rated voltage (VDC)	5	DC resistance (Ω)	33±5
Average current consumption (mA)	max. 80	Inductance (mH)	3.0
Sound pressure level (dB)	min.85 typ. 90 (at 10cm)	Operating voltage range (VDC)	3.0~6.0
Resonance frequency (Hz)	800	Net weight (grs.)	8.2

INTERVOX® by International
International Components Corporation

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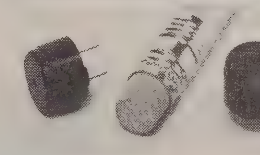
TRANSDUCERS

PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	MAX. CURRENT (mA)	SOUND OUTPUT	COIL RESISTANCE (Ohms)	COIL IMPEDANCE (Ohms)	TERMINAL TYPE	FREQUENCY	OPERATING TEMPERATURE
BRT0907P-01	1.5	1-2	80	80dB@10cm	5.5±1	9.5	2 Pins	3100Hz	-20° to +60°C
BRT1206P-01	1.5	1-2	10	70dB@10cm	50	140	2 Pins	2048Hz	-20° to +60°C
BRT1207P-01-SEHA	1.5	1-2	70	80dB@10cm	6.5	16	2 Pins	2048Hz	-20° to +60°C
BRT1207P-01-SEHB	1.5	1-2	70	75dB@10cm	6.5	22	2 Pins	2731Hz	-20° to +60°C
BRT1207P-01-SEHC	1.5	1- 2	10	70dB@10cm	50	140	2 Pins	2048Hz	-20° to +60°C
BRT1209L-01	1.5	1-2	30	80dB@10cm	16	40	2 Leadwires	2048Hz	-20° to +60°C
BRT1209P-01	1.5	1-2	30	80dB@10cm	16	40	2 Pins	2048Hz	-20° to +60°C
BRT1209L-01-50	1.5	1-2	10	80dB@10cm	50	140	2 Leadwires	2048Hz	-20° to +60°C
BRT1209P-01-50	1.5	1-2	10	80dB@10cm	50	140	2 Pins	2048Hz	-20° to +60°C
BRT1209PF-01	1.5	1-3	40	75dB@10cm	15	55	2 Pins	2400Hz	-40° to +85°C
BRT1209PF-06	5	4-8	40	85dB@10cm	50	80	2 Pins	2200Hz	-40° to +85°C
BRT1209PF-12	12	7-15	40	85dB@10cm	115	240	2 Pins	2200Hz	-40° to +85°C
BRT1209PF-05-RA	5	4-8	40	85dB@10cm	50	80	2 Pins	2200Hz	-40° to +85°C
BRT1209P-01-C	1.5	1.2-3	30	70dB@10cm	Not Applicable w/built in driver		2 Pins	2500Hz	-20° to +70°C
BRT1209P-06-C	5	4-8	30	80dB@10cm			2 Pins	2300Hz	-20° to +70°C
BRT1209P-12-C	12	7-15	30	80dB@10cm			2 Pins	2300Hz	-20° to +70°C
BRT1213P-01	1.5	1-2	30	80dB@10cm	16	40	2 Pins	2048Hz	-20° to +60°C
BRT1615P-01	1.5	1-3	12*	80dB@10cm	30*	80*	2 Pins	2048Hz	-20° to +70°C
BRT1615P-06	6	3-12	40*	85dB@10cm	50*	110*	2 Pins	2048Hz	-20° to +70°C
BRT1615P-12	12	6-18	40*	85dB@10cm	115*	200*	2 Pins	2048Hz	-20° to +70°C
BRT1615P-01-C	1.5	1.2-2	20	75dB@10cm*	Not Applicable w/built in driver		2 Pins	2300Hz	-20° to +70°C
BRT1615P-06-C	6	4-7	30	85dB@10cm*			2 Pins	2200Hz	-20° to +70°C
BRT1615P-12-C	12	8-16	30	85dB@10cm*			2 Pins	2200Hz	-20° to +70°C
BRT1623P-01	1.5	1-3	12*	80dB@10cm*	30	100*	2 Pins	2048Hz	-20° to +70°C
BRT1623P-06	6	3-12	40*	85dB@10cm*	45	135*	2 Pins	2048Hz	-20° to +70°C
BRT1623P-12	12	6-18	40*	85dB@10cm*	115	270*	2 Pins	2048Hz	-20° to +70°C
BST1811P-01	1.5	1-2	40**	80dB@10cm**	14 ± 9	22*	2 Pins	2000-2500Hz	-30° to +85°C
BST1811P-06	6	3-10	40**	85dB@10cm**	60 ± 9	90*	2 Pins	2000-2500Hz	-30° to +85°C
BST1811P-12	12	6-15	40**	85dB@10cm**	120 ± 18	170*	2 Pins	2000-2500Hz	-30° to +85°C
BRT2513P-06	5	3-5	80	85dB@10cm	27 ± 4	38	2 Pins	730Hz	-40° to +85°C
BRT2513P-06-C	6	3-8	75	85dB@10cm	36 ± 5	48	2 Pins	1000-1500Hz	-40° to +85°C
BRT2513P-12-C	12	8-14	55	85dB@10cm	120 ± 15	155	2 Pins	1000-1500Hz	-40° to +85°C

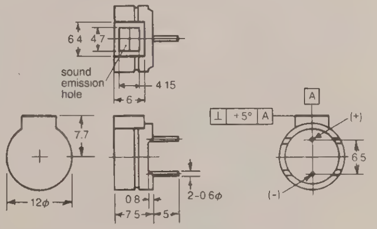
*Value applying Rated Voltage (2,048Hz ½ Duty, Square Wave)
**Value applying (2,048Hz, Sine Wave, Measuring Current 60μA)



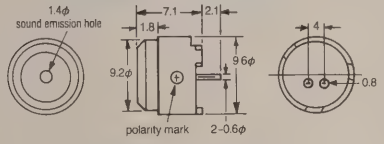
Size: 9.2mm diameter, 7.1mm depth, 4.0mm pin spacing

Carefully constructed, using highest quality materials, these extremely small and lightweight Intervox devices are designed to fulfill limited-space requirements without sacrificing sound quality. Some are pin type units that are sealed for wave solder washing and are dispensed from auto insertion carrier tubes for P.C. applications. So, if you're looking for dependability and long life, Intervox miniatures are the answer.

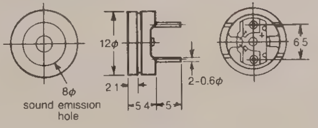
SERIES BRT1207P-SEH


6 4
4 7
sound emission hole
4 15
6
7.7
12ϕ
0 8
7 5
5
2-0 6ϕ
⊥ +5° A
A
(+)
(-)
6 5

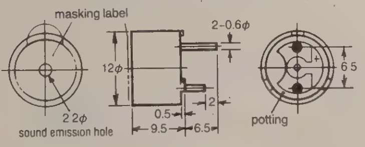
SERIES BRT0907P-01


1.4ϕ
sound emission hole
7.1
2.1
1.8
9.2ϕ
9 6ϕ
polarity mark
2-0.6ϕ
4
0.8

SERIES BRT1206P-01

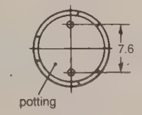

12ϕ
8ϕ
sound emission hole
2 1
5 4
5
2-0.6ϕ
6 5

SERIES BRT1209PF

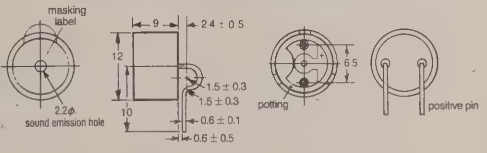

masking label
2-0.6ϕ
12ϕ
2 2ϕ
sound emission hole
0.5
2
9.5
6.5
potting
6 5

SERIES BRT1209P-C

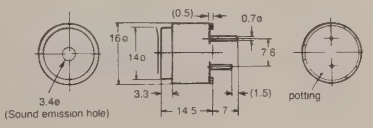
Same as BRT1209PF but with 7.6mm pin spacing.



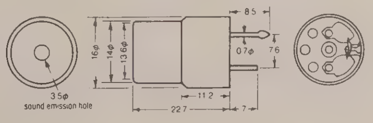
SERIES BRT1209PF-05-RA


masking label
2.2ϕ
sound emission hole
9
2 4 ± 0 5
12
10
1.5 ± 0.3
1.5 ± 0.3
0.6 ± 0.1
0.6 ± 0.5
potting
6 5
positive pin

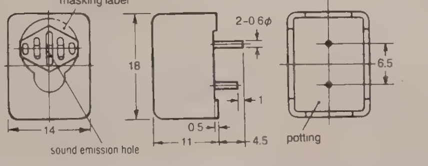
SERIES BRT1615


3.4ø
(Sound emission hole)
(0.5)
0.7ø
16ø
14ø
7 6
3.3
(1.5)
14 5
7
potting

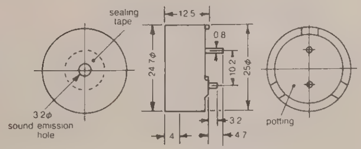
SERIES BRT1623


3 5ϕ
sound emission hole
16ϕ
14ϕ
13 6ϕ
8 5
0 7ϕ
7 6
11 2
22 7
7

SERIES BST1811P


masking label
14
sound emission hole
18
2-0 6ϕ
1
0 5
11
4.5
6.5
potting

SERIES BRT2513P


sealing tape
3 2ϕ
sound emission hole
12 5
0 8
24 7ϕ
10 2
25ϕ
3 2
4
4 7
potting

CONTINUED ON FOLLOWING PAGE

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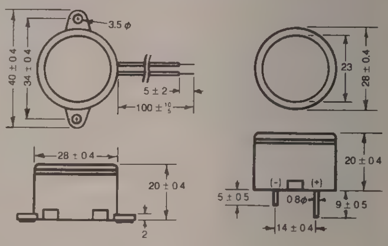
TRANSDUCERS

PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	MAX. CURRENT (mA)	SOUND OUTPUT @ 30cm dB	TERMINAL TYPE	FREQUENCY	OPERATING TEMPERATURE	TONE MODE	PULSE RATE (PULSE/SEC)
BRT2821L-06	6	4-9	35	90	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821L-12	12	9-15	40	95	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821L-24	24	15-28	25	95	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821P-06	6	4-9	35	90	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821P-12	12	9-15	40	95	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821P-24	24	15-28	25	95	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Continuous	N/A
BRT2821L-06-P	6	4-9	10	78	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821L-12-P	12	8-15	15	85	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821L-24-P	24	15-28	20	85	2 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821P-06-P	6	4-9	10	78	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821P-12-P	12	8-15	15	85	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821P-24-P	24	15-28	20	85	2 Pins	2800Hz±0.2KHz	-20° to +60° C	Intermittent	2-7
BRT2821L-06-D	6	4-9	35/10	85/70	3 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Dual	2-7
BRT2821L-09-D	9	6-11	35/15	85/75	3 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Dual	2-7
BRT2821L-12-D	12	8-15	40/15	90/80	3 Leadwires	2800Hz±0.2KHz	-20° to +60° C	Dual	2-7

SERIES BRT2821

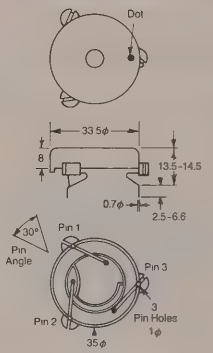


The Intervox Piezo-Electric series was created to provide the ultimate in buzzer technology. Distinctive in virtually any environment, it features a level of reliability, efficiency and clear, penetrating sound quality that is unavailable in ordinary buzzers. What's more, Intervox piezo-electric buzzers are offered in lightweight, compact packages. Some are self drive types and some with or without circuits.

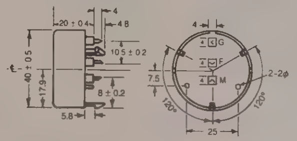
PIEZO ELECTRICS – *SELF DRIVE*

PART NUMBER	RESONANT FREQUENCY	RESONANT RESISTANCE (OHMS)	ELECTROSTATIC CAPACITY (PF)	MAX INPUT VOLTAGE	TERMINAL TYPE	SOUND PRESSURE LEVEL	OPERATING TEMPERATURE
BRP3408P-30	2500Hz ± 500Hz	300	25000 ± 30%	30Vp-p	3 Pins	95dB @ 30cm 15Vp-p	-20° to +60°C
BRP4016P-30	3200Hz ± 500Hz	200	30000 ± 30%	30Vp-p	3 Pins	95dB @ 30cm 9Vp-p	-20° to +60°C
BRP4216L-30	3000Hz ± 500Hz	300	25000 ± 30%	30Vp-p	3 Leadwires	85dB @ 1M 15Vp-p	-20° to +60°C
BRP4216P-30	3000Hz ± 500Hz	300	25000 ± 30%	30Vp-p	3 Pins	85dB @ 1M 15Vp-p	-20° to +60°C

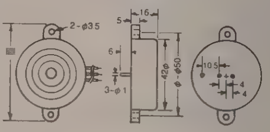
SERIES BRP3408P-30



SERIES BRP4016P



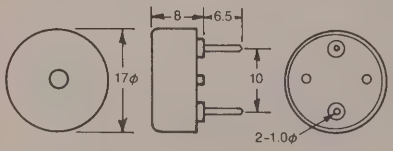
SERIES BRP4216



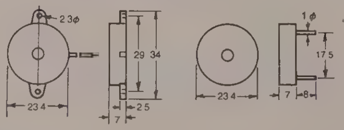
PIEZO ELECTRICS – *NO CIRCUITRY*

PART NUMBER	RESONANT FREQUENCY	RESONANT RESISTANCE (OHMS)	ELECTROSTATIC CAPACITY (PF)	MAX INPUT VOLTAGE	TERMINAL TYPE	SOUND PRESSURE LEVEL	OPERATING TEMPERATURE
BRP1708P-30	4500Hz± 500Hz	500	8000 ± 30%	30Vp-p	2 Pins	95dB @ 30cm 10Vp-p	-20° to +60°C
BRP2207P-30	4000Hz± 500Hz	300	12000 ± 30%	30Vp-p	2 Pins	95dB @ 30cm 10Vp-p	-40° to +120°C
BRP2407L-30	5600Hz ± 600Hz	1500	10000 ± 30%	30Vp-p	2 Leadwires	90dB @ 30cm 10Vp-p	-20° to +60°C
BRP2407P-30	5600Hz ± 600Hz	1500	10000 ± 30%	30Vp-p	2 Pins	90dB @ 30cm 10Vp-p	-20° to +60°C
BRP3005L-30	4500Hz± 500Hz	300	20000 ± 30%	30Vp-p	2 Leadwires	95dB @ 30cm 10Vp-p	-20° to +60°C
BSP3206FV-30	3000Hz ± 500Hz	400	16000 ± 30%	30Vp-p	2 Fast-on	95dB @ 30cm 10Vp-p	-20° to +60°C

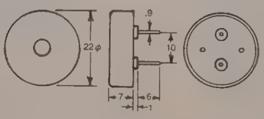
SERIES BRP1708P-30



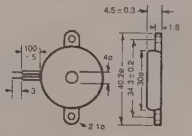
SERIES BRP2407



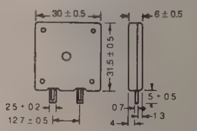
SERIES BRP2207P-30



SERIES BRP3005



SERIES BSP3206



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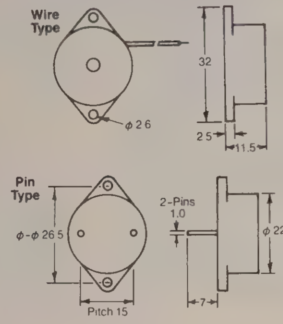
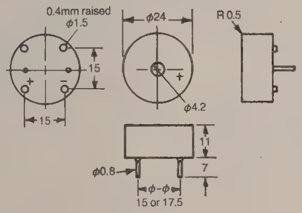
SERIES BRP2212L-12-C


Wire Type
32
φ 2.6
2.5
11.5
Pin Type
2-Pins
1.0
φ-φ 26.5
φ 22
Pitch 15
7

SERIES BRP2411P-12-CFS

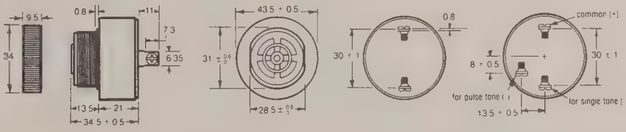

0.4mm raised
φ1.5
φ24
R 0.5
15
15
φ4.2
11
7
φ0.8
φ-φ
15 or 17.5

PIEZO ELECTRICS with Internal Circuitry @ 30cm dB

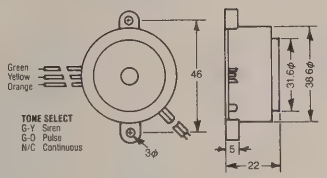
PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	MAX. CURRENT (mA)	SOUND OUTPUT	TERMINAL TYPE	TONE MODE	FREQUENCY	OPERATING TEMPERATURE
BRP2211P-12-C	12	3-15	4.5	75dB @ 30cm	2 Pins	Continuous	4000 ± 500Hz	-20° to + 70°C
BRP2211P-12-CS	12	3-15	4.5	75dB @100cm*	2 Pins	Continuous	4000 ± 500Hz	-40° to +120°C
BRP2212L-12-C	12	3-15	4.5	90dB @ 30cm	2 Leadwires	Continuous	4000 ± 500Hz	-10° to + 60°C
BRP2212P-12-C	12	3-15	4.5	90dB @ 30cm	2 Pins	Continuous	4000 ± 500Hz	-10° to + 60°C
BRP2411P-12-CFS	12	3-24	10	90dB @ 30cm	2 Pins	Continuous	2700 ± 500Hz	-40° to +120°C
BRP3017L-12-C	12	1.5-16	15	90dB @ 30cm	2 Leadwires	Continuous	3800 ± 500Hz	-20° to + 60°C
BRP3017L-24-C	24	1.5-28	20	90dB @ 30cm	2 Leadwires	Continuous	3800 ± 500Hz	-20° to + 60°C
BRP3017P-12-C	12	1.5-16	15	90dB @ 30cm	2 Pins	Continuous	3800 ± 500Hz	-20° to + 60°C
BRP3017P-24-C	24	1.5-28	20	90dB @ 30cm	2 Pins	Continuous	3800 ± 500Hz	-20° to + 60°C
BRP3025L-12-C	12	1.5-16	15	95dB @ 30cm	2 Leadwires	Continuous	3500 ± 500Hz	-20° to + 60°C
BRP3025L-24-C	24	1.5-28	20	95dB @ 30cm	2 Leadwires	Continuous	3500 ± 500Hz	-20° to + 60°C
BRP4222T-24-C	24	1-28	15	85dB @ 30cm	2 Lugs	Continuous	2900 ± 500Hz	-20° to + 60°C
BRP4526L-12-C	12	1-13	35	105dB @ 30cm	2 Leadwires	Continuous	2900 ± 500Hz	-20° to + 60°C
BRP4526P-12-C	12	1-13	35	105dB @ 30cm	2 Pins	Continuous	2900 ± 500Hz	-20° to + 60°C
BRP4535S-12-C	12	1-16	30	100dB @ 30cm	2 Screw Lugs	Continuous	2900 ± 500Hz	-20° to + 60°C
BRP4535S-24-C	24	1-28	15	90dB @ 30cm	2 Screw Lugs	Continuous	2900 ± 500Hz	-20° to + 60°C
BRP4535S-12-CP	12	4-16	20	90dB @ 30cm	2 Screw Lugs	Intermitt:0.8-1.2	2900 ± 500Hz	-20° to + 60°C
BRP4535S-24-CP	24	4-28	22	80dB @ 30cm	2 Screw Lugs	Intermitt:0.8-1.2	2900 ± 500Hz	-20° to + 60°C
BRP4535S-12-CP1	12	4-16	20	90dB @ 30cm	2 Screw Lugs	Intermitt: 4-6	2900 ± 500Hz	-20° to + 60°C
BRP4535S-24-CP1	24	4-28	22	80dB @ 30cm	2 Screw Lugs	Intermitt: 4-6	2900 ± 500Hz	-20° to + 60°C
BRP4535S-12-CD	12	4-16	25/20	95/90dB @30cm	3 Screw Lugs	Cont/Interm:0.8-1.2	2900 ± 500Hz	-20° to + 60°C
BRP4535S-24-CD	24	4-28	30/20	85/80dB @30cm	3 Screw Lugs	Cont/Interm:0.8-1.2	2900 ± 500Hz	-20° to + 60°C

*Special Purpose

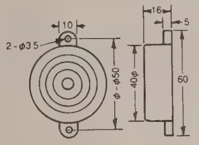
SERIES BRP4535


9.5
34
0.8
11
7.3
6.35
13.5
21
34.5 + 0.5
43.5 + 0.5
31 ± 0.6
28.5 ± 0.6
30 + 1
0.8
common (+)
8 + 0.5
30 ± 1
for pulse tone
for single tone
13.5 + 0.5

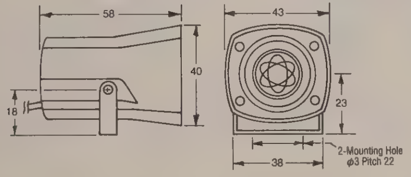
SERIES BRP3922L-C


Green
Yellow
Orange
46
31.6φ
38.6φ
TONE SELECT
G-Y Siren
G-O Pulse
N/C Continuous
3φ
5
22

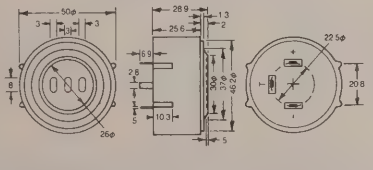
SERIES BRP4016


10
16
5
2-φ3.5
φ-φ50
40φ
60

SERIES BPS4358L-12-C


58
43
40
18
23
38
2-Mounting Hole
φ3 Pitch 22

SERIES BRP4629T-09-C

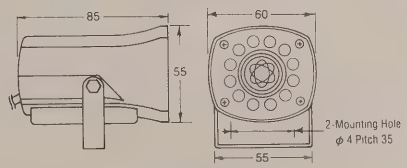

50φ
3
3
3
28.9
25.6
1.3
2
6.9
2.8
8
5
10.3
30φ
37φ
42φ
22.5φ
20.8
26φ
5

PIEZO ELECTRICS

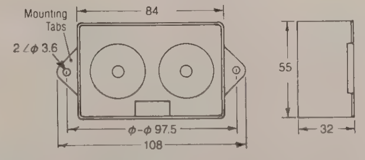
Internal Circuitry (100dB or Greater @ 1 Meter [100cm])

PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	MAX. CURRENT (mA)	SOUND OUTPUT	TERMINAL TYPE	TONE MODE	FREQUENCY	OPERATING TEMPERATURE
BRP3922L-12-CT3	12	6-15	95	107dB @ 1M	5 Leadwires	3 Tone	2800Hz	-20° to + 70°C
BRP3922L-24-CT3	24	6-28	85	109dB @ 1M	5 Leadwires	3 Tone	2800Hz	-20° to + 70°C
BRP3926L-12-C	12	3-24	18	101dB @ 1M	2 Leadwires	Continuous	3000Hz	-20° to + 60°C
BRP3926L-12-CP	12	3-24	18	101dB @ 1M	2 Leadwires	Intermitt: 2-7	3000Hz	-20° to + 60°C
BRP4016L-12-C	12	3-24	18	100dB @ 1M	2 Leadwires	Continuous	2800 ± 300Hz	-20° to + 60°C
BRP4016L-12-CP	12	3-24	18	100dB @ 1M	2 Leadwires	Intermitt: 1	2800 ± 300Hz	-20° to + 60°C
BPS4228L-12-C	12	6-15	90	107dB @ 1M	2 Leadwires	Siren	2800Hz	-20° to + 70°C
BPS4228L-24-C	24	6-28	50	109dB @ 1M	2 Leadwires	Siren	2800Hz	-20° to + 70°C
BPS4358L-12-C	12	6-12	160	105dB @ 1M	2 Leadwires	Siren	2500 - 3000Hz	-20° to + 70°C
BRP4629T-09-C	9	5-13	70	105dB @ 1M	3 Lugs	Continuous	2000 - 3000Hz	-20° to + 65°C
BPS6055L-12-C	12	6-12	350	115dB @ 1M	2 Leadwires	Siren	2500 - 3000Hz	-20° to + 70°C
BPS8432L-12-C	12	6-15	85	105dB @ 1M	2 Leadwires	Continuous	2500 - 2800Hz	-20° to + 70°C
BPS8432L-24-C	24	6-28	45	105dB @ 1M	2 Leadwires	Continuous	2500 - 2800Hz	-20° to + 70°C
BPS9234S-12-C	12	6-15	300	115dB @ 1M	Screw	3 Tone	2800Hz	-20° to + 70°C
BPS9234S-24-C	24	6-28	150	115dB @ 1M	Screw	Cont., Siren or Pulse	2800Hz	-20° to + 70°C

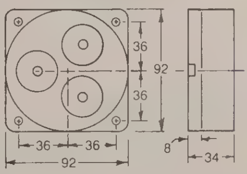
BPS6055L


85
60
55
2-Mounting Hole
φ 4 Pitch 35
55

BPS8432L


Mounting Tabs
84
2-φ 3.6
55
φ-φ 97.5
108
32

BPS9234S


36
92
36
36
36
92
8
34

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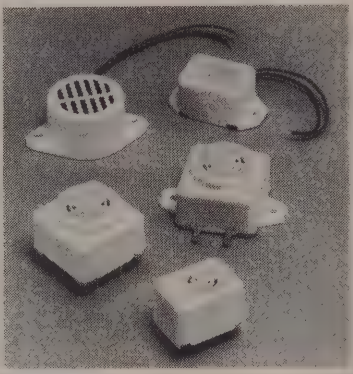
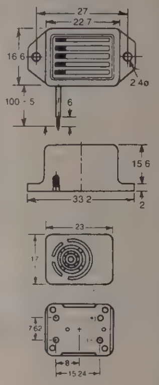
ELECTRONIC BUZZERS

Designed to eliminate the problems inherent in electromechanical buzzers, Intervox solid-state buzzers are simple, rugged and low cost. Yet, they produce a rich, broad sound consistent with a wide variety of requirements. High efficiency, custom internal circuits deliver reliable performance and long life. And there are no mechanical points to arc or require maintenance. RF noise is non-existent.

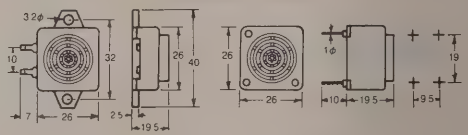
PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	MAX. CURRENT (mA)	SOUND OUTPUT	TERMINAL TYPE	FREQUENCY	OPERATING TEMPERATURE
BS2316L-01	1.5	1.3- 2	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316L-03	3	2- 5	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316L-06	6	4- 9	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316L-09	9	6-15	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316L-12	12	9-20	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316L-24	24	10-27	25	75dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BS2316P-06-C	6	4- 8	35	80dB @ 30cm	4 Pins	400 ± 50 Hz	-40° to +70°C
BS2316P-09-C	9	6-12	35	80dB @ 30cm	4 Pins	400 ± 50 Hz	-40° to +70°C
BS2316P-12-C	12	8-16	35	80dB @ 30cm	4 Pins	400 ± 50 Hz	-40° to +70°C
BS2316P-24-C	24	16-27	35	80dB @ 30cm	4 Pins	400 ± 50 Hz	-40° to +70°C
BS2620FV-03	3	2- 4	70	75dB @ 100cm	2 Fast-on	400 ± 50Hz	-40° to +70°C
BS2620FV-06	6	4- 8	70	75dB @ 100cm	2 Fast-on	400 ± 50Hz	-40° to +70°C
BS2620FV-12	12	8-16	60	75dB @ 100cm	2 Fast-on	400 ± 50Hz	-40° to +70°C
BS2620FV-24	24	20-28	60	75dB @ 100cm	2 Fast-on	400 ± 50Hz	-40° to +70°C
Low Current Trigger Models (1 mA @ Rated Voltage)							
BS2620PH-03-C	3	2- 4	30	75dB @ 100cm	4 Pins	400 ± 50Hz	-40° to +70°C
BS2620PH-06-C	6	4- 8	30	75dB @ 100cm	4 Pins	400 ± 50Hz	-40° to +70°C
BS2620PH-12-C	12	8-16	20	75dB @ 100cm	4 Pins	400 ± 50Hz	-40° to +70°C
BS2620PH-24-C	24	20-28	20	75dB @ 100cm	4 Pins	400 ± 50Hz	-40° to +70°C
BR2818L-01	1.5	1.3- 2	35	80dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-03	3	2- 5	35	80dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-06	6	4- 9	35	80dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-09	9	6-15	35	80dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-12	12	9-20	35	80dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-24	24	20-28	35	85dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C
BR2818L-48	48	30-54	35	85dB @ 30cm	2 Leadwires	400 ± 50Hz	-40° to +70°C



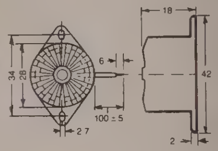
SERIES BS2316



SERIES BS2620



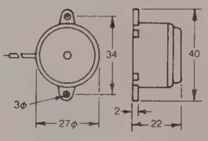
SERIES BR2818



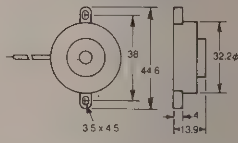
MELODY BUZZERS

PART NUMBER	RATED VOLTAGE (VDC)	OPERATING VOLTAGE (VDC)	CURRENT @ RATED VOLTAGE	SOUND OUTPUT	TERMINAL TYPE	FREQUENCY	OPERATING TEMPERATURE
BRM2722L-09-C	9	6-12	15 mA	80dB @ 100cm	2 Leadwires	400 ± 50Hz	-20° to +60°C
BRM3214L-09-C	9	6-12	6 mA	85 dB @ 100cm	2 Leadwires	400 ± 50Hz	-20° to +60°C
Features 7 Songs, Play Continuously							
BRM2722L-09-CT	9	6-12	15 mA	80dB @ 100cm	2 Leadwires	400 ± 50Hz	-20° to +60°C
BRM3214L-09-CT	9	6-12	6 mA	85dB @ 100cm	2 Leadwires	400 ± 50Hz	-20° to +60°C
Features 7 Songs, Play Each Trigger							

SERIES BRM2722L



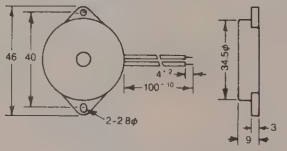
SERIES BRM3214L



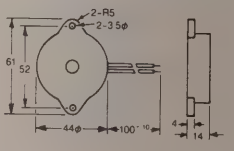
PIEZO TELEPHONE RINGERS *External Drive Types*

PART NUMBER	MAX INPUT VOLTAGE	ELECTROSTATIC CAPACITY (pF)	SOUND OUTPUT	TERMINAL TYPE	RESONANT FREQUENCY	OPERATING TEMPERATURE
BRP3409L-40-TR	40Vp-p	40,000 ± 25%	MIN. 70dB @ 1M	2 Leadwires	1000	-20° to +70°C
BRP4414L-30-TR	30Vp-p	75,000 ± 30%	MIN. 70dB @ 1M	2 Leadwires	1000	-20° to +70°C

SERIES BRP3409L-40-TR

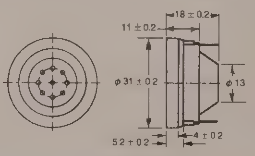


SERIES BRP4414L-30-TR



DYNAMIC RECEIVER *for Telephone Headsets*

PART NUMBER	IMPEDANCE (Ohms)	SENSITIVITY @ 1KHz	FREQUENCY RESPONSE (Hz)	MAGNET TYPE	FRAME DEPTH (mm)	FRAME DIAMETER (mm)
ST125RF-200-P	200 ± 20%	92 ± 3dB	100 - 5000	Ferrite	17.9	31.0



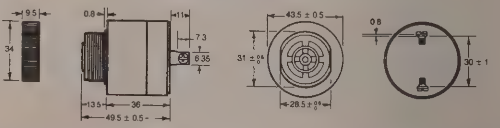
HEADPHONE DRIVERS

PART NUMBER	RATED POWER (mW)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	SOUND OUTPUT	MAGNET TYPE	FRAME DEPTH (mm)	FRAME DIAMETER (mm)	NET WEIGHT (Grams)
SHD100RF-32	50.0	32 ± 15%	50 - 2500	102 ± 3dB	Ferrite	8.5	27.0	5.9
SHD100RL-32	50.0	32 ± 15%	50 - 3000	112 ± 3dB	Sam. Cobalt	7.5	27.0	2.4
SHD150RF-32	50.0	32 ± 15%	30 - 4500	110 ± 3dB	Ferrite	9.5	40.0	18.5

AC BUZZERS

PART NUMBER	RATED VOLTAGE (VAC)	OPERATING VOLTAGE (VAC)	MAX. CURRENT (mA)	SOUND OUTPUT	TERMINAL TYPE	TONE MODE	FREQUENCY	OPERATING TEMPERATURE
BRP4549S-110-C	110	30-120	20	90 dB @ 30cm	2 Screw Lugs	Continuous	2900 ± 500Hz	-20° to +60°C
BRP4549S-240-C	240	60-250	20	90 dB @ 30cm	2 Screw Lugs	Continuous	2900 ± 500Hz	-20° to +60°C
BRP4549S-110-CP	110	30-120	10	80 dB @ 30cm	2 Screw Lugs	Intermitt: 0.8-1.2	2900 ± 500Hz	-20° to +60°C
BRP4549S-240-CP	240	60-250	10	80 dB @ 30cm	2 Screw Lugs	Intermitt: 0.8-1.2	2900 ± 500Hz	-20° to +60°C

SERIES BRP4549



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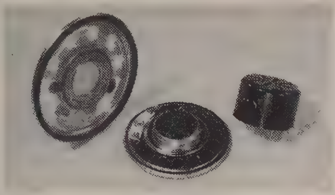
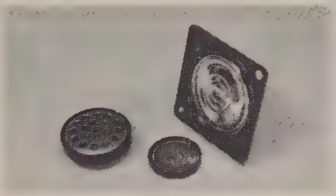
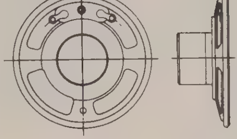


SPEAKERS



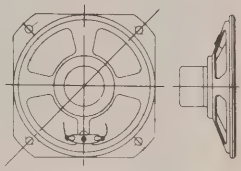
General Purpose Round
Alnico Magnet

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET WEIGHT (Ounces)	FRAME DEPTH (Inches)	FRAME DIAMETER (Inches)	NET WEIGHT (Ounces)
S100RA-M	0.1	8 ± 15%	600 ± 120	Fo - 6000	0.25	.539	1.10	0.44
S150RA	0.1	8 ± 15%	500 ± 100	Fo - 5200	0.35	.622	1.50	0.79
S175RA	0.1	8 ± 15%	470 ± 90	Fo - 5200	0.35	.653	1.75	0.87
S200RA	0.2	8 ± 15%	450 ± 90	Fo - 5000	0.35	.709	1.97	1.37
S225RA	0.2	8 ± 15%	400 ± 90	Fo - 5000	0.35	.748	2.24	1.41
S250RA	0.3	8 ± 15%	330 ± 90	Fo - 5000	0.35	.827	2.59	1.55
S275RA	0.3	8 ± 15%	280 ± 90	Fo - 5000	0.35	.858	2.76	1.62
S300RA	0.5	8 ± 15%	250 ± 90	Fo - 5000	0.35	.913	3.03	1.71
S350RA	1.0	8 ± 15%	190 ± 40	Fo - 12000	0.36	1.07	3.62	2.04
S400RA	1.0	8 ± 15%	180 ± 50	Fo - 20000	0.36	1.38	4.06	2.40



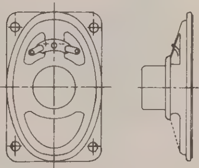
General Purpose Square
Alnico Magnet

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET WEIGHT (Ounces)	FRAME DEPTH (Inches)	FRAME DIAMETER (Inches)	NET WEIGHT (Ounces)	MOUNTING DIMENSIONS DIA. (Inches)
S175SA	0.1	8 ± 15%	470 ± 70	Fo - 4500	0.35	.630	1.77	0.91	1.988
S200SA	0.2	8 ± 15%	450 ± 90	Fo - 5000	0.35	.708	1.99	1.46	2.220
S250SA	0.5	8 ± 15%	350 ± 50	Fo - 5000	0.35	.843	2.62	1.65	2.894
S300SA	0.5	8 ± 15%	250 ± 50	Fo - 5000	0.35	.984	3.03	1.98	3.366
S350SA	1.0	8 ± 15%	190 ± 38	Fo - 12000	0.35	1.071	3.62	2.12	4.055
S400SA	1.0	8 ± 15%	180 ± 36	Fo - 20000	0.35	1.331	4.02	2.59	4.528



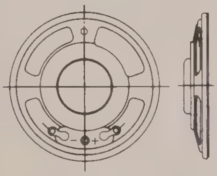
Oval Frame Alnico V Magnet

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET WEIGHT (Ounces)	FRAME DEPTH (Inches)	FRAME DIAMETER (Inches)	NET WEIGHT (Ounces)	MOUNTING DIMENSIONS (Inches)
S15X25VA	2.0	8 ± 15%	450 ± 90	Fo - 20000	0.41	1.161	1.61 x 2.79	1.95	1.315 x 2.496
S2X3VA	0.5	8 ± 15%	420 ± 84	Fo - 4000	0.34	0.980	1.89 x 2.82	1.59	1.49 x 2.24
S25X35VA	1.0	8 ± 15%	320 ± 64	Fo - 10000	0.35	1.094	2.48 x 3.57	2.09	1.85 x 3.031
S3X5VA	1.5	8 ± 15%	160 ± 32	Fo - 12000	0.59	1.547	3.03 x 4.92	3.26	2.56 x 3.56
S4X6VA	2.0	8 ± 15%	160 ± 32	Fo - 8000	0.60	1.858	3.94 x 5.91	4.93	3.15 x 4.33



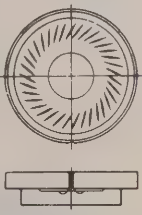
Low Profile Type
Rare Earth Samarium Cobalt Magnet

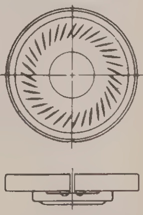
PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET WEIGHT (Ounces)	FRAME DEPTH (Inches)	FRAME DIAMETER (Inches)	NET WEIGHT (Ounces)
S125RL	0.1	8 ± 15%	680 ± 20%	Fo - 10000	0.056	.193	1.010	0.19
S150RL	0.1	8 ± 15%	550 ± 20%	Fo - 5000	0.056	.236	1.575	0.42
S150RLS	0.2	8 ± 15%	700 ± 20%	Fo - 5000	0.056	.315	1.496	0.37
S175RL	0.2	8 ± 15%	470 ± 20%	Fo - 4500	0.056	.327	1.752	0.42
S200RL	0.2	8 ± 15%	450 ± 20%	Fo - 4500	0.056	.354	1.969	0.50
S225RL	0.2	8 ± 15%	400 ± 20%	Fo - 4800	0.056	.378	2.244	0.53



Round Plastic Frame Types

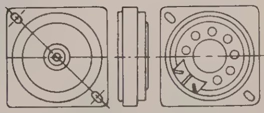
PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET TYPE	FRAME DEPTH (mm)	FRAME DIAMETER (mm)	NET WEIGHT (Grams)
SR800RMF	0.1	8 ± 15%	750 ± 150	Fo - 3000	Ferrite	6.0	20.0	7.4
S100RMF	0.1	8 ± 15%	800 ± 150	Fo - 5000	Ferrite	9.5	27.0	8.2
S125RMF	0.1	8 ± 15%	700 ± 150	Fo - 7000	Ferrite	9.8	29.0	8.3
S125RMFL	0.1	8 ± 15%	750 ± 150	Fo - 6000	Ferrite	6.2	29.0	8.2
S150RMF	0.1	8 ± 15%	350 ± 150	Fo - 3000	Ferrite	9.0	40.0	17.5
S150RMFS	0.1	8 ± 15%	550 ± 150	Fo - 3000	Ferrite	8.5	38.0	18.3
SR800RMS	0.1	8 ± 15%	750 ± 150	Fo - 5000	Sam. Cobalt	4.0	20.0	1.7
S100RMSS	0.1	8 ± 15%	550 ± 150	Fo - 5000	Sam. Cobalt	3.8	28.0	2.9
S150RMSS	0.1	8 ± 15%	550 ± 150	Fo - 5000	Sam. Cobalt	3.8	36.0	4.8


Ferrite


Cobalt

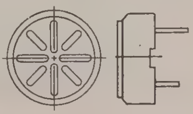
Square Plastic Frame Types

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET TYPE	FRAME DEPTH (mm)	FRAME DIAMETER (mm)	NET WEIGHT (Grams)	MOUNTING DIMENSIONS DIA. (mm)
S125SLA	0.1	8 ± 15%	550 ± 150	Fo - 7000	Sam. Cobalt	4.5	32.0	3.6	37.5
S150SLA	0.1	8 ± 15%	550 ± 150	Fo - 7000	Sam. Cobalt	4.5	40.0	6.0	46.8



P.C. Mount Speakers

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET TYPE	FRAME DEPTH (mm)	FRAME DIAMETER (mm)	NET WEIGHT (Ounces)	TERMINATION & SPACING
SR900R-PC	0.1	8 ± 15%	800 ± 150	Fo - 7000	Sam. Cobalt	10.0	23.0	0.127	2 Pin - 10mm



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Voice Coils from 4-100 Ohms. Commercial Sound Speakers also available.

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OTHER SPEAKER, MICROPHONE and HEADSET PRODUCTS

From the broad range of products we offer, it is likely we have exactly what your design calls for, eliminating the time and expense required for development. Should a custom design be necessary we can devise a solution to meet your requirement. For further information and Intervox product catalogs, contact our sales department.

All dimensions are in mm.

GENERAL PURPOSE & COMMERCIAL SPEAKERS

TYPE NUMBER	CONE DIAMETER & SHAPE	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	MAGNET MATERIAL	MAGNET WEIGHT (Oz.)
S500P3	5″ Pin Cushion	3	8	135~10,000	Ceramic	3
S500P6	5″ Pin Cushion	6	8	135~12,000	Ceramic	6
S525P3	5.25″ Pin Cushion	4	8	105~10,000	Ceramic	3
S525P6	5.25″ Pin Cushion	6	8	120~13,000	Ceramic	6
S525P10	5.25″ Pin Cushion	10	8	120~13,000	Ceramic	10
S650P3	6.5″ Pin Cushion	4	8	70~14,000	Ceramic	3
S650P6	6.5″ Pin Cushion	6	8	70~14,000	Ceramic	6
S6X9V3	6″ x 9″ Oval	3	8	80~10,000	Ceramic	3
S6X9V6	6″ x 9″ Oval	6	8	70~15,000	Ceramic	6
S6X9D10	6″ x 9″ Oval	15	8	70~15,000	Ceramic	10
S6X9C20	6″ x 9″ Oval	25	8	60~18,000	Ceramic	20
S6X9T20	6″ x 9″ Oval	25	8	60~20,000	Ceramic	20
S800R3	8″ Round	3	8	70~10,000	Ceramic	3
S800R6	8″ Round	6	8	70~10,000	Ceramic	6
S800C10	8″ Round	15	8	70~13,000	Ceramic	10
S800D10	8″ Round	15	8	70~12,000	Ceramic	10

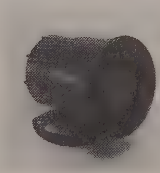
LOW LEAKAGE FLUX SPEAKERS

For Computer and Television Monitors

Low Leakage Flux Speakers are designed to prevent picture distortion as well as color shearing normally associated with magnetic fields. Intervox offers a wide range of these speakers with Alnico and Ferrite magnets in Oval, Square, and Round frames.

PART NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	RESONANT FREQUENCY (Hz)	FREQUENCY RESPONSE (Hz)	MAGNET WEIGHT (Ounces)	FRAME DEPTH (Inches)	FRAME DIAMETER (Inches)	NET WEIGHT (Ounces)
S20X35VF	5	8	200 ± 20%	Fo - 20k	0.6	1.70	1.69 x 3.49	6.6
S300RF	3	8	180 ± 20%	Fo - 20k	0.52	1.40	3.00	5.0

HORN SPEAKERS

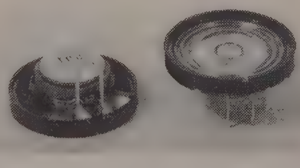


TYPE NUMBER	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)
5″	10W	8	180~13,000
5″ x 8″	25W	8	170~13,000
8″	25W	8	160~13,000
12″	35W	8	130~15,000

LOW PROFILE PC BOARD SPEAKERS

For Laptop Computers, Modems and Other Miniature Equipment

Unique square pin design permits uniform spacing for PC Board mounting.

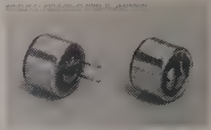


MICROPHONES

For Telecommunications, Intercom, Hearing Aid, Multi-Media, Speech Recognition, Computer, Security, Voice Activated Devices, Recording Equipment, Modems

ELECTRET CONDENSER

Omni
Directional



- Sensitivity: as low as -56dB
- Operating Voltage: 4.5V and 1.5V
- PIN and SMT Types
- Low Profile: 3.6mm
- Standard Height: 6.5mm

HAND HELD DYNAMIC

Omni and Unidirectional

- Lightweight
- Extremely Sensitive
- Noise Cancelling
- Natural Sound
- Wide Frequency Range

HEADPHONES

For Telecommunications, Digital, CD or Computer Sound

- Stereo and Mono
- Digital and Analog Design
- Wide Frequency Range: 20Hz -20KHz
- Volume Control Types
- Extra Long Cables
- SPL >100dB
- Ferrite or Samarium Cobalt (Rare Earth) Magnets
- Mylar Cones
- 40mm and 27mm
- Super Thin Lightweight
- Mike Types: Electret or Dynamic Boom

STEREO SPEAKER SYSTEMS

for Radio, Cassette, C.D., T.V., P.C. and Multimedia

With and Without Booster Amplifiers

- Digital Equipment Design
- High Quality Speakers
- Special Shielded Magnet Design prevents picture distortion or color shearing
- Volume Control Types
- Bass/Treble Control Types
- LED Indicators

INTERNATIONAL ELECTRO-MAGNETICS, INC.

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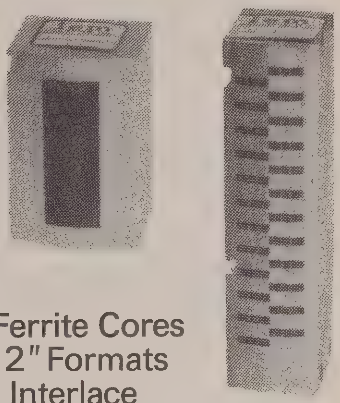
MAGNETIC RECORDING HEADS

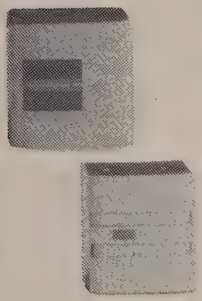
AUDIO MASTERING

- Tape and Film
- Standard Replacement
- Instrumentation Quality
- Custom Formats



ERASE

- Dual Gap Ferrite Cores
- Cassette—2″ Formats
- MultiTrack Interlace
- Full Track 1″ Video

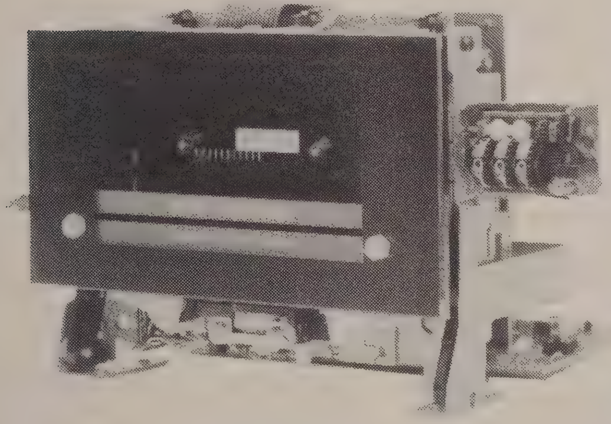


TIME CODE

- NeoPilot, FM, SMPTE
- Audio and Video
- Erase with Time Code
- High Wear Construction

MAGNETIC STRIPE

- High Wear Sendust
- High Coercivity
- Read/Write Combination



GR-8000 CASSETTE MECHANISM

- Auto-Reversing
- Full Remote Capability
- Infra-red Control Available
- Vertical Mount/Front Load

CUSTOM DESIGN AND PROTOTYPING

We have manufactured over 5,000 different head designs. If we don't have one to suit your requirements, we will design and prototype it quickly and economically. Our toolroom is well equipped to produce precision parts, and our design projects have included flux sensing systems, magnetic disk encoding, and electronic test equipment.

HEAD REPAIR SERVICE

- Electrical Test
- Microscopic Inspection
- Optical Alignment
- 24 Hour Turnaround

MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

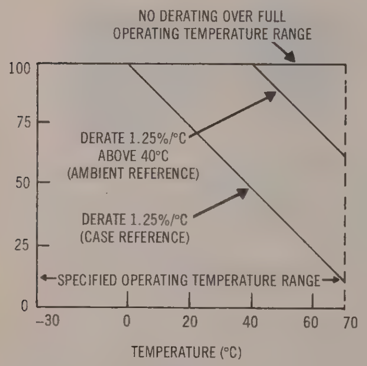


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

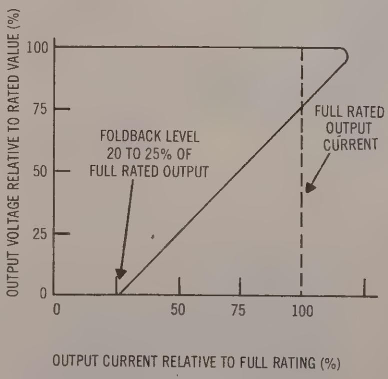


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

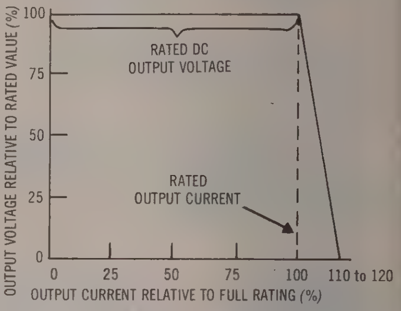


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

ISL PRODUCTS INTERNATIONAL LTD.

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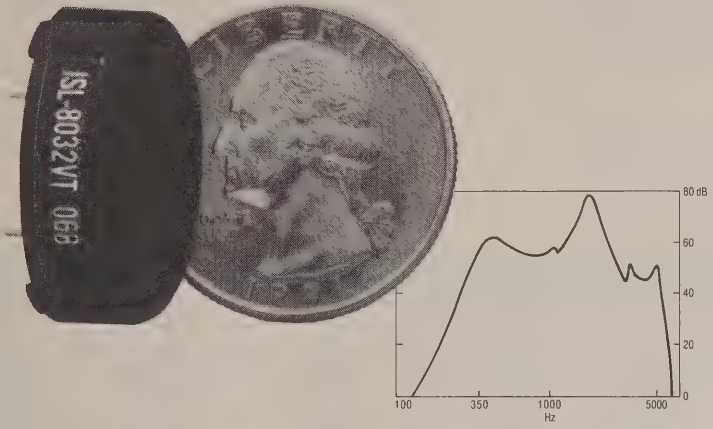
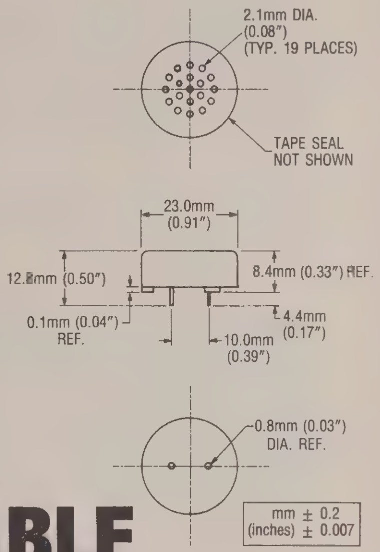
(516) 937-3475 FAX (516) 937-3840

CAPACITORS / SILICON DIODES / CUSTOM CABLE ASSEMBLIES / LEDS / CUSTOM HYBRID CIRCUITS / TRANSFORMERS / ADAPTORS AND POWER SUPPLIES





THE WAVESOLDERABLE MINIATURE SPEAKER FOR PC BOARDS

The ISL-8032VT adds voice or music to modems, laptops, telecommunications, toys, games...

Offering a 350 Hz to 5,000 Hz audio frequency response, this speaker can withstand wavesoldering temperatures of 245°C for 10 seconds or 260°C for 5 seconds plus chlorinated-solvent cleaning up to 10 minutes. It has a composite plastic body, epoxy bottom seal and foil-tape top seal and meets EIA/IS-49 Test Ta, Method 1A, 10 ±1 second.

SPECIFICATIONS

Usable frequency response: 350-5,000 Hz
Housing: Valox, UL94V-2
Impedance @ 1 kHz: 8 ohm ±15%
Resonant frequency: 2,000 Hz ±20%
Recommended operating power: 0.08 watts
Maximum input: 0.15 watts
Maximum throughput: 142 mA
Sound pressure level: 81 dB ±3 dB measured at 10 cm with a 1 kHz, 0.89 V input signal
Operating temperature range: -20 to +60°C
Storage temperature range: -30 to +70°C
Maximum processing temperature: 260°C up to 5 seconds; 240°C up to 10 seconds

ISL Products International Ltd., is an engineering/manufacturing company with facilities in New York and the Far East.

OTHER STANDARD AND CUSTOM AUDIO EQUIPMENT:

- Audible Alarms and Transducers
- Headphones
- Microphones
- Microphone Elements (Standard and Custom Design)
- Meters
- Speakers
- Audio Connectors
- Horns
- Potentiometers
- Transformers

See us in these sections also: 2100, 4750, 5600 & 6000

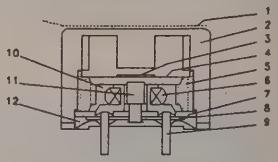
Audian™ **BUZZERS, HORNS SIRENS**

35 YEARS OF MANUFACTURING AUDIO COMPONENTS

Buzzers, Horns & Sirens - Piezo & Magnetic

Buzzers

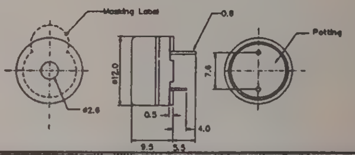
Japan Electronic offers a wide variety of audio transducers. We offer equivalents for most major brands. Our transducers are available in a assortment of sizes, pin configurations, wire leads, SPL and frequency. Please call for a complete listing.


1
2
3
4
5
6
7
8
9
10
11
12

JMB Series: ☆ TMB Equivelent

Magnetic Buzzer

Ultra small with built-in drive circuit


Masking Label
0.8
Potting
ø12.0
7.6
ø2.6
0.5
4.0
9.5
5.5

Model Number	JMB-01	JMB-03	JMB-05	JMB-09	JMB-12
Tone	Single	Single	Single	Single	Single
Operating Frequency (Hz)	2,300 ± 300	2,300 ± 300	2,300 ± 300	2,300 ± 300	2,300 ± 300
Rated Voltage (VDC)	1.5	3.0	5.0	9.0	12.0
Operating Voltage (VDC)	1.25-2.0	2.5-4.0	4.0-6.5	7.0-11.0	10.0-14.0
Sound Pressure Level (min)	75dB (min)	80dB (min)	85dB (min)	85dB (min)	85dB (min)
Current Consumption (mA)	30	30	30	30	30
Operating Temperature °C	-30≈+80	-30≈+80	-30≈+80	-30≈+80	-30≈+80
Weight (Gram)	2.4	2.4	2.4	2.4	2.4

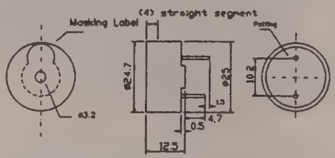
JDX Series:

Magnetic Transducer

☆ Equivalent

TMX Series

Pleasant Chime Sound

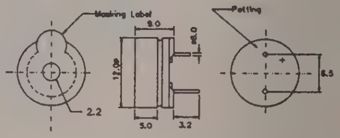

Masking Label
(4) straight segment
Potting
ø24.7
ø25
10.2
1.5
4.7
0.5
12.5
ø3.2

JBX Series

Magnetic Transducer

☆ Equivalent

QMX Series


Masking Label
Potting
9.0
ø6.0
12.0
6.5
2.2
5.0
3.2

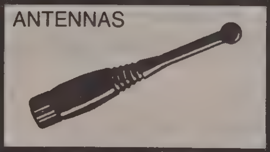
Model Number		JDX-06	JDX-06S	JDX-12S	JBX-05	JBX-12
Operating Frequency	(Hz)	730				
Reproduced Frequency	(Hz)		1,000≈1,500 min 80dB	1,000≈1,500 min 80dB	2,400 ± 300	2,400 ± 300
Rated Voltage	(VDC)	5	6	12	5.0	12.0
Coil Resistance	(Ω)	27±4	35±5	120±15	47±5	140±14
Operating Voltage	(VDC)	3-5	3-8	8-14	3-8	6-15
Sound Pressure Level	(dB)	Min 85	Min 85	Min 85	85dB (min)	85dB (min)
Rated Current	(mA)	Max 80	Max 75	Max 55	40	30
Operating Temperature	°C	-30≈+85	-30≈+85	-30≈+85	-30≈+80	-30≈+80
Weight	(Gram)	10	10	10	2.4	2.4

Related Products:

◆Custom Design & Engineering◆Raw Piezo Elements ◆Voice ROM◆Oscillation Circuitry
◆Audio transparent waterproof membranes◆Piezo speakers◆

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS

HEADPHONES / SETS



EOM
DYNAMIC
MICROPHONES

BUZZERS
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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

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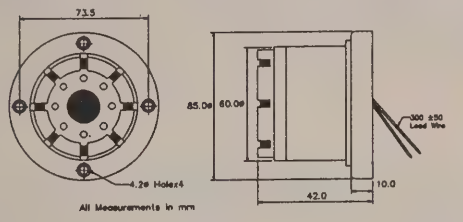
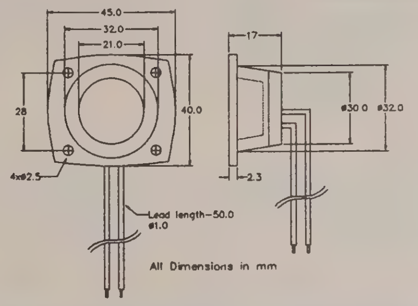
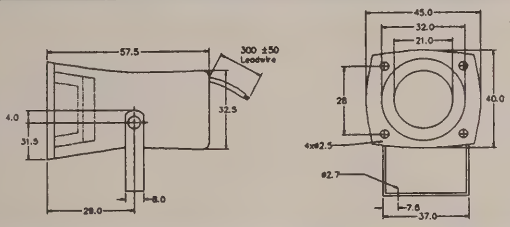
Sirens: LOUD! That's what our sirens are. Most come complete with oscillation circuitry and can be ordered with an assortment of duty cycles like pulse, warble, high/low, constant and even voice/siren combinations. This is just a sampling of the sirens offered. Please call so we may match the best product for your application.


73.5
85.0ø
60.0ø
300 ±50 Lead Wire
4.2ø Holex4
42.0
10.0
All Measurements in mm

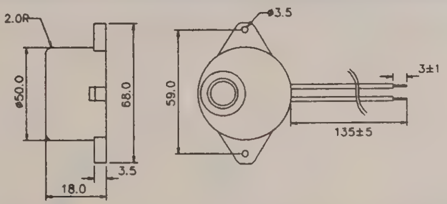
JP550 Series, 105dB, 12vdc, 100cm


45.0
32.0
21.0
17
28
40.0
ø30.0
ø32.0
4xø2.5
2.3
Lead length–50.0
ø1.0
All Dimensions in mm

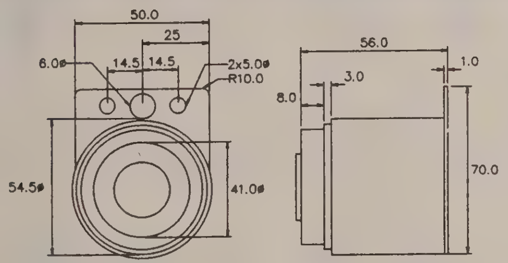
JP520A Sounder, 120dB. 12vdc, 100cm


57.5
300 ±50 Leadwire
4.0
31.5
32.5
28.0
8.0
45.0
32.0
21.0
28
40.0
4xø2.5
ø2.7
7.6
37.0

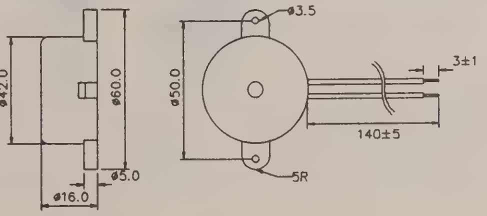
JP520A Folded Horn, 120dB. 12vdc, 100cm


2.0R
ø3.5
ø50.0
68.0
59.0
3±1
135±5
18.0
3.5

JP-580 Series, 100dB,. 12vdc, 100cm


50.0
25
6.0ø
14.5
14.5
2x5.0ø
R10.0
56.0
1.0
3.0
8.0
54.5ø
41.0ø
70.0

JP593, 115dB, 12vdc, 100cm

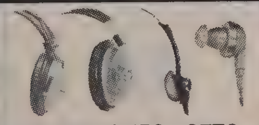

ø3.5
3±1
ø42.0
ø60.0
ø50.0
140±5
ø5.0
ø16.0
5R

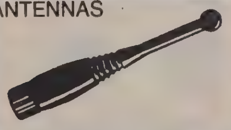
JP560 Series, 100dB, 12vdc, 100cm

Typical Electrical Specifications

Model Number	JP-550	JP-551	JP-552	JP-553
Tone	Constant	Pulsed	Hi-Low	Sweep
Operating Frequency	2.8±0.5	3.0±0.5	2.5-3.5	1.5-3.5
Operating Voltage (VDC)	7-15	7-15	7-15	7-15
Rated Voltage	12	12	12	12
Sound Pressure Level (min.)	105dB 12vdc	105dB 12vdc	105dB 12vdc	105dB 12vdc
Current Consumption (Max)12vdc	200	200	200	200
Sweep (pulse) Rate/at 12vdc(Hz)	-----	1.2±20%	1.2±20%	3.3±20%

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS


HEADPHONES / SETS

ANTENNAS


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MICROPHONES

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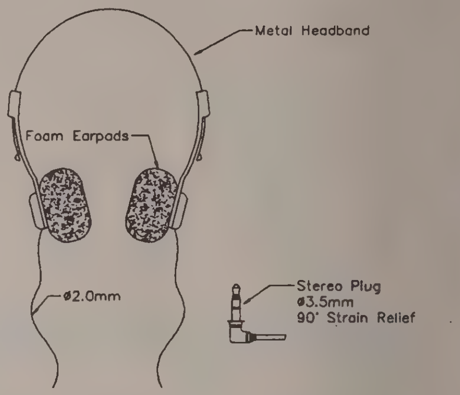
Headphones, Headsets and Earphones

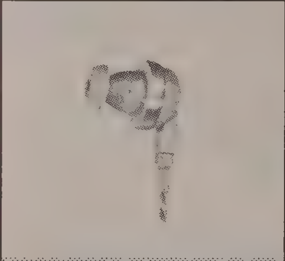
JEMA produces a complete line of OEM headphones, headsets and earphones to meet a broad range of performance criteria. JEMA serves audio communication applications configuring to:

- **Consumer**
- **Telecommunications**
- **Professional**
- **Military**
- **Airline**
- **Police and Security**

☆ *Custom Design capabilities*

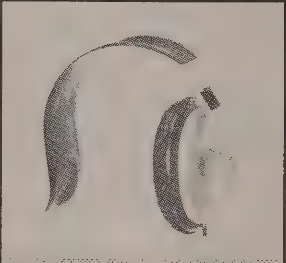


Consumer Grade Headphone

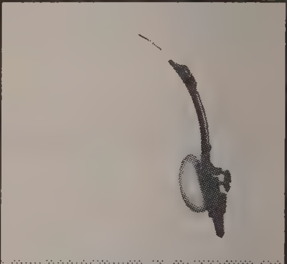


Earphones, Ear Mic
Style A

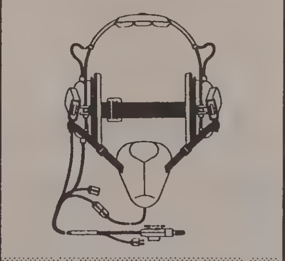
Headphones
Style B



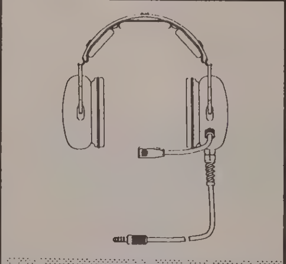
Headphones
Style C



Headphones
Style D



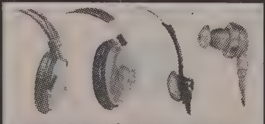
Military Headset
Style M-AF



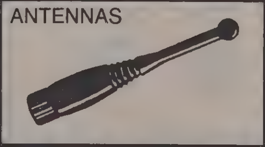
Military Headset
Style AV-P

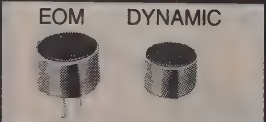
Related Products: ♦ Coiled Cords ♦ Foam Ear pads ♦ Audio Connectors ♦ Speakers ♦ Microphones

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS



HEADPHONES / SETS





MICROPHONES

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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

Audian™ MICROPHONES

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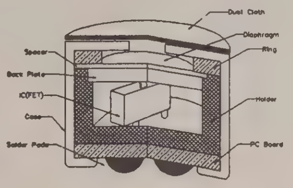
Audian Microphones - Electret, Condenser, Dynamic *(Omni & Uni)*

Electret Microphones

Japan Electronic offer a broad range of high-performance microphones designed for almost any sensitivity and application. Our microphones provide the best possible performance in each usage range, even in adverse conditions. Below is a listing of some of our most popular models. We have many models and if you don't see something for your application, please call.


Dust Cloth
Diaphragm
Ring
Spacer
Back Plate
IC(FET)
Case
Solder Pads
Holder
PC Board

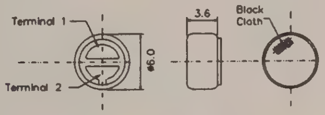
☆ *Custom Design Capabilities*

Omnidirectional Electret Condenser Microphone Cartridges: Sensitivity Ranges -58 to -70dB

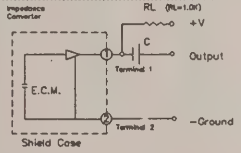
Fig.	JEMA Series Part #	Top Sensitivity -56 to...	Frequency Range	Operating Voltage Max/Std.	Current Consumption	Output Impedance	S/N Ratio	Physical Size(mm)	Directivity
A	JMS-70	-70dB ±2dB	50-12,000	2.0v/10v	500μA	1.7Ω±30%	<40dB	Ø6.0x3.6	Omni
E	JMP-70	-70dB ±2dB	30-16,000	4.5v/10v	600μA	2.2Ω±30%	<40dB	Ø9.4x6.5	Omni
D	JMT-70	-70dB ±2dB	30-16,000	4.5v/10v	600μA	2.2Ω±30%	<40dB	Ø9.4x6.5	Omni
D	JMT-70H	-70dB ±2dB	30-16,000	1.5v/10v	300μA	1.0Ω±30%	<40dB	Ø9.4x6.5	Omni
E	JMP-70H	-70dB ±2dB	30-16,000	1.5v/10v	300μA	1.0Ω±30%	<40dB	Ø9.4x6.5	Omni
B	JMT-768	-68dB ±2dB	30-16,000	4.5v/40v	800μA	2.2Ω±30%	<40dB	Ø9.7x6.5	Omni
C	JMT-7H64	-64dB ±2dB	30-16,000	1.5v/10v	300μA	2.2Ω±30%	<40dB	Ø9.7x6.5	Omni

Dimensions:

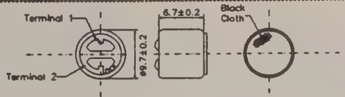
A ....


Terminal 1
Terminal 2
ø6.0
3.6
Black Cloth

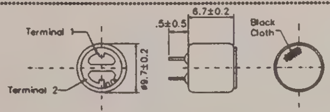
Circuit..........


Impedance Converter
RL (RL=1.0K)
+V
C
Output
Terminal 1
E.C.M.
Terminal 2
-Ground
Shield Case

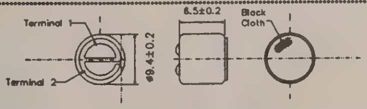
B..........


Terminal 1
Terminal 2
ø9.7±0.2
6.7±0.2
Black Cloth

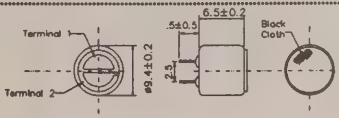
C ....


Terminal 1
Terminal 2
ø9.7±0.2
.5±0.5
6.7±0.2
Black Cloth

D ....

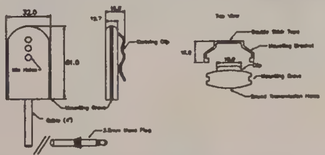

Terminal 1
Terminal 2
ø9.4±0.2
6.5±0.2
Black Cloth

E..........

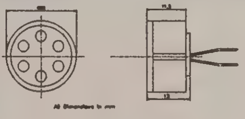

Terminal 1
Terminal 2
ø9.4±0.2
2.5
.5±0.5
6.5±0.2
Black Cloth

Dynamic Microphone Cartridges

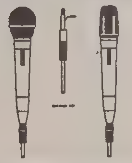
Model	JDM-143	JDM-107	JUM-108	JUM-102
Directional Characteristics	Omni-Directional	Omni-Directional	Omni-Directional	Omni-Directional
Frequency Response	80-10,000Hz	80-10,000Hz	80-12,000Hz	80-12,000Hz
Impedance	300Ω	300Ω	600Ω	600Ω
Sensitivity	-78dB ± 3dB	-78dB ± 3dB	-72dB ± 3dB	-70dB ± 3dB
Dimensions	26Ø x 13mm	22Ø x 17mm	29Ø x 23.5mm	29Ø x 39mm
Weight	19g	21g	30g	35g


32.0
Top View
Mic Holes
Mounting Clip
Double Side Tape
Mounting Bracket
Mounting Base
2.5mm Stereo Plug

Computer Multimedia Applications


All Dimensions in mm

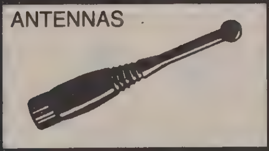
JDM-143 Cartridge



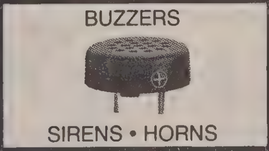
Complete Assemblies

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS

HEADPHONES / SETS



EOM
DYNAMIC
MICROPHONES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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

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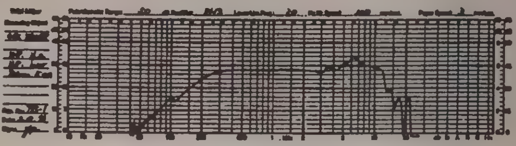
High Performance Speakers

Japan Electronic is the world's leading producer of standard and custom speakers. High performance for a wide range of applications.

♦ Headphones ♦ Computers ♦ Telephone ♦ Home Audio ♦ Mil Spec. ♦ Professional ♦ Noise Cancelling

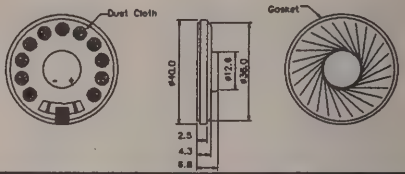


All speakers available from 4Ω-1000Ω

Speakers for Headphones

Cobalt Magnet

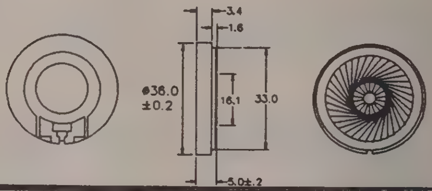
☆ **Custom Design Capabilities** for all speakers. We can fine tune for resonant frequency, overall response and impedance.



Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Power Input Max mW	Magnet Size mm	N.W. gr
JP-130C	13.5	6.5	32	150	16K	108	10	30	6.5x1.5	2.0
JP-15C	15.5	5.5	32	130	18K	110	10	50	6.5x1.5	2.0
JP-23C	23	5.5	32	160	18K	112	30	100	9.5x1.5	3.0
JP-27C	27	6	32	150	18K	120	40	100	9.5x1.5	5.0
JP-272C	27	6	32	150	20K	120	50	100	12.5x1.5	5.0
JP-28C	28	6.5	32	150	18K	105	50	100	9.5x1.5	3.40
JP-30C	30	6	32	140	20K	115	70	150	9.5x1.5	6.0
JP-302C	30	6	32	140	20K	118	70	150	12.5x1.5	5.8
JP-362C	36	5	32	360	5K	118	70	200	12.5x1.5	7.0
JP-40C	40	6.5	32	130	20K	105	70	200	9.5x1.5	6.6
JP-402C	40	6.5	32	130	20K	119	70	200	12.5x1.5	7.0
JP-503C	50	9	32	130	20K	113	100	200	12.5x1.5	15.0

Speakers for Digital Reproduction

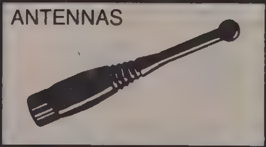
(Cobalt Magnet + Aluminum Coil)



Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Power Input Max mW	Magnet Size mm	N.W.
JP-302CW	30	6	40	120	20K	120	70	150	12.5x1.5	6.0
JP-342CW	34	4.8	32	110	20K	119	70	150	12.5x1.5	5.6
JP-362CW	36	5	40	120	20K	118	70	150	12.5x1.5	6.0
JP-40CW	40	5	40	130	20K	115	70	150	9.5x1.5	7.0
JP-402CW	40	5	40	130	20K	116	70	150	12.5x1.5	7.0
JP-442CW	40	8.2	32	120	20K	116	100	150	12.5x1.5	12.6
JP-503CW	50	9	32	110	20K	118	100	150	12.5x1.5	15.0

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS

HEADPHONES / SETS



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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

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Speakers for Tone Dialer

Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Max mW	Magnet Size mm	N.W.
JP-232F	23	5.5	100	260	3K	110	30	100	9.5x2	2.8
JP-282F	28	4.0	100	300	3K	104	70	100	9.5x2	3.0
JP-362F	36	5.0	100	360	5K	106	70	100	9.5x2	5.0

Speakers For Computer, Telephone, Alarm, Toy etc

Ferrite Magnet & Cobalt magnets

Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Max mW	Magnet Size mm	N.W.
JP-20F	20	9.2	8	700	5.8K	88	100	200	16x7x5	7
JP-203F	20	7.2	8	700	5.8K	88	100	200	16x7x3	5.2
JP-27FT	27	7.8	8	550	9K	82	100	200	12x3.8	7.0
JP-28FT	28	6.8	8	520	10K	86	100	200	21x12x3	7.2
JP-290F	29	9.5	8	700	4.5K	95	100	200	16x7x5	8.6
JP-29F	29	6.8	8	700	4.5K	90	100	200	21x7x3	8.6
JP-29FL	29	6.5	8	680	4K	92	100	200	21x7x2.5	7.4
JP-38FT	38	10	8	420	9K	87	100	200	27x17x3	18
JP-380F	38	11	8	550	9K	92	100	200	27x17x5	26
JP-40AL	40	16.8	8	240	8K	90	100	200	13x10	36.2
JP-401FL	40	5	8	250	3K	88	100	200	32x15x2	13.6
JP-403F	40	8	8	360	8K	90	100	200	32x15x3	20
JP-40FL	40	7.8	8	510	4.5K	93	100	200	27x17x3	13.6
JP-50FL	50	8	8	450	3K	92	100	200	32x15x3	20
JP-503F	50	9.5	8	400	4K	90	100	200	32x15x3	20.8

Super Thin Speakers

Metal Jackets, REM Magnets

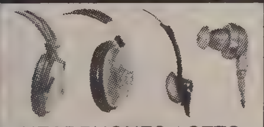
Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Max mW	Magnet Size mm	N.W.
JP-28CT	28	5.0	8	650	4.5K	79	100	150	9.5x1.5	5.0
JP-30CT	30	5.3	8	1000	10K	82	100	150	9.5x1.5	5.0
JP-360CT	36	5.8	8	560	4K	77	100	150	9.5x1.5	6.0
JP-36CT	36	4.5	8	450	7K	90	100	150	9.5x1.5	7.0
JP-362CT	36	4.5	8	480	7K	80	100	200	12.5x1.5	8.4
JP-40CT	40	6.0	8	540	5K	75	100	200	9.5x1.5	7.4
JP-402CT	40	6.0	8	540	5K	78	100	200	12.5x1.5	8.4

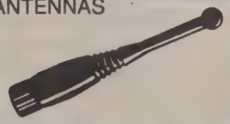
Printed Circuit Board Mountable Speakers

Model	Size Dia mm	Height mm	Imp. Ω	Resonant Freq. Hz	Freq. Range Hz(fo-)	Sensitivity dB(±3dB)	Power Input Nom mW	Max mW	Magnet Size mm	N.W.
JP-38FP	38	16	8	330		85	100	200	38	20
JP-/2308	23	12.4	8	1100		81	70	150	20	4.0
JP-/2908	29.8	17	8	1200		85	100	200	27	9.2

Related Products: ♦Speaker Dust Cloth, Die Cut to Size ♦ Audio Transparent Vapor Barrier (Wet or Humid applications)♦ Coiled microphone Cords ♦Metal Grills & wire mesh coverings

OTHER QUALITY JEMA AUDIO AND RF COMPONENTS


HEADPHONES / SETS

ANTENNAS


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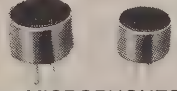
MICROPHONES

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JEMA 1000 SKOKIE BLVD., WILMETTE, IL 60091

SUPER THIN SPEAKERS

27RT

38RT

38RMT

40RT

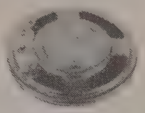
40RMT

50RT

45RMT

45RT

40RT3


40RT2

50RMT

50RMT2

57RMT

57RT

Model No.	Nominal Diameter mm	Resonant Frequency Hz	Frequency Range Hz	Max. Power W	Total Height mm	Magnet Weight g (Oz)	Net Weight g (Oz)
27RT	27	700	F_0-5000	0.1	6.1	0.7 (0.025)	5.4 (0.19)
38RT	38	700	F_0-5000	0.1	8	2.7 (0.056)	10.4 (0.37)
38RMT	38	600	F_0-5000	0.1	8	1.6 (0.056)	10.4 (0.37)
40RT	40	700	F_0-5000	0.1	8	1.6 (0.056)	11.3 (0.4)
40RMT	40	600	F_0-5000	0.1	8	1.6 (0.056)	11.3 (0.4)
40RT2	40	500	F_0-5000	0.1	6.7	1.6 (0.056)	12.2 (0.43)
40RT3	40	600	F_0-5000	0.1	7.4	0.7 (0.025)	8.2 (0.29)
45RT	45	500	F_0-4500	0.1	8.3	1.6 (0.056)	11.8 (0.42)
45RMT	45	500	F_0-4500	0.1	8.3	1.6 (0.056)	11.8 (0.42)
50RT	50	450	F_0-4500	0.2	9	1.6 (0.056)	14.1 (0.50)
50RMT	50	450	F_0-4500	0.2	9	1.6 (0.056)	14.1 (0.50)
50RMT2	50	450	F_0-3500	0.2	6.7	1.6 (0.056)	15 (0.53)
57RMT	57	400	F_0-4000	0.2	9.6	1.6 (0.056)	15 (0.53)
57RT	57	400	F_0-4000	0.2	9.6	1.6 (0.056)	15 (0.53)

RMT Series are Mylar Cone Type

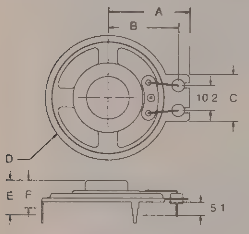
STANDARD MODELS ARE 8-OHM. OTHER VALUES ARE AVAILABLE UPON REQUEST.

PC BOARD MOUNTED MINIATURE SPEAKERS

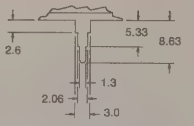
NEW

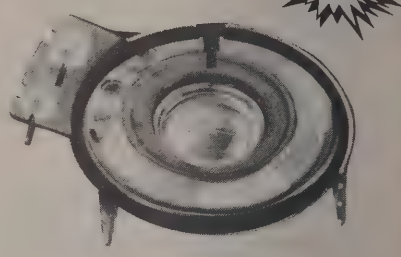
ALL MODELS ARE COVERED UNDER TAIWAN PATENT NO: 65728
U.S. PATENT PENDING SUMMER 1992

OG SERIES: ROUND SHAPE, METAL FRAME

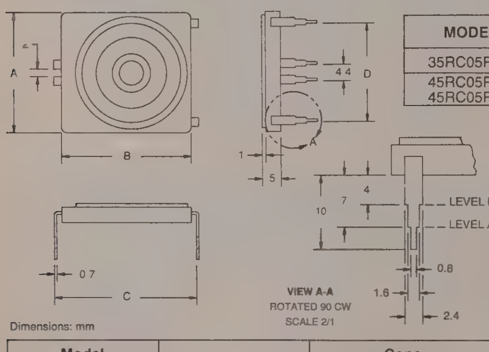


MODEL	A	B	C	D	E	F
OG38PC	26.4	21.8	19.6	38	13.7	10.9
OG50PC	33	28.4	19.1	50	14.2	11.4

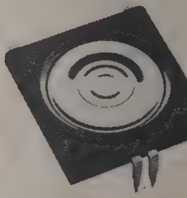


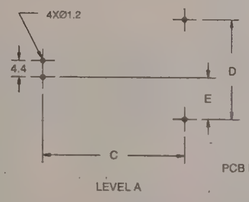


RC SERIES: RECTANGULAR SHAPE, PLASTIC FRAME

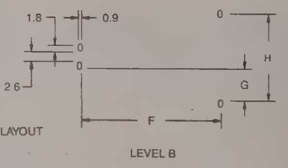


MODEL	A	B	C	D	E	F	G
35RC05PC	32	35	38.3	26.6	37.4	24.8	9.3
45RC05PC1 45RC05PC2	40	43	46.3	32.6	45.4	30.8	12.3





PCB LAYOUT



Dimensions: mm

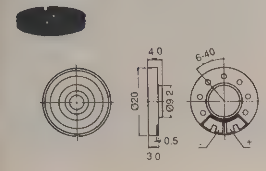
Model No.	Shape	Cone Type	Max Power	Nominal Diameter	Resonant Frequency	Frequency Range	Total Height	Total Weight
OG38PCWP2	Round	Waterproof Paper	0.2 W	38 mm	700 Hz	Fo 5000 Hz	8.7 mm	12 gr
OG38PCWP5	Round	Waterproof Paper	0.5 W	38 mm	700 Hz	Fo 5000 Hz	8.7 mm	12 gr
OG38PCMC2	Round	Mylar	0.2 W	38 mm	700 Hz	Fo 5000 Hz	8.7 mm	12 gr
OG38PCMC5	Round	Mylar	0.5 W	38 mm	700 Hz	Fo 5000 Hz	8.7 mm	12 gr
OG50PCWP2	Round	Waterproof Paper	0.2 W	50 mm	450 Hz	Fo 5000 Hz	9.2 mm	16 gr
OG50PCWP5	Round	Waterproof Paper	0.5 W	50 mm	450 Hz	Fo 5000 Hz	9.2 mm	16 gr
OG50PCMC2	Round	Mylar	0.2 W	50 mm	450 Hz	Fo 5000 Hz	9.2 mm	16 gr
OG50PCMC5	Round	Mylar	0.5 W	50 mm	450 Hz	Fo 5000 Hz	9.2 mm	16 gr
35RC05PC	Rectangular	Mylar	0.3 W	32 × 35	800 Hz	Fo 3500 Hz	5 mm	5.6 gr
43RC05PC1	Rectangular	Mylar	0.3 W	40 × 43	580 Hz	Fo 3500 Hz	5 mm	7.8 gr
43RC05PC2	Rectangular	Mylar	0.3 W	40 × 43	600 Hz	Fo 3500 Hz	5 mm	7.2 gr

NOTES: (1) Standard Models are 8 OHMS Impedance. Other values are available upon request.
(2) Total height is measured without the PC Board pins.

LZR *electronics, inc.* 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

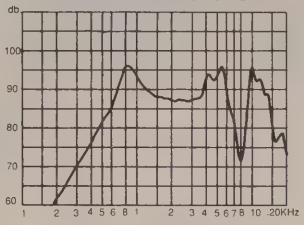
MINIATURE SPEAKERS

PN: 20R04

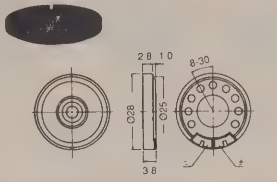

4 0
6-40
Ø20
Ø9 2
0.5
3 0
-
+

Housing: ABS Plastic

FREQUENCY RESPONSE

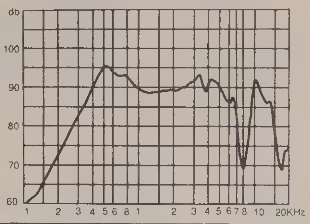


PN: 28R04

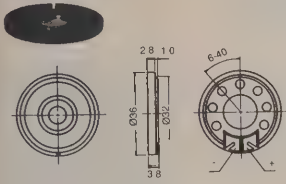

2 8 1 0
8-30
Ø28
Ø25
3 8
-
+

Housing: ABS Plastic

FREQUENCY RESPONSE

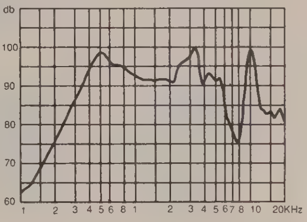


PN: 36R04

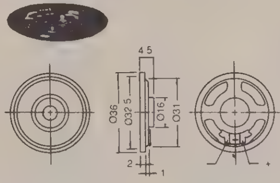

2 8 1 0
6-40
Ø36
Ø32
3 8
-
+

Housing: ABS Plastic

FREQUENCY RESPONSE

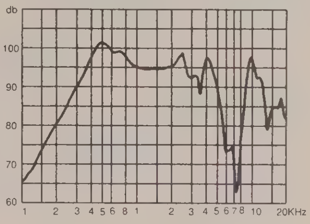


PN: 36R045F

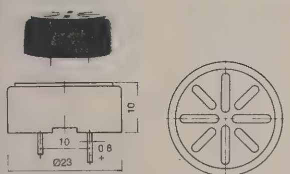

4 5
Ø36
Ø32 5
Ø16
Ø31
2
1
-
+

Housing: Iron

FREQUENCY RESPONSE

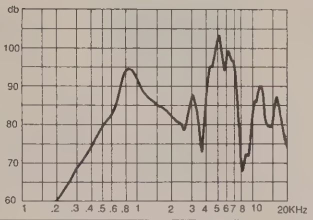


PN: 23RPC01
PC Board Mount



Housing: ABS Plastic

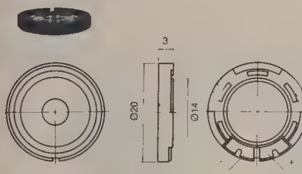
FREQUENCY RESPONSE



NOTES:

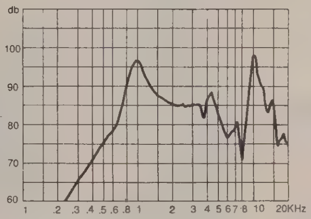
(1) Frequency Response Curves are plotted with 0.1 watt input, sine wave, at 10 cm distance.
(2) Impedance can be varied per customer requirements.
(3) Dimensions are in:mm

PN: 20R0332

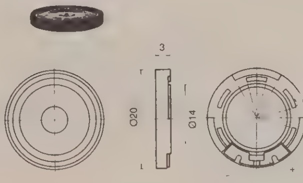


Housing: ABS Plastic

FREQUENCY RESPONSE

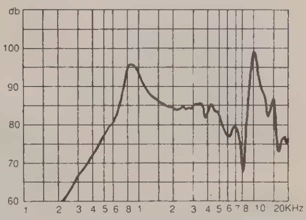


PN: 20R0364

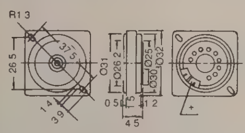


Housing: ABS Plastic

FREQUENCY RESPONSE

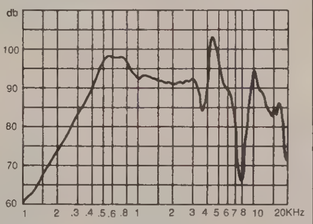


PN: 32S045
Square with Mounting Holes

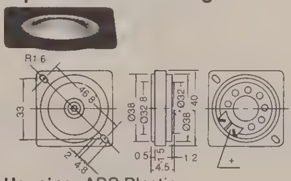

R1 3
26 5
37 5
Ø31
Ø26 2
Ø25
Ø30
Ø32
0 5
1 5
1 2
4 5
1 4
3 9
+

Housing: ABS Plastic

FREQUENCY RESPONSE

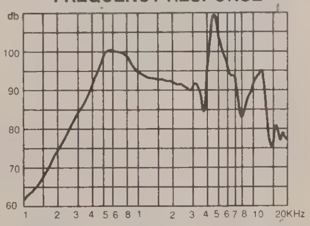


PN: 40S045
Square with Mounting Holes


R1 6
33
46 8
Ø38
Ø32 8
Ø32
Ø38
40
0 5
1 5
4.5
1 2
2 4
4 8
+

Housing: ABS Plastic

FREQUENCY RESPONSE



SPECIFICATIONS

Model No.	DIA mm	Height mm	Impedance ohms	Rated Power Watt	Max. Power Watt	Sound Level dB/WM	Resonant Freq. FO-HZ	Frequency Range FO-HZ	Weight grams
20R04	20	4	8 ± 15%	0.1	0.2	78 ± 3	750 ± 150	5000	1.7
28R04	28	3.8	8 ± 15%	0.1	0.2	80 ± 3	550 ± 150	5000	2.9
36R04	36	3.8	8 ± 15%	0.1	0.2	82 ± 3	550 ± 150	5000	4.8
36R045F	36	4.5	8 ± 15%	0.1	0.2	85 ± 3	500 ± 150	5000	7.8
23RPC01	23	10	8 ± 15%	0.1	0.2	89 ± 3	800 ± 150	3500	3.6
20R0332	20	3	32 ± 15%	0.1	0.2	76 ± 3	950 ± 150	5000	1.5
20R0364	20	3	64 ± 15%	0.1	0.2	75 ± 3	850 ± 150	5000	1.5
32S045	32 square	4.5	8 ± 15%	0.1	0.2	80 ± 3	550 ± 150	7000	3.6
40S045	40 square	4.5	8 ± 15%	0.1	0.2	82 ± 3	550 ± 150	7000	6.0

LZR *electronics, inc.*
8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301)921-9440 Fax (301)670-0436
LZR

GENERAL SPEAKERS

50F

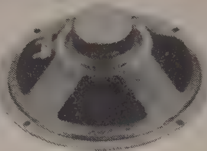
57F

70F

77F

92F

100F-02


200F

160F-01

120F-01

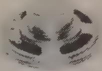
FERRITE MAGNET SPEAKERS, 8-OHM

MODEL NO.	NOMINAL SIZE Cm (INCH)	STYLE	RESONANT FREQUENCY Hz	FREQUENCY RANGE Hz	MAX. POWER W	MAGNET WT. g (Oz)	FLUX DENSITY GAUSS	TOTAL HEIGHT mm (INCH)	MOUNTING DIA. mm (INCH)	NET WT. g (Oz)
50F	5 (2)	ROUND	450	F_0-4500	0.2	16.9(0.6)	6300	17.2	–	52.3(1.84)
57F	5.7 (2¼)	ROUND	400	F_0-4000	0.2	16.9(0.6)	6300	18	–	53.5(1.89)
66F	6.6 (2½)	ROUND	360	F_0-4000	0.3	16.9(0.6)	6300	20	–	57.5(2.03)
70F	7 (2¾)	ROUND	300	F_0-4000	0.5	16.9(0.6)	6300	20.6	–	60(2.12)
77F	7.7 (3)	ROUND	250	F_0-4500	0.5	16.9(0.6)	6300	22.3	–	62(2.19)
87F	8.7 (3¼)	SQUARE	200	F_0-10000	0.5	16.9(0.6)	6300	29	100	74.3(2.62)
92F	9.2 (3½)	ROUND	200	F_0-10000	1	16.9(0.6)	6300	26.2	–	72(2.54)
100F-01	10 (4)	SQUARE	190	F_0-10000	1	16.9(0.6)	6300	33.5	114	86(3.10)
100F-02	10 (4)	SQUARE	180	F_0-10000	2	46.2(1.7)	8500	30.5	115	106.5(5.94)
100F-03	10 (4)	SQUARE	160	F_0-12000	3	80(2.8)	10300	36.5	117	255(8.99)
120F-01	12 (5)	PIN CUSHION	140	F_0-12000	3	48.2(1.7)	8500	43.7	119	187(6.601)
120F-02	12 (5)	PIN CUSHION	140	F_0-12000	5	80(2.8)	10300	43.7	119	267(9.42)
160F-01	16 (6½)	PIN CUSHION	90	F_0-12000	3	46.2(1.7)	8500	54	156	250(8.82)
160F-02	16 (6½)	PIN CUSHION	90	F_0-13000	6	80(2.8)	103000	56	156	334(11.8)
200F	20 (8)	ROUND	80	F_0-12000	6	80(2.8)	10300	65	195	425(14.9)

ALNICO MAGNET SPEAKERS, 8-OHM

27R

45R


50R

57R

66R

87S

100S

MODEL NO.	NOMINAL SIZE Cm (INCH)	STYLE	RESONANT FREQUENCY Hz	FREQUENCY RANGE Hz	MAX. POWER W	MAGNET WT. g (Oz)	FLUX DENSITY GAUSS	TOTAL HEIGHT mm (INCH)	MOUNTING DIA. mm (INCH)	NET WT. g (Oz)
27R	2.7 (1)	ROUND	800	F_0-6000	0.1	7.1(0.25)	5200	14	–	14.4(0.51)
40R	4 (1½)	ROUND	600	F_0-5000	0.1	9.9(0.35)	5500	15.8	–	23.5(0.83)
45R	4.5 (1¾)	ROUND	470	F_0-4500	0.1	9.9(0.35)	5500	16.6	–	24.7(0.87)
50R	5 (2)	ROUND	450	F_0-4500	0.2	9.9(0.35)	6300	18.3	–	39(1.38)
57R	5.7 (2¼)	ROUND	400	F_0-4000	0.2	9.9(0.35)	6300	19.2	–	40.5(1.43)
66R	6.6 (2½)	ROUND	350	F_0-4000	0.3	9.9(0.35)	6300	21	–	44(1.55)
70R	7 (2¾)	ROUND	300	F_0-4000	0.5	9.9(0.35)	6300	21.6	–	46(1.62)
77R	7.7 (3)	ROUND	250	F_0-4500	0.5	9.9(0.35)	6300	23.2	–	48.5(1.71)
87S	8.7 (3¼)	SQUARE	200	F_0-10000	0.5	9.9(0.35)	6300	30	100	62(2.19)
92R	9.2 (3½)	ROUND	200	F_0-10000	1	9.9(0.35)	6300	27.2	–	58.7(2.07)
100S	10 (4)	SQUARE	190	F_0-10000	1	9.9(0.35)	6300	36	114	73.5(2.59)

SPECIAL TYPE SPEAKERS

57RH

57FH-01

AAP-J7739

MINI FULL-RANGE SPEAKER, 8-OHM

MODEL NO.	NOMINAL SIZE Cm (INCH)	RESONANT FREQUENCY Hz	FREQUENCY RANGE Hz	MAX. POWER W	MAGNET WT. g (Oz)	FLUX DENSITY GAUSS	DIAMETER mm (INCH)	DEPTH mm (INCH)	MOUNTING DIA. mm (INCH)	NET WT. g (Oz)
57RH	5.7(2¼)	220	F_0 ~ 10000	0.5	9.9(0.35)	6300	57(2¼)	21.7(27/32)	—	42 (1.48)
57FH-01	5.7(2¼)	220	F_0 ~ 10000	1	27.2(0.96)	7000	57(2¼)	23.5(15/16)	—	90.5(3.19)
77RH	7.7(3)	220	F_0 ~ 20000	1	9.9(0.35)	6300	77(3)	26.3(1 1/32)	—	49.5(1.75)
AAP-J7739	7.7(3)	220	F_0 ~ 20000	2	27.2(0.96)	7000	77(3)	27.5(1 5/64)	—	100(3.53)

WATER-PROOF SPEAKERS

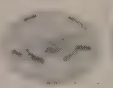
STANDARD MODELS ARE 8-OHM.

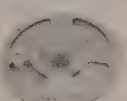
27RM

38RM

45RM

50RM


57RM


66RM

70RM

ABM-7745

BDM-1060

BDM-8760

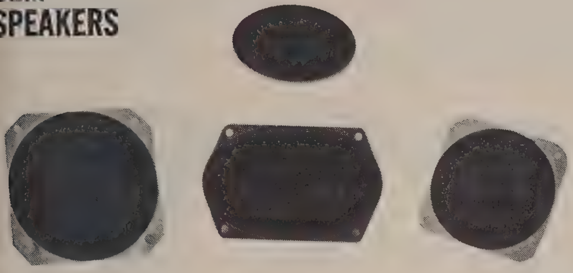
MYLAR CONE SPEAKER

MODEL NO.	NOMINAL SIZE Cm(INCH)	STYLE	RESONANT FREQUENCY Hz	FREQUENCY RANGE Hz	MAX. POWER W	MAGNET WT. g(Oz)	FLUX DENSITY GAUSS	TOTAL HEIGHT mm(INCH)	MOUNTING DIA. mm(INCH)	NET WT. g(Oz)
27RM	2.7(1)	ROUND	600	F_0 ~ 6000	0.1	7.1(0.25)	5500	13.7(35/64)	—	12.6(0.44)
38RM	3.8(1½)	ROUND	600	F_0 ~ 6000	0.1	9.9(0.35)	5600	15.8(⅝)	—	22(0.78)
45RM	4.5(1¾)	ROUND	500	F_0 ~ 4500	0.2	9.9(0.35)	5600	16.6(21/32)	—	24.7(0.87)
50RM	5 (2)	ROUND	450	F_0 ~ 5000	0.2	9.9(0.35)	6300	18(11/16)	—	38.8(1.37)
57RM	5.7(2¼)	ROUND	400	F_0 ~ 4000	0.2	9.9(0.35)	6300	19(¾)	—	40(1.41)
66RM	6.6(2½)	ROUND	350	F_0 ~ 4500	0.3	9.9(0.35)	6300	21(53/64)	—	43(1.52)
70RM	7(2¾)	ROUND	350	F_0 ~ 8000	0.5	9.9(0.35)	6300	21.8(⅞)	—	46(1.62)
ABM-7745	7.7(3)	ROUND	500	F_0 ~ 10000	3	48.2(1.7)	8500	29.2(1⅛)	85.5(3⅜)	150(5.29)
BDM-8760	8.7(3¼)	SQUARE	550	F_0 ~ 8500	12	80(2.8)	8500	35.5(1⅜)	100(3⅞)	280(9.88)
BDM-1060	10(4)	SQUARE	500	F_0 ~ 6000	12	80(2.8)	8500	38.5(1½)	117(4 9/16)	295(10.4)

LZRelectronics,inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

MG SPEAKERS & HORNS — FOR OEM OR DISTRIBUTOR

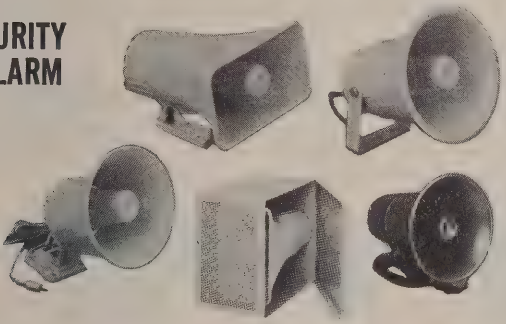
OEM SPEAKERS



- ☐ COMMUNICATIONS
- ☐ COMPUTER APPLICATIONS
- ☐ INTERCOM SYSTEMS
- ☐ ELECTRONIC TOYS AND GAMES

MG's wide range of miniature speakers are available in sizes from 1″ to 4″, round or square. Voice coil impedances range from 3.2 to 100 ohms. Magnets are available in ferrite and alnico V.

SECURITY & ALARM



- ☐ HORNS AND SIRENS FOR PROTECTION AND SIGNAL SYSTEM APPLICATIONS

MG's paging, signaling horns, and electronic sirens all designed with built in drivers and available in sizes from 5″ to 12″. All constructed with heavy duty ABS or aluminum housings.

MG offers a wide range of high quality loudspeaker products for hundreds of industrial and commercial applications at competitive pricing. Speakers are "manufactured to your specifications" and available in OEM quantities. A broad range of options in configuration, voice coil impedance, magnet type and weight, and cone finish can be specified.

We also maintain a huge "off the shelf" raw speaker inventory of hundreds of assorted speaker types and sizes from 1″ to 18″. — Call us for availability.

LOW PROFILE MINIATURE SPEAKERS, BUZZERS & TRANSDUCERS

- ☐ TELEPHONE SYSTEMS
- ☐ MODEMS
- ☐ ALARMS
- ☐ KEYBOARD APPLICATIONS

These miniature thin line speakers produce a clean and natural sound. The wide frequency response make these speakers ideal for a broad range of O.E.M. applications.

GENERAL PURPOSE & COMMERCIAL SOUND SPEAKERS

- ☐ BACKGROUND MUSIC
- ☐ PUBLIC ADDRESS AND PAGING
- ☐ SOUND COLUMNS
- ☐ AUTOMOTIVE
- ☐ COMMUNICATIONS AND GENERAL REPLACEMENT APPLICATIONS

Paging horns are available in a wide range of sizes from 5″ to 12″, in plastic or aluminum housings. Speakers are available in single cone, dual cone and coaxial types in sizes from 4″ to 8″. All 8″ speaker baskets are prestamped for easy transformer mounting. A wide variety of voice coil sizes and magnet weights are available.

MG ELECTRONICS

32 RANICK ROAD • HAUPPAUGE, N.Y. 11788
(516) 582-3400 Telex: 64-5113 FAX #516-582-3229

Loudspeaker Technology---Only From MISCO®

Designed and Made in U.S.A.

The following information is excerpted from MISCO's complete literature package. Contact the factory or your Rep for more complete information.

WATERPROOF LOUDSPEAKERS FOR TOUGH ENVIRONMENTS

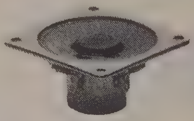
- Rugged steel basket with a zinc dichromate finish
- A solid aluminum voice coil for higher power handling & protection against humidity
- Cones are constructed of vinyl impregnated cloth to withstand actual immersion, direct sunlight, and temperature extremes
- MISCO's patented "Sealed-Linear" magnet circuit yields new levels of linearity, energy utilization & voice coil protection
- All standard and non-standard impedances available

Environmental Specifications

Ambient Operating Temperature: -67°F (-55°C) to +185°F (+85°C)

Water Resistance: Total immersion for 96 hours without deterioration of sound quality

*Voice Coil Protection: Voice Coil area protected from ferrous and non-ferrous particles by SEALED-LINEAR Design

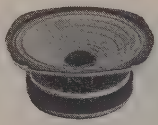

A2WP
A2RWP(Round)
AC2RWP (Round)

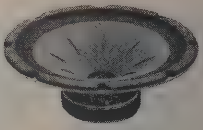
AC22WP
AC3WP
DC3WP
DC22WP

DC32WP

DC4WP

EC5WP EC54WP
Full Range


JC6WP
Full Range


JC8WP
Full Range

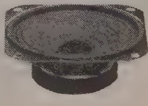
Specifications

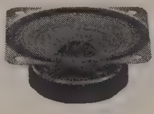
Model	Size/Shape	Magnet Weight Ounces	Program Watts	RMS Watts	Mounting Diameter Inches	Depth Inches	Rated Impedance	Frequency Response	Sensitivity above .0002 Dynes/CM^2
A2WP	2" Square	.53 Alnico	6	3	2-3/8	15/16	8	450 to 4KHz	82 dB
A2RWP	2" Round	.53 Alnico	6	3	-	15/16	8	450 to 4KHz	82 dB
AC2RWP	2" Round	.70 Ceramic*	6	3	-	7/8	8	450 to 4KHz	82 dB
AC22WP	2-1/2" Square	.70 Ceramic*	8	4	2-15/16	1-1/8	8	300 to 6KHz	84 dB
DC22WP	2-1/2" Square	2.5 Ceramic*	8	4	2-15/16	1-5/32	8	300 to 6KHz	88 dB
AC3WP	3" Square	.70 Ceramic*	8	4	3-3/8	1-3/16	8	250 to 7KHz	83 dB
DC3WP	3" Square	2.5 Ceramic*	8	4	3-3/8	1-7/32	8	250 to 7KHz	87 dB
DC32WP	3-1/2" Square	2.5 Ceramic*	8	4	3-7/8	1-5/16	8	195 to 7KHz	91 dB
DC4WP	4" Square	2.5 Ceramic*	8	4	4-11/16	1-13/32	8	180 to 6KHz	93 dB
EC5WP	4" Pin Cushion	3.0 Ceramic*	12	6	4-11/16	1-23/32	8	120 to 8KHz	92 dB
EC54WP	5-1/4" Pin Cushion	3.0 Ceramic*	12	6	5-1/2	1-7/8	8	110 to 8KHz	92 dB
JC6WP	6" Pin Cushion	10.0 Ceramic*	30	15	6-3/16	2-3/8	8	110 to 8KHz	95 dB
JC8WP	8" Round	10.0 Ceramic*	30	15	7-5/8	2-13/16	8	50 to 8KHz	94 dB

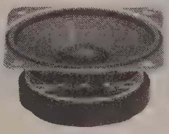
HIGH INTELLIGIBILITY GENERAL PURPOSE LOUDSPEAKERS

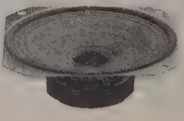
- Greater power handling by using larger magnets, special adhesives, and high temperature voice coils
- High efficiency and intelligibility from curvilinear cones
- Shielded Ceramic Magnets available on all sizes
- MISCO's patented "SEALED-LINEAR" magnet circuit in all ceramic models yields new levels of linearity, energy utilization and voice coil protection
- All standard and non-standard impedances available

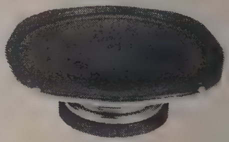
Miniature OEM
Style Speakers


A22S AC22S
DC22S


A3S AC3S
DC3S


A32S DC32S


A4S DC4S


EC5S EC6S

Specifications

Model	Size/Shape	Magnet Weight Ounces	Program Watts	RMS Watts	Mounting Diameter Inches	Depth Inches	Rated Impedance (Ohms)	Frequency Response	Sensitivity above .0002 Dynes/CM^2
A22S	2-1/2"Square	.53 Alnico	8	4	2-15/16	1-3/16	8	260 to 8 KHz	84 dB
AC22S	2-1/2" Square	.70 Ceramic*	8	4	2-15/16	1-1/8	8	260 to 8 KHz	84 dB
DC22S	2-1/2" Square	2.5 Ceramic*	12	6	2-15/16	1-5/32	8	260 to 8 KHz	89 dB
A23S	2" x 3" Oval	.53 Alnico	8	4	2 x 3-3/4	1-5/32	8	250 to 8 KHz	84 dB
AC23S	2" x 3" Oval	.70 Ceramic	8	4	1-1/2 x 2-7/8	1	8	400 to 10 KHz	86 dB
DC26S	2" x 6" Oval	2.5 Ceramic*	12	6	1-7/8 x 4-3/4	1-5/8	8	260 to 8 KHz	83 dB
A3S	3" Square	.53 Alnico	8	4	3-3/8	1-1/4	8	250 to 8 KHz	87 dB
AC3S	3" Square	.70 Ceramic*	8	4	3-3/8	1-3/16	8	250 to 8 KHz	87 dB
DC3S	3" Square	2.5 Ceramic*	12	6	3-3/8	1-7/32	8	250 to 8 KHz	92 dB
A32S	3-1/2" Square	.53 Alnico	8	4	3-7/8	1-11/32	8	220 to 10 KHz	88 dB
DC32S	3-1/2" Square	2.5 Ceramic*	12	6	3-7/8	1-5/16	8	220 to 10 KHz	93 dB
A35S	3" x 5" Oval	.53 Alnico	8	4	2-9/16 x 3-9/16	1-17/32	8	200 to 10 KHz	88 dB
DC35S	3" x 5" Oval	2.5 Ceramic*	12	6	2-9/16 x 3-9/16	1-1/2	8	200 to 10 KHz	93 dB
A4S	4" Square	.53 Alnico	8	4	4-11/16	1-7/16	8	140 to 9 KHz	83 dB
DC4S	4" Square	2.5 Ceramic*	12	6	4-11/16	1-13/32	8	140 to 9 KHz	88 dB
EC5S	5" Pin Cushion	3.0 Ceramic*	12	6	4-11/16	1-23/32	8	120 to 8 KHz	92 dB
EC6S	6" Pin Cushion	3.0 Ceramic*	12	6	6-3/16	2	8	70 to 11 KHz	92 dB

ADDITIONAL DESIGNS ENGINEERED FOR ALL APPLICATIONS

MISCO also manufactures loudspeakers for Intercom, Waterproof Intercom, Commercial Sound, Automotive, and Custom Designed O.E.M. Applications. MISCO can build hundreds of special design speakers to meet your exact requirements without special tooling or set-up charges. Please specify frame size, powerhandling, impedance, magnet type, and the application for which the speaker will be used. MISCO engineers will do the rest. **CALL • FAX • OR WRITE**

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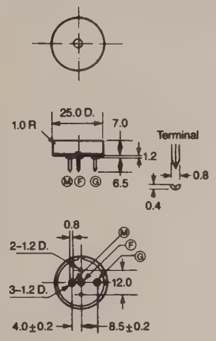
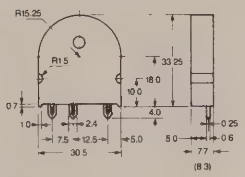
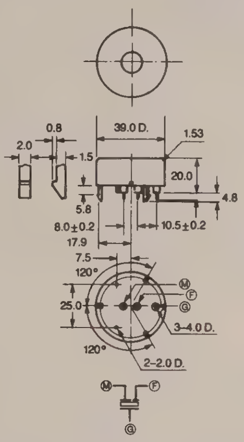
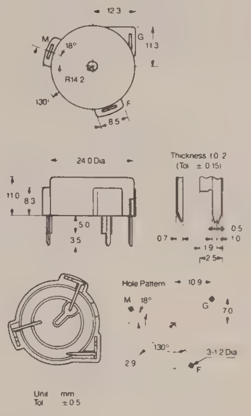
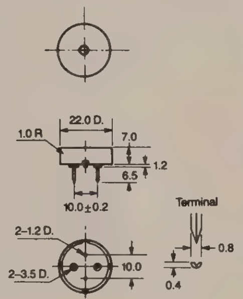
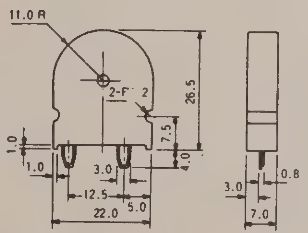
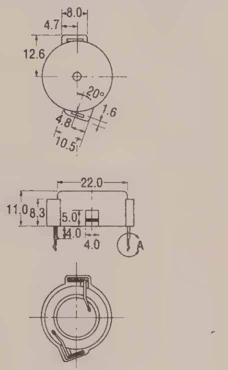
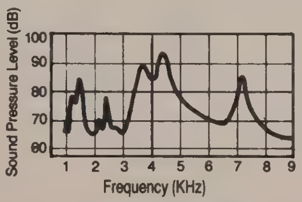
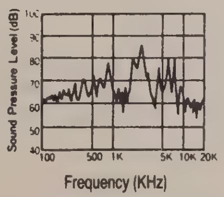
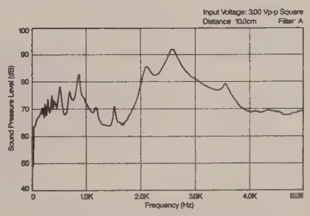
piezoelectric audio alarms

MURATA ERIE NORTH AMERICA

ENCASED PIEZO-ALARMS SELF-DRIVE (no internal circuitry)

Part Number	PKM25-6A0	PKM30SPT-2001	PKM29-3A0	PKM24SP-3805
Sound Pressure Level	85dB min./6.5VDC/10cm	75dB min./12VDC/10cm	85dB min./9VDC/1m	90dB min./12VDC/10cm
Oscillating Frequency	6.8±0.7KHz (6.5VDC)	2.0±0.3KHz (9VDC)	3.40±0.4KHz (9VDC)	3.8±0.4KHz (12VDC)
Current	10mA max.	20mA max.	20mA max.	12mA max.
Operating Voltage	3 to 20VDC	3 to 20VDC	4.5 to 15VDC	3 to 20VDC
Operating Temp. Range	-20°C to +70°C	-20°C to +70°C	-20°C to +70°C	-20°C to +70°C
Storage Temp. Range	-30°C to +80°C	-30°C to +80°C	-30°C to +80°C	-30°C to +80°C
DIMENSIONS: (mm)				

ENCASED PIEZO-ALARMS EXTERNAL DRIVE (no internal circuitry)

Part Number	PKM22EPP-4001	PKM22EPT-2001	PKM22EP-2001
Sound Pressure Level	70dB min. (3Vp-p square wave 10cm, 4KHz)	70dB min. (3Vp-p square wave 10cm, 2.0KHz)	75dB min. (3Vp-p, square wave, 10cm, 2.0KHz)
Current	1.0mA max.	2.0mA max.	2.5mA max.
Capacitance	12000pF±30% (1KHz)	19000pF±30% (1KHz)	17,000pF±30%
Max. Input Voltage	30Vp-p	25Vp-p	25Vp-p
Operating Temp. Range	−20°C to +70°C	-20°C to +70°C	−20°C to +70°C
Storage Temp. Range	−30°C to +80°C	-30°C to +80°C	−40°C to +80°C
DIMENSIONS: (mm)			
SOUND PRESSURE LEVEL VS. INPUT VOLTAGE	 Input Voltage: Square Wave 3Vp-p Measuring Distance: 10cm	 Input Voltage: Square Wave 9Vp-p Measuring Distance: 30cm	 Input Voltage: Square Wave 9Vp-p Measuring Distance: 30cm

piezoelectric acoustic alarms

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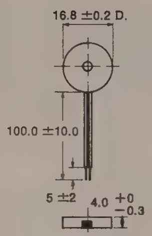
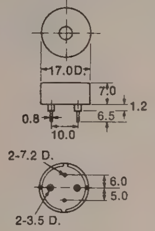
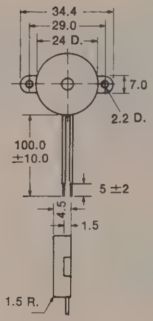
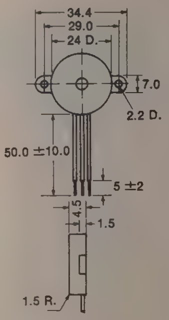
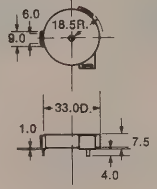
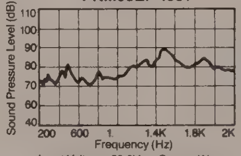
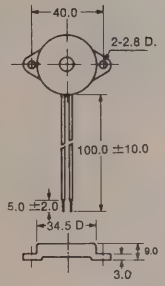
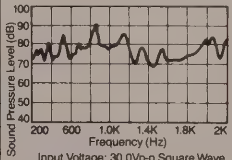
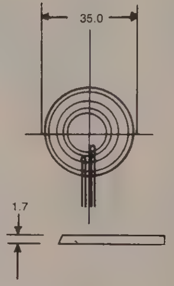
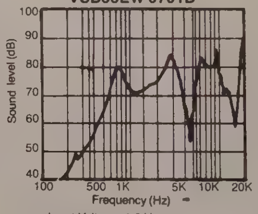
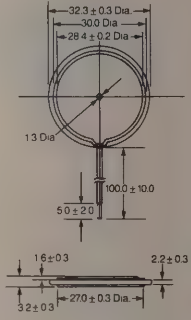
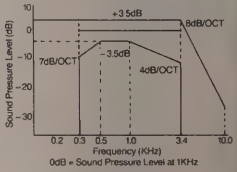
Miniature Encased Piezo-Alarms

Part Number	**PKM35-4A0**	**PKM17EPP-4001**	**PKM11-4A0**	**PKM11-6A0**
Input Voltage	3Vp-p square wave	3Vp-p square wave	3Vp-p square wave	3 to 15VDC
Sound Pressure Level	75dB min. (10cm from source)	72dB min. (10cm from source)	75dB min. (10cm from source)	75dB min. (10cm from source)
Current	1mA max.	1mA max.	1mA max.	4mA max. (3VDC in.)
Capacitance	9500pF ±30% (1KHz)	7000pF ±30% (1KHz)	10000pF ±30% (1KHz)	—
Max. Input Voltage	25Vp-p	20Vp-p	25Vp-p	—
Lead Wire	32 AWG UL-1685	—	30 AWG UL-1571	30 AWG UL-1571
DIMENSIONS: (mm)	 16.8 ±0.2 D. 100.0 ±10.0 5 ±2 4.0 +0 −0.3	 17.0D. 7.0 1.2 0.8 6.5 10.0 2-7.2 D. 6.0 5.0 2-3.5 D.	 34.4 29.0 24 D. 7.0 2.2 D. 100.0 ±10.0 5 ±2 4.5 1.5 1.5 R.	 34.4 29.0 24 D. 7.0 2.2 D. 50.0 ±10.0 5 ±2 4.5 1.5 1.5 R.

Piezo Ringers for Low Frequency Applications

Part Number	**PKM33EP-1001**	**PKM34EW-1101**	**VSB35EW-0701B**	**PKD33EW-01R**
Sound Pressure Level	70dB min./50cm/20Vp-p square wave at 1.0KHz	70dB min./1m/30Vp-p square wave at 1.1KHz	70, ±5dB at 1KHz, 1Vrms Sine wave at 10 cm	
Allowable Input	30Vp-p max.	40Vp-p max.	4 Vrms max.	
Operating Temp. Range	−30°C to +70°C	−20°C to +70°C	−20°C to +70°C	−20°C to +70°C
Storage Temp. Range	−40°C to +80°C	−30°C to +80°C	−30°C to +80°C	−30°C to +70°C
Lead Wire		30 AWG UL-1571	32 AWG, UL-1685	30AWG (UL-1571)
DIMENSIONS: (mm)	 6.0 9.0 18.5R. 33.0D. 1.0 7.5 4.0 **SOUND PRESSURE LEVEL VS. FREQUENCY CHARACTERISTICS** **PKM33EP-1001**  Input Voltage: 20.0Vp-p Square Wave Distance : 50.0cm	 40.0 2-2.8 D. 100.0 ±10.0 5.0 ±2.0 34.5 D 9.0 3.0 **PKM34EW-1101**  Input Voltage: 30.0Vp-p Square Wave Distance : 1m	 **VSB35EW-0701B**  Input Voltage: 1.0 Vrms Sine Distance: 10 cm	 32.3 ± 0.3 Dia. 30.0 Dia 28.4 ± 0.2 Dia 1.3 Dia 100.0 ± 10.0 5.0 ± 2.0 1.6 ± 0.3 2.2 ± 0.3 3.2 ± 0.3 27.0 ± 0.3 Dia.  0dB = Sound Pressure Level at 1KHz

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Acoustic Elements

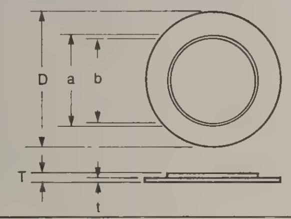
FEATURES

- Extremely clear penetrating sound
- Completely solid state
- One-tenth the power consumption of a comparable electromechanical buzzer
- No electronic noise generation
- Compact size and lightweight
- Variety of models for various tone functions

APPLICATIONS

- Fire alarms
- Gas detectors
- Calculators
- Medical electronics
- Appliances
- Burglar alarms
- Automobiles
- Aircraft
- Clocks
- Watches
- Communications systems
- Data processing
- Instrument and control systems
- Restaurant equipment
- Recreational equipment

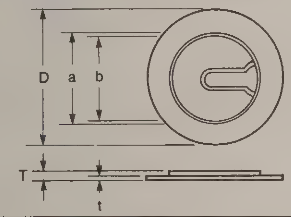
EXTERNAL DRIVE (without feedback electrode)



Part Number	Characteristics (*1, *2)			Dimensions: mm				
	Resonant frequency (KHz)	Resonant resistance (Ω)	Capacitance (pF)±30%	D	a or c	b	T	t
7BB-20-6	6.3±0.6	≤350	10000	20.0±0.2	14.0±0.6	12.8±0.2	0.42±0.1	0.20±0.05
7BB-27-4	4.6±0.5	≤200	20000	27.0±0.2	19.7±0.6	18.2±0.2	0.54±0.1	0.30±0.05
7BB-35-3	2.8±0.5	≤200	30000	35.0±0.2	25.0±0.6	23.0±0.2	0.53±0.1	0.30±0.05
7BB-41-2	2.2±0.3	≤250	30000	41.0±0.2	25.0±0.6	23.0±0.2	0.63±0.1	0.40±0.05
7NB-41-25DM-1	.85±.25	≤300	75000	41.0±0.2	25.0±0.5	23.0±0.2	0.21±0.5	0.10±0.03
—	—	—	—	—	—	—	—	—

*1 Insulation resistance 100MΩmin. (at 100VDC)
*2 Maximum applied voltage 30Vp-p

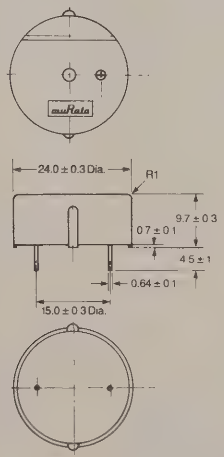
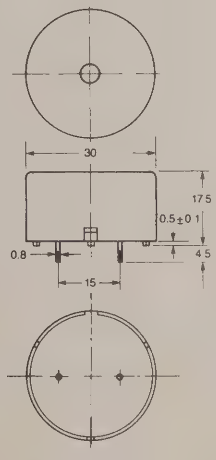
SELF-DRIVEN (with feedback electrode)



Part Number	Characteristics (*1, *2)			Dimensions: mm				
	Resonant frequency (KHz)	Resonant resistance (Ω)	Capacitance (pF)±30%	D	a	b	T	t
7BB-20-6C	6.3±0.6	≤500	8500	20.0±0.2	14.0±0.6	12.8±0.2	0.42±0.1	0.20±0.05
7BB-27-4C	4.6±0.5	≤200	18000	27.0±0.2	19.7±0.6	18.2±0.2	0.54±0.1	0.30±0.05
7BB-35-3C	2.8±0.5	≤200	24000	35.0±0.2	25.0±0.6	23.0±0.2	0.53±0.1	0.30±0.05
7BB-41-2C	2.2±0.3	≤250	24000	41.0±0.2	25.0±0.6	23.0±0.2	0.63±0.1	0.40±0.05
7SB-34R7-3C	3.3±0.3	≤150	40000	34.7±0.2	25.0±0.6	23.4±0.2	0.50±0.1	0.25±0.05
7SB-34R7-3C2	3.1±0.5	≤160	24000	34.7±0.2	25.0±0.6	23.0±0.2	0.50±0.1	0.25±0.05

Concentric circuit feedback electrode type for Molex housing ATM7373.

ENCASED PIEZO-ALARMS WITH INTERNAL CIRCUITRY

Part Number	**PKB24SPC-3601**	**PKB30SPC-2001**
Sound Pressure Level	90dB min./10cm/12V	75dB min./1m/12V
Oscillating Frequency	3.6±0.5KHz	2.0±.4KHz
Operating Voltage	3.0 to 15.0 VDC	3.0 to 15 VDC
Operating Temp. Range	−20°C to +70°C	−20°C to +70°C
Diameter	24.0±0.3	30.0±0.3
Height	9.7±0.3	17.5±0.3
Pin Pitch	15.0±0.3	15.0±0.3
Pin Diameter	0.64±0.1	0.8±0.1
DIMENSIONS: (mm)		

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OHMITE®

PIEZO AUDIO INDICATORS

Manufacturing Company

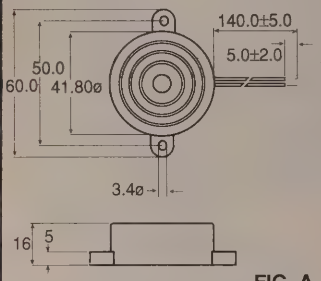

140.0±5.0
5.0±2.0
50.0
60.0
41.80ø
3.4ø
16
5

FIG. A

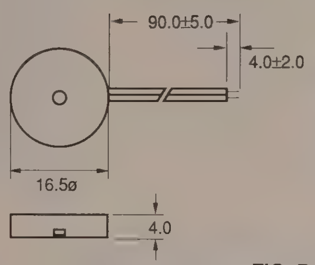

90.0±5.0
4.0±2.0
16.5ø
4.0

FIG. B

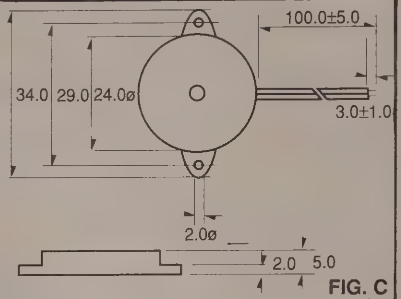

100.0±5.0
34.0
29.0
24.0ø
3.0±1.0
2.0ø
2.0
5.0

FIG. C

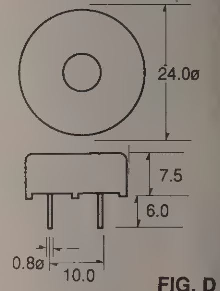

24.0ø
7.5
6.0
0.8ø
10.0

FIG. D

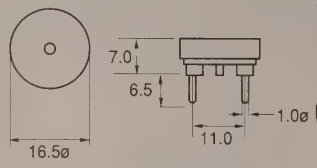

7.0
6.5
1.0ø
11.0
16.5ø

FIG. E

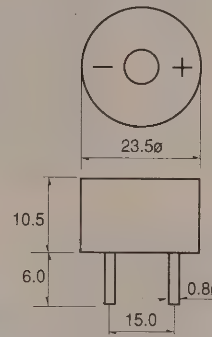

−
+
23.5ø
10.5
6.0
0.8ø
15.0

FIG. F

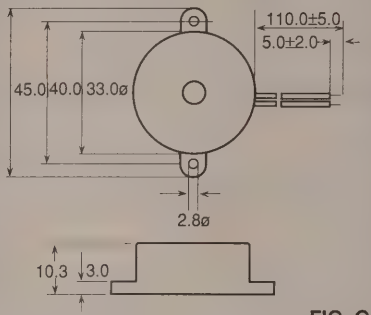

110.0±5.0
5.0±2.0
45.0
40.0
33.0ø
2.8ø
10.3
3.0

FIG. G

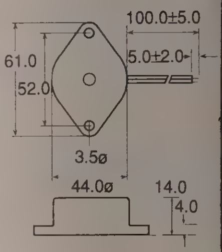
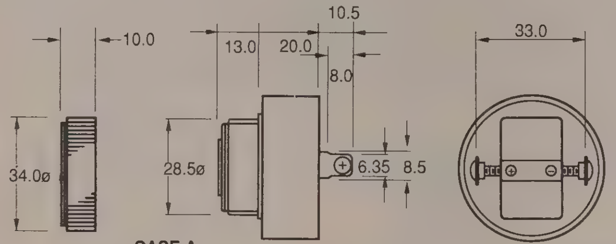
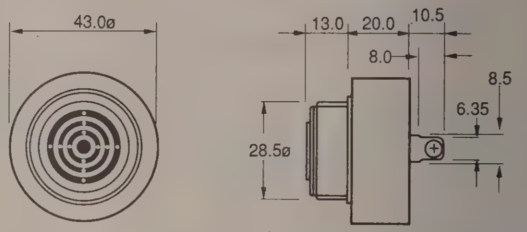

100.0±5.0
5.0±2.0
61.0
52.0
3.5ø
44.0ø
14.0
4.0

FIG. H


10.0
10.5
13.0
20.0
8.0
33.0
34.0ø
28.5ø
6.35
8.5

CASE A

FIG. K


43.0ø
13.0
20.0
10.5
8.0
8.5
6.35
28.5ø

▲ CASE A

FIG. L

All dimensions in millimeters. 1.0"=25.4mm

Part No. OMT#	Osc. Freq. ± 500hz	Operating Voltage	Sound Pressure	Current Ma Max.	Tone	Mallory Part No.	Murata Part No.	Star Part No.	FIG.
Panel Mount									
OMT650S	2900	4-28	70-85	4-18	Continuous	SC 628	—	—	K
OMT651S	2900	6-28	70-85	4-18	Fast Pulse	SC 628P	—	—	K
OMT653S	2900	6-28	70-85	4-18	Slow Pulse	SC 628J	—	—	K
OMT655S	2900	6-28	70-85	4-18	Cont. + Fast	SC 616PU	—	FMB-628	K
OMT610SN	2900	30-120	70-95	4-18	Continuous	SC 110	—	—	L
OMT611SN	2900	30-120	70-95	4-18	Fast Pulse	SC 110P	—	—	L
OMT635SN	2900	30-120	70-95	4-18	Slow Pulse	—	—	—	L
Flange Mount									
OMT350	2700	3-28	91	8	Continuous	—	PKB5-3AO	—	A
OMT350L	2700	3-20	97	10	Continuous	—	PKB5-3BO	—	A
PC Mount									
OMT202L	3000	3-20	95	1.0	Continuous	—	PKB8-4AO (lower frequency)	—	F
OMT222	3400	3-20	84	1.0	Continuous	—	PKB-24SPC-3601	—	F
External Drive Piezo Ceramic									
OMT110	4100	30	90@4.1Khz	1.0	Continuous	—	PKM11-4AO	SEC-2437L	C
OMT112	4000	30	90@4.1Khz	1.0	Continuous	—	PKM22EPP-4001	SEC-2437P	D
OMT150	5000	25	82@5.0Khz	1.0	Continuous	—	PKM35-4AO	—	B
OMT152	5000	25	80@5.0Khz	1.0	Continuous	—	PKM17EPP-4001	—	E
Piezo Ringers									
OMT140	1100	30	86@1.1Khz	1.2	Continuous	—	PKM34EW-1101	—	G
OMT142	750	50	87@750Hz	1.2	Continuous	—	PKM44EW-1001A	—	H

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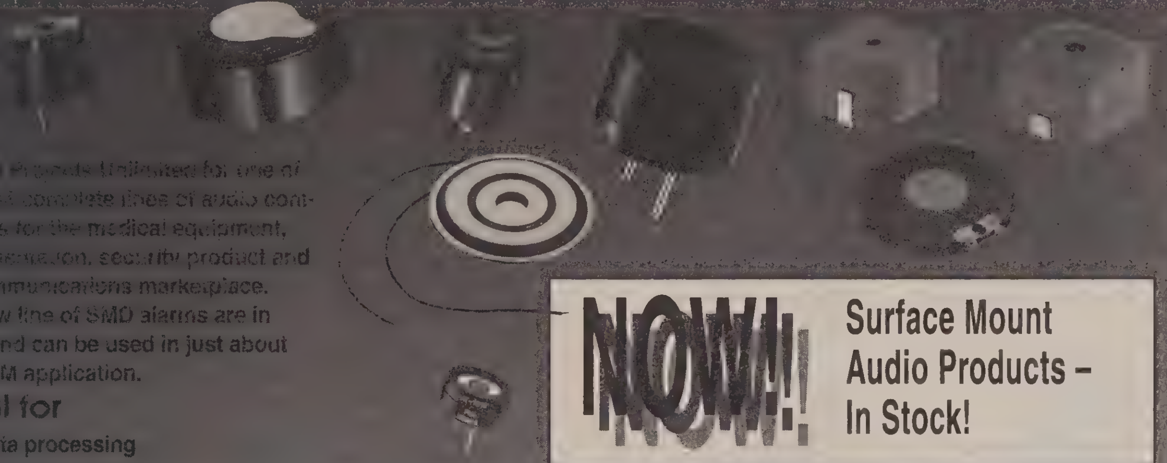

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- Modems
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  - AC Operated Transducers
  - Output of 85 dBA or better
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force

Quam Loudspeakers: The Sound Decision

For Industrial, Intercom and Outdoor Applications

MODEL NUMBER OT-Outdoor	SIZE (inches) AND SHAPE CM-Corner Mount PC-Pincushion RD-Round SQ-Square	FREQUENCY RESPONSE (Hertz)	POWER HANDLING CAPACITY (Watts) FOR PROPERLY ENCLOSED SPEAKERS	VOICE COIL IMPEDANCE (Ohms)	VOICE COIL DIAMETER (inches)	MAGNET MATERIAL AND WEIGHT (Ounces) AV-Alnico V BF-Ceramic	DEPTH (inches)	SHIPPING WEIGHT (Lbs.)
2A05	2RD	300HZ to 6K HZ	1	3 - 4	9/16	.52AV	7/8	1/4
2A05Z8	2RD	300 HZ to 6K HZ	1	8 - 10	9/16	.52AV	7/8	1/4
2A05Z45	2RD	300 HZ to 6K HZ	1	45	9/16	.52AV	7/8	1/4
22A05Z8	2 1/4 RD	300 HZ to 10K HZ	1	8 - 10	9/16	.52AV	1	1/4
22A05Z100	2 1/4 RD	300 HZ to 10K HZ	1	100	9/16	.52AV	1	1/4
23A05	2x3 Oval CM	250 Hz to 15K Hz	1	3 - 4	9/16	.52AV	1 1/8	1/4
23A05Z8	2x3 Oval CM	250 Hz to 15K Hz	1	8 - 10	9/16	.52AV	1 1/8	1/4
25A07	2 1/2 SQ	130 HZ TO 14K HZ	1 1/2	3 - 4	9/16	.65AV	1 1/4	1/4
25A07Z8	2 1/2 SQ	150 Hz to 12K Hz	1 1/2	8	9/16	.65AV	1 1/4	1/4
25A0Z45	2 1/2 SQ	150 Hz to 12K Hz	1 1/2	45	9/16	.65AV	1 1/4	1/4
25C1Z80T	2 1/2 SQ	200 Hz to 8K Hz	4	8 - 10	9/16	1.1BF	1 1/16	1/2
26A07Z8	2x6 Oval CM	130 Hz to 16K Hz	2	8 - 10	9/16	.65AV	1 19/32	1/2
27A05Z8	2 3/4 RD	150 Hz to 8K Hz	1	8 - 10	9/16	.52AV	1 3/16	1/4
27A05Z45	2 3/4 RD	130 Hz to 6K Hz	1	45	9/16	.52AV	1 1/16	1/4
3A05Z8	3 1/2 RD	130 Hz to 12K Hz	2	8 - 10	9/16	.52AV	1 5/16	1/4
3A07Z450T	3 1/2 RD	150 Hz to 10K Hz	2 1/2	45	9/16	.65AV	1 7/16	1/2
30A05Z8	3 SQ	150 Hz to 12K Hz	2	8 - 10	9/16	.52AV	1 9/32	1/4
30A05Z8R	3 RD	250 Hz to 12K Hz	2	8 - 10	9/16	.52AV	1 3/16	1/4
30A05Z45	3 SQ	130 Hz to 14K Hz	2	45	9/16	.52AV	1 3/16	1/4
30C05Z8	3 SQ	150 Hz to 14K Hz	5	8 - 10	9/16	2.35BF	1 3/16	3/4
30C1Z450T	3 SQ	170 Hz to 12K Hz	4	45	9/16	1.1BF	1 3/16	1/2
35A05Z8	3x5 Oval CM	130 Hz to 14K Hz	2	8 - 10	9/16	.52AV	1 1/2	1/4
35A05Z16	3x5 Oval CM	100 Hz to 12K Hz	2	16	9/16	.52AV	1 1/2	1/4
35C3Z8	3x5 Oval CM	130 Hz to 12K Hz	5	8 - 10	3/4	3BF	1 11/16	3/4
4A1Z8	4 SQ	200 Hz to 12 K Hz	3	8 - 10	9/16	.65AV	1 5/8	3/4
4A1Z16	4 SQ	180 Hz to 15K Hz	3	16	9/16	.65AV	1 5/8	3/4
4A1Z45	4 SQ	180 Hz to 12K Hz	3	45	9/16	.65AV	1 13/16	3/4
4C1Z8	4 SQ	200 Hz to 12 K Hz	4	8 - 10	9/16	1.1BF	1 7/16	1/2
4C25Z8	4 SQ	200 Hz to 12 K Hz	5	8 - 10	9/16	2.35BF	1 5/8	3/4
4C30T	4 SQ	130 Hz to 9K Hz	4	3 - 4	3/4	3BF	1 5/8	3/4
4C3Z80T	4 SQ	130 Hz to 9K Hz	4	8 - 10	3/4	3BF	1 5/8	3/4
4C5Z8	4 SQ	120 Hz to 15K Hz	7	8 - 10	3/4	4.8BF	1 5/8	1
46C3Z8	4x6 Oval CM	130 Hz to 10K Hz	6	8 - 10	3/4	3.0BF	1 3/4	1
48C3Z8	4x8 Oval CM	120 Hz to 12K Hz	6	8 - 10	3/4	3BF	2 1/16	1 1/2
5A1Z8	5 PC	125 Hz to 12K Hz	3 1/2	8 - 10	9/16	.65AV	1 13/16	3/4
5A1Z45	5 PC	130 Hz to 9K Hz	3 1/2	45	9/16	.65AV	1 13/16	3/4
5C3Z8	5 PC	130 Hz to 14K Hz	5	8 - 10	3/4	3.0BF	1 7/8	1
52C10Z8	5 1/4 PC	125 Hz to 9K Hz	10	8 - 10	1	10BF	2 1/4	2 1/4
57C3Z8	5x7 Oval CM	75 Hz to 10K Hz	7	8 - 10	3/4	3BF	2 5/16	1
6C5Z8	6 1/2 PC	70 Hz to 14 K Hz	7	8 - 10	3/4	4.8BF	3	1 3/4
69C3Z10	6x9 Oval CM	70 Hz to 15K Hz	8	8 - 10	3/4	3BF	2 3/4	1 1/4
8C10PA0T	8 PC	80 Hz to 8K Hz	12	8 - 10	1	10BF	2 7/8	2 1/2
8C10Z45	8 PC	70 Hz to 12K Hz	12	45	1	10BF	3	2 1/2

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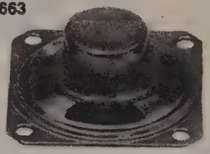
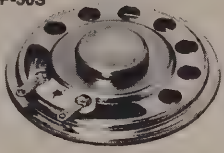
SPEAKERS

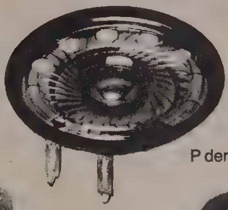
PS-663



HSP-50S



HSP-50SAP



HSP-36SAP

P denotes PC terminal

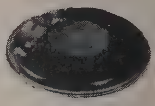
HSP-28BSCB ▲

PR-383N

PST-045CA

PB-852

HSP-36S



MICRO

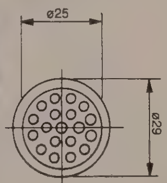
MODEL NO.	NOMINAL SIZE mm (inch)	MAX POWER W	RESONANT FREQUENCY Hz	FREQ. RANGE Hz	MAGNET WEIGHT g(oz)	MAGNET SIZE mm	FLUX DENSITY gauss	DIAMETER (A) mm(inch)	DEPTH (B) mm(inch)	MOUNTING DIAMETER(C) mm(inch)	NET WEIGHT g(oz)
HSP-23S	23 (1)	0.2	600	F_0~12,000	1 (.035)	9.5x1.5	5,500	23 (.91)	4.9 (.19)	-	4 (.14)
HSP-28S	28 (1)	0.3	550	F_0~12,000	1 (.035)	9.5x1.5	4,000	28 (1.10)	5.3 (.21)	-	5.5 (.19)
HSP-28BSB**	28 (1)	0.2	550	F_0~10,000	1 (.035)	9.5x1.5	4,000	28 (1.10)	4.9 (.17)	-	5.5 (.19)
HSP-28BSCB▲	28 (1)	0.2	500	F_0~15,000	1.5 (.05)	12.5x1.5	4,500	28 (1.10)	4.6 (.18)	31(1.22)	8 (.28)
HSP-30S	30 (1¼)	0.2	500	F_0~15,000	1 (.035)	9.5x1.5	4,000	30 (1.18)	5.7 (.224)	-	6.5 (.23)
HSP-32F	32 (1¼)	0.2	500	F_0~15,000	4.5 (.16)	21x12x3	4,500	32 (1.25)	11.1 (.44)	-	17 (.60)
HSP-36S	36 (1½)	0.5	320	F_0~10,000	1.5 (.05)	12.5x1.5	6,600	36 (1.42)	4.2 (.165)	-	12 (.42)
HSP-38SA	38 (1½)	0.2	500	F_0~10,000	1.5 (.05)	12.5x1.5	6,000	38 (1.50)	8.3 (.33)	-	10.5(.37)
PR-383	38 (1½)	0.2	650	F_0~ 5,000	8.6 (.28)	11.5x10	6,000	38 (1.5)	17 (.67)	-	21 (.74)
HSP-40SB	40 (1⅝)	0.2	600	F_0~15,000	1 (.035)	9.5x1.5	5,500	40 (1.57)	6.7 (.26)	-	8.5 (.30)
HSP-40BSB**	40 (1⅝)	1.0	600	F_0~15,000	1 (.035)	9.5x1.5	5,500	40 (1.57)	6.0 (.24)	-	12 (.42)
HSP-40BF*	40 (1⅝)	1.0	420	F_0~20,000	5.1 (.18)	27x17x3	4,500	39.5(1.56)	9.1 (.358)	-	16 (.56)
FR-401†	40 (1⅝)	0.2	600	F_0~ 5,500	5.1 (.18)	27x17x3	4,000	40 (1.6)	12.5 (.49)	-	27 (.96)
HSP-45S	45 (1¾)	0.2	400	F_0~10,000	1.5 (.05)	12.5x1.5	5,600	45 (1.77)	5.5 (.217)	-	11 (.43)
PST-045CA	45 (1¾)	0.3	500	F_0~ 4,800	1.5 (.05)	12.5x1.5	10,000	45 (1.7)	8.5 (.335)	60(2.36)	12 (.42)
PST-045A	45 (1¾)	0.3	580	F_0~ 3,800	9.7 (.34)	13.0x10	6,000	45 (1.7)	17 (.67)	-	25 (.86)
HSP-50S	50 (2)	0.5	400	F_0~20,000	1.5 (.05)	12.5x1.5	6,500	50 (2)	8.5 (.335)	-	13 (.45)
HSP-50SC	50 (2)	0.5	400	F_0~20,000	1.5 (.05)	12.5x1.5	6,500	50 (2)	8.5 (.335)	-	13 (.45)
HSP-57S	57 (2¼)	0.5	400	F_0~10,000	1.5 (.05)	12.5x1.5	6,600	57 (2¼)	10.3 (.41)	-	15 (.53)

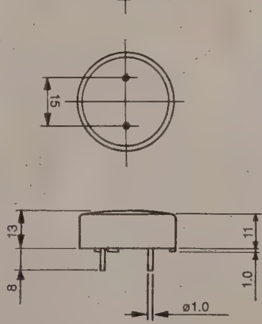
NOTES: Speakers in the HSP Series are supplied with samarium cobalt and mylar cone as standard.
*Plastic frame and black mylar cone.
**Black mylar cone.

†Metal frame, paper cone (mylar available by adding "N" after -401).
▲Black mylar cone, oval frame (custom)
PC pins available on 36ϕ, 40ϕ, 45ϕ, 50ϕ, 57ϕ by adding "P" suffix to part number.

PC MOUNT, ENCLOSED

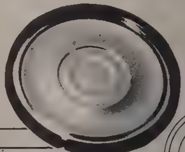
- Available in 8, 32 and 100 ohm
- Flame retardant outer case
- Mylar cone



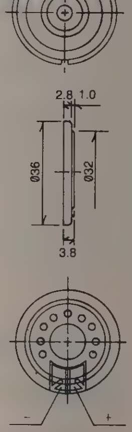


SPECIFICATIONS	
RDIE Model No.	FR-29PC
Nominal Size	29mmΦ
Resonant Frequency	1050Hz +/− 100Hz
S.P. Level	110dB/W +/− 3dB 0.1W @ 1cm
Response	1050Hz - 4KHz
Crossover Frequency	700Hz +/− 5Hz
Input Power	Nominal Input 0.1W Handling Cap 0.15W
Operation	Must be normal at program source 0.1
Buzz, Rattle, etc.	Must be normal at sine wave 1.2
Flux Density	4,800 Gauss
Magnet	16 x 7 x 3
Distortion	96 max
Heat Test	80°C +/− 2.0°C 20-50% R.H. 8 Hours
Humidity Test	80°C +/− 2.0°C 20-50% R.H. 8 Hours
Case Material	FR-4 - Black
Terminals	Brass, Tin Plated

36mm "DIGITAL"



SPECIFICATIONS	
Model No.	36CS08G-1
Dimension	Outer diameter: 36 mm Baffle opening: 33 mm Height: 3.8 ± 0.2 mm Weight: 4.6 grams
Magnet	Material: Rare Earth Size: 12.5 x 1.5 mm
Voice coil	Impedance: 8 Ω ± 15% Diameter: 13.60 mm
Power rating	Normal: 200 mW Maximum: 400 mW
Resonant Frequency	550 ± 150 Hz
Output S-P-L	81 ± 3 db/W-M average at 800, 1000, 1200, 1500 Hz
Frequency range	*fo* ~ 3500 Hz average S.P.L. – 10 db
Distortion	10% maximum at 1500 Hz 200 mW
Abnormal sound	Must be Normal tested by 1.3 Volts sine wave
Load test	White noise: 1.3 Volts 24 Hours
Polarity	Apply a positive DC current to the + (or marked) terminal the diaphragm shall move forward.



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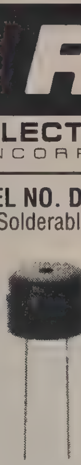
RDI ELECTRONICS INCORPORATED

The following information is excerpted from our catalog. Please contact us for your complete guide to the components available from RDI Electronics.

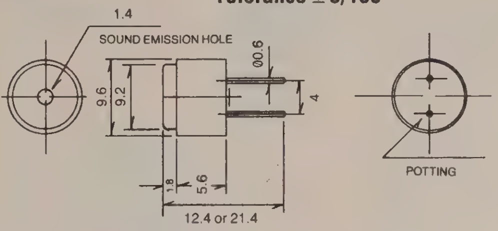
TRANSDUCERS

MODEL NO. DMT-09 Series

(Flow Solderable and Washable)



Dimensions in mms
Tolerance ± 3/100

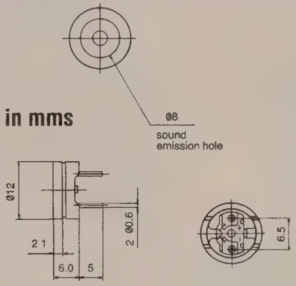


SPECIFICATIONS		
Rated Voltage	DC(V)	1.5
Operating Voltage	DC(V)	1 to 2
*Rated Current	(mA)	MAX. 80
Coil Resistance	(Ω)	5.5 ± 1.0
†Coil Impedance	(Ω)	9.5
*Sound Output	(dB)	MIN 80
Resonant Frequency	(Hz)	2,731
Operating Temperature	(°C)	-20° to +60°
Storage Temperature	(°C)	-30° to + 70°
Weight	(g)	1

*Value applying voltage (2,731 Hz 1/2 duty, square wave)
†Value applying (2,731 Hz, sine wave, measuring current 60μA)

MODEL NO. DMT-11B Series

Dimensions in mms

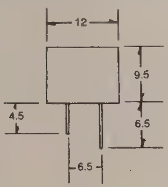


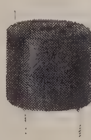
SPECIFICATIONS		
Type		DMT-11B
Rated Voltage	(V)	1.5
Operating Voltage	(V)	1 ~ 2
*Rated Current	(mA)	MAX. 30
Coil Resistance	(Ω)	15 ± 4.5
†Coil Impedance	(Ω)	40
*Sound Output 10CM	(dB)	MIN. 70
Resonant Frequency	(Hz)	2,048
Operating Temperature	(°C)	-20° ~ + 60°
Storage Temperature	(°C)	-30° ~ + 70°
Weight	(g)	2

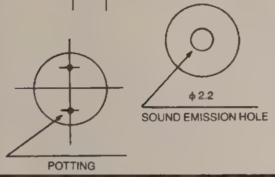
*Value applying rated voltage (2,048Hz, 1/2 duty, square wave)
†Value applying (2,048Hz, sine wave, measuring current 60μA)
(Note) Lead wire type is available on request

MODEL NO. DMT-12 Series

(Flow Solderable and Washable)







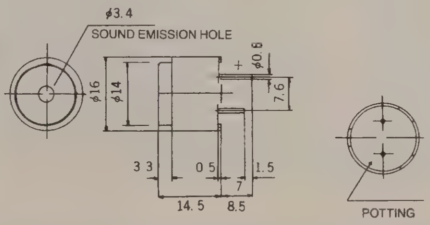
Dimensions in mms
Tolerance ± 3/100

SPECIFICATIONS Without Circuit			
Type		DMT-1206	DMT-1212
Rated Voltage DC	(V)	6	12
Operating Voltage	DC(V)	4~8	7~15
Current	(mA)	MAX. 40	
Coil Resistance	(OHM)	50	115
Sound Output 10CM	(dB)	MIN. 85	
Resonant Frequency	(Hz)	2,200	
Temperature Range	(°C)	-40° ~ +85°	
Weight	(g)	2	
Dimensions	(mm)	12ø x 9.5H	

SPECIFICATIONS With Circuit				
Type		DMT-1201-S	DMT-1206-S	DMT-1212-S
Rated Voltage DC	(V)	1.5V	6	12
Operating Voltage	DC(V)	1~3	4~8	7~15
Current	(mA)	MAX. 30		
Sound Output 10CM	(dB)	MIN. 75	MIN 80	
Resonant Frequency	(Hz)	2,400	2,300	
Temperature Range	(°C)	-20° ~ +70°		
Weight	(g)	2		
Dimensions	(mm)	12ø x 9.5H		

MODEL NO. DMT-16 Series - PC Mount

(Flow Solderable and Washable)



Dimensions in mms
Tolerance ± 3/100

SPECIFICATIONS Without Circuit			
Type		DMT-1606	DMT-1612
Rated Voltage DC	(V)	6	12
Operating Voltage	DC(V)	3~12	6~18
*Rated Current	(mA)	MAX. 40	
Coil Resistance	(Ω)	50	115
*Coil Impedance	(Ω)	110	200
*Sound Output 10CM	(dB)	MIN. 85	
Resonant Frequency	(Hz)	2,048	
Operating Temperature	(°C)	-20° ~ +70°	
Weight	(g)	5	

SPECIFICATIONS In Circuit			
Type		DMT-1606-S	DMT-1612-S
Rated Voltage	DC(V)	6	12
Operating Voltage	DC(V)	4~7	8~16
Current	(mA)	MAX. 30	MAX. 30
*Sound Output	(dB)	MIN. 85 (at 10cm)	
Resonant Frequency	(Hz)	2,200	
Temperature Range	(°C)	-20° ~ +70°	
Weight	(g)	7	

*Value applying rated voltage (2,048Hz 1/2 duty, square wave)

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The following information is excerpted from our catalog.

TRANSDUCERS

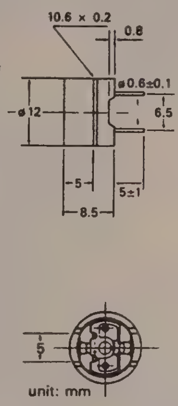
DMT-11 Series-Wire leads or PC Mount

SPECIFICATIONS
Without Circuit

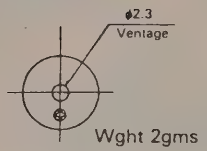
Rated Voltage V ~	1.5
Operating Voltage V ~	1 to 12
*Rated Current mA ~	MAX 30
*Coil Direct Current Resistance Ω	50
*Sound Output @ 10 cms dB	80
Resonant Frequency Hz	2048
Operating Temperature °C	-10 to +60

***Value applying rated voltage (2,048Hz 1/2 duty, square wave)**

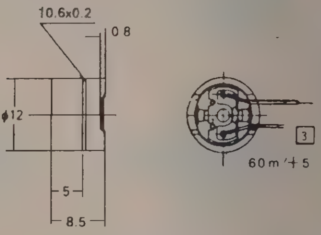
DMT-11
(PIN type)



Wght 2gms



DMT-11
(LEAD type)

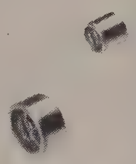


Dimensions in mms
Tolerance ± 3/100

HEADSETS

RDI Electronics offers a complete line of stereo & monaural lightweight and isolation style headsets. Impedence range from 4 to 600 Ohms. Boom Mikes are available in both noise cancelling and standard versions.

MICROPHONES

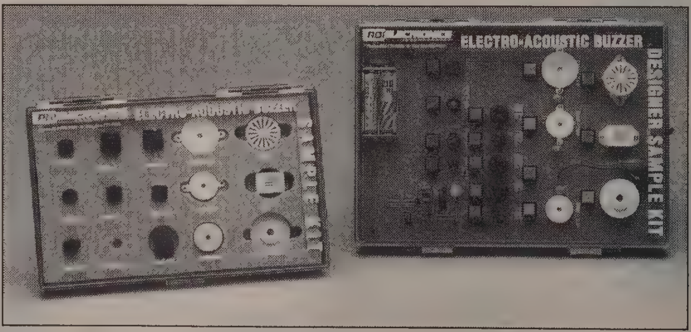


Impedance: Low Impedance
Frequency Range: 50-20, 000Hz
Operation Voltage: 2-10V DC
Current Consumption: 0.7mA Max.
S/N ratio: More than 40dB
Directivity: Omni-directional & Uni-directional
Max. Operation Voltage: 10V
Sensitivity Reduction: Within-3dB at 2V

A DESIGN GUIDE
FEATURING—
MINIATURE SPEAKERS
TRANSDUCERS
BUZZERS
PIEZO CERAMIC ALARMS

audio devices

RDI ELECTRONICS



RDI Electronics offers a design guide created specifically for audio devices. We also offer a sample kit and working designer kit to asist in the choice of the correct transducer or buzzer for use in your application. Please contact us for more details.

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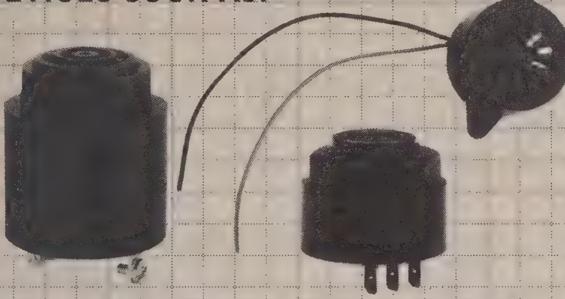
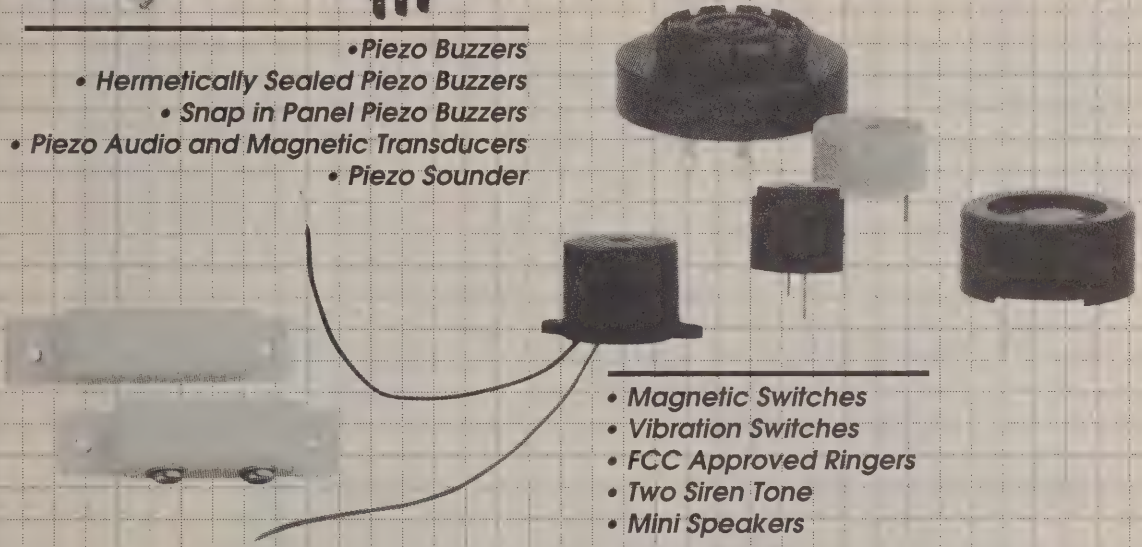
AUDIBLE SIGNAL COMPONENTS BUZZERS AND SIRENS

MANY TYPES AVAILABLE. WE FEATURE A WIDE RANGE OF AUDIBLE SIGNALING DEVICES SUCH AS:

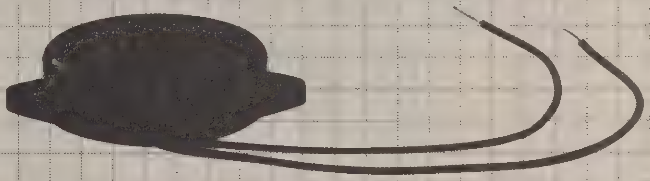


- *Magnetic Buzzers*
- *Multiple Tone Buzzers*
- *Single Pulse and Dual Tone Buzzers*
- *DC and AC Buzzers*
- *Electronic Buzzers*
- *Two Tone Buzzer with Adjustable Volume Control*

- *Piezo Buzzers*
- *Hermetically Sealed Piezo Buzzers*
- *Snap in Panel Piezo Buzzers*
- *Piezo Audio and Magnetic Transducers*
- *Piezo Sounder*

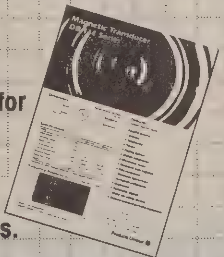


- *Magnetic Switches*
- *Vibration Switches*
- *FCC Approved Ringers*
- *Two Siren Tone*
- *Mini Speakers*



A wide variety of frequencies, operating ranges, current drains and sound levels. PC board mounting, Inline mounting or screw mounting available.

With over 70 standard models for diversified applications, we could not possibly list all our products in this ad. We supply products ranging from a simple DC powered audible reminder or key confirmation device, to more sophisticated 120/240 VAC alarm sounders.



We welcome inquires for free catalogs. We also welcome your unique specifications for custom design products.

"Please give us an opportunity to quote on your requirements. We are sure our competitive prices will give you a real buzz"

RODALE
Technical Sales Inc.

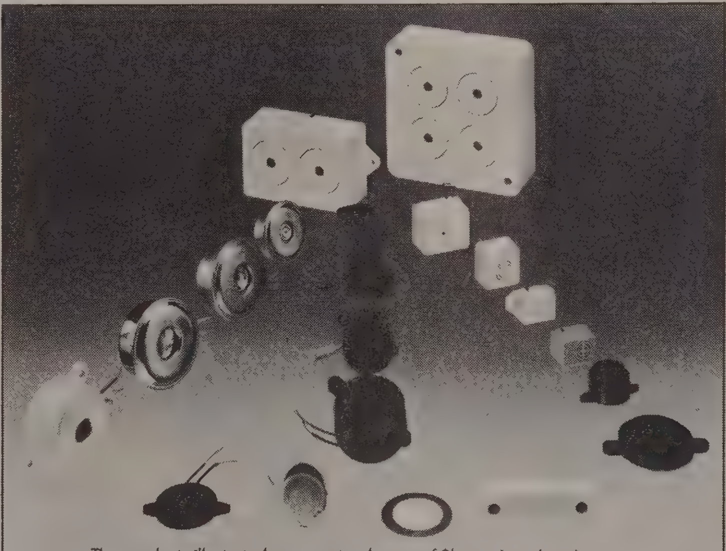
577 Main Street, Islip, New York 11751
516-277-5454 FAX: 516-277-8375
West Coast Sales Office: 714-283-3140

SHOGYO BUZZERS & SIRENS

Your design deserves Shogyo quality and reliability.
You deserve...
Shogyo Service...comprehensive, responsive and fast
Shogyo Professionalism...the helpful experience you need
Shogyo Prices...always competitive, usually better
and...
Shogyo Selection...with complete custom design capabilities

Including a diverse offering of:
- *Electrical AC buzzers*
- *Electrical DC buzzers*
- *Piezo buzzers*
- *Electronic buzzers*
- *Piezo elements in housings*
- *Piezo sirens*

And featuring:
- *In-line or PC mount operation*
- *Low current drain*
- *No arcing or RF noise*
- *Temperature tolerances from −20°C to +60°C*
- *A wide variety of frequencies, operating ranges, current drains and sound levels*
- *Single, pulse, continuous or siren tone*
- *Elements in brass quality metal or ABS quality plastic housings, with low profiles and thin size mechanical mounting constraints, and high frequency pure tone audible signals*
- *Sirens with warble tone sound outputs up to 100dBa/10 ft., in duplex, quadruplex, 12 and 24 VDC, in operating ranges of 6–15 and 16–28 VDC*



The products illustrated represent only part of Shogyo's wide selection.

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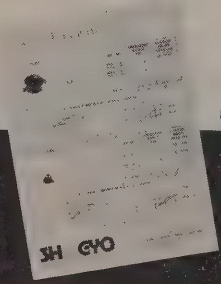

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SHOGYO

SHOGYO SPEAKERS

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You deserve…
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Shogyo Professionalism…the helpful experience you need
Shogyo Prices…always competitive, usually better
and…
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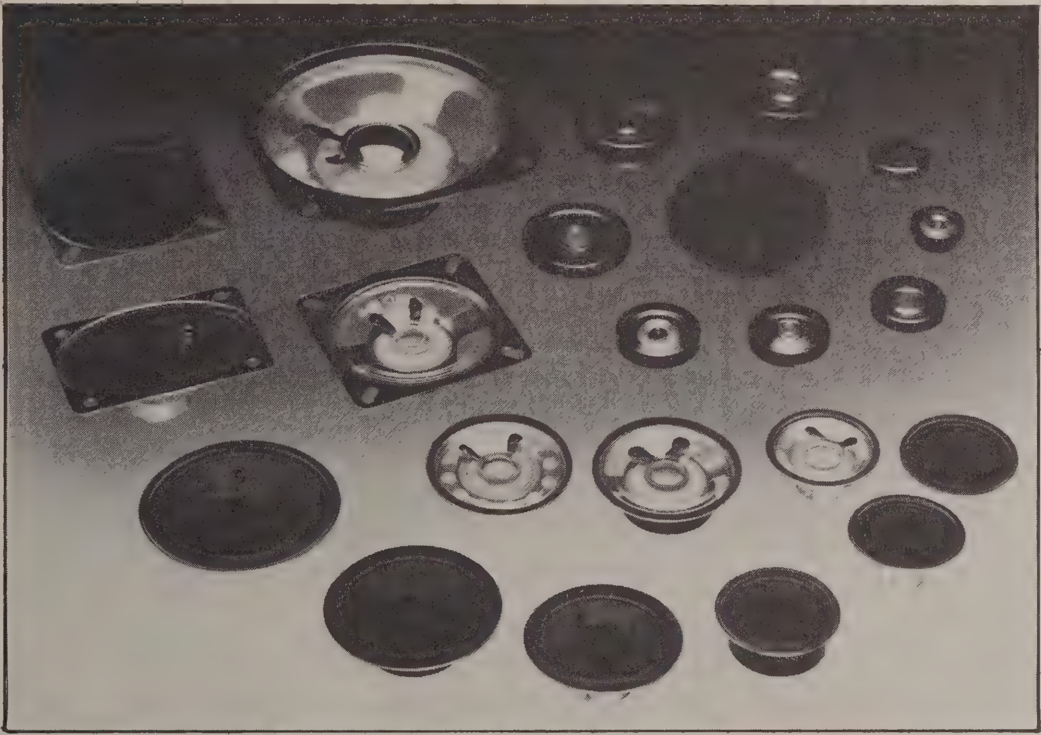
- Low profile speakers
- Oval speakers
- Low leakage flux speakers
- Mylar cone (weatherproof) or paper speakers
- Car speakers
- Public address speakers
- Hi-fi speakers

And featuring:

- Diameters from one to fifteen inches
- A wide selection of frequencies and impedances
- Alnico, samarium cobalt, and ferrite magnets



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SPEAKERS

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SHOGYO

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MINIGLOSSARY

BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11					Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11		Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		First Hexadecimal Digit
			12				12	12		12	12	12		12	12					Zone Punches
				11				11	11	11		11	11	11		11				
					0		0		0	0	0		0	0			0			
			9	9	9	9	9	9	9	9										
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1	
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1	
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2	
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3	
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4	
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5	
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6	
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7	
1000	8	8		CAN							h	q	y		H	Q	Y	8	8	
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9	
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2	
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3	
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4	
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5	
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6	
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7	
			12				12				12	12		12	12	12		12		
				11				11				11	11	11		11	11	11		Zone Punches
					0				0		0		0	0	0		0	0		
			9	9	9	9									9	9	9	9		

Card Hole Patterns

① 12-0-9-8-1
② 12-11-9-8-1
③ 11-0-9-8-1
④ 12-11-0-9-8-1
⑤ No-Punches
⑥ 12
⑦ 11
⑧ 12-11-0
⑨ 12-0
⑩ 11-0
⑪ 0-8-2
⑫ 0
⑬ 0-1
⑭ 11-0-9-1
⑮ 12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

FOR THE JAPANESE, *SHOKAI* MEANS INTRODUCTION

WHAT DOES *SHOKAI* MEAN FOR YOU? (HINT: IT MAKES YOUR IDEAS PROFITABLE)

Let's face it. As a source for electronic and electromechanical components, the quality and pricing of the Far East can't be matched on our side of the ocean. But you can't go to the Far East whenever you need to source a product.

That's why, if up to now, your knowledge of Japanese was limited to "sushi" and "sayonara", we respectfully suggest that you learn another word . . . SHOKAI®. . . Your introduction to the Far East.

SHOKAI® is an American company, with over 30 years experience manufacturing and importing components from the Far East. We were serving American manufacturers long before everybody with a fax machine and a foreign telephone book could claim to be an overseas supplier. And we will be here long after they are gone.

We speak your language. We understand you - your time frames - your requirements - your problems – the quality and personal attention you and your customers demand. As hundreds of "Top 500" companies have learned, let SHOKAI® be your source for components from Japan, Taiwan, Hong Kong and the rest of the Far East.

OUR PRODUCT LINE INCLUDES:

- Alarm & Signal Systems
- Antennas (Cordless Phone, Radio, Rubber-Ducky, Telescopic, UHF/VHF, Whip)
- Audible Alarms & Transducers
- Bells & Buzzers (Electronic, Electro-Mechanical and Piezo Buzzers, Piezo Elements, Sirens)
- Headphones
- Microphone Elements (Electret, Crystal and Dynamic)
- Meters (Ammeter, Audio, Battery, Edgewise, Moving Iron or Coil, Panel, Tuning, Level, Volt, VU)
- Speakers (Miniature & Subminiature)

And many more. Try us. You can start by requesting a catalog. Let us know what product you're looking for. Or better yet, tell us exactly what you want. You won't be disappointed.

Why don't you use your new word as soon as possible. You won't have to eat raw fish to try it. Just pick up your phone. We're waiting for your call.

SHOKAI ® – WE MAKE YOUR IDEAS PROFITABLE.™

SHOKAI®
FAR EAST LTD.
9 Elena Court, Peekskill NY 10566
914-736-3500 Fax: 914-736-3656
Telex: 224219 SHFE

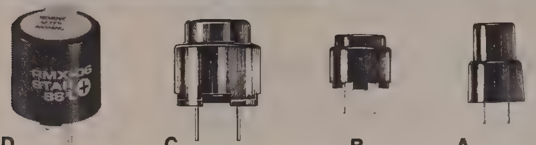
COMPLETE LINE OF ELECTRONIC AUDIO DEVICES

BUZZERS AND TRANSDUCERS

TRANSDUCERS

MINIATURE AUDIO

SEALED VERSION FOR WAVE SOLDERING


RMX-06
STAR
D
C
B
A

The following Series of miniature electromagnetic audio transducers are sealed against contamination from wave solder washing. They have two PCB pins of different lengths for polarity notation and a tripod base for secure stance on the board. The small size and efficient design suit it for volume production. It is extremely economical for applications where a drive signal, such as a microprocessor clock, already exists.

FEATURES

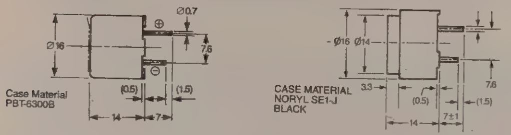
- Sealed against wave solder contamination
- Acoustically & electronically designed for efficiency
- Different pin length for polarity notation
- Small size
- Low cost
- Lower power consumption

APPLICATIONS

- Pocket pagers
- Telecommunication equipment
- Tone pad-audio feedback
- Computers & peripheral equipment
- Medical instruments
- Automotive safety equipment
- Microwave ovens & other small appliances
- Alarm clocks
- Cash registers & business machines
- Radar detectors

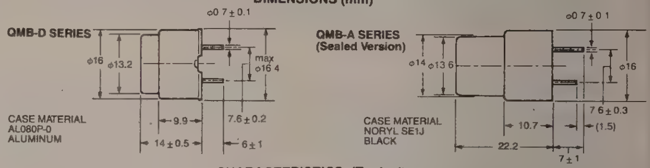
RMX SERIES QMB 16mm SERIES

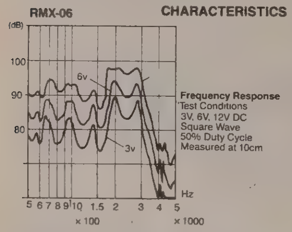
DIMENSIONS (mm)

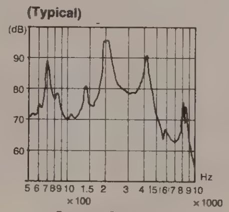

Ø0.7
Ø16
7.6
Case Material
PBT-6300B
(0.5)
(1.5)
14
7
Ø16
Ø14
CASE MATERIAL
NORYL SE1-J
BLACK
3.3
(0.5)
7.6
(1.5)
7±1
14

QMB D and A Series

DIMENSIONS (mm)

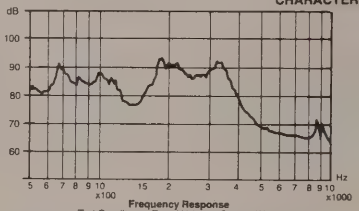

QMB-D SERIES
ø0.7±0.1
ø16
ø13.2
max ø16.4
CASE MATERIAL
AL080P-0
ALUMINUM
9.9
7.6±0.2
14±0.5
6±1
QMB-A SERIES
(Sealed Version)
ø0.7±0.1
ø14
ø13.6
ø16
7.6±0.3
CASE MATERIAL
NORYL SE1J
BLACK
10.7
(1.5)
22.2
7±1



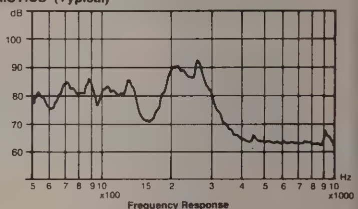


Frequency Response
Test Conditions: Rated Voltage, Square Wave
50% Duty Cycle

CHARACTERISTICS (Typical)



Frequency Response
Test Conditions. Rated Voltage, Square Wave
50% Duty Cycle



Frequency Response
Test Conditions: Rated Voltage, Square Wave
50% Duty Cycle

SPECIFICATIONS

Item	RMX-06	RMX-12	QMB-01	QMB-06	QMB-12	QMB-01A	QMB-06A	QMB-12A	QMB-06D	QMB-12D
Rated Voltage (V) dc	6	12	1.5	6	12	1.5	6	12	6	12
Operating Voltge (V) dc	3-12	6-18	1-3	3-12	6-18	1-3	3-12	6-18	3-13	6-18
Rated Current* (mA)	Max. 40	Max. 40	12	40	40	12	40	40	40	40
Coil Resistance (Ω)	45	115	30 ± 4.5	45 ± 7	115 ± 17	30 ± 4.5	45 ± 7	115 ± 17	52 ± 8	115 ± 17
Coil Impedance* (Ω)	110	200	80	110	200	100	135	270	120	220
Sound Output @ 10cm* (dB)	Min. 85		80	85		80	85		85	
Resonant Frequency (Hz)	2K ~ 3K		2048			1,850 ~ 2,500			2048	
Operating Temperature (°C)	− 40 ~ + 85		− 30 ~ + 85			− 20 ~ + 70			− 20 ~ + 100	
Weight (g)	7		7			7			7	

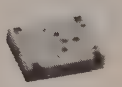
*Measured at rated voltage, 2,048Hz, square wave (50% duty cycle)

MUT-01A SURFACE MOUNT TRANSDUCER

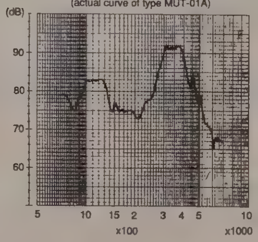
SPECIFICATIONS

Item	MUT-01A
Rated Voltage (V)	DC: 1.5
Operating Voltage (V)	DC: 1.2 ~ 1.7
* Rated Current (mA)	80 max.
Coil Resistance (Ω)	9 ± 2
* Sound Pressure Level (dB)	85 min./10cm
Resonant Frequency (Hz)	3200
Operating Temperature (°C)	—10 ~ +50
Storage Temperature (°C)	—55 ~ +85
* Weight (g)	1

* Value applying rated voltage (within reproduced frequency, 1/2 duty, square wave)

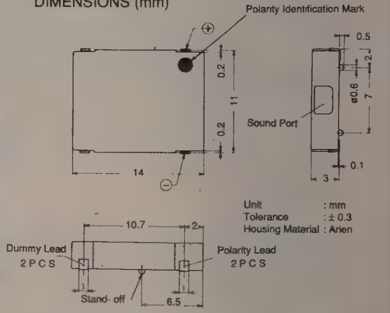


Frequency Response
(actual curve of type MUT-01A)



applied voltage: 1.5V, 1/2 duty, square wave
distance for measurement: 10 cm

DIMENSIONS (mm)


Polarity Identification Mark
0.5
0.2
11
0.2
Sound Port
ø0.6
7
2
0.1
14
3
Unit : mm
Tolerance : ± 0.3
Housing Material : Arlen
10.7
2
Dummy Lead
2 P C S
Polarity Lead
2 P C S
Stand- off
6.5

FEATURES

- Compact slim size
- Unique structure & casing allows for reflow process
- Tape & reel packaging for auto mounting
- Side sound port
- Achieves a sound pressure level equal to conventional units in spite of the size

APPLICATIONS

- Pagers
- Portable telephones
- Computer & peripheral units

OEM DIVISION
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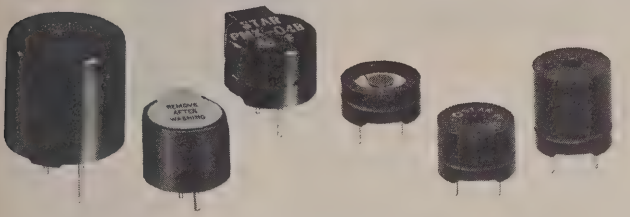
star® COMPLETE LINE OF ELECTRONIC AUDIO DEVICES

BUZZERS AND TRANSDUCERS

TRANSDUCERS MINIATURE AUDIO–12mm SERIES



The Star 12mm Series are ultra-miniature, electromagnetic audio transducers specifically designed for applications where space limitations are critical.

FEATURES

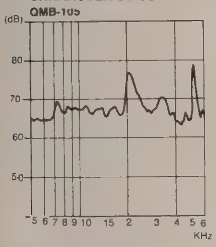
- Miniaturized design for applications with critical space requirements.
- Very low current drain and operating voltage.
- Pin-type construction for easy PC board soldering.
- Each of these models may be obtained with right angle PCB pins, or longer pins (up to 18mm) or wire leads to facilitate your installation requirements. Please consult Star directly for lead time and pricing.

APPLICATIONS

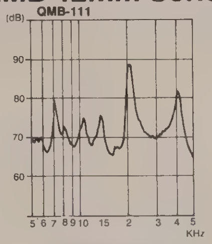
- Radar Detectors
- Clocks
- Small Appliances
- Telecommunication Equipment
- Medical Equipment
- Cash Registers & Business Machines
- Computer Peripherals
- Electronic Toys & Games
- Low Profile Keyboards
- Mobile Phones

QMB 12mm Series

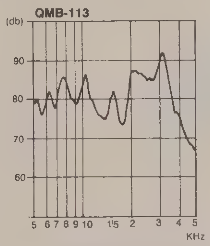
CHARACTERISTICS



Frequency Response
Test Conditions: 1.5V DC, Square Wave
50% Duty Cycle

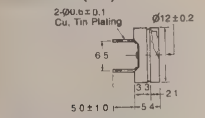


Frequency Response
Test Conditions: 1.5V DC, Square Wave
50% Duty Cycle

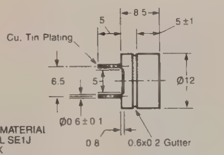


Frequency Response
Test Conditions: 1.5V DC, Square Wave
50% Duty Cycle

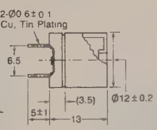
DIMENSIONS (mm)



CASE MATERIAL
NORYL SE1J
BLACK



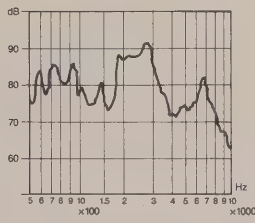
CASE MATERIAL
NORYL SE1J
BLACK



CASE MATERIAL
NORYL SE1J
BLACK

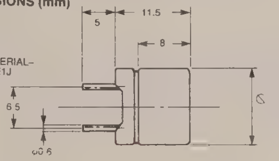
FMX-01

CHARACTERISTICS



Frequency Response
Test Conditions: Rated Voltage, Square Wave
50% Duty Cycle

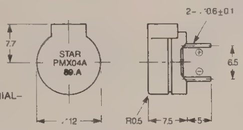
DIMENSIONS (mm)



CASE MATERIAL–
NORYL SE1J

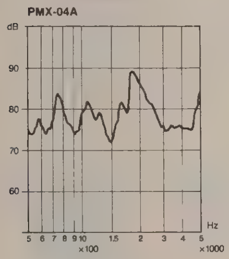
PMX Series

DIMENSIONS (mm)

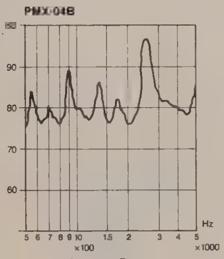


CASE MATERIAL–
NORYL SE1J

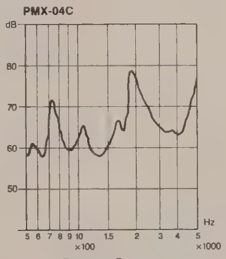
CHARACTERISTICS



Frequency Response
Test Conditions: 1.5V VDC, Square Wave
50% Duty Cycle



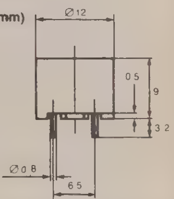
Frequency Response
Test Conditions: 1.5V VDC, Square Wave
50% Duty Cycle



Frequency Response
Test Conditions: 1.5V VDC, Square Wave
50% Duty Cycle

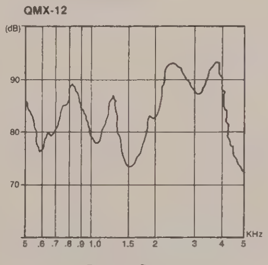
QMX Series

DIMENSIONS (mm)



CASE MATERIAL NORYL SE1-GFN2J

CHARACTERISTICS



Frequency Response
Test Conditions: Rated Voltage, Square Wave
50% Duty Cycle

SPECIFICATIONS

Item	QMB-105	QMB-111	QMB-113	PMX-04A	PMX-04B	PMX-04C	QMX-05	QMX-12	FMX-01
Rated Voltage (V) dc	1.5	1.5	1.5	1.5			5	12	1.5
Operating Voltage (V) dc	1-2	1-2	1-2	1-2			3~8	6~15	1-2
Rated Current* (mA)	Max. 10	Max. 10	Max. 30	Max. 70		Max 10	Max. 40		70 Max.
Coil Resistance (Ω)	50±7.5	50±7.5	16±4.5	6.5		50	47	140	6.5
Coil Impedance* (Ω)	140	140	40	16	22	140	80	240	14
Sound Output at 10cm* (dB)	Min. 70	80	80	Min. 80	Min. 85	Min. 70	Min. 85 (A-Range)		Min. 85 @ 2.7K Hz
Resonant Frequency (Hz)	2,048			2,048	2,731	2,048	2,400		2-3K Hz (80dB Min.)
Operating Temperature (°C)	−20~+60			−20~+60			−40 to +85		−20~+60
Weight (g)	2			2			2		2

*Measured at rated voltage 2048 Hz square wave (50% duty cycle)

star® micronics
OEM DIVISION
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star® COMPLETE LINE OF ELECTRONIC AUDIO DEVICES

BUZZERS AND TRANSDUCERS

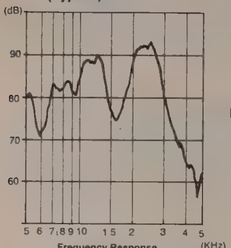
TRANSDUCERS

MINIATURE AUDIO

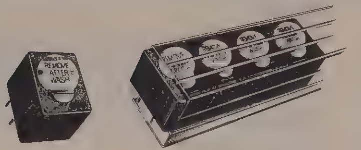
SEALED VERSION FOR WAVE SOLDERING

SMX SERIES

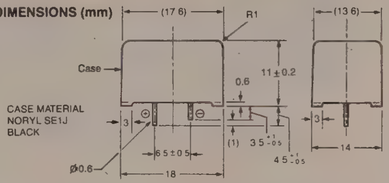
CHARACTERISTICS
(Typical)



Frequency Response
Test Conditions: Rated Voltage, Square Wave 50% Duty Cycle at 10cm

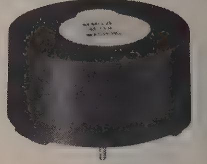


DIMENSIONS (mm)

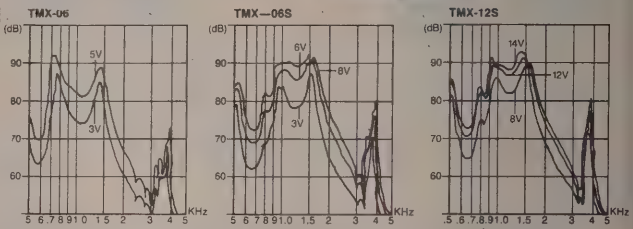


The Star SMX Series, a completely sealed audio transducer, is designed to provide an exceptionally wide frequency response range. A consistent pure tone signal allows the SMX to be used in a variety of applications. SMX transducers are also the first audio components specifically engineered to meet the requirements of automatic printed circuit board production. Forty SMX transducers are packaged in a rigid, plastic easy-feed magazine compatible with automatic insertion equipment.

TMX SERIES



CHARACTERISTICS



The charts above represent the SPL characteristics plotted at minimum and maximum operating voltages throughout the frequency range.
TEST CONDITIONS: Square Wave, 50% Duty Cycle, measured at 10cm

The Star TMX Series are electro-acoustic transducers designed to produce a more pleasing, low frequency tone as an output. The TMX-06 is resonant at 730 Hz while the TMX-S models provide optimum performance between 1KHz and 1.5KHz. The basic TMX is available in only a nominal 5V DC package; the "S" type has nominal DC ratings of 6V and 12V.

HGP-12A LOW FREQUENCY MINIATURE TRANSDUCER

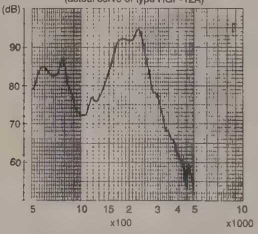
SPECIFICATIONS

Item		HGP-12A
Rated Voltage	(V)	DC: 12
Operating Voltage	(V)	DC: 6 ~ 15
ΔRated Current	(mA)	50 max.
Coil Resistance	(Ω)	135 ± 20
* Coil Impedance (Typical)	(Ω)	210
ΔSound Pressure Level	(dB)	85 min./10cm
Reproduced Frequency	(Hz)	1700 ~ 2200
Operating Temperature	(°C)	−40 ~ +90
Storage Temperature	(°C)	−40 ~ +90
Weight	(g)	4

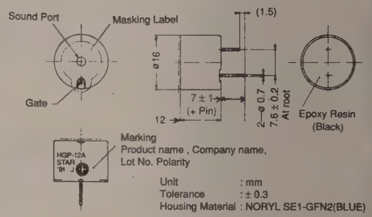
Δ Value applying rated voltage (within reproduced frequency, 1/2 duty, square wave)
* Value applying (2,048Hz, sine wave, measuring current 60μA)

DIMENSIONS (mm)

Frequency Response
(actual curve of type HGP-12A)



applied voltage: 12V, 1/2 duty, square wave
distance for measurement: 10 cm



FEATURES

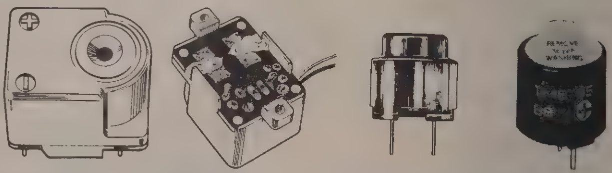
- Enhanced wide band
- Small size
- Dip-solderable and washable

APPLICATIONS

- Automobiles
- Computer peripherals
- Communication equipment

AUDIO TRANSDUCERS WITH BUILT-IN DRIVE CIRCUIT

This series of transducers features built-in oscillation circuits to drive each unit at the correct frequency. They also allow operation from a direct voltage source and can replace older arcing type buzzers. The "pure tone" signal is at a basic frequency of 2200 Hz and is pleasant yet penetrating enough for alert/alarm functions.



SPECIFICATIONS

Item		AMB/KMB-06	AMB/KMB-12	HMB-06	HMB-12	TMB-05	TMB-12
Rated Voltage (V) dc		6	12	6	12	5	12
Operating Voltage (V) dc		4-8	8-16	4-7	8-16	4~6.5	8~16
Rated Current* (mA)		20		Max. 30		Max. 30	
Sound Output at 10 cm* (dB)		85		85		Min. 85	
Resonant Frequancy (Hz)		2150		2200		2300	
Operating Temperature (°C)		−20 ~ +70		−30 ~ +85		−40 ~ +85	
Weight (g)		10		4.8		Min. 1.0	
Connections (AMB Only)	Positive (+)	Orange	Red				
	Negative (−)	White	White				
Trigger Terminal (KMB Only)		3.5V @ 0.4mA	6.0V @ 0.4mA				

The HMB and TMB Series are sealed for wave solder/wash operations.

*Measured at rated voltage

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COMPLETE LINE OF ELECTRONIC AUDIO DEVICES

BUZZERS AND TRANSDUCERS

BUZZERS MINIATURE SOLID STATE ELECTRONIC

Star's electronic buzzers utilize their patented solid state design and precise manufacturing that has made Star the world leader in this technology. The built-in oscillator circuit provides consistant sound output and eliminates RF noise associated with electro-mechanical design.

MMB - 01

Star's MMB series is the state-of-the-art in miniature electronic buzzers. Tiny size, high efficiency, and value are obtained through use of surface mount components in the drive circuits. As all circuitry is solid state, the MMB's simplicity of design provides high reliability not found in conventioinal "make and break" type alarms. There are no mechanical points to arc or require maintenance, and RF noise is non-existent.

SPECIFICATIONS

		SMB-01	CMB-06 & SMB-06	CMB-12 & SMB-12	CMB-24 & SMB-24	MMB-01
Operating Voltage (VDC)		1.1≈2	3≈7	7≈17	16≈30	1.1≈2.0
Max current (mA)		17	23	14	16	10
Temperature Range (°C)		−20≈ +60	−40≈+80			−30≈+80
Sound Ouput at 20 cm (dB)		70				70 at 1.5V DC
Weight (g)		10				5
Connections (SMB Only)	Pos. (+)	Red	Orange	Red	Orange	
	Neg. (−)	Black	White	White	Black	
Trigger Terminal (CMB Only)			1 mA Vt ≥3	1mA Vt ≥8	1mA Vt ≥18	

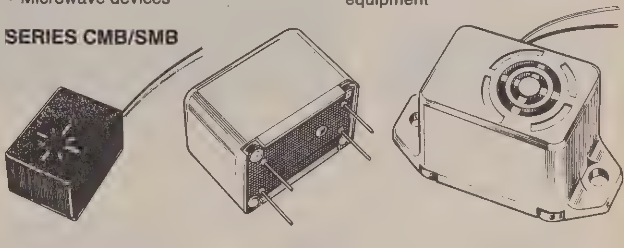
FEATURES

- Solid state design
- High sound output
- PC board pin or screw mounting
- Low current consumption
- High reliability

APPLICATIONS

- Alarm clocks
- Timer and control devices
- Portable and battery operated equipment
- Computer peripherals
- Microwave devices
- Gas detectors
- Aircraft stall indicators
- Automotive warning systems
- Instruments and test apparatus
- Portable and battery operated equipment

SERIES CMB/SMB

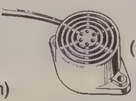


SERIES MMB (18.5L × 14.5W × 11H) **SERIES CMB** (22.5L × 16W × 14.6H) **SERIES SMB** (33L × 16W × 14.5H)

Star series CMB pin-type electronic buzzers fit standard DIP sockets or may be wave-soldered. Model CMB-06 is TTL compatible; Model CMB-12 is CMOS compatible. MMB and SMB series have lead wires.

RMB/IMB Series

IMB (∅41mm × 28mm)



RMB (∅41mm × 17.6mm)

Extraordinary audio penetration, long life and compact, rugged construction are combined in Star's unique Series of miniature electronic buzzers. Because all circuitry is solid state, Star buzzers differ significantly from conventional "make and break" type alarms. There are no mechanical points to arc or require maintenance and RF noise has been eliminated.

All three of the IMB Series are available in two models with different sound sequences.

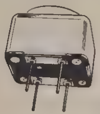
- IMB-06-05, IMB-12-05 and IMB-24-05 emit sound for 1/4 second on, 1/4 second off.
- IMB-06-10, IMB-12-10 and IMB-24-10 emit sound for 1/2 second on, 1/2 second off.

SPECIFICATIONS

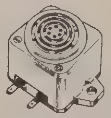
Item		RMB-03	RMB-06	RMB--12	RMB-24	IMB-06	IMB-12	IMB-24
Rated Voltage (V) dc		3	6	12	24	6	12	24
Operating Voltage (V) dc		2-4	4-8	7-16	20-28	4-8	7-16	20-28
Max. Current* (mA)		35	33	23	21	35	23	21
Sound Output at 100 cm* (dB)		75				75		
Operating Temperature* (°C)		−40~+70				−40~+70		
Weight (g)		18				24		
Connections	Positive (+)	Red				Red		
	Negative (−)	Black				Black		

*At Rated Voltage

YMB/PMB Series



YMB (26L × 26W × 20H)



PMB (40L × 26W × 20H)

Star Series YMB and PMB are low-cost, precision-engineered solid state electronic buzzers which provide a minimum audible signal of 75 dB at a distance of 1 meter (39.4"). Each is available in four models rated at 3, 6, 12 and 24 volts DC. The YMB and PMB are similar in operating characteristics and performance, but provide different assembly options: Series YMB is a pin-type buzzer designed to be soldered directly to PC boards without additional wiring. Because the pins include a control, or "trigger" terminal with a maximum starting current of 1 mA, the buzzers create a perfect interface with integrated circuits. The control terminal is logic compatible. Series PMB has connector tabs which may be soldered or inserted in crimp-on connectors. It has flanges with screw holes and may be mounted firmly on any rigid, non-resonant surface.

SPECIFICATIONS

Item	YMB-03	YMB-06	YMB-12	YMB-24	PMB-03	PMB-6	PMB-12	PMB-24
Rated Voltage (V) dc	3	6	12	24	3	6	12	24
Operating Voltage (V) dc	2-4	4-8	8-16	20-28	2-4	4-8	8-16	20-28
Max. Current* (mA)	35	35	25	25	35	33	23	21
Sound Output at 100 cm* (dB)	Min. 75				Min. 75			
Operating Temperature* (°C)	−40~+70				−40~+70			
Weight (g)	17				17			
Trigger Terminal Requirements	1mA, Vt≥2V	1mA, Vt≥4V	1mA. Vt≥8V	1mA, Vt≥20V				

*At Rated Voltage

star micronics

OEM DIVISION
70-D ETHEL ROAD WEST, PISCATAWAY, N.J. 08854 (908) 572-9512 FAX: (908) 572-5095

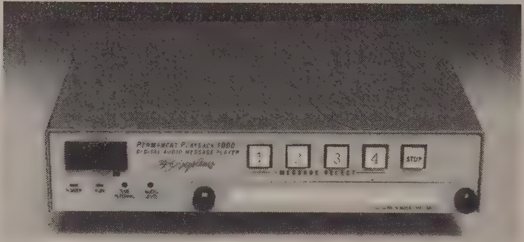
DIGICART/II DIGITAL AUDIO HARD DISK RECORDER

DigiCart/II

360 Systems

- All Digital Medium — Premium Quality Audio
- Stereo 16 Bit Random Access Record/Playback — 92dB Dynamic Range, 20kHz Bandwidth
- Dolby® AC-2 Data Reduction Included — Increases Storage Capacity by 5 Times
- Instant Access — Playback with Zero Delay
- Internal Hard Disk — Available in 3 Sizes: 200mb, 400mb & 1GB Drives with Storage Capacities of up to 8 Hours
- External Hard Disk System — Holds up to 5 Drives for 40 Hour Storage Capacity
- Removable Media (Bernoulli Disk) — Available in 3 Sizes: 65mb, 105mb & 150mb with Storage Capacities of up to 68 minutes
- Digital Audio Workstation Features — Non-Destructive, Precise Editing
- Serial Interfacing — EIA-422 with ES Bus Protocol
- SMPTE Time Code Option — Synchronize with Video Equipment
- Remote Control Models — Two Dedicated Units & Mini Keyboard

PERMANENT PLAYBACK™
SOLID STATE AUDIO MESSAGE SYSTEMS



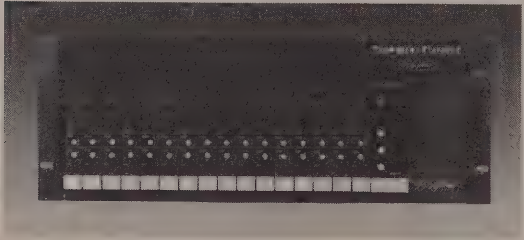
SERIES 1000 DIGITAL AUDIO MESSAGE PLAYER

- 4 Separate Messages Play Independently
- 3 Minutes of Playback Time
- Removable EPROM Message Cartridge
- Built-in 10 Watt Power Amp
- Wide Range Interfacing
- High Reliability with no Moving Parts

Permanent Playback

QUADFILE DIGITAL AUDIO MESSAGE SYSTEM

- 4 Separate Messages Can Play Simultaneously
- 24 Minutes of Playback Time per Enclosure
- 4 Reproducer Cards in Half-Rack Enclosure
- Remote Control of All Functions
- Available in DC Powered Models



SERIES 2000 / SERIES 4000 DIGITAL AUDIO MESSAGE SYSTEMS

- 16 Separate Messages Can Play Simultaneously
- 48 or 96 Minutes of Playback Time per Enclosure
- 16 Reproducer Cards in Full-Rack Enclosure
- Low Impedance Transformer Balanced Outputs
- Multi-Track Start/Stop Control Bus
- 10kHz or 15kHz Bandwidth Options

360 Systems
PROFESSIONAL DIGITAL AUDIO

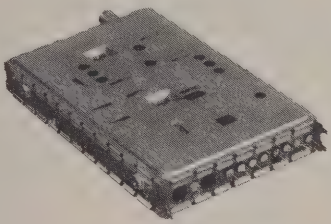
18740 Oxnard Street Tarzana, California 91356 USA Tel 818 342-3127 Fax 818 342-4372

EPD
ELECTRONICS INC.

P.O. BOX 2517, GARDENA, CA 90247
16921 S. Western Ave., No. 300, Gardena, CA 90247
(310) 515-4996

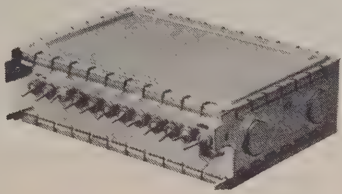
DBT 479, DBT 402

SATELLITE RECEIVER TUNER
950 MHZ TO 1,750 MHZ INPUT
VIDEO, SOUND IF (BASE BAND) OUT



PIF 45CM02

45.75 MHZ PICTURE CARRIER INPUT
B+ 12V ± 10% MAX 13.2V
AFT, AGC, AFT SW, AUDIO
ATTENUATOR AND VIDEO
AND SOUND OUT

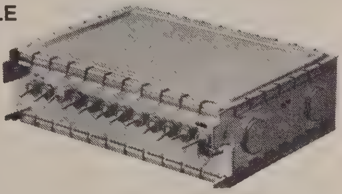


PIF 61CM02

61.25 MHZ CHANNEL -
3 INPUT DEMODULATOR
VIDEO AND SOUND OUT

PIF CC101

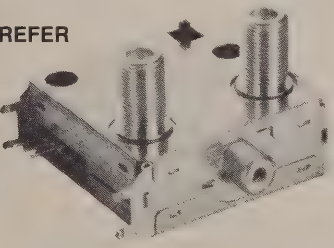
CLOSED CAPTION MODULE



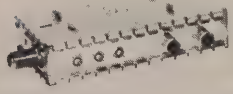
MODEL NO. RM-EPMS3411

RF MODULATOR
W/AB SWITCH

SPECIFICATION REFER
TO OUR 3405/6



DBT950
D8T1750

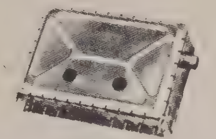


SATELLITE TUNERS

IF = 70 MHz	A.I/P Impedance = 75 Ω Unbalanced
FC = 950 MHz—1.500 MHz	Output Impedance = 75 Ω Balanced
Prescribe Option by Order.	

OTHER VHF, UHF, CATV TUNERS AVAILABLE.

MODEL UHF TUNER



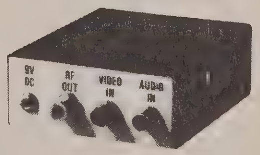
MODEL	EPU202	EPU252 HIGH GAIN
Power Gain	6dB or More	20dB or More
Gain Deviation	8dB or Less	
Gain Reduction	30dB or More	35dB or More
Noise Figure	12dB or Less (Measured with 4dB IF Amplifier)	
Radio Frequency (RF) Bandpass Limits	The picture carrier point shall not be down more than 3dB below the maximum point on all channels. The sound carrier poinnt shall not be down more than 6dB below the maximum point on all channels.	
Image Rejection	40dB or More	50dB or More
Intermediate Frequency (IF) Rejection	60dB or More	55dB or More
Oscillator Frequency Change with Temperature 20°C to 40°C	±1200 KHz Maximum	
Oscillator Frequency Change		
AFT Voltage	6.8V ±4V 0.5 MHE to 2 MHE	

MODEL NO. RF-3405/3406 RF-MODULATOR

CRYSTAL CONTROLLED
FOR STABILITY

RATING		
Channel Output:	USA, Channel 3 NTSC USA, Channel 4 NTSC	
Supply Voltage	9V ±0.5V	
Current Consumption:	45 ma. maximum	
RF Output Impedance:	75 ohm unbalanced (phono jack)	
Input Voltage:	Video: 1 ±0.2Vpp	Sound: 0.5 ±0.1 RMS
Temperature Range:	0-50°C	
Humidity Range:	10-80%	
PERFORMANCE VIDEO		
Video Carrier Frequency	CH-3 61.25 ±50 KHz CH-4 67.25 ±50 KHz	
Video Modulation	75 ±10% VR1 at mid point	
Video Carrier Output	66 ±3dbm 75 ohm loaded	
Differential Gain	±10% at standard modulation	
Differential Phase	±10%	
PERFORMANCE SOUND		
Subcarrier Frequency	500 ±5 KHz	
Sound Carrier Output	−16 = 3db value against FV	
Distortion	3% maximum	
Signal To Noise	40db maximum	
Dimensions	2″ L x 1.5″ W x ¾″ H	

MODEL NO. VM-1000 RF MODULATOR

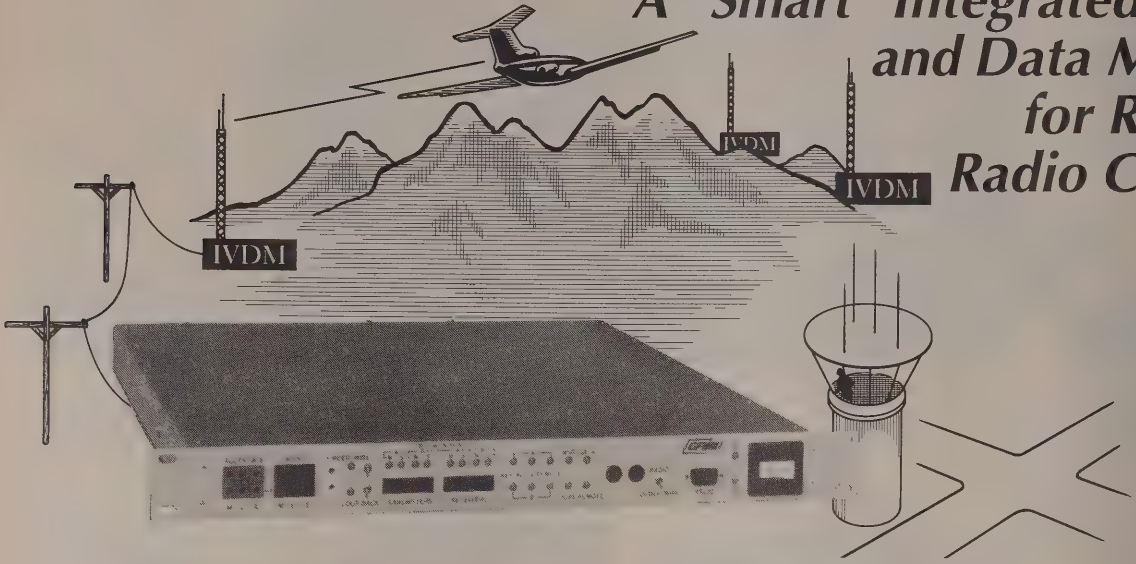


ELECTRICAL SPECIFICATIONS

Rating: Channel Output:	USA CH 3 NTSC/USA CH 4 NTSC	
Supply Voltage:	9 ±0.5 VDC	
Current Consumption:	60 ma Max.	
RF Output Impedance:	75 ohm unbalanced	
Input Voltage:	Video 1 ±0.2 VP-P/Audio 0.5 ±0.1 VRMS	
PERFORMANCE VIDEO:		
Video Carrier:	CH 3 61.250 ±50 KHz/CH 4 67.250 ±50 KHz	
Video Carrier Output:	66.5 ±2.5 dbu	
Video Modulation:		
Smear:	7% max./S/N 45db min.	
PERFORMANCE—SOUND:		
Sub-Carrier Frequency:	4500 ±5 KHz	
Sound Carrier Output:	−15dB	
Sound Modulation:	70 ±10%/S/N 40 db min	
Radiation:	23.5 dbu 1m method	
Spurious Response:	−32db max.	
Dimensions:	3.375″ L x 3″ W x 1.250″ H	Weight: 6 oz.

IVDM-102

A "Smart" Integrated Voice and Data Modem for Remote Radio Control



OVERVIEW

The IVDM-102 is a versatile, cost effective "smart" universal subsystem specifically engineered to handle a variety of remote radio control requirements. Normally connected via a 4-wire voice grade telephone line that is not distance limited, the IVDM provides simultaneous trans- smission and reception of voice data.

The IVDM has a number of operating features that allow use in typical two-way voice plus radio control combinations. Simultaneous audio can be switched to any of six locations on a priority basis while analog and digital data inputs allow operator monitoring and control.

FEATURES

- Transparent RS-232 serial data, remote maintenance monitoring and automatic order wire
- Basic 3002 4-wire voice grade telephone line, microwave, or other transmission medium compatible
- Front access RS-232C bi-directional port with data rates to 1200 baud
- Front access RS-422/485 multidrop serial port for multiple equipment interface
- Automatic transmission line compensation over 35 dB range with degradation reporting
- Front panel status LED's and monitor/test jacks
- Thirty-two (32) digital control inputs/outputs
- Six (6) opto-isolated one ampere control outputs
- Automated analog loop back
- 2 x 6 built-in audio switch
- AC and/or DC source powered

APPLICATIONS

Two way voice plus communications of the following:

- Remote radio transmitter and receiver control
- Control to computer interface over long distances
- Remote monitoring and intrusion detection
- Remote radio frequency tuning and selection
- Alarm and control functions
- Telemetering

SPECIFICATIONS

PHYSICAL

- **Dimensions:**
1.75" H x 19" W (EIA standard rack mount) x 17" D
- **Weight:** 10 lbs
- **Finish:**
all surfaces are protected from corrosion and deterioration. Front panel standard paint color is light gray.

VOICE AUDIO INTERFACE

- **Frequency Response:** 300 to 2400 Hz, ±3 db
- **Four (4) Radio Interface Ports:**
  Inputs: 600 ohm, transformer-coupled, balanced. Nominal -20 to 0 dBm average voice level.
  Outputs: 600 ohm, transformer-coupled, balanced. Nominal -20 to 0 dBm average voice level
- **One (1) Transparent Operation Order wire (Intercom):**
  Input: 600 ohm, single-ended, -10 dBm typical
  Output: 200 ohm, single-ended, -10dBm typical
- **One (1) Audio Loopback Test Port:**
  Input: 600 ohm, single-ended, -10dBm typical
  Output: 600 ohm, single-ended, -10dBm typical

LOCAL AND REMOTE CONTROL INTERFACE

- **Inputs:** 32
- **Voltage:** +5 VDC or +12VDC ±5% furnished by IVDM
- **Current:** 1.5 ma maximum
- **Outputs:** 32 outputs sink or source, 5 VDC12 VDC, or external Sink Current: 30 ma (350 ma option) Source Current: 2 ma, 5V or 12V using internal source, 30 ma using external source, 6 high-current outputs, opto-isolated, 400 Vp-p at 1 amp max.

ANALOG INTERFACE

- **Inputs:** 15
- **Range:** 0 to +10 volts, ground referenced
- **Resolution:** 8 bits, 0.04 volts increments
- **Access:**
Block dump from memory to RS-485 ports on command

TELEGENIX/GRIM

AN INDUCTOTHERM COMPANY

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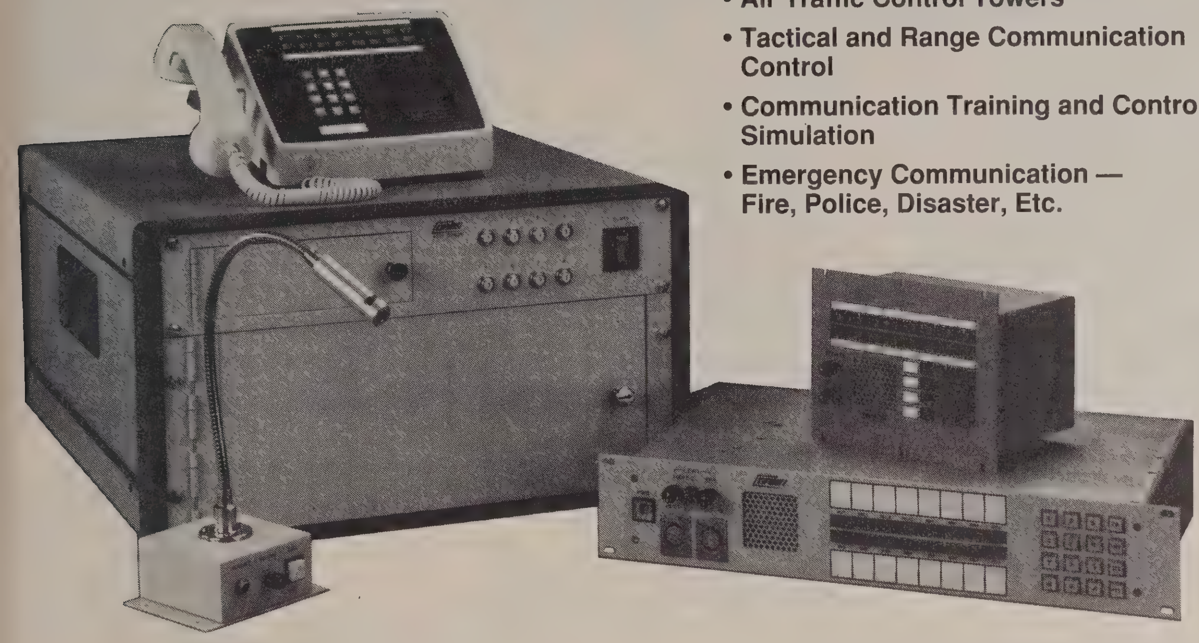
PROCOM-1400 SERIES

Integrated Communication Switching Systems For...

- Air Traffic Control Towers
- Tactical and Range Communication Control
- Communication Training and Control Simulation
- Emergency Communication — Fire, Police, Disaster, Etc.



Applications

PROCOM-1400 Integrated Communication Systems are ideal for small to large switching requirements where voice and data control from one or more operator positions are needed. Systems are typically used in command and control centers such as:

- Air Traffic Control Towers
- Tactical and Range Communication Control
- Communication Training and Simulation
- Emergency Communication — Fire, Police, Disaster, etc.

Small in size, the powerful PROCOM-1400 Central Control Switching Unit (CCU), along with multiple remote Communication Access Operator Units (CAU's), provides three primary modes of communications:

- Radio network control (ground/air/ground), local and remote
- Telephone communications with other facilities via dedicated point-to-point or switch network trunk facilities
- Intercommunications among system operating positions and stations

Overview

The PROCOM-1400 Series is a family of off-the-shelf, modularly constructed, Programmable Communication Switching Systems that are integrated in accordance with a user's specifications and needs. Using distributed "smart" electronic circuits along with redundant system power and efficient, high density packaging, the versatile PROCOM-1400 Series systems can provide just the right communication control system to fit any requirement.

As a fully developed, fully featured, console-controlled voice and data communications system, the PROCOM-1400 Series is capable of serving more than 400 subscribers (combinations of operator positions, radio devices, telephone trunks, and other external circuits).

All PROCOM-1400 Series system configurations use modular, distributed microprocessor supervision and control with the user's specific configuration protocol resident in solid state EPROM (Erasable Programmable Read-Only Memory). Most systems provide user access to real-time local configuration via nonvolatile RAM (Random Access Memory).

A representative PROCOM-1400 configuration is shown above.

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MINIGLOSSARY
FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image.

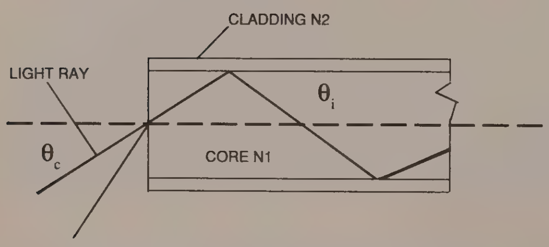
For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 µm.

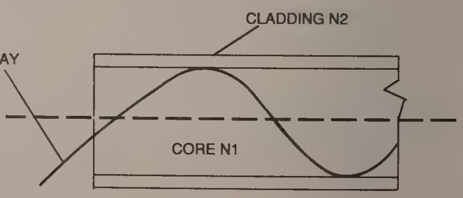
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

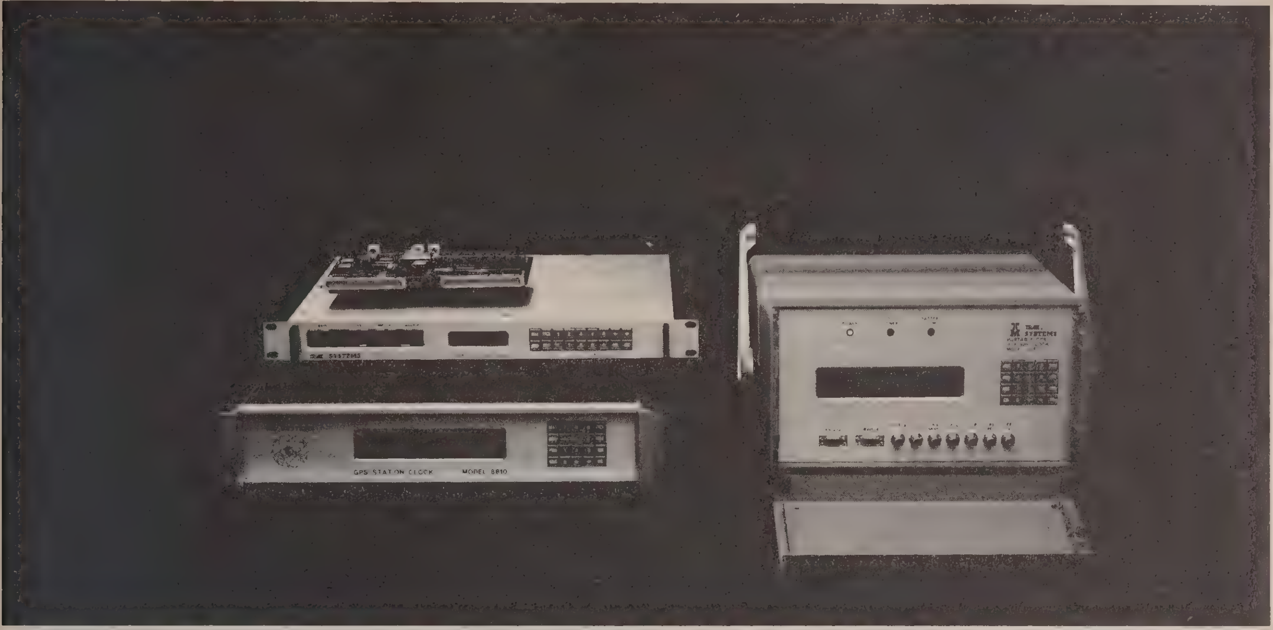
Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.



Four Affordable Ways To Go GPS

GPS-corrected time and frequency are important in power plants, observatories, test/tracking ranges, digital communications installations, and telecommunications facilities. But qualified suppliers are few.

Now from TRAK Systems, you get your choice of solutions — a family of four tested, proven performers — at very competitive prices.

Model 8810 This is the product that broke the price barrier: A full-featured, option-rich GPS timing station in one neat, rack-mounted unit. It contains virtually every option you can imagine — a list of specifications that would fill this page — yet it remains the clear price-value leader in its category.

Model 8820 GPS Station Clock Need to replace a GOES clock? Here's a slim-line model with many of the same features of our 8810, offering precise timing and frequency within a highly affordable and space-saving module. It has a precise time signal generator, a GPS receiver, and a disciplined crystal oscillator packed into its 1-3/4" rack-mount chassis — truly a "clock in a box."

Model 8830 Low-Cost "Card" Clock A single printed circuit card contains the major features of our Model 8810 GPS Station Clock — all packed into one card! Just plug it into a base station for radio communications, paging systems, data switches, cellular radio or TV transmitters — anywhere a highly accurate oscillator and time are required. Includes six-channel GPS receiver, disciplined time signal, RS-232 interface, and much more.

Model 8840 Portable GPS Station Clock This battery-powered unit lets you go where you want without sacrificing capabilities or quality. You get all the features of the Model 8820, plus a built-in 2-hour rechargeable battery, provision for 10-15 Vdc vehicle power through a cigarette lighter, and more. For precise timing on-the-go, the Model 8840 is the way to go.

All four models, ready to deliver today! These are state-of-the-art instruments, built with the care and quality that have made TRAK synonymous with excellence in precise timing for over 30 years. If you want the kind of highly precise instruments and systems employed at NASA, then send your next timing RFP to the same company NASA buys from — TRAK.

You could be in for a pocketbook-pleasing surprise.

TOTAL QUALITY LEADERSHIP

THINK TRAK

TRAK SYSTEMS
DIVISION OF TRAK MICROWAVE CORP.

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TRAK Europe • Dept E3, Dunsinane Avenue • Dundee Scotland DD2 3PN • Phone 44-382-833411 • FAX 44-382-833599

AXIOHM

MANUFACTURER OF THERMAL PRINTHEADS, PRINTER MECHANISMS AND ACCESSORIES

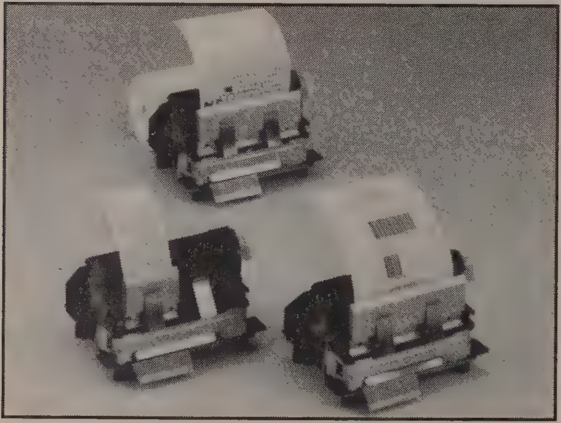
Axiohm provides an entire range of printing solutions designed and manufactured by a single source. At every level - Printheads, Mechanisms and Accessories - Axiohm products respond to the demanding requirements of industrial applications.

With valuable experience in both micro-electronics and electro-mechanics, Axiohm is one of the few companies in the industry capable of establishing a meaningful partnership with its customers.

• PRINTHEADS

Axiohm offers a wide range of fast and dependable products for direct and thermal transfer printing. With over fifteen years experience in industrial printhead design and manufacture, Axiohm printheads are unmatched in abrasion and pulse life (up to 100 km or 10^9 pulses). For additional security and design flexibility, Axiohm can provide the printheads for voltage levels from 5 to 30 volts.

This year, Axiohm's new 5v and 12v printheads will fulfill the growing requirements of new industrial needs such as hand-held products.



• MECHANISMS

Axiohm's range of print mechanisms use Axiohm Printheads to provide unmatched reliability. Axiohm uses compact injection molded chassis that are rugged, cost competitive, and designed to be integrated with other Axiohm accessories.

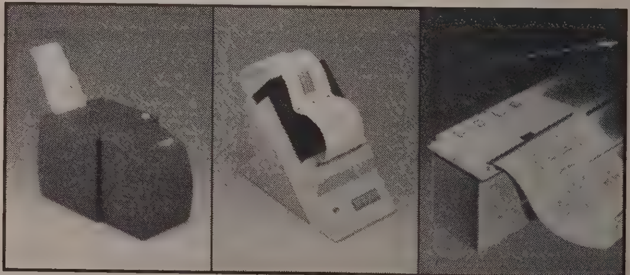
Axiohm's compact, ultra reliable mechanism is designed for harsh environments where the printer/cutter must not fail.

• BOARDS AND ACCESSORIES

Axiohm controllers are full-featured compact boards designed to provide flexibility, performance, and protection. The controller allows optimization of power consumption, print speed, print quality, and power management. In addition, Axiohm has a full range of accessories including cutters, document presenters and power supplies to enable with a complete solution. Axiohm's complete control over the entire product line guarantees maximum efficiency and reliability.

• CUSTOMIZED PRODUCTS

Beyond Axiohm's full line of standard products, our engineering team can provide the OEM with a custom solution at any level : printhead, mechanism, complete product. Axiohm offers a cost effective solution optimized for specific applications and opportunities.



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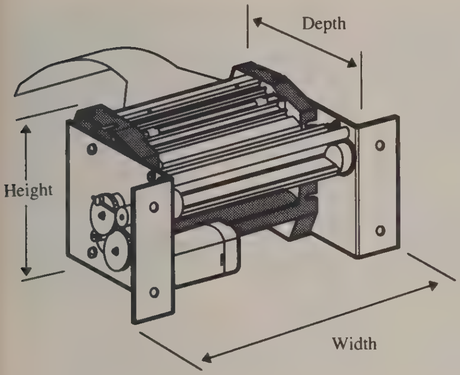
AXIOHM

MANUFACTURER OF THERMAL PRINTHEADS, PRINTER MECHANISMS AND ACCESSORIES

Use Axiohm's S/L Series 60 mm wide print mechanism for kiosk, POS, hand-held and ticketing applications. This compact, ultra-reliable mechanism is designed for harsh environments where the printer/cutter must not fail. The non-moving print head assures printing on over 50km of paper at 100% duty cycle. When combined with the integrated ceramic-bladed cutter, it is the perfect kiosk printer.

60 mm mechanism



Reliable

- Axiohm Industrial printers

Fast

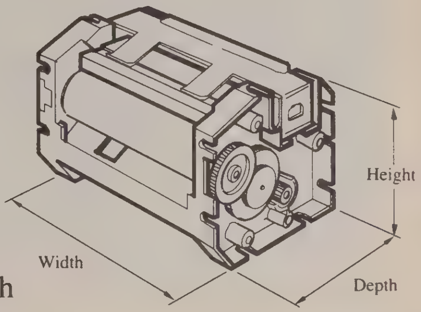
- up to 6" per second

Quiet

- virtually silent

Complete

- May be factory equipped with controller and ceramic cutter



			60mm mech.					80mm mech.	
PRODUCT REFERENCE	Mechanism only		HTP	CLDK	CLAA	CLBI	CLDF	CEGE	CFEG
	Mechanism + cutter			XLDK	XLAA	XLBI	XLDF	XECC	XEEG
	Controller		CONT	CONT	CONT	CONT	CONT	CONT	CONT
	Power Supply			PS001180	PS001180	PS001180	PS001180	PS001180	PS001180
GENERAL	Paper stock width	mm	60	60	60	60	60	82.5	80
	Printing width	mm	50.8	50.5	50	50.8	50.5	75	80
	Number of dots		384	384	160	192	384	448	640
	Dot density	dots/mm	7.6	7.6	3.2	3.78	7.6	6	8
ELECTRICAL (nominal)*	Dot resistance	Ω	90	220	630	640	700	1000	800
	Supply voltage (dot line/Motors)	Vdc	5	12	24	24	24	24	24
	Typical heating energy	mJ	2	0.5	3.5	1.8	0.5	1	0.6
	LSI supply voltage	Vdc	5	5	5	5	5	5	5
	LSI driver chips		6(64)	6(64)	2(64)	3(64)	6(64)	7(64)	10(64)
	Number of strobes		1	6	4	6	6	7	10
	Clock frequency (max)	MHz	5	5	5	5	5	5	5
	Thermistor	kΩ	100	100	100	100	100	100	100
MECHANICAL	Printhead connector		FLEX	HE10	HE10	HE10	HE10	HE10	HE10
	Dimensions without cutter	mm							
	Width		73	80	80	80	80	120	120
	Depth		76	55	55	55	55	63	63
	Height		55	73	73	73	73	43.7	43.7
	Dimensions with cutter	mm							
	Width			114	114	114	114	127	127
	Depth			78	78	78	78	87	87
	Height			73	73	73	73	43.7	43.7
	Weight	g		250	250	250	250		
	Weight w/cutter	g		450	450	450	450		
ENVIRONMENTAL	Operating temperature °C		0 to 50°C (-25°C with preheating. Printhead & motor) Optional high temp : 70°C						
	Humidity	%RH			Up to 90% without condensation				
	Life time (printhead typical)*								
	Mechanical (abrasion)	km		50	50	50	50	50	50
						100 (optional)			
	Electrical (pulse)	10^8 pulses		3	3	3	8		

* Per AXIOHM standard test conditions with medium sensitivity paper stock (printer grade).

Specifications subject to change without notice

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AXIOHM

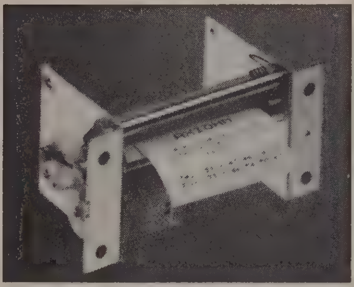
MANUFACTURER OF THERMAL PRINTHEADS, PRINTER MECHANISMS AND ACCESSORIES

Kiosk printer

The kiosk printer uses an Axiohm print mechanism with a print width of 50.5 mm at a dot density of 7.6 dots/mm. This is mounted in a rugged metal frame that includes cutter, paper reservoir, presenter, controller board and power supply.

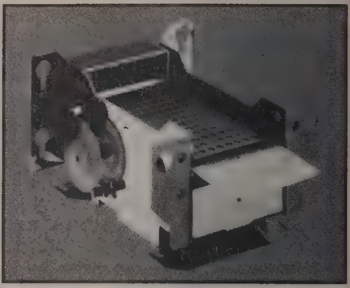
KIOSK PRINTER

The Axiohm kiosk printer has a paper stock external diameter up to 10" (2,800 ft roll) and a print speed of 3" per second.
It uses a RS232C or Centronics interface.



AUTO CUTTERS

Axiohm's patented ceramic cutter blades give a lifetime in excess of one million cuts in harsh environmental conditions.



DOCUMENT PRESENTER

The paper presenter transports documents directly to the user insuring proper delivery.

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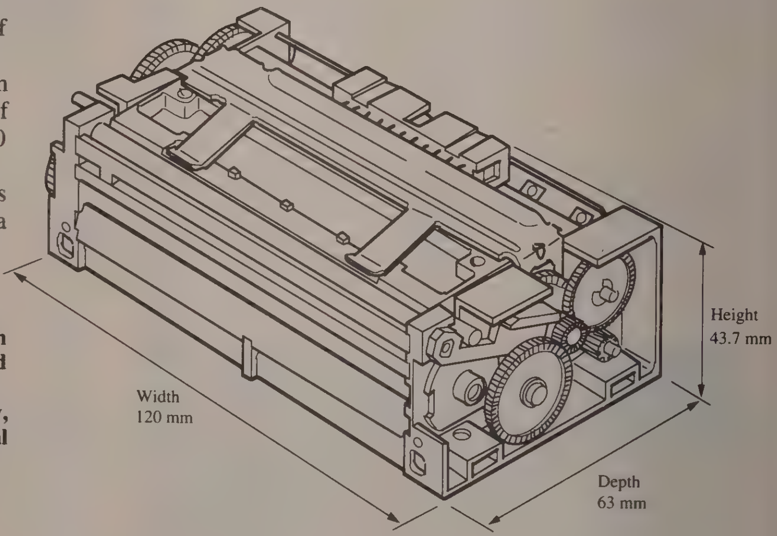
80 mm mechanism

The 80 mm mechanism is fast, printing up to 4.5" a second with high resolution (up to 8 dots per millimeter) graphic images.
It is also capable of handling a wide variety of media including label and ticket stock.
The flexible design of the Axiohm 80 mm allows it to handle two different widths of paper : 80 mm paper stock or two rolls of 40 mm paper stock.
This ultra compact, lightweight mechanism is extremely reliable and integrates easily into a host of designs.

You can combine the Axiohm's 80mm mechanism with power supply, integrated ceramic cutter and document presenter.
The result is an ideal printer for ATB, lottery, POS terminals, label printing, ticketing, medical equipment and other similar instruments.



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AXIOHM

MANUFACTURER OF THERMAL PRINTHEADS, PRINTER MECHANISMS AND ACCESSORIES

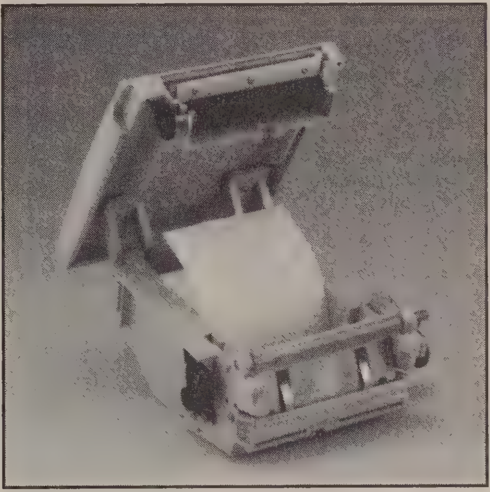
POS mechanism and/or complete Printer

The Axiohm POS printer makes paper loading simple :
1- open the cover
2- place the paper roll inside the printer
3- close the cover

The Axiohm POS printer is one of the easiest loading printers ever designed.

The Axiohm printer can sit on a counter or can be mounted on a wall for application where space is at premium such as ticket and teller booths.

As with other Axiohm mechanisms, the POS mechanism can integrate into a host of designs.



The POS mechanism is made up of 3 parts :

- **The printer chassis, incorporating the stepper motor and printhead. The chassis is also the paper reservoir.**
- **The 80 mm wide printhead (6 dots/mm)**
- **A cover, incorporating the platen roller**

The POS mechanism may be factory equipped with controller, and/or a ceramic cutter.

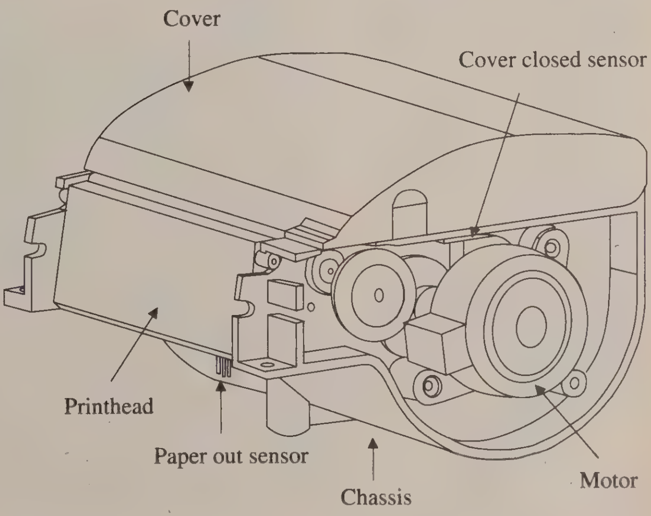
HTP 5V mechanism

If you are looking at a battery-powered hand-held application, the new Axiohm HTP (Hand-held Thermal Printer) is ideal for a wide range of hand-held products where low power consumption and ease of use are essential.

The Axiohm HTP is a compact, light weight thermal printer mechanism that provides fast and high quality graphic or alphanumeric output.

SPECIFICATIONS :

Controller board	**- Optionnal**
Paper stock width	**- 60 mm**
Paper stock diameter	**- 50 mm max**
Speed	**- 1.2" / 30 mm per sec.**
Number of dots	**- 192 / 384 dots**
Supply voltage	**- 5V**
Dimensions	
Width	**- 2.87"**
Depth	**- 2.99"**
Height	**- 2.16"**



As in the Axiohm POS mechanism, paper loading is in 3 simple steps.

A flexible connecting circuit incorporates the printhead, motor and sensors. It is the only connection to the controller board.

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NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

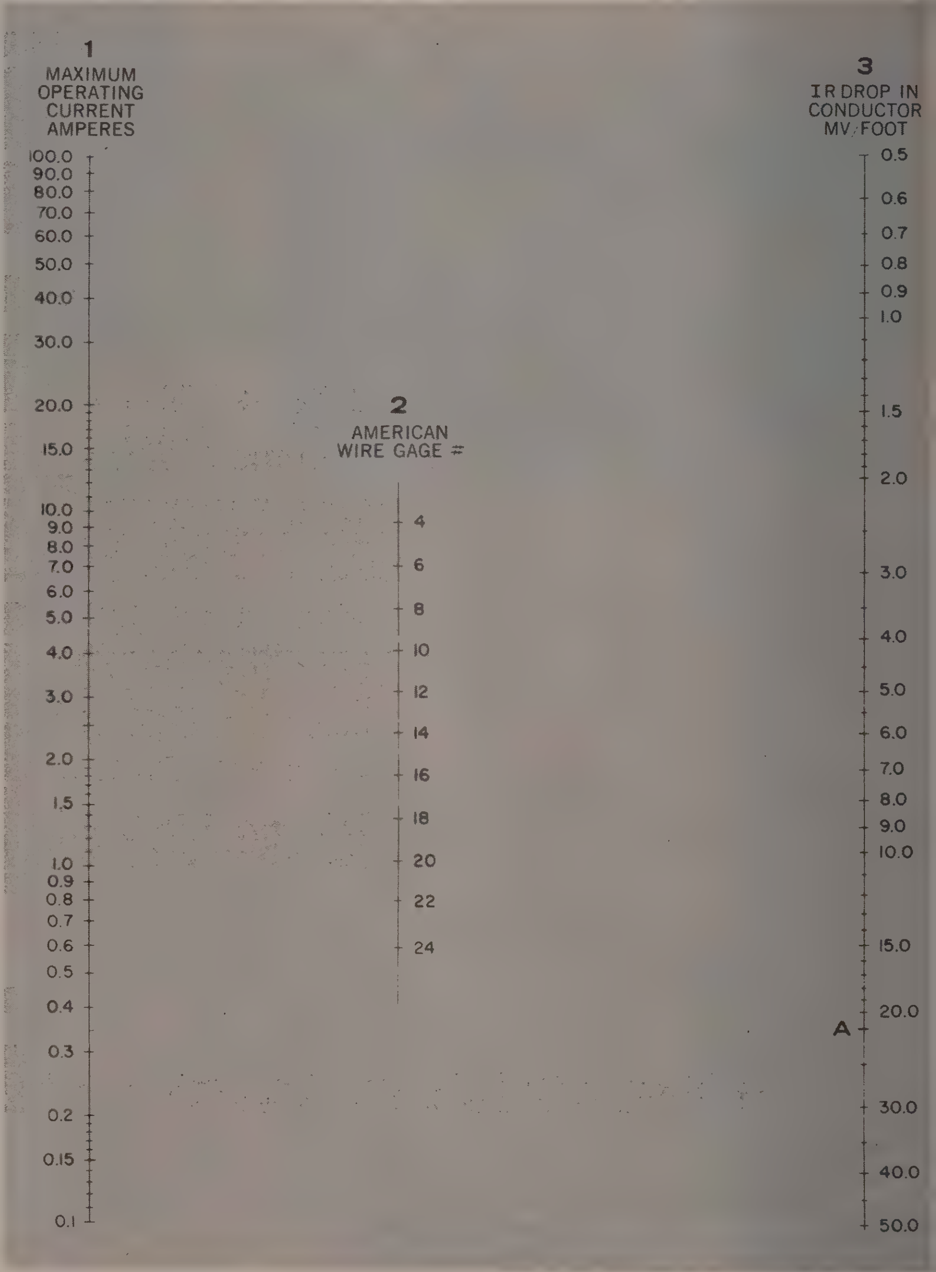
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

** Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



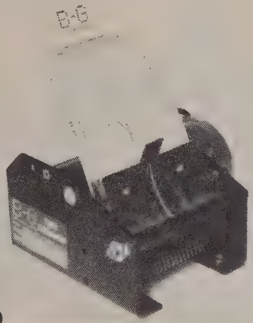
NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

Smart, versatile OEM printer/plotters.

For graphic and alphanumeric data recording.

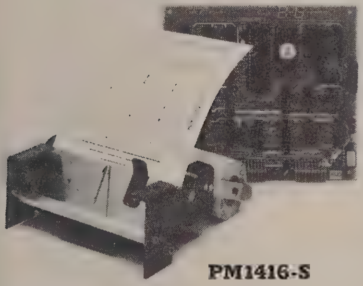
CB1224

PM1224-V



PM1320

CB420



PM1416-S

DataPlot Thermal Print Mechanisms

Model Number	Paper Width	Columns Across[2]	Dots /Inch	Dots /Line	OEM Price[1]
PM1224	2.6 inches	18 to 37	100	224	$311
PM1320	2.6 inches	23 to 53	150	320	$296
PM1416	4.5 inches	29 to 69	100	416	$443

1. This is the 300-piece OEM price. It is subject to change without notice.
2. The maximum number of columns depends on the font and size selected. The higher number is for 5 x 7 characters, approximately 16 characters/in.

DataPlot Printer Control Boards

Model Number	Digital Input	Analog Inputs	OEM Price[1]
CB1224	Parallel & Serial	Optional to 8 channels	$136
CB1320	Parallel & Serial	Optional to 8 channels	$136
CB1416	Parallel & Serial	Optional to 8 channels	$136
CB1100	Parallel & Serial	10-bit, 8-channel std.	$236
CB420	Parallel Only	None	$113

A complete printer normally includes a print mechanism and a control board.

Reliable. All B-G Instruments' printers use fixed-dot, thick-film thermal printheads to achieve fast, quiet operation, long life and reliable performance.

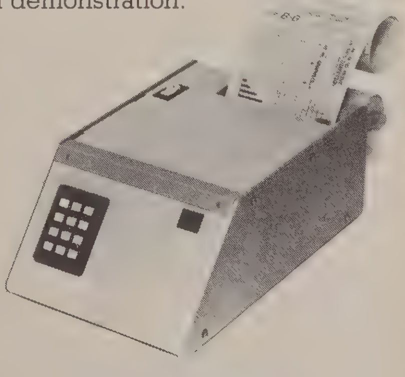
Powerful. B-G's standard DataPlot software makes it easy to print across the paper, print down the paper, and print while you plot data. Simple plotting commands produce curves, grids and bar graphs directly from the input data.

Versatile. For a moderate one-time fixed charge, any B-G printer can quickly be reprogrammed to meet the special requirements of a specific application. Custom character sets, printing stored forms with inserted data, clock/calendar functions, special calculations, conditional operations, these are but a few of the many features that have been included in specially programmed B-G printers.

THERMOGRAPH

Custom Instruments. The recording thermograph shown above is built around a DataPlot 1224-V printer with a custom control/interface board that performs A/D conversion, corrects for thermistor non-linearity, drives a panel display and provides the entire logic system. May we design an instrument for your application?

More Information. Detailed brochures, a price list and sample printouts will be mailed to you as soon as we receive your inquiry. If you have an upcoming OEM application, we would be pleased to discuss it with you in detail and arrange a demonstration.



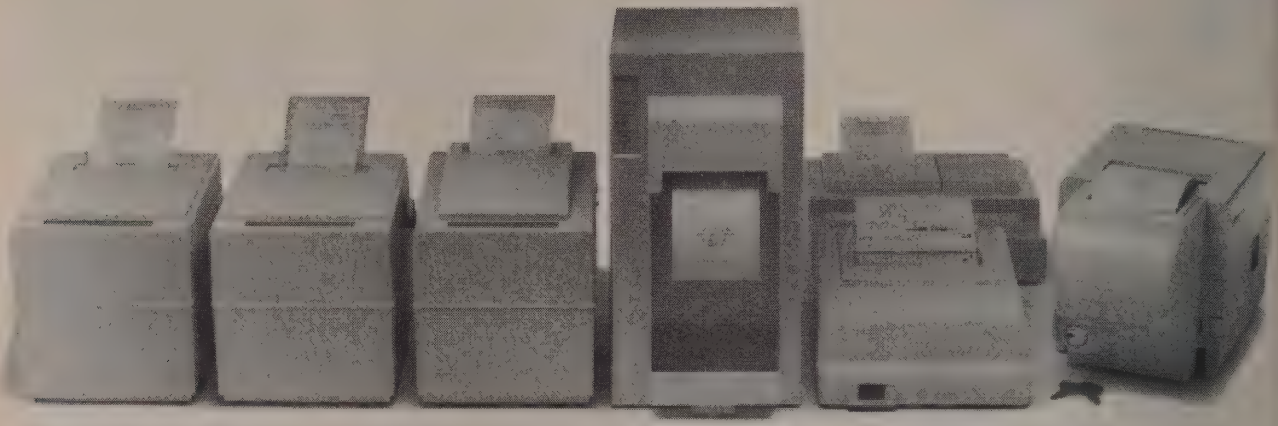
Cabinets and power supplies are also available.

B-G Instruments
Route 1, Box 258 • Mead, WA 99021 • Phone: (206) 567-5000 • FAX: 509/238-4920

CITIZEN

CBM America Corporation
2020 Santa Monica Boulevard, #410, Santa Monica, CA 90404

Engineered to keep everything rolling smoothly.

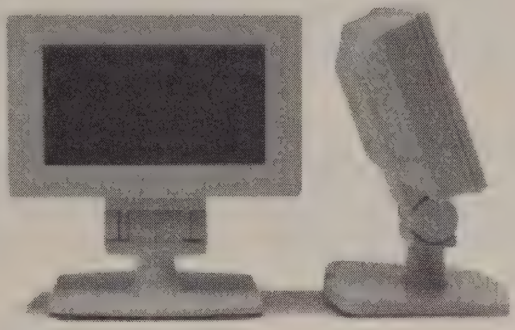


Model Item	iDP-562	iDP-3100•24X	iDP-3530F iDP-3530P	iDP-3540F iDP-3540P	iDP-3541	CBM-750	CBM-210
Print method	Serial dot impact method						Thermal line dot
Print speed	1.6 LPS	2.5 LPS	3.0 LPS	40 C OL. 3.0 LPS			120 Dot Lines / sec
Paper feed	Friction	Friction	Friction or Sprocket	Friction or Sprocket	Friction	Friction	Friction
Paper width	69 mm	57.5 mm	Friction,76 mm Pinfeed,76~89 mm	Friction,76 mm Pinfeed,76~89 mm	76 mm	76 mm	112 mm
Columns	40	24	40	23/28/40	23/28/40	23/28/40	40
Interface	Parallel: Centronics Standard type; Serial: RS-232C, current loop 20 mA, RS-422, RS-485 (except iDP-3530)						
Input buffer	1 line	1 line	2 lines	7K bytes	7 K bytes	7 K bytes	—
Paper end detection	None	None	Standard (buzzer) Pinfeed - No	None Pinfeed - No	Standard (buzzer)	Standard (buzzer)	—
Paper cutter	None	None	None	None	Equipped	Equipped	—
Paper winder	—	None	AW-3 (option)	AW-3 (option)	AW-3 (option)	None	—
Ink Ribbon	Red/Black Cassette	Purple Cassette	2 color (Red / Black), Single color (black or Purple) Cassette				N/A
Power supply voltage	AC 100/115/230V	DC 7V±1V	AC 100/115/230V				
Power consumption	35 W. max.	7 VA printing	approx. 30W	approx. 30 W	approx. 30 W.	approx. 30 W.	40 W. max.
Weight	approx. 2.3 kg	approx. 400 g	approx. 2.8 k g	approx. 2.8 kg	approx. 3.0 kg	approx. 3.0 kg	approx. 2.4 kg
External dimensions (W) X (D) X (H)	240 x 231.5 x 111.5 mm 9.5 x 9.1 x 4.4 inches	106 x 180 x 88 mm 4.2 x 7.1 x 3.5 inches	106 x 184 x 173 mm 6.3 x 7.2 x 6.8 inches	106 x 184 x 173 mm 6.3 x 7.2 x 6.8 inches	106 x 184 x 199 mm 6.3 x 7.2 x 7.8 inches	106 x 184 x 199 mm 7.0 x 8.0 x 13.O inches	190 x 230 x 94.8 mm
Operating temperature	5~40°C,41~104°F	5~35°C, 41~95°F	-20~60°C,-4~140°F				5~40°C,41~104°F
Reliability	1 million lines	MCBF: 1 million	1 million lines	Printer: MCBF 4M lines, Head: 80M characters			MCTF3x10^7 pulses
Cash drawer control	—	—	One drawer	Two drawers	Two drawers	—	—

Telephone (310) 828-8245 Toll-free (800) 421-6516 FAX (310) 828-0846 **CITIZEN**

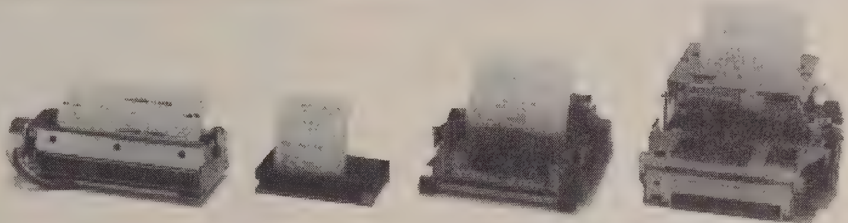
Liquid Crystal Display Terminal

The Citizen LCT-6200 display terminal is designed by fully applying high-density LCD and electronic technologies. The CPU controllers of the terminal intelligently controls the 640 X 200 dot matrix module. The terminal has almost the same performance as an ordinary CRT terminal and can be used for various display devices by using a standard RS-232C interface.



LCT- 6200	SPECIFICATIONS
LCD type	Transmissive B/W STN
Backlight	CFL
No. of dots	640 x 200
Dot dimensions	0.265 (W) x 0.45 (H) mm
Dot pitch	0.295 (W) x 0.48 (H) mm
Screen size	189 (W) x 96 (H) mm
Display mode	Character / Bit image
Character font	8 x 8/16 x 16 dots
Interface	Parallel, RS232C
Display memory	VRAM 32K + ARAM 32K
Power supply	DC 5V, 1.5A Max.
Weight	1 kg
External dimensions	259 (W) x 85 (H) x 162 (D) mm
Operating temp. range	0° C ~ 45° C
Storage temp. range	-20° C ~ 80° C

Printer Mechanisms



LINE THERMAL PRINTERS

ITEM	SPECIFICATIONS
Print method	Thermal line dot
Dot composition	LT-280: 448 dots/line; LT-480-482: 832 dots/line
Printing width	LT-280: 56mm; LT-480: 104mm; LT-482: 44x2mm
Print speed	400 dot line/sec or 50mm/sec.
Paper feed	Friction feed
Paper feed force	100g min.
Paper size	LT-280: 60mm (W); LT-480: 111.5 ± 0.5mm (W) LT-482: 49.5 ± 0.5mm (Citizen recommended)
Operating voltage	5V model: DC 5V ± 5% 24V models: 24V ± 5% Current: 200mA
Head-up detection	Mechanical switch
Paper end detection	Photo interupter
External dimensions	LT-280: 110 (W) x 55 (D) x 40 (H)mm LT-480: 161 (W) x 54 (D) x 36 (H)mm LT-482: 154 (W) x 54 (D) x 72 (H)mm
Weight	LT-280: 300g; LT-480: 500g; LT-482:600g
Operating temperature	5°C ~ 40°C / 35 ~ 80% humidity (no condens.)
Storage temperature	–20%C ~ 60°C / 10 ~ 90% humidity
Reliability	MCTF printing pulse 5 x 10^7 Printing distance: 30km

MD-910 SPECIFICATIONS

ITEM	SPECIFICATIONS
Printing method	Serial impact dot matrix
Printing speed	24 columns: approx. 2.5 lines/sec (3.0 optional) 40 columns: approx. 1.8 lines/sec.
No. of columns	24 columns: 144 dots/line 40 columns: 180 dots/line
Font	24 cols: (5+1) x 7; 40 cols: (4+0.5) x 7
Number of wires	4 x 2
Character size	24 col: 1.7 x 2.4mm; 40 col: 1.1 x 2.4mm
Motor	Voltage: 4.8 ± 0.7/1.0 VDC Average current: 0.3A max.; Peak: Approx. 1A
Printing solenoid	Voltage: 4.8 ± 0.7/1.0 VDC Resistance: 1.7 ± 0.3Ω (25°C)
Paper feed solenoid	Voltage: 4.8 ± 0.7/1.0 VDC Resistance: 9 ± 2Ω (25°C)
Connecting method	PCB fixed to frame with copper foil patterns at 2.54mm pitch
Drive voltage	3.5~5.5 VDC
Printing paper	Ordinary paper 57.5 ± 0.5mm wide or specified pressure-sensitive paper
Copying power	Original print + 1 copy
Ink ribbon	Black or purple cartridge
Paper feed speed	24 columns: Approx 5 lines/sec. 40 columns: Approx. 3.6 lines/sec.
Dimensions	90 (W) x 45.5 (D) x 16 (H)mm
Weight	10.5g ± 10%
Operating temperature	0°C ~ 50°C
Operating humidity	Must be free from abnormality when operated at 40°C and 90% relative humidity for 12 hours
Storage humidity	Must be free from abnormality when stored at –25°C ~ 70°C for 96 hours
Reliabilty	MCBF: 1 million lines

DP-505 SPECIFICATIONS

ITEM	SPECIFICATIONS
Print method	Serial dot impact method
Print speed	575 L/R Approx. 4 lines/second (cont. printing, 5 columns) Approx 1.2 lines/second (cont. printing, all columns) 555 L/R Approx. 4 lines/second (cont. printing, 5 columns) Approx 1.9 lines/second (cont. printing, all columns)
Printing direction	L Series Left to right (horizontal) R Series Right to left (horizontal)
Columns	575 L/R 40 columns 555 L/R 24 columns
Font	5 X 7 Matrix
Character dimensions	575 L/R 1.25(W) x 2.75(H)mm 555 L/R 1.7(W) x 2.75(H)mm
Column spacing	575 L/R 1.5mm 555 L/R 2mm
Line spacing	5.5mm
Motor	Voltage: 12± 1V DC Current: Peak value approx. 2.5 A (12V, 25°C) Average approx. 0.25A
Print solenoid	Voltage: 12±1V DC Resistance: 4.9± 0.5Ω (25°C) Energized time: 2 dot pulses (700±50μS) Peak current: Approx. 2A
Main solenoid	Voltage: 12±1V DC Resistance: 18.4± 1Ω (25°C) Energized time: 16ms±10% (maximum of 5 continuous seconds)
Color change solenoid	Voltage: 12±1V DC Resistance: 18.4± 1Ω (25°C) Energized time: 20±2ms (maximum of 5 continuous seconds)
Insulation resistance	10MΩ minimum (250V DC between terminal board & frame)
Insulation voltage	AC 300V /1 minute / 2mA
Connection method	Flexible cable (SMCD -18 x 91 ES 10)
Ribbon	Color: 2 colors (red & black) Width: 13mm Spool diameter: 30ms or 35mm
Paper feeding speed	Approx. 8 lines/second
Paper size	575 L/R Width: 69±0.5mm Outside diameter: 86mm max. (center guide) 555 L/R Width: 57.5±1mm Outside diameter: 86mm max. (center guide) Recommended paper: Fine quality regular paper, approx 45kg (60μ~80μ thick)
External dimensions	120.5 (W) x 114 (D) x 44.5 (H) mm
Weight	Approx. 450g
Printer angle of inclination	Less than 15° (in direction of dothead motion)
Operating temparature	0°C~50°C
Paper feed traction	More than 100g (Citizen recommended paper)
Reliability	Printer Mechanism MCBF: 1,500,000 lines Dot head: 50,000,000 characters

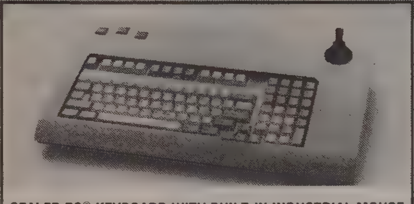
DP- 600 SPECIFICATIONS

ITEM	SPECIFICATIONS
Print method	Serial dot impact method
Print direction	Bidirectional
Printing speed	7x7 DP-610 (23 ch.): approx. 4.0 lines/sec. DP-612 (28 ch.): approx. 3.5 lines/sec. DP-614 (40 ch.): approx. 3.0 lines/sec. DP-617 (40 ch.): approx. 2.4 lines/sec.
No. of columns	DP-610 23 columns, 230 dots/line DP-612 28 columns, 280 dots/line DP-614 40 columns, 360 dots/line DP-617 40 columns, 400 dots/line
Font	7 x 7 Matrix
Character size	DP-610: 1.8 x 2.4 DP-612: 1.5 x 2.4 DP-614: 1.36 x 2.4 DP-617: 1.2 x 2.4
Line spacing	1/6 inch
Motor	Terminal voltage: 24V DC ± 1/2 V DC Peak current: Max. 1A (24V DC 25°C) Mean current: Approx. 0.2 A or less Note: Current should not be carried for more than two minutes under motor lock state.
Dot pulse sensor	Photo interupter
Home position sensor	Photo interupter
Paper feed solenoid	Terminal voltage: 24V DC ± 1/2V DC Direct current resistance: 48Ω (25°C) Driving pulse width: 30 DP, approx. 20ms (current should not be carried continuously for 5 seconds more)
Paper feed solenoid	Terminal voltage: 24V DC ± 1/2 V DC Direct current resistance: 48Ω (24V DC,25°C)
Color change solenoid	Terminal voltage: 24V DC ± 1/2 V DC Direct current resistance: 48Ω (24V DC,25°C)
Connecter terminals	Connecter 1 (MMP17R-1: Counterpart MMH17-1 manufactured by BURNDY) Connecter 2 (MMP7R-1: Counterpart MMH7-1 manufactured by BURNDY)
Paper feed	Friction and sprocket
Paper width	Friction: 3 inches Sprocket: 3.5 inches
Paper	Friction feed: Rolled paper Sprocket feed: Fan fold paper (Single paper) High-quality paper with smooth surface 45kg~55kg/1,000 shts. x 788mm x 1,091mm
Copy	No-carbon paper (1+2 copy) each 34kg (Total thickness: 1 less than 0.2mm)
Paper feed power	More than 100g (Citizen reccommended paper)
Ink ribbon	Two colors (Red and black) Single color (Black or purple)
Quick feed speed	DP-610: Approx. 25 lines/second DP-612: Approx. 21 lines/second DP-617: Approx. 15 lines/second
External dimensions	Two colors: 137(W) x 136(D) x 63.5(H)mm Single color: 134(W) x 136(D) x 63.5(H)mm
Operating temp. range	0°C~50°C
Reliability	Printer: MCBF 4 million lines Head: 80 million characters

Joysticks, Touchscreens, & Trackballs

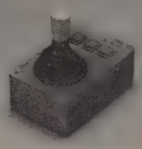
• Joysticks & Touchscreens for Harsh Industrial Environments

INDUSTRIAL MOUSE™



SEALED PC® KEYBOARD WITH BUILT-IN INDUSTRIAL MOUSE

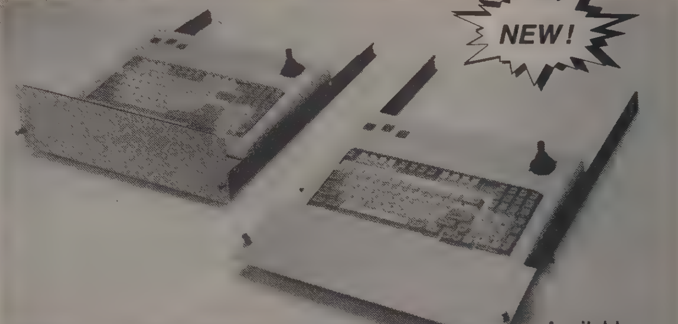
H0000-N30



M30X9

M18X0

- **CTI's mouse replacement for all popular computers in harsh industrial environments**
- NEMA 12 rated, NEMA 4 available
- No moving electrical parts, patented design
- Sophisticated interfaces for any pointing device, mouse simulation
- Custom keyboard assemblies for shelf mounting in a 19" rack
- Electrohydraulic control handles
- One year limited warranty
- Custom designs welcomed

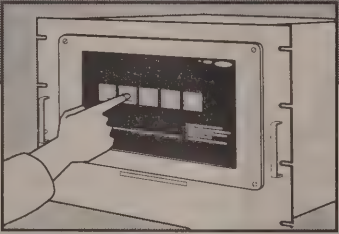


NEMA 12 keyboard with joystick, ready for rack mounting. 5 1/4"H, fold-down front panel.

Available without joystick.

• Touchscreen Mouse

- NEMA rated 4 and 12
- Rack mountable
- Full mouse emulation (patent pending)



Touchscreen Mouse™

• Trackballs for High Reliability Requirements

- Stand alone or integrated into keyboards
- High reliability • Water resistant
- Operates on single +5V supply

T60X0

T70X3

T40X0

NEMA 12 keyboard with 2" trackball, ready for rack mounting. 3 1/2"H, fold-down panel.

Available without trackball.

PC is a registered trademark of the International Business Machines Corporation.

CTI ELECTRONICS CORPORATION
Interfacing people and machines

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VERSATILE IC CARDS AND CONTROLLERS

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MEMORY CARD
FLASH
PCMCIA
FLASH

PCMCIA/JEIDA IC Card Testers and Controllers

MSD3 offers a range of PCMCIA IC Card functional verifiers, testers and operators for the ISA Bus structure, including systems for 3 volt Memory and I/O cards

These systems are ideal for the end user. OEM and VAR alike, accepting 2 Type I or Type II cards or 1 Type III Disk Drive in the same space.

Anywhere stringent quality control. critical performance and complete customer satisfaction is required. MSD3 products are the answer.

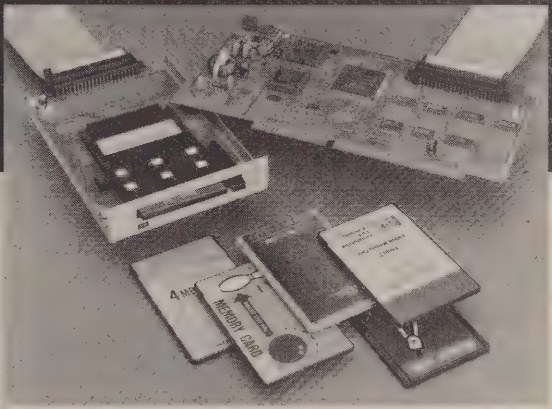
Applications include medical, military,aerospace process control etc.

Other Bus structures, like SCSI, supported.

Memory Systems Design
Development and Distribution, Inc.
365-700 Woodview Ave.
Morgan Hill, CA 95037
PHONE: (408) 778-7267
FAX: (408) 778-2597

FAST PCMCIA READER/WRITERS

USA HOTLINE
1-800-541-ELAN



PCMCIA Reader/Writers

ELAN "J" Series of PCMCIA IC Card units provide all standard read/write functions required by memory cards, as well as the ability to operate FAX/Modem and other I/O cards.

Up to 100 times faster than RS232 and parallel port systems.

Can be configured to replace a standard 3 1/2" disk drive or any IBM PC or compatible; or housed in an external unit and connected to an IBM PC or compatible via a 600mm ribbon cable.

OEM drivers available.

PCMCIA is a trademark of the Personal Computer Memory Card Association.
JEIDA is a trademark of the Japan Electronic Industry Development Association.

ELAN Systems Inc.
365-700 Woodview Ave.,
Morgan Hill, CA 95037
PHONE: (408)-778-7267
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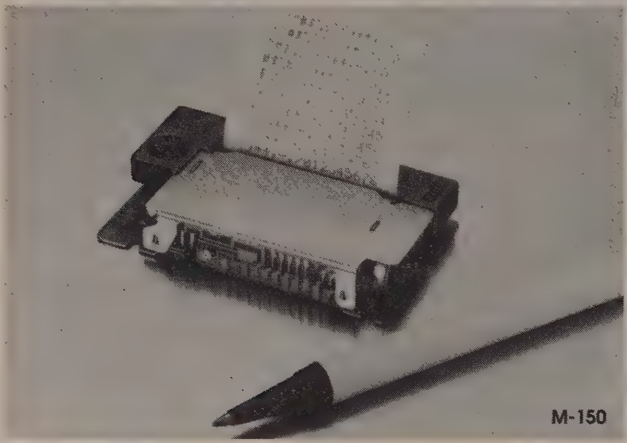
elan

M-150 Series

The World's Smallest Printer



M-150

Series	Model	Columns	Paper Width
M-150 Series	M-150 II	16 Columns	45 mm
	M-160	24 Columns	58 mm

FEATURES

The Smallest Printers in the World

The M-150 series of impact dot matrix printers are the world's most compact printers. They weigh less than 100 grams yet offer an extremely high performance.

Perfect for Compact Devices

Because they're so compact and require so little power, M-150 series printers are ideal for numerous printing applications, from handy terminals to lap-top computers and compact measuring instruments.

A Variety of Symbols and Characters

The graphic printing capability allows the M-150 series to print out a variety of symbols as well as alphanumeric characters.

Capable of Battery Operation

Low power consumption allows M-150 series printers to operate on battery (Ni-cd).

Numerous Models to Meet a Variety of Needs

Numerous models are available varying in paper width and number of columns to accommodate each customer's needs.

SPECIFICATIONS

Model		**M-150 II**	**M-160**
Print Method		Shuttle impact dot matrix	
Print Font	Font	5 x 7	
	Column Capacity	16 columns	24 Columns
	Character Size	1.8 (W) x 2.5 (H) mm	1.7 (W) x 2.4 (H) mm
	Line Spacing	* 3.5 mm	
	Column Spacing	2.1 mm	
	No. of Total Dots	96 Dots/line	144 dots/line
Print Speed		1.0 line/sec.	0.7 line/sec.
Head	Terminal Voltage	3.3 to 5.0V DC	
	Peak Current	3A	

Model		**M-150 II**	**M-160**
Motor	Voltage	3.8 to 5.0V DC	
	Mean Current	0.17A	0.2A
Paper	Width	44.5±0.5 mm	57.5±0.5 mm
	Thickness	0.07 mm	
Inked Ribbon		ERC-05	ERC-09
Ambient Temperature		0 to 50°C (operating)	
Reliability	Mechanism (MCBF)	0.5 x 10^6 lines	
	Head (Life)	0.5 x 10^6 lines	
Overall Dimensions		73.2 (W) x 42.6 (D) x 12.8 (H) mm	91.0 (W) x 42.6 (D) x 12.8 (H) mm
Weight		60 g	75 g

* In case of 5 x 7 font and 3 dots/line paper feed

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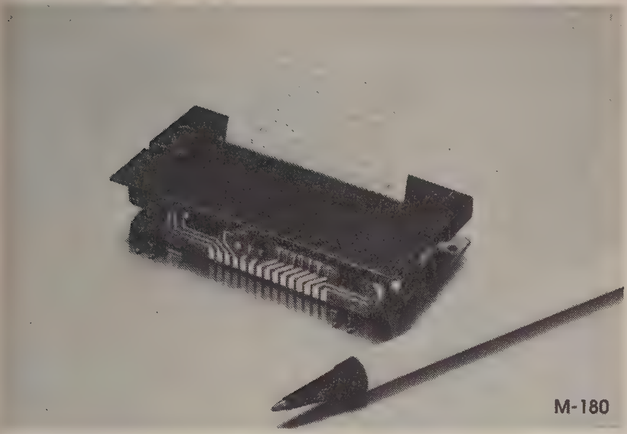
M-180 Series

Ultra Small-Sized Printer



Series	Model	Columns	Paper Width
M-180 Series	M-180	24 Columns	58 mm
	M-181	30 Columns	
	M-182	36 Columns	
	M-183	42 Columns	
	M-185	18 Columns	45 mm
	M-186	20 Columns	Card Type

FEATURES

An Improved Series of the Model-150 Printers

M-180 impact dot matrix printers offer greater speed and durability than even M-150 printers. The maximum printing speed is 1.7 lines per second (as opposed to 0.7 line per second for the M-160) and an MCBF of 1 x 10^6 lines (as opposed to 0.5 x 10^6 lines for the M-160).

Ultra-Compact Design

Weighing less than 100 grams and extremely compact, M-180 printers offer an amazing performance for their size.

Perfect for Compact Measuring Instruments

M-180 printers accommodate specialized needs with selectable print formats (18 to 42 columns), making this series one of the most popular of those used with compact measuring instruments.

Fast Paper Feed Function

The fast paper feed function is standard on all M-180 printers.

SPECIFICATIONS

Model		M-180	M-181	M-182	M-183	M-185	M-186
Print Method		Shuttle impact dot matrix					
Print Font	Font	5 x 7					
	Column Capacity	24 columns	30 Columns	36 columns	42 columns	18 columns	20 columns
	Character Size (5x7 font)	1.7 (W) x 2.6 (H) mm	1.4 (W) x 2.6 (H) mm	1.2 (W) x 2.6 (H) mm	1.1 (W) x 2.6 (H) mm	1.7 (W) x 2.6 (H) mm	—
	Line Spacing	* 3.78 mm					
	Column Spacing	2.06 mm	1.66 mm	1.44 mm	1.29 mm	2.06 mm	—
	No. of Total Dots	144 dots/line	180 dots/line	216 dots/line	252 dots/line	108 dots/line	120 dots/line
Print Speed		1.7 lines/sec.	1.3 lines/sec.	1.1 lines/sec.	1.0 line/sec.	1.7 lines/sec.	Typ. 83ms/1 dot line
Head	Terminal Voltage	3.3 to 5.5V DC					5.0 to 6.0V DC
	Peak Current	3A					3.5A
Motor	Voltage	3.8 to 5.5V DC					
	Mean Current	0.2A					
Paper	Width	57.5±0.5 mm				44.5±0.5 mm	Card type (Max. width 54mm)
	Thickness	0.06 to 0.085 mm					0.21 to 0.25 mm
Inked Ribbon		ERC-09/ERC-22					ERC-24
Ambient Temperature		0 to 50°C (operating)					
Reliability	Mechanism (MCBF)	1.0 x 10^6 lines		0.7 x 10^6 lines	0.7 x 10^6 lines	1.0 x 10^6 lines	1.0 x 10^6 lines
	Head (Life)	1.0 x 10^6 lines		0.7 x 10^6 lines	0.7 x 10^6 lines	1.0 x 10^6 lines	1.0 x 10^6 lines
Overall Dimensions		91.0 (W) x 46.9 (D) x 15.8 (H) mm					93.9(W)x59.3(D)x21.1(H)mm
Weight		95 g					140 g

* In case of 5 x 7 font and 3 dots/line paper feed

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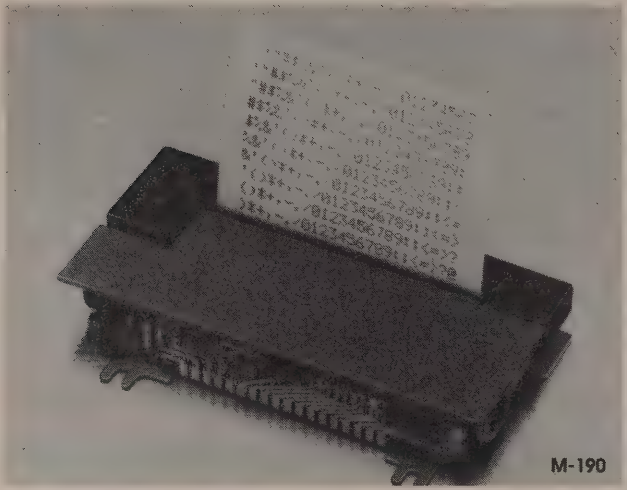
M-190 Series NEW

The Fast, Ultra-Compact Printers for ECR and EFT Applications



Series	Model	Columns	Paper Width
M-190 Series	M-190	24 Columns	58 mm

FEATURES

Ultra-Compact and Lightweight

The new M-190 mechanical dot printer is only 15.8mm high and weighs a mere 100 grams, making it suitable for incorporation within a variety of compact products.

Highly Reliable for ECR and EFT Applications

Capable of printing at a speed of 2.5 lines per second, the M-190 helps improve customer service. The fast printer speed is complemented by high reliability — an MCBF of 1,500,000 lines — ensuring suitability for ECR and EFT applications.

Mount-Compatible with the M-180

The M-190 mount has exactly the same dimensions as the M-180 mount. No additional costs for producing mount molds are required.

Ni-Cd Battery Operation

As with as the M-180, the M-190 can be operated by four Ni-Cd batteries.

SPECIFICATIONS

Model		M-190
Print Method		Shuttle impact dot matrix
Print Font	Font	5 x 7
	Column Capacity	24 columns
	Character Size (5x7 font)	1.7 (W) x 2.6 (H) mm
	Line Spacing	* 3.78 mm
	Column Spacing	2.06 mm
	No. of Total Dots	144 dots/line
Print Speed		2.5 line/sec.
Head	Terminal Voltage	3.3 to 5.5V DC
	Peak Current	TYP 2.5A (4.8V 25°C)

Model		M-190
Motor	Terminal Voltage	3.8 to 5.5V DC
	Mean Current	0.35A (4.8V, 25°C)
Paper	Width	57.5±0.5 mm
	Thickness	0.06 to 0.085 mm
Inked Ribbon		ERC-09/ERC-22
Ambient Temperature		0 to 50°C (operating)
Reliability	Mechanism (MCBF)	1.5 x 10^6 lines
	Head (Life)	1.5 x 10^6 lines
Overall Dimensions		91.0 (W) x 46.9 (D) x 15.8 (H) mm
Weight		100 g

* In case of 5 x 7 font and 3 dots/line paper feed

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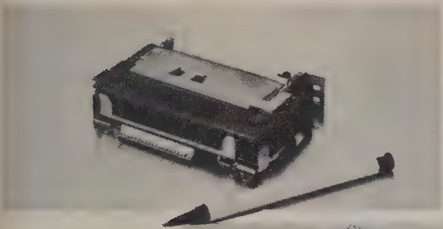
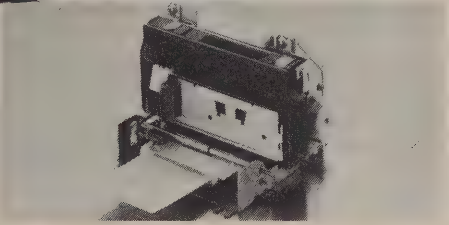
M-260 Series

High-Performance Portable-Sized Printer


M-260


M-260C

Series	Paper Width	Voltage	Model	Distinction
M-260 series (1-sheet)	M-26□ series (76 mm paper width)	12V	M-160	Single Color
			M-262	Double colors
			M-260A	Single color w/auto cutter
			M-262A	Double colors w/auto cutter
			M-260C	Card printer
			M-264	w/o paper feeder
		24V	M-265	Single color
			M-267	Double colors
			M-265A	Single color w/auto cutter
			M-267A	Double colors w/auto cutter
	M-25□ series (58 mm paper width)	12V	M-250	Single color
			M-252	Double color
			M-250A	Single color w/auto cutter
			M-252A	Double colors w/auto cutter
		24V	M-255	Single color
			M-257	Double colors
			M-255A	Single color w/auto cutter
			M-257A	Double colors w/auto cutter

Some products listed above are under development.

FEATURES

Compact, Light, and Thin

The M-260 is amazingly small and light. In addition, it has a very low profile, making it extremely easy to incorporate in a wide variety of products.

Operates on 12V Battery Current

The M-260 is built to draw current from any 12-volt battery, making it possible to use the M-260 in virtually any situation or environment.

Full-Graphic Red/Black Printing

With the M-260, you can enjoy a wide variety of graphic functions as well as a two-color red/black printing capability.

Outstanding Cost-Effectiveness

The affordability, reliability and efficiency of the M-260 make it ideally cost-effective for all types of product categories.

SPECIFICATIONS

Model		M-250	M-260	M-255	M-265
Print Method		Shuttle impact dot matrix			
Print Font	Font	7 x 7			
	Column Capacity	30 columns	42 Columns	30 columns	42 columns
	Character Size	1.3 (W) x 2.9 (H) mm			
	Line Spacing	Approx. 4.2 mm (In case of 7 x 7 font and 3 dots/line paper feed)			
	Column Spacing	Approx. 1.6 mm			
	No. of Total Dots	150 dots/line	210 dots/line	150 dots/line	210 dots/line
Print Speed		Approx. 2.3 lines/sec. (13.2V DC)		Approx. 2.3 lines/sec. (26.4V DC)	
Head	Terminal Voltage	12V D ±10%		24V DC±10%	
	Peak Current	Approx. 2.2A/solenoid		Approx. 1.6A/solenoid	
Motor	Voltage	12V DC±10%		24V DC±10%	
	Mean Current	Approx. 0.2A		Approx 0.15A	
Paper	Width	Roll paper 76.0±0.5 (W) x O.D. 80.0 / 57.5±0.5 (W) x O.D. 80.0 mm			
	Thickness	0.06 to 0.085 mm			
Inked Ribbon		ERC-23 (Black or purple) ERC-34 (Purple) — only available with models having no cutter			
Ambient Temperature		0 to 50°C (operating)			
Reliability	Mechanism (MCBF)	1.5 x 10^6 lines			
	Head (Life)	7.2 x 10^6 characters/1 Head			
Overall Dimensions		122.0 (W) x 83.6 (D) x 25.4 (H) mm			
Weight		Approx. 0.34 kg			
Option		Take-up device			
Safety standard		UL478, CSA220 UL/CSA recognized products are available on request			

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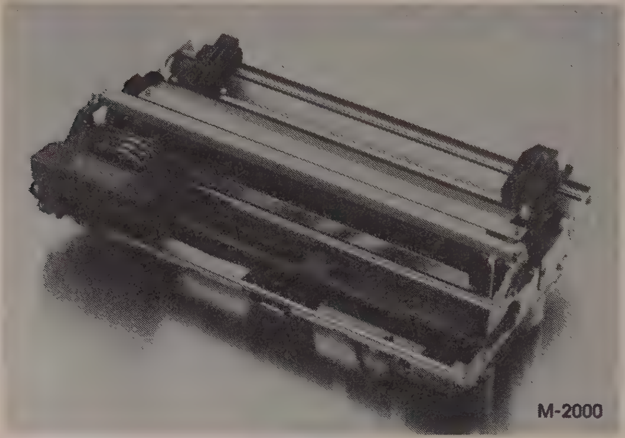
M-2000 Series

The world's first 80-column mechanical dot printer



M-2000

Series	Model	Columns	Paper Width
M-2000 Series	M-2000	80 Columns	127 to 216 (W) mm x Max. 305 (L) mm

FEATURES

Superb Environmental Characteristics

With an operating temperature range from -10 to +60°C, M-2000 functions reliably under severe environmental conditions.

A Car Battery is All the Power It Needs!

Epson's M-2000 is a first — an 80-column mechanical dot matrix printer that runs on a 12-volt car battery. This amazing capability makes M-2000 the ideal printer for portable data collectors and other terminals as well as lap-top computers.

Compact

Although it can print 80 columns per line, M-2000 is only 315 mm wide, 186 mm deep and 79 mm high. Its compact size dramatically simplifies printing terminal design.

No Wasted Paper!

Printers which have an ordinary tractor feeder waste the beginning sheet of fan-folded paper. Not so with M-2000 which is equipped with a innovative Push Tractor Feeder.

SPECIFICATIONS

Model		M-2000
Print Method		Serial impact dot matrix
Print Font	Font	9 x 5
	Column Capacity	80 columns
	Character Size (5x7 font)	2.1 (W) x 3.15 (H) mm
	Line Spacing	* 1.05 mm
	Column Spacing	2.54 mm
	No. of Total Dots	480 dots/line
Print Speed		150 characters/sec.
Head	Terminal Voltage	10 to 16V
	Peak Current	20.7A

Model		M-2000
Motor	Voltage	10 to 16V DC
	Mean Current	0.95A (CR motor), 0.62A (PF motor)
Paper	Width	127 to 216 (W) x Max. 305 (L) mm
	Thickness	0.06 to 0.1 mm
Inked Ribbon		ERC-28
Ambient Temperature		-10 to 60°C (operating)
Reliability	Mechanism (MCBF)	3 x 10^6 lines
	Head (Life)	2 x 10^6 strokes/wire
Overall Dimensions		**315 (W) x 186 (D) x 56.1 (H) mm**
Weight		2.2 kg

* In case of 9 x 5 font and 3 dots/line paper feed

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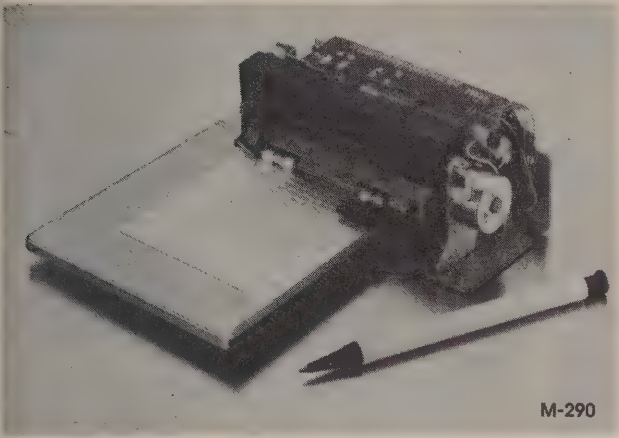
M-290 Series

The World's Smallest 2-Sheet/Slip Printer


M-290

FEATURES

Easy Terminal Design

The M-290 is smaller and thinner than any other slip printer in the world. For terminal designers, this means greater ease, greater freedom and greater product innovation.

Beautiful Print Quality

The high-quality print is extremely clear and legible every time. And in the full graphic mode, up to 42 separate columns can be formatted.

No Limit to Slip Design

The slip can be designed in any number of ways thanks to the use of a stepping motor and numerous advanced features such as Forward and Reverse Paper Feed, 25-Line Fast Feed and Single-Dot Feed. Create precisely the slip design best for your product.

Printer Control Board

An optionally available Printer COntrol Board is specially designed to control the M-290 slip printer..

SPECIFICATIONS

Model		**M-290**
Print Method		Shuttle impact dot matrix
Print Font	Font	5 x 7 (7 x 7)
	Column Capacity	35 (42 columns)
	Character Size	1.3 (W) x 2.9 (H) mm
	Line Spacing	Approx. 4.2 mm
	Column Spacing	Approx. 1.6 mm
	No. of Total Dots	210 dots/line (420 dots/line with half dots)
Print Speed		Approx. 2.3 lines/sec. (26.4V DC)
Head	Terminal Voltage	24V DC±10%
	Peak Current	Approx. 1.6A/solenoid
Motor	Voltage	24V DC ±10%
	Mean Current	Approx. 0.15A

Model		**M-290**
Paper	Dimension	Min. 80.0 (W) x 80.0 (L) Max. 102.0 (W) x 257.0 (L) mm
	Thickness	0.09 to 0.25 mm
Inked Ribbon		ERC-27 (Cassette ribbon)
Ambient Temperature		0 to 50°C (operating)
Reliability	Mechanism (MCBF)	1.5 x 10^6 lines
	Head (Life)	7.15 x 10^6 characters/7 pins
Overall Dimensions		138.0 (W) x 70.5 (D) x 59.5 (H) mm
Weight		Approx 0.55 kg
Option		Mechanical form stopper, T.O.F. sensor, B.O.F. sensor, document table, PC board, insulation cover
Safety Standard		UL478, CSA220 recognized products are available on request

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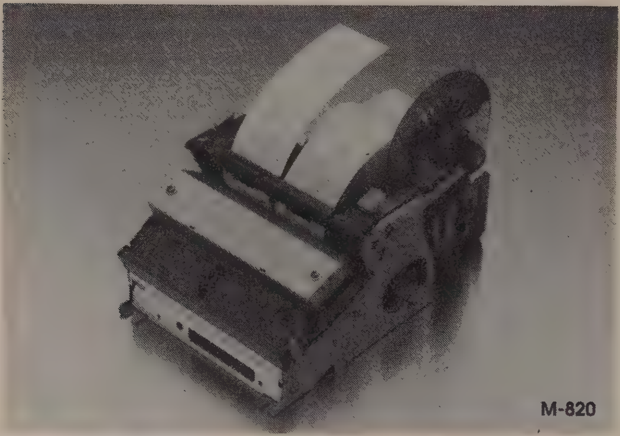
M-800 Series NEW

A New Generation of 2-station Printers for ECRs



Series	Model	Columns	Paper width
M-820 Series	M-820	Receipt: 21 columns Journal: 21 columns Validation: 47 columns	Receipt: 45 (W) x Max. 83 mm dia. (Roll) Validation: 135 to 210 (W) x Min. 70 (H) mm
	M-825	Receipt: 24 columns Journal: 24 columns Validation: 55 columns	
M-870 Series	M-875	Receipt: 32 columns Journal: 32 columns Validation: 69 columns	Receipt: 58 (W) x Max. 83 mm dia. (Roll) Validation: 70 to 180 (W) x Min. 70 (H) mm

FEATURES

A New Standard for ECR Printers

The M-820 has been developed with user-friendly features uppermost in mind. Various versions are scheduled to comprise an impressive lineup.

Fast Yet Quiet

The printing speed of the M-820 is as fast as 2.8 lines per second at 26.4 volts, yet operating noise is remarkably low. The new printer also offers 1-line validation printing.

Easy Paper Removal

One of the M-820's user-friendly features is its clamshell design. This innovative design offers several distinctive advantages including easy removal of jammed paper — just one way the M-820 offers greatly enhance serviceability.

A Wide Variety of Options

A wide variety of options are offered for the M-820, including an automatic cutter mechanism, supplying unit, near-end detector, and validation detector.

SPECIFICATIONS

Model		M-820	M-825	M-875
Print Method		Shuttle impact dot matrix		
Print Font	Font	7 x 7	7 x 9	
	Column Capacity	Receipt:: 21columns Journal: 21 columns Validation: 47 columns	Receipt: 24 columns Journal: 24 columns Validation: 55 columns	Receipt: 32 columns Journal: 32 columns Validation: 69 columns
	Character Size	1.5 (W) x 2.7 (H) mm	1.35 (W) x 3.1 (H) mm	1.4 (W) x 3.1 (H) mm
	Line Spacing	4.3 mm		
	Column Spacing	1.83 mm	1.57 mm	
	No. of Total Dots	Receipt::95 dots/line Journal: 95 dots/line Validation: 213 dots/line	Receipt: 107 dots/line Journal: 107 dots/line Validation: 247 dots/line	Receipt: 143 dots/line Journal: 143 dots/line Validation: 311 dots/line
Print Speed		2.8 line/sec.	3.2 line/sec.	2.6 lines/sec.
Head	Terminal Voltage	21.6 to 26.4V DC		
	Peak Mean Current/9-wire	8.4A	10.8A	

Model		M-820	M-825	M-875
Motor	Voltage	21.6 to 26.4V DC		
	Mean Current	200 mA	550 mA	
Paper	Width	Receipt:: Roll paper 44.5 ± 0.5 (W) x O.D. 83 mm Validation: 135 to 210 (W) x Min. 70 (H) mm		Receipt:Roll paper 57.5 ±0.5 (W) X O.D. 83MM Validation: 135 to 210 (W) x Min. 70 (H) mm
	Thickness	Receipt: 0.06 to 0.09 mm, Validation: 0.2 mm		Receipt: 0.06 to 0.09 mm Validation: 0.07 to 0.14 mm
Inked Ribbon		ERC-32		ERC-35
Ambient Temp.		0 to 50°C		
Reliability	Mechanism (MCBF)	2 x 10^6 lines	4 x 10^6 lines	
	Head	2.8 line/sec.	3.2 line/sec.	2.6 lines/sec.
Overall Dimensions		154(W) x 226(D) x159.2(H)mm	150(W) x 228(D) x159.2(H)mm	171(W) x 228(D) x 162(H) mm
Weight		31.5 kg		1.7 kg
Option		Validation sensor, Take up device, Near end sensor, Auto cutter	Validation sensor (Receipt), Near end sensor (Receipt), Manual cutter, Auto cutter	

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EPSON AMERICA, INC. (OEM)

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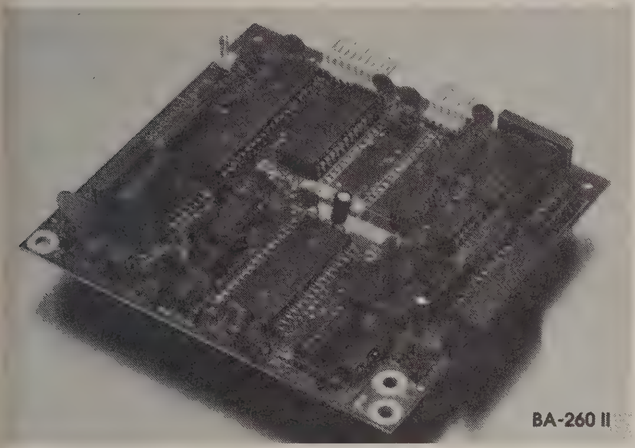
BA/LA Series

Convenient Control Board



BA-260 II

FEATURES

For Greater Convenience

BA series control boards conveniently interface Epson printers with other products. The customer is therefore saved the cost and time otherwise required to develop a control board.

Perfect for All Applications

The user-friendly BA control boards are perfectly suited to any application, from measuring devices and "New Media" devices to computer terminals.

Compact and Highly Reliable

Despite their compact size, BA control boards are extremely reliable, consume very little power, and offer trouble-free performance.

SPECIFICATIONS

Model	BA-170 III	BA-180	BA-260 III	BA-280	BA-290
Print	M-150 II, M-160, M-163, M-164, M-170	M-180, M-181, M-182, M-183	M-250, M-250A, M-252, M-252A M-255, M-255A, M-257, M-257A M-260, M-260A, M-262, M-262A M-265, M-265A, M-267, M-267A	M-280 M-280A	M-290
Character	JIS mode: 128 characters ASCII mode: 31 characters Graphic mode: 36 characters Download mode: 8 characters		ASCII mode: 96 Characters International: 32 characters Graphic mode: 256 characters Download mode: 95 characters	ASCII mode: 96 characters International: 32 characters Graphic mode: 384 characters Download mode: 95 characters	ASCII mode: 96 characters International: 32 characters Graphic mode: 384 characters
Data Input Form	• 8 bit parallel 2500 cps (Max.) • Unsynchronous serial 1200 bps or 2400 bps	• 8 bit parallel 2500 cps (Max.) • Asynchronous serial 4800 bps or 9600 bps	• 8 bit parallel Centronic compatible TTL level • Asynchronous serial RS-232C compatible	• 8 bit parallel Centronics compatible TTL level • Asynchronous serial 110, 150, 300, 600, 1200, 2400, 4800, or 9600 bps RS-232C compatible	• 8 bit parallel Centronics compatible TTL level • Asynchronous serial RS-232C compatible
Operating Voltage Range	4.0 to 5.25 VDC	4.0 to 5.75 VDC	5 VDC ±5% (for control circuit) 12 VDC ± 10% or 24 VDC ±10% (for printer mechanism)	5 VDC ±5% (for control circuit) 24 VDC ±10% (for printer mechanism)	
Overall Dimensions	70 (W) x 90 (D) x 16 (H) mm	88 (W) x 80 (D) x 19.5 (H) mm	120 (W) x 150 (D) x 20 (H) mm	120 (W) x 140 (D) x 20 (H) mm	120 (W) x 155 (D) x 20 (H) mm
LSI model (flat type or dip type)	LA-170F	LA-180	LA-260A	—	

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PCMCIA-COMPATIBLE MEMORY CARDS

MEMORY CARD
RAM 256KB
INSERT THIS WAY
MEMORY CARD
ROM 2MB
MEMORY CARD
DRAM 4MB
INSERT THIS WAY
MEMORY CARD
DRAM 8MB
MEMORY CARD
F-ROM 4MB

FDK's DEDICATION to your SATISFACTION

FDK is noted for its memory technologies accumulated over 25 years of memory development and production, and for its mass production techniques involving small-sized, thin-shaped products. FDK also produces lithium batteries that serve as a memory backup power source. For these reasons, FDK can produce reliable memory cards at a low cost in the shortest delivery time.

Card type	Model No.		Memory capacity (Byte)								Cycle time/ Access time Tc/Ta max.	Power source current +5V Typ.	Memory retention period Ta=25°C	Battery excharge mechanism (RAM)	JEIDA	Note
			64K	128K	256K	512K	1M	2M	4M	8M						
SRAM	SC9001		●	●	●	●					250ns./250ns.	45mA	5/4/2/1 years	Slide lock type	Ver. 3.0	—
	SC9016		●	●	●	●								Screw stop type	Ver. 4.0	Rechargeable battery back up
	SC9013				●	●	●	●								
	SC9014				●	●	●	●						Slide lock type		
OTP-ROM	SC9005				●	●	●	●			250ns./250ns.	50mA	—	—	Ver. 4.0	—
	SC9011				●	●	●	●								Card write enable
MASK-ROM	SC9021						●	●	●*		250ns./250ns.	45mA	—	—	Ver. 4.0	—
FLASH-ROM	SC9008				●	●	●	●			250ns./250ns.	70mA	—	—	Ver. 4.0	—
	SC9015					●	●	●	●							
PSEUDO-SRAM	SC9010				●	●	●	●			250ns./250ns.	130mA	—	—	Ver. 4.0	—
SRAM+ OPT-ROM	SC9007	SRAM	●								250ns./250ns.	50mA	5 years	Slide lock type	Ver. 3.0	Rechargeable battery back up Card write enable
		ROM				●										
	SC9018	SRAM			●								2 years			
		ROM				●										
DRAM	SC9020								●	●	160ns./80ns.	650mA	—	—	Ver. 1.0	88 pin

68 pin except DRAM Card

*also 3M available

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Clear Focusing with No Dispersion or Diffusion caused by etched surfaces

TOLERATES HIGH HUMIDITY

Hermetically sealed surface operates at 100% humidity with condensation

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Capacitive Technology continuous resolution

HIGH ACCURACY

Accuracy and linearity within 1%

DURABILITY

Scratch and wear-resistant proprietary coating

SCREEN SIZES

Curved and flat screens to fit most CRT's and flat panel displays

CONTROLLERS

Serial, Parallel and Stand-alone controllers

UNIVERSAL INTERFACE

Serial interfaces compatible with ISI and other touch screen application drivers

OPTIONS

Driver for Windows 3.0 and DOS Mouse
Emulation of MicroTouch and Elographics controllers

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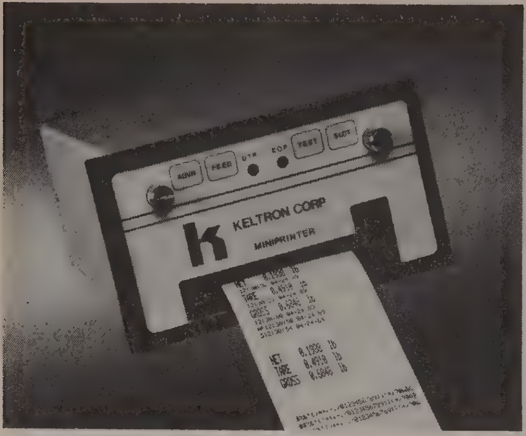

KELTRON CORPORATION
MINIPRINTER DIVISION

Miniature High-Speed Instrumentation/Industrial SmartPrinters™

Low Cost / General Purpose / Special Purpose

Impact Panel Mount Models

Keltron Miniprinters incorporate many features not usually offered in panel mounted printers. Scientific applications include analytical instrumentation, patient monitors and diagnostic testers; industrial applications include logging temperature, pressure, frequency, power and other parameters.

LOW COST (LC SERIES) WITH NO-SACRIFICE PERFORMANCE

24 or 32 Column, Programmable
2K Data Buffer
Choice of Input Power: AC or DC, European or USA
Standard Communications Interface. Choose from:
RS-232C, RS-422, RS-485, Parallel (Centronics)
Standard Calculator Paper, 2.5 inch dia. roll

GENERAL PURPOSE UNITS

8K Data Buffer, Expandable to 64K
16 to 42 Column Units Available
Red/Black Printing Option
Hardware Clock Option
Choice of Input Power, Including Wide Range 9-40 VDC
Dual Series / Parallel Interface Option

STANDARD FEATURES

Full 256 Character ASCII Set
Autoprint with Built-in Interval Timer
Double Height, Double Width Characters
Line Counter
Test/List Operation
Membrane Switch Front Panel
Graphics Capability
Hardware/Software Handshaking, Serial Interfaces

AND MANY STANDARD / OPTIONAL FEATURES NOT READILY AVAILABLE ELSEWHERE:

BCD Input
Minimum Depth
Line Counter
Internal Paper Take-up
64K Data Buffer
Interval Timer
Standard Software Clock

PRINTOUT DATA

	Number of Columns	Speed (lpm)	MTBF (lines)
LC Series (Low Cost)	24, 32 (programmable)	150	1,000,000
MM Series (Standard Speed)	16, 24, 32, 40	25 to 60	500,000
MH Series (High Speed)	24, 30, 36, 42	60 to 102	500,000 to 700,000
VS Series (Very High Speed)	35, 42	138	1,500,000

SPECIAL PURPOSE

PLC PRINTER

The PLC-compatible, PLC80P is a 24-column printer designed for use with "shoe box" type PLCs.

Features:

Field Programmable Messages
Built-in Clock/Calendar
256 Character Set, Double Height on Command

ANALOG PRINTER

The AM2481 Analog Printer is available with a variety of optional input modules for direct reading, scaling and printing of temperature, pressure, frequency and more...

Features:

Self Calibrating
Battery-backed Clock/Calendar
15 Bit A/D
Formattable Output

KELTRON CORPORATION

225 Crescent Street, Waltham, MA 02154 TEL (617) 894-8700 / FAX (617) 899-9602

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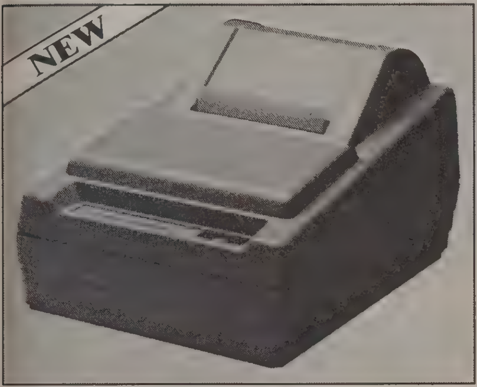
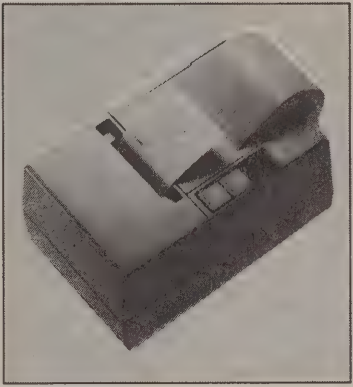
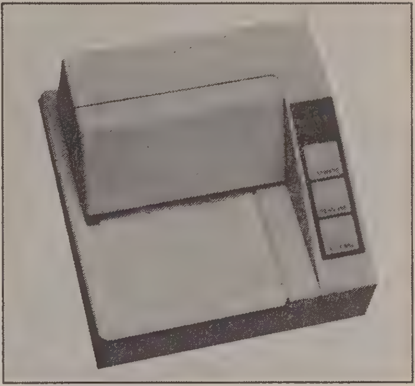


TM 300 SERIES High Speed Impact Printer
Cutter and Take Up Models Too.



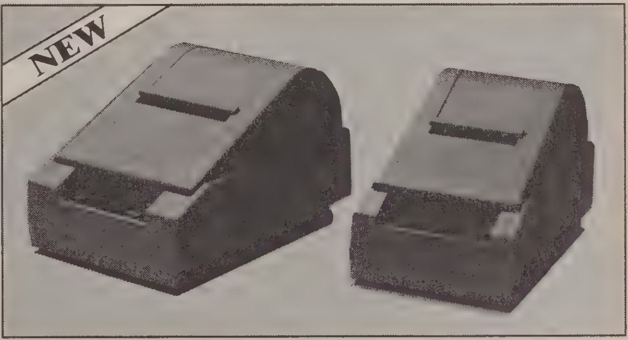
TM 267 Printer Take Up Spooler
and Cutter Models Available



Flat Bed Slip Printer TM-290

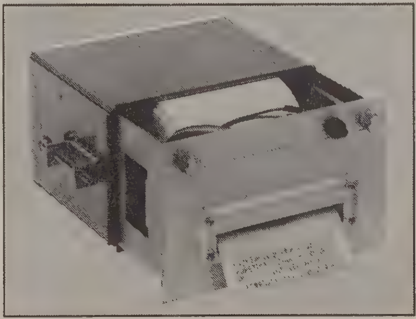
M-180 MECHANISM Small 20-42
Column Mech for Hand Held Units

EPSON Cutter

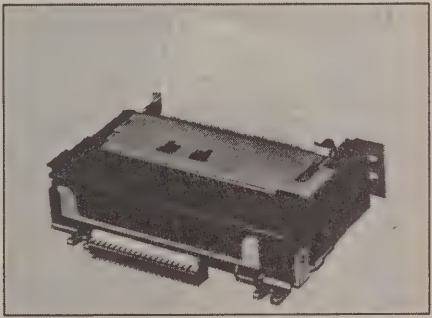


Very High Speed Thermal Bar Code Printers

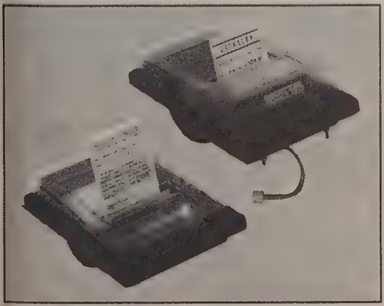
Paper Sense Switch Take Up Spooler



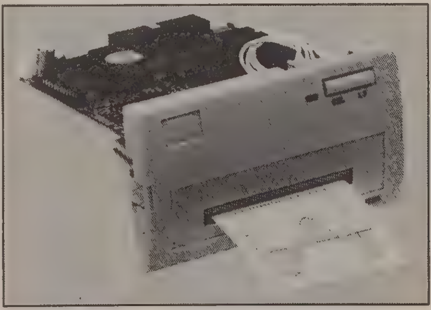
Panel Mount Printer with EPSON Mechanism



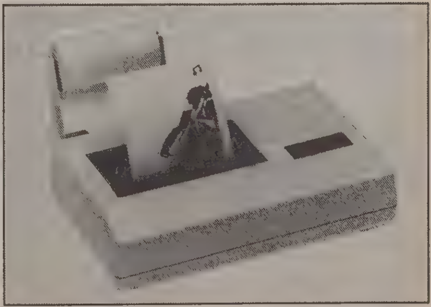
Reliable Shuttle Mech. M-260



Case For EPSON M160 M180 Series
For EPSON M 260 Series. Cutter Option.



Low Cost Panel Printer with EPSON Mechanism



Small Portable Printer
Battery Option

eem

MINIGLOSSARY

BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digi
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1
②	12-11-9-8-1
③	11-0-9-8-1
④	12-11-0-9-8-1
⑤	No-Punches
⑥	12
⑦	11
⑧	12-11-0
⑨	12-0
⑩	11-0
⑪	0-8-2
⑫	0
⑬	0-1
⑭	11-0-9-1
⑮	12-11

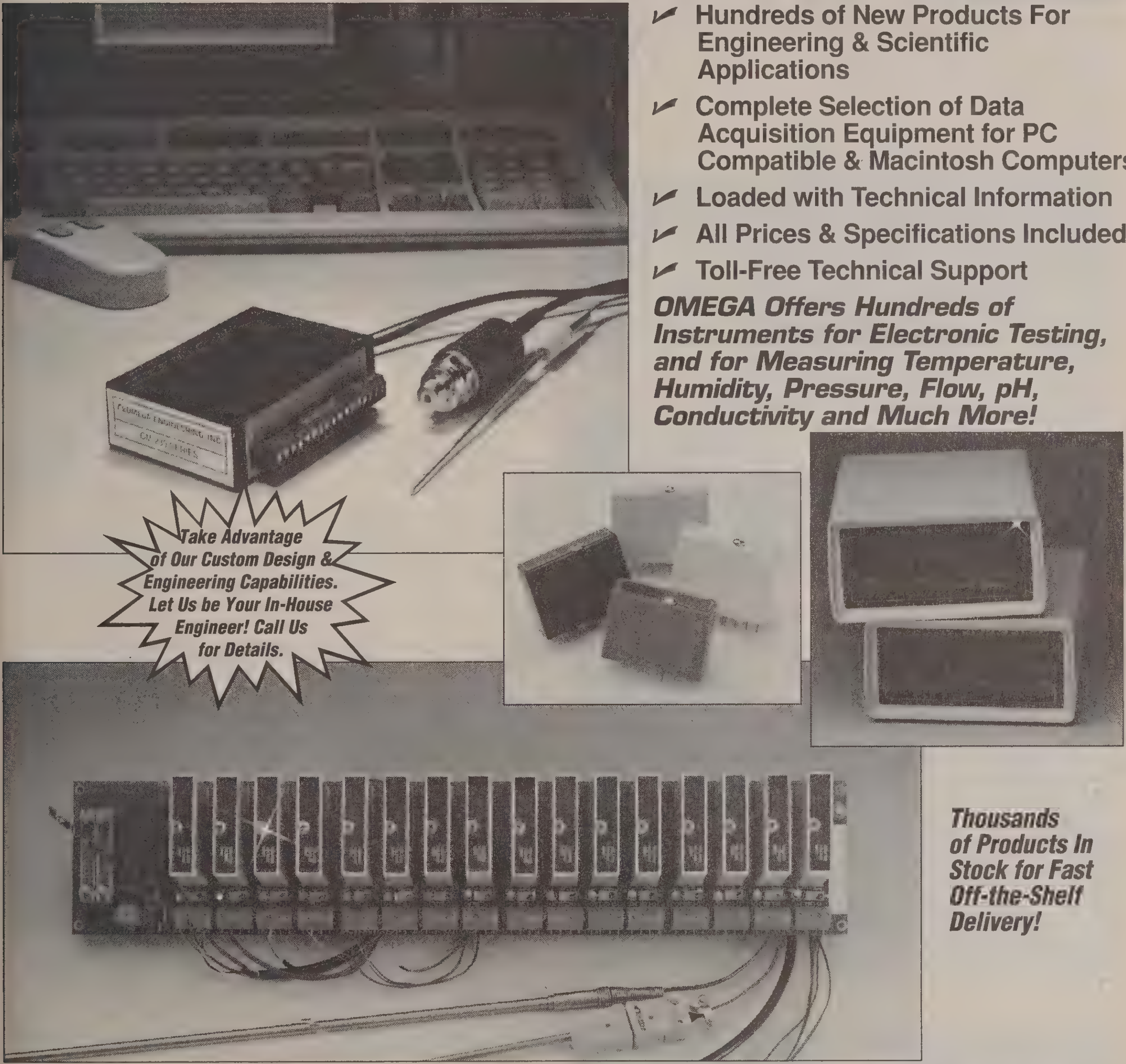
Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

OMEGA... FOR DATA ACQUISITION



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*OMNI**Print*** provides complete mechanical, electronic, and software design, and manufacturing of dot matrix thermal, impact, and ink-jet printers. *OMNI**Print*** offers a comprehensive line of high quality, reliable, multipurpose and special purpose printers as complete standalone, or as component sub-assemblies designed for easy, cost effective integration into the OEM's systems.

Applications include point of sale, electronic cash registers, remote receipt printers, automatic teller machines, medical and industrial instruments, scientific test equipments, time clocks and recorders, video text, coupon dispensers, and many other industrial, financial and commercial applications.

*OMNI**Print*** is an authorized distributor of **Epson and Olivetti** print mechanisms, control boards, and standalone mini-printers.

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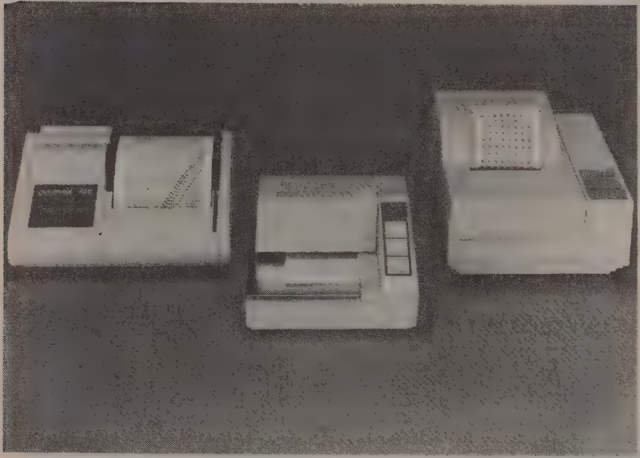


STANDALONE PRINTERS

Packaged thermal and impact printers for OEM, system and industrial applications incorporating the well-proven Epson, Seiko, or Olivetti high quality printers.

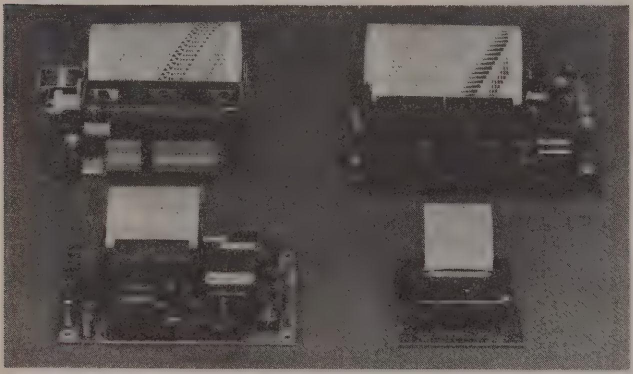
OM 267
Cost effective multicopy 2-color receipt printer with outstanding features and options.

TM 290
The world's smallest slip printer with excellent cost to performance ratio.

OM 426
Extremely reliable thermal line printer, fast and quiet with 256 bit mapped dots per line.

PX 40
Low cost, compact, battery powered. 40 (compressed 80) columns.

OM 40, OM 20, TM 210, and more.
Options include: Internal drivers for cash drawers, paper rewind device, auto-cutter, extended memory, custom characters, multiple interface, etc.

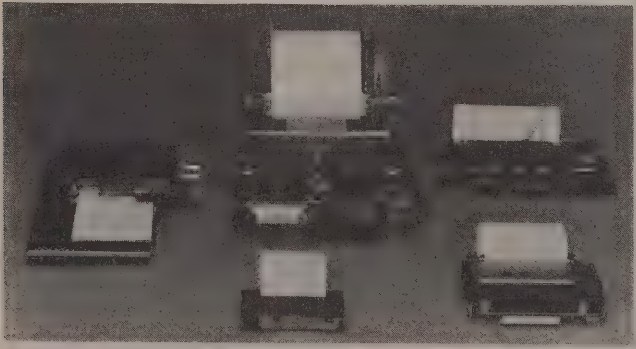


CONTROL BOARDS and CHIPS

A series of controller boards and microprocessors are designed to control a number of Epson and Olivetti dot matrix printers. Combination of board and mechanism as sub-assembly allows for maximum ease in product integration or replacement of less satisfactory printers in existing installations.

- Serial or parallel
- 5,12, or 24 VDC
- CMOS, Low Power Consumption
- Multiple Hand Shakes
- Bit Image Graphics
- Print Direction Switching
- AC or DC
- Single Power Source
- Compact and Reliable

Modification to operation software instruction or special user commands are convenient and easy to accomplish.



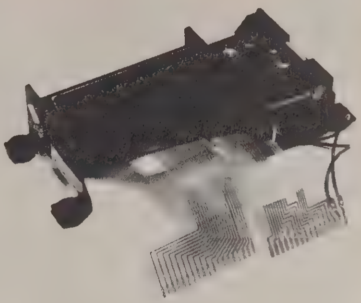
MECHANISMS

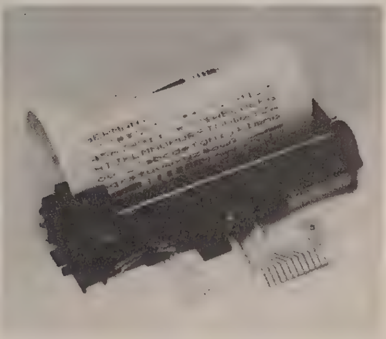
A wide variety of Epson and Olivetti dot matrix thermal and impact print mechanisms provides the OEM's with an optimum solution to virtually any hard copy requirement.

- Fast, up to 6 lines per second
- Reliable, up to 100 million characters
- Graphics, up to 150 DPI
- 20-42 (compresses 80) columns
- Low Power Consumption
- Low Cost
- Compact
- Multicopy
- 1 or 2 color

Options such as auto-cutter, validation sensor, low paper detection, paper rewind device, etc. are also available.

OMNI**Print** *SPECIALITY PRINTERS FOR THE OEM*





PRINTER MECHANISMS

	Model*	Column Capacity	Graphics Dots/Line	Paper Width, mm(in)	Speed LPS	Voltage VDC +/- up to 10%	Overall Dimensions WXDXH (mm)	MCBF (Mil Chr Line)	Features
Thermal	PU 1800	20	140	60(2.4)	1.8	6	130x70x34	1	Over 4 million sold (of this family)
	PU 1840/2	40	320	110(4.3)	1.8	18	181x70x34	1	Low cost, easily replaceable heads
	PU 1840/4	40	280	110(4.3)	3.6	18	181x70x34	1	
Impact	PU1300	16x2	No	44.5(1.75)	2.0	18	170x145x65	2	ECR Printer, (Rcpt/Journal) Options: 6 line Validation, Auto Cutter
	PU1336	34	No	89(3.5)	2.0	18	170x145x65	2	Credit Card Slip and Roll Printer
	PU 1700	24x2	Yes	44(1.73)	2.1	24	220x130x85	1.5	3 Station ECR Printer (Rcpt/Journal, Validation)
	PU1790	52	Yes	90(3.54)	2.1	24	220x130x85	1.5	Slip Printer Versions, 56 char., cutter & take-up opt.
	Model**								
Thermal	Model-1221	40	480	112(4.4)	0 8	4.45.6	140x46x22	0.5	Battery Operation
Impact	Model-150	16	96	44.5(1.75)	1.0	4.5	73x42x12	0.5	Receipt Printers
	Model-160	24	144	57.5(2.25)	0.7	4.5	91x42x12	0.5	Micro Size
	Model-170	40	240	69.5(2.75)	0.4	4.5	103x45x15	0.4	Battery Operation,
	Model-180	24	144	57.5(2.25)	1.7	4.8	91x46x15	0.7	Graphics
	Model-183	42	252	57.5(2.25)	1.0	4.8	91x47x16	0.5	
	Model-210	31	158/315	76(3)	2.4	24	122x280x153	2	Excellent Cost Performance Ratio,
	Model-211	40	392	76(3)	2.4	24	122x281x153	2	Multiple Options available
	Model-240	31	315	Min 210x(297)	2.4	24	138x156x136	2	Model 240: Slip Printer
	Model-250	30	150	57.5(2.25)	2.3	12 or 24	122x84x26	1.5	Compact, Fast Options: Cutter, Rewind
	Model-260	42	210/420	76(3)	2.3	12 or 24	122x83x25	1.5	Light, Compact, Low Priced Options: Cutter, 2 Color, Take-up
	Model-280	18x2	90+90/180+180	37.5 (1.5) Min	2.3	24	126x271x114	1.5	ECR Printer, several options
	Model-290	42	210/420	80X80	2.3	24	138x71x60	1.5	Slip Printer, several options
	Model512-G	40	240/480	88.5 (3.5)	3.0	24	170x156x94	5	Long Life Print Heads (100 milion Chrs)
	Model-542-G	40	240/480	Min 108X(210)	3.0	24	74x120x144	5	Multiple Options available including Auto Cutter

*Olivetti line ** Epson line

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(800) 878-6880
Fax: (714) 457-9016

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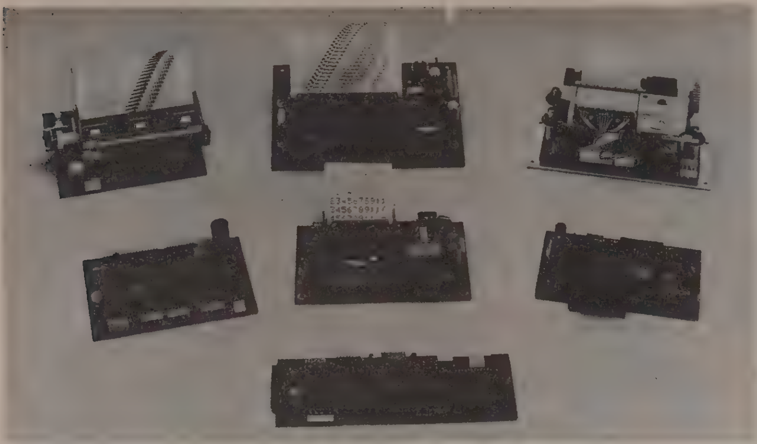
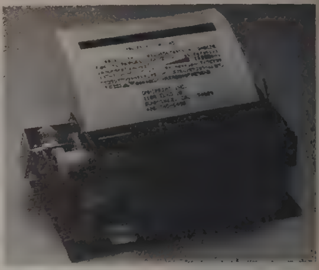
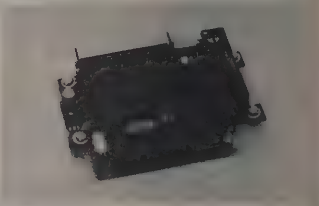
10 Purchase Street
Fall River, MA 02720
Tel: (508) 324-1574
Fax: (508) 324-0182

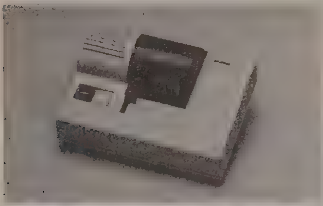


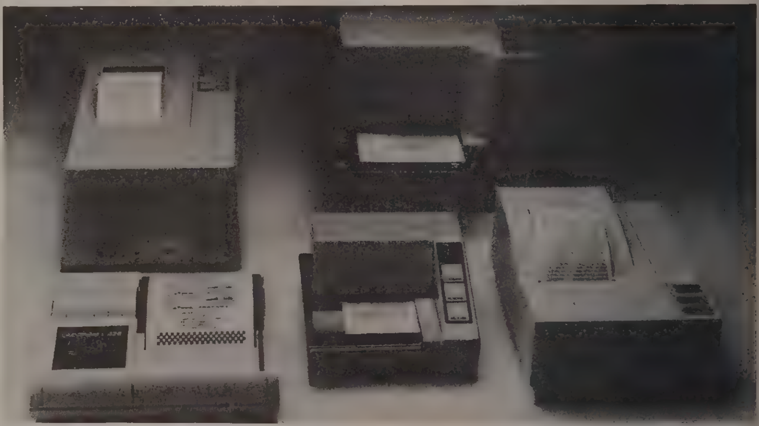




CONTROLLERS

	Model	Column Capacity	Graphics (Dots/Line)	Paper Width, mm(in)	Speed LPS	Voltage(VDC) +/- up to 10%	Overall Dimensions WxDxH(mm)	LSI Model	Interface	Features
Thermal	OPC 1800	20	140	60(2.25)	1.8	12	133x99x37	R1070	Serial/Parallel	Sideways and Upside Down Printing, Multiple Character Sizes, Custom CHR set
	OPC 1822	20	140	60(2.25)	1.8	24	152x101.6x38	R1070	Serial/Parallel	
	OPC 1844	40	280	110(4.3)	3.6	24	188x127x38.10	NA	Serial/Parallel	
	OPC 1451	42	256	112(4.4)	6.0	24	143x102x50	NA	Serial/Parallel	Quiet, Fast, Graphics
	BA-1200	40/80	480	112 mm (4.4)	1.12	5.0	140x34x19	NA	Serial/Parallel	Compact
Impact	OPC 267	35/42	210/420	76(3.0)	2.3	24	Approx. 125x175x20	LSI-267	Serial/Parallel	2 Color Multipart Options: Auto cutter, buffering
	BA-170	150,160,170 Family	ASCII/ Graphics	-	-	4 to 5.25	90x94x16	LA170	Serial/Parallel	Compact, Low Cost, Reliable Ready to interface
	BA-180	180 Family	ASCII/ Graphics	-	-	4 to 5.75	88x80x20	LA180	Serial/Parallel	
	BA-260 II	250 & 260 Family	ASCII/ Graphics	-	-	5 & 12 or 24	120x150x20	LA260	Serial/Parallel	





COMPLETE PRINTERS

	Model	Column Capacity	Graphics (Dots/Line)	Paper Width, mm (in)	Speed LPS	Voltage +/- up to 10%	Overall Dimensions WxDxHx (mm)	MCBF (Mil Chr Line)	Interface	Features
Thermal	OM 20	20	140	60(2.4)	1.8	12 VDC	191x142x79	1	Serial/Parallel	Low cost, desktop models
	OM 40	40	280	110(4.3)	3.6	110 or 220 VAC	267x191x97	1	Serial/Parallel	
	OM426	42	256	112(4.4)	6.0	110 or 220 VAC	241x191x76	3	Serial/Parallel	Quiet, Fast, Reliable
	P40	40	320/640	112(4.4)	1.12	5 VDC	216x128x46	0.5	Serial/Parallel	Battery Operation
Impact	TM-210A	35	158	76(3.0)	2.4	110 or 220 VAC	210x358x144	2	Serial/Parallel	Options: Wall Bracket
	TM-290	42	210	Min. 80(W)x80(H)	2.3	24 VDC	180x191x99	1.5	Serial	Compact, Low Cost A/C Power supply option
	TM-545B	40	240	Min. 100(W)x80(H)	3.0	110 or 220 VAC	282x62x215	4	Serial/Parallel	Heavy Duty, Reliable
	OM267	35/42	210/420	76(3.0)	2.3	110 or 220 VAC	203x254x114	2	Serial/Parallel	Low cost desk top for POS/data logging Options: RS422/423, 2 cash drawer kick, customization

CUSTOM DESIGN AND PRIVATE LABEL
Omniprint will Design, Develop and Manufacture to OEM Specifications
CUSTOMER SUPPORT
Up to one year standard warranty on certain products, In/Out Warranty repair through Service Center.

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DATA ENTRY TERMINALS

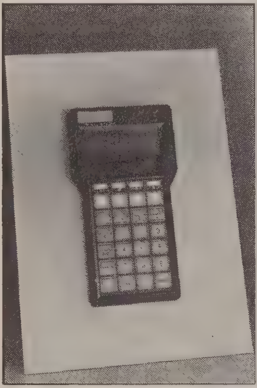
Handheld

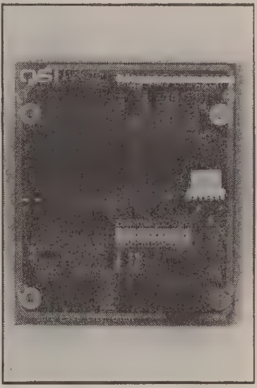
- Rugged construction for reliable operation in the field.
- Easy-to-read 4x20 Supertwist LCD display is available in backlit or wide-temperature versions.
- 40- or 24-key, tactile, fully-programmable keypads with LED indicators.
- EIA-232/422/423 communications interfaces available on all units.
- Super low-power 5 volt operation; other supply voltages optional.
- Attractive, comfortable housings coupled with superior programmability give your system great looks and unrivaled performance.
- FREE custom labeling available in any quantity. Other custom options are available at reasonable rates.

Panel-Mount & Modular

QSI terminals are available in easily-installed, panel-mount versions. Our board-level modular terminals have the interfaces and programmability of our handheld or panel-mount terminals with the addition of a general-purpose, multi-size, LCD and keypad interface.

- The panel-mount QTERM-II makes it easy to complete your instrument with a reliable, attractive user interface.
- The modular QTERM-III contains all the circuitry and firmware to drive most LCDs from 1x8 up to 4x80, and decode any keypad or switch matrix up to 8x6 keys.





Accessories

A variety of accessory equipment is available for use with our terminals. These accessories include holsters, soft cases, cables, interface units, and many others.

Call us, we'll help!

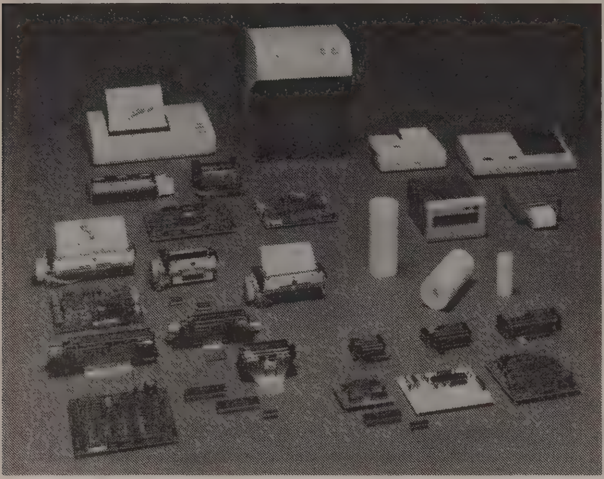
QSI is committed to providing you with the best in data-entry and operator-interface terminals. We are constantly expanding our line of terminals and related equipment. Give us a call; let us know what *you* want in a user interface.

QSI
CORPORATION

QSI Corporation
2212 South West Temple, #46
Salt Lake City, UT 84115 • USA
Telephone: 801-466-8770 • (FAX: 801-466-8792)

SII
Seiko Instruments

Thermal Printers



Seiko Instruments manufactures thermal printer mechanisms, stand-alone printers, interface boards and paper products for the OEM. We concentrate on supplying the most reliable and highest quality products that solve specialized problems for a variety of applications.

When you select a Seiko Instruments thermal printer, you can design in premium products offering years of consistent and trouble-free operations. Choose from a broad range of competitively priced thermal printers, standard & specialty papers and interface boards.

MTP Series

Meets the needs for small, inexpensive printers
- Low cost, quiet, compact
- Maintenance free
- Character and graphic output
- Speeds up to 1.5 lines per second
- Low power, 5 Volts
- 13-40 Columns

STP Series

Meets the needs for small bidirectional printers
- Compact & lightweight
- Character bidirectional logic seeking
- Graphics unidirectional logic seeking
- Prints up to 46 cps
- Stepper motors for quiet operation
- Low power, 5 Volts

LTP 3000 Series

Low power, high speed line printers
- High definition print quality 8 dots/mm
- Alphanumeric and graphic printing
- Automatic "Paper Out" &"Head Up" detection
- Battery powered
- Operating temperatures 0° to 50° C
- On board thermistor
- Prints thermal paper or label stock
- 5 Volts head and logic

LTP 5000 Series

High speed - high resolution graphic line printers
- Prints up to 700 cps
- Near photographic print quality 8 dots/mm
- Alphanumerics and graphics
- 12 or 24 VDC
- Automatic paper load
- Operating temperature
- Auto-cutter option

DPU Series

Standalone and panel mount printers
- 13-40 Columns
- Horizontal or vertical configurations
- Operating temperatures 0° to 50° C
- High quality
- Up to 11 lines/second
- Compact, lightweight
- Quiet operation
- 2.3" to 4.4" paper width

Thermal Paper

For sharp, consistent, high quality thermal printing
- Standard & custom sizes
- Specialty papers
- Extended temperatures 80° to 120° C
- Label paper, 2-ply, perforated

SII
Seiko Instruments

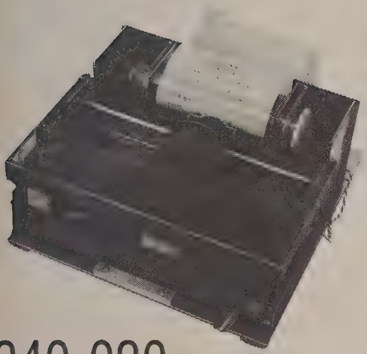
Seiko Instruments USA, Inc.
Micro Printer Division
2990 W. Lomita Blvd., Torrance, CA 90505
Phone (310) 517-7778
Fax (310) 517-8154

(Specifications subject to change without notice)
Each application is unique and require specifications.
Please contact Seiko Instruments today.

SINGER DATA PRODUCTS

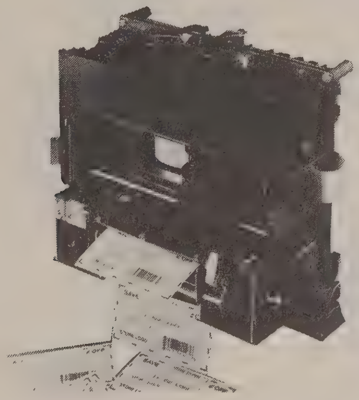
SMALL MATRIX PRINTERS

SMALL IMPACT and INK JET PRINTERS, MECHANISMS, CONTROLLERS, and OEM CASES



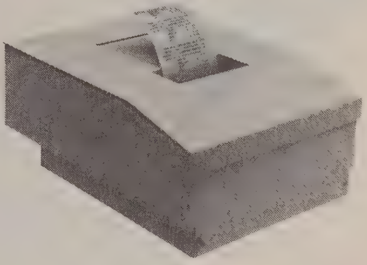
240-020

High Speed Impact Mechanism with optional controller, cutter, 2-color ribbon and rewind



240-220

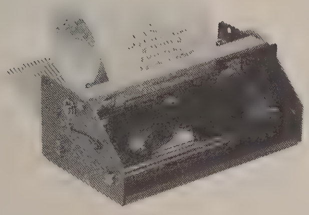
Heavy Duty Kiosk Printer - includes electronics and cutter



240-021

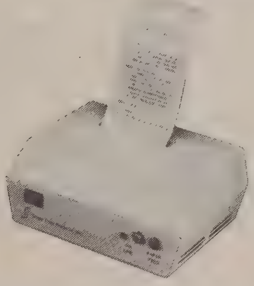
High Speed unit in case - options available

SINGER FOR CUTTERS, WINDERS and PAPER FEED SYSTEMS



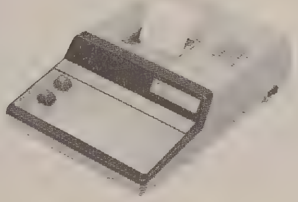
340

Ink Jet Mechanism 120cps w/ optional electronics, cutter and panel mount



340-310

Ink Jet Stand Alone Printer in small case



340-111

OEM Ink Jet in custom molded case with space for keyboard and display

INK JET PRINTERS AVAILABLE WITH BATTERY POWER-PAK

SINGER DATA PRODUCTS is a manufacturer of custom print heads, mechanisms and electronics as well as a variety of *VENDING MACHINES AND CURRENCY VALIDATORS.*

ALL PRODUCTS MADE IN THE USA

ASK ABOUT YOUR CUSTOM DESIGN

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Bensenville, Illinois 60106
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FAX (708) 860-3672

MANUFACTURING PLANT
3800 Buckner
El Paso, Texas 79925
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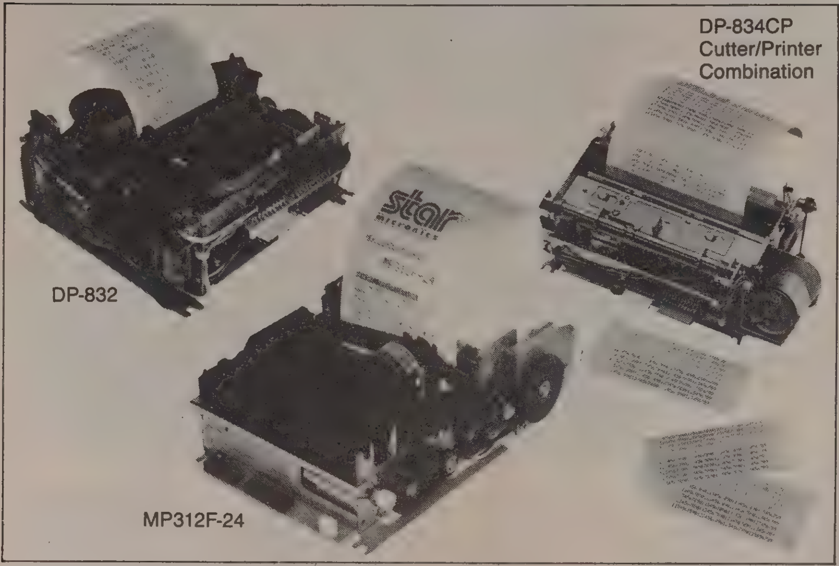
star® COMPLETE LINE OF IMPACT PRINTER MECHANISMS

21, 22 & 40 COLUMNS, IMPACT DOT-MATRIX



Star printer mechanisms are all guaranteed for 100 % reliability. They're compact, easy to install and inexpensive to maintain.

The MP300 Series mechanisms offer quiet operation at 3.2 lines/sec. The simple stepping motor paper drive offers full graphics capability, and reliability is in excess of 8 million lines. The MP300 Series offers 28 column, 40 column, cutter and sprocket fed versions.

832-22 column dot matrix printer mechanism has a 9 wire head to produce characters with true descenders. Its two color bidirectional printing make it ideal for applications requiring print speeds of 3 LPS.

834-40 column dot matrix printer has 5 x 9 or 9 x 9 dot array. It prints on 4 1/2" 1 ply roll paper as well as 2 ply carbonless (original plus 1 copy). Models with sprocket feed and graphics are also available.

Plus, there's a selection of replacement print heads, control boards, ribbon and paper supplies available. All with the Star name on them and behind them.

SPECIFICATIONS

	MP311F-24	MP341F-24	MP312F-24	MP342F-24	MP321S-24	MP322S-24
Print Method	9-pin Serial Impact Dot Matrix					
Character Font	7 x 9, 5 x 9					
Print Direction	Bi-directional or Uni-directional					
Printing Speed (line/sec.)	4.2		3.2		4.2	3.2
Paper Feed Speed	3 inches/sec.					
Min Paper Feed Pitch	1/144 inch				1/72 inch	
Total Number of Dots	140		200		140	200
Ink Ribbon						
Type	Ribbon cassette					
Life	Purple: 6 million characters; Black: 1.6 million characters					
Paper						
Media	Roll paper					Sprocket paper
Material	Normal or carbonless					
Width	57.5mm, 76mm, 82.5mm (2.25", 3", 3.25")				76mm, 89mm (3", 3.5")	89mm (3.5")
Thickness	0.07 ~ 0.10mm (Single paper)					
Copies	Original +2 copies (each paper 0.05 ~ 0.08mm, Max. 0.2 mm)					
Auto Cutter	N/A	Standard	N/A	Standard	N/A	
Reliability MCBF	More than 8 million lines (print head excluded)					
Head	200 million characters					
Operating Conditions	0°C ~ 50°C, 10 ~ 80% RH (without condensation)					
Storage Conditions	–20°C ~ +70°C, 5 ~ 95% RH (without condensation)					
Voltage For Mechanism	25V ± 5%, 1.7 more than (Chemical capacitor is necessary for power supply output)					
For Logic	5V ± 10%, 220mA					
Weight	760g	1300g	760g	1300g	760g	

APPLICATIONS

- Information kiosks
- Video lottery terminals
- Medical and scientific instruments
- Industrial measurement, process and control systems
- Mini-microcomputers: business professional and hobby
- Point-of-sale (POS) terminals
- Security monitoring systems
- Emergency vehicle data receivers
- Fast-food kitchen printers
- Telecommunications equipment...and many more!

SPECIFICATIONS

	DP-832	DP-834
Number of characters/ line of print	22 (12 cpi)	40 (12 cpi)
Standard matrix array	5 x 9	5 x 9
Character height	1.71mm (Horiz.) x 2.42mm (Vert.)	1.71mm (Horiz.) x 2.42mm (Vert.)
Direction of printing	Bidirectional	Bidirectional
Speed of printing	3 lines/sec.	2 lines/sec.
Printing area	46.16mm @ 22 col.	84.26mm @ 40 col.
Paper slew speed	Up to 12 lps during continuous paper advance	Up to 12 lps during continuous paper advance
Dimensions	Width: 5.334" (135.5mm) Length: 5.433" (138mm) Height: 2.322" (59mm)	Width: 7.17" (182mm) Length: 5.43" (138mm) Height: 2.32" (59mm)
Weight	1.4 lbs. (680 grams)	1.74 lbs. (790 grams)
Operating temperature	+5°C to +45°C	+5°C to +45°C

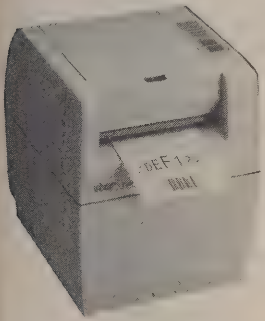
star® micronics

OEM DIVISION
70-D ETHEL ROAD WEST, PISCATAWAY, N.J. 08854 (908) 572-9512 FAX: (908) 572-5095

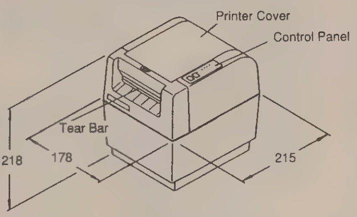
HIGH SPEED PRINTERS

ULTRA HIGH SPEED THERMAL PRINTERS

TSP300 SERIES



DIMENSIONS (mm)



The TSP300 is an extremely high speed direct thermal printer. Special software allows graphics such as logos and bar codes to be generated from the printer. The software, thermal design, and label capability permit the TSP300 to produce extremely accurate bar codes that can be used for shelf and product labeling. This feature is usually only available on more expensive dedicated bar code printers. The printer is command set compatible with Star's SP300 and DP8340 printer series, allowing the TSP300 to be easily installed in existing systems currently using Star printers. As with all thermal printers, the TSP300 is extremely quiet during operation. A model with an automatic paper cutter is also available.

Print Method	Direct Linear Thermal Head
Print Mode	Receipt Print; Bar Code Print
Paper Width	82.55mm (3.25 inch)
Resolution	8 dots/mm (H) x 7.6 dots/mm (V)
Roll Paper Diameter	80mm (max.)
Interface	RS232C or RS422 Serial (Standard)
Power Supply	100V/120V, or 220V/240V 50/60HZ
Operating Temp.	5° to 35°C
Receipt Mode	a) Print Characters: ASCII, International, Block Graphics, Bit Addressable Graphics b) Print Pitch: 15 CPI, 12 CPI, 10 CPI
Bar Code Modes	UPC-A, JAN/EAN-8,JAN/EAN-13, Code 39 ITF, Code 128, Code 39

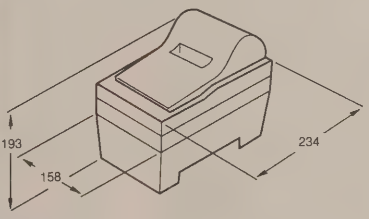
All specifications subject to change without notice.

FEATURES

- Straight, Completely Accessible Paper Path
- Linear Thermal Head
- Number of Columns, 40 (at 15 CPI)
- High Resolution
- High Speed Printing
- Receipt Printing on Roll Paper
- Label Printing Capability
- Internal, High Quality Bar Code Printing
- Compact and Silent
- Dual Cash Drawer Drivers
- 8KB Buffer

SP200 DOT MATRIX PRINTER

DIMENSIONS (mm)



THE SP200 is a high speed printer that is ideal for financial terminals and data logging systems. Standard features include small footprint,RS-232C interface via a DB25 connector, semi-automatic paper load and MCBF/reliability of 2.5 million lines. The integrated cash drawer driver helps maintain minimum system cost. The built-in self test function allows the user to check and reset dip switch settings. The printer utilizes popular 3" wide roll paper and can print an original plus two copies. The long life metal tear bar provides accurate and reliable paper cutting.

Print Method	Serial Impact Dot Matrix Bi-Directional Printing Single Color (Purple or Black) in a cassette
Print Format	42 Column Mechanism At 16 cpi 7x7 or 9x7 font configuration Dot Pitch: 0.316(H) x 0.423(V) mm Print Area: 66.0mm
Printer Speed	Approx. 2.5 Lines/Second Continuous Paper Feed Of 9 Lines/Second
Media	Friction Feed Roll Paper Paper Thickness: (Single) 0.07mm to 0.10mm (Copies) Original + 2 Copies (Max. 0.2mm) Paper Width: 76mm +/-0.5mm (3.0") Roll Diameter: 85mm (3.35") Core Diameter: 12mm +/- 1.0mm Paper should not be glued to the core
Other	1KB Data Buffer 96 ASCII Characters 64 Special Characters 12 International Characters Power Supply: 120VAC +/- 10% 0.3A 60Hz Peripheral Unit: 1 Circuit (24V, Max. 1A) Temperature: 0°C to +50°C Operating Temperature -20°C to +70°C Storage Temperature

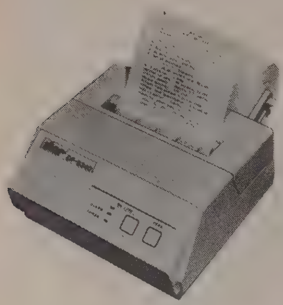
FEATURES	BENEFITS
2.5 Lines/Second	Fast, Low End Printing Speed
Mechanism Reliability	2.5 Million Lines MCBF
Print Head Life	75 Million Characters
Ribbon Life	Purple (standard) 3 Million Characters
Size	Small Foot Prin
Cassette Ribbon	Easy To Load, User Friendly,Clean Hands
Cash Draw Driver	Low System Cost
Semi-Auto Paper Loading	Fast/Easy Paper Loading
Paper	Three Inch, Three-Ply Carbonless
Captive Paper Holders	Less Replacements
Recessed Connectors' Under Printer	Reduces Over-All Length
Interface	Standard DB25 Connector (RS-232C)
Self Test	Easy To Follow DIP Switch Settings (Manual Not Required)
Metal Tear Bar	Provides Continuous Accurate And Reliable Paper Cutting
DIP Switch/EPROM	Easy Access, Saves Time
Star Emulation	Compatible With Existing Software Packages

All specifications subject to change without notice.

OEM DIVISION
70-D ETHEL ROAD WEST, PISCATAWAY, N.J. 08854 (908) 572-9512 FAX: (908) 572-5095

FULLY PACKAGED DOT MATRIX PRINTER

DP-8340 SERIES



DP-8340 FM
DP-8340 SM
40 columns
Accommodates 4.5″ paper
Single peripheral cash drawer driver
RS232 multiple handshake
Sprocket (SM) or friction (FM) feed

DP-8340 FC
DP-8340 SC
40 columns
Accommodates 4.5″ paper
Dual cash drawer driver
Parallel Centronics™
Sprocket (SC) or friction (FC) feed

DP-8340 RM
DP-8340 RC
44/29 columns
Accommodates 3.25″ paper
One line validation option available
Available in serial RS232 or
Parallel Centronics™

The DP-8340 is a housed dot matrix printer designed for heavy-duty applications requiring maximum reliability at a competitive price.

The units are packaged as a printer module and separate power supply module so that it will occupy a minimum of counter space.

The included cash drawer driver provides a large reduction in system cost as it allows the use of simple non-intelligent cash drawers.

FEATURES

- Two color printing capability
- Separate power supply and printer modules provide minimum footprint and adaptability to mobile operation
- Features Star Micronics reliability in a small package

SPECIFICATIONS

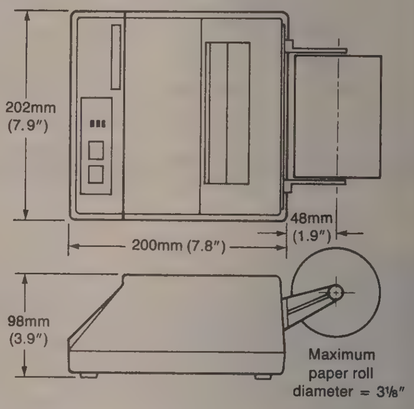
		FM	FC	SM	SC	RM	RC
Printing Method	9 Wires Serial Impact Dot Matrix	*	*	*	*	*	*
Printing Direction	Bi-directional	*	*	*	*	*	*
Printing Speed	2 Lines per Second	*	*	*	*	*	*
Standard Matrix	5 x 9 dots (12 CPI)	*	*	*	*		
	7 x 7 dots (15 CPI), 5 x 7 dots (10 CPI)					*	*
Number of Columns	40 (12 CPI)	*	*	*	*		
	44 (15 CPI), 29 (10 CPI)					*	*
Character Size	1.71mm Horiz. x 2.42mm Vert.	*	*	*	*		
	1.32 x 2.42 @15CPI, 2.00 x 2.42 @10CPI					*	*
Character Spacing	2.12mm @12CPI	*	*	*	*		
	1.70mm, @15CPI, 2.55mm @10 CPI					*	*
Line Spacing	4.23mm 1/6inch	*	*	*	*	*	*
Paper Feed Speed	12 Lines per Second	*	*	*	*	*	*
Printing Area	84.3mm @12CPI	*	*	*	*		
	74.46mm @15CPI, 73.03mm @10CPI					*	*
Paper Grade	Standard or Carbonless	*	*	*	*	*	*
Width	114.3 +0.5 −1.0mm (4.5 inches)	*	*	*	*		
	82.55 +/−0.5mm (3.25 inches)					*	*
Roll	80mm diameter maximum	*	*	*	*	*	*
Copy	Original +1 Carbonless 0.13mm Max	*	*	*	*	*	*
Ribbon Color	Black/Red, Black, Purple	*	*	*	*	*	*
Type	35mm diameter spool, 13mm width	*	*	*	*	*	*
Peripheral Driver	Two (1A, 12V)		*		*		*
	One (1A, 12V)	*		*		*	
Power Req. w/Power Supply	120V AC +/− 10V	*	*	*	*	*	*
w/o Pwr. Supply	12V DC +10%/−5%	*	*	*	*	*	*
Operating Temperature	+5C to +40C	*	*	*	*	*	*
Reliability	5 million lines MCBF	*	*	*	*	*	*

Six Models Available to Match Your Application Requirements

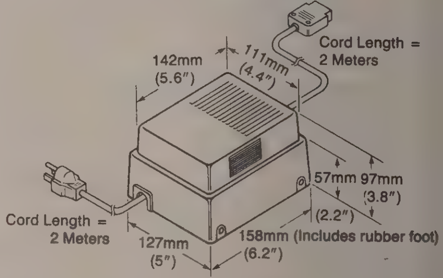
	DP8340FM*	DP8340FC*	DP8340SM*	DP8340SC*	DP8340RM*	DP8340RC*
INTERFACE	Serial	Parallel	Serial	Parallel	Serial	Parallel
PAPER	4.5″ Roll	4.5″ Roll	4.5″ Sprocket	4.5″ Sprocket	3.25″ Roll	3.25″ Roll

* add (−120) to part number to indicate power supply included

PRINTER DIMENSIONS



POWER SUPPLY DIMENSIONS



INTERFACE

* SERIAL RS-232C: Support a full duplex interface providing complete status information and error checking capability to the driving device. The RS-232C interface provides a 1.5K byte buffer and will allow operation without handshake at low baud rates. Supports Xon/Xoff handshake protocol and DTR level type busy.
* CENTRONICS PARALLEL: Centronics (TM) parallel interface providing data transfer rates of 1000-6000 characters per second.

PAPER

* 4.5″ ROLL: (MODEL FM/FC) Standard ECR type roll paper (up to Original +1 carbonless copy)
* 3.25″ ROLL: (MODEL RM/RC) Standard ECR type roll paper (up to Original +1 carbonless copy)
* 4.5″ SPROCKET: (MODEL SM/SC) Fanfold or roll (up to Original +1 carbonless copy)

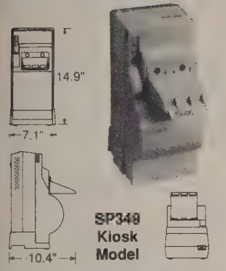
CASH DRAWER/PERIPHERAL DRIVERS

All serial interface models have one peripheral drive circuit capable of driving a 12V device with up to 1 Amp. All parallel interface models have two peripheral drive circuits capable of driving a 12V device up to 1 Amp.

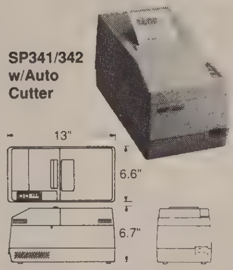
star micronics
OEM DIVISION
70-D ETHEL ROAD WEST, PISCATAWAY, N.J. 08854 (908) 572-9512 FAX: (908) 572-5095

HIGH PERFORMANCE DOT MATRIX PRINTER

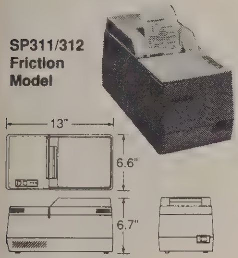
SP 300 SERIES



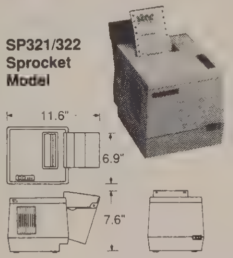
SP349 Kiosk Model



SP341/342 w/Auto Cutter



SP311/312 Friction Model



SP321/322 Sprocket Model

DESCRIPTION

The SP300 Series printer is designed for a wide range of applications. The SP311/312 and SP341/342 are suitable for PC-Point of Sale and restaurant systems. The SP321/322 offers sprocket paper drive providing the ability to print on pre-printed forms. They deliver high performance with respect to printing speed and reliability at a very competitive price. The stepping motor paper drive system has several advantages including quiet operation and adjustable line feed increment. This feature along with the cassette ribbon offers a printer mechanism that is simple in design and virtually maintenance free. Other standard features include dual cash drawer drivers and single line validation. The cutter version supports full cut and perforate functions. The SP349 Kiosk printer is specifically designed for unattended printer applications directly operated by the general public. Its special packaging and simulated presenter provides protection for the printing system and prevents damage from improper operation.

FEATURES

- High Print Speed
- Dual Cash Drawer Drivers
- Reversible Print
- Adjustable Paper Path
- Rewind Option Available
- Graphics Capability (Bar Codes, Logo)
- Friction or Sprocket Models

BENEFITS

- **Stepping Motor Paper Feed** Fast, flexible, reliable, quiet paper transport.
- **Dual Cash Drawer Driver** Supports two "solenoid only" cash drawers.
- **Serial or Parallel Interface** Models offer serial or parallel interface to meet systems requirements.
- **Addressability** 14 printer addressability is available with RS422 option. Saves printer cabling costs/serial port requirements.
- **Cassette Ribbon** This "clean hands" cassette ribbon loading is good for 6 million characters. Purple ink.
- **Narrow Footprint** Small enough to fit next to the CRT in a POS system.
- **Temperature Range** High upper temperature limit of 50°C is ideal for kitchen applications.
- **Compatibility** Command set is compatible with other Star printers (SP600 & DP8340).
- **Adjustable Paper Width** Models available with adjustable paper paths ranging from 2.25" to 3.5" for added flexibility.
- **Data Buffer** 4K standard with backup to eliminate problems with short power interruptions.

OPTIONS

- **Power Rewinder - PW300** (Friction Drive Models Only) For those applications requiring journal or take up capabilities, the SP300 series offers an optional, customer installed, internal power rewinder.
- **Autographic Table** User comments or notes can be made on rewound copy.
- **RS422 Interface Board - BD300K** The RS422 interface board permits system addressability when installed by the customer in the serial version of the SP300 series. Printer installation costs are dramatically reduced when used in multiple printer installations with long cable runs.
- **Current Loop Adapter - BD300L** An interface board to convert the SP300 series printers to a serial current loop operation is available. This option allows interfacing with 10-20mA current loop systems. It supports full duplex operation and will permit the use of XON/XOFF handshake.
- **Automatic Paper Cutter** The SP341/342 and SP 349 include an automatic paper cutter for applications where a tear bar is not sufficient.

SERIAL INTERFACE

Baud Rates	150, 300, 600, 1200, 2400, 4800, 9600	
Interface Standards	EIA RS232 EIA RS422 20mA Current Loop	Standard Optional Optional
Addressability (with RS422 Option)	14 address selectable by DIP switches	
Connector	DB 25S on rear of printer	

*Other standards available via customer installed sub board

PARALLEL INTERFACE

Interface Standards	Centronics Parallel™
Connector	Mini-Ribbon 36 Pin Female

QUICK ORDER GUIDE

Serial Interface		Parallel Centronics™ Interface	
SP312	FD-120	SP312	FC-120
SP311	FD-120	SP311	FC-120
SP342	FD-120	SP342	FC-120
SP341	FD-120	SP341	FC-120
SP322	SD-120*	SP322	SC-120*
SP321	SD-120*	SP321	SC-120*
SP349	FD-120	SP349	FC-120

*Sprocket Version

SPECIFICATIONS

Serial Interface **Parallel Interface**	**349 FD** **349 FC**	**341 FD** **341 FC**	**342 FD** **342 FC**	**321 SD** **321 SC**	**322 SD** **322 SC**	**311 FD** **311 FC**	**312 FD** **312 FC**
No. Columns	40	28	40	28	40	28	40
Media Type	Roll	Roll	Roll	Fanfold	Fanfold	Roll	Roll
Paper Width in Inches	2.25		2.25				2.25
	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	3.25	3.25	3.25			3.25	3.25
				3.5	3.5		
Character Pitch (CPI)	15.0		15.0		15.0		15.0
				12.2			
	12.0	12.0	12.0		12.0	12.0	12.0
				10.2			
		10.0				10.0	
	8.0		8.0				8.0
Print Speed (LPS)	3.2	4.2	3.2	4.2	3.2	4.2	3.2
Paper Feed	Friction	Friction	Friction	Sprocket	Sprocket	Friction	Friction
Auto Cutter	Full Cut / Perforate	Full Cut / Perforate		N / A		N / A	
Dimensions In Inches	W. D. H. 7.1 x 10.4 x 14.9	W. D. H. 6.6 x 13 x 6.7		W. D. H. 6.9 x 11.6 x 7.6		W. D. H. 6.6 x 13 x 6.7	
Paper Feed Speed	3 inches per second						
Ink Ribbon	Cartridge Type - Purple (std.) 6 mil Characters - Black (opt.) 1.6 mil Characters						
Print Direction	Bi - Directional						
Print System	Serial Dot Matrix Impact						
No. of Pins	9						
Copies	1 Original + 2 Carbonless Copies						
Data Buffer	4 K with Backup						
Cash Drawer	2-Drawer Drivers with Compulsion Support						
Temperature	Operating: 0°C to +50°C				Storage: –20°C to +70°C		
Humidity	Operating: 10% to 90% (w/o condensation)				Storage: 5% to 95% (w/o condensation)		
Line Spacing	1/6" - 1/8" - n/144"						
Paper Detector	Paper Out Detector Standard						

All specifications subject to change without notice.

OEM DIVISION
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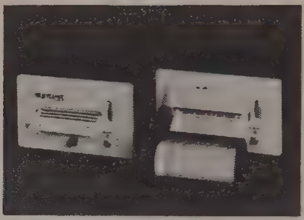
syntest CORPORATION



SP-201/401
Thermal Mount Thermal Printers

The SP-201 and SP-401 thermal panel-mount printers are "smart," low-cost solutions to difficult applications, including factory floor, outdoors, and vehicular. Optional non-volatile RAM can store alarms, messages, account numbers, etc. EPROM is programmable to specify functions like font changes or to number crunch input data. Advanced electronic design provides built-in protection for mobile use. With options, the SP-201/401 can both provide reliable hardcopy and can ensure graphic validation of critical manufacturing or other industrial processes. **Available in impact as well.**

SPECIFICATIONS:

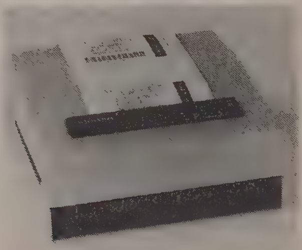
- RS-232C, RS-422/485, 20mA interfaces
- Time/date stamp (optional)
- Takeup journal for unattended stations (optional)
- 7K buffer
- Dimensions are 4.5"W x 2.7"H x 5.7"D
- Wide input power…6 to 30VAC/DC
- SP-201: 12 characters/inch
  19 characters/second
- SP-401: 16 characters/inch
  24 characters/second

SP-2020
High Speed KIOSK Thermal Printer

The SP-2020 KIOSK Printer provides quiet and reliable unattended public hardcopy for such applications as: Super Market, coupons, Travel maps, Gaming ATM's and directory info. The 2020 KIOSK incorporates a rotary paper cutter and an intelligent paper delivery system which will automatically clear itself if the paper exit path becomes obstructed.

SPECIFICATIONS:

- Windows compatible, IBM compatible
- High Speed, up to 1048 characters per second
- Paper Dimensions: 8.5 inches (216 mm) wide. Standard custom sizes available
- Operating temperature: +14 to +122 F (-10 to 50 C.)
- Size KIOSK: 11.5 x 15.5 x 5.5 inches
  291 x 393 x 139mm
- A.C. operations: Switchable 110/220 volt A.C. power input
- Interface: RS232 serial bi-directional communications or a Centronics parallel type interface
- Comm Speed: 50-19.2 K Baud local connection via a DB-25 connector RS232.
- Also available in rack mount version



SP-315
Portable Bar Code Printer

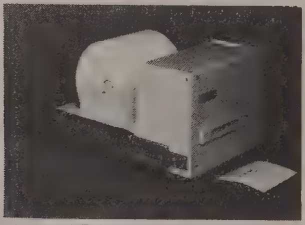
The SP-315B Portable Bar Code Printer is a rugged light weight direct thermal printer that operates from its own **Gell Cell Battery**. It also boosts an intelligent power switch that **will automatically turn the printer on** when incoming RS232 data is received, prolonging the time between battery recharging. The unit features a large (4.12" x 4.12") label format ideal for shipping and receiving labels, inventory maintenance, rental car operations and delivery vehicle receipt printing.

The SP-315B easily connects with most popular portable handheld terminals and personal computers via a simple RS232 interface.

The unit is also capable of printing a broad range of character styles including condensed, standard, enlarged, international character sets and a wide variety of bar code selections available in both ladder and fence format. All bar code fonts are internal to printer.

SPECIFICATIONS:

- Portable & mobile versions
- Label or normal direct thermal printing
- 4.4" wide paper, 2" diameter roll
- Gel cell rechargeable battery
- Carry bag with shoulder strap
- 8.1" x 8.0" x 3.9", 5.8 lbs with battery & bag
- RS232C serial bi-directional interface
- Clock & non volatile memory optional

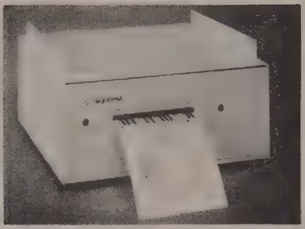


SP-318
High Speed Thermal Printer

In just under 4 seconds the SYNTEST SP-318 kiosk printer will print and cut a 45 line 80 column 5.5" long slip. It will produce over 2000 of these slips before the paper requires replenishment. This level of performance, well above that of competitive units, translates directly into cost savings by reducing the frequency of routine maintenance calls. This low maintenance, high reliability and high speed printer finds application in kiosk, ATM and other unattended consumer operated systems. Other high-speed thermal units are the SP-315 and SP-324.

SPECIFICATIONS:

- 80 column 8 x 16 dot matrix thermal printing
- 4.5" wide x 1000 ft. paper roll
- Built-in paper cutter
- IBM graphics
- Barcode 39
- Fast 15 lines/sec printing
- Measures 8.75"W x 6.0"H x 12.5"D
- Accepts 115/230 VAC or 24 VDC
- 4K data buffer
- 0-50°C operation
- RS-232C, 20ma loop, Centronics interfaces



SP-320
12V Mobile Ticket Printer

The SP-320 ticket printer allows reliable dot matrix printing of invoices, pick lists, and other documents while operating from 12V battery power. Utilizing a 9 wire dot matrix printhead the SP-320 p[rovides a 40 column print field and bi-directional printing at a speed of 160 cps on a 4.25" wide by 10" long multi-part form. Ideally suited for use in delivery vehicles the SP-320 features shock and vibration resistant design with operation over -40°C to +55°C temperature range. A 7K internal data buffer is standard. Input interfaces include RS-232C, 20mA, and Centronics parallel.

SPECIFICATIONS:

- 40 column 5 x 9 dot matrix printing
- 190 character per second print speed
- Environmentally hardened
- 12 vdc powered
- Accepts 4.5" x 10" multipart forms
- 7K data buffer
- IBM graphics and barcode available
- RS-232C, 20ma loop, Centronics interfaces
- Measures 10.7"W x 4.9"H x 10.9"D
- Optional Time/Date Stamping

SP-2010A
80 Rack Mounted Printer

The Syntest SP-2010A is a ruggedized 80 column impact printer designed for integration into harsh environments. Housed in a heavy aluminum case and featuring a self-cleaning, self-lubricating mechanism, this rackmountable unit can withstand severe temperatures as well as shock and vibration. Standard interfaces to choose from include RS-232c, 20mA Current Loop, and Centronics parallel. RS-422/485 is available as option.

SPECIFICATIONS:

- 168 characters per second
- Max. print rate is 2.1 lines per second
- IBM Hi-Res graphics (optional)
- Operates in 0 to 50 degrees Celsius
- 115/230VAC, 12/24VDC
- Barcode 39 (optional)
- Time/date stamping (optional)
- Non-volatile RAM (optional)
- IBM Proprinter mimic firmware (optional)
- Dimensions are 18.5"L x 16.5"W x 7.00"H

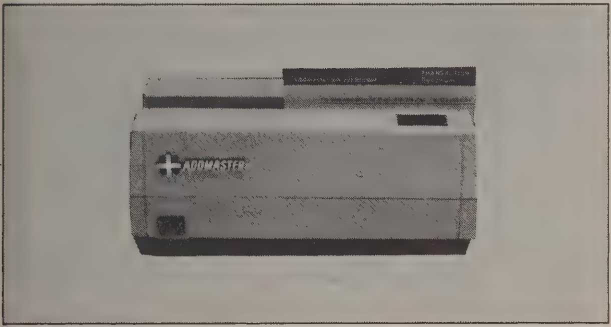
Experienced customizers of printers for tough applications

SYNTEST CORP. ■ 40 Locke Dr., Marlboro, MA 01752 U.S.A. ■ 508-481-7827 ■ 508-481-5769

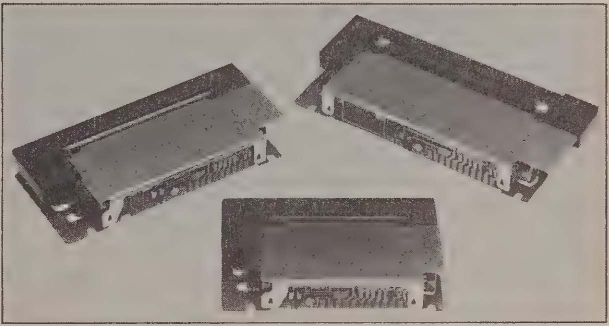
MINI-PRINTERS FOR THE OEM FROM NCR, EPSON®, FUJITSU AND ADDMASTER

Telpar is a manufacturer of its own line of printers as well as a distributor and value-added-reseller of mini-printers made by NCR, **EPSON**®, ADDMASTER and FUJITSU. Telpar can offer a wide range of features as well as provide custom controllers to meet the needs of the mini-printer marketplace:

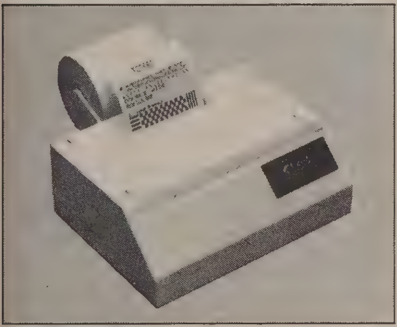
- **MECHANISMS ALONE OR WITH CONTROLLERS**
- **IMPACT, THERMAL AND INK JET**
- **12 TO 80 COLUMNS**
- **STANDALONE AND RACK MOUNTS**
- **CUSTOM CONTROLLERS**
- **MULTIPLE INTERFACES**
- **GRAPHICS**
- **BAR CODE**
- **KNIFE CUT-OFF OPTION**
- **AC OR DC INPUT POWER**
- **PORTABLE, BATTERY POWERED**



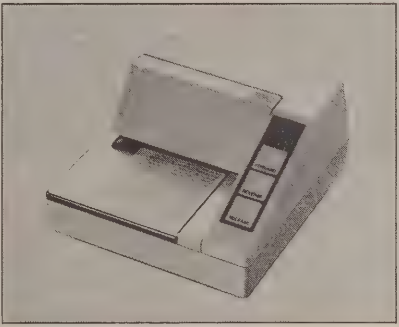
- **Addmaster Ink Jet Printer**



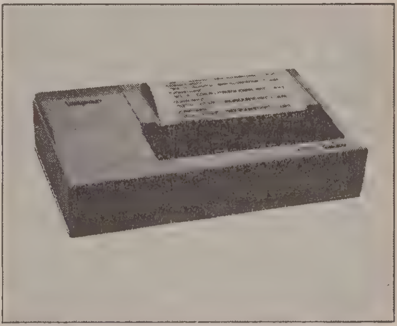
- **EPSON® Mini Impact Mechanisms (See Adjacent Page For Controllers)**



- **Telpar Receipt Printer**

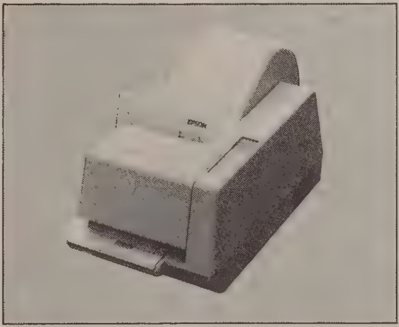


- **EPSON® Slip Printer**

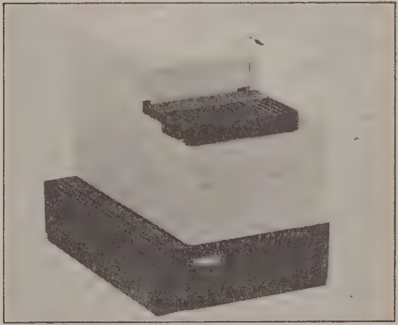


- **Standalone-Desktop and Portable**

- **NCR Slip Printer**



- **EPSON® Multi-Function Printer (Slip, RJ and Validation)**

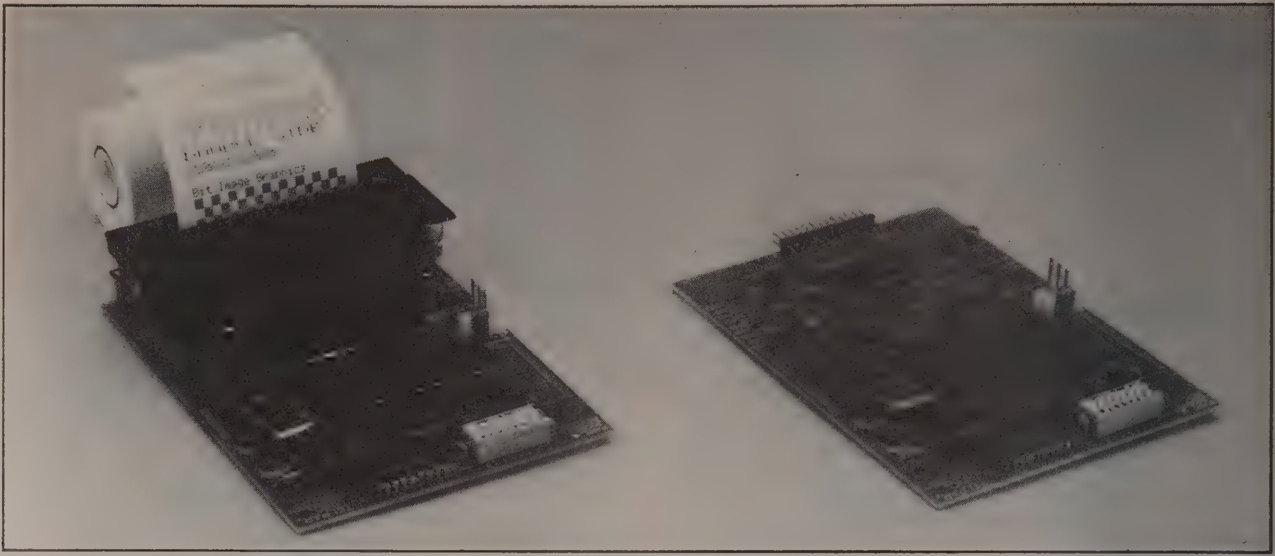


- **NCR Receipt Printer**

telpar, inc. *Mini-Printers for the OEM*

P.O. Box 796, Addison, TX. 75001 • 4137 Billy Mitchell Drive, Addison, TX. 75244
Tel: (214) 233-6631 Fax: (214) 233-8947

CONTROLLERS FOR EPSON® MINI-PRINTERS



Telpar's T5678 Controllers are designed to drive the Epson M150 Series and M180 Series of impact mini-printer mechanisms. Mechanisms and controllers are available separately to be connected with a cable, or with the mechanism mounted directly on the board (except M170).

- **RS232 Serial or Centronics Parallel**
- **5 VDC Power (for Controller and Mechanisms)**
- **Board Size: 3.80" x 5.35"**
- **6900 Character Input Buffer**
- **Autocutter Driver Option (for AU100 Cutter)**
- **Double Wide Print, Double High Print, or both**
- **Bit Image Graphics**
- **Fast Paper Feed (M180 Series only)**
- **Normal or Inverted Print**
- **150 to 19.2K Baud**
- **176 Printable Characters**
- **Custom Designs Available**

Model (Controller plus attached printer)	**T150E**	**T160E**	**T163E**	**T164E**	**T170E***	**T180E**	**T181E**	**T182E**	**T183E**
Number of Columns	16	24	32	40		24	30	36	42
Dots per Line	96	144	192	240		144	180	216	252
Print Speed (lines per second)	1.0	0.7	0.5	0.4		1.7	1.3	1.1	1.0
Character Size W x H (mm)	1.8 x 2.5	1.7 x 2.4	1.3 x 2.4	1.1 x 2.4	1.3 x 2.4	1.7 x 2.6	1.4 x 2.6	1.2 x2.6	1.1 x 2.6
Column Spacing (mm)	2.1		1.5	1.2	1.5	2.06	1.66	1.44	1.29
Line Spacing (mm) 5x7 font, 3 dots/per line Paper Feed	3.5	3.3				3.78			
Reliability									
Mechanism MCBF (lines)	0.5×10^6			0.4×10^6		1×10^6		0.7×10^6	
Head Life (lines)	0.5×10^6			0.4×10^6		1×10^6		0.7×10^6	
Paper Width (inches)	1.75	2.25			2.75	2.25			
Current Requirements (amps)									
Peak	3					6			
Average Printing ASCII Text	0.6					1			

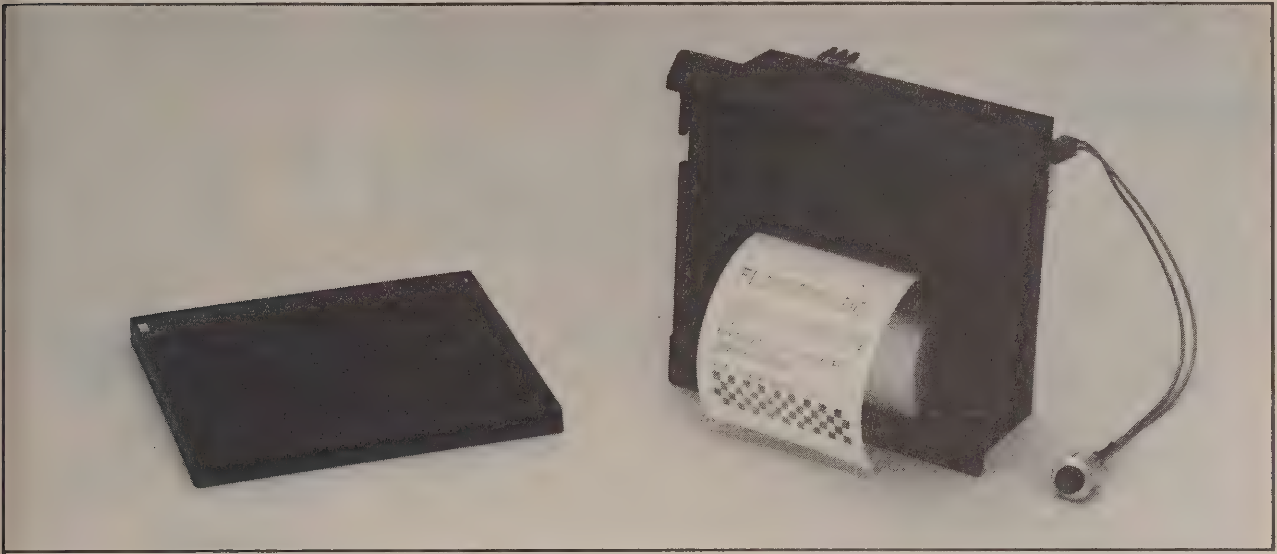
EPSON® is a trademark of Epson America, Inc.

*Printer is not attached to the Controller

telpar, inc. *Mini-Printers for the OEM*

P.O. Box 796, Addison, TX. 75001 • 4137 Billy Mitchell Drive, Addison, TX. 75244
Tel: (214) 233-6631 Fax: (214) 233-8947

LOW COST PANEL MOUNT PRINTERS



- **IMPACT DOT MATRIX TECHNOLOGY**
- **RS232 SERIAL or CENTRONICS PARALLEL**
- **24, 30, 36 & 42 COLUMN VERSIONS**
- **5 VDC, 12 VDC, OR 120 VAC POWER**

- **6900 Character Input Buffer**
- **150 to 19.2K Baud On Serial Version**
- **Front Cover Slides Off For Easy Paper Loading And Paper Replacement**
- **Plain Paper: 2-1/4"W x 1.6"OD**
- **Fast Paper Feed**
- **Paper Feed Switch**
- **Bit Image Graphics Mode**
- **Weight: 11 Oz.**
- **176 Printable Characters, 5 x 7 Font**
- **Normal or Inverted Print**
- **Double High Text, Double Wide Text, or Both; Underline Mode**
- **Current Requirements:**
  - **Standby 25ma. typical**
  - **Printing 4.5A peak**
    1A avg when printing ASCII text.

MODEL	PL180RM	PL181RM	PL182RM	PL183RM
Number of Columns	24	30	36	42
Dots Per Line	144	180	216	252
Print Speed (lines per sec)	1.7	1.3	1.1	1.0
Character Size W x H (mm)	1.7 x 2.6	1.4 x 2.6	1.2 x 2.6	1.1 x 2.6
Column Spacing (mm)	2.06	1.66	1.44	1.29
Line Spacing (mm)	3.78 (for 5 x 7 font and 3 dots/line paper feed)			
Reliability: Mechanism MCBF (lines)	1 x 10^6	1 x 10^6	0.7 x 10^6	0.7 x 10^6
Head life (lines)	1 x 10^6	1 x 10^6	0.7 x 10^6	0.7 x 10^6

telpar, inc. *Mini-Printers for the OEM*

P.O. Box 796, Addison, TX. 75001 • 4137 Billy Mitchell Drive, Addison, TX. 75244
Tel: (214) 233-6631 Fax: (214) 233-8947

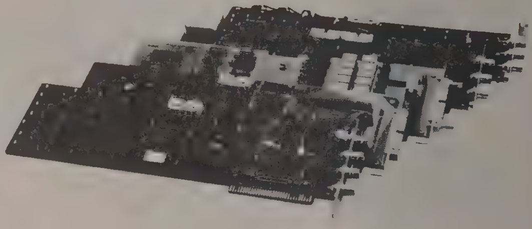
BANCOMM
DIVISION OF DATUM INC.

Bus Level Timing Modules

Bancomm Division specializes in microprocessor based timing products, especially bus level timing modules designed to operate within a user's computer processing system. Relative to conventional rack mount timing products, bus level timing modules save space, simplify system interconnections, and make it possible to fully utilize the speed of bus level data transfers and interrupt driven processing.

PC AT/XT Modules

- *PC03XT Time Code Reader*
- *PC03AT Time Code Processor*
- *PC05XT Time Code Generator*
- *PC09XT SLOCODE Generator*
- *PC11XT Parallel Output Module*
- *RTC-AT Real Time Clock*



PC AT/XT Modules

VMEbus Timing Modules

- *PC03V VMEbus Time Code Processor*
- *PC05V VMEbus Time Code Generator*
- *PC26V Time Display*

VMEbus Modules

DEC® Buses

- *PC03Q Qbus® Time Code Processor*
- *PC03U Unibus Time Code Processor*

Macintosh Bus

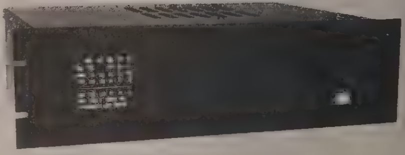
- *PC03MAC Time Code Processor*

Multibus

- *PC03SBX Time Code Reader Interface*

Timing Instruments

Bancomm manufactures a variety of rack mount timing instruments that utilize bus level modules packaged in a dedicated chassis. The **M80T Controller** performs a wide variety of time code translation, generation, and tape recorder control functions using plug-in STD bus modules. It has space for five optional modules and features a front panel CRT alphanumeric display for programming and data display. The **M80XT Controller** is similar; however it uses PC XT bus modules, can accept 12 optional modules, and features a front panel vacuum florescent display. The **M80T Sequencer** is a special configuration of the **M80T Controller** which maintains a countdown clock and initiates 16 external test events with millisecond resolution. The **M48 Controller** is another special configuration of the **M80T Controller** which generates and decodes time data inserted into and recovered from the M48 data block within AMPEX Corp High Density Digital Tape Recorders (HDDR).



M80T Controller

TYMCOR® Time Base Correctors

The TYMCOR® line of digital time base correction products all serve a common objective - to reduce the effect non-constant tape speed has on data recorded and reproduced by instrumentation recorders. Bancomm has supplied a number of custom time base correctors for linear instrumentation recorders, cassette recorders, and rotary head machines. The keystone of the division's standard product line is the **TYMCOR® 1400 Digital Time Base Corrector**. This unit is compatible with any standard wideband linear instrumentation recorder and offers an order of magnitude improvement in time base error performance.

Model 1400

DEC is a registered tradename of Digital Equipment Corporation *Qbus is a registered tradename of Digital Equipment Corporation*

BANCOMM
DIVISION OF DATUM INC.
6541 Via del Oro, San Jose, CA 95119 (408) 578-4161 FAX (408) 578-4165
800-938-3286

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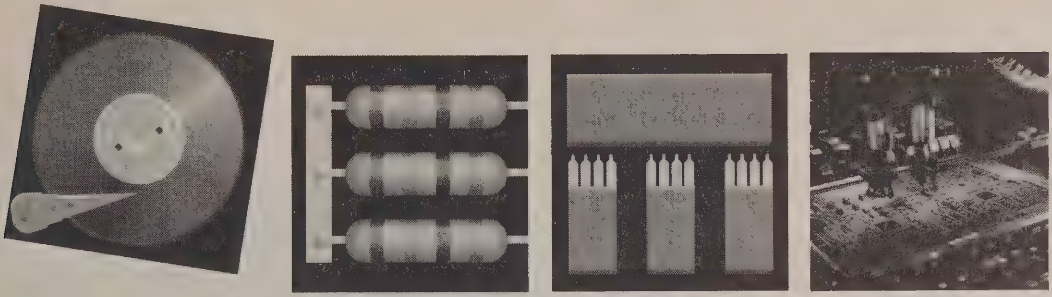

As an engineer, buyer or specifier, you're constantly searching for sources of high-quality technology that will give your products an edge in the marketplace.

IBM can help you reduce your research and development investment by providing cost-competitive products that have already been developed and refined. So if you're in the market to improve your R&D focus and your return on assets, we may well have the answer you're looking for.

What follows on these pages are the specification sheets for a representative cross section of the IBM OEM products and systems that are available to you. For a complete listing, use the 800 number shown below to call for your copy of our current OEM Products Catalog. If you need immediate information on a specific product, your call will be directed to the appropriate IBM representative.

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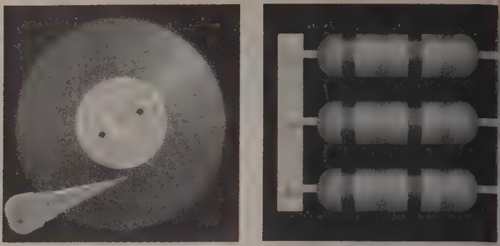


3½-Inch 1GB Low Profile Disk Drives

0662 Models S12, S1D, SW1 and SWD

The 0662 is the industry's first 1.0 GB disk drive in the 1-inch high, 3½-inch form factor and the first of a new product family from ADSTAR*, IBM's storage products line of business. Using industry-leading areal density made possible by our exclusive Magnetoresistive head and second generation PRML (Partial Response Maximum Likelihood) channel chip, 1.05GB is packaged on just three disks. These technologies, combined with a simple and robust design, provide a unique combination of leadership in capacity, performance, reliability, and low power.

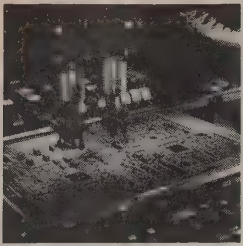
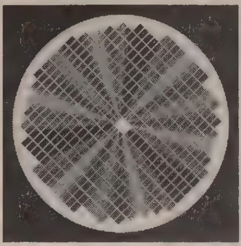
The 0662's formatted capacity is achieved using only two data zones, allowing a consistently high sustained data rate over the entire surface of the disk and making it a compelling alternative for data-intensive applications. It also provides the capacity, performance and packagability required for technical/commercial workstations, mini/mainframes, file servers, and arrays.

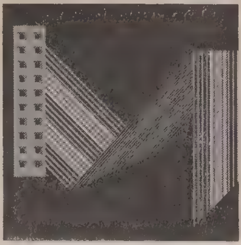
A simple design with few components and an automated manufacturing process combine to help the 0662 set a new standard for reliability with a projected 800,000 hours MTBF.

The 0662 is available with a SCSI-2 interface and comes in four models: 50-pin Fast Single Ended (S12), 50-pin Fast Differential (S1D), 68-pin Fast and Wide Single Ended (SW1), and 68-pin Fast and Wide Differential (SWD).

Highlights

- 1-inch high, low profile 3½-inch form factor
- 3-disk design
- 2 data recording zones
- 800,000 hours projected MTBF
- PRDF data channel (PRML with digital filter)
- Supports mounting in any orientation
- Fast SCSI-2 interface (50 pin)
- Fast & Wide SCSI-2 interface (68-pin P Cable)
- Predictive Failure Analysis for increased data protection
- Drive-supported SCSI term power
- LED driver supported
- 512 KB multi-segmented data buffer
- Low command overhead
- Dedicated servo with thermal compensation
- Command reordering
- Back-to-back writes
- Self-optimizing buffer ratios
- Read Ahead caching
- Write cache (volatile)
- Automatic sector reallocation
- Spindle synchronization
- Automatic power management



Product Description

3½-Inch 1GB Low-Profile Disk Drives			0662 Models S12, S1D	0662 Models SW1, SWD
Disk Drive Configuration	**Formatted Capacity (512 bytes)**		1052MB	
	Number of Disks		3	
	Number of Heads		6	
	Recording Surfaces		5	
	Tracks per Surface		ID 1120 / OD 3016	
	Track Density		4077 TPI	
	Areal Density		354/319 Mb/sq in	
	Recording Density		86,900/78,200 BPI	
	Bytes per Sector		Variable	
	Disk Type		Thin Film	
	Channel		PRML	
	Actuator Type		Rotary VCM	
	Head Type		Magneto-resistive (MR)	
Performance	**Media Data Rate**	Banded	5.0/6.0 MB/sec	
	Access Times	Average Read	8.6 ms	
		Average Write	10.1 ms	
		Track to Track Read	.6 ms	
		Full Stroke Read	16.5 ms	
	Rotational Speed		5,400 RPM	
	Command Overhead (Read)	Random	0.28 ms	
		Sequential w/ Read Ahead	0.41 ms	
	Data Transfer Rates (max)	Synchronous	10 MB/sec	20 MB/sec
		Asynchronous	5 MB/sec	10 MB/sec
	Buffer Size		512 KB	
Reliability	**MTBF**		800,000 Hours	
	CDF[1]		3.75% at 500 POH	
	Recoverable Read Errors	Population Average	<10 in 10^{11}	
	Non-Recoverable Read Errors	Population Average	<10 in 10^{15}	
	Seek Errors		<10 in 10^{8}	
	Predictive Failure Analysis		Yes	
	Buffer Memory Parity		Yes	
Power Requirements	**+5 VDC Idle**		1.10 Amps	
	+12 VDC Idle		0.4 Amps	
	+12 VDC Start-up		1.65 Amps	
	Power		10.3 Watts	
Physical size	**Dimensions**	Length	146.0 mm	
		Height	25.4 mm	
		Width	101.6 mm	
		Weight	0.5 kg	
	Mounting		Industry Standard/All Orientations	
Environmental Characteristics			**Operating**	**Non-Operating**
	Temperature		5° to 55°C	-40° to 65°C
	Relative Humidity	Non-Condensing	5% to 90%	5% to 95%
	Shock (11 ms)		10G	60G
	Vibration		1G[2]	2G
	Audible Noise	Population Average - Idle	<34dba@ 1 M	NA

[1] Cumulative Distribution Failure rate. At 800,000 hours MTBF, 3.75% of the files are projected to fail in 5 years running at 500 Power On Hours per month.

[2] 1G swept sine vibration is for frequencies between 5 and 200 Hz. Levels above 200 Hz vary with frequency and orientation, and are available upon request.

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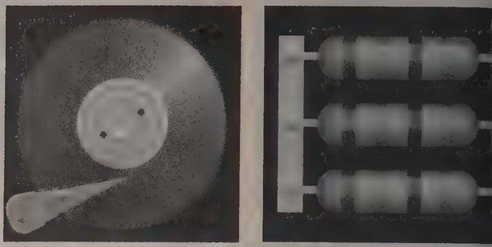


3½-Inch
133, 171, 256 and 342MB Disk Drives

Models H3133, H3171, H3256 and H3342

This 3½-inch disk drive family is the latest in a series of IBM storage solutions for desktop personal computers. Maximum flexibility is provided by a range of formatted capacities from 133 to 342MB in an industry-standard package. The average seek time of 14ms provides excellent performance for desktops or other interactive applications.

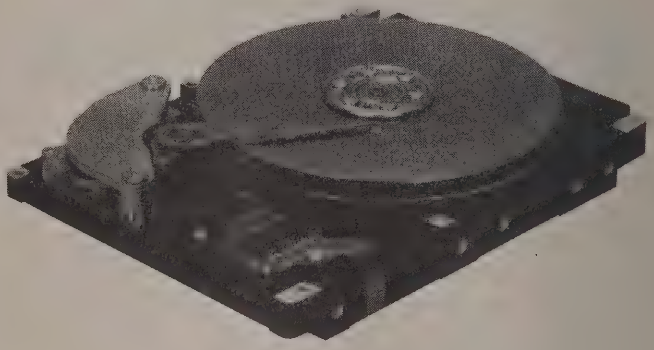
Reliability has been improved over previous models, giving a projected 250,000 power-on hours MTBF.

Quality and availability

These IBM drives are manufactured to stringent standards for quality and performance, with sensitive components assembled in a rigidly controlled, clean environment.

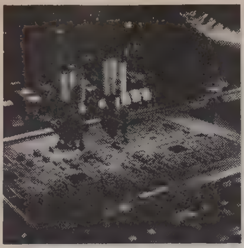
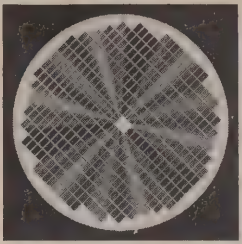
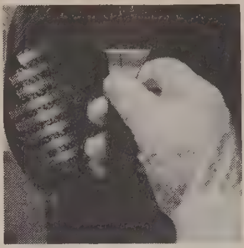
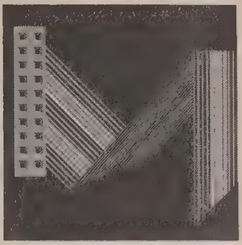
Extensive quality control and testing procedures are used throughout the manufacturing process to assure product reliability and data integrity.

Worldwide IBM manufacturing facilities provide multi-site, high-volume production capability.



Highlights

- 133, 171, 256 and 342MB capacity
- AT* (IDE) and SCSI-2 interfaces
- ECC on the fly
- Zone Bit Recording
- 250,000 power-on hours MTBF
- Mounts in all six directions
- Dedicated head landing zone
- Automatic actuator lock
- 96KB segmented data buffer for read look-ahead and write
- 8.3MB/sec interface data transfer rate

Product Description

3½-Inch 133, 171, 256 and 342MB Disk Drives		AT version only	Models H3133, H3171, H3256, H3342	
Configuration	**Interface**		AT (IDE)	
	Device Capacity	Formatted	133 / 171 / 256 / 342MB[1]	
	Sector Size		512 Bytes	
	Recording Zones		2	
	User Cylinders		2420	
	Data Heads		2 / 2 / 3 /4	
	Disks		1 / 1 / 2 / 2	
	Recording Density	Maximum	55000 BPI	
	Track Density		2800 TPI	
Performance	**Rotational Speed**		3600 RPM	
	Media Transfer Rate		18.0 (Inner), 26.5 (Outer) Mbits/sec	
	Interface Transfer Rate	Maximum (AT only)	8.3 MB/sec	
	Data Buffer	Read Look-Ahead and Write	96KB (Three segments, 32KB each)	
	Latency	Average	8.33 msec	
	Seek Time (Typical)	Average (Read)	14 msec	
		Track to Track	4.5 msec	
		Full Track	28 msec	
Reliability	**MTBF**	Projected power-on hours	250,000	
	Error Rates	Non-Recoverable Errors	≤1 per 1.0E13 Bits Transfer	
Power	**Requirements**		+ 5VDC ±5%, +12 VDC + 10% -8%	
	Dissipation (typical)	Start Up (Maximum Peak)	12.6 Watts	
		Seek	4.2 Watts	
		Idle	2.5 Watts	
Physical Size	**Height**		25.4 mm	
	Width		101.6 mm	
	Depth		146 mm	
	Weight	Maximum	510 g	
			Operating	**Non-Operating**
Environmental Characteristics	**Ambient Temperature**		5° to 55°C	-40° to 65°C
	Relative Humidity	Non-Condensing	8% to 90%	5% to 95%
	Maximum Wet Bulb	Non-Condensing	29.4°C	35°C
	Shock	Half-sine-wave	15 G/5 msec	75 G/11 msec
	Vibration	Random (RMS)	0.67 G (5-500Hz)	1.04 G (2-200 Hz)

[1] MB=1,000,000 Bytes

Product Description data represents IBM's design objectives and is provided for comparative purposes; actual results may vary based on a variety of factors. This product data does not constitute a warranty. Questions regarding IBM's warranty terms or methodology used to derive this data should be referred to your IBM representative. Data subject to change without notice.

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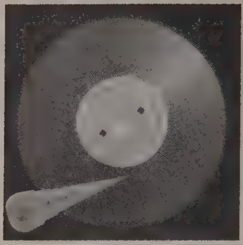
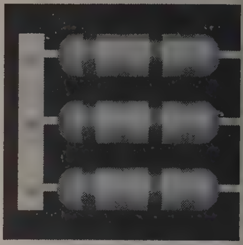




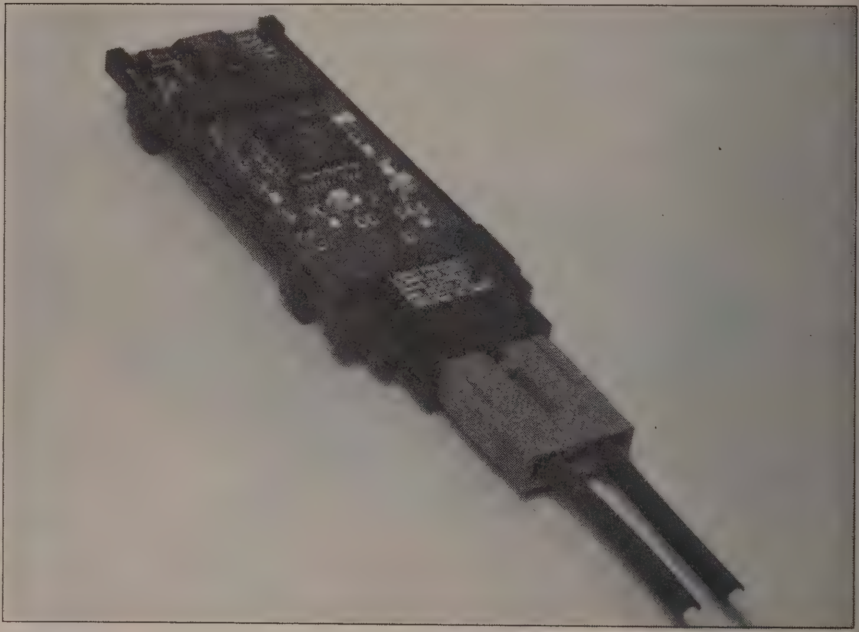
266 Mbps Optical Link Card

Fibre-optic technology for rapid, cost-effective transfer of data

The 266 Mbps Optical Link Card (OLC 266) is a laser-based data communications link that enables computer manufacturers to integrate low-cost, high-speed fibre-optic communications into computers and peripherals. The OLC 266 uses a high-reliability version of the same cost-effective shortwave lasers found in today's compact disc players.

The OLC 266 supports the American National Standards Institute's (ANSI's) emerging Fibre Channel standard. Fibre Channel is designed to provide a standardized protocol for system-level interconnect, while being flexible and cost effective. Fibre Channel was developed primarily to provide high-speed, medium-distance (less than 10 km) data links between host computers and peripherals (disk drives, printers, displays).

Because of its high speed and low latency, the OLC 266 is also useful for connecting two or more computers in shared computing and parallel processing environments.

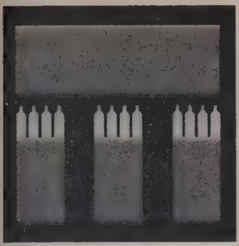
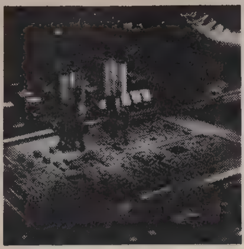
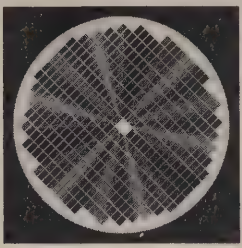
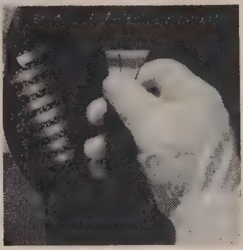
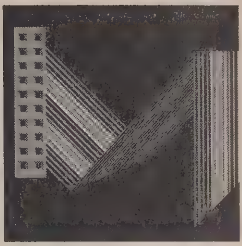


Function

Encoded 10-bit data is serialized and converted into pulses of laser light for transmission into the optical fibre. These pulses are received by another OLC 266 and deserialized back into encoded 10-bit data along with the requisite synchronous clocking signals. Open Fibre Control (OFC) circuitry disables the lasers whenever there is a break in the optical link. These cards support continuous, full-duplex communication.

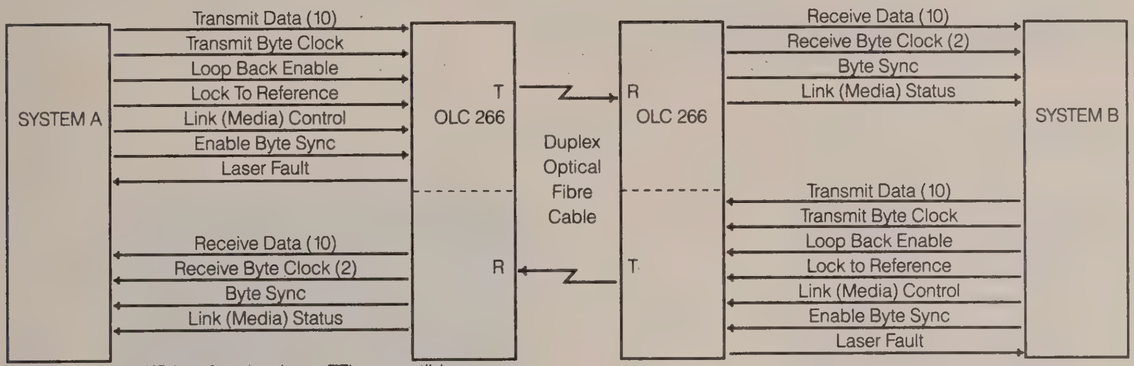
Highlights

- 266 Mbps transmission rate
- Up to 2 km distance
- Certified to be in conformance with international Class 1 laser safety regulations
- High-reliability optics
- Bit error rates lower than 10E^{-12}
- Low-loss SC type push-pull connectors
- Parallel 10-bit data I/O interface compatible with ANSI Fibre Channel standard 8B/10B encoding
- Double-sided surface-mount technology

Specifications

Electrical


SYSTEM A
Transmit Data (10)
Transmit Byte Clock
Loop Back Enable
Lock To Reference
Link (Media) Control
Enable Byte Sync
Laser Fault
Receive Data (10)
Receive Byte Clock (2)
Byte Sync
Link (Media) Status
OLC 266
T
R
Duplex Optical Fibre Cable
R
T
OLC 266
Receive Data (10)
Receive Byte Clock (2)
Byte Sync
Link (Media) Status
Transmit Data (10)
Transmit Byte Clock
Loop Back Enable
Lock to Reference
Link (Media) Control
Enable Byte Sync
Laser Fault
SYSTEM B

All electrical and I/O interface levels are TTL compatible.

Optical	Data Rate	265.625 Mbps
	Wavelength	780 nm
	Maximum Launch Power in Fibre	-0.9 dBm (average)
	Minimum Launch Power in Fibre	-4.7dBm (average)
	Minimum Receiver Sensitivity	-17.5 dBm (average)
	Minimum Receiver Input	0 dBm (average)
	Recommended Optical Fibre	50/125 micron
	Recommended Fibre Bandwidth	400 MHz-km at 780 nm
	Recommended Max. Fibre Attenuation	4.0 dB/km at 780 nm
Reliability	Average Failure Rate	<.063%/1000 Hours (40°C)
	Bit Error Rate	$<10^{-12}$ at -17.5 dBm
Power	+5V +10%/-5%	.6A Maximum
Environmental	Operating	10°C to 50°C
		8% RH to 80% RH
	Storage	-40°C to 75°C
		5% RH to 95% RH
Physical Size	Height	13.5 mm (0.51 In.)
	Width	40 mm (1.57 In.)
	Depth	114 mm (4.53 In.)
Laser Safety (Class 1)	U.S.	DHHS 21 CFR(J) conformant
	International	IEC 825 and amendment 1 (1990) conformant

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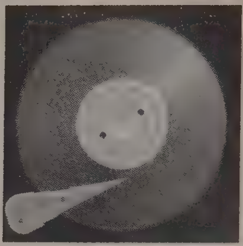
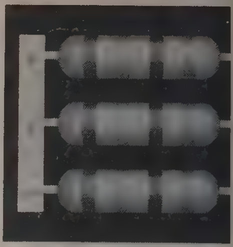




19-Inch VGA Color Display and TouchSelect Feature

Custom Commercial Systems

The OEM version of the IBM* 7554 Commercial Systems 19-Inch VGA Display is designed to complement the family of IBM Custom Commercial Systems. The display provides 640 x 480 and 1024 x 768 pels definition. It can display up to 16 colors in standard VGA mode or 256 colors with the proper adapter. These colors are selected from a palette of 262,144 colors.

The 7554 is free-standing for use on the bench top, and, with the optional rack-mount feature, may be mounted in a standard EIA 19-Inch rack. Filtered cooling air allows continuous operation in environments with extended temperatures, particulates and vibration. For added convenience, the 7554 provides brightness and contrast controls as well as a power-on light emitting diode.

With it's hardened case, fan, filter and anti-glare screen, the IBM 7554 lets you bring the advantage of high-resolution to workstations into many environments.

Technical information

- Vertical scan frequency: 55Hz to 85Hz
- Resolution:
  - 320 x 200
  - 640 x 480
  - 1024 x 768
  - 720 x 400 (text mode)
- Dot Pitch: 0.31 mm
- Non-interlaced and interlaced operation

7554 TouchSelect

The 7554 TouchSelect* is a touch screen for the 7554 19-Inch display. It utilizes state-of-the-art IBM Strain Gauge technology. This technology allows the use of any input medium—finger, glove or stylus.

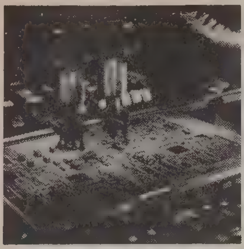
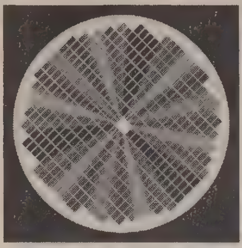
In addition to horizontal and vertical screen positions, the TouchSelect can measure the pressure applied to the screen. This allows the using program to emulate a mouse button or use the pressure applied directly in the program.

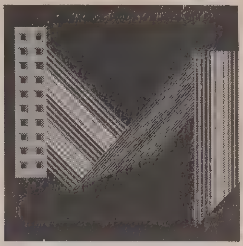
The easily installed TouchSelect requires no adapter card or separate power supply. A single cable connects the TouchSelect to a PS/2 mouse port.

Device drivers are available for DOS, OS/2 and DOS Windows** 3.0.

International and European standards

- Power Line Harmonics
  IEC 555-2 EN60555
- Electrostatic Discharge
  EC 801-2 Level 3, 6KV EN55101-2
- Radiated electro-magnetic susceptibility
  IEC 801-3 Level 3, 10V/m EN 55101-3
- Fast transients/bursts
  IEC 801-4 Level 3, 2KV on Power Cables
- Power line surges
  IEC 801-5 Level 3, 1KV
- Conducted immunity
  801-6 Level 2
- Safety IEC 950 EN60950
- Enclosure
  IEC 297-1 rack-mount units only
- Environment IEC 529 IP50
- Vibration
  IEC 68-2-6 Random: 0.27G RMS from 5Hz to 500Hz
- Shock (operating)
  IEC 68-2-27 30G at 3 ms duration



Custom Commercial Systems

The OEM versions of IBM* Custom Commercial Systems are designed to be used in areas with demanding environments—high temperature, particulates, power problems, shock, vibration and continuous power-on—where standard systems are not reliable.

IBM Commercial workstations are convertible 19" rack- or bench-mount systems supporting both IBM Micro Channel* and Personal Computer AT* bus architectures. All systems provide integrated keyboard, pointing device, XGA*/2, serial and parallel ports.

Machine types

- 7537, 80486SLC2 50/25Mhz PC AT bus
- 7546, 80486SLC2 50/25Mhz Micro Channel
- 7546 80486DX2 66/33Mhz Micro Channel

Highlights

- Micro Channel or Personal Computer/AT bus architectures
- 80486SLC2 or 80486DX2 processors
- 4 DASD bays with selectable fixed disk configurations up to 2.212 GB
- 1.44 or 2.88MB 3.5" diskette drives
- 4 or 5 expansion slots
- Worldwide power supply with optional battery back up
- Choice of standard or space-saving keyboard
- Built for 24-hour operation

Environmental specifications

Temperature
- Operating 0-50° C
  - Max = 45° C w/ 400MB files
  - Max = 40° C w/one 1.0GB file
  - Max = 35° C w/ two 1.0GB files
  - Max = 40° C w/ Rewritable Optical Drive
- Non-Operating 0-55° C
- Shipping -40 to 60° C

Shock
- -30G at 3 ms duration operating

Vibration
- 5 to 10Hz at .03"
- 10 to 200Hz at .15G
- 200 to 240Hz at .077G

Particulate Protection
- Filtered cooling air
- Positive air pressure

Agency certifications

- UL** Listed (UL 1950, 1st Edition)
- CSA Certified (CSA22.2 No. 950-M1990)
- FCC Class A
- VCCI Class 1
- IOP
- VDE or TUV (EN60950/IEC 950)
- CISPR 22 - Class A
- BABT- UK General Approval NS/G/1234/J/1000003

Operating environment

- Operating temperature: 0°C-50°C (32°F-120°F)
- Relative humidity: 8%-90% non-condensing
- Dimensions:
  - Width: 451 mm (17.75 in)
  - Depth: 476 mm (18.75 in)
  - Height: 400 mm (15.75 in)
- Weight: 29.44 kg (65 lb)
- Signal cable length: 1.8 m (5 ft 11 in)
- Electrical:
  - 110 to 220 VAC; 50-60 Hz

Industry standards

The 7554 Display and the TouchSelect feature are recognized by Underwriters' Laboratories, Inc. (UL**) as an acceptable component for computerized systems signaling and burglar alarm systems. The applicable standards are:
- UL 294: Access Control System Unit
- UL 864: Component - Control Units, System
- UL 864: Process Management Equipment
- UL 864: Signal Appliances, System Units
- UL 864: Control Unit Accessories, System
- UL 916: Management Equipment - Energy
- UL 1076: Proprietary Alarm Units
- UL 1610: Central-Station Burglar Alarm Units

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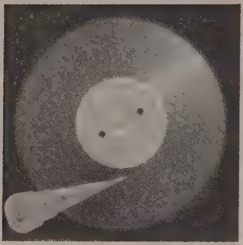
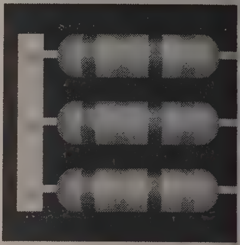




ARTIC 32-bit Memory Controller Chip and Micro Channel Interface Chip

ARTIC 32-bit Memory Controller

This OEM chip interfaces a 25 MHz Intel 80960CA, a 32-bit Local Bus, and two dynamic random access memories (DRAM). The memory interfaces can be accessed independently for concurrent operation of the 80960CA processor and the Local Bus. The chip also allows high-speed access from the processor to Local Bus memory and from the Local Bus to processor memory, allowing full addressability of both memories from each bus. Memory protection support and Error Checking and Correcting (ECC) ensure data integrity.

Highlights

- Two independent DRAM controllers (up to 32 MB each)
- 25 MHz, 80960CA processor bus to Local Bus conversion
- High-speed, 32-bit Local Bus with address and data parity
- Supports 3-1-1-1, burst transfers to either memory
- Flow-through ECC with single-bit correction, double-bit detection on both memories
- Hardware support for memory protection
- Five programmable timers
- 304-pin plastic flat pack (PFP)
- 126.5K devices (32K gates)

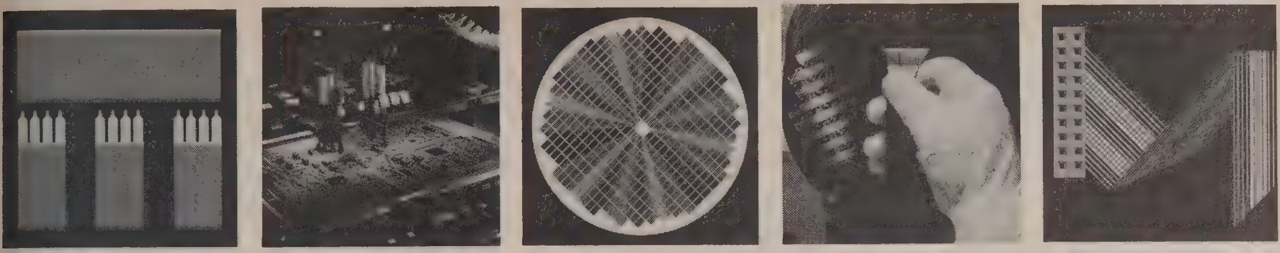
ARTIC 32-bit Micro Channel* Interface

This OEM chip provides high-speed access between the Micro Channel and a high-speed, 32-bit Local Bus. The chip can stream data at 80 MB streaming rates as both a Micro Channel bus master and slave. Internal buffering and a bursting Local Bus allow the chip to sustain streaming on the Micro Channel for large burst transfers.

Two independent, full-function bus master channels provide the bus master compatibility. The chip is also easily attachable to the Micro Channel, requiring only one transceiver for control signals.

Highlights

- Two Micro Channel Bus Master channels, addressable from Local Bus
- 128-bytes of buffering per channel
- Linked List Chaining for auto-initialization of either channel
- Full support for Subsystem Control Block (SCB) Move and Locate Modes
- Directly attachable to Micro Channel with only one external transceiver (-S0, -S1, -CMD, -ADL, -SD STROBE)
- 240-pin plastic flat pack (PFP)
- 220K devices (55K gates)
- Slave interface maps Local Bus to Micro Channel memory space
- Support of eight-byte, 100 ns streaming data as Micro Channel master and slave
- Micro Channel address and data parity support



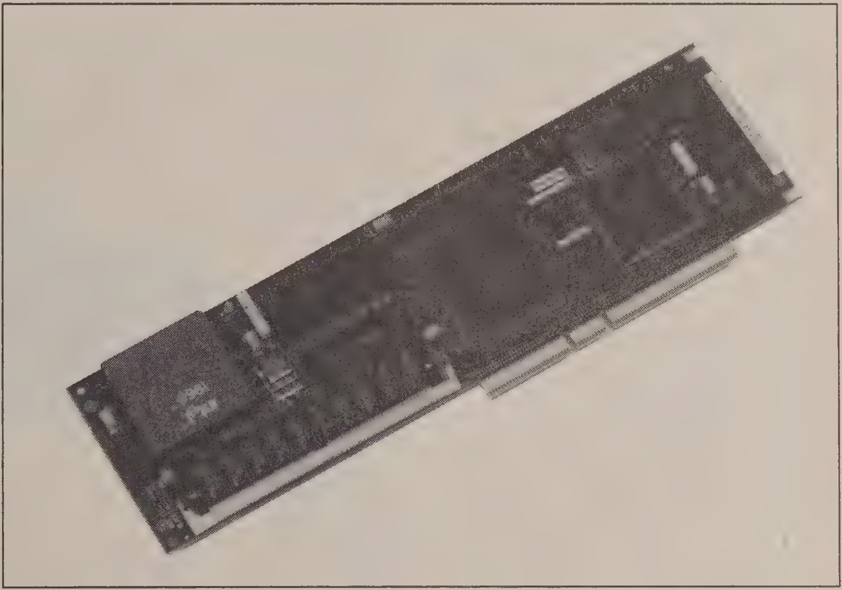
ARTIC Family of Coprocessor Adapters

Custom Commercial Systems

The OEM versions of IBM'S ARTIC (A Realtime Interface Coprocessor) adapter cards provide a family of high-performance coprocessors that can be used to offload real-time demands, front-end process data and I/O, and communications tasks.

ARTIC is Intel 80186-based and offers computer-within-a-computer capabilites, featuring up to 2MB RAM and an interface to share storage with system-unit memory via a movable window. ARTIC includes on-board communication chips and a real-time multitasking kernel. ARTIC versions are offered for both the AT* and MCA bus.

Multiport versions provide up to eight ports of mix-and-match device connectivity supporting a variety of protocols and physical interfaces including asynchronous, bisync and multidrop.



Highlights

- Intel 80186 microprocessor, 7.3 to 12.5 MHz speeds
- Real-time multitasking kernel (RCM) prioritizes 255 tasks
- Up to eight ports of serial I/O per card
- Up to 38.4 Kbps throughput on all eight ports simultaneously
- Up to 64 Kbps synchronous throughput on six ports simultaneously
- Multidrop via RS-422-A/X.21 on four or eight ports per card
- X.25 version offers single high-speed (US T 1) port on MCA bus
- Variety of daughter cards and cables available
- Developer Kit available for OEM daughter-card support
- Extensive third-party infrastructure for programming support

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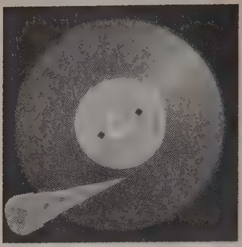
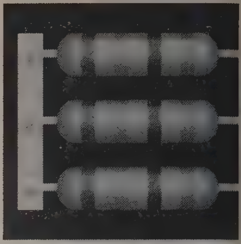
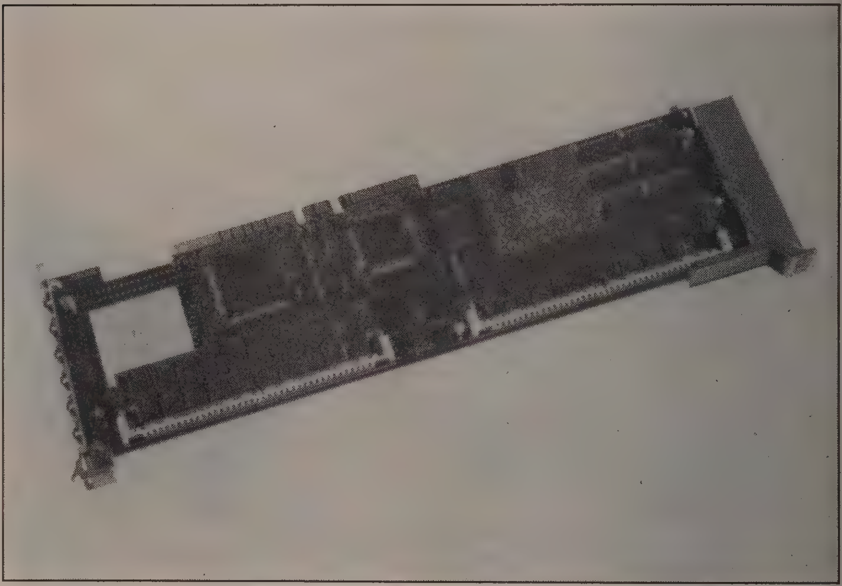




Personal/370 Adapter/A



The OEM Personal/370 Adapter/A (P/370) is a co-processor for selected Micro Channel* Architecture Personal System/2* (PS/2)* computers. It adds a standalone S/370* processor function to a PS/2 computer running Operating System/2* (OS/2)*. This creates a personal workstation that can run S/370 applications concurrently with OS/2 applications.

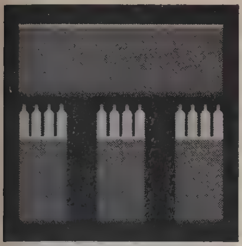
The P/370 gives you the ability to integrate software from the extensive S/370 catalog with a full range of personal computing connectivity and applications with software or hardware solutions to form powerful new products to meet your customers' needs.

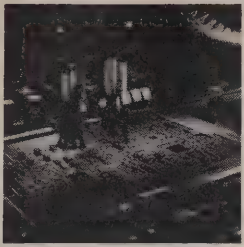
Whether you provide S/370 solutions or are in need of a processor with a powerful and stable architecture for your product, the P/370 may be the answer.

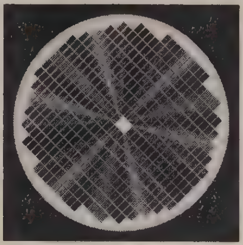
The P/370 can run selected S/370 operating systems and associated applications standalone. It can also communicate with multiple concurrent local IBM* 3215 and IBM 3270 sessions, and host 3270 sessions through OS/2 Communication Manager windows.

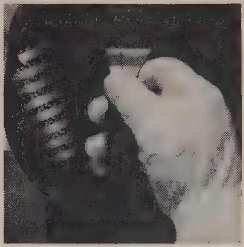
A Personal/370 Adapter/A with selected IBM PS/2s can provide all the benefits of OS/2 plus:

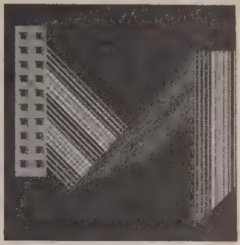
- Multiple 3270 sessions through Communication Manager windows with GDDM*-OS/2 Link support.
- Multiple 3215 sessions through OS/2 Presentation Manager* (PM) windows.
- Selected S/370 channel-attached devices are supported with an optional S/370 Channel Emulator/A.
- Can peer attach to a S/370 or S/390* host through an IBM 3088.
- LAN-attached PCs running OS/2 can have multiple 3270 sessions with GDDM support.
- Remote dial-in capability through the PS/2 serial port.
- Ability to communicate with other LAN attached P/370s via RSCS and PVM.
- File transfer between all sessions (OS/2-HOST-LOCAL).
- Transparent VM minidisk sharing between host VM and local VM using the SRPI interface.
- S/370 processor console functions in PM windows.
- Minidisks can be located on a LAN file server and shared between P/370 systems.
- Can use VM tape commands with the floppy diskette drive.











Specifications

Personal/370 Adapter/A			
Adapter		Single Card Assembly 11.5" x 3.5" (292mm x 89mm) (normal IBM PS/2 form factor for adapter cards) The adapter is designed to meet the requirements of the PS/2 8595 (Model 95).	
Electrical		The adapter is designed to conform with the electrical specifications as outlined in the Micro Channel power specifications for adapter cards in the PS/2 Model 95.	
Environmental		The Adapter conforms to the IBM class "B" operating environment; CES 1-9700 000.	
	Air Temperature	Minimum: 16° C (60° F)	
	Operational	Maximum: 32° C (90° F)	
	Air Temperature	Minimum: 10° C (50° F)	
	Non-operational	Maximum: 43° C (110° F)	
	Air Relative Humidity	8% to 80%	
	Altitude	0 to 3,000 feet* (914 meters)	
		*The upper limit of air temperature may be derated 1° F (0.6° C) per 250 feet (76 meters) of elevation above 3,000 feet (914 meters). Maximum altitude is 7,000 feet (2,135 meters).	
	System Environment	Hours: 500 POH/month, 40 K POH total	
		Machine on/off cycles	Nominal: 40 cycles/month
			Maximum: 80 cycles/month
	Regulatory Compliance	EMI - The adapter will comply with the limits for a Class A digital device, pursuant to Part 15 Subpart J of the FCC rules.	
		Safety - The adapter will comply with the safety regulations that apply to the PS/2 8595.	

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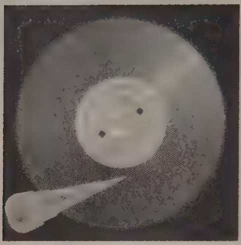
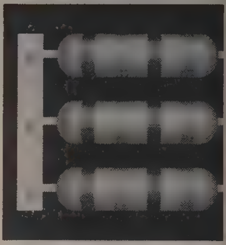


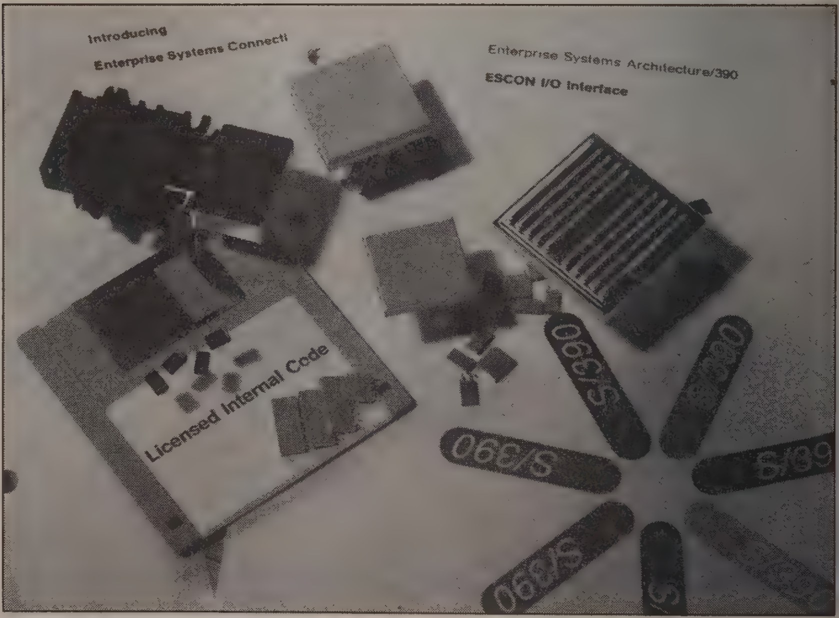


ESCON Enabler Technologies

Total solution package for ESCON attachment

The OEM ESCON* Enabler Technologies is a special-purpose subsystem of discrete components and Licensed Internal Code (LIC). It is used to facilitate attachment of input/output devices to ESCON channels and ESCON directors, or to provide ESCON channel functionality.

The subsystem provides control of ESCON fiber optic interface and protocols and provides the user with a simple memory-type hardware connection point and a logical software connection point, the LIC. Hardware and software development effort and difficulties associated with ESCON attachment can be eased significantly through the application of this package.


Introducing
Enterprise Systems Connecti
Enterprise Systems Architecture/390
ESCON I/O Interface
Licensed Internal Code
S/390
S/390
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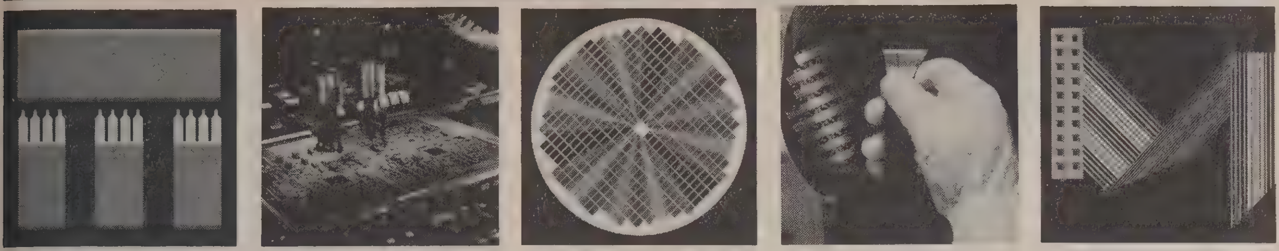
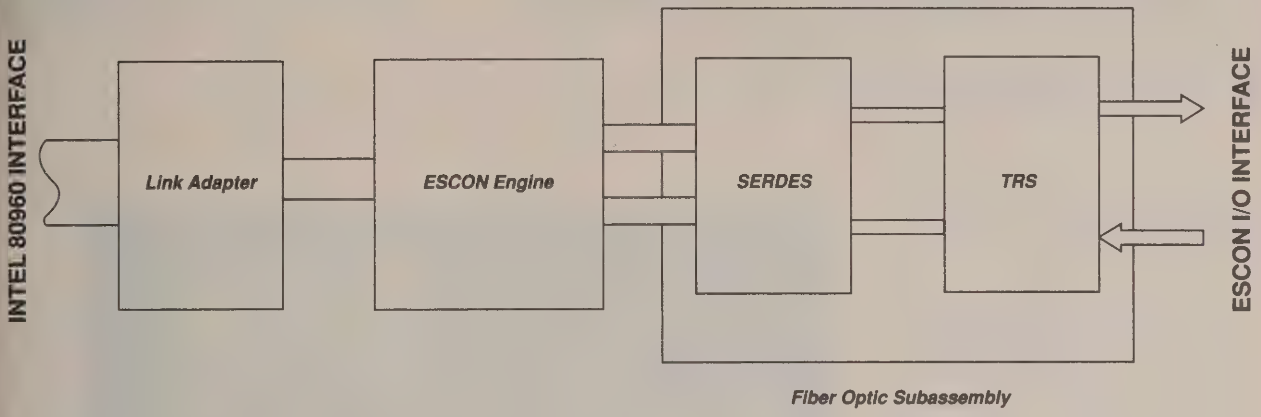
Highlights

- Compatible with all IBM* ESCON products
- Highly reliable components
- Intel** 80960** user interface
- Loadable Licensed Internal Code
- Available in ESCON channel and control unit image





Link Adapter: *Uses TTL logic levels to provide communication between the ESCON engine and an INTEL 80960 bus*

ESCON Engine: *Uses Licensed Internal Code to provide communication to and from the driving ESCON Channel or ESCON Control Unit*

Fiber Optic Subassembly: *Uses a serializer/deserializer (SERDES), a LED or Laser transmitter-receiver subassembly (TRS), and several discrete components (200 MHz crystal, Rpacs, Cpacs, and inductors)*

Optical characteristics

- Data: 8-bit/10-bit code
- Data rate: 200 megabits/second ±100 ppm
- Link bit error rate: Supports 10^{-15} at optical power budget
- Optical power budget: 8.0 dB maximum
- Transmitter:
  - LED 1300 nm
  - Laser 1300 nm
- Fiber:
  - LED attachment 62.5/125 μm, 0.275 numerical aperture graded-index
  - Laser attachment: 9/125 μm, zero dispersion wavelength 1310 μm
- Link length:
  - LED 3 km (1.87 miles) maximum
  - Laser 20 km (37.4 miles) maximum

- Fiber:
  - LED attachment 62.5/125 μm, 0.275 numerical aperture graded-index
  - Laser attachment: 9/125 μm, zero dispersion wavelength 1310 μm
- Link length:
  - LED 3 km (1.87 miles) maximum
  - Laser 20 km (37.4 miles) maximum

Package characteristics

- Power: 5v ±5% at 3.0A maximum
- Environment: 10°C to 40.6°C
- Size: Approximately 127 mm wide, 127 mm long, and 13 mm high when configured with supplied component placement and wiring (actual size based on user package)

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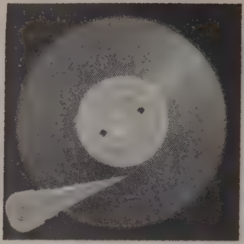
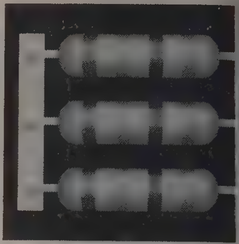
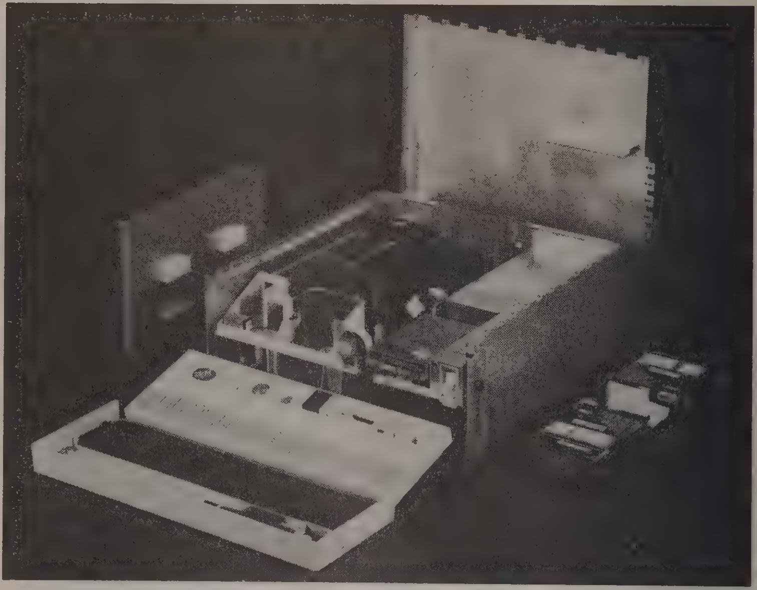




Environmentally Hardened RISC System/6000

POWERstation®/POWERserver®, Models 340R and 350R



More and more computing today is performed in hostile environments. Users demand computer systems capable of performing in conditions of extreme temperature, humidity, dust, vibration and shock. The IBM RISC System/6000® Models 340R and 350R are designed to operate under such conditions.

Engineers, researchers, geophysicists and geologists are among those who require environmentally hardened systems. Models 340R and 350R can be mounted in trucks and vans or aboard ships. Major application areas include seismic data acquisition and processing, quality control, well logging, production monitoring, mapping, modeling and plotting of gas and oil reserves.

In the area of plant operations, companies are increasing the amount of data acquisition, testing and analysis that is performed close to the manufacturing process in order to improve production quality, cost and productivity. The 340R and 350R are high-performance, rack-mounted RISC System/6000s that will operate in the challenging environmental conditions found in the manufacturing area. Application areas include production monitoring, quality inspection, statistical process control (SPC) material handling and laboratory management.

Military applications include any location where rugged construction is required and where cost is a concern. Models 340R and 350R offer excellent environmentally hardened characteristics at a modest cost increase above the standard Models 340 and 350.

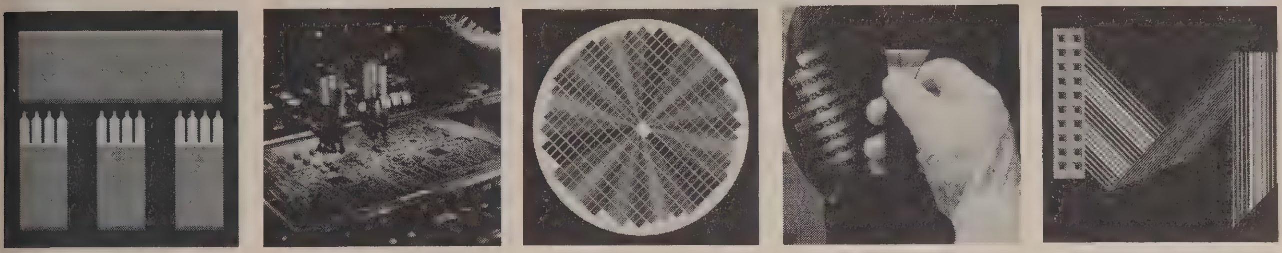
Highlights

- Mountable in a standard 19-inch equipment rack
- High capacity fan to enhance cooling
- Card retention and advanced hard disk mounting systems to withstand vibration and shock
- Dust cover over diskette reader and provisions for air filter
- 400MB hard disk
- Full one-year warranty
- Excellent price, performance and environmental characteristics

Product description

The environmentally hardened RISC System/6000 Models 340R and 350R bring the power of IBM's advanced RISC technology to a wide range of field applications. This equipment is commercial-off-the-shelf (COTS) operating hardware that has been repackaged to perform in hostile environments.

Models 340R and 350R maintain 100 percent functional equivalency with their standard counterparts, RISC System/6000 Models 340 and 350. Both environmentally hardened units support the same Micro Channel® interface adapter cards, memory upgrades and options used in the standard Models 340 and 350. The only exception is the hard disk—Models 340R and 350R do not support the 160MB hard disk.



Specifications

Environmentally Hardened RISC System/6000		Model 340R	Model 350R
Performance	Clock	33MHz	41MHz
	SPECmark	56.6	71.4
	SPECInt89	28.8	36.2
	SPECfp89	88.7	112.3
	MFLOPS	14.8	18.6
Environmental			
Temperature	Operational	+5°C to + 45°C	
	Non-operational	-40°C to + 60°C	
Altitude	Operational	-1000 ft to + 10,000 ft	
	Non-operational	-1000 ft to + 40,000 ft	
Humidity	Operational	10% to 90%, non-condensing	
Random Vibration	Operational	3 Axis: 2.0 Gs RMS	
		10 Hz to 2.0 KHz	
Sine Vibration	Operational	3 Axis: 1.0 Gs	
		10 Hz to 2.0 KHz	
Shock	Operational	3 Axis: 12 Gs, 1/2 Sine. 10mSec	
EMI/EMC		FCC Class A	

Because SCSI and Ethernet functions have been integrated onto the planar as standard features, Models 340R and 350R have four usable Micro Channel adapter slots. Two memory slots allow a maximum of 128MB of memory. Provisions for two internally mounted 400MB, 3.5-inch SCSI hard disks allow a maximum of 800MB of additional storage.

Standard features for the 340R include 16MB of memory and a 400MB SCSI hard disk.

Standard features for the 350R include 32MB of memory and a 400MB SCSI hard disk.

Mountable in a standard 19-inch rack, the environmentally hardened RISC System/6000 340R and 350R are 4 EIA units (7 inches) high and weigh 15.4 kg (33 lbs).

A fold-down front bezel on each model contains a built-in foam block that fits over the diskette opening to prevent dust entry. Space has also been provided for an air filter.

A one-year warranty is standard, and an optional maintenance agreement is available.

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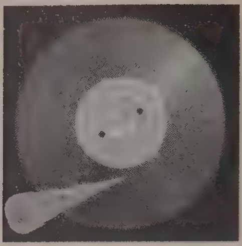
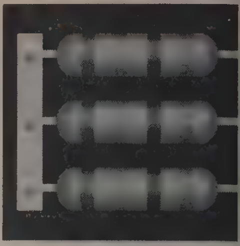




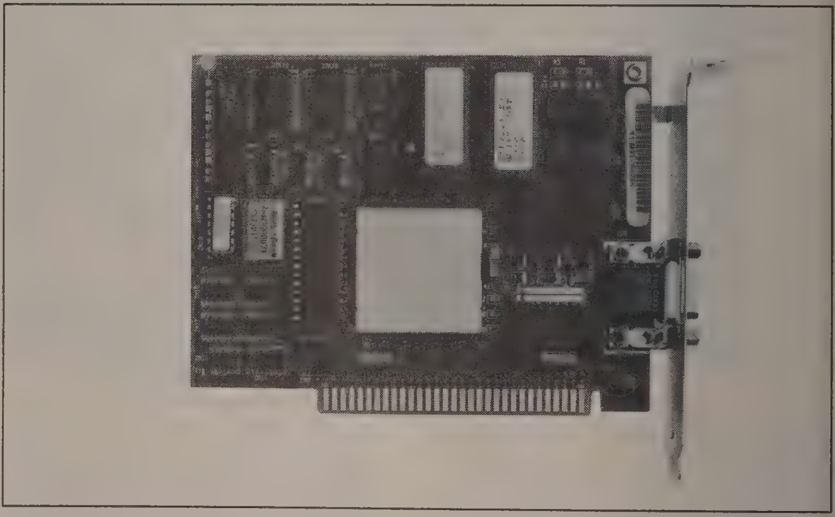
Token-Ring Network 16/4 Adapters

IBM offers OEM versions of its best-selling Token-Ring Network 16/4 Adapters.

The Token-Ring 16/4 Adapter and Token-Ring 16/4 Adapter II attach a host system, using an Industry Standard Architecture (ISA) bus to a Token Local Area Network operating at either 4 or 16 Mbps.

The 16/4 Adapter is a companion to the 4Mbps IBM* Token-Ring Network PC Adaptor II. It is the ideal choice for DOS users with memory constraint considerations, since it requires less workstation memory than the Token-Ring Network 16/4 Adapter II.

Token-Ring 16/4 Adapter II supports PS/2* and PC workstations with 16-bit ISA buses and provides enhanced data transfer capabilities on ISA machines. These capabilities make possible increased throughput by allowing adapter-to-system-memory data transfer independent of the host processor. The host processor is then available for other tasks.

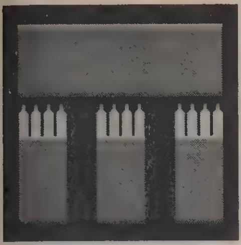
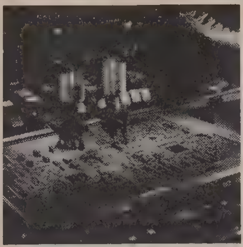
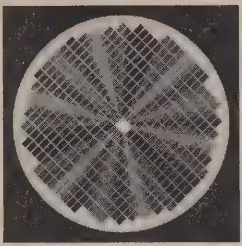
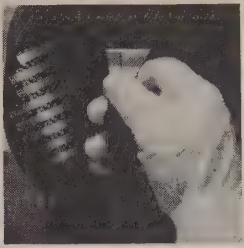
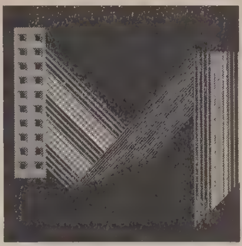


The Token-Ring 16/4 Adapter II also provides Unshielded Twisted Pair (UTP) support at both 4Mbps and 16Mbps. This allows the option of using either cost-effective telephone twisted-pair media or advanced IBM Cabling System Shielded media (STP) for network wiring. UTP filters are standard for Adapter II.

The Token-Ring 16/4 Adapter/A (Micro Channel*) attaches a host system using IBM PS/2 Micro Channel Architecture, to a Token-Ring Local Area Network operating at either 4 or 16 Mbps. It is switchable by software and is changed as part of machine setup during the power-up sequence.

Highlights

- Operates at either 4 or 16 Mbps
- Max frame size is 18K at 16Mbps and 4.5K at 4Mbps
- Max link stations (sessions) is 254
- Adapter and ring diagnostics supplied
- Early Token Release supported at 16Mbps
- Requires a customer-supplied attachment cable, IBM PN 6339098 or equivalent
- Conforms to IEEE 802.5
- FCC Operating Class A
- Occupies a single adapter slot
- Provides Remote Program Load (RPL) (optional feature on the 16/4 Adapter)
- Early Token Release at 16 Mbps

Specifications

16/4 Adapter	**Slot**	Standard Length
Hardware		The following ISA machines have been tested and operate properly with the Token-Ring Network 16/4 Adapter: IBM PC Models 5160, 5162, 5170, 7531, and 7532 IBM PS/2 Models 8525, 8530, 8535, and 8540.
Software		The following products have been tested and operate properly with the Token-Ring Network 16/4 Adapter: IBM OS/2* Extended Edition 1.2 or higher IBM LAN Manager IBM LAN Network Manager IBM Token-Ring Network Bridge Program 2.2 IBM DOS 3.3 IBM OS/2 LAN Server 2.0 or 3.0 IBM PC LAN Program 1.3
Wiring		IBM Cabling System (STP) or Unshielded Twisted Pair (UTP) with external filters
RPL		Optional

16/4 Adapter/II	**Slot**	Standard Length
Hardware		The following ISA machines have been tested and operate properly with the Token-Ring Network 16/4 Adapter II: IBM PS/2 Models 7537, 8525, 8530, 8535, and 8540
Software		The following products have been tested and operate properly with the Token-Ring Network 16/4 Adapter II: IBM DOS 3.3, 4.0 or 5.0 LAN Support Program 1.3 IBM OS/2 LAN Server 2.0 or 3.0 IBM Extended Services for OS/2 1.0 IBM OS/2 Standard Edition 1.30.1 or 1.30.2 and OS/2 2.0 NetWare from IBM Version 2.2 or 3.11 Novell** NetWare** 2.2 or 3.11 IBM Personal Communications/3270 Version 2.0 IBM PC LAN Program 1.3 (Requester) Novell OS/2 Open Datalink Interface (ODI) Workstation Driver Novell DOS ODI Workstation Driver IBM OS/2 Network Device Interface Specifications (NDIS) Driver IBM DOS NDIS Driver
Wiring		IBM Cabling System (STP) or Unshielded Twisted Pair (UTP) without external filters
RPL		Standard

16/4 Adapter/A		
Hardware		One half-size feature slot in the PS/2 Models 50 and above
Software	**For PC DOS**	IBM PC DOS Version 3.3 or higher and IBM Local Area Network Support Program
	For OS/2	OS/2 Extended Edition 1.1 or higher. OS/2 does not support PC 5160 systems.
Wiring		IBM Cabling System (STP) or Unshielded Twisted Pair (UTP) with external filters
RPL		Standard

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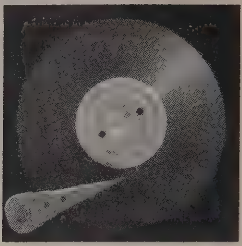
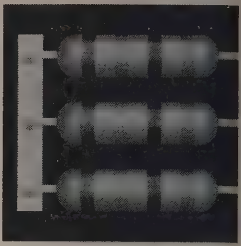
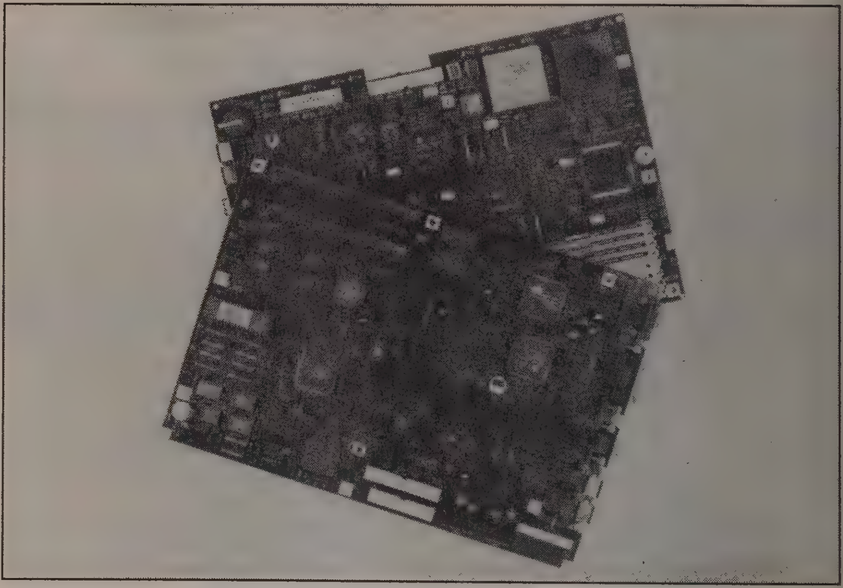




Motherboards



IBM offers the OEM market a wide range of motherboards in both Micro Channel* and AT* designs. The processors in these boards are from IBM and Intel** and range from a 386SLC-25 to a 486DX2-33/66.

IBM's new SLC performance processors, 386SLC and 486SLC, have double clocking, on-chip cache and optimized instructions. With these features, the new IBM-designed motherboards outperform their industry couterparts while providing compatibility and price points that fit the OEM marketplace.

Intel's 486 processors provide speedy, reliable performance today, plus a growth path for the future. Motherboards are available with the Intel 486SX-25, 486DX-33 and 486DX2-33/66 processors.

Compatibility is viewed in several ways. First, our processors are either from Intel or completely compatible (as certified by Intel) with Intel instruction sets. This allows for attachment to a variety of motherboards and provides upgradeability on the same motherboard. This is particularly true with the IBM 386SLC and 486SLC2.

Second, application compatibility is preserved. By upgrading to a faster processor, the same applications usually run faster. And this is done without the need to change operating systems in the case of the processors that have 32-bit internal and 16-bit external data paths.

The IBM 386SLC and 486SLC2 lead the way from a price point of view. They combine high-speed features with low operating cost to provide excellent price performance. These also provide an upgrade plan, and future upgrades will follow IBM's upgrade strategy.

Innovative technology

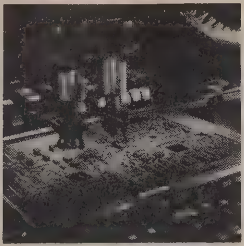
The breadth of the IBM processor and motherboard offerings provides technology that supports many areas of the marketplace. The innovative technology of the IBM SLC processors supports low-power applications such as laptop and notebook computers, while providing speed comparable to some 32-bit processors. Other 32-bit processors support multitasking applications. All in all, IBM processors and motherboards provide a wide range of technology from price sensitive markets to performance-intensive environments.

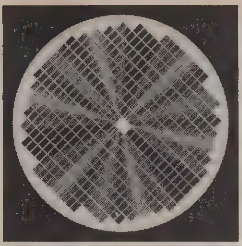
Flexibility

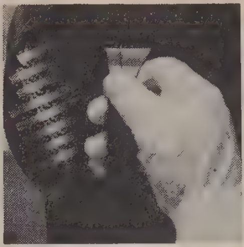
With Intel compatibility, you can mix and match processors and motherboards to meet the needs of most environments. Flexibility of design allows for a mix of motherboard components that helps match current standards and provide compatibility with installed equipment.

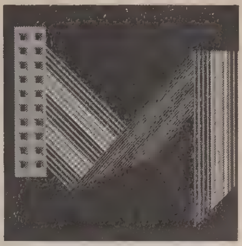
Investment protection

With the IBM processors and motherboards, you can provide cost effective performance to your customers whether in the Micro Channel or AT environment. Both your investment and your customer's investment are protected through upgradeability designed into our processors and motherboards.









Motherboard Specifications

FUNCTIONAL	**IS-01**	**IS-02**	**IS-03**	**IS-04**	**AT-01**	**AT-02**
Processor						
386SLC-25	x				x	
486SLC2-50/25						x
486-SX-25		x				
486DX-33			x			
486DX2-33/66				x		
Pros. Cache	8K	8K	8K	8K	8K	16K
L2 Cache	N/A	N/A	128K	128K	N/A	N/A
Pros. Up-Grade	No	DX2	DX2	N/A	SLC2	Module
Co-pros. Up-Grade	Yes	Yes	N/A	N/A	Yes	Yes
IBM BIOS	Eprom	Eprom	Eprom	Eprom	Flash	Flash
Video	SVGA	SVGA	SVGA	SVGA	XGA*-2	XGA-2
640 x 480 16 Colors	x	x	x	x		
640 X 480 256 Colors	x	x	x	x		
640 x 480 65536 Colors					x	x
800 X 600 256 Colors	x	x	x	x		
800 X 600 65536 Colors					x	x
1024 X 768 256 Colors	x	x	x	x		
1056 X 400 256 Colors	x	x	x	x		
1188 X 480 256 Colors					x	x
Max. Resolution 16 Colors 1280 X 1024	x	x	x	x	x	x
132 Col. Enabled (MFI)	Yes	Yes	Yes	Yes	Yes	Yes
VRAM	1MB	1MB	1MB	1MB	1MB	1MB
Audio	Beeper	Beeper	Beeper	Beeper	Speaker	Speaker
Expansion Riser						
3 Slot	x				x	x
5 Slot	x	x	x	x	x	x
I/O Adapter Cards (8.5W Average)						
Full Length - 16 Bit	3/4	4	4	4	3/5	3/5
Half Length - 16 Bit	0/1	1	1	1	-	-
RAM (Memory)						
80ns	2MB	4MB	4MB	8MB		
70ns					4MB	4MB.
Max	16MB	32MB	32MB	32MB	16MB	16MB
Addressing	24Bit	32Bit	32Bit	32Bit	24Bit	24Bit
Sockets	2	8	8	8	2	2
Type	72 Pin	30 Pin	30 Pin	30 Pin	72 Pin	72 Pin
Configs.	2,4,8MB	1,4MB	1,4MB	1,4MB	2,4,8MB	2,4,8MB
Banks	N/A	2	2	2	N/A	N/A
Combinations	Any Mix	Spec.	Spec.	Spec.	Any Mix	Any Mix
ASICs						
Video	Cirrus	Tseng	Tseng	Tseng	IBM	IBM
System Interface & Memory Controller	IBM/OKI				IBM/OKI	IBM/OKI
Peripheral Interface	VLSI				VLSI	VLSI
System Chipset	IBM	VLSI	VLSI	VLSI	IBM	IBM

FUNCTIONAL (cont)	**IS-01**	**IS-02**	**IS-03**	**IS-04**	**AT-01**	**AT-02**
Keyboard Type	PS/2*	PS/2	PS/2	PS/2	PS/2	PS/2
Diskette Type (AT)	1.44	1.44	1.44	1.44	2.88	2.88
Media Sense	-	-	-	-	x	x
Hard Disks (AT)	IDE	IDE	IDE	IDE	IDE	IDE
(ATA Revision 3.0)						
Power-on password	Yes	Yes	Yes	Yes	Yes	Yes
PHYSICAL						
Standard Interfaces						
Video Feature	1	1	1	1	1	1
Serial (9 Pin-RS232D)	1	2	2	2	1	1
Centronics Parallel (24 Pin/Bi-Directional)	1	1	1	1	1	1
Keyboard	1	1	1	1	1	1
Mini DIN Pt. Device	1	1	1	1	1	1
Dimensions						
Width(I/O side)-Length 09.0 X 13.0 (228 mmX 378 mm)	x	x	x	x		
Width-Length(I/O side) 08.5 X 11.0 (217mm x 278mm)					x	x
Height (Tallest Component) .5 (13 mm-Approx.)	x	x	x	x	x	x
ELECTRICAL						
Power Requirements						
+ 5V dc (+/- 5%)	x	x	x	x	x	x
- 5V dc (+/-10%)	x	x	x	x	x	x
+12V dc (+/- 5%)	x	x	x	x	x	x
-12V dc (+/-10%)	x	x	x	x	x	x
OPERATING SYSTEMS						
DOS	V5.0	V5.0	V5.0	V5.0	V5.0	V5.0
Windows**	V3.1	V3.1	V3.1	V3.1	V3.1	V3.1
Novell**	V3.11	V3.11	V3.11	V3,11	x	x
OS/2*	V2.00.1	V2.00.1	V2.00.1	V2.00.1	V2.0	V2.0
OS/2 Lanserver	V2.0	V2.0	V2.0	V2.0	x	x

OPTIONAL DOCUMENTATION

(Available thru: 800-IBM-PCTB - 800-426-7282)

PS/2 Tech Ref-AT Bus Systems (S85F-1646-00)

PS/2 Tech Ref-Common Interface (S84F-9809-00)

PS/2 Tech Ref-Architecture (S84F-9808-00)

386 SVGA Drivers/Utilities Users Guide (S52G-9963-00)

486 SVGA Drivers/Utilities Users Guide (S52G-9964-00)

REGULATORY AGENCY APPROVALS

IBM systems using these mother boards have successfully qualified for the following Agency Approvals. OEMs are responsible for doing the necessary testing and qualification of their own systems using components. FFC, Part 15 Class B; UL, UL1950 - 1st Ed; CSA, C22.2 No. 950; IEC, IEC-950; VCCI, Class 2 (Odb); TUV-GS, EN60950; TUV-GS, ZH1/618; NEMKO, EN60950; SEMKO, EN60950; DEMKO, EN60950; EIF (SETI), EN60950; OVE, EN60950; CE92 BABT; NS/G/1243/J/100003

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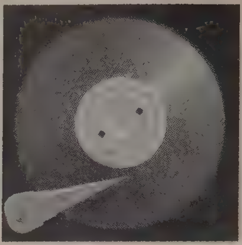
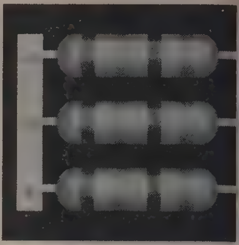




AT Architecture Systems

The AT* family offers the OEM market many configuration choices and a broad range of possibilities with industry-standard AT-bus compatibility. IBM's leading design features and performance are delivered with the benefits of low cost, high quality, and proven compatibility.

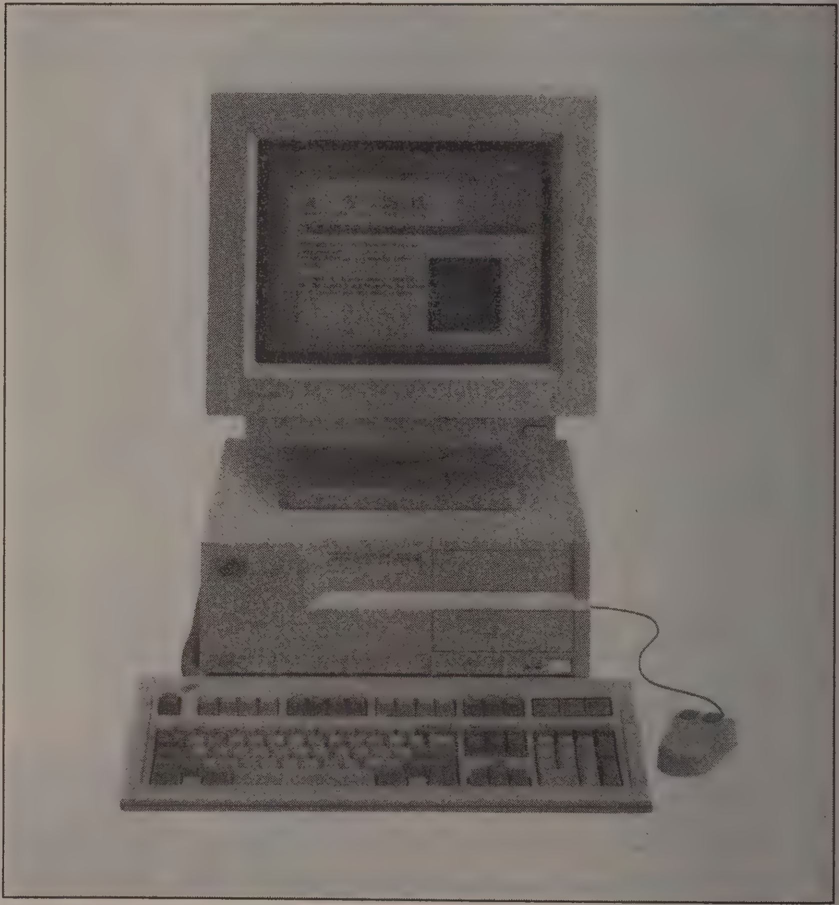
IBM's AT family provides something for everyone—from industry-standard compatibility to IBM's exclusive logic designs—with upgradeability built in. Processors available range from IBM's 386SLC-25 to the Intel** 486DX-33.

Configuration possibilities range from industry-standard 5-slot, 5-bay systems to a space saving 3-slot and 3-bay desktop/floor-standing design that is also available in a 5-slot and 4-bay system.

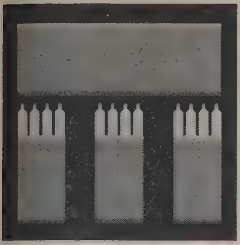
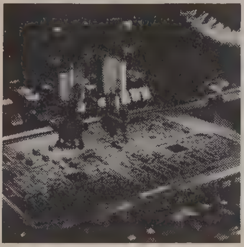
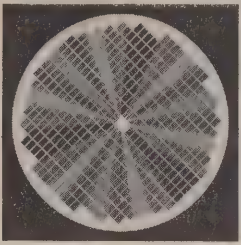
The choices are yours—thousands of industry-standard options plus your choice of 80MB, 170MB, and 212MB IDE Hard Disks.

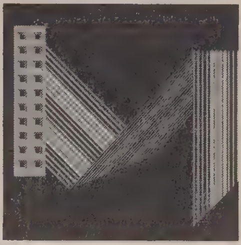
IBM's AT Architecture systems provide a smart solution for OEMs:

- Unprecedented performance: full system functionality plus IBM quality, reliability, and enhanced technical support—all at a competitive price.
- Preloaded operating systems and application environments are available, including DOS and OS/2*.



- Compatibility with systems, peripherals and software across the board through industry-standard components.
- Expandability and connectivity through a wide range of IBM and industry options that protect your customer's investment.
- OEM partnership that provides a working relationship yielding a wordwide scenario of quality customer solutions, utilizing reliable/certified components and solutions with investment protection.



AT Architecture Systems Specifications

FUNCTIONAL	IS-01	IS-02	IS-03	IS-04	AT-01	AT-02
Processor						
386SLC-25	x				x	
486SLC2-50/25						x
486-SX-25		x				
486DX-33			x			
486DX-33/66				x		
Processor Cache	8K	8K	8K	8K	8K	16K
L2 Cache	N/A	N/A	128K	128K	N/A	N/A
Processor Up-Grade	No	25/50	DX2	N/A	SLC2	Module
Coprocessor Up-grade	Yes	Yes	N/A	N/A	Yes	Yes
IBM BIOS	Eprom	Eprom	Eprom	Eprom	Flash	Flash
Video						
VRAM	1MB	1MB	1MB	1MB	1MB	1MB
SVGA	x	x	x	x	x	x
XGA*-2					x	x
Max. Res. 1280x1024 (16 Colors)	x	x	x	x	x	x
132 Col. Enabled (MFI)	Yes	Yes	Yes	Yes	Yes	Yes
Expansion Slots						
Full Length - 16 Bit	4	4	4	4	3/5	3/5
Half Length - 16 Bit	1	1	1	1	-	-
Memory						
Standard	2MB	4MB	4MB	8MB	4MB	4MB
Speed	80ns	80ns	80ns	80ns	70ns	70ns
Maximum	16MB	32MB	32MB	32MB	16MB	16MB
Addressing	24 Bit	32 Bit	32 Bit	32bit	24 Bit	24 Bit
SIMM Sockets	2	8	8	8	2	2
Keyboard						
Enhanced 101 Key	x	x	x	x	x	x
Audio						
Beeper	x	x	x	x		
Speaker					x	x
Mass Storage Bays	5	5	5	5	3/4	3/4
Diskette type (AT)	1.44	1.44	1.44	1.44	2.88	2.88
Media Sense					x	x
80MB IDE Hard Disk	x	x			x	
170MB IDE Hard Disk	x	x	x			x
212MB IDE Hard Disk			x	x		
Standard Interfaces						
Video Feature	1	1	1	1	1	1
Serial (9 Pin)	1	2	2	2	-	-
DMA Serial (9 Pin)	-	-	-	-	1	1
Centronics Parallel (24-Pin/Bi-Directional)	1	1	1	1	-	-
DMA Parallel (24 Pin)	-	-	-	-	1	1
Mini DIN Keyboard	1	1	1	1	1	1
Mini Din Pointing Device	1	1	1	1	1	1
Security						
Power-on Password	Yes	Yes	Yes	Yes	Yes	Yes
Key Lock	Yes	Yes	Yes	Yes	Yes	Yes

OPERATING SYSTEMS	IS-01	IS-02	IS-03	IS-04	AT-01	AT-02
DOS	V5.0	V5.0	V5.0	V5.0	V5.0	V5.0
Windows**	V3.1	V3.1	V3.1	V3.1	V3.1	V3.1
Novell**	V3.11	V3.11	V3.11	V3.11	x	x
OS/2*	V2.00.1	V2.00.1	V2.00.1	V2.00.1	V2.0	V2.0
OS/2 Lanserver	V2.0	V2.0	V2.0	V2.0	x	x
PHYSICAL						
Dimensions						
Width - Depth - Height (15.9 x 16.6 x 5.7) (405 x 421.5 x 144.3 mm) Weight - 22.2 lb	x	x	x	x		
Width - Depth - Height 14.2 x 15.6 x 4.5 (360 x 395 x 115 mm) Weight - 23.8 lb					x	x
Width - Depth - Height 17.3 x 15.5 x 6.7 (440 x 394 x 169 mm) Weight - 27.8 lb					x	x
ELECTRICAL						
Power						
145 Watt (Dual Voltage/Switch)	x	x	x	x		
118 Watt (Dual Voltage/Auto)					x	x
197 Watt (Dual Voltage/Switch)					x	x
50/60 Hz	x	x	x	x	x	x

OPTIONAL DOCUMENTATION

(Available at: 800-IBM-PCTB, 800-426-7282)

PS/2* Tech Ref-AT Bus Systems	S85F-1646-00
PS/2 and PC BIOS Interface Tech Ref	S04G-3283-00
PS/2 Tech Ref-Common Interface	S84F-9809-00
PS/2 Tech Ref-Architecture	S84F-9809-00
386 SVGA Drivers/UtilitiesUsers Guide	S52G-9963-00
486 SVGA Drivers/Utilities Users Guide	S52G-9964-00

REGULATORY AGENCY APPROVALS

FCC, Part 15 Class B; UL, UL1950—1st Ed; CSA, C22.2 No. 950; IEC, IEC-950; VCCI, Class 2 (Odb); TUV-GS, EN60950; TUV-GS, ZH1/618; NEMKO, EN60950; SEMKO, EN60950; DEMKO, EN60950; EIF(SETI), EN60950; OVE, EN60950; CE92; BABT; NS/G/1243/J/100003

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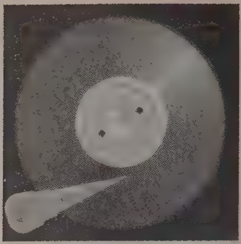
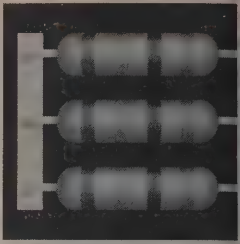


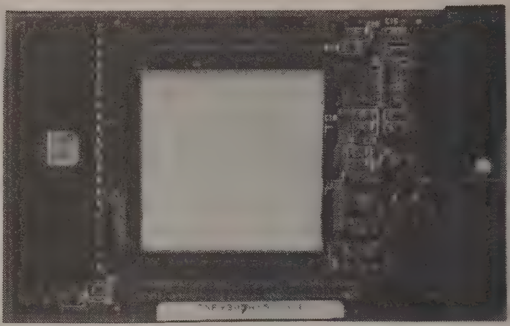


16/4 Mbps Token-Ring Mini-Card

The Token-Ring Mini-Card (daughter board) has communication chip technology equivalent to that which is presently available on IBM's 16/4 Mbps Token-Ring PC/AT® and Micro Channel® cards. This technology includes read only memory (ROM) and front-end analog circuitry. The Mini-Card mounts on a host card that must contain the additional components needed to achieve a fully functional adapter. The Mini-Card microcode supports MAC, LLC and Bridge Source Routing.

For other unique system interfaces, vendors can design their own custom logic to adapt to the mode that best fits their applications.

Vendors must provide the front-end connector Adapter Identification Prom (AIP), external jumpers, data buffering, 32 MHz oscillator and RAM in order to obtain a fully functional Token-Ring card.

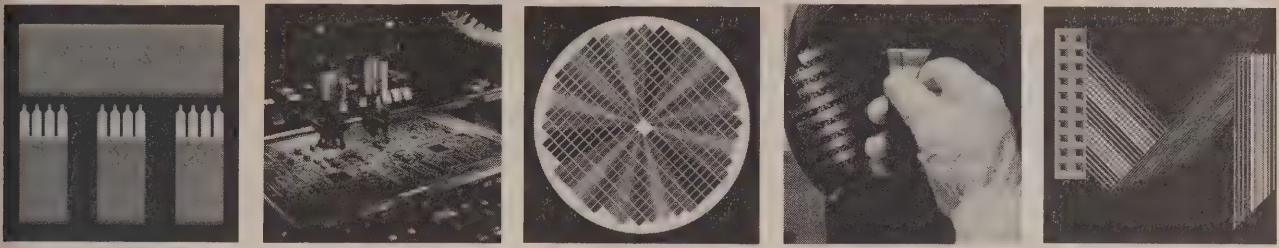


Highlights

- Memory Mapped Input/Output (MMIO) shared interface
- Programmable for three different modes:
  - –IBM Family: PC/AT 8-bit bus or 16-bit generic bus
  - –Motorola 68000: 16-bit data bus
  - –IBM Micro Channel: 16-bit data bus

Specifications

16/4 Mbps Token-Ring Mini Card		
Physical Dimensions	102.4 mm x 63.5 mm (4.02 in x 2.5 in)	
	Height above base card: 14.4 mm maximum; 13.6 mm nominal	
Interface Buses	Host Interface	1M addressability
		Byte/half-word data bus
	Local Memory Interface	64K-byte addressability
		16-bit data bus with or without parity
		Parity required
Power requirements	Card power supply voltage is 5VDC ±5%	
	Power consumption is 2.75W typical, 4.0 maximum	
	TTL signal levels	
Operating Environment	Air temperature	15.6°C to 32°C (60°F to 90°F)
	Relative humidity	8 to 80%
FCC Electromagnetic Radiation	The Mini-Card is a "subassembly" and cannot be given an FCC rating. However, a PS/2*-25 using a Token-Ring adapter incorporating the Mini-Card successfully passes FCC Class A and German Class B (GOP).	



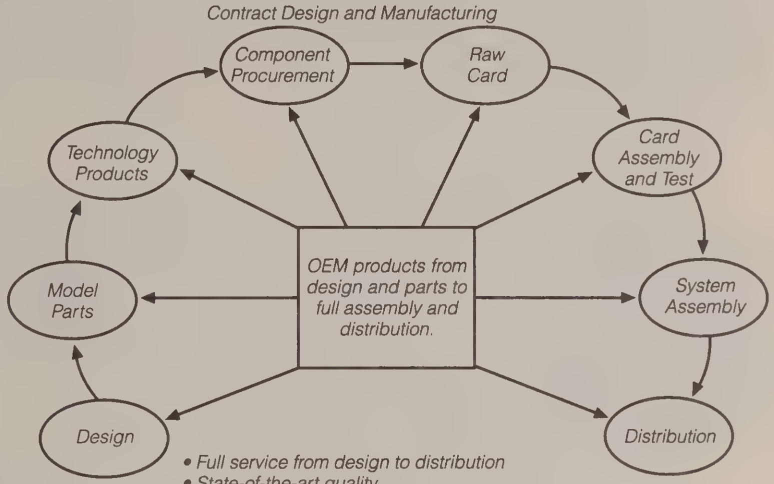
Contract Design and Manufacturing

IBM's world-class manufacturing facilities in Austin, Texas, and Research Triangle Park (RTP), North Carolina, are available to perform contract design and manufacturing for customers with significant volumes.

This allows original equipment manufacturers (OEMs) to take advantage of IBM's state-of-the-art manufacturing and design technologies, as well as leading-edge quality processes. Both Austin and RTP hold ISO certification

The range of services that can be provided are:

- Product design and IBM technology integration
- Fast prototype
- Raw card manufacturing
- Miniaturized SMT assemble and test
- Part procurement and/or assembly
- Built-to-order capabilities
- System assembly and configuration
- Distribution



- *Full service from design to distribution*
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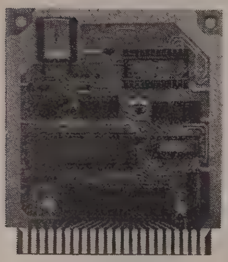
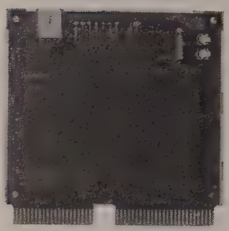


- 6502, 65802 CPU
- Crystal Oscillator
- 1K RAM
- 2K, 4K, 8K ROM, EPROM
- 16 I/O Lines
- Serial Data Port
- Handshake Capability
- Two 16 Bit Timer/Counters
- Size: 4 x 4½ Inches
- Available: NMOS, CMOS; 1 MHz, 2 MHz.

6502LBE MICROCOMPUTER



- 6502, 65802 CPU
- Crystal Oscillator
- 2K, 8K, 16K RAM
- 2K-16K, 64K ROM, EPROM
- 16 I/O Lines
- Serial Data Port
- Handshake Capability
- Two 16 Bit Timer/Counters
- Active Reset Circuit
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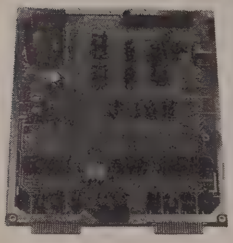

- 6502, 65802 CPU
- Crystal Oscillator
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- 2K-8K ROM, EPROM
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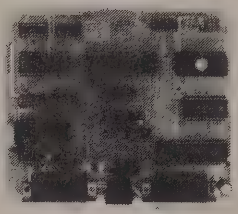
PS-2B	• Power Supply for Basic μC
DRB-1	• MOCOMM BASIC Communications Software
MB-1	• BASIC Users Manual
OPT-X	• HMOS, CMOS; Battery Backed RAM, Clock

6502KD MICROCOMPUTER



- 6502, 65802 CPU
- 2K-8K RAM
- 2K-16K EPROM
- 16 I/O Lines
- Two 16 Bit Timer/Counters
- 20 Key Keyboard Port
- 6 Digit Seven Segment LED Display Port
- Serial Port
- Control Signals
- 15 BAUD Rates
- Battery Backed RAM (optional)
- Clock (optional)
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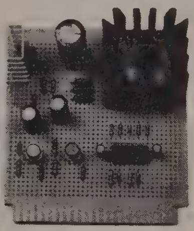

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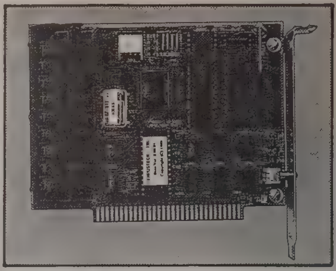

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- Low power usage, CMOS design
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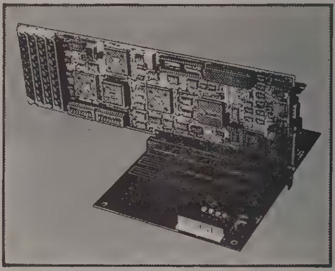

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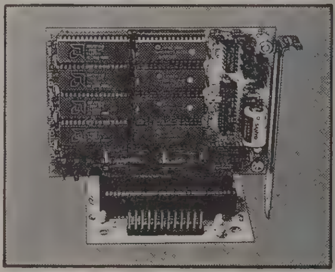

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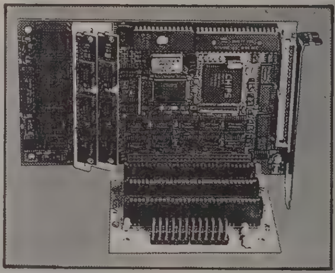

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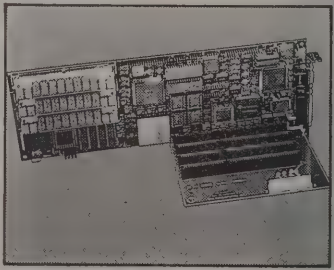

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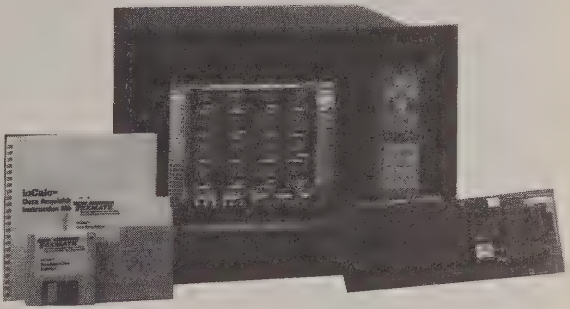

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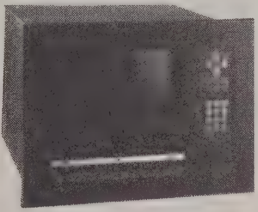
This family of industrial computers can be combined with any of our other data acquistion products. By using some of the powerful data acquisition software and hardware exemplified by the 'Acquisitor' data acquisition system(see Data Acquisition Section of EEM), you can create a total data acquisition workstation complete from Texmate. This is advantageous because you have the benefit of a system with one vendor responsible for total system performance.



IDC-465 14" VGA color screen

IDC-422 10" VGA color screen

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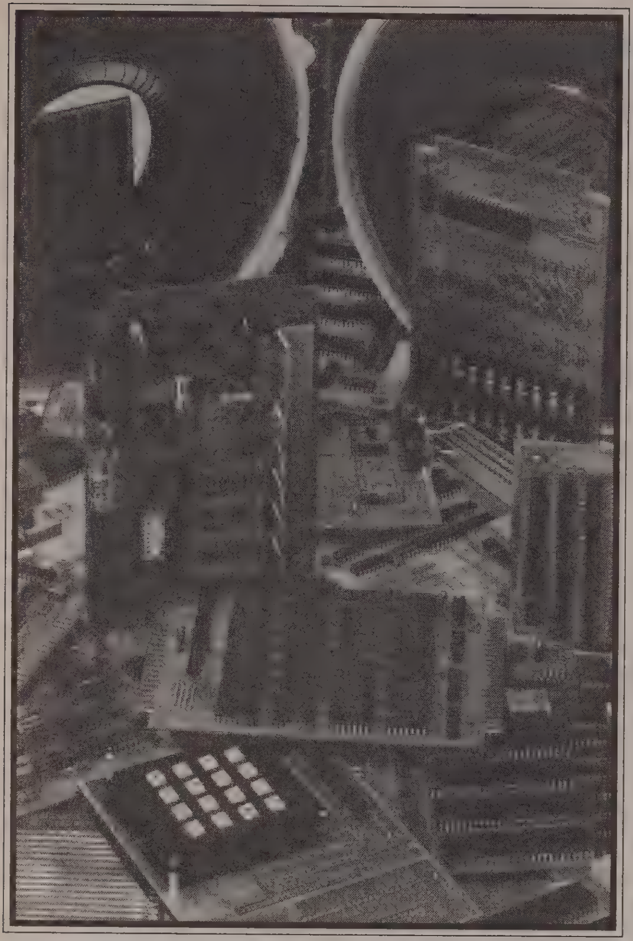

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MCH48	6809 MPU, 8K RAM, 3 ROM sockets, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	$205
MCH78	6809 MPU, 32K RAM, 3 ROM sockets, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	$238
MCH88	6809 MPU, 56K RAM, 2 ROM sockets, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	$283
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MDS44	Driver/sensor module with 4 optically-isolated inputs and 8 open-collector drivers (28 VDC, 250 mA)	$102
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PAS05	6805 Macro Assembler	$495
PAS09	6809 Macro Assembler	$495
PAS11	68HC11 Macro Assembler	$495
PCC00	6800 C Compiler and Macro Assembler	$895
PCC01	6801 C Compiler and Macro Assembler	$895
PCC09	6809 C Compiler and Macro Assembler	$895
PCC11	68HC11 C Compiler and Macro Assembler	$895

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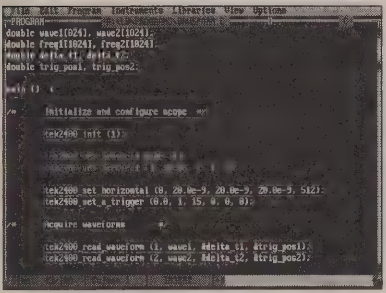
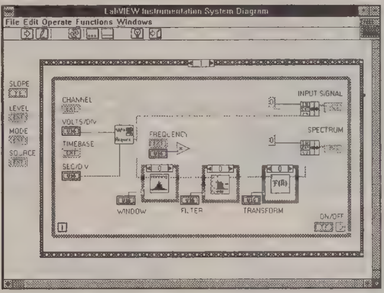
ACQUISITION


File Edit Program Instruments Libraries View Options
PROGRAM

```
double wave1[1024], wave2[1024];
double freq1[1024], freq2[1024];
double delta_t1, delta_t2;
double trig_pos1, trig_pos2;

main () {

/*      Initialize and configure scope  */

        tek2400_init (1);


        tek2400_set_horizontal (0, 20.0e-9, 20.0e-9, 20.0e-9, 512);
        tek2400_set_a_trigger (0.0, 1, 15, 0, 0, 0);

/*      Acquire waveforms        */

        tek2400_read_waveform (1, wave1, &delta_t1, &trig_pos1);
        tek2400_read_waveform (2, wave2, &delta_t2, &trig_pos2);
```


LabVIEW Instrumentation System Diagram
File Edit Operate Functions Windows
SLOPE
LEVEL
MODE
SOURCE
CHANNEL
VOLTS/DIV
TIMEBASE
SEC/DIV
FREQUENCY
INPUT SIGNAL
SPECTRUM
WINDOW
FILTER
TRANSFORM
F(ω)
ON/OFF

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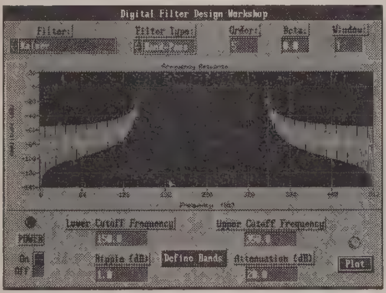
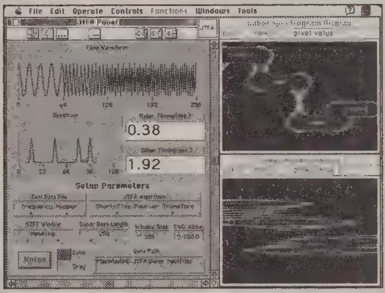
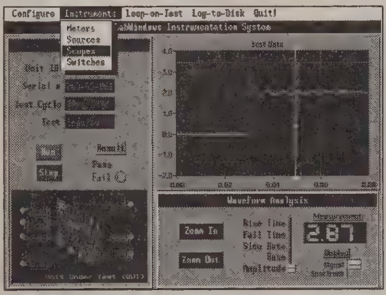
ANALYSIS

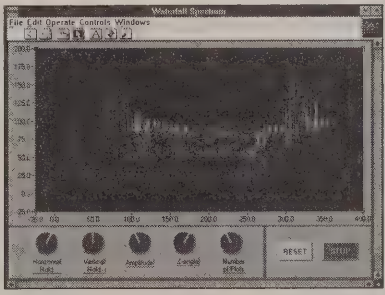

Digital Filter Design Workshop
Filter:
Filter Type:
Order:
Beta:
Window:
Frequency Response
Frequency (Hz)
POWER
On
Off
Lower Cutoff Frequency
Upper Cutoff Frequency
Ripple (dB)
Define Bands
Attenuation (dB)
Plot


File Edit Operate Controls Functions Windows Tools
Time Waveform
Spectrum
0.38
1.92
Setup Parameters
Noise

DSP • Statistics • Linear Algebra • Filters • Windows

PRESENTATION


Configure
Instruments
Loop-on-Test
Log-to-Disk
Quit!
Meters
Sources
Scopes
Switches
LabWindows Instrumentation System
Unit ID
Serial #
Test Cycle
Test
Run
Stop
Result
Pass
Fail
Test Data
Waveform Analysis
Zoom In
Zoom Out
Rise Time
Fall Time
Slew Rate
Base
Amplitude
Measurement
2.87
Signal
Spectrum
Unit Under Test


Waterfall Spectrum
File Edit Operate Controls Windows
RESET
STOP

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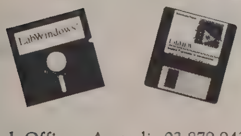
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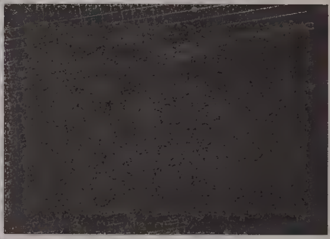

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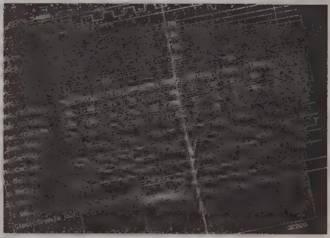
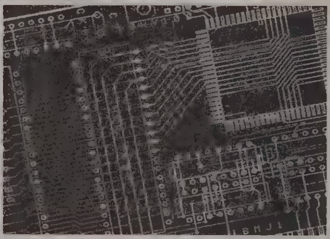


Digital Simulation Tools 386+

This timing based, 12 state, event driven simulator allows simulation of digital designs of up to 200,000 gates. The PLD modeling capability enables simulation of multiple PLDs in a single design. Hundreds of models are included and new models can be created by the user to support new technologies. Thanks to OrCAD's intuitive ESP Framework, Digital Simulation tools 386+ works seamlessly with other OrCAD products.



OrCAD Printed Circuit Board Layout Tools 386+

OrCAD provides a complete layout package with a powerful, high quality autorouter at a very affordable price. PCB 386+ offers all object editing and all the utilities needed to release a board to manufacturing.

Call or write today for a FREE demo disk and other information

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The Better Solution

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A
C
I

ACTIVE CONTROL INSTRUMENTATION

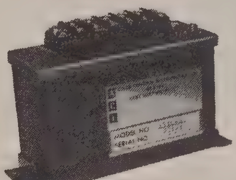
P.O. BOX 243, KEY LARGO, FLORIDA 33037
(305) 451-1000

MEASUREMENT AND CONTROL

NEW!! *ACICOM* — on line data communications use the phone connected to your computer
(305) 451-3232 MODEM or FAX — Fill your own request immediately while 'on-line'—
— *instant* FAX Data retrieval - *or* –ACI Specification Library viewing

PHASE ROTATION/PHASE LOSS MONITOR/CONTROLLER

Model 4331: 3φ Voltage — 50-400 Hz
Temperature: −20°C to +71°C
Size: 7½″ x 1½″ x 3″
Output Relay: DPDT 1 Amp



FREQUENCY TRANSDUCER/CONTROLLER

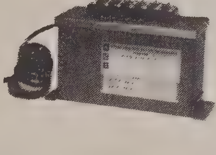
Model 3750: 50 - 60 - 400 Hz
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Time Delay: Adjustable 0 to 2½ SEC.
Accuracy: 1%
Linearity: .05% center frequency
Temperature: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

D.C. CURRENT SENSOR/CONTROLLER

Model 4502

Current Ranges: 0-10 MA Thru 0-100 Amp
Excitation: 28 VDC ±4 VDC
Output 1: 0-5 VDC
Output 2: Solid State or Relay
Accuracy: 0.5%
Size: 4½″ x 1½″ x 3″

Undercurrent
or
Overcurrent



A.C. CURRENT SENSOR/CONTROLLER

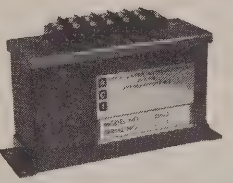
Model 4025: 50-400 Hz
Excitation: 115 or 220 VAC
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Time Delay: Adjustable 0 to 2½ SEC.
Temperature: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

A.C. CURRENT MONITOR—ECONOMY

CURRENT RANGES: 0-1 Amp **THRU** 0-100 Amp
50-400Hz **ADJUSTABLE**

	OUTPUT	SIZE
MODEL 4101	0-5 VDC	4½″ x 1½″ x 3″
MODEL 4210	RELAY SPDT	6½″ x 1½″ x 3″

TEMPERATURE: −20°C to +71°C



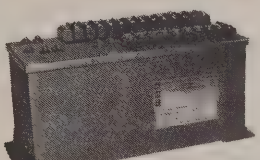
A.C. VOLTAGE TRANSDUCER/CONTROLLER

Model 9601: 50-400 Hz
Input: 90-140 VAC
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Accuracy: 1%
Response: Less than 0.25 Hz
Time Delay: Adjustable 0 to 2½ SEC.
Size: 6½″ x 1½″ x 3″

POWER LINE MONITOR/CONTROLLER

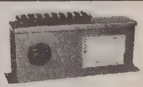
Model 4301: 1φ Voltage and Frequency
Model 4302: 2 or 3φ Voltage and Frequency
Voltage Band: 95 - 135 VAC
Frequency Band: ±10% center frequency
Hi-Lo Limits: Adjustable to any points within Band
Output Relay: SPDT or 3PDT 10 Amp
Time Delay: Adjustable 0 to 2½ SEC.
Temperature: −20°C to +71°C
Size: 7½″ x 3″ x 3½″

50-60-400 Hz



M8 — φ Rotation
MS — mil qual

WATTS/TRUE POWER TRANSDUCER CONTROLLER



Model 9401 **50-60-400 Hz**
Input: 90-150 & 160-250 VAC — 0-500 W to 0-100 kW
Output 1: 0-1, 0-2 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Size: 6½″ x 1½″ x 3″
Watts Ranges: 0-500 W, 0-1 kW, 0-2 kW, 0-5 kW, 0-10 kW, 0-20 kW, 0-50 kW, 0-100 kW

D.C. CURRENT SENSORS

Pass-Thru

Model 6001 — Model 6002 Bi-Directional

Thru-Current Ranges:
0-10 MA
0-20 MA
0-50 MA
0-100 MA
0-200 MA
0-500 MA
0-1 Amp
0-2 Amp
0-5 Amp
0-10 Amp
0-20 Amp
0-50 Amp
0-100 Amp

Excitation: 28 VDC ±4 VDC
Output: 0-5 VDC
Accuracy: 0.5%
Response: 1 MSEC
Temp.: −20°C to +71°C
Size: 4½″ x 1½″ x 3″

CURRENT SENSOR

MODEL 7101	Bi-Directional MODEL 7201
GENERAL PURPOSE	**HIGH PERFORMANCE**
±5% D.C. TO 1 KHz	**±1% D.C. TO 10KHz**

EXCITATION: ±15VDC
OUTPUT: 0 to ±5VDC
TEMP: −20°C to +71°C
SIZE: 4½″ x 1½″ x 3″

THRU-CURRENT RANGES
0-10 Amp
0-20 Amp
0-50 Amp
0-100 Amp
0-200 Amp
0-500 Amp

D.C. CURRENT SENSOR

Pass-Thru
50 KV Isolation

Model 6011

Thru-Current Ranges:
0-10 MA
0-20 MA
0-50 MA
0-100 MA
0-200 MA
0-500 MA
0-1 Amp
0-2 Amp
0-5 Amp
0-10 Amp
0-20 Amp
0-50 Amp
0-100 Amp

Excitation: 115 VAC ±10% 50 - 400 Hz
Output: 0-5 VDC
Accuracy: 1%
Response: 0.5 Sec.
Temp.: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

D.C. CURRENT SENSOR/CONTROLLER

Model 4560

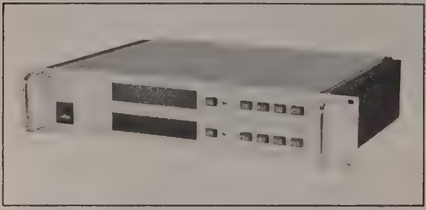
Thru-Current Ranges:
0-10 MA
0-20 MA
0-50 MA
0-100 MA
0-200 MA
0-500 MA
0-1 Amp
0-2 Amp
0-5 Amp
0-10 Amp
0-20 Amp
0-50 Amp
0-100 Amp

Excitation: 115 VAC ± 10% 50-400 Hz
Output 1: 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Accuracy: 1%
Temp.: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

ACS

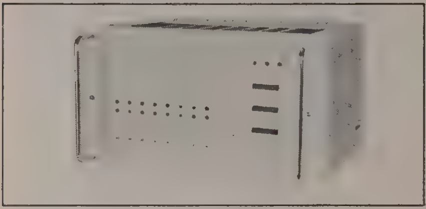
ADVANCED CONTROL SYSTEMS CORPORATION

OLD MINE ROCK WAY, HINGHAM, MA 02043, USA TEL: (617) 740-0223 FAX: (617) 740-4227



MCU-2 DRIVES TWO STEPPING MOTORS

- High speed, high precision indexing and speed control
- High power drivers, up to 6 Amp per motor phase
- Front panel manual controls and position display
- Host computer control of several units via RS232C port
- 19" rack mountable, 3.5" high front panel

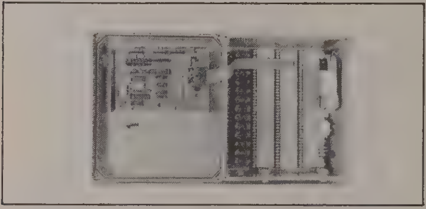


MDU- 8 POWER DRIVERS FOR EIGHT STEPPING MOTORS

- Efficient bi-level drivers; up to 6 Amp per motor phase
- Each channel accepts TTL step pulse and direction level
- Adjustable current limiting resistors and fusing
- Forced air cooling for high power operation
- 19" rack mountable; 10.5" high front panel

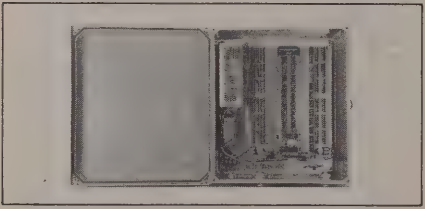
RCU-4 INDUSTRIAL ENVIRONMENT REMOTE CONTROL UNIT

- Four control relay outputs; 250 VAC/30 VDC, 10 Amp
- Four On/Off type inputs; optoisolated
- Four analog inputs; 0-1 mA or 0-5 VDC
- NEMA- 4 enclosure; dimensions, 13.5" x 10.0 " x 7.0" (H x W x D)
- Battery backed-up for uninterrupted operation
- RS232 / RS485 communication-control port



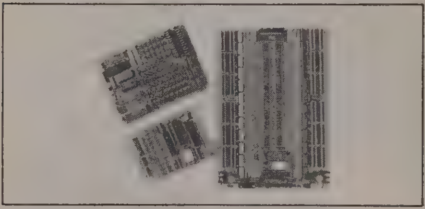
RCU-16 INDUSTRIAL ENVIRONMENT REMOTE CONTROL UNIT

- Thirteen control relay outputs; 250 VAC / 30 VDC. 10 Amp
- Sixteen On / Off type inputs; optocoupled
- Sixteen analog inputs; 0-1 mA or 0-5 VDC
- NEMA-4 enclosure; dimensions, 17.5" x 14.0" x 8.0" (H x W x D)
- Battery backed- up for uninterrupted operation
- RS232 / RS485 communication-control port



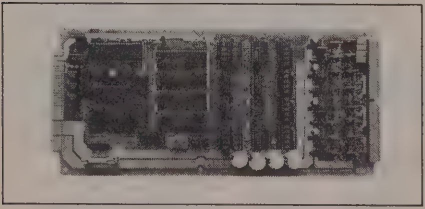
RCU-200 INDUSTRIAL I/O CONTROLLER

- Twenty-four input/output control ports (8 lines each)
- Inputs are filtered and diode protected
- Outputs have 50 V / .6 Amp driver; inductive load protected
- Logic and I / O power supply included
- NEMA enclosure; dimensions 13.5" x 10.0" x 7.0" (H x W x D)
- RS 232 / RS485 communication-control port



BOARD LEVEL MACHINE CONTROLLERS

- CCB-3; Serial port, 24 TTL I / O lines, 8 opto inputs, 10 opto outputs, firmware.
- CCB-6; Board level of RCU-200 firmware
- CCB-9; Serial port, 48 opto inputs, 24 opto outputs, firmware



For further information on these or other products, please call our Sales Department

MCB-4 COMPLETE 4 AXIS STEPPING MOTOR CONTROLLER/ DRIVER

- Drives four four-phase stepping motors; 2 Amp per phase
- High efficiency, low noise bi-level motor drivers
- Stepping rates up to 10,000 steps/sec.
- Up to 16.7 million steps per move
- Programmable acceleration/ deceleration
- Optoisolated home and four limit inputs for each motor
- Power section is optoisolated from control section for noise reduction
- Nonvolatile memory for motion control variables and programs
- Comprehensive instruction set
- Resident BASIC interpreter
- RS-232 and RS-485 communication ports
- 19 " rack enclosure for multiple boards available
- Single board enclosure also available

MASTER CLOCKS...REMOTE DISPLAYS SYNC'D TO COORDINATED UNIVERSAL TIME

MULTI-SYSTEM CLOCK/CALENDAR

Provides time to five or more independent computer systems

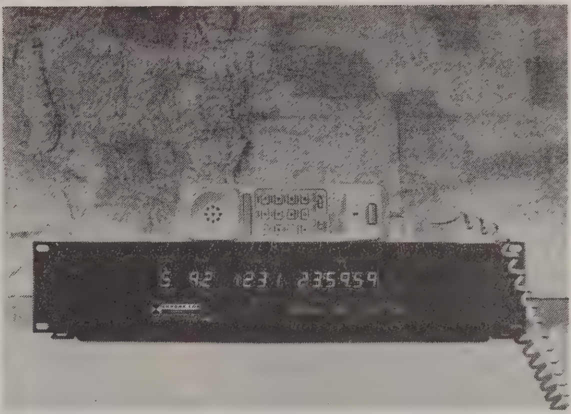
Bi-Directional I/O Options
- RS232C or 20ma Current Loop
- RS422, RS423, RS485

Output Options
- IRIG B Time Code
- Parallel BCD (TTL or Tristate)
- Byte Serial 4, 8 or 16 Bit
- Remote Display Driver (RS422 signal to Chrono-log Remote Time Displays described below)

Synchronization Options
- ACTS/NIST UTC Phone Synchronizer
- WWV/WWVH Synchronizer
- SUB-MASTER Clocks at remote locations sync to MASTER Clock via 2-wire cable or phone line

Time Base Options
- Line frequency - 50 or 60 Hz
- Internal crystal oscillators
- External frequencies

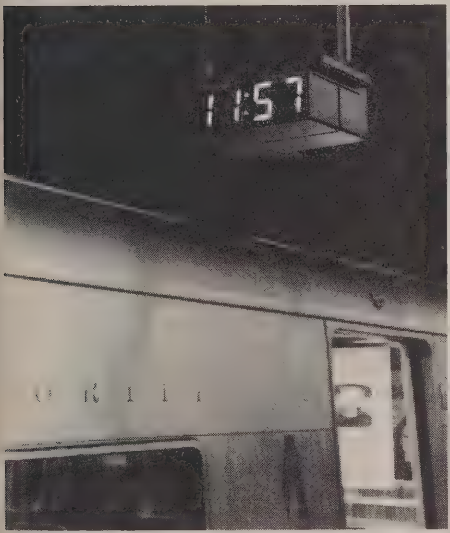
Battery Backup - 4 or 30 Days



LOW COST ACTS/NIST UTC PHONE SYNCHRONIZER

Sets Multi-System Clock/Calendar to within 10 ms. of Coordinated Universal Time (UTC) by...

Automatic Phone Calls to NIST (formerly NBS)
- at power-up and after power failure
- at preselected intervals from once-per-hour to once-per-week
- Automatic Daylight Saving/Standard Time change
- Time Zone Offset
- Automatic re-dial if call is not completed



TIME DISPLAY SYSTEMS

Synchronized...Modular Components...Indoor/Outdoor...Fail-Safe

A unique Time Display System, synchronized by receiving and retransmitting an RS422/485 time-of-day data stream five times per second over **low-voltage, 2 or 3-wire cabling**...continuously checking for errors and keeping time independently upon detection of error or loss of signal.

Specifications
- 4" high hyper-bright red LED (75 mcds)
- 4" high standard green LED
- 4" high yellow or white Electromagnetic
- 0.6" high red LED with dimming control
- Sophisticated error checking
- Internal power failure relay bypasses Display so time signal continues to remaining Displays
- Modular design reduces repair time
- Weather, dust and vandal resistant option
- Temperature ranges from –25° to 80°C

OTHER CHRONO-LOG TIMING PRODUCTS - Master Clocks...Programmable Master Clocks and Displays to control ON/OFF times of external equipment...IRIG A, B and E Time Code Reader/Generators...Video Character Generators to insert date and time onto video tapes or monitors.

Call 1-800-247-6665 for assistance with your digital timing needs.

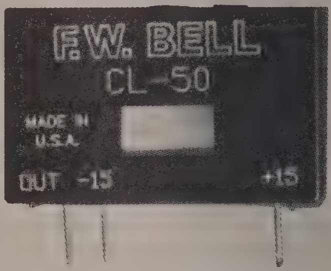
CHRONO-LOG CORPORATION

1-800-CHRONOLOG
TELEX 831579
FAX 215-853-3972
2 WEST PARK ROAD
HAVERTOWN, PA 19083-4691

CLOSED LOOP CURRENT SENSORS

NEW!
F.W. BELL
CL-50
MADE IN U.S.A.
+15
OUT -15

- ***Low cost replacement for shunts***
- ***Measures dc and high frequency ac current***
- ***Provides electrical isolation***
- ***Fast response***



CL-50 (actual size)

CLOSED LOOP CURRENT SENSORS

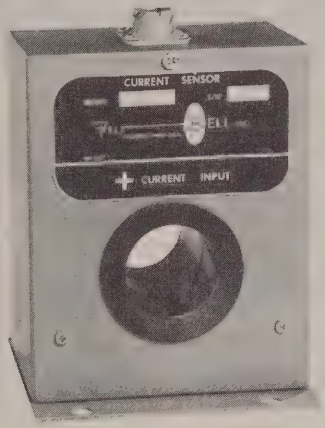
The closed loop current sensor consists of a coil wound around a magnetic core, a Hall generator placed in an air gap of the core, and an amplifier which drives the coil. The current in the coil sets up a magnetic field which opposes the field produced by the current carrying conductor placed through the aperture of the sensor. The Hall generator provides the feedback needed to keep the flux in the core at zero. The output is current proportionate to the current through the aperture.

Model	Rated rms (A)	Linearity (%)	Output (+/-mA/A)	Frequency Range	Aperture (inches)
CL-25	25	0.2	1	dc to 150 kHz	—
CL-50	50	0.15	1	dc to 200 kHz	0.28 x 0.5
CL-100	100	0.1	1	dc to 150 kHz	0.394
CL-200	200	0.1	0.5	dc to 150 kHz	0.788
CL-300	300	0.1	0.5	dc to 150 kHz	0.788
CL-500	500	0.1	0.2	dc to 150 kHz	0.985
CL-1000	1000	0.1	0.2	dc to 100 kHz	1.576

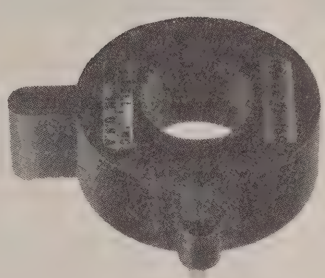
F.W. Bell, Inc. • 6120 Hanging Moss Road, Orlando, FL 32807 • Phone: 407-678-6900 • 800-775-2550 • Fax: 407-677-5765

ac & dc HALL-EFFECT CURRENT SENSORS

IF



IA



PI (PC board mountable)

DESCRIPTION

F.W. Bell current sensors measure ac and dc currents with the advantage of electrical isolation between the output of the sensor and the current carrying conductor.

FEATURES

- Electrical isolation
- Zero dc insertion loss
- Ability to measure complex waveforms
- Special models available

TYPICAL APPLICATIONS

- Motor Drives
- UPS Systems
- Power Supplies
- Battery Chargers
- Replacement for Shunts

OPEN LOOP CURRENT SENSORS

The open loop current sensor consists of a Hall generator inserted in an air gap of a magnetic core with associated circuitry used to amplifier and temperature compensate the output of the Hall generator. The current sensor's output is a voltage proportionate to the magnetic field produced by the current carrying conductor placed through the aperture of the sensor.

Model	Rated Current (+/-A)	Full Scale Linearity (+/-%F.S.)	Full Scale Output (+/-V)	Frequency Range	Aperture (inches)
IHA-25	25	1	1	dc to 50 kHz	0.38
IHA-100	100	1	5	dc to 50 kHz	0.38
IHA-150	150	1	5	dc to 50 kHz	0.84
PI	350	1.5	0.175-0.385	dc to 1 kHz	0.8
PI-600	600	2	0.150-0.330	dc to 1 kHz	0.8
IA-5025P	100	0.5	10	dc only	1.5
IA-5023P	250	0.5	10	dc only	1.5
IA-5022P	500	0.5	10	dc only	1.5
IA-5021P	1000	0.5	10	dc only	1.5
IA-5020P	2000	0.5	10	dc only	1.5
IA-2024P	3000	0.6	10	dc only	1.5
IF-5025P	100	0.5	10	dc to 1 kHz	1.67
IF-5023P	250	0.5	10	dc to 1 kHz	1.67
IF-5022P	500	0.5	10	dc to 1 kHz	1.67
IF-5021P	1000	0.5	10	dc to 1 kHz	1.67
IF-5020P	2000	0.5	10	dc to 1 kHz	1.67
IF-5024P	3000	0.6	10	dc to 1 kHz	1.67

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MINIGLOSSARY
BASIC
ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null	DLE	Data Link Escape (CC)
SOH	Start of Heading (CC)	DC1	Device Control 1
STX	Start of Text (CC)	DC2	Device Control 2
ETX	End of Text (CC)	DC3	Device Control 3
EOT	End of Transmission (CC)	DC4	Device Control 4
ENQ	Enquiry (CC)	NAK	Negative Acknowledge (CC)
ACK	Acknowledge (CC)	SYN	Synchronous Idle (CC)
BEL	Bell	ETB	End of Transmission Block (CC)
BS	Backspace (FE)	CAN	Cancel
HT	Horizontal Tabulation (FE)	EM	End of Medium
LF	Line Feed (FE)	SUB	Substitute
VT	Vertical Tabulation (FE)	ESC	Escape
FF	Form Feed (FE)	FS	File Separator (IS)
CR	Carriage Return (FE)	GS	Group Separator (IS)
SO	Shift Out	RS	Record Separator (IS)
SI	Shift In	US	Unit Separator (IS)
		DEL	Delete

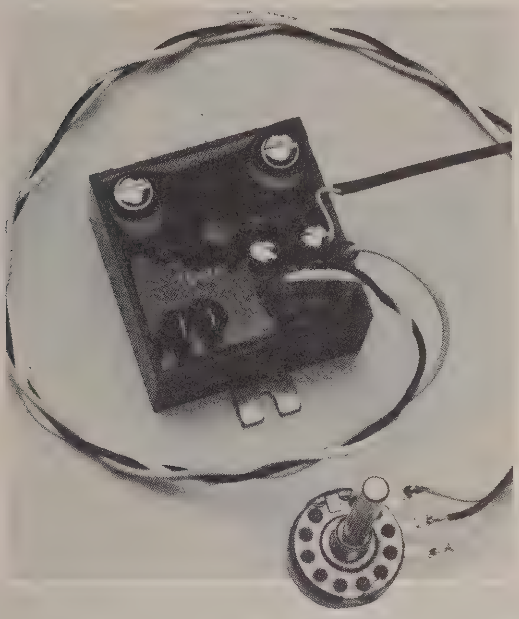
(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

Special Graphic Characters

SP	Space	<	Less Than
!	Exclamation Point	=	Equals
|	Logical OR	>	Greater Than
"	Quotation Marks	?	Question Mark
#	Number Sign	@	Commercial At
$	Dollar Sign	[	Opening Bracket
%	Percent	\	Reverse Slant
&	Ampersand	]	Closing Bracket
'	Apostrophe	^	Circumflex
(	Opening Parenthesis	¬	Logical NOT
)	Closing Parenthesis	—	Underline
*	Asterisk	`	Grave Accent
+	Plus	{	Opening Brace
,	Comma	¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
-	Hyphen (Minus)	}	Closing Brace
.	Period (Decimal Point)	~	Tilde
/	Slant		
:	Colon		
;	Semicolon		

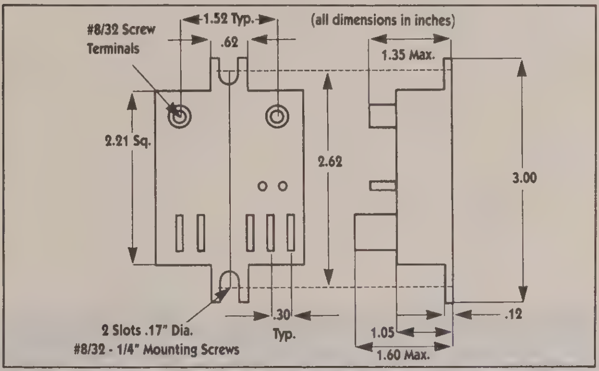
DOUGLAS RANDALL, INC

Solid State Temperature Controllers



Features & General Specifications

- SCR output for high power applications
- Temperature Sensor, standard type "K" thermocouple.
- Compatible with process control equipment and manual operation.
- Opto-isolation between input control circuits and load.
- Arc-free switching for long life.
- Fail Safe Feature. Safety circuits shuts the systems down if thermocouple not properly connected or open.
- Accessory Driver. DC voltage available to drive a remote light emmiting diode (LED) cycling indicator.
- Epoxy molded case with aluminium base plate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.



		TC 40B
Input Data	Temperature Range	+10 to +1000
	Temperature Sensor	Type "K" Thermocouple
	Control Voltage Range	0 to 10 VDC
	Control Voltage Calibration.	10mV/Deg. C
	Supply Voltage Range	20 to 24 VDC
	Supply Current	Less than 100 mAmps
	Isolation:	
	Input - Output	2500V RMS
	Input - Base	2500V RMS
Output Data	Load Current	40 Arms Max.
	Load Voltage	20 to 300 VRMS
	Type of Switching	Zero Crossing
	Maximum Single Cycle Surge	400 Amps
	Off State Leakage Current	20 mA
	Isolation: Output to Base	2000 VRMS

100 Mechanics Street, P.O. Box 506, Pawcatuck, CT 06379 • **(800) 447-6799** • in Connecticut 599-2075 • Fax (203) 599-1754

See our additional data pages in sections 4500 B•1473 and 4800 A•2144

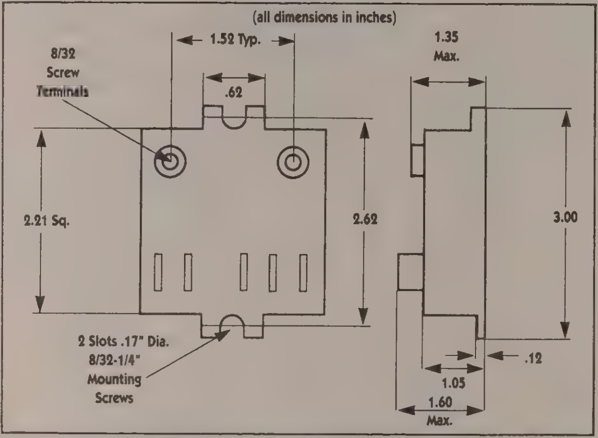
DOUGLAS RANDALL, INC

Linear Proportional Controller - AC Output

(to 100 Amps)

LC SERIES

25 AMP
240 VAC
DOUGLAS RANDALL



Features & General Specifications

- Output configuration,
  Triac or Back-Back SCR.
- Precision proportional load control.
- 50 Hz output models available.
- Industry standard snubber network.
- Opto-isolated Input circuits.
- DC input, 0-5V, 0-10V, and 4-20mA.
  Reverse polarity protected.
- High input impedance on 0-5 and 0-10V input devices.
- Control circuit requires no adjustment or calibration.
- Manually controllable via user supplied potentiometer.
- Compact epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Input terminals, 1/4" quick connect.
- Output terminals, 8-32 screws

NOTES:

(1) Substitute 15, 25, 40, 70 or 100 for (xx) to designate the desired device current rating.

(2) Substitute 5, 10, or MA for (x) to designate applicable input.

Input Data

	LC(xx)B-5	LC(xx)B-10	LC(xx)B-MA
Range	0-5VDC	0-10VDC	4-20VDC
Impedance	12.7K Ohms	25K Ohms	460 Ohms
Turn On Threshold	.25 V	.5 V	4.5 mA
Isolation-Signal to Load	4000 V peak	4000 V peak	4000 V peak
Isolation-Signal to Base	4000 V peak	4000 V peak	4000 V peak
Temperature Range (Deg. C)			
Operating	-20 to +65	-20 to +65	-20 to +65
Storage	-30 to +80	-30 to +80	-30 to +80

Output Data

	LC15B-(x)	LC25B-(x)	LC40B-(x)	LC70B-(x)	LC100B-(x)
Maximum Current (Amps)	15	25	40	70	100
Voltage Range (RMS)	20-300	20-300	20-300	20-300	20-300
Voltage Drop at 100% ON (V Max)	1.6	1.6	1.6	1.6	1.6
Minimum Holding Current (Amps)	.05	.10	.10	.15	.20
Off State DV/DT (V/uSec.)	150	200	200	500	500
On State DI/DT (A/uSec.)	150	150	150	150	150
Off State Leakage Current (ma)	10	15	20	30	50
Maximum Non-Repetitive Single Cycle Surge Current(Amps.)	150	300	400	1000	1500
I^2T for Fusing (T=8.3mS) (A^2/Sec.)	90	800	1000	7000	12000
Isolation, Out to Gnd (Vrms)	4000	4000	4000	4000	4000
Power Factor (minimum)	.5	.5	.5	.5	.5

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See our additional data pages in sections 4500 B•1473 and 4800 A•2144

DOUGLAS RANDALL, INC

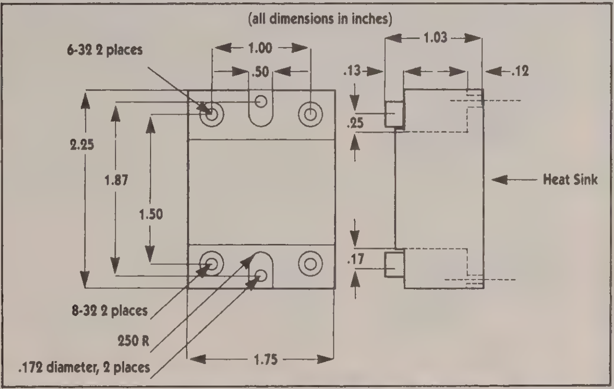
Solid State Proportional Controllers - RES Input/AC Output

R SERIES

1
OUTPUT
2
DOUGLAS RANDALL
SOLID STATE CONTROL
3
INPUT
4

Features & General Specifications

- Output configuration:
  Triac or Back-to-Back SCR.
  Full wave phase angle control.
- Precision proportional load control, 0 to 100%.
- Industry standard internal snubber network on most models.
- Input control, variable resistance or Input control module.
- Control circuit requires no adjustment or calibration.
- Compact epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Input terminals, 6-32 screws.
- Output terminals, 8-32 screws.



		R15A	R25A	R40A	R15B	R25B	R40B	R15D	R25D	R40D
Input Data	Resistor, Varible (Ohms)	150K, 1 W.	150K 1 W.	150K 1 W.	1M 1/2 W.	1M 1/2 W.	1M 1/2 W.	1M 1/2 W.	1M 1/2 W.	1M 1/2 W.
	Input Control Module (Optional)	RDA	RDA	RDA	RDB	RDB	RDB	RDD	RDD	RDD
Output Data	Voltage Range @260 Hz	90--130 VAC	90--130 VAC	90--130 VAC	200-240 VAC	200-240 VAC	200-240 VAC	400-480 VAC	400-480 VAC	400-480 VAC
	Off State Leakage Current	10Ma (typ.)	10Ma (typ.)	10Ma (typ.)	7Ma (typ.)	7Ma (typ.)	7Ma (typ.)	3Ma (typ.)	3Ma (typ.)	3Ma (typ.)
	Snubber	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Maximum Current	15 A	25 A	40A	15 A	25A	40A	15 A	25A	40A
	Minimum Holding Currentt	.07 A	.08 A	.09 A	.07 A	.08 A	.09 A	.07 A	.08 A	.09 A
	Single Cycle Surge Current	150 A (max.)	225 A (max.)	400 A (max.)	150 A (max.)	225 A (max.)	400 A (max.)	150 A (max.)	225 A (max.)	400 A (max.)
	One Second Overload Current	50 A	70 A	150 A	50 A	70 A	150 A	50 A	70 A	150 A
	Output configuration	Triac	SCR	SCR	Triac	SCR	SCR	Triac	SCR	SCR

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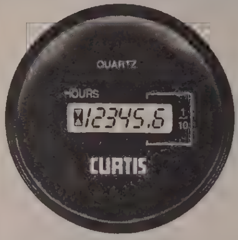
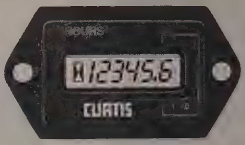
See our additional data pages in sections 4500 B•1473 and 4800 A•2144

CURTIS

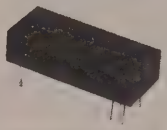
CURTIS 700 SERIES SOLID-STATE HOUR METERS



Designed to outlast the equipment they monitor, 700 Series hour meters cost less than units they replace. Built with customized, dedicated microchip technolgy, they are crystal quartz-driven with totally solid-state circuitry. Housed in a sealed module with LCD readout, they have *no moving parts*. Available for DC or AC, their non-volatile memory holds data *without battery or power* for as long as required. CURTIS 700 Series tolerate extremes of shock, dust, vibration, moisture and temperature (-40°C to 85°C). Shallow-depth housing permits easier installation. Voltages from 6VDC to 220VAC (50, 60Hz).



DIGITAL SOLID-STATE ELAPSED TIME INDICATORS



PC BOARD-MOUNT UNIT

PANEL-MOUNT UNIT

CURTIS SSETIs—the elapsed time indicator that has pioneered *the solid-state* ETI—feature:

- RELIABILITY—outlasts the equipment they monitor
- Impervious to shock
- Highest accuracy
- Non-volatile memory
- Built-in RFI/EMI protection
- Low power use; as low as 2mW
- Records up to 99,999.99 hrs.
- Military: panel-mount unit with handheld reader—form, fit and function interchangeable with electromechanical MIL spec devices
- Commercial (and military): PC board-mount unit for remote readout via data bus, panel test connector, or handheld reader interface
- Priced lower than the unit they replace.

HANDHELD READER

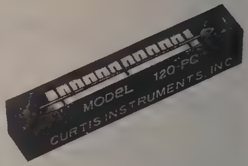
ANALOG ELAPSED TIME INDICATORS

Smallest-size, Lightest-weight, Lowest-cost, AC or DC at any Voltage

CURTIS
520-LNA
CURTIS INDACHRON

LNA & LC (non-resettable) Series: Easily-readable, very low-cost units used by OEM for warranty-by-use and P/M scheduling in office equipment, test instruments, etc. AC and DC with various time scales and electrical ratings. LNAs are adhesive-mounted, LCs via circuit board pins.

120PC (non-resettable) Series: Specially designed with circuit board pins for PC cards, components, and subassemblies, 120PCs are totally encapsulated in epoxy for optimum reliability. Run from DC current with customer-supplied series resistor to achieve desired time scale.



TYPICAL APPLICATIONS FOR CURTIS ETIs

ETI innovation since 1960

Warranty and P/M Scheduling: Provides a low-cost means of monitoring actual use time of equipment.

Reliability Engineering: Provides MTBF data or subsystem replacement-time data without costly, unreliable logging.

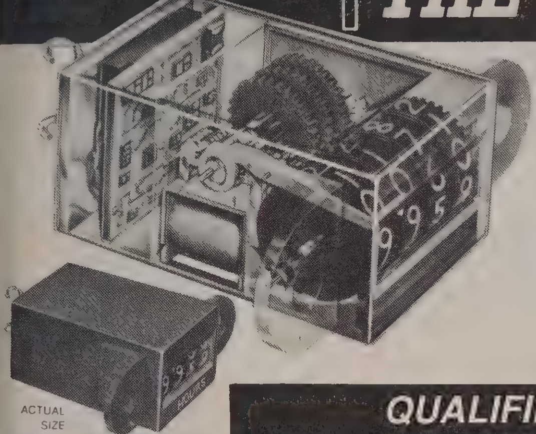
Test Equipment Utilization/Calibration: Provides utilization data for savings in capital investment for test instruments, tools, etc., as well as a means for calibration scheduling.

The ETIs that've been to the moon and back

CURTIS

CURTIS INSTRUMENTS, INC.
200 Kisco Avenue · Mount Kisco, NY 10549
(914) 666-2971 · FAX (914) 666-2188

THE DYNATIME Series


ACTUAL SIZE

SUBMINIATURE ELAPSED TIME INDICATORS

The NEW INDUSTRY STANDARD in ETI technology . . . with CMOS microelectronics that delivers precisely controlled power to the patented stepper drive module. Summarily, a remarkably efficient system that has proven its versatility. For example, Models D76 and TTL-compatible D46 are proven performers from logic buss or low-voltage DC power. Or take advantage of Model D16's stability between 10 and 34 VDC. It is now qualified to new MIL-M-7793E, as is the down-sized 60 Hz Model D92. All are POWER MISERS, with expanded voltages to match today's tougher equipment specs. And the SHORT CASES will SAVE SPACE, too. That's DYNATIME versatility . . . you can rely on it.

QUALIFIED TO MIL-M-7793

MODEL D16 (12 & 28 VDC)
New M7793/1 & /2, Short
New MS21341A (Short) & B (Long)
New M7793/5, Long (was MS17321)

MODEL D92 (115V/60 Hz)
New M7793/3 & /4, Short

MODEL D95 & D25 (400 Hz)
New M7793/6 (was MS17322)
D95 to MS27651 (115V)
D25 to MS27650 (26V)

BASIC MODEL	DYNATIME FEATURES	INPUT VOLTAGE RANGE	INPUT VOLTAGE NOMINAL	NOMINAL POWER, MW	MAX. CASE LENGTH, IN.	TYPICAL MODEL NO.'S	FIG. NO.	TYPICAL MILITARY NO.'S
D16	The SHORT CASE, EXPANDED VOLTAGE RANGE, VERY LOW POWER, QUARTZ ACCURACY . . . All these proven features are now requirements for the new MS21341A, M7793/1 and /2 meters. And Model D16 is fully qualified!	10/34 VDC	12VDC & 28 VDC	13 (AVG) & 85 (AVG)	1.094 SHORT	D16C8C2 D16C8C*-136 D16C8C*-16 D16D8A	1 2 2 3	M7793/1-001 M7793/1-** MS21341A-** NONE
16	Delivers Model D16 performance, but is qualified in the traditional long case per MS21341B and M7793/5 specs.				2.062	16C8C2 16C8C*-16	1 2	M7793/5-002 (was MS17321-10) MS21341B-**
D46	Proven performance from your TTL buss or other regulated low-voltage DC power, and needs only 3 MW (Avg)!	4.5/6.5 VDC	5 VDC	3 (AVG)	1.094 SHORT	D46C8C2 D46C8C* D46D8A	1 2 3	NONE
D76	Another POWER MISER, keeps accurate time from 12 VDC or other logic buss power down to 6.5 VDC.	6.5/13 VDC	9VDC	8 (AVG)		D76C8C2 D76C8C* D76D8A	1 2 3	NONE
D92	MICROELECTRONICS ACCURACY, EXPANDED VOLTAGE RANGE, VERY LOW POWER—All packed into a SUBMINIATURE CASE, and now qualified to new M7793/3 and /4 specs.	75/150 60 Hz	115 60 Hz	300		D92C8C2 D92C8C*-136 D92D8A	1 2 3	M7793/3-001 M7793/3-** NONE
		NOTE: FOR 50 Hz METER, REPLACE D92 ABOVE WITH D91.						
D95	A new choice, with improved MICROELECTRONICS ACCURACY, EXPANDED VOLTAGE RANGES, and VERY LOW POWER compared to our motor-driven meters—D95 saves 50 percent, while D25 saves 90 percent! Both meters are now qualified to existing MS27650, 27651 and M7793/6 specs, but you can reply on the DYNATIME performance ratings you see here.	75/150 400 Hz	115 400 Hz	300	1.094 SHORT	D95C8C2 D95C8C*-16	1 2	M7793/6-002 (was MS17322-10) MS27651-**
D25		15/40	26	40		D25C8C*-16	2	MS27650-**

NOTES: 1. Also available—Other 4 & 5 DIGIT READOUTS, MOUNTS, ROUND CASE per M7793/2, /4, /5, /6.
2. *Denotes "X" Dim.; A = Flush, B thru T in .031" steps, then U thru Z in .062" steps.
3. **Denotes Mount setback & type. See applicable Military Drawings.
4. Code "-136" in Model No. defines tin-plate mount face; "-16" is same plus added testing.

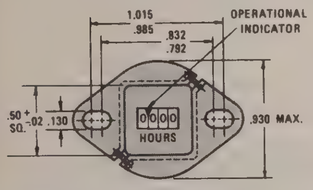


FIG. 1 ADJUSTABLE "C2"

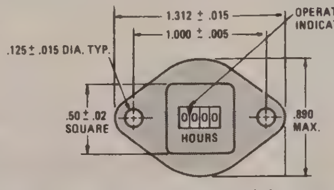


FIG. 2 "C" MOUNT

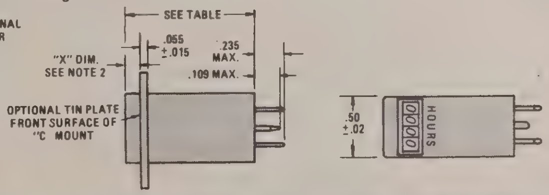


FIG. 3 SIDE-READING

ELECTRODYNAMICS, INC.

28 VDC EVENTS COUNTERS

REPLACES MS21228 M8974/2-		M8974/1A-	
CASE LENGTH 1.094" MAX.		CASE LENGTH 1.333" MAX.	
CATALOG NO.	DASH NO.	CATALOG NO.	DASH NO.
B16C8A-245	-001	B16C8A-312	-001
B16C8CE-245	-002	B16C8CE-312	-002
B16C8A-232	-003	B16C8A-313	-003
B16C8CE-232	-004	B16C8CE-313	-004

a TALLEY INDUSTRIES Company
1200 T Hicks Road
Rolling Meadows, Illinois 60008
Telephone (708) 259-0740
Fax (708) 255-3827

FOX

FC 400 and FC 600 SERIES CONTROLLERS

☐ CONTROL FROM SERIAL ASCII AND PARALLEL DATA
☐ CONTROL FROM AC AND DC, VOLTAGES AND CURRENTS
☐ CONTROL FROM PROCESS AND TEMPERATURE SIGNALS
☐ CONTROL FROM RATE, TACH AND FREQUENCY INPUTS
☐ CONTROL FROM UP / DOWN AND QUADRATURE INPUTS

☐ FOX CONTROLLERS PROVIDE :

1. PID CONTROL FUNCTIONS
2. ISOLATED 4 to 20 mA OUTPUTS
3. ON / OFF RELAY CONTROL
4. EXCLUSIVE REPETITIVE PROCESS CYCLE CONTROL INPUT

To build a model number, make selections from tables A, B and C and combine as shown in the box at right. Total prices.

A B - C

TABLE "A" - BASE CONTROLLER SELECTION

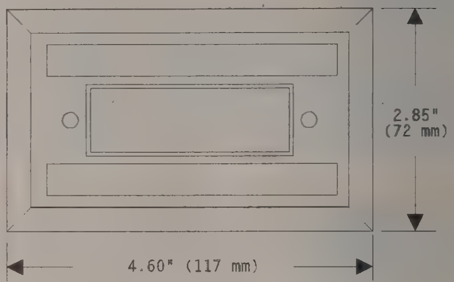
CODE	DESCRIPTION / SPECIFICATION	PRICE
FC41	6 DIGIT LED REMOTE DATA DISPLAY	$ 565
FC44	6 DIGIT LED UP / DOWN COUNTER / QUADRATURE	$ 595
FC45	6 DIGIT LED RATE / FREQ / TACH / PERIOD METER	$ 600
FC47	6 DIGIT LED HOUR, MIN OR SEC TIMER / CONTROLLER	$ 600
FC61	6 DIGIT LED UNIVERSAL DC SPECIFY VOLTS OR CURRENT	$ 698
FC62	6 DIGIT LED UNIVERSAL DC WITH CURRENT EXCITATION	$ 723
FC63	6 DIGIT LED UNIVERSAL DC WITH VOLTAGE EXCITATION	$ 723
FC64	6 DIGIT LED UNIVERSAL AC SPECIFY VOLTS	$ 713
FC66	6 DIGIT LED UNIVERSAL DC NON-LINEAR	$ 713
FC67	6 DIGIT LED UNIVERSAL THERMOCOUPLE SPECIFY J, K OR T	$ 723
FC68	6 DIGIT LED UNIVERSAL RTD THERMOMETER 100 OHM PT	$ 713

TABLE "B" - CONTROLLER POWER SELECTIONS

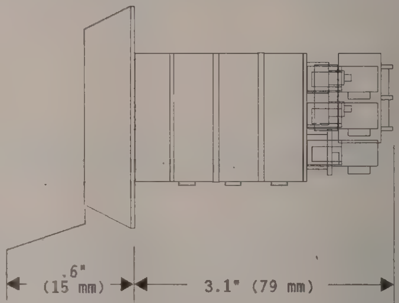
CODE	DESCRIPTION / SPECIFICATION	PRICE
1	120 VAC, 50/60 Hz	$ 20
3	240 VAC, 50/60 Hz	$ 20
5	4.8 TO 12 VDC	$ 0
7	10 TO 30 VDC	$ 25
8	120 VAC WITH BATTERY BACKED DATA	$ 37
9	10 TO 30 VDC WITH BATTERY BACKED DATA	$ 42

TABLE "C" - INPUT AND OUTPUT SELECTIONS

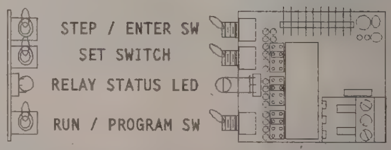
CODE	DESCRIPTION / SPECIFICATION	PRICE
651	RS232C SERIAL DATA I/O	$ 29
652	RS422 / RS485 SERIAL DATA I/O	$ 20
655	CURRENT LOOP SERIAL DATA I/O	$ 60
657	RS232C PRIMARY PORT / RS232C AUXILLARY PORT	$ 149
658	RS232C PRIMARY PORT / RS422 AUXILLARY PORT	$ 140
659	NO DATA	$ 0
671	RS232C AND PARALLEL DATA OUTPUT	$ 116
672	RS422 AND PARALLEL DATA OUTPUT	$ 107
675	CURRENT LOOP AND PARALLEL DATA OUTPUT	$ 147
681	RS232C AND PARALLEL DATA INPUT	$ 116
682	RS422 AND PARALLEL DATA INPUT	$ 107
685	CURRENT LOOP AND PARALLEL DATA INPUT	$ 147
692	PARALLEL DATA OUTPUT SINKING	$ 87
693	PARALLEL DATA INPUT SINKING	$ 87
694	PARALLEL DATA OUTPUT SOURCING	$ 87
695	PARALLEL DATA INPUT SOURCING	$ 87



PHYSICAL SIZE - FRONT VIEW



PHYSICAL SIZE - SIDE VIEW



FRONT PANEL CONTROL MODULE

☐ **PROGRAMMABLE CONTROL FUNCTIONS**

1. DISPLAY SCALE, UPDATE RATE
2. CONTROL BAND RAMP
3. SLOW DOWN BAND SIZE AND RAMP
4. DEAD BAND SIZE
5. END OF CYCLE OUTPUT PARK VALUE

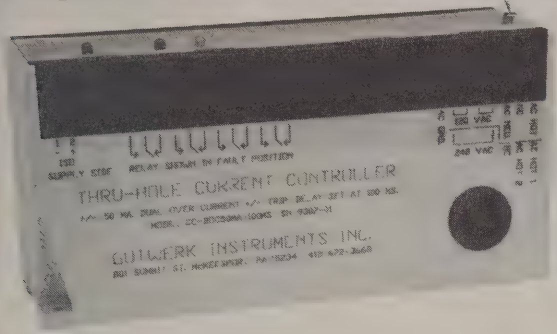
CONTACT FACTORY FOR TECHNICAL ASSISTANCE @ 815-758-7000

FOX METER INC. ALSO MANUFACTURES A FULL LINE OF DIGITAL PANEL METERS, SEE VOL. D, SECT. 2950 AND LARGE DISPLAYS VOL. B, SECT. 2450

333 Dietz Avenue, Unit B, DeKalb, IL 60115-2672 - Phone 815-758-7000 - *Fax 815-758-1640*

Failsafe Sensor/Controllers

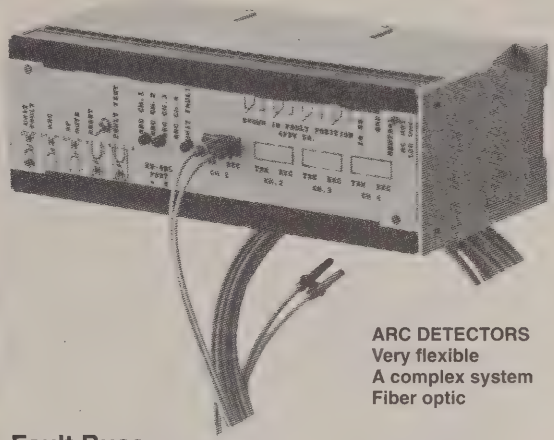
"Expansion, Reliability and Flexibility Are Designed In"



Fail-Safe Operation

All units are fail-safe. Each unit is continuously self testing, *(even while in use!)* to assure that it will detect a fault condition when it really counts. • A wide range of settable fault options. • LEDs provide a local indication of status, with a local reset switch. • 4PDT relay and optoisolators provide output status and remot inputs for all functions. • An isolated power source is provided to assist the user in setting up remote control operation. • Using high reliability Schindengen DC-DC converters throughout.

• Optional RS-485 Interface is also available. •
If you want to know your fault protection will be there when you need it, this is the unit for you!



ARC DETECTORS
Very flexible
A complex system
Fiber optic

Fault Buss

This is very useful feature found on all our units. By connecting the FAULT BUSS of any number of units together, a complete monitoring system is formed. When any unit sees a fault the FAULT BUSS will command all units to "Hold" the analog data it contains at the "Real Time" of the fault. This enables the operator to analyze all monitored points at the time of the fault. It also assists a computer operated or monitored system to scan all controllers without missing data that results from speed related problems.

All units can be bussed together

Thru-Hole Current Sensors

- AC or DC 10mA to 100A F.S.
- large thru-hole
- Faraday shielding

Arc Detectors

- Fiber-Optic Coupled
- 1 to 4 Inputs
- High speed <15µS.

AC Power Line Monitors

- Voltage
- Current
- Frequency
- Phase loss
- Phase rotation

Voltage Sensors

for AC, DC, or RF

RF Power Monitors

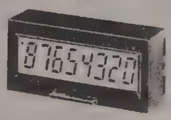
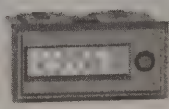
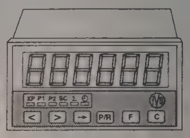
Forward and Reverse Power
Forward Power DIP Detection

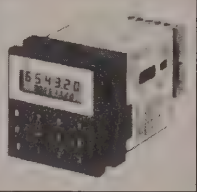
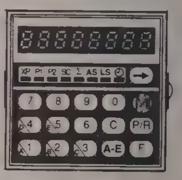
Spotted Contact Detectors

- Monitors 3 phase contactors to prevent single phasing in off mode
- Air Flow Detectors

GUTWERK INSTRUMENTS INC.
801 Summitt Street • McKeesport, PA 15132
Tel: (412) 672-3668 • Fax: (412) 672-7371

Electronic Counters and Controls

Length measurement, positioning, batch counting counters for a wide range of industrial applications.				
	LCD/Totalizer	LCD/Totalizer	LCD/Totalizer	**New**
Model	N 120	N 100*	N 121*	NE214
Supply voltage	2.5-3.4VDC	3VDC	Self Powered	24VDC,110-220
Count speed	to 10kHz	to 10 kHz	20 or 2kHz	15,25 and10kHz
Encoder Supply	n/a	n/a	n/a	24VDC±50%
Panel Cutout	PCB mount	PCB mount	22 x 45mm	45x92 Din
Price (List)	$19.00	$25.00	$ 29.00 / $39.00	$200.00
Comments: *Also available as hour meter and /or timer	The smallest of IVO's counter line. Ideal for battery powered applications. Also available as add/subtract counter. Used on printers, copy machines etc.	8 digit, ultra low power (<10µA) totalizer designed for PCB applications. With or without front reset, large 0.3 inch high display, Optional panel mount housing available.	8 digit totalizer with 10 year battery. Excepts contact closure inputs as well as voltage pulses from 12-230VDC or VAC. NEMA 4 front panel.	6 digit 2 preset large LED display counter with prog. input scaling. Complete with running time indicator and totalizer. 2 relays or solid state outputs.

Make your decisions count with IVO products				
	LCD/Preset	LED/Preset	LED/Preset	**New**
Model	NE 120*	NE 210*	NE 212	NE213
Supply voltage	12-24 or110-220	24DC,110-220AC	24DC,110-220AC	EEPROM based µP control. For OEM's who require customized programming or features other than what is available in our standard line of counters. Incorporate several functions like tachometers, timers, counters, rate indicators together with your own custom keypad design.
Count speed	to 9 kHz	15,25 and10kHz	15,25 and10kHz	
Encoder Supply	12VDC, 50 mA	24VDC±50%	24VDC±50%	
Panel Cutout	45 X 45 Din	45 X 45 Din	68 x 68 Din	
Price (List)	$ 129.00	$ 149.00	$ 249.00	
Comments: *Also available as hour meter and /or timer	6 digit single preset counter, programmable prescaler, quadrature counting, 10 year EEPROM memory, Both relay and solid state outputs.	5 digit single preset counter, programmable prescaler, quadrature counting 10 year EEPROM memory, Both relay and solid state outputs are programmable in length.	7 digit 2 preset with batch counter and totalizer. prog. prescaler, quad. counting, 10 year EEPROM memory, Relays and solid state outputs, RS232,422,485	

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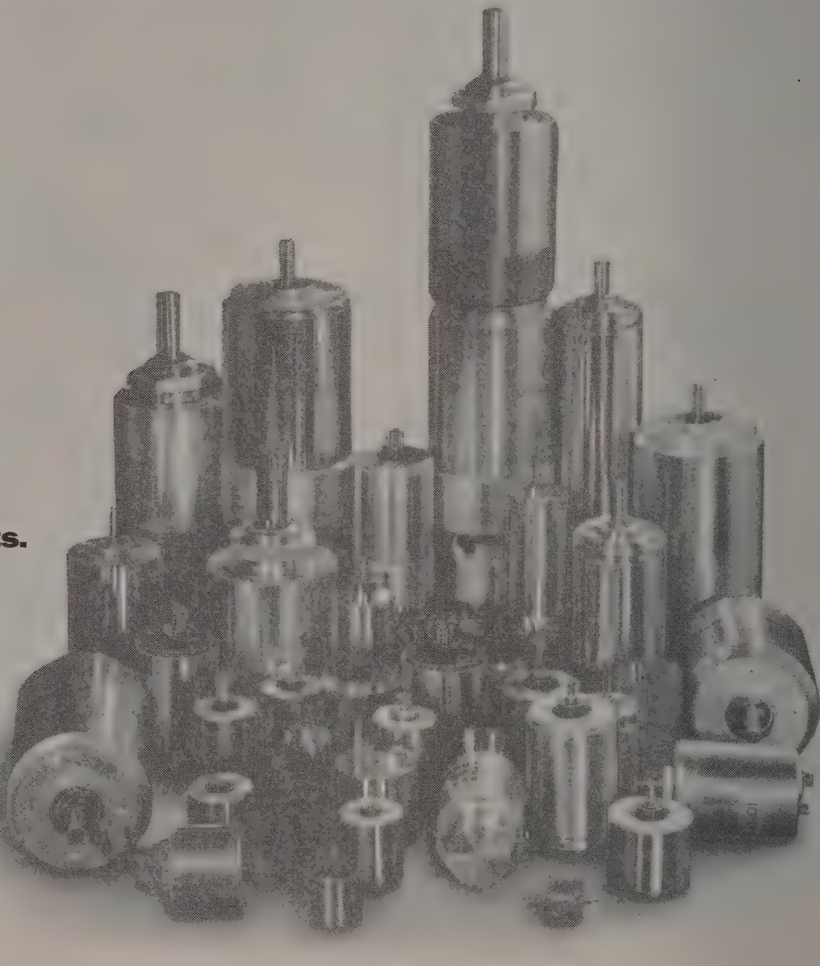

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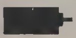
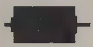
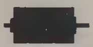
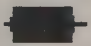
MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MA.X. POWER OUTPUT (W)	MAX.CONT. TORQUE (oz.-in)	RECOMMENDED MAX SPEED (RPM)
	1016	10	(.39)	16	(.63)	0.45	.07	13,000
		FITS GEARHEAD SERIES 10/1, & 12/3						
	1212	12	(.47)	12.2	(.48)	0.1	.01	15,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1219	12	(.47)	18.7	(.74)	0.45	.11	12,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1319	13	(.51)	19	(.75)	0.9	.17	12,000
		FITS GEARHEAD SERIES 14/1, 15/1, 15/2,15/3, & 15/5						
	1331	13	(.51)	31.2	(1.23)	2.0	.36	12,000
		FITS GEARHEAD SERIES 14/1,15/5 & 15/8						
	1516	15	(.59)	15.8	(.62)	0.3	.07	12,000
		FITS GEARHEAD SERIES 15/1, 15/2,15/3,15/5,15/8, & 16A						
	1524	15	(.59)	23.8	(.94)	0.6	.14	12,000
		FITS GEARHEAD SERIES15/1, 15/2, 15/3,15/5, 15/8, & 16A						
	1616	16	(.63)	15.8	(.62)	0.45	.11	12,000
		FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8, & 16A						
	1624	16	(.63)	23.8	(.94)	0.9	.21	12,000
		FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8, & 16A						
	1717	17	(.67)	17	(.67)	1.8	.20	13,000
		FITS GEARHEAD SERIES 16A & 16/7						
	1724	17	(.67)	24	(.95)	2.2	.28	8,000
		FITS GEARHEAD SERIES 16A & 16/7						
	2017	20	(.79)	17.2	(.68)	0.45	.11	12,000
	2025	20	(.79)	24.8	(.98)	0.9	.21	8,000
	2225	22	(.87)	24.8	(.98)	1.0	.28	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2230	22	(.87)	30.0	(1.18)	2.0	.36	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2233	22	(.87)	32.8	(1.29)	2.0	.43	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2338	23	(.91)	37.6	(1.48)	3.5	.85	8,000
		FITS GEARHEAD SERIES 23/1, 30/1, 32PG, & 34PG						
	2842	28	(1.10)	42.0	(1.65)	6.0	2.80	5,000
		FITS GEARHEAD SERIES 23/1, 30/1, 32PG, 34PG, 38/1, & 38/2						
	3540	35	(1.38)	40.0	(1.57)	10.0	3.55	5,000
		FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2						
	3557	35	(1.38)	57.0	(2.24)	15.0	6.38	5,000
		FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2						
	3557...CS	35	(1.38)	57.0	(2.24)	25.0	7.09	5,000
		FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2						
	3557...CR	35	(1.38)	57.0	(2.24)	50.0	8.50	5,000
		FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2						
GEARMOTORS								
	2020	20	(.79)	20.0	(.79)	0.4	.21 to 1.42	200 to 3,000
	2034	20	(.79)	33.3	(1.31)	0.8	.43 to 1.42	500 to 2,000

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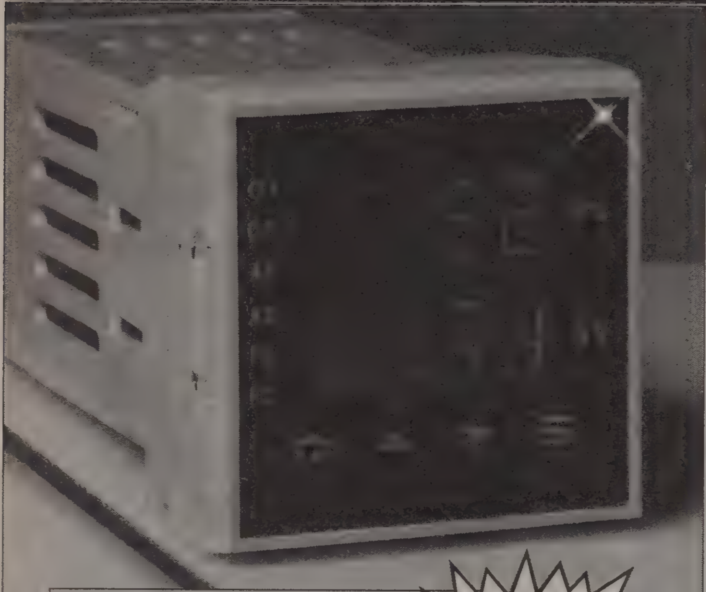

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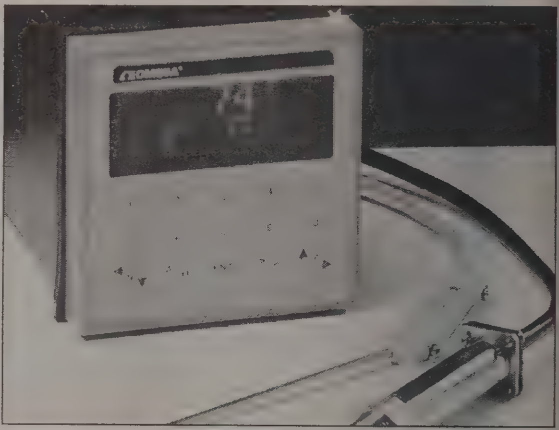

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- 90 Degree Phase Shifted Outputs
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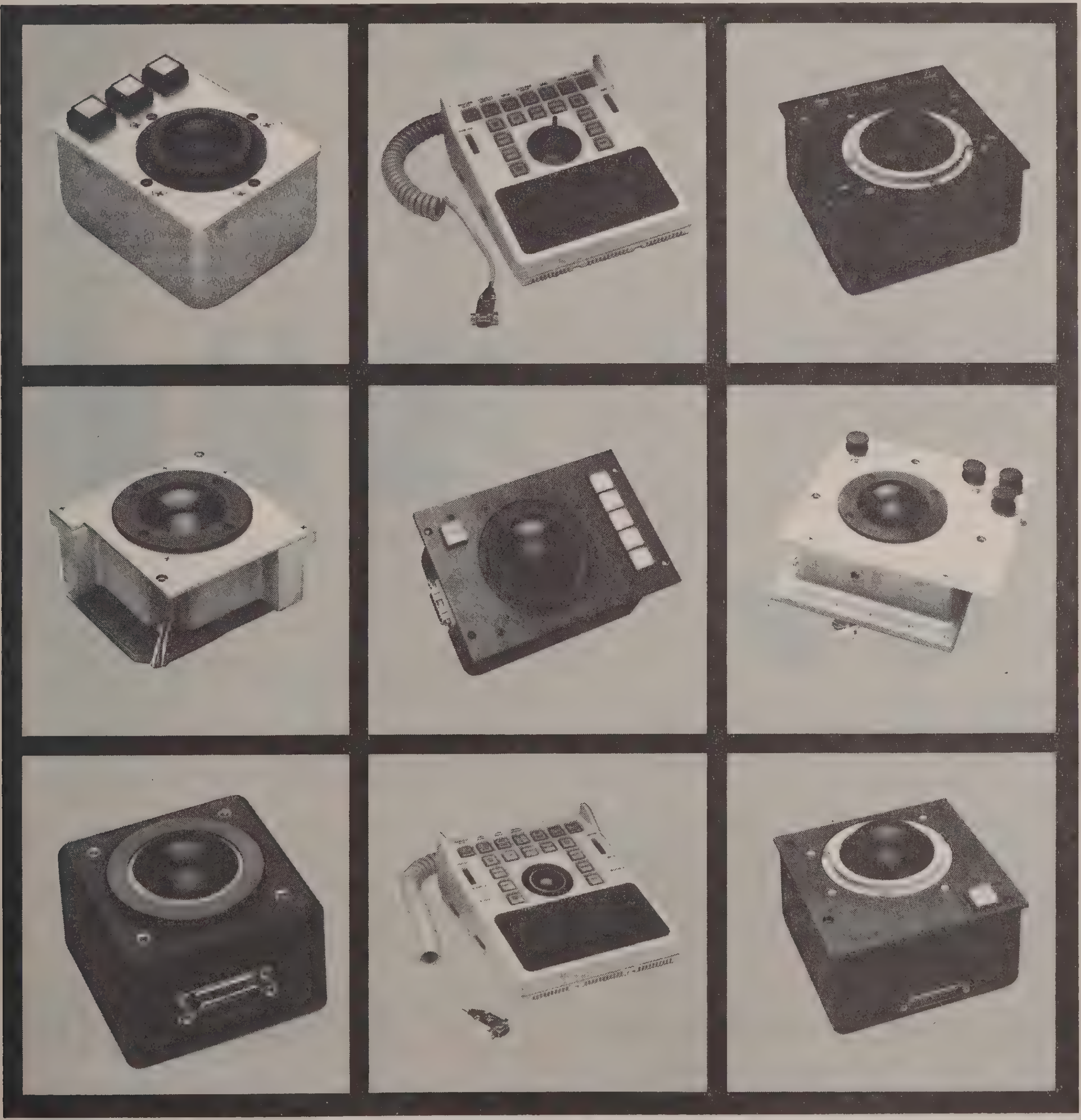
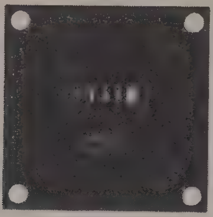


INDICATORS AND COUNTERS

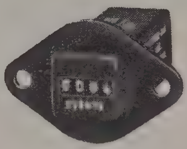
Our versatile product line offers the highest standards to virtually any application. Meet all your elapsed time indicator and events counter requirements from the best source. Contact Philips Technologies, Airpax Instruments, Cheshire Industrial Park, Cheshire, CT 06410.
(203) 271-6000. FAX (203) 271-6100.



Military Elapse Time Indicators

Maintain records of equipment on/off time and provide utilization time information for maintenance, warranty or reliability 5-digit readouts in hours or hours/tenths. Meets M7793/9 and M7793/10.

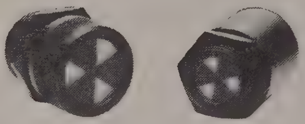
MIL Designation	Voltage/ Frequency	Readout Hours	Airpax Instrument Part Number
M7793/9-001	115 VAC/400 Hz	9999.9	K25209-001
M7793/9-002	115 VAC/400 Hz	99999	K25209-002
M7793/10-001	115 VAC/60 Hz	9999.9	K23210-001
M7793/10-002	115 VAC/60 Hz	99999	K23210-002



Microminiature Events Counters

Meet MIL-I-8974 environmental requirements. Up to 6-digit display, depending on model. Non-resettable. Many standard mountings.

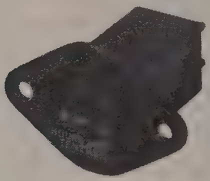
Type	Digits	Series No.		
		28 VDC	115V60 Hz	115V 400 Hz
Non-resettable	4	K19502	K19511	K19501
	5	K19554	K19513	K 19503
	6	K19506	K19515	K19505



Fault Indicators—B.I.T.E.

Monitor circuits and systems for operation beyond design parameters. Contrasting flag indicates fault condition. Magnetically latched until manually or electrically reset. Units with internal switches for remote signaling.

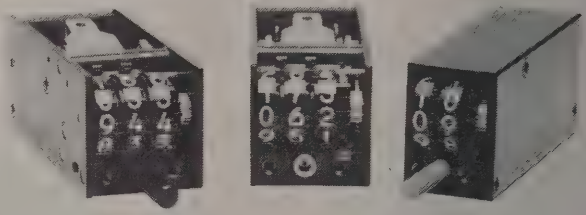
Type	Series	MIL Ref.	VDC	Operating Time
Round-Manual Reset Internal Sw	L21603/05	MIL-I-83287	5-30	50ms
Round Manual Reset	L21603/01	MIL-I-83287/01	3-30	50ms
Round-Electric Reset	L21603/02	MIL-I-83287/02	10-30	50ms



MIL Spec Elapsed Time Indicators

Meet MIL-M-7793 environmental requirements. In our microminiature (4 & 5-digit) sizes. "Hours" in white numerals on black, "tenths" digit red on white. Hermetically sealed.

Type	Digits	Series No.	Operating Voltage
Microminiature	5	K4200	28 VDC
	5	K23200	115 VAC, 60 Hz
	5	K25200	115 VAC, 400 Hz
	4	K 19200(Square)	24 or 120 VAC
	4	K19220 (Round)	400 Hz
	4	K19600 (Square)	115 V 60 Hz
	4	K19793 (Sqr./Rnd.)	10-34 VDC
	4	K19796 (Sqr./Rnd.)	5-7 VDC
	5	K19795 (Rect.)	10-34 VDC
	5	K19798 (Rect.)	5-7 VDC



Subtractive and Additive Events Counters

Two- and three-digit military grade counters. Meet MIL-STD-202F tests. Maximum count rate 1000 pulses per minute. Additive (countup) and subtractive (countdown) models. Presettable. Operates on 21-29 VDC pulses.

Type	Digits	Series No.	Operating Voltage
Subtractive	2	K-4702-PI	21-29 VDC
	3	K-4701-PI	
Additive	2	K-4702 P2	
	3	K 4701 P2	

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PHILIPS

U.RD

United Research and Development

AC CURRENT SENSOR
CTL-6-P □ CTL-6-S

SPECIFICATIONS:

Dimension/Wieght: Refer to Fig. 1,2
Housing: Polycarbonate Rosin (L-125#)
Terminal: 59BS1411
Dielectric Strength: 1,000 volts A.C.
Primary Current: 0~50 amp. A.C. (rms) 50 Hz/60 Hz
Output Voltage: Refer to Fig. 3, 4
Eo = 4.7V (St'd): (at Io = 5 A,
RL = 1 K Ω. Freq. = 6- Hz)
where: Eo: output voltage
Io: Thru Hole Current (A)
RL: Load Resistance (ohms)
Internal Resistance: 39 ± 3 ohms
Linearity: 1~50 amp. ± 1% (at RL = 10Ω)
Ambient Temperature: -20°~+75°C; Refer to Fig. 5
Storage Temperature: -30°~+90°C
Vibration & Impact: 50 Hz 10 G in X•Y•Z axes for 3 hrs.; 10 times free falls from 1 meter high
Frequency Response: 20 Hz~10 KHz ± 1 db

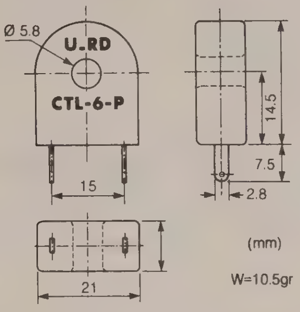


Figure 1 CTL-6-P

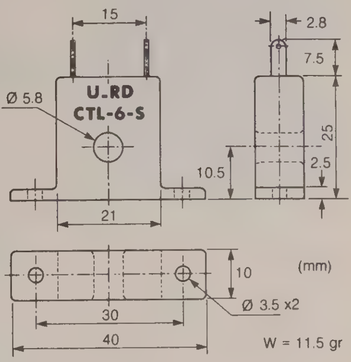


Figure 2 CTL-6-S

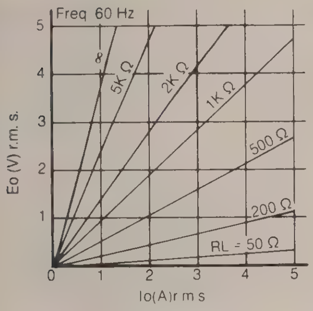


Figure 3 CTL-6-P (S)
Pass Through Current vs. Output Voltage

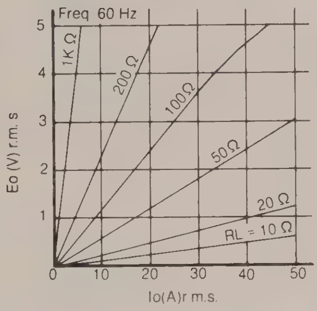


Figure 4 CTL-6-P(S)
Pass Through Current vs. Output Voltage

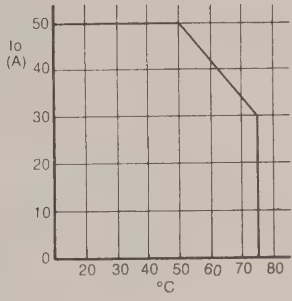


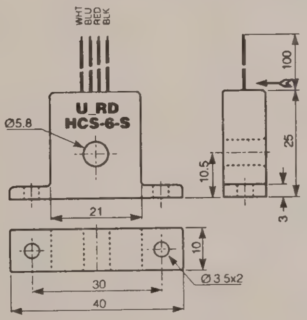
Figure 5 CTL-6-P(S)
Ambient Temperature vs.Through-Hole Current

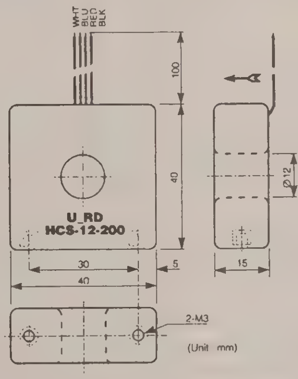
HALL EFFECT AC/DC CURRENT SENSORS
HCS-6-S □ HCS-12-200 □ HCS-24-200

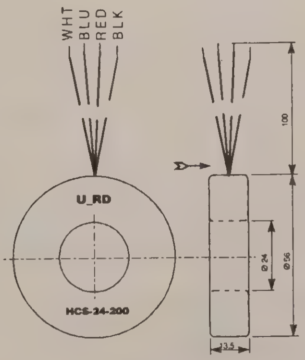
SPECIFICATIONS:

Shape & Dimension: (Refer to Figures)
Weight: **HCS-6-S** 12 grams
HCS-12-200 44 grams
HCS-24-200 50 grams
Inputs: + RED – BLACK
Outputs: + BLUE – WHITE
(Note: ➡ indicates a direction of thru-hole current flow respect or polarities.)
Shock & Vibrations:
50 Hz, 10G each axis for 3 hrs.
10 times free falls form 1 meter high on to wooden board.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Rated Current (Ifs)	for HCS-6-S	0		300	A
	HCS-12-200, HCS-24-200	0		500	A
Satulation	for HCS-6-S	500			A
Current (Ifs)	HCS-12-600, HCS-24-200	600			A
Sensitiviy (Eo)	k = 5 mA	0.4	0.6	0.8	mV/A
Residual Voltage (Vo)				±8	mV
Control Current (Ic)			5	10	mA
Frequency Response	(Refer to figure)	DC	6		KHz
Temperature Influence	0°~40°C			±2	mV
Operating Temperature		-30		+80	°C
Storage Temperature		-55		+125	°C
Dielectric Strength	1,000 volts AC for 1 minute between lead wires and thru-hole wire				
Insulation Resistance	> 100 Mohms @ 500 Vdc between lead wires and thru-hole wire				

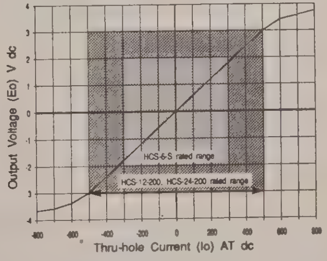






DC Thru-hole Current (Io) vs. DC Output Voltage (Eo)

used with CMD-HC-1 module GAIN = 20 (26 db)



Note: HCS-6-S rated current range is limited by a hole size.

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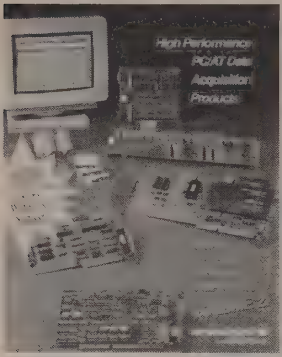

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PC/AT

Hardware Configuration Chart

Board	Bits/kHz	Accessories	Description	Software
DAS-12/50	12/50	STB	Screw Terminal Box	LabTech
DAS-12/125	12/125	MUX-16TC	16 Channel Thermocouple Board	*...DOS & Windows*
		MUX-16TC/EX	128 Channel Capability for MUX-16TC	LCDAS-LIB
		DASMUX-64	64 Channel Multiplexer	*...µSoft C*
		DASMUX-64/EX	256 Channel Capability for DASMUX-64	*...Turbo Pascal*
		Qwik Connect	Low Cost Screw Terminal Connector	
		DASMUX-64/5B	64 Channel Multiplexer for DCB5B Series	
		DASMUX-64/5B/EX	256 Channel Capability for DASMUX-64/5B	
		STB-5B	Terminal Box for DCP5B Series	
		DCP5B Series	Isolated Signal Conditioners	
LSDAS-12	12/100	STB	Screw Terminal Box	HEM Data
MSDAS-12	12/200	MUX-16TC	16 Channel Thermocouple Board	*...DOS & Windows*
HSDAS-12	12/400	MUX-16TC/EX	128 Channel Capability for MUX-16TC	LabTech
LSDAS-16	16/50	DASMUX-64	64 Channel Multiplexer	*...DOS & Windows*
HSDAS-16	16/200	DASMUX-64/EX	256 Channel Capability for DASMUX-64	TurboLab
		DASMUX-64/5B	64 Channel Multiplexer for DCB5B Series	*...DOS*
		DASMUX-64/5B/EX	256 Channel Capability for DASMUX-64/5B	DADisp
		STB-5B	Terminal Box for DCP5B Series	*...Dos rev 3.0*
		DCP5B Series	Isolated Signal Conditioners	IPCXpert
		Qwik Connect	Low Cost Screw Terminal Connector	*...Windows*
				LCDAS-LIB
				...µSoft C
				...Turbo C
				DriverLinx
				...Windows
FAST 12-1-(x)	12/1000	STB-FAST	BNC Connector for FAST Series Boards	FAST-LIB
FAST 14-1-(x)	14/1000	SSH-8	8 channel Simultaneous Sample & Hold Board	*...µSoft C*
FAST 16-1-(x)	16/1000	STB-SSH	Screw Terminal Box for SSH-8	*...Turbo C*
		Qwik Connect *(analog only)*		
DAC-812		STB-DAC812	Screw Terminal Box for DAC812	LabTech
		Qwik Connect	Low Cost Screw Terminal Connector	*...DOS & Windows*
				...µSoft C
PDIO-24/48/72/96		STB-PDIO	Screw Terminal Box for PDIO	LabTech
				...DOS & Windows
CTRTM-05		STB-CTRTM	Screw Terminal Box for CTRTM	*...µSoft C*
CTRTM-10				*...Basic*
				...Turbo C
ACOM-8			RS-232/RS-485 Serial Communications Board	
D Series		ACOM-8	RS-232/RS-485 Serial Communications Board	

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

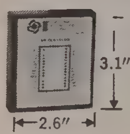
WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	**D•2221**
Batteries, Product Selection Guide	**D•1419**
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C•1003**
Capacitors, Product Selection Guide	**A•1003**
Coils, Chokes, Inductors, Product Selection Guide	**A•1179**
Connectors, Terminals & Sockets, Product Selection Guide	**C•1139**
Cores, Magnets & Ferrites	**A•1317**
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A•1326**
DC-DC Converters	**D•2049**
DC Power Supplies, Product Selection Guide	**D•1488**
Delay Lines, Product Selection Guide	**A•1513**
Discrete Semiconductors, Product Selection Guide	**A•2130**
Displays, Readouts, & CRTs, Product Selection Guide	**B•1017**
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C•1557**
Fiber Optics, Product Selection Guide	**B•1200**
Filters, Power, Product Selection Guide	**A•1584**
Filters, Signal, Product Selection Guide	**A•1617**
Instruments, Test & Measuring, Product Selection Guide	**D•1215**
Interconnection Systems, Product Selection Guide	**C•1670**
Keyboards & Keypads, Product Selection Guide	**B•1818**
Lamps, Lights, & Indicators, Product Selection Guide	**B•1131**
Microwave Components, Product Selection Guide	**A•1719**
Military Qualified Products List	**B•1002**
Motors, Drives, & Rotating Components, Product Selection Guide	**B•1231**
Oscilloscopes, Product Selection Guide	**D•1402**
Panel Hardware, Product Selection Guide	**C•1522**
Panel Meters, Analog & Digital, Product Selection Guide	**D•1336**
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A•2053**
Power Supplies, AC, Product Selection Guide	**D•2221**
Power Supplies, DC, Product Selection Guide	**D•1488**
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B•1341**
Relays, Product Selection Guide	**B•1401**
Resistors, Product Selection Guide	**A•1859**
Solenoids, Product Selection Guide	**B•1626**
Switches, Product Selection Guide	**B•1658**
Thermal Components, Product Selection Guide	**B•1857**
Transducers & Encoders, Product Selection Guide	**B•1911**
Transformers, Product Selection Guide	**A•2229**
Wire & Cable, Product Selection Guide	**C•1701**

SYNCHRO CONVERTERS/DISPLAYS/ENCODERS

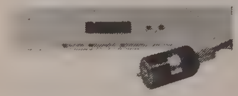
STANDARD LOW COST UNITS TO SATISFY ALMOST ANY SYNCHRO/RESOLVER OR SHAFT INTERFACING REQUIREMENT

SYNCHRO/RESOLVER TO BCD Series SBC



INPUT: 11.8/90V RMS L-L, 60 or 400Hz. Ref: 26/115V RMS **OUTPUT:** 3, 4 or 5 decade BCD-scaleable unipolar or bipolar **ACCURACY:** ±30, ±6, or ±2 minutes of arc ±1 LSB. **PACKAGE:** 2.6″ x 3.1″ x .82″H module. **OPTIONS:** Choice of Scale factors, Zero offset adjustments (±5%).

MULTITURN ABSOLUTE ENCODERS Series MDS90



INPUT: MULTI-TURN Shaft angle position. **OUTPUT:** 4, 5, or 6 Digit LED Display +BCD or Binary Data. **ACCURACY:** Up to ±1 pt. in 100,000. **PACKAGE:** Size 23 Pickoff with full or half rack electronics. **OPTIONS:** Zero Offset, NEMA 12 Housings, Presets, power supplies.

TYPICAL UNITS

Multiturn Encoders	Output Code	Resolution Counts/360°	Revolution for Full Count	Data Range
MDS90-DBC-16	Binary	2^{10}	64	2^{16}
MDS90-DBC-10	BCD	1000	10	10,000
MDS90-DBC-100	BCD	1000	100	100,000

LOW COST ANGLE INDICATOR Series AI540

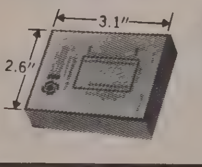
COMPUTER CONVERSIONS CORP
+179.9

INPUT: 11.8/90V RMS L-L, 60 or 400Hz, Ref: 26/115V RMS +115V 60Hz power. **OUTPUT:** 3, 4 or 5 Digit .5″H LED Display (Unipolar or Bipolar) **ACCURACY:** ±3, ±6 or ±30 minutes of arc, ±1 LSB. **PACKAGE:** (A) 5.5″W x 7.5″L x 2.0″H panel mount (DC supplies included); (B) 9½″W x 1¾″H half rack mounting (DC supplies included). **OPTIONS:** Choice of scale factors, Zero offset adjustment (±5°).

TRANSFORMER ISOLATED MULTIPLEXED SYNCHRO TO DIGITAL Series MSI

INPUT: 11.8/90V RMS L-L 60 or 400Hz, Ref. 26/115V RMS, up to 128 channels. **OUTPUT:** 14 Bits parallel binary or 4 decade BCD **ACCURACY:** ±4.6 minutes of arc ±.5 LSB. **PACKAGE:** (A) Central Converter 2.6″ x 3.1″ x .43″H module; (B) Four channel input module 2.6″ x 3.1″ x .43″H module. **OPTIONS:** (A) Scale Factor choice on BCD output. (B) Linear DC output. (C) Systems mounted on PC boards or racks

MULTISPEED SYNCHRO TO DIGITAL ONE MODULE Series SDT



INPUT: 11.8/90V RMS L-L, 60 or 400Hz Ref: 26/115V RMS **SPEEDS:** 10, 16, 18, 32, 36, 64. **OUTPUT:** 16 Bits parallel binary and velocity. **ACCURACY:** ±.01 or ±.005 degrees **PACKAGE:** One 2.6″ x 3.1″ x .82″H module. **OPTIONS:** (A) Systems packaged on PC cards or racks; (B) 6 Digit Display

ABSOLUTE ENCODERS Series DS90

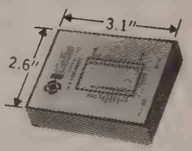
INPUT: Shaft angle position coupled to "DIGI-SHAFT" system; **OUTPUT:** four digit (.5″H) LED display (0 to 9999) +BCD or Parallel binary data (ANY SCALE FACTOR DESIRED); **ACCURACY:** ±1 part in 3600 (single turn) From shaft input to digital output; **PICKOFF:** Resolver (Size 8, 11, or 15); **PACKAGE:** (A) 5.44″W x 7.00″ x 1.75″H; (B) Full or half rack; **OPTIONS:** Multichannels, Zero offset, Presets, DC output, Multiturn units with 5 digit (99999) output, NEMA 12 Housings.

TYPICAL UNITS (single Turn)

Pt. No.	Output	Counts/360°
DS90-DB-12	Binary Data	2^{12}
DSR90-36-BC	0-3599 display +BCD data	3600
DSR90-10	0–999 display	1000
DSR90-25-BC	0 to ±2500 display +BCD data	±2500

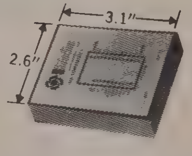
FULL SCALE OUTPUTS OF UP TO 9999 AVAILABLE
MULTITURN UNITS WITH UP TO 999999 FULL SCALE OUTPUTS AVAILABLE

SOLID STATE CONTROL TRANSFORMER Series SCT



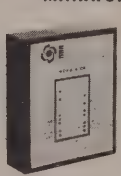
DIGITAL INPUT ANGLE (φ): 14, 12, or 10 bits parallel binary. **SYNCHRO RESOLVER INPUT ANGLE** (θ): 11.8/90vrms L-L, 60 or 400Hz. **OUTPUT:** E out=(V ref ±7%) sin (θ-φ) Sin wt; **GRADIENT:** .4 or 1vrms/degree. **RANGE:** ±7 or ±12.5 degrees; **ACCURACY:** ±4, ±15, or ±30 minutes of arc. **PACKAGE:** 2.6″ x 3.1″ x .82″H Module.

SOLID STATE CONTROL DIFFERENTIAL TRANSFORMER Series SCDX



DIGITAL INPUT ANGLE (φ): 14, 12, or 10 bits parallel binary. **SYNCHRO/RESOLVER INPUT ANGLE** (θ): 11.8/90vrms L-L, 60 or 400Hz. **OUTPUT:** (1) 9.2K (φ) Sin (θ-φ) Sin wt. [7vrms.] (2) 9.2K (φ) Cos (θ-φ) Sin wt. [7vrms.] **ACCURACY:** ±4, ±15 or ±30 minutes of arc. **PACKAGE:** 2.6″ x 3.1″ x .82″H.

MINIATURE MODULATORS Series MOD500



INPUT: 0 to ±10 OR ±100V DC and 26V/115V RMS reference. **OUTPUT:** 0 to 7V RMS (other voltages available). **ACCURACY:** ±.2% **F.S.: NULL:** ±.1% F.S. **PACKAGE:** (A) 2.6″ x 3.1″ x .625″ Module. (B) 1.3″ x 1.3″ x .42″H module. **OPTIONS:** Gain+Zero adjust, external output transformers.

MINIATURE DEMODULATORS Series D400

INPUT: 0 to 5, 10, 25 or 100V RMS, 400 to 5000Hz, 5/26V RMS, reference. **OUTPUT:** 0 to ±5 or ±10V DC. **ACCURACY:** ±.2, .3 or .5% **F.S.: NULL:** ±.1% F.S. **PACKAGE:** (A) 1.3″ x 1.3″ x .42″H module. (B) 1.75″ x 1.75″ x .6″H module

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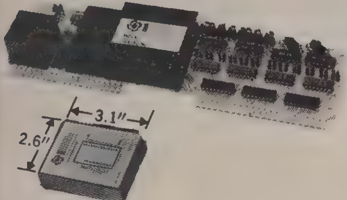
SYNCHRO CONVERTERS/DISPLAYS/ENCODERS

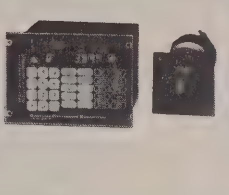
STANDARD LOW COST UNITS TO SATISFY ALMOST ANY SYNCHRO/RESOLVER OR SHAFT INTERFACING REQUIREMENT

SYNCHRO/RESOLVER TO DIGITAL Series SDC40/60



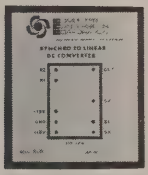
INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** 16, 14, 12, or 10 Bits parallel binary or BCD. **ACCURACY:** ±1, ±4, ±6 or ±30 minutes or arc. **PACKAGE:** (A) 2.6" x 3.1" x .42"h Module (B) 2.6" x 3.1" x .82"h or (C) 4.5" x 6.5" x .75"h repairable PC card.

PROGRAMMABLE LIMIT SWITCH Series PLS1000



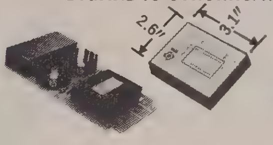
INPUT: Single, Multiturn or Linear Resolver. **RESOLUTION:** Field Scaleable to 1 part in 4096/turn. **OUTPUTS:** 16 & 1 fault, field select TTL or DC to 50V, Solid State and Electromechanical relay boards. **DISPLAY:** 8 character electro fluorescent and status LEDs. **SPEED:** 5 us throughput fully loaded, 3000 RPM. **FUNCTIONS:** Hi/Low setpoints, dwells, timers, tach, cycle count RS232 I/O, force outputs, offsets, 5 speed advance. **MEMORY:** Non-volatile EEPROM 10–100 programs, serial buffer. **SIZE:** 7.4" x 6.2" x 4.5" panel mount or 14" x 12" x 10" Nema 13.

SYNCHRO/RESOLVER TO LINEAR DC Series SLD200



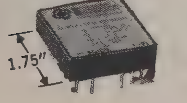
INPUT: 11.8/90vrms L-L, 60 or 400 Hz., Ref: 26/115vrms. **OUTPUT:** (A) –10 to +10 vdc linear with angles from –180° to +180° (standard) (B) o to +10V DC linear with angle from 0° to 360° (special) (C) –10 to —10 vdc linear with angles from –90° to +90°. **ACCURACY:** ±6 minutes of arc at input speeds up to 1440°/sec, or ±15, ±30, ±60 minutes of arc. **PACKAGE:** (A) 2.6" x 3.1" x .82" Module; (B) 3.06" x 2.6" x 3.18"H Can; (C) 4.5" x 6.5" x .75"H repairable PC card.

DIGITAL TO SYNCHRO/RESOLVER Series DSC40/60



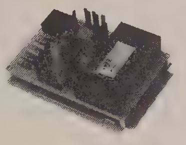
INPUT: 14, 12 or 10 bits parallel binary and 26/115 vrms reference. **OUTPUT:** 11.8/90 vrms L-L, 60 or 400 Hz capable of driving 1VA, 2VA, 5VA (up to 3 TRS) or 25VA loads. **ACCURACY:** ±4, ±15, or ±30 minutes. **PACKAGE:** A) 2.6" x 3.1" x .6"h. B) 2.6" x 3.1" x .82"h module. C) PC card with edge connector (5VA and 25VA units).

SYNCHRO/RESOLVER TO SINE-COSINE DC Series SD100



INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** ±10 sin θ vdc; ±10 cos θ vdc. **ACCURACY:** ±2 or ±4 minutes of arc. **PACKAGE:** 1.75" x 1.75" x .6"h or 3" x 3" x .625"h Module.

DC ANGLE TO SYNCHRO/RESOLVER Series LDS500

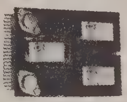


INPUT: ±10V DC or ±100V DC representing ±180° of angle. **OUTPUT:** 11.8/90V RMS L-L, 60 or 400Hz capable of driving up to three size 11 T.R.'s (75 Ohms L-L). **ACCURACY:** ±15 or ±30 minutes of arc. **PACKAGE:** (A) 4.5" x 9.25" x 2.0"H repairable PC board with 22 pin edge connector. (B) 2.6" x 3.1" x 1"H module (1.5VA Output).

INVARIANT SYNCHRO/RESOLVER TO SINE-COSINE Series SD100 I

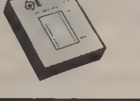
INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** ±10 sin θ vdc, ±10 cos θ vdc. **ACCURACY:** ±4 minutes of arc. **INVARIANCY:** A ±10% change in the input or reference voltage results in a ±.5% change in the individual DC outputs. **PACKAGE:** 3" x 3" x .625"h Module.

DC SIN COS TO SYNCHRO DRIVERS Series DCS400



INPUT: ±10 vdc representing sin θ and cos θ. **OUTPUT:** 11.8/90 vrms L-L, 60 or 400 Hz capable of driving up to three size 11 T.R.'s (75 ohms L-L). **ACCURACY:** ±6, ±15, ±30 minutes of arc. **PACKAGE:** A) 4.5" x 6.5" x .8"h repairable PC Card. B) 4.5" x 9.25" x 1"h PC Card.

DIGITAL TO LVDT Series DLV

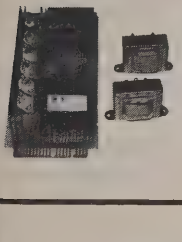


INPUT: Two 14 Bit offset binary or two's complement. **OUTPUT:** 0–7V RMS at 3KHz (2000 ohm minimum load). **ACCURACY:** ±.1% of Full Scale. **PACKAGE:** 2.6" x 3.1" x .43"H Module.

DIGITAL to SYNCHRO/RESOLVER Series DSP REFERENCE POWERED

INPUT: 14 or 12 bits parallel binary and 115V RMS REF: 60 or 400Hz. **OUTPUT:** 90 V L-L 60 or 400Hz capable of driving 4.5VA. **ACCURACY:** ±4 minutes of arc. **PACKAGE:** 2.6" x 3.1" x .82"H. No external transformer required.

SYNCHRO/RESOLVER POWER AMPLIFIERS Series SPA



INPUT: 7V RMS L-L to 90V RMS L-L, 60 to 400Hz Synchro and 26V RMS to 115V RMS Reference input. **OUTPUT:** 7V RMS L-L to 90V RMS L-L Synchro capable of driving loads up to 125 VA. **ACCURACY:** ±3 or ±10 minutes of arc. **PACKAGE:** **(A)** 2.6" x 3.1" x .82"H module (1–5VA); **(B)** 4.5" x 9.25" PC card (5 to 25VA); **(C)** 5.2" x 6.0" x .75"H pc card (10 to 25VA); **(D)** 5.1" x 7.4" x 2.6"H max bulkhead mount metal case (25 to 125 VA)

ADDITIONAL PRODUCTS:

- Hi Speed Multiplexed Synchro to Digital
- Multiplexed Encoders
- Multiplexed Synchro to Linear DC
- Digital Sine/Cosine to Synchro
- Modular Encoders
- Standard Bus S/D & D/S
- Two Speed Digital to Synchro
- Synchro Reference Supply
- Selsyn to Digital/DC
- Azimuth Change Pulse Conv.
- BCD to Binary Converters

ALL SYNCHRO INPUT/OUTPUT UNITS

- Available in 0°C to 70°C or –55°C to +85°C temperature range.
- TTL compatible output and inputs or CMOS, or LP Shottky
- Operate from ±15 v, or ±15 and +5 vdc
- Transformer isolated inputs/outputs
- Solid State construction — 883 Level B Available
- CAN BE MADE FIELD OR FACTORY REPAIRABLE
- Available hermetically sealed and to MIL SPECS (E-5400)
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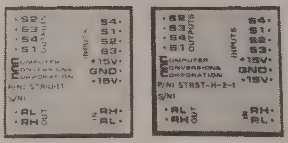
SYNCHRO CONVERTERS/DISPLAYS/ENCODERS

STANDARD LOW COST UNITS TO SATISFY ALMOST ANY SYNCHRO/RESOLVER OR SHAFT INTERFACING REQUIREMENT

MINIATURE SYNCHRO/RESOLVER TO DIGITAL
Series HSDC

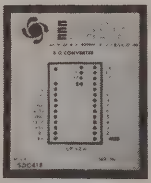
INPUT: 11.8V/90V rms L-L, 60 or 400Hz. Ref: 26/115V rms. **OUTPUT:** 16, 14 or 12 bits parallel binary. **ACCURACY:** ±2, ±4 OR ±8.5 minutes of arc. **PACKAGE:** A: 2.23 x .78 x .6"H module.
B: 1.1 x 2.1 x .7"H. C: 1.9 x 2.1 x .4"H
TRANSFORMER ISOLATION AVAILABLE

MINIATURE SYNCHRO TO RESOLVER CONVERTERS (SCOTT T TRANSFORMERS) – Series ST



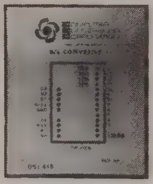
INPUT: 11.8V/90V rms L-L, 60 or 400Hz. Ref: 26/115V rms. (optional) **OUTPUT:** 6V or 2V rms, **ACCURACY:** ±1, ±2 ±4 minutes of arc. **PACKAGE:** 1.3 x 1.3 x .4" COMPATIBLE WITH ALL MONOLITHIC RESOLVER TO DIGITAL CONVERTERS.

HIGH ACCURACY SYNCHRO TO DIGITAL
Series USD



INPUT: 11.8V/90V rms L-L, 60 or 400Hz. Ref: 26/115V rms. (optional) **OUTPUT:** 18 bits parallel binary. **ACCURACY:** ±.005 Degrees. **PACKAGE:** 2.6 x 3.1 x .8"H module. **OPTION:** 6 digit BCD output.

HIGH ACCURACY DIGITAL TO RESOLVER
Series UDR

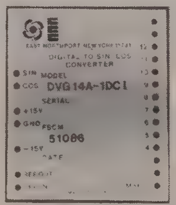


INPUT: 18 bits parallel binary and 26V/115V 60 or 400Hz reference. **OUTPUT:** 7V rms, 60 or 400Hz, capable of driving 2K ohm load. **ACCURACY:** ±.005 degrees. **PACKAGE:** 2.6 x 3.1 x .8"H module. **OPTION:** 1. 6 Digit BCD input. 2. Separate power amplifier modules.

HIGH POWER DIGITAL TO SYNCHRO/RESOLVER
Series DSPH

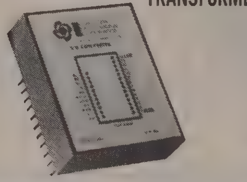
INPUT: 16, 14, 12 or 10 bits parallel binary and 115V 60 or 400Hz reference. **OUTPUT:** 90V rms, 60 or 400Hz capable of driving 25 or 50VA loads. **ACCURACY:** ±3, 6 or 10 minutes of arc. **PACKAGE:** 5.1 x 7.4 x .6"H. Bulkhead mounting aluminum case with short circuit protection, current limiting & thermal cutoff.

VECTOR GENERATOR
Series DVG



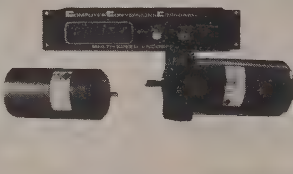
INPUT: 14 bit parallel binary & Reference 10V DC or 7V rms plus power ±15V DC. **OUTPUT:** ±10V DC sine & cosine. DC to 2.5KHZ load – 2K ohms minimum. **REFERENCE OUTPUT:** ±10V DC. **ACCURACY:** ±4 minutes of arc or ±.1% of full scale. **PACKAGE:** 2.6 x 3.1 x .43"H module.

ANALOG DEVICES REPLACEMENT SYNCHRO CONVERTER MODULES TRANSFORMER ISOLATED



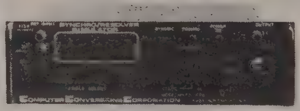
CCC has exact equivalents to almost all Analog Devices Synchro to Digital & Digital to Synchro Converters. Upon request a detailed cross reference can be supplied. These are the only EXACT TRANSFORMER ISOLATED equivalents available.

MULTISPEED HIGH ACCURACY ANGLE INDICATORS
Series AIM



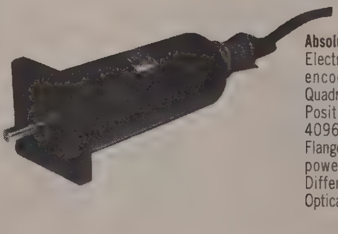
INPUT: 11.8V/90V rms L-L, 60 or 400Hz. Ref: 26/115V rms & 115V 60Hz power. **SPEED RATIO:** 1, 8, 10, 16, 18, 32, 36, 64 & 128. **OUTPUT:** 5 or 6 digit .5" LED display (uni-polar or bi-polar) & 5 or 6 digit BCD digital data (optional). **ACCURACY:** ±.002, ±.005, OR ±.01 degree. **PACKAGE:** a: 9.5 x 8 x 2.0"H. b: 19 x 12 x 3.5"H. **OPTION:** Choice of scale factor, other speed ratios, watchdog timer, tristate, binary and BCD output data simultaneously, dimmer.

SYNCHRO/RESOLVER SIMULATORS
Series SRS



INPUT: Up to 18 bits digital parallel binary or 6 digits BCD, or manual 6 digit thumbwheel switches. Power: 115V 60Hz. **OUTPUT:** 11.8V or 90V rms L-L 60 or 400Hz capable of driving up to 25VA loads. Dynamic range. .125 to 16 RPS. Display 5 or 6 digits .5"H LED of input or output angle. **ACCURACY:** ±.002, ±.005, OR ±.01 degrees. **PACKAGE:** Bench mount: 12 x 13 x 3.25"H, Portable case: 9 x 12 x 12 (splashproof) **OPTION:** Multispeed synchro input and bus board interface.

UNI-CODER



Absolute & Incremental Outputs. No External Electronics, Ultra-Reliable electromagnetic encoder with Real-Time Incremental Quadrature Square & Serial/Shifted Absolute Position Data in one. **Resolution:** 1024 – 4096 parts/turn. Nema 12, Size 25 std. Flange mount. Single +5 VDC, or 10-30 VDC power-in. Isolated Multidrop RS485 Differential outputs. Replaces Disposable Opticals. Model #UN-1, **$495**. OEM Qty's.

STOCKED RESOLVERS

Size 11 • NEMA 13 • Two-Speed Multiturn • Geared • Explosion-Proof • Radiation Resistant • Converters • Readouts • Encoders

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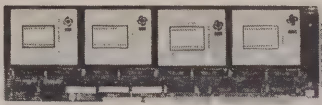
SYNCHRO/RESOLVER & ENCODER BUS CARDS

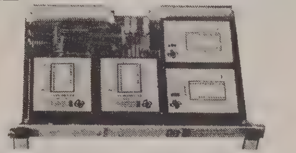
*IBM PC/AT (EISA BUS) "IB SERIES"

IB Cards' feature 4+ channels of Converter, I/O, and Control functions. Converters feature Industry Std. Pin-outs, and can be mix/matched as req'd. Transformer Isolation on Signal & reference lines. Resolution: 1024 to 65,536 parts/turn. Includes Demo Software and driver segments in C, assembly and basic.



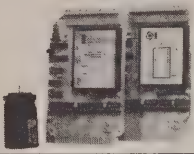
VME BUS "VB SERIES"

Same Features as above, Software independent, Register based A24:D16 VME Slaves. 4+ Channels std. 3 Channel cards permit Loop-Back Self-Test 16 Channel Digital to LVDT/RVDT simulator too!. Industrial and Military Grade Models. 6U std.



STD BUS "STB SERIES"

One-2 Channel cards, any function per card. Lowest cost I/O bus. I/O and Memory addressing, Expanded addressing supported. High/Low Byte priority selectable. Double Buffered Outputs. Terminal Blocks or Mil spec. connectors on I/O.



ABSOLUTE MOTION CONTROL "ALL BUS CARDS"

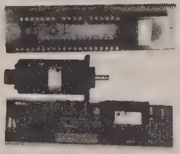
All CCC Absolute Encoder Cards & Synchro and Resolver to Digitals; are available with "Real-Time" Incremental Encoder Outputs for Direct Compatibility with all Mfg's Bus based motion Control Cards. Absolute preset, offset, verification, and electronic homing routines allow these cards to Enhance any Motion Control with; Ultra-reliable position feedback & True Absolute Position Control.

ABSOLUTE PLC ENCODERS/NEW PLUG-IN 1771CCC'S

These encoders include both a terminalized remote decoder & a rugged/reliable electromagnetic transducer. Control logic guarantees synchronized data transfer to any PLC.– These Ultra-Reliable systems provide true absolute position data. Furthermore, they are ideally suited for electronically noisy environments, long cables, shock/vib. & temp extremes.

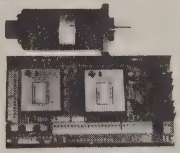
SNAPTRAK ENCODERS

Resolution 100 to 65,536 parts/turn. Basic full function system, +12 or +15VDC power in, Buffered 5V TTL or Open Collector 5-30VDC logic outputs. All digital output formats, BIN, BCD, Gray Code, Absolute & Incremental available. Remote offset option.



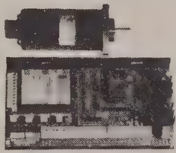
TRACK II ENCODERS

Valued added system, +24VDC power in, field-selectable 5, 15 or 24VDC logic level outputs. Opto-Isolated PLC Handshake, Position status LED's & Remote Zero-set Std. BCD, Binary, Gray Code outputs, Incremental output option. Rotary differentials & Limit Switch outputs available. Resolution: 4096 parts/turn.



MULTITRACK ENCODERS

Multiturn absolute encoder system. Resolution 65,536 representing 1-128 turns full absolute range of travel. All Features Std. +24VDC power-in, field selectable 5,15 or 24 VDC logic level outputs, binary data, Opto-Isol. PLC handshakes for data latch, watchdog, and multiplex enable. Real-time incremental outputs too. Status LED's, & remote zero set. Built-in test & cable disconnect.



DC SNAPTRAK ENCODERS

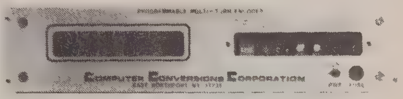
DC Snaptrak units feature analog 0-10VDC, ±10VDC and 4-20ma. current loop outputs, +12 or +24VDC power. High reliability electromagnet (no wear) pot replacers. 1000' long cables. Rotary differentials available too!

BUS CONVERTER FUNCTIONS

STANDARD SELECTIONS:
- ☐ ABSOLUTE ENCODER SYSTEMS
- ☐ SYNCHRO/RESOLVER TO DIGITAL
- ☐ DIGITAL TO SYNCHRO/RESOLVER
- ☐ SYN/RES CONTROL TRANSFORMERS
- ☐ MULTISPEED/MULTITURN SYS'S
- ☐ SYNCHRO/RES. DIFFERENTIALS
- ☐ ACTIVE CONTROL DIFFERENTIALS
- ☐ ABS. & INCREMENTAL OUTPUTS
- ☐ DC SIN/COS VECTOR GENERATOR
- ☐ DIGITAL MODULATORS & DEMOD'S
- ☐ COORDINATE CONVERTERS
- ☐ LVDT/RVDT CONVERSION
- ☐ A/D & D/A CONVERTERS
- ☐ MULTISPEED DIG. TO SYNCHRO

BUS FEATURES/OPTIONS

- ☐ TRANSFORMER ISOLATED I/O, NO GROUND LOOPS POSSIBLE! PRESERVES BUS INTEGRITY!
- ☐ NO EXTERNAL XFORMERS REQ'D.
- ☐ SYN./RES. REFERENCE SUPPLY
- ☐ REFERENCE POWERED UNITS
- ☐ BUS POWERED UNITS
- ☐ COMBINATION FUNCTIONS
- ☐ OEM CONFIGURATIONS
- ☐ SELF-TEST, & BUILT-IN-TEST
- ☐ MULTIPLEXED CONVERTERS
- ☐ 18 BIT 20 SEC. CONVERTERS
- ☐ 25 VA SYNCHRO POWER AMP'S
- ☐ STEPPERS/SERVO'S W/FEEDBACK



MULTITURN ENCODERS

Convert from 1 to 1024 turns of shaft input into 1,000 to 4,194,304 unique position locations. These true absolute encoders that retain their position information forever, regardless of any motion during a power outage. The encoder transducer is a highly reliable, environmentally sound, dual speed, rotary transformer.

TMDS–PC SERIES

PC card 4.5 x 6.5" & 64, 128, or 1024 turn position transducer, resolution 1024 to 16,384 part/turn. Buffered +5VDC TTL logic, parallel binary formats, three-state & data latch control lines, separate dual data ports opt. +12 and +15VDC power.

TMSAI SERIES

5 digit scaled panel mount LED readout, 9.5"W x 2.5"H x 8"D and with a size 23 Nema 12 transducer. Scaled BCD output & 16 bit binary output. 10, 36, 64, 100, 128 turns. 115VAC Power.

TMRE–CIM SERIES

1 million part full function readout system, 10,000 parts/turn, 100 turns full range, excellent for rack & pinion systems, adjustable datum point, pushbutton offsets, 5-30VDC BCD outputs, 115VAC power.

TMDS SERIES

2–1024 turns, resolution 100 to 65,536 per turn. Outputs optional. 4, 5, or 6 digit scaled readouts, operator offset options, panel or rack mount decoders. BCD binary, analog, gray code, RS232/422/485 serial, pulse-width, or bus compatible outputs, units with incremental & absolute outputs, multi-channel systems too!

*IBM is a trademark of International Business Machines

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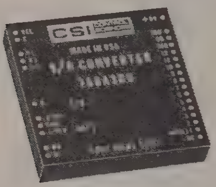
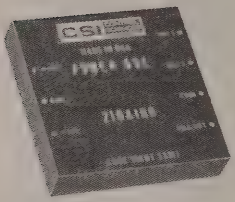
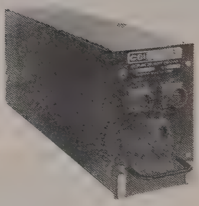
CSI CONTROL SCIENCES, INC.

CSI means ***FAST*** delivery!

OVER TWENTY YEARS OF COMMITMENT TO QUALITY







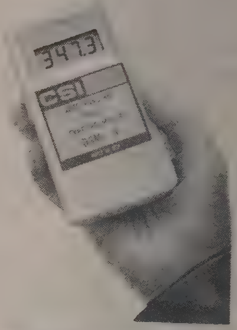
CSI specializes in providing ***real time, tracking,*** converters to digitize or simulate a wide variety of transducers such as . . .

SYNCHROS - RESOLVERS - LVDT's
RVDT's - INDUCTOSYN's™

. . . for military, industrial and commercial applications. CSI provides over ***sixty families*** of modules, boards, systems and instruments including:

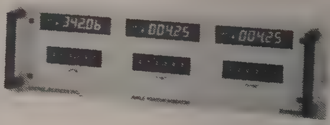
Synchro/Digital	Digital/Synchro
Resolver/Digital	Digital/Resolver
LVDT/Digital	RVDT/Digital
Inductosyn/Digital	Preamplifier
Angle Position Indicators	Testers
Solid State CT's	Solid State CDX's
Binary/BCD-BCD/Binary	Custom Converters

CSI is dedicated to maintaining the industry's ***highest reliability and fastest delivery.*** The actual field MTBF for standard products exceeds 2,000,000 hours and CSI delivers . . .



ON TIME - EVERY TIME!!!

Contact our Applications Hot Line for *immediate* assistance...(818) 709-4705



PIN FOR PIN REPLACEMENT GUIDE FOR ANALOG DEVICES CONVERTERS

Analog Devices Series	Control Sciences Series	Analog Devices Series	Control Sciences Series	Analog Devices Series	Control Sciences Series
AP1750	110A102	RDC1602	168F100	SDC1604	168H100
DSC1605	192B500	RDC1603	168F200	SDC1700	168F300V
DSC1705	192B700	RDC1700	168F300V	SDC1702	168F200V
DSC1706	192B800	RDC1702	168F200V	SDC1704	168F100V
DTM1716	192B203	RDC1704	168F100V	SDC1725	168T350
DTM1717	192B303	RDC1725	168T350	SDC1786	168F200
IPA1751	220A100	RDC1786	168F200	TSDC1608	168C300-8
IRDC1730	168L500	SBCD1756	168E600	TSDC1609	168C300-16
IRDC1731	168L400	SBCD1757	168E600	TSDC1610	168C300-32
OSC1754	110A200	SDC1602	168F100	TSDC1611	168C300-64
RBCD1756	168E600	SDC1603	168F200	TSL1612	167B100
RBCD1757	168E600				

Contact factory for second source replacements to other manufacturer's conversion products

CSI CONTROL SCIENCES INCORPORATED

9509 VASSAR AVENUE • CHATSWORTH, CA 91311
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synchro/resolver/Inductosyn™/LVDT converters

CSI

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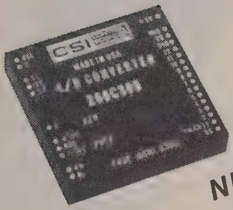
micro-module converter series (2" x 2")



NEW!

SYNCHRO/RESOLVER/INDUCTOSYN TO DIGITAL CONVERTERS

Series	Input Type	Frequency	Resolution	Accuracy	Remarks
268A300	Syn/Res	50-2600 Hz	12 bits	8.5 minutes	Tracking to 100 RPS. Velocity, inter LSB, ripple count, direction outputs
268B300	Res/Ind	400-10 KHz	12 bits	8.5 minutes	
268C300	Syn/Res	50-1200 Hz	12 bits	8.5 minutes	Low power 268A300
268D300	Syn/Res	50-5000 Hz	12 bits	8.5 minutes	+5 volt only, 3-state out
368H200	Syn/Res	50-2600 Hz	16 bits	3.5 minutes	3-state, synthesized ref
268A600	Syn/Res	50-1200 Hz	4 digit BCD	0.2 degrees	0-360/±180 modes*

*User Programmable

DIGITAL TO SYNCHRO/RESOLVER CONVERTERS

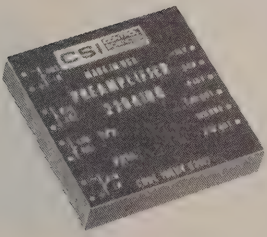
Series	Resolution	Output Type	Frequency	Accuracy	Remarks
292A700	14 bits	Syn/Res	50-2600 Hz	4 minutes	1.5 VA power out; drives CT loads
292A800	12 bits	Syn/Res	50-2600Hz	6 minutes	
392A100	16 bits	Syn/Res	47-440 Hz	2 minutes	5.0 VA power out; drives CT, CDX, TR loads
392A700	14 bits	Syn/Res	47-440 Hz	4 minutes	
392A800	12 bits	Syn/Res	47-440 Hz	6 minutes	

NEW!
NEW!
NEW!

LVDT (RVDT) CONVERTERS

Series	Description	Input type	Output	Frequency	Accuracy
278A300	LVDT/Digital	LVDT (RVDT)	11 bit offset binary	400Hz-10Khz	0.1% F.S.
378A100	Military LVDT/Digital	LVDT (RVDT)	14 bit offset binary	400Hz-5Khz	0.03% F.S.

NEW!



RESOLVER/ENCODER CONVERTER

Series	Input type	Ref. Osc.*	Frequency*	Resolution*	Outputs	Accuracy
268E300	Resolver 2.5 Vrms	Built in Osc., 2.5-7.0 Vrms	1000, 2600, 4000, 5000 Hz	128, 256, 512 1024 cycles	A quad B, zero marker	8.5 minutes

*User Programmable

RELATED PRODUCTS

Series	Description	Input	Output	Remarks
210A100	5 VA Oscillator	± 15 vdc	2.5-7.0 Volts	400 Hz-10 KHz, 90 deg output
220A100	Dual Preamp	Inductosyn	3 volts rms	Gain = 1300, 2.5 to 10 KHz
269A100	Binary/BCD	12 bit binary	4 decade BCD	0.125 rounding error, 30 mw pwr
280A300	Solid State CT	Syn/Res + binary angle	Demodulated ac	6 minute accuracy, 50-2600 Hz

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CSI synchro/resolver/Inductosyn™ to digital converters

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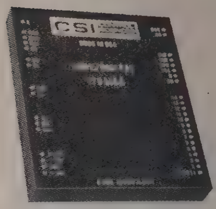
SPECIAL FUNCTION DEVICES

NEW!

Series	Description	Input	Output	Accuracy	Remarks	Size
110A100	5 VA power oscillator		6-115 Vrms 400-10 KHz		Adjustable amplitude	B
110A200	5 VA power oscillator		5, 10, 15, 20 Vrms, 10 KHz	±5%	Replaces OSC1754	B
175A100	3 VA Ampl.	S,R	S,R	±3 min.	3 VA power	B
178A100	LVDT/RVDT converter + pwr. osc.	LVDT, RVDT 2.5 Vrms 400-5000 Hz	14 bit binary + excitation	±0.03% F.S. @ × 1 gain	High BW, prog. gain, overrange	A
185A400	Solid-state CDX	S,R plus 13 bit digital angle	Output difference angle	±6 minutes	3 VA output power	B



SOLID STATE CONTROL TRANSFORMERS

Series	Resolution	Accuracy	Package[1]	Input[2]	Output	Remarks
180A200	10 Bits	± 15 Minutes	A	S,R 11.8 V or 90 Vrms	0.4 V/Deg (11.8 V In) 1.0 V/Deg (90 V In)	Output represents difference between input S(R) angle and digital angle. Output range ±7° from null.
180A300	12 Bits	±6 Minutes				
180A100	14 Bits	±4 Minutes				
188A300	12 Bits	N/A	B	Two Digital Angles, AC Ref.	± 10V for ½ scale	Output represents difference of two digital angles.

TWO SPEED TRACKING CONVERTERS

GENERAL DATA

CSI offers a broad line of modular and card mounted two-speed S/D and R/D converters with resolutions to 22-bits and accuracies to ±3-seconds of arc. All are type II tracking converters featuring no velocity error and only minor acceleration errors. Inputs withstand 1000% overvoltage without damage. Models available for multi-pole resolvers with up to 70° phase shifts.

FEATURES
- High accuracy
- Low cost
- 1000% overvoltage protection
- Industry standard pinouts

APPLICATIONS
- Geared two speed
- Multiple pole two speed
- Radar systems
- Robotics

NEW!

Series	Resolution	Accuracy	Tracking	Package[1]	Input[2]	Remarks
168H500	16 Bits	±20 Seconds	To 3 RPS	B	S,R 1:36 1:16, 1:32 3-130 Vrms 50-3000 Hz	Low cost single module version of above unit.
168M500				A		Low profile version of above.
168T500						Low profile 3-state version of above.
168K400	16 Bits	±20 Seconds	3 RPS	B	S,R 1:16, 1:32, 1:36. 3-130 Vrms 400-5000 Hz. Designed for multi-pole S,R.	Accurate single module 2-speed converter with **3-state outputs** and auto-correction for phase shifts to ±70°, ambiguity correction and "stick-off" voltage.
168K500	20 Bits	±7 Seconds	½ RPS			
168C300	10 Bits	±30 Minutes	30 RPS	B	S, R Binary Ratios 3-130 Vrms 50-1200 Hz	Coarse converter includes combiner for operation with 12 to 16 bit std. fine converter.
167B100	19 Bits	±½ LSB	—	B	Input from two std. S/D, R/D	Combiner for 36:1, 18:1, 9:1 speed ratios from two R/D, S/D converters.

[1] A = 3.125" × 2.625" × 0.40" module B = 3.125" × 2.625" × 0.80" module

[2] S = Synchro, R = Resolver

CSI CONTROL SCIENCES INCORPORATED

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synchro/resolver/Inductosyn™ to digital converters CSI

CSI means ***FAST*** delivery!

SINGLE SPEED TRACKING SYNCHRO/RESOLVER/INDUCTOSYN™ CONVERTERS

GENERAL DATA

CSI tracking converters will operate with over a wide range of voltages and frequencies with no degradation in performance. Most units will withstand 1000% overvoltage indefinitely without damage. By design, units may be supplied to fit non-standard requirements without impacting price or delivery. No cost options include non-standard input voltages, non-standard tracking rates and dynamic responses, plus dc output proportional to velocity.

FEATURES

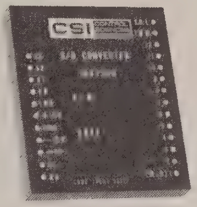
- Low power consumption
- True Type II tracking converter
- Industry standard pin-out
- 1000% overvoltage protection
- Insensitive to amplitude and frequency variations

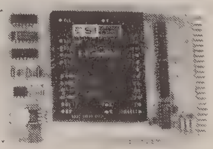
APPLICATIONS

- Radar tracking systems
- Navigation systems
- Industrial control systems
- Collision avoidance systems

GENERAL PURPOSE TRACKING

Series	Resolution	Accuracy	Tracking	Package[1]	Input[2]	Remarks
168F200	10 Bits	±30 Minutes	70 RPS	A	S,R 3-130 Vrms 50-1200 Hz	Industry standard broadband series. 1000% input overvoltage protection. Optional velocity output.
168F300	12 Bits	±8.5 Minutes	30 RPS			
168F100	14 Bits	±5.3 Minutes	10 RPS			
168T300	12 Bits	±8.5 Minutes	50 RPS	A	S,R 3-130 Vrms 50-2600 Hz	Outputs have three-state latches. Single word or two byte read.
168E700	1°	±1°	36 RPS	B	S,R 3-130 Vrms 50-1200 Hz	BCD converter features ultra-low power consumption. 1000% input overvoltage protection.
168E600	0.1°	±0.2°	36 RPS			
900B101S	4¼×6¼ inch card for most above units including sockets.					
SCB-24	4¼×6¼ inch system card accepts most tracking converters. Includes oscillator, optional 3-state latches or encoder (A quad B) output.					





HIGH ACCURACY/FAST TRACKING

Series	Resolution	Accuracy	Tracking	Package[1]	Input[2]	Remarks
168H100	16 Bits	±1.3 Minutes	3 RPS	B	S,R 3-130 Vrms 50-440 Hz	Synthesized reference corrects up to 70° phase shift.
168H200	16 Bits	±3.5 Minutes (±1.8 Minutes Repeatability)	5 RPS	A	S,R 3-130 Vrms 50-2600 Hz	Low cost 16 bit series with high repeatability.
168H600	14 Bits	±2.6 Minutes	30 RPS	A	R 2.5-11.8 Vrms 360-2600 Hz	High accuracy/fast tracking series.
168H700	15 Bits	±1.6 Minutes	17 RPS			
168H800	16 Bits	±1.3 Minutes	8 RPS			
900B115S	4¼×6¼ inch mounting card for above units including sockets.					

INDUCTOSYN™/RESOLVER CONVERTERS

Series	Resolution	Accuracy	Tracking	Package[1]	Input[2]	Remarks
168L400	4000 Counts	±2 Counts	100 RPS	A	R,I 2.5 Vrms 5000 Hz	Serial data plus zero crossing and direction outputs.
168L500	12 Bits	±8.5 Minutes	67, 87, 170 RPS	A	R,I 2.5 Vrms 400-10k Hz	Ripple carry and direction outputs, velocity output.
TACH-12	12 Bits	±8.5 Minutes	50, 75, 100 RPS	A	R 2.5-11.8 Vrms 400-5000 Hz	Features 1% precision velocity to replace tachometers. Flat response to 200 Hz.

1. A = 3.125" × 2.625" × 0.40" module B = 3.125" × 2.625" × 0.80" module
2. S = Synchro, R = Resolver, I = Inductosyn™

CSI CONTROL SCIENCES INCORPORATED

9509 VASSAR AVENUE • CHATSWORTH, CA 91311
(818) 709-5510 FAX (818) 709-8546

CSI **digital to synchro/resolver converters**

CSI means ***FAST*** delivery!

DIGITAL TO SYNCHRO/RESOLVER CONVERTERS

GENERAL DATA

The series 192 is a family of TTL/LSTTL/CMOS compatible digital to synchro/resolver converters with 1.5 VA to 125 VA output power ratings. Natural parallel binary angle data is continuously converted to analog AC form . . . either as 3-wire synchro or 4-wire resolver signals capable of driving most control transformers or torque receivers. All models are short circuit and overload protected.

FEATURES

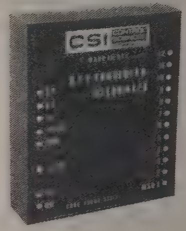
- 12 to 14 bit resolution
- Module or card mounted models
- 1.5 to 125 VA output power
- "Locked rotor" protected (5, 125 VA)
- Thermal overload protected (5, 25, 125 VA)
- Automatic shutdown/recovery (125 VA)

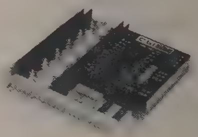
APPLICATIONS

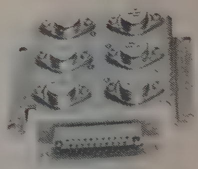
- Trainers
- Simulators
- Remote indicators

Series	Resolution	Output Drive	Output[2] Level	Accuracy	Package[1]	Remarks
192B200	14 Bits	5 ma	R, ±10 V DC-2600 Hz	± 3 Minutes	A	High accuracy vector generator with 0.1% scale factor variation.
192B500	14 Bits	1.5 VA	S,R 11.8 or 90 Vrms 60 or 400 Hz	±4 Minutes	B	Logic voltage +5 to +10 Vdc
192B700	14 Bits	1.5 VA	S,R 11.8 or 90 Vrms 60 or 400 Hz	±4 Minutes	B	Internal +5V logic voltage.
192B800	12 Bits	1.5 VA		±8 Minutes		
192E500	12 Bits	5 VA	S.R 11.8 or 90 Vrms 60 or 400 Hz	±6 Minutes (CT) ±12 Minutes (TR)	B	Built in heat sink with integral overtemperature cutoff, automatic "locked rotor" prevention. Loss of one ±15 Vdc supply will not damage unit.
192E600	14 Bits	5 VA		±4 Minutes (CT) ±12 Minutes (TR)		
SCB-22	4¼×6¼ inch card includes 192B700, 192B800, 192E500 or 192E600, 400 Hz models and features input data latches					
SCB-25	4¼×6¼ inch card includes 192B700, 192B800, 192E500 or 192E600, 60 Hz models with transformers and input data latches.					
192A600	12 Bits	25 VA	S, 11.8 or 90 Vrms 60 or 400 Hz	±10 Minutes (CT) ±21 Minutes (TR)	5¼ x 5⅜ inch card + transformer.	Board mounted unit features input data latches, output disable, overtemperature cutoff, external transformers. Kits available.
192A650	12 Bits	125 VA	S. 11.8 or 90 Vrms 60 or 400 Hz	±6 Minutes No Load ±21 Minutes Full Load	5¼ x 5⅜ inch card + power buffer & transformer.	Board mounted unit as above 192A600 plus automatic "locked rotor" prevention, automatic overload shutdown and recovery. External transformers and power buffer. Kits available.
SCC-10	5¼×5⅜ inch transformer card for 192A600 series, one or two pair per card assy.					

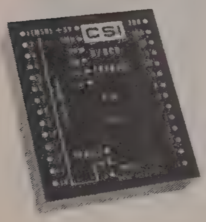
1. A = 3.125″ × 2.625″ × 0.40″ module B = 3.125″ × 2.625″ × 0.80″ module
2. S = Synchro, R = Resolver







BINARY/BCD, BCD/BINARY CONVERTERS



NEW!

Series	Input	Output	Accuracy	Package[1]	Conversion Time	Remarks
169A107	16 Bits	359.99°	±01°	B	2.5 us	5 Decade Binary/BCD
169A108	19 Bits	359.999°	±0009°	B	75 ms	6 Decade Binary/BCD
169A200	To 19 Bits	scalable	±0.0003%	B	400 ms	To 6 Decade Binary/BCD
196A100	359.99°	16 Bits	±.003°	B	300 ns	5 Decade BCD/Binary
196A102	359.999°	19 Bits	±.0006°	B	600 ms	6 Decade BCD/Binary

1. B = 3.125″ × 2.625″ × 0.80″ module

CSI CONTROL SCIENCES INCORPORATED

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(818) 709-5510 FAX (818) 709-8546

CSI **synchro/resolver/encoder systems/related products**

CSI means ***FAST*** delivery!

Now you can measure, align, or checkout synchro systems with a rugged meter that fits in your hand.

The *world's first* handheld Digital Synchro Meter . . .the DSM-4™.

347.3
CSI
AUTO RANGING
DIGITAL
SYNCHRO METER
DSM 4

- Auto ranges to accept all standard military synchro signals
- 7-14/54-108 volt stators
- 20-140 volt reference
- 47 to 1200 Hz frequency range
- Large 0.5″ four digit LCD display
- 0 to 359.9 degrees range
- ±0.2 degree accuracy
- Rugged, battery powered

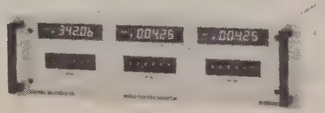
And now the world's first handheld Digital Resolver Meter. . .the DRM-4.™

All features of the DSM-4™ except autoranging. The DRM-4™ features two voltage ranges selectable by the power switch. Standard voltage ranges are 3.5 to 7.0 and 7.0 to 14 volts rms. Reference is 3.5 to 30 volts, 47 to 2600 Hz.

ANGLE POSITION INDICATORS

FEATURES

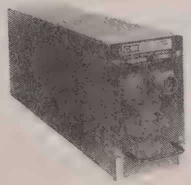
- 1, 2, or 3 Channels
- Synchro/Resolver/Encoder inputs
- 5 or 6 Decade display
- Binary digital outputs
- Full 360° offset
  Maintenance/Calibration Free



AIRBORNE SYNCHRO AMPLIFIER

FEATURES

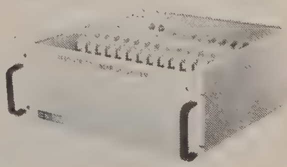
- ½ ATR case
- 2 input channels
- Four 5 VA outputs
- Exceeds MIL-STD-704D
- MIL-STD-810, 514.2
- MIL-E-5400, Class 1A



MULTICHANNEL DATA ACQUISITION SYSTEM

FEATURES

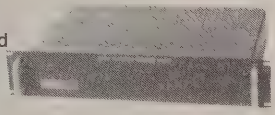
- Synchro or resolver input
- Up to 26 channels
- 0-10V analog output
- Integral power supply
- 60 or 400 Hz



8 CHANNEL DIGITAL/SYNCHRO CONVERTER SYSTEM, 57-440 HZ

FEATURES

- Synchro or Resolver Output
- Dual Rank Data Registers
- 8 Bit Byte or 12 Bit Data Word
- 1.2 VA Outputs 57 to 440 Hz
- ±6 Minutes Accuracy



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(818) 709-5510
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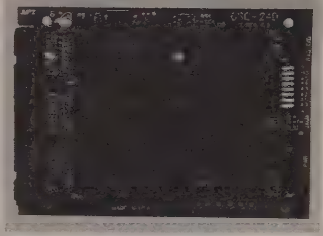
DATA ACQUISITION

GORDOS

SERIAL COMMUNICATION DEVICES

24-POINT DIGITAL CONTROLLER MODEL GSC-24D

- Controls any combination of 24 digital Input and Output modules
- Programmable input filters prevent contact bounce effects
- 16-bit input counters
- 500 Hz input count rate
- High current open-collector outputs



Specifications: Multidrop, 63 addresses, RS-422/485 @ 1200, 2400, 4800, 9600 baud; 5000' cable length; 5.5" long x 4.0" wide; power 5VDC @ 80 mA; Input low -0.5 to 0.8VDC; Input high 2 to 5VDC

16-POINT DIGITAL CONTROLLER MODEL G1

- Controls any combination of 16 digital Input and Output modules
- Serial data communication rates from 300 to 38.4K baud
- Plug-compatible with H-series module mounting boards
- Low-power CMOS design

Specifications: Multidrop RS-422/485 @ 300, 600, 1200, 2400, 4800, 9600, 19.2K, 38.4K baud; 5000' cable length; 4.5" long x 4.0" wide; power 5VDC @ 65 mA

64-POINT ANALOG CONTROLLER MODEL GSC-64A

- Controls any combination of 64 analog Input and Output modules
- 12-bit ADC plus sign bit
- 12-bit digital to analog converter
- 390 µsec per point scan time

Specifications: Multidrop, 63 addresses, RS-422/485 @ 1200, 2400, 4800, 9600 baud; 5000' cable length; 5.5" long x 4.0" wide; power 5VDC @ 40 mA; ±12VDC @ 100mA; Analog ±5V

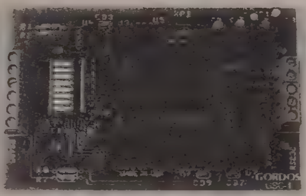
24-DIGITAL AND 64-ANALOG POINT CONTROLLER MODEL GSC-64A24D

- Controls any combination of 24 digital and 64 analog I/O modules
- All GSC-64A and GSC-24D features in one-third less space
- Dual micro-controllers assure uncompromised performance

Specifications: Multidrop, 63 addresses, RS-422/485 @ 1200, 2400, 4800, 9600 baud; 5000' cable length; 6.0" long x 5.5" wide; power 5VDC @ 120 mA; ±12VDC @ 100mA; Analog ±5V

INTELLIGENT RS-232 TO RS-422 CONVERTER MODEL GSC-1

- RS-422/485 multi-drop
- Programmable RS-232 baud rate
- 25000 byte buffer queue
- Programmable RS-232 STX-EOT
- Programmable character substitution
- Supports XON/XOFF protocols



Specifications: RS-422/485 and RS-232 @ 1200, 2400, 4800, 9600 baud; Multidrop, 63 addresses, 5000' cable length; 4.5" long x 2.8" wide; power 5VDC @ 80 mA

INPUT-OUTPUT EXTENDER MODEL GSC-IOX

- Replaces 24 heavy gauge wires and conduit with two light-gauge twisted-wire pairs
- Outputs reflect status of inputs
- Updates 24 points in < 1.5 msec.
- No programming required
- 5000 foot range

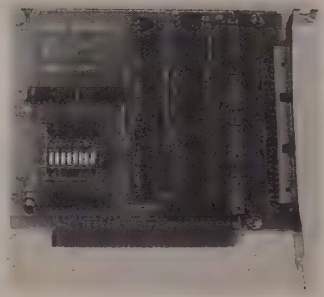
GORDOS
ARKANSAS

Specifications: RS-422/485 @ 9600, 31K, 41K, 125K baud; 5000' cable length; 5.5" x 4.0"; power 5VDC @ 90mA

PC/XT/AT COMPATIBLE INTERFACES

24-CHANNEL PARALLEL INTERFACE MODEL IPI-24

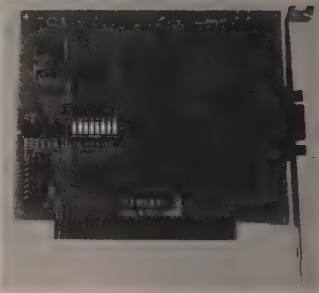
- Controls any combination of 24 digital Inputs and Outputs
- Drives PAM bus, I/O modules or G-series SSRs directly
- Open-collector output drivers
- Outputs held off during power-up
- 300 foot cable range



Specifications: connector 50-pin 4-wall header; inputs: -.5 to .8VDC low; 2 to 5VDC high; Outputs: low = .9VDC @ 100mA., high = 5VDC open-collector; PC power = 5VDC @ 250mA

RS-422/485 SERIAL INTERFACE MODEL ISI

- 5000 foot range
- Multi-drop capability
- Serial communication rates from 150 to 57.6K baud
- Switch and jumper selectable COM addresses and INTs
- Serial line Transorbs®



Specifications: RS-422/485 @ 120 to 57.6K baud; 8250 UART; Jumper select: COM1 - COM4; DTR or RTS tri-state RS-485; 5000' cable length; power = ±5VDC @ 150mA

See Gordos Relays & Digital I/O in Section 4500 and Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

DATA ACQUISITION

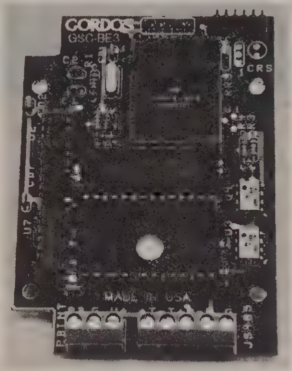
GORDOS

SINGLE BOARD PROGRAMMABLE DEVICES

BASIC ENGINE
MODEL GSC-BE3

- Piggy-backs on GSC controllers
- Miniature computer for local control
- Programmable in BASIC language
- Additional RS-422/485 serial port
- Battery-backed RAM and clock
- Software Master or Slave operation

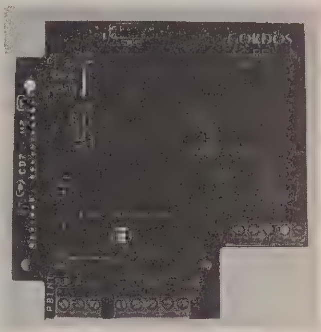
Specifications: RS-422/485 port; 68HC811A2 micro-controller; 27C256 EPROM; 58256 RAM; DS1216 smart socket; 8MHz xtl; 2.8" x 4"; power = 5VDC @ 100mA



SUB-NET BASIC ENGINE
MODEL GSC-BE3/SN

- Piggy-backs on GSC controllers
- Two RS-422/485 serial ports
- Master or Slave operation
- Battery-backed RAM and clock
- Programs in BASIC language

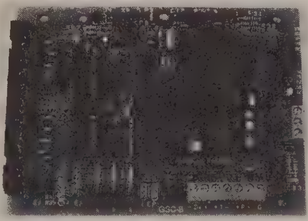
Specifications: Two RS-422/485 ports; two 68HC811A2 µC; 27C256 EPROM; 58256 RAM; DS1216 smart socket; 8MHz xtl; 4" x 4"; power = 5VDC @ 100mA



MICRO ENGINE
MODEL GSC-8

- Stand-alone microcomputer with digital and analog I/O
- Programmable in BASIC language (optional "C" language model)
- RS-422/485 or RS-232 serial port
- Protected analog and digital inputs
- Battery-backed RAM and clock

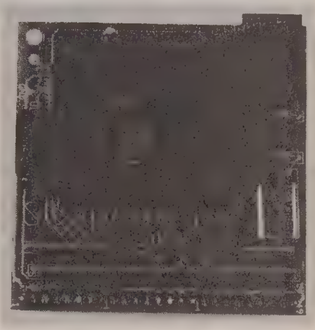
Specifications: RS-232/422/485 port; 68HC811A2 µC; 27C256 EPROM; 58256 RAM; DS1216 smart socket; 8MHz xtl; 5.5" x 4"; 5VDC @ 100mA; 8 DI; 8 DO; 8 AI



STEPLADDER PLC
MODEL STEPLADDER

- Ladder logic programming
- Piggy-backs on H-series boards
- RS-232 serial port for programming and linking two STEPLADDERS
- Direct host operation of I/O points, internal relays, counters and timers
- Mix inputs and outputs

Specifications: RS-232 port; 1200, 2400, 4800, 9600 baud; 24 I/O points; 88 internal relays; 20 msec. scan time; 68HC705 µC; 2.6" x 2.6"; 5VDC @ 15mA



ANALOG I/O MODULES AND BOARDS

ANALOG I/O
MODULES

- High accuracy (±0.05%)
- Fully isolated
- IEEE STD-472 transient protection
- 240V RMS field wiring protection
- 4-20mA & 0-20mA output models
- mV, V, mA, RTD, TC, strain gauge, wide-band mV & V, linearized TC

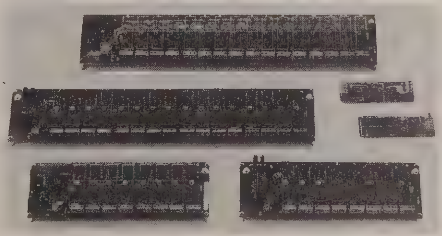
Specifications: xtr coupling; 1500 VRMS CMV isolation; 2.25" x 2.25" x 0.6"; 5VDC; 4Hz or 10KHz bandwidth, ±5 or 0 to 5V output; 20 µsec. select time

AI30
AI31
AI32
AI34
AI37
AI38-02
AO39
AI40
AI41
AI47

PA SERIES ANALOG
MODULE MOUNTING BOARDS

- Mix input and output modules
- 1, 2, 8, 16-position models
- 8 and 16-point multiplexed models (compatible with GSC-64A)
- Thermocouple-wire junction temperature compensation circuits
- Current-conversion resistor sockets

Specifications: 5VDC; 4-pin field conn.; 26-pin header logic conn.; PA-1 & PA-2 DIN compatible, PA-8: 3.5" x 10"; PA-16: 3.5" x 17.4"



See Gordos Relays & Digital I/O in Section 4500 and Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

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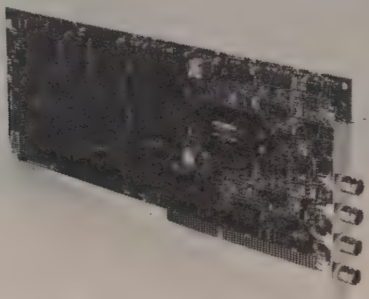
A/D - D/A & ATE BOARDS High Performance PC & VME



MADE IN USA

FEATURES

- Resolution to 14 bits
- Sample rates to 5MHz
- On-board A/D memory for gapless streaming to disk or memory with no lost samples
- 2 to 4-channel, high-speed, simultaneous sampling for signal phase de-skewing
- Very low harmonic distortion and wide input bandwidth
- Ideal for DSP and FFT's

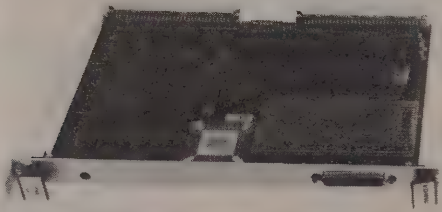
PC, PC/AT, EISA

ANALOG INPUT - PC, PC/AT, EISA

Model	Channels	Speed	Resolution	Data Memory	Notes
PC-411/412 Series	16S / 8D A/D	83kHz	12, 14 bits	512 Samples	4 simultaneous D/A (PC-412), DMA, interrupt, digital I/O.
PC-414 Series	16S / 8D A/D	5MHz	12, 14 bits	16k Samples	2 / 4 channel simultaneous sampling, streaming design.
PC-430 Series	16S / 8D A/D	5MHz	12, 14 bits	220k Samples	320C30 DSP, "no programming" library, 512 kb SRAM.
PC-440	32S or 16D A/D channel expander slave board - cascadable to 256 channels.				
PC-415 (Q4 93)	16S / 8D A/D	5-10MHz	12, 14 bits	32k Samples	32-bit EISA bus, non-bus port to streaming slave memory.
MS-DOS and WINDOWS "virtual instrument" data save / display / math software.					

ANALOG OUTPUT AND SPECIAL FUNCTIONS - PC/AT

MEM-30/30A	1 or 4 megabyte, high-speed A/D expansion memory for PC-430 or DVME-630				
PC-422A/B	8 / 16 D/A	330kHz	12 bits	None	16-channel simultaneous update, programmable timer / interrupt.
PC-462	4 D/A, 4 A/D	Quad programmable power supply board. Isolated outputs (2) ±6V @ 1A, (2) ±20.5V @ 250mA.			
PC-420	2-channel, 40MHz Arbitrary Waveform Generator board, 64ks waveform memory, 8 filters.				



FEATURES

- Resolution to 16 bits
- Sample rates to 5MHz
- 6U VME "double height" format
- On-board A/D memory for gapless streaming to disk or memory with no lost samples
- 2 to 4-channel, high-speed, simultaneous sampling for signal phase de-skewing
- Very low harmonic distortion and wide input bandwidth
- Ideal for DSP and FFT's

VME

ANALOG INPUT

Model	Channels	Speed	Resolution	Data Memory	Notes
DVME-611/612 Series	32S / 16D A/D	400kHz	12, 14, 16 bits	None	Expansion to 160 channels. Software gain amplifier.
DVME-601 Series	16S / 8D A/D	300kHz	12, 14, 16 bits	128kb	68010 CPU, "no programming" monitor/EXEC library.
DVME-613 Series	16S / 8D isolated	40kHz	12, 14, 16 bits	None	Protected inputs, digital I/O, interrupt, A/D clock.
DVME-614 Series	16S / 8D A/D	5MHz	12, 14 bits	16k Samples	2/4 channel simultaneous sampling, streaming design.
DVME-630 Series	16S / 8D A/D	5MHz	12, 14 bits	220k Samples	320C30 DSP, "no programming" library, 512kb SRAM.
DVME-641/643/645	A/D MUX Channel Expanders, slave to DVME-611, 601. Thermocouple, 8 channel simultaneous.				

ANALOG OUTPUT AND SPECIAL FUNCTIONS

DVME-628	8 D/A	167kHz	12 bits	--	Selectable 4-20mA loops or voltage output.
DVME-626V	6 D/A	67kHz	16 bits	--	±0.005% non-linearity.
DVME-621	4 D/A isolated	91kHz	12 bits	--	Power DAC, ±11V @ 100mA or 160mA loops.
DVME-622	8 / 16 D/A	330kHz	12 bits	--	16-channel simul. update, programmable timer/interrupt.
DVME-691	Rack-mount signal conditioner screw terminator w/flat cables for A/D and D/A.				
DVME-660	48-line digital I/O, programmable In/Out, timer, interrupt, external trigger, comparator.				

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DATA CONVERSION Components

Sampling Analog-to-Digital Converters

Model	Resolution (Bits)	Throughput Rate (MHz)	Performance at Nyquist SNR (dB)	Performance at Nyquist THD (dB)	Power Dissipation (Watts)	Package
ADS-CCD1201 ③	12	1.0	71	–78	1.3	24-PIN DDIP
ADS-112	12	1.0	71	–73	1.3	24-PIN DDIP
ADS-193	12	1.0	71	–73	1.3	40-PIN TDIP
ADS-CCD1202 ③	12	2.0	70	–76	1.6	24-PIN DDIP
ADS-117	12	2.0	71	–71	1.6	24-PIN DDIP
ADS-132	12	2.0	68	–71	2.9	32-PIN TDIP
ADS-118/118A	12	5.0	68	–73	1.8	24-PIN DDIP
ADS-119 ①	12	10.0	68	–67	1.4	24-PIN DDIP
ADS-120 ①	12	20.0	66	–69	3.9	40-PIN TDIP
ADS-926	14	0.500	80	–87	1.3	24-PIN DDIP
ADS-928	14	0.500	81	–82	2.5	32-PIN TDIP
ADS-927	14	1.0	78	–80	1.4	24-PIN DDIP
ADS-941	14	1.0	79	–82	2.8	32-PIN TDIP
ADS-942/942A	14	2.0	77	–79	2.9/2.2	32-PIN TDIP
ADS-944 ①	14	5.0	76	–77	2.9	32-PIN TDIP
ADS-945 ②	14	10.0	73	–76	4.9	Custom DIP
ADS-930	16	0.500	84	–85	3.4	40-PIN TDIP
ADS-931 ②	16	1.0	84	–85	3.9	40-PIN TDIP

Evaluation boards are available for all Sampling A/D's ① Q3 - 1993 ② Q4 - 1993 ③ Application specific for imaging systems

Multiplexers

Model	Channels	Settling Time	Access Time (ns)	Input Range (Volts)	Power Dissipation (Watts)	Package
MX-826	8 SE	225 ns to 0.01% 400 ns to 0.003%	70	±10	0.395	24-PIN DDIP
MX-850	4 SE	50 ns to 0.01% 100 ns to 0.001%	20	±10	0.207	14-PIN DIP

Sample-and-Hold Amplifiers

Model	Linearity (%)	Acquisition Time (ns)	Aperture Jitter (ps)	Input Range (Volts)	Gain	Bandwidth (MHz)	Power Dissipation (Watts)	Package
SHM-43	0.01	25	±1	±2	+1	150	0.460	14-PIN DIP
SHM-49	0.01	160	±25	±10	–1	16	0.365	8-PIN DIP/LCC
SHM-945	0.00076	400	±10	±10	–1	16	0.305	24-PIN DDIP
MSH-840①	0.01	775	±15	±10	+1	13	2.25	32-PIN TDIP

① Quad simultaneous sample-hold with 4-channel multiplexer, output amplifier, and control logic

Hybrid Data Acquisition Systems

Model	Resolution (Bits)	Throughput Rate (kHz)	Linearity Error (LSB)	Input Range (Volts)	Power Dissipation (Watts)	Channels	Package
HDAS-8	12	50	±1	±0.05 to ±10	1.25	8 DE	62-PIN QDIP
HDAS-16	12	50	±1	±0.05 to ±10	1.25	16 SE	62-PIN QDIP
HDAS-75	12	75	±3/4	±0.1 to ±10	0.500	8 SE	40-PIN DDIP
HDAS-76	12	75	±3/4	±0.1 to ±10	0.500	4 DE	40-PIN DDIP
HDAS-534/524	12	250/400	±3/4	±0.1 to ±10	2.6	4 DE	40-PIN DDIP
HDAS-538/528	12	250/400	±3/4	±0.1 to ±10	2.6	8 SE	40-PIN DDIP

Note: Most models offer an extended temperature range (-55°C to +125°C) as well as a commercial temperature range (0°C to +70°C) version. Selected models offer MIL-STD-883 and DESC standard military drawing versions. Contact DATEL for availablility and price.

MADE IN USA

***Also available*: Analog-to-Digital Converters, Digital-to-Analog Converters, Tuneable Active Filters, Operational Amplifiers, Isolation Amplifiers, and Instrumentation Amplifiers.**

DATUM TIMING

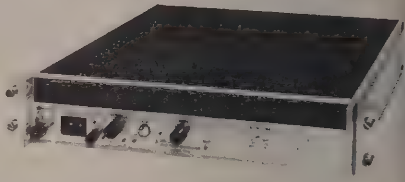
Time Code Generators

Designed for applications requiring low cost, simplicity and high reliability, Datum's time code generators develop time code signals suitable for magnetic tape recording and distribution to remote locations. These units are available in many configurations, and a wide variety of optional features permits the equipment to be tailored to virtually any application.

Model 9100/9110 Time Code Generators

Model 9100

The Model 9100 generates a modulated IRIG B time code signal and multiple pulse rate outputs. Front panel controls enable the instrument to be preset, started and halted. Each time digit can be preset individually to facilitate time-of-year or elapsed time operation. A front panel LED display provides a continuous indication of the encoded time value. The generator is contained in a 1-3/4" high chassis designed for mounting in a standard 19" equipment rack.

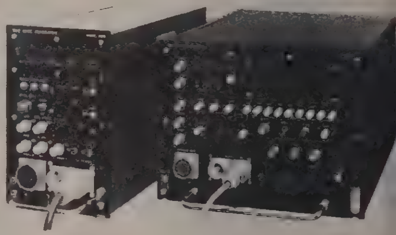

Model 9110

The Model 9110 includes all the features of the Model 9100, with increased chassis space and added internal power capacity. This unit also generates both modulated and DC-level-shift versions of the IRIG B time code, and a 30-line parallel BCD output reflecting encoded time. Available in 3-1/2" and 5-1/4" high chassis configurations, the Model 9110 accommodates a greater number of optional features than the Model 9100.

Model 9150 Time Code Generators

This family of time code generators is designed for airborne, shipboard and portable applications, where reliable operation in rugged environmental conditions is essential. Available in many configurations, these units offer the systems engineer a wide choice of optional features, functional capabilities and physical sizes in order to meet the requirements of virtually any mobile application. A few of these configurations are described below.

Model 9150-100 Time Code Generators


Model 9150-100

This instrument offers the greatest potential for multiple capabilities of any of the 9150 family. The unit is contained in a 1/2- or full-ATR chassis (depending on internal space requirements) conforming to Military Standard MS91403 (ATR type) requirements. Basic circuitry and optional features are mounted on individual circuit cards to facilitate both maintenance and future expansion.

The basic unit is driven by a temperature compensated, crystal controlled oscillator and produces 1-, 10- and 1k-pps pulse rate outputs. A nine-digit LED time display is located on the front panel. Input power requirement is +28 Vdc. All electronic components are mounted on plug-in PC boards to facilitate maintenance and future expansion.

Model 9150-406 Time Code Generators

Model 9150-406

This unit is smaller than the Model 9150-100, but still offers a comprehensive list of capabilities. Basic outputs include modulated IRIG B time code, 1-, 1k- and 1M-pps pulse rates, and 30-bit parallel BCD time data.

The generator can be automatically synchronized to an incoming IRIG B signal or manually reset for elapsed time applications. Several functions can also be remotely controlled via dedicated input lines. Input power requirement is +28 Vdc. A rechargeable battery supply is also included. The unit measures 4" high, 5" wide and 8" deep.

Model 9150-300 Time Code Generators

Model 9150-300

Measuring just 2" high, 5" wide and 4" deep, this light weight, microprocessor controlled instrument is designed for installation in confined spaces. The unit generates a modulated IRIG B time code output and features a nine-digit LED time display. CMOS microcircuits minimize space and power requirements.

The unit operates on +12 Vdc power, and is equipped with a Nicad battery supply for continued operation in the event of a power failure.

Model 9150-3000 Time Code Generators

Model 9150-3000

Its miniature size (2-3/4" high, 3" wide, 5-3/4" deep) makes this instrument an ideal candidate for applications involving airframes, remotely piloted vehicles, etc. The unit generates modulated IRIG B time code, and operates on either +12- or +28-Vdc power. An internal battery supply is included.

Time Code Translators, Readers, Displays

Model 9200/9210 Time Code Translators

This unit is ideally suited to applications requiring precise time code translation, coupled with low cost, high reliability and space for a limited number of optional features. Configured to read the standard IRIG B code format, the basic Model 9200 includes a front panel display and TTL-compatible, multiple-rate pulse train outputs. Wide band input, automatic forward/reverse code translation and digital error filtering make the unit particularly useful for high-speed tape search operations. Measuring just 1-3/4" high, the chassis is designed for mounting in a standard 19" equipment rack.

The Model 9210 includes all the features of the Model 9200, with increased chassis space and added internal power capacity. In its basic configuration, this unit translates multiple IRIG time code formats, and produces multiple-rate pulse trains and a 42-line parallel BCD output reflecting encoded time. Available in 3-1/2" and 5-1/4" high chassis configurations, the Model 9210 accommodates a greater number of optional features than the Model 9200.

Model 9200

Model 9210

Model 9500 Remote Displays

A Model 9500 Remote Display can be used with any Datum Timing instrument, or similar source of parallel BCD input data, to display time and/or event information. Units are available in configurations ranging from six digits (seconds, minutes and hours) to 13 digits (time and event data). LED display elements are employed in sizes ranging from 0.4" to 2.0" and larger. Multiple units can be daisy chained via rear panel connectors. The Model 9500 measures 1-3/4" or 3-1/2" high and is designed for mounting in a standard 19" equipment rack.

Model 9500

Model 9520 Time Display

The Model 9520 reads an IRIG A, B or E modulated time code signal (as optionally defined) in order to display time information in installations involving long distances and/or multiple sites. A modulated code signal transmitted over a single transmission line is much more satisfactory for a widely distributed network.

A 30-bit parallel BCD time output is provided via a rear panel connector. LED display elements are employed in sizes ranging from 0.4" to 2.0" and larger. The unit measures 1-3/4" or 3-1/2" high and is designed for mounting in a standard 19-inch equipment rack.

Model 9520

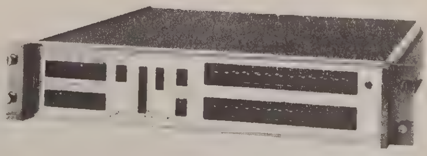
Tape Search and Control Units

Model 9241 Tape Search and Control Units

This unit provides all control functions required by an instrumentation tape transport to locate a segment of tape defined by preselected start and stop times. By comparing its start/stop time switch settings with translated time code from the data tape, the 9241 exercises precise control over the transport to conduct an automatic forward/reverse search operation.

Microprocessor control and modular construction provide high reliability, enhanced field maintenance capability, and future expandability. The unit measures 3-1/2" high, 17" wide and 18" deep, and is designed for mounting in a standard 19-inch equipment rack.

Remote operation via RS-232, IEEE 488 or General Purpose Input/Output interfaces are optionally available.



Model 9241

DATUM TIMING

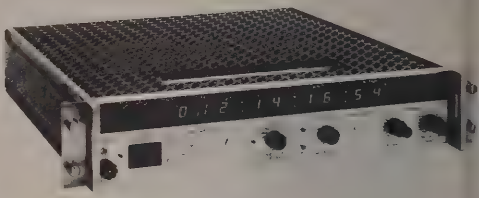
Multifunction Instruments

Model 9300/9310 Time Code Generator/Translators

The Model 9300 combines the primary functions of the 9100 and 9200 to provide generation and translation of the IRIG B time code. Multi-rate pulse trains (1k, 100, 10 and 1 pps) are also generated by the basic unit. Designed for mounting in a standard 19" equipment rack, the unit measures just 1-3/4" high. A nine-digit LED display reflects translated or generated time, depending on the selected mode of operation. Each digit can be preset by the operator. All controls and indicators are located on the front panel.

The Model 9310 includes all the features of the 9300, with increased chassis space and added power capacity. In its basic configuration, this unit translates multiple IRIG time code formats, and produces multiple-rate pulse trains and a 42-line parallel BCD output reflecting encoded time. Available in 3-1/2" and 5-1/4" high chassis configurations, the Model 9310 accommodates a greater number of optional features than the Model 9300.

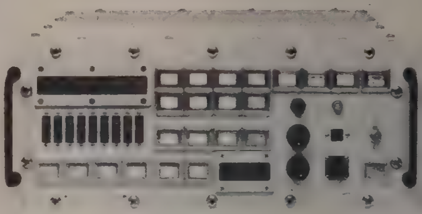
Model 9300



Model 9310

Model 9340 Service Qualified Timing Subsystem

The only equipment of its type to meet MIL-E-16400 requirements, the Model 9340 Timing Subsystem (TD-1307/U) is service qualified for shipboard operation. The unit generates and translates IRIG B time code and conducts automatic tape search operations. Internal circuitry is mounted on a series of plug-in modules. Each module also includes self-test circuitry to check for proper operation and display test status information. The Model 9340 is designed for mounting in a standard 19" equipment rack and measures 7" high.



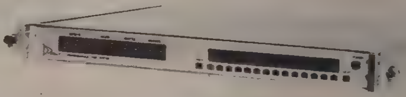
Model 9340

Model 9700/9710 Programmable Time Systems

The Model 9700 is available as either a time code generator or generator/translator, suitable for data correlation, magnetic tape recording, etc. Tape search capability can also be included. Microprocessor based design and modular construction provide high reliability, user friendly operation, expandability and compact size. All setup data and status indications are shown on an alphanumeric display, which also prompts the operator through the various programming procedures required for setup and operation. Diagnostic self tests are automatically performed each time power is applied. Time is continuously visible via the LED display.

The Model 9710 includes all the features of the Model 9700, with increased chassis space and added internal power capacity.

The basic generator function produces IRIG B code. Seven variations of the IRIG code can be processed by the translator. Both units are designed for mounting in a standard 19" equipment rack. The 9700 measures 1-3/4" high and the 9710 is 3.5" high.



Model 9700

Model 9710

Synchronized Time Code Generators

Synchronized Time Code Generators are designed to generate IRIG time code either in the normal fashion or in synchronism with an incoming IRIG time code signal. In the synchronized generator mode, the internal clocking oscillator is servo controlled to maintain phase coherency with the input time code. This produces IRIG time codes and multiple pulse rate outputs in synchronism with the input code. Generation will continue even if the input code is interrupted.

Units are available either as dedicated instruments (the Model 9390 Synchronized Time Code Generator), or as derivatives of other equipment such as the Model 9100, 9300 or 9700. Designed for mounting in a standard 19" equipment rack, chassis range in height from 1-3/4" to 5-1/4".

Model 9390 Sync Generator

Special Application Instruments

Current Datum GPS Users are invited to call our Hotline Information Center at (714) 533-4956

Model 9390 GPS Time/Frequency System

By monitoring code transmissions from Navstar satellites in the GPS constellation, Datum's 9390 family of GPS receivers offers convenient, on-site access to time and frequency data of unparalleled precision, anywhere on earth. These instruments have enjoyed wide acceptance in the time and frequency community and have opened a host of new possibilities to instrumentation professionals.

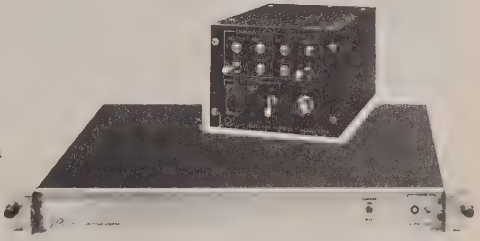
Dual channel design enables the 9390 to function as a time and frequency measurement device equally well in dynamic (vehicle speeds up to 600 knots) and fixed-platform installations. Retention of time and almanac data enables the unit to perform visible satellite acquisition in less than two minutes. Geographical position in latitude, longitude and altitude (WGS 84) is determined automatically via an internal position locator algorithm.

Two types of packaging are available – a 19" rack mounting or tabletop unit, and ruggedized versions for portable or mobil applications. In either case, the receivers are completely self contained except for their antenna/preamp assemblies. The antenna/preamp assemblies are very compact (1.5" high, 4.75" wide, and 4.0" deep, including base) and weather proof, and can be installed in any location providing line-of-sight reception.

Model 9390 GPS Receivers

Video Time/Data Inserters

Video Time Inserters insert translated IRIG B time information into a composite video signal, thereby enabling time to be displayed on a video monitor or television screen. With a time tag in every frame, the video data can also be correlated with various system elements, such as strip chart recorders, printers, magnetic tape units and computers. Units are available in a variety of configurations, ranging from plug-in PC boards to miniaturized airborne units. Optionally, a line of up to 16 alphanumeric characters can be inserted immediately below the time word.



Video Time/Data Inserters

Video Data Encoders and Readers

These units permit digital information to be transmitted within a composite video signal in a manner that is completely transparent to the viewer. The basic characteristics of the video signal remain unaffected.

The Video Data Encoder converts parallel input data into a Datum serial NRZ format. The data, representing up to eight consecutive lines of information, is inserted into the vertical blanking interval of the composite video signal for transmission to a video recorder or remote receiver. The Video Data Reader extracts the encoded information from a received video signal and converts it to an eight-bit parallel format meeting the requirements of most computer interface specifications.

Both the Encoder and Reader are contained in a 1-3/4 inch high chassis designed for mounting in a standard 19" equipment rack.

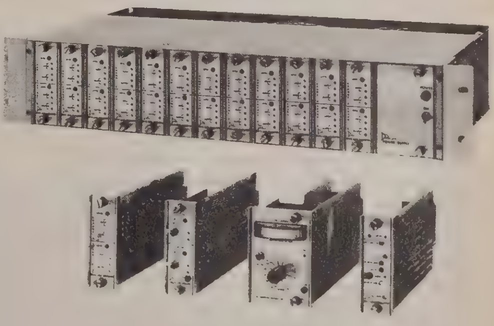
Video Encoders/Readers

Model 9610 Timing Terminal Unit System

The Model 9610 Timing Terminal Unit System comprises a highly versatile group of components (housing, power supply and functional modules) that can be configured to meet a wide variety of signal conditioning and distribution requirements. Each housing may contain a power supply and slots for up to 12 functional modules.

Typical applications include signal conditioning and distribution in central timing systems, repeater amplifier distribution at remote locations, or special processing for terminal equipment.

Compact size, convenient access to components, rack mounting or portable housing chassis, and a large selection of functional modules make the 9610 an attractive solution for the systems designer. Functional modules include line drivers, demodulators, amplifiers, pulse generators, oscillators, decoders and many others.



Model 9610

800-938-3286

DATUM INC TIMING DIVISION 1363 S. STATE COLLEGE BLVD., ANAHEIM, CA 92806 • (714) 533-6333 • FAX (714) 533-6345

DDC
ILC DATA DEVICE CORPORATION

A/D, D/A, SYNCHRO,

1553 DATA BUS PRODUCTS

MODEL	TYPE	PACKAGE	DESCRIPTION/FEATURES
BUS-61553-605 BUS-61553-606	BC/RT/MT	1.9 x 2.1 x 0.25" (DDIP) 1.6 x 2.2 x 0.17" (Flatpack)	BC/RT/MT with enhanced radiation hardness and screening for space, and other high-rel applications.
BU-61580 ACE SERIES BU-65170	BC/RT/MT RT Only	1.9 x 1.0 x 0.215" 70 Pin Ceramic DIP, Flatpack or J-Leads	Fully integrated 1553A/B (Notice 2) McAir BC/RT/MT. Includes dual transceiver plus complete protocol, memory management, processor interface, and 4K x 16 internal RAM. Supports a wide variety of interfaces to host processor and external RAM. Includes many advanced architectural features including BC retries and programmable intermessage gap times, RT Subaddress double buffering and circular buffers, a message monitor, and a simultaneous RT/Monitor mode.
BU-61590 UNIVERSAL ACE	BC/RT/MT	1.9 x 2.1 x 0.25" 78 Pin DDIP	Same as above however, universal ACE supports all platforms using 1553 today with Built-in Universal Transceivers.
BUS-63100 II SERIES	Universal Transceiver and 1553 Transceivers	1.26 x 1.26 x 0.17" Hybrid or 36 Pin DDIP Hybrid	Universal transceiver conforms to MIL-STD-1553 A/B and McDonnell Douglas A-3818, A-5232, A-4905, and A-5690. Dual redundant monolithic low power transceivers. Listed on MIL DWG No. 5962-87579. Conforms to MIL-STD-1553 A/B. High S/N ratio, internal filtering. Drives Harris 15530 directly. Complete isolation, including separate power and signal connections. SEAFAC tested. Eliminates non-standard part approval when specified by the Military Drawing number.
BUS-65153	Dual Redundant RTU	70 Pin DDIP, Ceramic Package 1.9 x 1.0 x 0.2"	Complete dual redundant MIL-STD-1553A B Notices 1 & 2/1760A Small Terminal Integrated Circuit (STIC) Remote Terminal. Includes CMOS Protocol and BiPolar low power MK II transceivers, timing control logic, and latchable RT address
BUS-65142-602 BUS-65144-606	Dual Redundant RTU	1.9 x 2.1 x 0.25" (DDIP) 1.6 x 2.2 x 0.17" (Flatpack)	Complete dual redundant 1553 RT. Complete 1553 transceiver and protocol implementation, including mode codes, SEAFAC testing, and 16 Bit DMA interface. Includes enhanced radiation hardness and screening for space and other high-rel applications.
BUS-65522/23 II BUS-65524	VME/VXI Bus Controller, Remote Terminal or Bus Monitor	9.2 x 6.3 x 0.4" VME Eurocard	Dual redundant Bus Controller, Remote Terminal Unit, or Bus Monitor with VME/VXI interface. Supports all MIL-STD-1553 message formats mode codes and provides Built-In-Test capability. Its 8K x 16 dual access RAM and four types of interrupts minimize CPU overhead. BUS-65524 Ruggedized VME bus for high reliability applications. Free BUS-69053 "C" run time library routines.
BUS-65515	IBM® PC RT/BC/MT	13.125 x 4.2" IBM® PC Card	Dual redundant Bus Controller, Remote Terminal Unit, or Bus Monitor with IBM® PC interface. Supports all MIL-STD-1553 message formats, 13 mode codes, and provides Built-In-Test capability. Its 4K x 16 bit dual access RAM and command registers minimize CPU overhead. Free BUS-69052 "C" run time library routines.
BUS-65517II BUS-65519 BUS-65520	IBM® PC XT/AT Test and Simulation Cards	13.125 x 4.2" IBM® PC Card	Simultaneously simulates a Bus Controller, an Active Monitor, and up to 31 Remote Terminals. Provides comprehensive error injection/detection. Fully dual redundant 1553A/B. Includes user friendly menu driven software. Optional "C", "Pascal" run time libraries and menu driven PTP production test, VTP validation test, and simulations card.
BUS-61559 SERIES AIM-HY'er	Advanced Integrated MUX Hybrid with enhanced features.	2.1 x 1.9 x 0.25" (DDIP) 2.2 x 1.6 x 0.17" (Flatpack)	The AIM-HY'er is a complete MIL-STD-1553B Notice 2 RT/BC/MT terminal. Contains dual low power MKII transceivers, protocol with enhanced RT features, and an 8K x 16 shared RAM host interface. Included are three-state address/Data buffers, command illegalization, on/off-line self test, and passed SEAFAC. Free BUS-69051 "C" run time library routines.
BUS-65529	IBM® AT BC/RT/MT	6.5 x 4.5" IBM® AT half slot card	Dual Redundant MIL-STD-1553B Notice 2 RT/BC/MT IBM® AT half slot card. Supports all 1553 message formats mode codes and provides built-in test. Its 8K x 16 dual access RAM and enhanced RT features (see AIM-HY'er minimize CPU overhead). Free BUS-69054 "C" run time library routines.

SSP-21110 SSP-21116	Solid-State Power Controllers	2.74 x 1.34 x 0.33" 2 x 3 x 0.33"	The DDC 28V & 270VDC SSPC's replace electro-mechanical circuit breakers offering solid-state reliability.
SSP-21120	Module	3.13 x 3.75 x 3"	The 28V 80 amp module replaces electro-mechanical circuit breakers offering solid-state reliability

ANALOG TO DIGITAL (A/D) CONVERTERS

MODEL	RESOL.	CONVERSION TIME	LINEARITY ERROR	PACKAGE	OPERATING TEMP. RANGE	POWER DISSIPATION	DESCRIPTION/FEATURES
ADC-00145	14 Bit	200 nsec	1 LSB	40 Pin TDIP Hybrid	0°C to +70°C	2.9W	5 MHz word-rate, T/H & A/D
ADC-00300+	12 Bit	500 nsec	±0.025% FSR	40 Pin TDIP Hybrid	−55°C to +125°C	3.0W	2 MHz word rate, includes T/H and all timing circuits.
ADC-00305	12 Bit	500 nsec	±0.012% FSR	40 Pin TDIP Hybrid	0°C to +70°C	2.6W	2 MHz word rate; containing T/H, A/D converter, Tri-State output registers, and timing circuits. Low cost.

DIGITAL TO ANALOG (D/A) CONVERTERS

MODEL	RESOL.	F.S. SETTLING TIME		LINEARITY ERROR	PACKAGE	OPERATING TEMP. RANGE	POWER DISSIPATION	DESCRIPTION/FEATURES
		VOLTAGE	CURRENT					
DAC-02320	12 Bit	200 nsec	—	±½LSB	24 Pin DDIP Hybrid	−55°C to +125°C	2.2W	Deglitching D/A with 15 MHz update.
DAC-02306 DAC-02307	14 Bit	— 350 nsec	50 nsec —	±0.006% FSR	24 Pin DDIP Hybrid	−55°C to +125°C	1.8W	Latched voltage DAC. Settles to 0.006% in 350-nsec. High accuracy with low impedance voltage output.
DAC-02310+	14 Bit	1.5 μsec	—	±0.01% FSR	32 Pin TDIP	−55°C to +125°C	1.7W	14 bit deglitched D/A converter with 10MHz update rate, and 50m V · nsec differential glitch energy.

SAMPLE/HOLD and TRACK/HOLD AMPLIFIERS

MODEL	ACQUISITION TIME (F.S. CHANGE)	LINEARITY ERROR	PACKAGE	APERTURE JITTER	DROOP RATE	OPERATING TEMP. RANGE	DESCRIPTION/FEATURES
TH-8530	10 nsec	±0.012% FSR	24 Pin DDIP Hybrid	20 psec	1.0mV/μs	-55°C to +125°C	Buffer ampl. 50MHz sample rate. −60 dB feedthrough.
THA-05203	150 nsec	±0.005% FSR	24 Pin DDIP Hybrid	100 psec	1.0mV/μs	−55°C to +125°C	−74 dB feedthrough.

SYNCHRO INSTRUMENTS

MODEL	FUNCTION	RESOLUTION	ACCURACY	PACKAGE	DESCRIPTION/FEATURES
SR-103/203	Angle indicator	to 0.01°	to ±0.005°	1.7" High (103) 3.5" High (203) ½ Rack	Wideband 47-1000 Hz, automatic gain ranging, bit fault monitor, synthesized reference, programmable 0-360° or ±180°, IEEE-488 option.
SIM-31200	Angle Simulator	to 0.001°	±0.003°	14.5 x 8.12 x 3.47" Instrument	Synchro or resolver angle simulator with high accuracy, wide band operation (47 Hz to 11 kHz). Front panel keyboard or remote I/O. Rate, auto stepping option.
SIM-36010	Synchro/Resolver to 16 Bits Simulator	to 16 Bits	to ±25 sec	Full Size IBM® Card	Low cost, wideband 360-5000 Hz, programmable synchro or resolver output, dynamic rotation.
API-36005	Angle Indicator to 20 Bits	to 20 Bits	to ±18 sec	Full Size IBM® PC Card	Low cost, wideband 360-5000 Hz, programmable synchro or resolver, BIT.

POWER, 1553 BUS PRODUCTS

SYNCHRO TO DIGITAL (S/D)

MODEL	RESOLUTION	ACCURACY	PACKAGE	TRACKING RATE	DESCRIPTION/FEATURES
RDC-19200 SERIES	10 thru 16 Bits	to ±1 min, +1 LSB	40 Pin TDIP	3.2 to 800 rps	Pin programmable for 10, 12, 14, or 16 bits resolution. Features include velocity output to 0.25% linearity, BIT, LOS, and Major Carry signals.
RDC-19220	10, 12, 14 or 16 Bits	to ±2.3′	28 Pin DDIP 1.4 x 0.6 x 0.2″ 40 Pin DDIP 2.0 x 0.6 x 0.2″	to 1152 rps	Low cost, monolithic programmable Resolver and LVDT to Digital converter with tach grade velocity output. Available in military and industrial models.
SDC-14550 SDC-14620	10 thru 16 Bits	to ±2.3 min.	1.0 x 0.8 x 0.2, 34 Pins 1.5 x 0.8 x 0.2, 54 Pins	to 160 rps	Low cost, small, one and two channel +5 Volt only, programmable resolution, BIT, quality velocity output, synchro and resolver inputs.
SDC-14560 SERIES	10 thru 16 Bits	to ±1 min,	36 Pin DDIP	0.61 to 160 rps	Pin programmable for 10, 12, 14, or 16 bits resolution. Features include velocity output to 0.25% linearity, BIT output, synthesized reference, and CT operation. Models for synchro or resolver inputs.
DTC-19300	12 Bit 14 Bit	0.05% of F.S.	36 Pin DDIP	1 full range per sec., min.	LVDT/RVDT to digital converter; built-in reference oscillator; programmable resolution.
SDC-14570/75 SDC-14600/05 SDC-14610/15	14 Bit/16 Bit	to ±2.3′	1.0 x 0.8 x 0.2″ 28 Pin DDIP 36 Pin DDIP	to 10 rps	Small, low cost, one, two, and three channel synchro or resolver to digital converter, with BIT or Velocity outputs.
SDC-634A	14 Bit	to ±2.6′	2.6 x 3.1 x 0.4″ Module	10 rps	Low profile (0.4) industry standard. All common inputs. Transformer isolated.
SDC-36015	10 thru 16 Bit	to ±1.3′	Full Size IBM® PC Card	3.2 to 800 rps	Synchro/Resolver Interface for IBM® PC/XT/AT. Provides up to 6 channels of synchro and/or resolver and a high quality velocity output voltage. Also available as *Instrument grade*, angle position indicator, API-36005.

Also available, VME/VXI component and instrument grade cards, dual and triple channel S/Ds, multi-speed, multiplexed, and BCD coded converters.

DIGITAL TO SYNCHRO (D/S) CONVERTERS

MODEL	RESOLUTION	ACCURACY	PACKAGE	OUTPUT DRIVE	DESCRIPTION/FEATURES
DSC-10510	16 Bit	±1′	40 Pin TDIP	7VA	High power hybrid D/S with μP compatible latched input. Can be used for driving CT, CDX, and TR loads
DRC-10520	16 Bit	±1′	32 Pin TDIP Hybrid	2VA	High power hybrid D/R with μP compatible latched input. AC or DC power amps. Protected output. BIT output.
DRC-11524	16 Bit	±1′	36 Pin DDIP Hybrid	15mA	Pin programmable synchro or resolver. Direct coupled for DC SIN/COS or rotating PPI applications, low ±2% scale factor variation.
DSC-36020	16 Bit	to ±1′	Full Size IBM PC Card Card	15mA	Provides up to 6 channels of synchro and/or resolver outputs. Uses DSC-11524. Also available as *Instrument* grade synchro/resolver simulator, SIM-36010.
DSC-36022	14 Bit	to ±4′	Full Size IBM PC Card	to 4.5 VA	Up to four channels of high power, 1.5 to 4.5 VA, synchro or resolver outputs
DSC-644	14 Bit	±4′	2.6 x 3.1 x 0.5″ Module	1.5VA	Low profile industry standard pin-out. Metal heat sink, current limited and transient protected. Internal 400 Hz transformers. Low scale factor variation
DSC-544	14 Bit	±4′	2.6 x 3.1 x 0.8″ Module	4.5VA	Powered from ref, metal heat sink, all internal transformers. Short circuit proof & transient protected. Thermal cutoff.

Also available: High-powered D/S card assemblies, "S2 grounded" D/S references oscillators.

POWER, H-BRIDGES, AND MOTOR DRIVERS

MODEL	TYPE	DRAIN-SOURCE BREAKDOWN VOLTAGE	DRAIN CURRENT	ON RESISTANCE/ Vce Sat.	PACKAGE	DESCRIPTION
PWR-82330	N-Channel	100V	5A	0.10 ohms	2.6 x 1.4 x 0.25″	3-phase low power smart motor drive
PWR-82331	N-Channel	200V	30A	0.11 ohms	3.0 x 2.1 x 0.390″ copper flat pack	3-phase smart power motor drive with internal drive circuitry and power supply
PWR-82340	N-Channel	200V	30A	0.11 ohms	3.0 x 2.1 x 0.390″ copper flat pack	2-phase smart power motor drive with internal drive circuitry.
PWR-82341	N-Channel	100V	5A	0.10 ohms	1.8 x 1.4 x 0.25″	2-phase low power smart motor drive.

MODEL	TYPE	BREAKDOWN VOLTAGE	OUTPUT CURRENT	ON RESISTANCE/ Vce Sat.	PACKAGE	DESCRIPTION
PWR-82333	IGBT	500V	30A	3.0V	3.0 x 2.1 x 0.390″ copper flat pack	3-phase high voltage motor drive with internal drive circuitry and power supply
PWR-82342	IGBT	500V	30A	3.0V	3.0 x 2.1 x 0.390″ copper flat pack	2-phase high voltage motor drive with internal drive circuitry and power supply

3-PHASE MOTOR CONTROLLER

MODEL	OUTPUT STAGE	MAX VOLTAGE	OUTPUT CURRENT	PACKAGE	DESCRIPTION
PWR-82500	N-Channel Fet	100V dc	5A	3.1 x 2.1 x 0.395″	Complete 3 phase controller and drive user configurable as position, current or velocity loop
PWR-82505	N-Channel IGBT	500V dc	5A	3.1 x 2.1 x 0.395″	

DC-DC CONVERTERS

	PACKAGE	DESCRIPTION/FEATURES MODEL
PWR-82400	3.2 x 2.45 x 0.595″	±15V & +5V, ±12V & +5V 60W DC-DC converters.
PWR-82402	3.2 x 2.45 x 0.595″	±12V & +5V, 60W DC-DC converters.
PWR-82415	3.085 x 2.52 x 0.430″	+5V at 60W DC-DC converter low profile.
PWR-82425	3.085 x 2.52 x 0.430″	±15V at 60W DC-DC converter low profile.
EMI-82470	2.09 x 1.11 x 0.495″	MIL-STD-461 & MIL-STD-704 filter.

NOTE: Most hybrid products are available with military screening
†Some products available to military drawings. Call for details
*0.2 V·µs optional.
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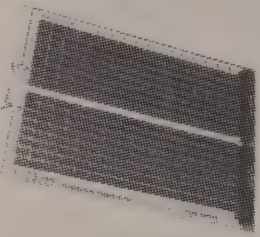
9000 SERIES

MATRIX SWITCHING SYSTEMS

ITI's 9000 Series matrix system incorporates the HIGHEST CROSSPOINT DENSITY of all ITI's matrix switching systems. It was specifically designed to meet the growing demand for large scale (up to 3000 inputs x 3000 outputs) but affordable matrix switching.



Has features of 8500 series and:

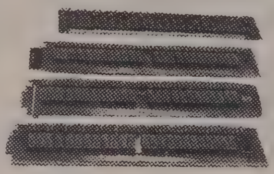
- Sizes up to 3000 inputs x 3000 outputs
- Choice of 16 x 16 or 20 x 20 relays per circuit card
- Models from DC to 1 MHz
- Transmission Characteristics
  - Isolation > 95 dB at 1 kHz
  - Insertion Loss < .1 dB at 100 kHz

HIGH FREQUENCY

MATRIX SWITCHING SYSTEMS

The New ITI High Frequency switching system was developed to handle wide bandwidth switching of general purpose analog and digital voltage signals from DC to 100 MHz. The system is suitable for VHF-UHF Band, wideband IF, antenna and airborne switching.

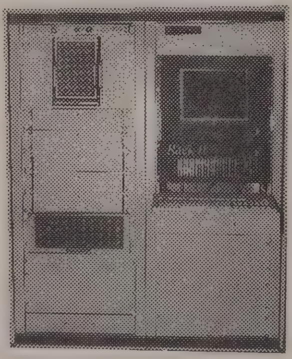
The switching function can be divided into multiple sections under common control; i.e., one section can provide high frequency switching, and the second section can provide audio switching.



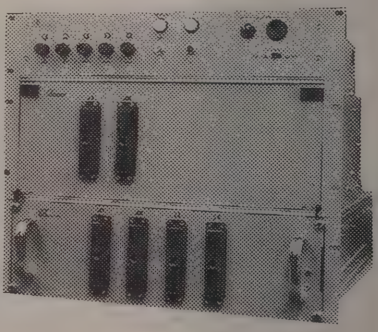
- Frequency Range: DC - 100 MHz
- Crosstalk Isolation: >55 dB at 100 MHz
- Insertion Loss: <1.0 dB at 100 MHz
- Impedance: 75 ohms

ATE SWITCHING SYSTEMS

Custom ATE Switching Systems from Standard "OFF-THE-SHELF" ITI Products



- Switch contacts rated for microvolts to kilovolts and milliamps to 20 amps
- Latching and non-latching crosspoints
- IEEE-488 (GPIB), RS-232-C, Parallel BCD Interfaces
- Manual controls available
- Fast connect and disconnect through use of ZIF connectors
- Multiple switching
- Forms A, B, and C switches
- Front and/or rear panel access for fixtures and instruments



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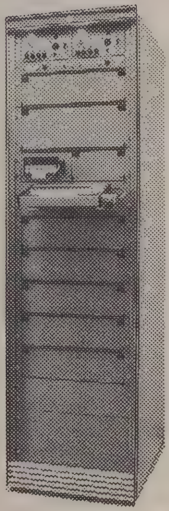
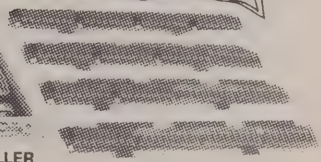
8500 &8800 SERIES AUTOPATCH MATRIX SWITCHING SYSTEMS



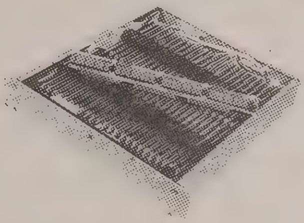
THEY ARE AVAILABLE IN:

- Sizes from 8 inputs x 8 outputs to 1000 inputs x 1000 outputs
- Models from DC to 25 MHz
- IEEE-488 (GPIB), RS-232-C and Parallel BCD interfaces
- Models with built-in maintenance terminals
- Models with redundant power supplies
- Magnetically latched crosspoints
- Models that switch from 1 to 16 poles per crosspoint
- Models with custom designed I/O panels

ITI 8800 MATRIX CONTROLLER



ITI 8800 RELAY CARDS

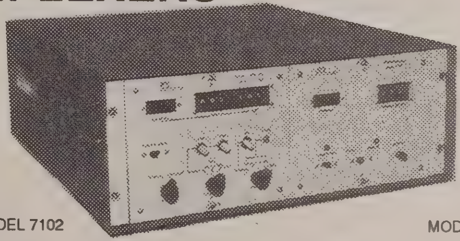


ITI 8800 MATRIX MODULE

7100 SERIES SCANNER/MULTIPLEXERS

MODEL 7102 & 7103

- Interfaces available - See general information
- Manual backup with front panel controls
- Expandable to 10,000 channels
- Seven-inch, rack-mounting enclosure



MODEL 7102 MODEL 7103

GENERAL INFORMATION

- Available for 1,2,3 and 4 wire switching
- Number of poles can be program selectable (option)
- Expandable in 10-channel increments with plug-in cards
- Variety of switch contacts available: low-level signal to high-current requirements
- Switch contacts intermixed in same scanner
- Interfaces for IEEE-488 (GPIB) bus, RS-232-C port and parallel BCD address
- IEEE-488 and RS-232-C interfaces control multiple scanners
- Programmable scan rate and first to last channel selection
- Custom I/O panels available

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MINIGLOSSARY

BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null	DLE	Data Link Escape (CC)
SOH	Start of Heading (CC)	DC1	Device Control 1
STX	Start of Text (CC)	DC2	Device Control 2
ETX	End of Text (CC)	DC3	Device Control 3
EOT	End of Transmission (CC)	DC4	Device Control 4
ENQ	Enquiry (CC)	NAK	Negative Acknowledge (CC)
ACK	Acknowledge (CC)	SYN	Synchronous Idle (CC)
BEL	Bell	ETB	End of Transmission Block (CC)
BS	Backspace (FE)	CAN	Cancel
HT	Horizontal Tabulation (FE)	EM	End of Medium
LF	Line Feed (FE)	SUB	Substitute
VT	Vertical Tabulation (FE)	ESC	Escape
FF	Form Feed (FE)	FS	File Separator (IS)
CR	Carriage Return (FE)	GS	Group Separator (IS)
SO	Shift Out	RS	Record Separator (IS)
SI	Shift In	US	Unit Separator (IS)
		DEL	Delete

(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

Special Graphic Characters

SP	Space	<	Less Than
!	Exclamation Point	=	Equals
|	Logical OR	>	Greater Than
"	Quotation Marks	?	Question Mark
#	Number Sign	@	Commercial At
$	Dollar Sign	[	Opening Bracket
%	Percent	\	Reverse Slant
&	Ampersand	]	Closing Bracket
'	Apostrophe	^	Circumflex
(	Opening Parenthesis	¬	Logical NOT
)	Closing Parenthesis	—	Underline
*	Asterisk	`	Grave Accent
+	Plus	{	Opening Brace
,	Comma	¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
-	Hyphen (Minus)	}	Closing Brace
.	Period (Decimal Point)	~	Tilde
/	Slant		
:	Colon		
;	Semicolon		

LOW LEVEL ANALOG and DIGITAL SCANNERS by MATRIX CORPORATION

Low Level General Instrumentation

MODEL 1701 SCANNER

Random access: Channels selected by manual front panel switch, remotely by-parallel BCD, IEEE-488 or RS 232C.

GENERAL: Scan voltages from microvolts to 300 volts. Microprocessor based interface provides two-way communications with a computer via IEEE-488, RS-232C or parallel BCD.

COMPUTER INTERFACE: parallel BCD std., optional IEEE-488 or RS232C.

CAPACITY: 10 to 999 channels — master 10 to 100 channels, slave units add 10 to 200 channels each. Master and slave require 3½" std. rack space.

NUMBER OF POLES: 3 to 100 per channel.

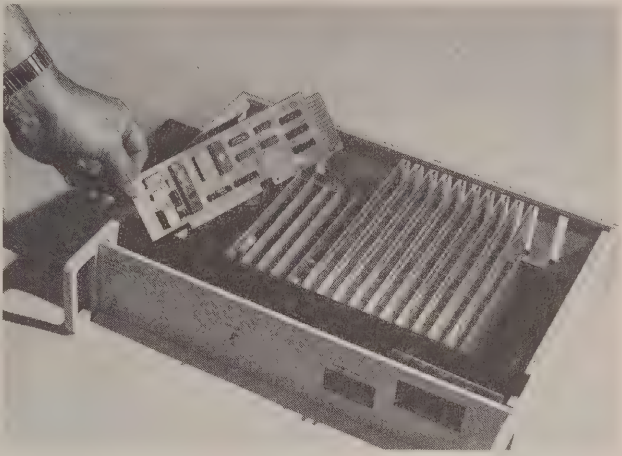
SWITCHING RATE: to 200 channels per second.

CONTACT RATINGS: Microvolts to 300 volts

DISPLAY: 7 segment LED — 3 digits for channel, 4½ digits for data.

DIMENSIONS: 3½" high x 17" wide x 10" deep.

USES: Reading tranducers, thermocouples, RTD's, switch positions, BCD and binary data lines.



Shown with the Model 1701 Scanner is the Computer Interface Board.

OPERATION FROM A COMPUTER: Commands such as SELECT CHANNEL and SEND DATA are accomplished by two-way communications between a terminal or controller and the Model 1701 using ASCII. Send "25C" to select channel 25. Send "I" to have the scanner respond with 4½ digits of data, sign and decimal point.

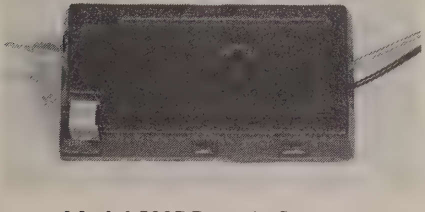
LITERATURE: Write for Bulletin 1701-MIB

COMPUTER CONTROLLED SENSING DEVICES

For Environmental Management, HVAC and Remote Monitoring Systems

Model 2705 Remote Sensor/Controller

An IBM or compatible computer with RS232 output makes all decisions for the Matrix Model 2705 remote sensor/controller. The RS232 interface provides 4 place resolution using .1 second time base. On a 3 wire system the Model 2705 provides control for 10 isolated power output functions and 8 inputs. Up to 1023 controllers can be controlled through one interface unit.



Model 5897 Remote Sensor

Matrix Corporation Model 5897 remote sensors have accuracy of .05%, and 100 microvolt resolution. They are isolated to 300V and each can measure volts, temperature, humidity or current, etc. There can be up to 255 sensors on a 4 wire system that is computer controlled via an RS232 interface using an 8 bit address.

MATRIX CORPORATION

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NATEL

SYNCHRO/RESOLVER-TO-DIGITAL CONVERTERS

MODEL NO.	DESCRIPTION	REMARKS
HSRD1006	**Synchro/Resolver-to-Digital Converter Microprocessor Compatible 16-bit Hybrid**	Industry's first 16-bit hybrid converter; currently qualified on over 12 major programs world-wide ■ Uses single 5V power at only 20 mA ■ 1.3 arc-minute accuracy ■ Pin-programmable Synchro/Resolver modes and resolution ■ BIT ■ Reference Synthesizer ■ AGC.
HSRD1056 RADIATION HARDENED MODEL 1056RH ALSO AVAILABLE	**Improved 2nd Generation, Pin Programmable Synchro/Resolver-to-Digital Converter Microprocessor Compatible 16-bit Hybrid**	The Second Generation "encore" to the popular Model 1006 including all the 1006 features plus ■ High Quality Velocity ■ Anti-180° lock-up circuit ■ High frequency option (higher tracking and wider bandwidth) ■ Very low (50 mW) power consumption.
HRD1346 NEW	**3-Channel, Single Package 16-Bit Resolver-to-Digital Converter Microprocessor Compatible, 5 V-dc Only**	3 Channels in one 40-pin TDIP Hybrid ■ 1.3 arc-minute accuracy ■ True single supply...5V power at only 3.3 mA per channel ■ High speed HCT type 3-state enable ■ High output drive of 10 LSTTL ■ Reference synthesizer ■ High frequency option ■ 3 Independent tracking loops ■ 3 Independent BIT outputs ■ 3 Independent analog velocity outputs.
HRD1416 NEW	**One-Inch Square, Single 5 Volt Powered R/D Converter with Reference Oscillator Microprocessor Compatible, 16-bit Hybrid**	Industry's only R/D converter with Built-in Reference Oscillator ■ 1.3 arc-minute accuracy ■ True single supply...5V power at only 15 mA per channel (including power required for reference oscillator) ■ BIT output ■ Reference synthesizer ■ Anti-180° lock-up circuit ■ High frequency/High tracking option ■ DIR (direction) and CO (carry output) for revolution counting.
H2SD1626 **H2RD1626**	**2-Speed, Single Package, 22-Bit 0.0004° Accuracy, 5V-dc Only Synchro (Resolver)-to-Digital Converter Programmable Speed Ratio, µP Compatible**	Industry's only 2-speed, single 40-pin TDIP Hybrid ■ Accuracy to 0.0004° (1.5 arc-seconds) ■ Programmable speed ratios ■ Uses single 5V power at only 20 mA ■ Velocity Output ■ Reference Synthesizer ■ µP Compatible.

DIGITAL-TO-SYNCHRO/RESOLVER CONVERTERS

MODEL NO.	DESCRIPTION	REMARKS
HDSR2006	**Digital-to-Synchro/Resolver Converter Microprocessor Compatible 16-bit Hybrid**	Industry's first 16-bit hybrid converter ■ 1 arc-minute accuracy ■ Pin programmable Synchro/Resolver format, Reference voltage input, and set-up/test modes ■ 0.05% scale factor conformance (radius accuracy) ■ Does not require 5V supply.
HDSC2036	**Two-Channel, Double-Buffered Four-Quadrant Multiplying SIN/COS DAC Microprocessor Compatible 16-bit Hybrid**	Two complete Digital-to-SIN/COS converters with excellent features ■ Single 36-pin hybrid DDIP package ■ Ideal for applications where PC board space is at a premium.
HDR2116 5VA OUTPUT, 40-PIN HYBRID 2616 ALSO AVAILABLE	**2VA Output, 32-pin Hybrid 16-bit Digital-to-Resolver Converter Microprocessor Compatible**	■ Fully protected output including current limiting, short circuit and voltage feedback transients. ■ 1 arc-minute accuracy ■ Does not require +5V power supply.
DSC/DRC5001 **DSC/DRC5002** 3VA OUTPUT MODEL 5101 ALSO AVAILABLE	**16-bit Digital-to-Synchro (Resolver) Converter Low Profile (0.42") µP Compatible**	Industry's only 0.42" high unit with 1.3VA fully protected output including current limiting, short circuit protection, and thermal cut-off. Other features include: ■ Transformer isolated reference input and analog outputs ■ 1% load regulation ■ Pin programmable set-up and test modes ■ No 5-V supply required.

TEL: (805) 581-3950

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L200

Programmable Dynamic Angle Synchro/Resolver Simulator

World's First Dynamic Angle Synchro Simulator
Accurate Enough To Be A Standard
Includes 4 Related Instruments
Why A Dynamic Angle Synchro Simulator ?
Applications
Angle Synchro/Resolver Simulator
It does the job!

- 3 arc-second accuracy
- Fully IEEE-488 programmable
- Includes 4 Related Instruments
  - Digital Modulator
  - Phase Shifter
  - dc Bench Supply
  - Power Oscillator (ac source)
- Maintains excellent accuracy under load
- *Ask for 20 page data sheet*

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CUSTOM HYBRIDS

YOUR DESIGN

YOUR SPECIFICATION

OUR 1772 CERTIFIED MANUFACTURING

MODEL NO.	DESCRIPTION	REMARKS
SD570/RD570	**6 Arc-second accuracy, 20-bit Synchro(Resolver)-to-Digital Converter**	■ Instrument grade accuracy in 4.5" x 3.0" x 0.8" size ■ Transformer isolated inputs ■ 1.24 arc-second resolution ■ Reference synthesizer ■ Anti-180° lock-up circuit ■ Analog velocity output ■ High tracking rate ■ BIT output.
DSC6206 12.5 VA OUTPUT MODEL 5206 ALSO AVAILABLE	**Reference Powered, 25 VA Output 16-bit, 4 Arc-minute Accuracy Digital-to-Synchro Converter**	Fully isolated, microprocessor compatible, virtually indestructible output, high efficiency, high accuracy converter. ■ Does not require any dc power supply. ■ Capable of driving torque Receiver and Synchro loads. Other features include ■ Remote sensing ■ BIT ■ Built-in kick circuit ■ Output disable control.
DSC5031 **DSC5032** 5VA MODEL 5131 ALSO AVAILABLE	**Reference Powered, Low Profile (0.42") 1.3 Arc-minute Accuracy, 1.5 VA Ouptut 16-bit Digital-to-Synchro Converter**	Does not require any dc power supply, since internal power is derived from the reference input ■ Fully protected output including current limiting, short circuit protection, and thermal cut-off ■ Excellent (0.1%) load regulation.
HCDX3106	**Solid State Control Differential Transmitter Microprocessor Compatible 16-bit Hybrid**	Only Control Differential Transmitter available in a single 36-pin hybrid DDIP. Other features include ■ Double-buffered inputs ■ 2 arc-minute accuracy.

MANY OTHER POPULAR SYNCHRO/RESOLVER CONVERSION PRODUCTS AVAILABLE

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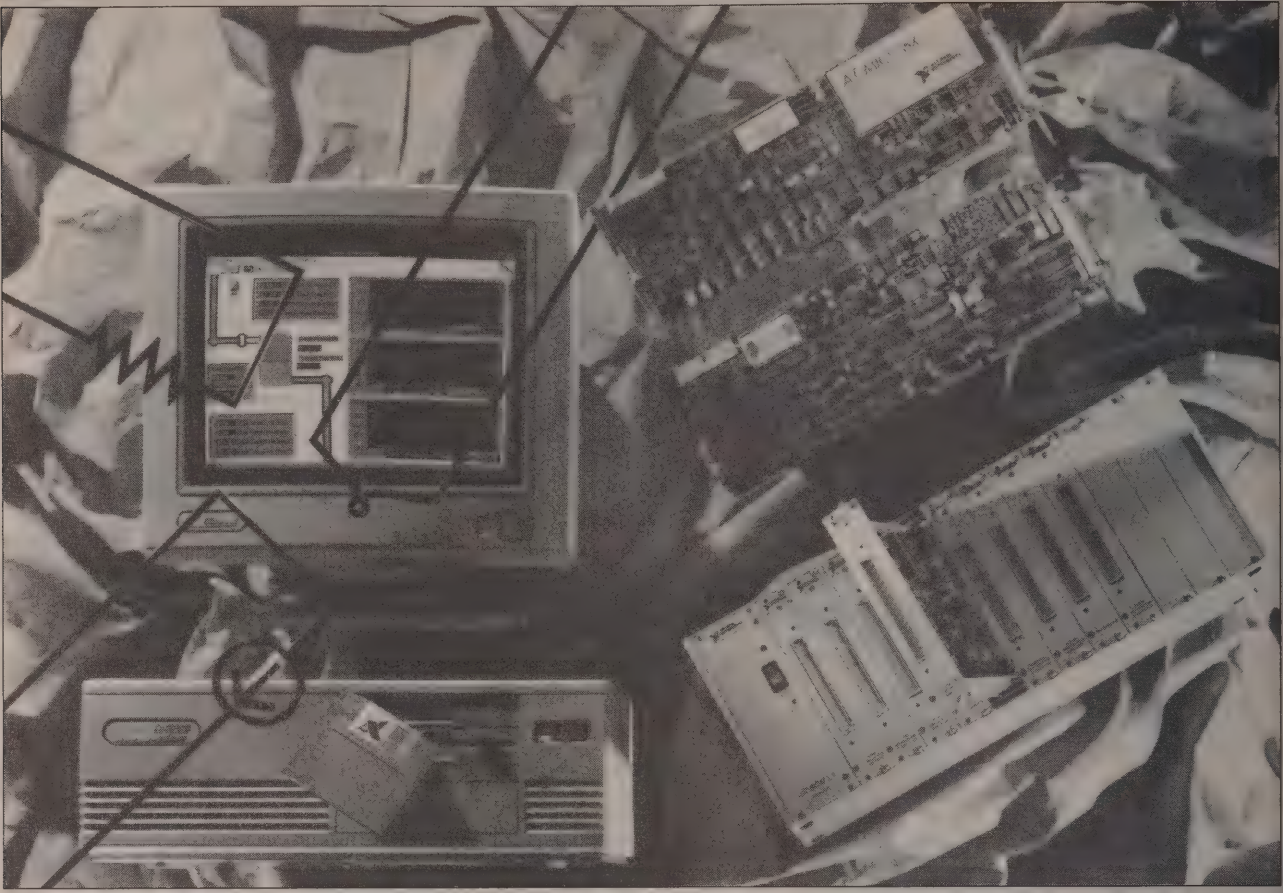

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We continue to introduce new technologies on our boards for the PC/XT/AT, EISA, and PS/2. Innovations include an instrumentation amplifier that settles so fast that accuracy is maintained at all gains and sampling rates, antialiasing filters that cut off at the rate of 90 dB in one-sixth octave, and integrated multiboard synchronization with our RTSI® bus.

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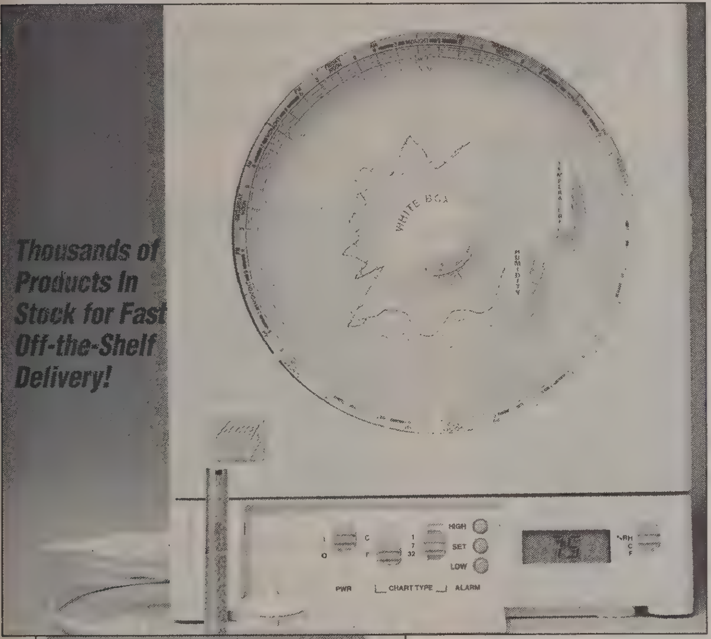
FOR DATA ACQUISITION SYSTEMS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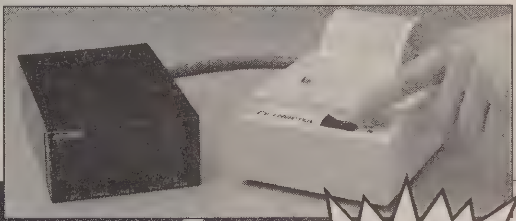
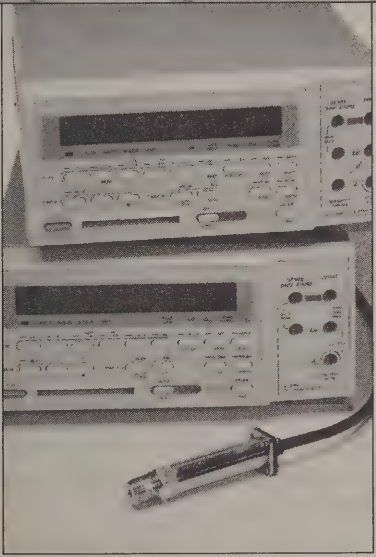
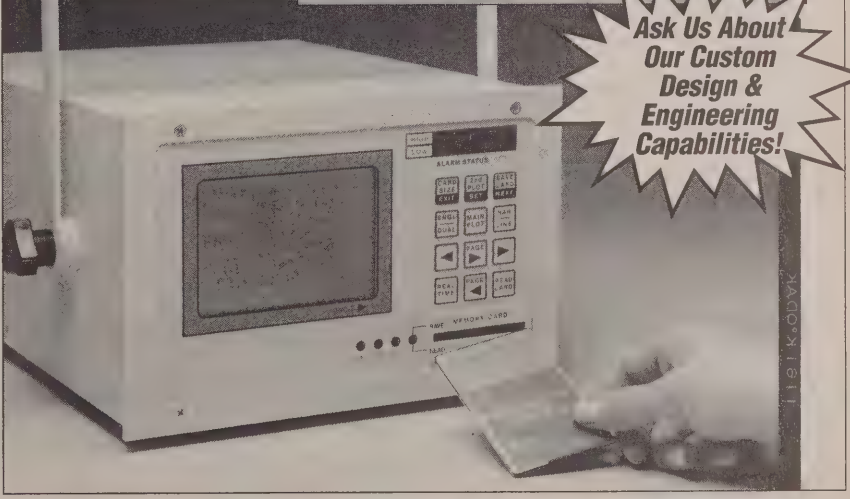
- ✓ Wide Variety of Sensors and Input Types



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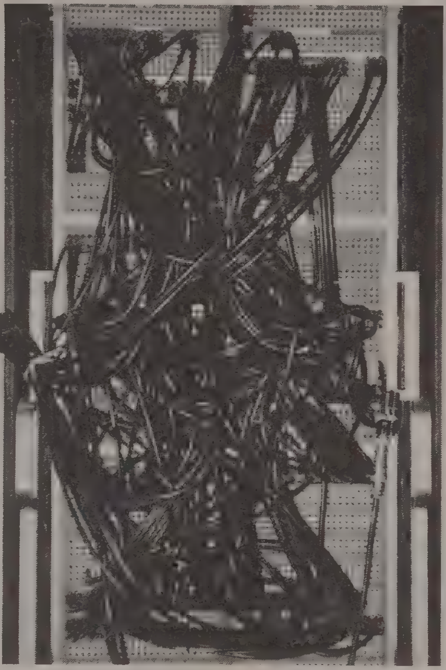
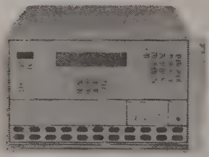
PRECISION FILTERS, INC.

THE BEST REASON YOU EVER HAD TO CLEAN OUT THE RAT'S NEST.



Now, you can manage hundreds of signal channels with simple programming. Connect them. Change them. Verify them. A few minutes does it.

Forget the hours and expense of hand patching.



Precision Programmable Patch

Enjoy the computer control you demand for all your other instruments with the Precision Programmable Patch.

We customize the Precision Patch to your work, using standard hardware. Up to 50,000 crosspoints. Random access for your signal channels. Bank switching if you wish. Reed relays or solid state. We make the Patch fit your needs today, but expandable for tomorrow. Turnkey, of course. With all the performance you expect of Precision Filters.

Let us give you the details in terms of your signal patching. Call, write or fax. We'll help you clean out old problems.

Precision Programmable Patch

4000 Relay Bank Switches

- High density—up to 288 1-of-2 bank switches in a single mainframe
- 1 MHz performance
- High level switching: 100V, 500mA
- 2-pole switching: high and low lines switched for each signal path

4096 Relay Switches

- 1 MHz performance
- High level switching: 100V, 500mA
- Bi-directional signal path
- Random access and bank switches
- Up to 4,608 crosspoints/frame

4196 Solid State Switches

- Analog "T" switch system
- Solid state reliability
- Signal switching (±10 Vpk) to 400 kHz
- Small signal bandwidth greater than 1 MHz
- Solid state input/output buffers for low insertion loss
- Up to 23,040 crosspoints/frame
- Custom systems from standard hardware

A/D Converters

12-bit to 16-bit,
High throughput,
Self test.

Precision 5000

High Data Throughput

A new high in throughput that puts the Precision 5000 ahead of all other analog-to-digital conversion systems. 26 MB/S throughput. Up to 64 simultaneously sampled channels/mainframe.

Multiple Sampling Rates

Up to four different sampling rates can run concurrently. Integrate high and low bandwidth channels in one mainframe.

Calibration

Internal end-to-end, go/no-go diagnostic fault detection allows a confidence check of the system before taking data.

Flexible

Sample and hold input boards and ADC boards with per channel sample rates to 1 MHz and resolution from 12 to 16 bits. Programmable input range. Differential or single-ended inputs. Parallel interfaces to all popular host computers.

Features include:

- Up to 26 MB/second throughput
- 2 to 64 channels per mainframe
- 12-bit to 16-bit resolution
- End-to-end, go/no-go self test
- Differential or single-ended input
- Fixed or programmable input ranges
- Setup and control via RS-232C, GPIB or RS-422

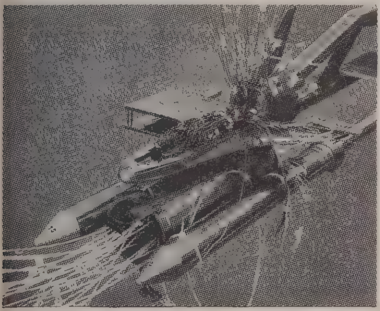
- See Precision Filter/Amp systems in Section 2750.
- See Precision Amplifier systems in Section 1100.

Precision Filters, Inc. ● 240 Cherry Street ● Ithaca, New York ● 607-277-3550 ● Fax 607-277-4466

Precision 27000

All the Transducer Conditioning You Need, Now or Later.

Applications today routinely require data from hundreds of points on a test model. More transducers are required, as well as more channels.



So we enable Precision 27000 to expand to your needs. Modular construction permits you to buy what you need now and expand later as test requirements change. All of these transducer conditioners are available in the Precision 27000 and may be mixed to meet your requirements.

Resistive Bridge. Isolated, programmable excitation supply. Constant voltage or current. 2- to 10-wire bridge connections. Auto balance. Prog. anti-alias filters. Diff. amplifier with 120 dB CMRR, 300 VCM and 100 kHz BW.

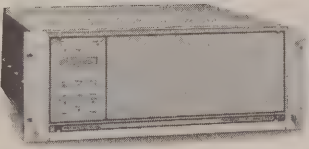
Voltage (Filter/Amplifier). Differential input amplifier, 120 dB CMRR, with pre- and post-filter gain totaling 1024. Programmable filter cutoffs from 1 Hz to 127.5 kHz. 1° phase match.

Thermocouple. Cold junction compensation, remote isothermal block with temp sensor, open thermocouple detection and galvanic isolation. 1500 VCM, 130 dB CMRR. Tempco 1μV/°C.

RTD. Prog. current excitation. 120 dB CMRR. Tempco 1μV/°C. Anti-alias filter with programmable gain.

AMPLIFIED PERFORMANCE AT AN ATTENUATED PRICE.

Nobody matches the performance you get with Precision 27000. And you get this extraordinary performance at the cost per channel of an ordinary system. What's more, nobody matches the choice. From a few channels to a few thousand or more. Any transducer conditioning you wish—resistive bridge, thermocouple, RTD, potentiometer, charge, current, pulse rate or voltage. In any combination. State of the art, of course. Choose Bessel, Butterworth, time delay or go for the high performance elliptic Precision filters that continuously pioneer industry standards. Your cost per channel will be as low as for ordinary conditioners. Call for a quote on the configuration that fits your work. Complete software includes a graphic user interface for easy operation. Built-in self-test and verification with end-to-end calibration. Precision total turnkey systems include switching and data acquisition as well as signal conditioning. Whatever you need between the transducers and computer. Call or fax for more information. Let us turn up the gain for performance. Call 607-277-3550. Fax 607-277-4466. Or write Precision Filters, Inc., 240 Cherry St., Ithaca NY 14850.



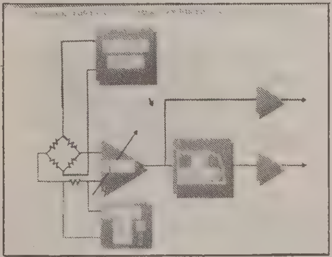
NEW PRECISION 27000 FILTER/AMPLIFIER AND SIGNAL CONDITIONING SYSTEM

PRECISION FILTERS, INC.
CONDITIONERS • SWITCHES • DATA ACQUISITION • SYSTEMS

Potentiometer. Prog. voltage excitation. 120 dB CMRR. Tempco 1μV/°C. Anti-alias filter with prog. gain.

Charge. Isolated charge converter with programmable sensitivity. 100 kHz BW. Prog. anti-alias filter.

Current. 10 μA to 10 mA fullscale. Open line detection. 100 kHz BW.



Helpful graphical user interface.

• See Precision Filter/Amp systems in Section 2750. • See Precision Amplifier systems in Section 1100.

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THE DAServer. NOW YOU CAN NETWORK DATA ACQUISITION.

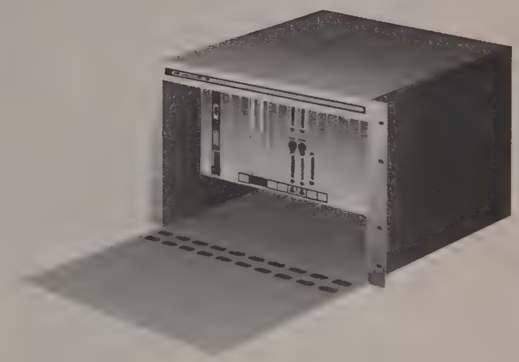
Now you can set up tests from anywhere on the net. You can monitor data quality all during the test. And get the full set of data right at your work station immediately after the test.

All this convenience comes with the Precision DAServer, our new networked data acquisition and recording system. It manages the data acquisition, so your computer doesn't have to. It stores test data directly in RAM, on disk, disk array or tape.

You can have greater than 16-bit resolution with up to 10 MSPS throughput. For long duration recording, transient capture or a combination. As many channels as you wish.

DAServer connects to your network for access by all your computers. The graphical user interface uses the X Window system so you get point and click convenience.

A new approach by Precision. A systems approach that can also host all Precision transducer conditioning, filtering and switching in one integrated system. All on a turnkey basis.



NEW DAServer. IT CAPTURES YOUR TEST DATA FOR ACCESS OVER THE NETWORK.

- A/D resolution 12 to 16 bits, and beyond
- Integral data storage
- Data throughput 20 MB/s +
- High channel density
- Real time data monitoring, analysis and display
- Sampling flexibility with programmable timebase, trigger system and scan memories
- Many A/D architectures to choose from, including A/D per channel and SS/H
- Access auxiliary data as part of the sampling program
- Front-end signal conditioning may be integrated into the user interface
- Host system independent; uses open industry standards
- Local, remote or network operation
- Networking based on Ethernet, TCP/IP, NFS
- Full featured GUI based on the X Window system
- Built-in self test and diagnostics
- Highly expandable and easily upgraded
- Relieves host system and network from real-time data handling and storage tasks

System Platforms

Standard platforms include 5-, 14- and 21-slot fully enclosed, powered, and cooled chassis with an integral CPU/Controller and operating/user interface software. Features include:

- Ethernet with TCP/IP or DECnet, TCP/IP, and NFS
- X Window X11R5 GUI
- Three asynchronous serial communications ports (RS-232C, RS422, RS485 configurable)
- SCSI port
- Optional IEEE-488 T/L/C interface

Local Operator Consoles

A wide range of portable, table top and rack mount color graphics consoles for direct connect local control. DAServer may be controlled from a remote host or any X-Server on Ethernet.

A/D Digitizers

Plug-in multi-channel A/D modules provide 12- to 16-bit—and beyond—resolution. Up to 32 channels per module, with external multiplexing capability for even higher channel densities.

- SS/H, sequential scan and A/D per channel configurations
- High speed Master/Slave interconnect over dedicated local bus
- Differential inputs
- Fully programmable timebase, trigger system, data readout sequencer, and channel scan memories
- Aux data (digital I/O, time code) may be encapsulated in data stream
- User programmable headers, trailers and framing information
- On-the-fly input scaling
- Aggregate sampling rates to 10 MSPS

Integral Data Storage

Flexible high speed mass data storage right at the test cell. Storage options range from high speed data capture RAM to tape, disk, disk array and magneto-optical media.

Flexible Data Transfer

Transfer data over the network or any of the standard interface ports.

Monitor Data in Real Time

Options tap into the real time data flow for instant visualization and analysis of selected channels.

A Very Cost-Effective Solution

Don't let the complexity of the DAServer family fool you. Complete turnkey, network ready, 32-channel 16-bit SS/H, high speed DAServer systems are available for under $15,000.

• See Precision Filter/Amp systems in Section 2750. • See Precision Amplifier systems in Section 1100.

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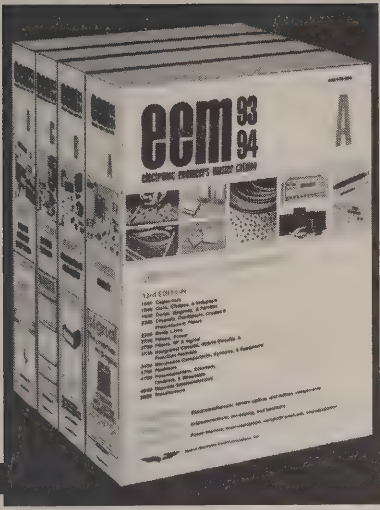

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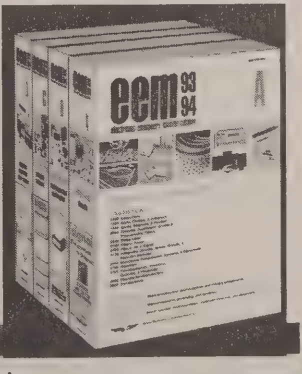

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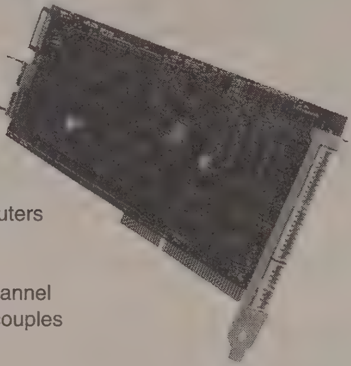
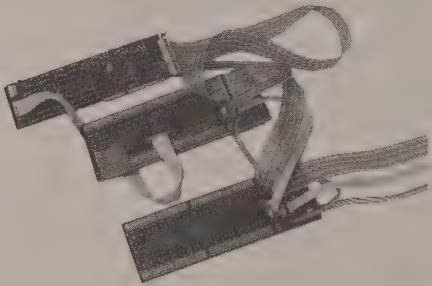
High Speed DAS Board for PC/AT

NEW!

PC-226 DAS Board $1750



- Plugs into PC/AT computers
- 16 channel boards
- 16 bit high accuracy
- Fast (750kHz) single channel
- Millivolts, volts, thermocouples
- RJC for thermocouples
- Expand to 256 channels
- DIN rail or stackable
- Full software support (Labtech Notebook drivers included)
- EX 205 termination panel
- EX 201 expansion panel
- Manufactured to ISO 9000 Quality
- Fast delivery from stock
- 4-20mA inputs - scaleable
- T/C Linearization (std + custom). Free software.
- Excellent documentation and manuals
- Open thermocouple detection
- Four boards powered by computer



Input Termination Panel for PC 226 (above)

EX 205 $530

Provides proper termination of all analog and digital signals to the PC 226 along with a cold junction compensation circuit for users making temperature measurements and an accurate voltage reference circuit to allow error corrections to be made if required.

Input Expansion Panel for PC 226 (above)

EX 201 $740

Allows a variety of signal conditioning to be added but, if none is required, both panels can be used just as they are without changes. Analog signal conditioning can be added channel by channel by making up or purchasing custom headers which plug into the DL socket available on each input channel.

- Slight extra charge for analog, digital and control cables.

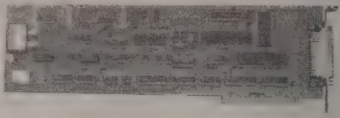
Plug-In Data Acquisition Boards

DASH 300

DASH 300 is the suggested software to use with the following products. Call Texmate for more information.

DMA Data Acquisition & Control Board

PC-30AT $685



16 channels of 12 bit A/D & 2 channels of 12 bit D/A • DMA capability on A/D, throughput 90kHz maximum & D/A 200kHz max. • Typical conversion time 10 μ sec. • Turbo Pascal & Quick BASIC callable libraries included • Applications: process control, high performance data acquisition, accurate waveform generation, teaching tool

Economical Analog Data Acquisition

PC-27 A/D Board $290

Full function16 channel 12 bit A/D • Typical conversion time 10 μ sec.• On board 4MHz frequency reference • Two 16 bit counters available • Three conversion trigger options • Applications: quality control, low cost data acquisition, educational establishments, production testing, data logging

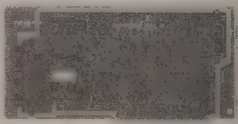
NOTE: Connectors and terminations are extra.

Serial Communication Boards

Low Cost, High Quality RS-232, RS-422, and RS-485 Boards for Computer Interface

SERIAL

For example: The dual independent port RS-485 PC-48AT will support up to 64 external devices such as Texmate's DI-45C smart meter.Prices include board and manual only.



Dual independent port RS-232C	**PC-47AT** (½ length)	$250
Dual independent port RS-485/422	**PC-48AT** (½ length)	$250
1 RS-232 port &1 RS-232/422 port	**PC-49AT** (½ length)	$250
Eight RS-232 ports	***PC-31AT** (full length)	$775
RS-232 to RS-422/485 converter	**DA-485**	$135
Quad RS422/RS485 board	**PC-40**	$1170

Optional Supporting Software

COMBIOS™ RS-232C/422/485 Communication Software $220

Manual & both 3.5" & 5.25" disks. 1 software supports unlimited ports.

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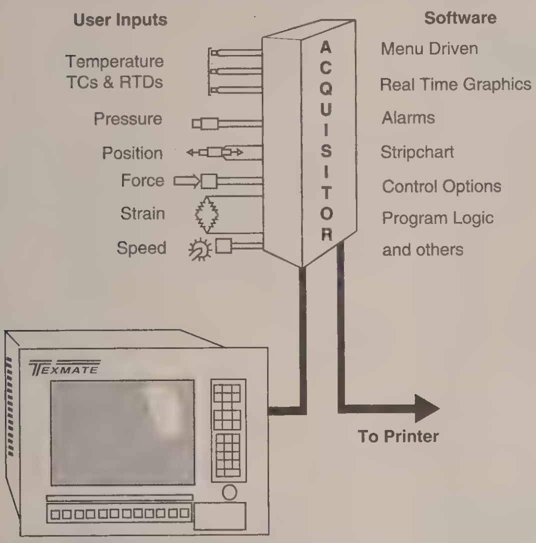


IDC-Series Industrial Computer

A minimal system consisting of an industrial computer with Acquisitor hardware and software included is priced from $8000. Complete custom system quotes on request (DAS, sensors, industrial computers). Call Texmate for more information.

LAB-ACQ for TABLE TOP USE
- 6 channels, expandable to 48 channels
- Plugs into any PC parallel printer port
- Hardware and software driver included
- Dimensions: 4"W x 14"H x 10"D
- Power: 115VAC
- Price from $2080

The Acquisitor Systems are designed for collecting and analyzing data outside of the host computer. They are electronically identical and accept the same user inputs but are housed in different cases depending on the type of environment in which they are to be used. They are connected to a computer through a parallel or serial port. The Acquisitor Systems offer a high channel count, reduced electrical noise, portability, a variety of transducer inputs, and use with standard PC/AT computers.

Acquisitor Systems Hardware Options

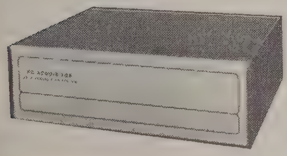
Texmate offers the Acquisitor in the following housings: table top; industrial; portable; thermocouple; rack mount and remote (latter two not shown). There are many internal and external options to customize these products, such as a printer driver and signal conditoning.

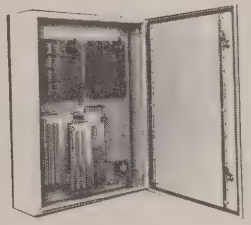
The systems offered by Texmate share the following general specifications.

GENERAL SPECIFICATIONS

Inputs	Outputs
• Volts: 0.3μV to 10VDC	• Digital
• Process: 4-20mA	• Relays
• T/C: J, K, E, T, R, S, B	• Analog outputs
• RTDs: Pt-100 ohm	4-20mA
• SG: Pressure, load cells	1-5VDC
• Excitation: 5 and 10VDC	0-50mA
• 16 bit resolution	• Reverse outputs
• Accuracy: ±0.02% range	• 16 bit resolution
• Linearity: ±0.015%	
• Input Impedance: 10,000M	
• Digital	

Software
Menu driven real time graphics. FREE demo disk available . Ask for "RTG" (Real Time Graphics).





THERM-ACQ for THERMOCOUPLE USE
- 6 channels, expandable to 14, 48, 96 channels
- Types: J, E, T, K, R, S, B (standard ISA ranges)
- Isothermal cold junction compensation
- Multinomial linearization (±0.2°)
- Dimensions:17"W x 5¼"H x 14"D
- Special types: W, X, Y (tungsten rhenium)
- Price from $3795

TRAVELOGGER for PORTABLE USE
- 6 channels, expandable 14, 48, 96 channels
- Inputs: 4-20mA, T/C, RTD, SG, Volts, etc.
- Dimensions: 14"W x 2"H x 15"D (6-48 ch); 24"W x 6"H x 16"D (96 ch., pictured above)
- Weight: 6.5 lbs. (6-48 ch); 9 lbs. (96 ch)
- Power: 5 or 12 VDC. Rechargeable battery (NiCad)
- Price from $2260

PROCESS-ACQ for INDUSTRIAL PROCESSES
- 6 channels, expandable to 1000 channels
- Plugs into any PC parallel printer port or optionally RS-232 or RS422 can be used
- Dimensions:16"W x 18"H x 14"D (NEMA 4 enclosure, size depending on number of channels)
- Power: 115VAC, 10W
- Price from $2305

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MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

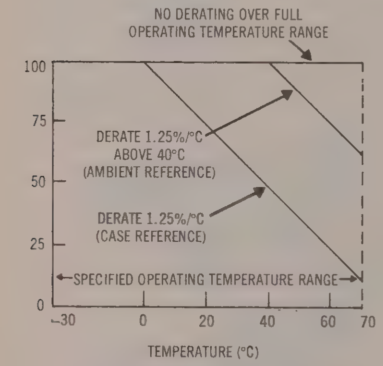


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

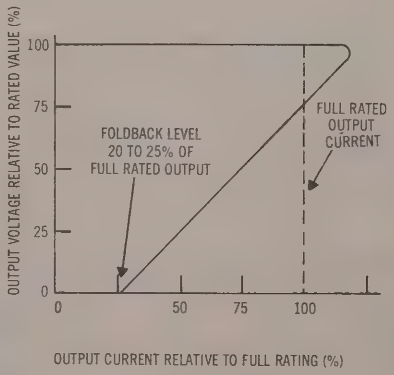


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

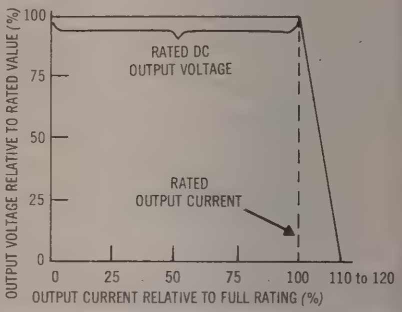


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(–) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

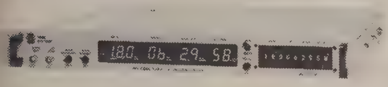
TRAK® SYSTEMS
®DIVISION OF TRAK® MICROWAVE CORP.

TIMING INSTRUMENTS

TRAK Systems has been supplying precision timing instruments to government and industry for over 30 years. The company offers a broad line of standard products meeting most needs for highly reliable timekeeping, precision synchronization, code generation, code distribution, and frequency distribution. Product designs are continually updated to incorporate proven state-of-the-art enhancements.

TRAK Systems is well equipped to comply with military specifications and with all types of data requirements. Representative of our capability are triple redundant timing systems being supplied to both NASA and DOD, worldwide. These systems produce multiple time code outputs coherent to within 50 ns of each other and synchronized to within 100 ns of GPS time.

Precision Timing Instruments

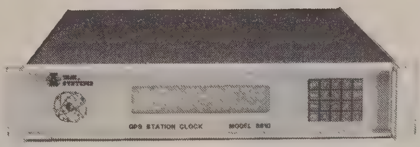


- **Time Code Processors**
- **Computer Controlled Tape Search**
- **Satellite Synchronized Time Code Generators**
- **Time Code Generators**
- **Time Code Readers**
- **Time Code Translators**

TST Instruments

- **Micro Phase Stepper**
- **High Performance Clocks**
- **Precise Rate Distribution**

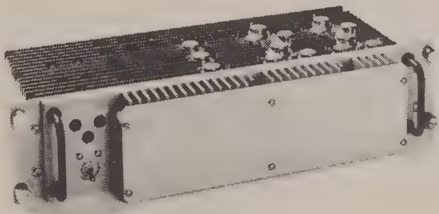
GPS Station Clock



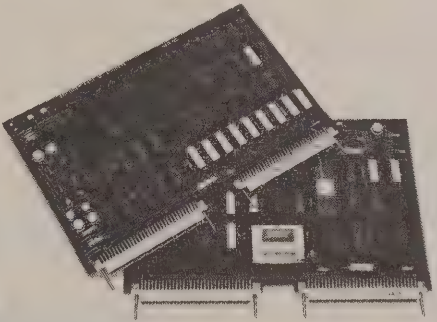
- **100 nanosecond accuracy worldwide**
- **Automatically determines position**
- **Six continuous channels (not commutated) give 8 dB better tracking sensitivity**
- **Full accuracy at 1000 mph platform speed**
- **RS-232 & IEEE-488 control & output ports**
- **Multiple time code and rate outputs**

See Section 1900 page D•1077 for further information.

Custom Products

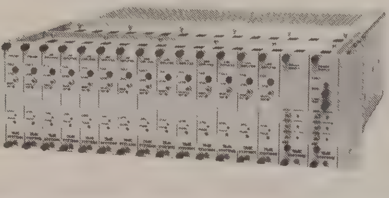


- **MIL-SPEC Units**

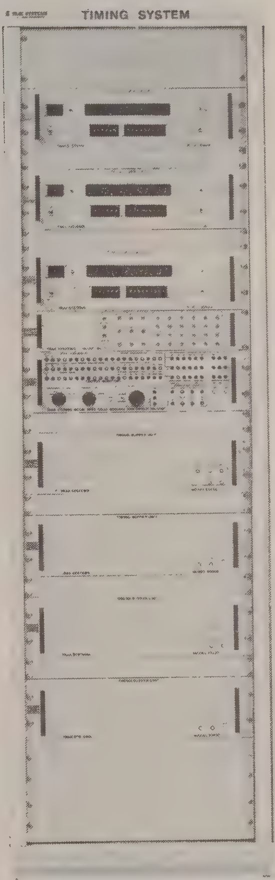


- **Multi-layer Card Subsystems**

Signal Distribution

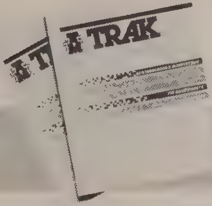


Timing Systems



TRAK Systems' 8421 Series Master Timing Systems provide the superior accuracy, reliability, and maintainability demanded for modern primary timing stations. These systems feature a GPS Station Clock for time and frequency traceability to UTC; atomic frequency standards; triple-redundant time signal generation; centralized fault location and status monitoring; and multiple time and frequency distribution.

Available built-in test features in the 8421 Series include phase, amplitude, and frequency monitoring of the frequency standards; 100% fault sensing and isolation of time code generator outputs; and 100% fault sensing of distributed outputs.



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Specifications subject to change without notice.

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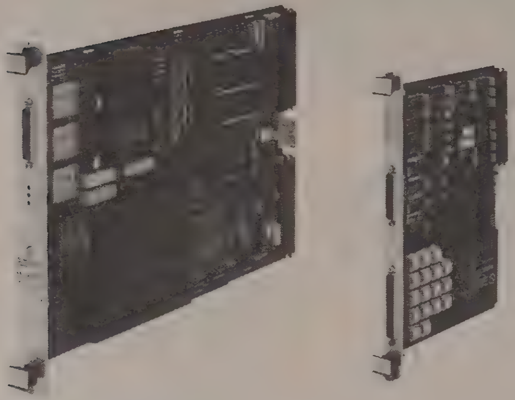
TRAK Europe • Dept E3, Dunsinane Avenue • Dundee Scotland DD2 3PN • Phone 44-382-833411 • FAX 44-382-833599

VME and VXI Instrumentation



Synchros, Resolvers D/A, A/D, LVDT, RVDT Phase Angle Voltmeter AC Power Controllers

VMEbus: Series 5410: We supply customized boards to meet specific customer requirements. Ruggedized MIL versions are available.

5410C-21:	Eight S/D channels. 14 bit. 6 arc minute accuracy. 360 Hz to 3 kHz. Single slot.
5410C-61:	Six S/D channels. Self-test. 16 bit. 50 Hz to 10 kHz. Single slot.
5410C-8:	Three S/D channels to 16 bits. 360 Hz to 2.5 kHz.
5410C-16:	Two S/D channels with 5 VA generator. 360 Hz to 2.5 kHz.
5410C-23:	Two S/D channels with turn counters. 16 bit. 50 Hz to 2045 Hz.
5410C-40:	Three Two-speed S/D channels. 50 Hz to 5 kHz. Single slot.
5410C-9:	Two Two-speed S/D channels, any speed ratio. 360 Hz to 2.5 kHz.
5410C-35:	Four D/S channels. 16 bit. 360 Hz to 3 kHz. Single slot.
5410C-15:	Three D/S channels. 14 bit. 360 Hz to 3 kHz.
5410C-14:	Two D/S channels with 1 arc minute accuracy. 16 bit. 360 Hz to 3 kHz.
5410C-36:	Two D/S channel & one16 bit S/D channel. 16 bit. 360 Hz to 2045 Hz.
5410C-17:	High power Synchro Driver (5 VA)
5410C-22:	Sixteen channel LVDT/RVDT measurement with DC outputs. 360 Hz to 5 kHz. Single slot.
5410C-62:	Ten channel LVDT/RVDT Stimulus with differential output. 360 Hz to 5 kHz. Single slot.
5410M-44:	Six D/A & eight A/D channels with self-test. Single slot.
5410C-75:	Two programmable 12 bit resistor channels. Isolated output. Single slot.
5410C-108-1:	EightD/A channels. 16 bit. External trigger.
5411C-5:	One 12, 14, or 16 bit S/D channel on 3U card. 50 Hz to 10 kHz. Single slot.
5411C-15:	One 12, 14, or 16 bit D/S channel on 3U card. Single slot.

VXIbus Instruments on a "C" size card. Message based (MATE/CIIL) or SCPI. All units include full wraparound self- test.

A5410C-30-1:	One 0.001° Synchro Measurement and two independent 0.01° Synchro Stimulus.
5410C-82:	One 0.001° Synchro Measurement and two independent 0.01° Synchro Stimulus with Rotation.
5410C-43:	Programmable for either five individual or one single and two two-speed Syn measurement channels.
5410C-47:	Eight independent 14 or 16 bit S/D channels.
5410C-89:	Three 16 bit S/D channels & three 16 bit D/S channels. All D/S can be rotated.
5410C-42:	Programmable Simulator (7 Single or 1 Single with 3 16:1 Multispeed).
5410C-31:	Wideband Phase Angle Volmeter.
5410C-55-1:	Twelve 16 bit D/A channels. Remote sensing. 60 mA per channel, single output up to 410 mA.
5410C-55-2:	Three 16 bit D/A channels. Remote Sensing. Up to 250 mA per channel.
5410C-57:	Eight Isolated D/A channels. Remote Sensing. Isolated outputs. 50 mA per channel.
5410C-83:	Eight Channel Differential LVDT/RVDT Stimulus. Output programmable 0-10 Vrms. Excitation programmable 2-10 Vrms. Additional ability to drive each channel from an external source.
5410C-59:	Sixteen Channel LVDT/RVTD Stimulus. Ratiometric conversion.
5410C-66:	Sixteen Channel LVDT/RVTD Measurement. Ratiometric conversion or absolute.
5410C-60:	Power Supply Controller: Programmable Voltage & Frequency (1Φ & 3Φ Driver).

TRANSMAGNETICS, INC.

210 ADAMS BLVD., FARMINGDALE, N.Y. 11735
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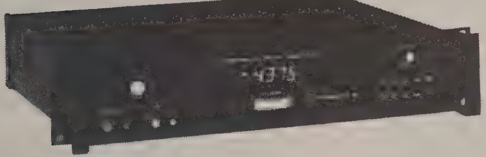
Synchro/Resolver Instrumentation
Phase Angle Voltmeters

Phase Angle Voltmeters

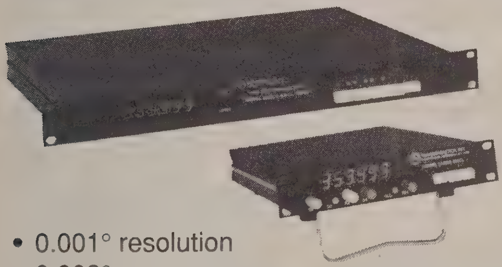


- Accuracy ±.25% F.S.
- Wideband 30 Hz to 100 kHz (Total)
- Digital readout
- Direct measurement
- Self-test
- Isolated Signal and Reference
- IEEE-488 with MATE CIIL
- Ratiometric measurement
- Total harmonic distortion
- DC Output
- 10 mV to 300 V, 6 ranges or autoranging
- Phase offset (359.9°)

VXIbus Instrumentation

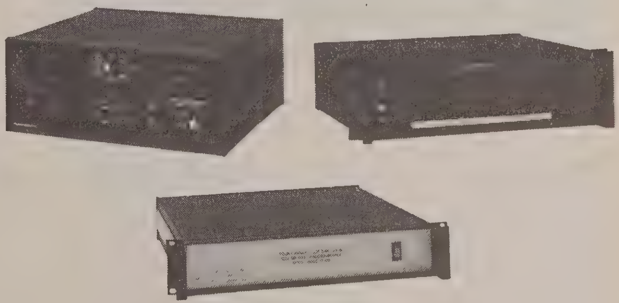
- Wideband Phase Angle Voltmeter
- Synchro measurement and stimulus
- LVDT measurement and stimulus
- D/A and A/D
- Power Supply Controller
- See facing page for details

Angle Position Indicators



- 0.001° resolution
- 0.003° accuracy
- 47 Hz to 10 kHz frequency
- Full rack and half rack versions
- Autoranging reference and input
- Two-speed units
- IEEE-488, MATE available
- Local or remote operation
- 25 distinct models to choose from

Synchro/Resolver Simulators



- 0.001° resolution
- 0.003° accuracy
- 47 Hz to 10 kHz frequency
- Full rack and half rack versions
- IEEE-488, RS232C, MATE available
- Local or remote operation
- Programmable output
- Dynamic mode
- 15 distinct models to choose from

TRANSMAGNETICS, INC.

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PCbus, STDbus

Synchro, Resolver, LVDT, RVDT, A/D & D/A

PCbus Syn/Rsvr-to-Digital Summary Table

MODEL	NO. OF INPUTS	INPUT FORMAT	RES	ACCURACY	INPUT	INPUT (Ƶ) (Ohms)	REF (Vrms)	FREQ (Hz)	TRACKING RATE (rps)
5672C-1	4	LVDT	12 bit	0.1% F.S.	7.0 Vrms	20 k	7.0	1800	N/A
5672C-3	6	Synchro	14 bit	0.1°	11.8 V_{L-L}	40 k	26	400	25
5672C-4	4	Synchro	16 bit	0.05°	90 V_{L-L}	100 k	115	50/400	3.13 at 50 Hz
5672C-5	4	Synchro	14 bit	0.1°	90 V_{L-L}	100 k	115	50/400	325 at
5672C-6	3	Resolver	12 bit	0.15°	11.8 V_{L-L}	40 k	26	400	25
5672C-7	4	Synchro	14 bit	0.1°	11.8V_{L-L}	40 k	26	400	25
5672C-8	4	Synchro	12 bit	0.15°	90 V_{L-L}	100 k	115	400	25
5672C-10	3	Synchro	14 bit	0.1°	11.8V_{L-L}	40 k	26	400	25

Includes self-test, transformer isolation and reference and signal loss detection.

PCbus Digital-to-Syn/Rsvr Summary Table

MODEL	NO. OF OUTPUTS	OUTPUT FORMAT	RESOLUTION	ACCURACY	OUTPUT (V_{L-L})	LOAD	REF (Vrms)	FREQ (Hz)
5691C-1	6	Synchro	16 bit	0.033°	11.8	40 kΩ	26	400
5691C-2	2	Synchro	16 bit	0.033°	90	100 kΩ	115	400
5691C-3	4	Synchro	16 bit	0.033°	11.8	40 kΩ	26	400
5691C-4	4	Synchro	16 bit	0.033°	90	50 kΩ	115	500
5691C-6	3	Resolver	16 bit	0.033°	11.8	40 kΩ	26	400
A5691C-8	1	Synchro	14 bit	0.067°	90	6 kΩ	115	50/400
5691C-9	2	Resolver	16 bit	0.033°	3.5	1 kΩ	7.0	3000
5691C-10	1	Synchro	16 bit	0.033°	90	100 kΩ	115	400
5691C-11	6	Synchro	16 bit	0.033°	90	100 kΩ	115	400

Other combinations can be supplied.

STDbus Syn/Rsvr-to-Digital Summary Table

PART NUMBER	TYPE	RES	ACCURACY	FREQ (Hz ±10%)	REF (Vrms ±10%)	INPUT (V_{L-L})	INPUT Ƶ (ohms)	Vcc
5405C-03/14	Synchro	14 bits	.067°	50/400	115	90.0	100 K	±15 VDC
5405C-06/12/12	Resolver	12 bits	.142°	400	26	11.8	40 K	±12 VDC
5405C-08/14	SynRslvr	14 bits	.067°	400	26	11.8/11.8	40 K	±15 VDC
5405C-40/16/12	Synchro	16 bits	.011°	400	26	11.8	40 K	±12 VDC
5405C-55/12	LVDT	12 bits	.05% FS	1800	7.0	7.0	40 K	±15 VDC
5405C-52	Resolver	12 bits	.067°	400	6.4	6.4	40 K	±12 VDC

Includes self-test, transformer isolation and reference and signal loss detection.

STDbus Digital-to-Syn/Rsvr Summary Table

PART NUMBER	OUTPUT FORMAT	RESOLUTION	ACCURACY	OUTPUT (V_{L-L})	LOAD	REF (Vrms)	FREQ (Hz)
5406C-1	Synchro	14 bits	.067°	11.8	1.2 VA	26	400
5406C-6	Synchro	16 bits	.017°	11.8	1.2 VA	26	400

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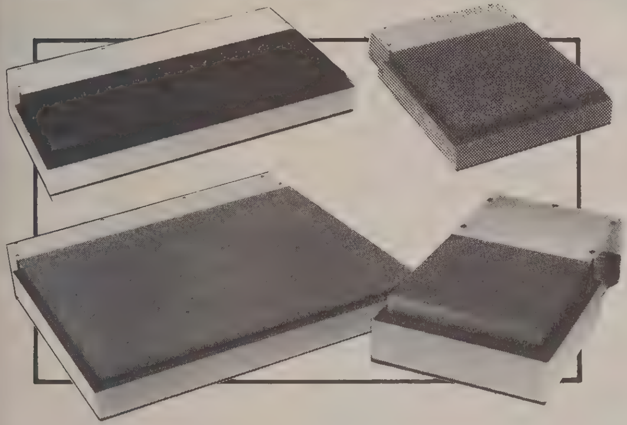
SIGMA SYSTEMS
SAN DIEGO

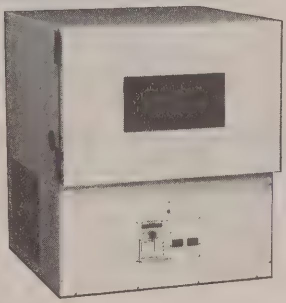
Environmental Test Equipment
Quality, Ingenuity, Integrity — Since 1955

Cold Plates (Thermal Platforms)



- Efficient, accessible, thermally conductive surfaces
- Ramp rates to 100°C per minute!
- Stable within hundredths of a degree
- Seven standard sizes available.
- Enclosure and fixturing options
- Mil-883 and 510 compatible

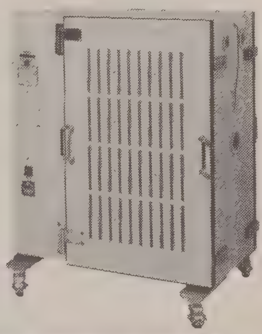
Cycling Chambers



- Fast, Dependable, Economical, Wide range, Programmable control
- Thermal Shock per MIL -202 in a single zone chamber

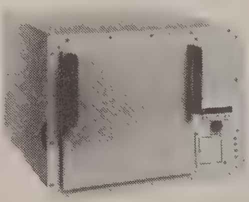
Burn-In-Ovens

- Conventional and *Dual Access* (Entire rear wall removable for fixturing)

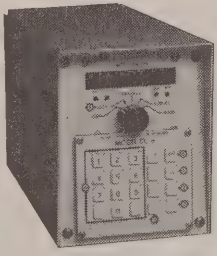


Temperature Chambers

- Portable, rack mount, bench and floor models
- Single stage, cascade, LN_2, CO_2, and air cooled
- Custom chambers a specialty



Controllers (Digital & Analog)



- Programmable
- Dual probe capability responds to both process and product temperature
- Both IEEE-488 and RS-232 interfaces built in
- Platinum RTD's traceable to National Bureau of Standards
- Permanent storage of stand alone programs and setup parameters
- Direct plug-in compatibility for all Sigma thermal products
- Superlative accuracy and stability
- Self instructing manual operation — easy programming

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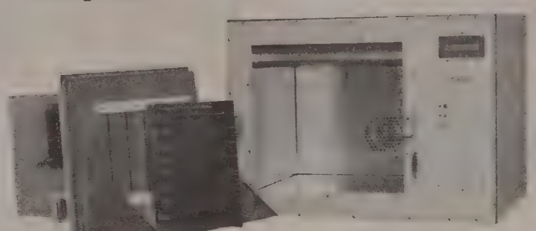
Become accustomed to Sigma quality — it's a pleasure.

Model EC13HA

POWERFUL

enough for the most demanding automated test systems

Switching Matrix



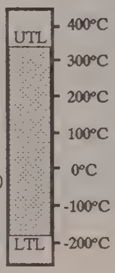
Model EC10,
EC11,
EC10,
and EC01

QUIET

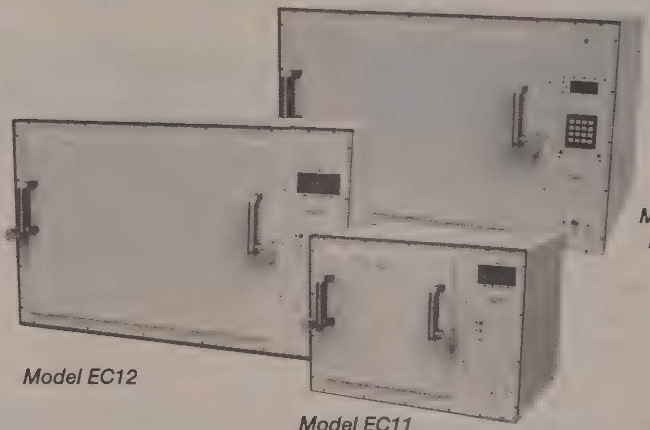
Zero voltage Switching

Broad Operating Range

(°C,°F,or °K)



ENVIRONMENTAL TEST CHAMBERS



Model EC03

Model EC12

Model EC11

FAST

enough for
MIL STD 883
upto 1°C/sec

OPTIONS:

- 3 Tank LCO_2 manifold
- Air cooled Chambers
- N_2 Gas Purge
- PC-based ATE Systems
- Carts, Racks, Fixturing
- LN_2 Auto Purge
- Switching Matrix

Model EC10

Features

- IEEE-488 & RS232
- Local Programming
- PID Algorithms
- 2 Year Warranty
- Engineering Support
- Competitive Pricing
- Fast Delivery
- Purchase or Rent
- Ramping
- User Probe
- Chart Outputs
- Menu Setups
- Digital User Port
- RS422
- Serial User Port
- Analog I/O

Model EC10

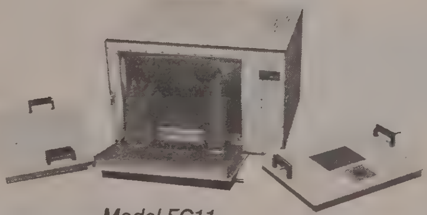
Retrofit ...

your existing temperature or temp/humidity chamber with:

IEEE-488

RS232,
Programmability,

and more.



Model EC11

30 Day Free Trial

Other SUN SYSTEMS Products

Sun Systems also designs and manufactures PROCESS CONTROLS which offer state-of-the-art control of processes such as temperature, humidity and pressure with a wealth of user-friendly features.

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Telephone

Sun Electronic Systems, Inc.
5307 NW 35th Terr, Ft. Lauderdale, FL 33309

305 739 7006
Fax

EC Series Environmental Chambers

Model	EC0A	EC01	EC02	EC03	EC1A	EC10	EC11	EC12	EC13	EC13HA	EC16	EC16HA
List Price	$3150	$3500	$4650	$5100	$3900	$4300	$4600	$5450	$5900	$6750	$9700	$9950
Chamber Volume	0.37 ft^3	0.7 ft^3	2.2 ft^3	3.0 ft^3	0.37 ft^3	0.7 ft^3	0.7 ft^3	2.2 ft^3	3.0 ft^3	3.0 ft^3	6.16 ft^3	6.16 ft^3
Interior Dim. [Inches]	10.0 "W 8.0 "H 8.0 "D	12.0 "W 9.75"H 10.25"D	20.0"W 12.0"H 16.0"D	20.0"W 12.0"H 22.0"D	10.0"W 8.0"H 8.0"D	12.0 "W 9.75 "H 10.25 "D	12.0 "W 9.75 "H 10.25 "D	20.0 "W 12.0 "H 16.0 "D	20.0 "W 12.0 "H 22.0 "D	20.0 "W 12.0 "H 22.0 "D	22.0 "W 22.0 "H 22.0 "D	22.0 "W 22.0 "H 22.0 "D
Heat/Cool Rate of Change	30 °C/min	30 °C/min	15 °C/min	15 °C/min	30 °C/min	30 °C/min	60 °C/min	15 °C/min	15 °C/min	30 °C/min	15 °C/min	30 °C/min
Controller	MODEL TC01 (included in chamber price)				MODEL TC10 (included in chamber price)							
Temp. Setpoint Range	-73°C to +300°C in 0.1° Steps (LN$_2$ Option; -100°C to +300°C)				-73°C to +315°C in 0.1°C Steps (LN$_2$ Option: -184°C to +315°C)							
Time at Temp. Range	0.1 to 1800 minutes or Continuous (Optionally, 0.1 to 1800 hours)				1.0 sec to 99 hr 59 min 59 sec or Continuous							
Ramping Rate Control	Not controlled Locally				Locally Controlled from 0.01°C/min up to the Specified Heat/Cool Rate of Change							
Set Temps and Times	10 Programmable Set Temperatures and Times				Number of Set Temperatures and Set Times Limited Only By Available Program Memory. Typically 100+ Segments							
Temp Resolution	0.1°C				0.02°C							
Temp. Loop Control	1 to 1800 Cycles of Programmable Set Temperatures and Set Times or Continuous				1 to 65,535 FOR/NEXT Loop Executions for 10 Loops, Nesting Supported							
Control Technique	PID Algorithm/Pulse Width Modulated, Programmable from Remote Interfaces				PID Algorithm / Pulse Width Modulated, Programmable from Keyboard or Remote Interfaces							
Local Operation	16 Keyboard / 4 Digit Display				29 Key Keyboard / 2 Line LCD							
Remote Operation	Built-in IEEE-488 / RS232 Interfaces				Built-in IEEE-488 / RS232 /RS422 Interfaces							
Additional I/O Capability	IEEE-488 to RS232 Transparent Mode, 2 Auxiliary Outputs, 1 Auxiliary Input				Electrically Isolated USER Temperature/Voltage Probe, 4 Channels of Analog Input and Analog Output, 16 Bit Address/8 Bit Data Parallel Port, 56 KBit Auxiliary High Speed Serial Port, IEEE-488 to RS232/RS422 Transparent Mode, 5 Auxiliary Outputs, 8 Auxiliary Inputs							
Safety Features	Open/Short Probe Detection, Adjustable Over Temperature Thermostat, Software Upper Temperature Limit				Open/Short Probe Detection, Adjustable Over Temperature Thermostat, Software Upper and Lower Temperature Limit							

HC Series **TEMPERATURE HUMIDITY CHAMBERS** also available.
Please contact Sun Systems for information.

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5307 NW 35th Terr, Ft. Lauderdale, FL 33309

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IET LABS, INC.

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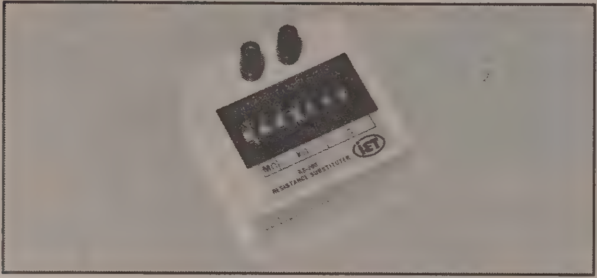
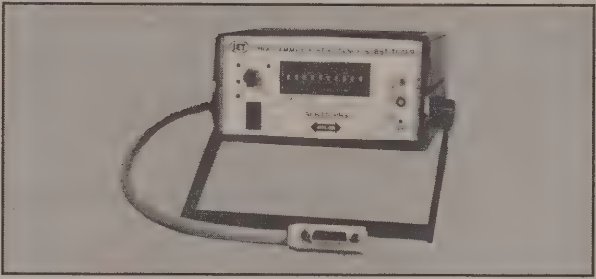
CALIBRATION • TEST • MEASUREMENT



Decade Substituters

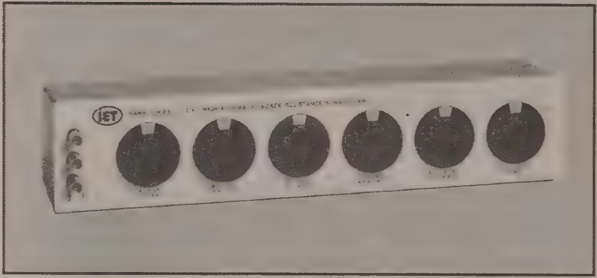
- Resistance
- Capacitance
- Inductance
- RTD



Programmable

- IEEE-488
- BCD

IEEE-488



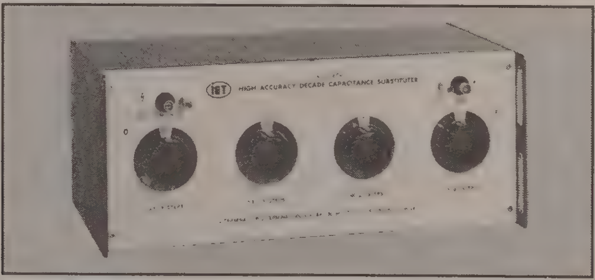
High Accuracy Resistance

High Resistance

Kelvin Varley Voltage Dividers

Transfer Standards

Standards

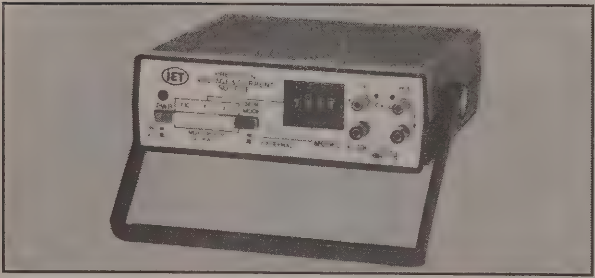


High Accuracy Capacitance

High Accuracy Inductance

High Power Resistance

Standards



Precision Sources

- Voltage
- Current

Impedance Meters

Component Testers

See our catalog on pages D•1266-1273

CALIBRATORS, REFERENCES, STANDARDS, SOURCES

Manufacturer	Starting EEM Page No.	Model/ Series	DeviceType				Parameters												Parameter Range From-To Units	Readout Features
			Calibrator	Reference, DC	Standard	Source	Current		Frequency	Phase Angle	Power	Resistance	Signal		Thermal Voltage AC/DC	Voltage				
							AC	DC					Audio	Test		AC	AC (RMS)	DC		
AT & T Capital	D•1228																			Equipment rentals/ leasing.
Clarke-Hess	D•1246	828	√		√	√	√	√								√	√	√		Digital.
		5500	√		√	√				√										Digital, programmable, IEEE-488 compatible.
		5050				√	√			√										Programmable, IEEE-488 compatible.
Cytec Corp.	D•1250	All	√	√	√	√	√	√	√	√	√	√				√	√	√		Analog, digital, programmable, IEEE-488 compatible.
Davis Instruments Manufacturing Co.	D•1251	Several	√	√	√	√	√	√	√	√	√	√				√	√	√		
Electronic Development Corp.	D•1253	621	√		√							√							1Ω-19MΩ	Digital, programmable, IEEE-488 compatible.
		4601	√		√	√										√			1mVac-1100Vac	Digital, programmable, IEEE-488 compatible.
		522	√	√	√	√		√										√	100mV-1000Vdc 10mA-100mAdc	Digital, programmable, IEEE-488 compatible.
		CR-103/J	√	√	√	√		√										√	10mA-100mAdc	Digital
																		√	0.1µV-10Vdc	Digital
Electronic Precision Components	D•1254			√	√			√												
Empro Manufacturing Co.	D•1257	DC Ammeter shunts																		
General Resistance	D•1352		√	√	√	√		√				√						√		Analog, digital, programmable, IEEE-488 compatible.
IET Labs, Inc.	D•1266	HARS-X/-Q/-L	√		√							√							.001-10M	Digital.
		HRRS	√		√							√							.01M-1,110M	Digital.
		PRS	√		√							√							0.01-100M RTD Simulator	Digital, programmable, IEE-488 compatible.
		PRTD	√		√							√							0.001-1K RTD Simulator	Digital, programmable, IEEE-488 compatible.
		HATS-LR	√		√							√							1-100K	Digital, transfer std.
		HATS-Y	√		√							√							10K-100M	Digital, transfer std.
		SR	√		√							√							1-10M	Std. resistor.
		KVD-600/700	√		√							√						√	Voltage divider	
		HACS	√		√														100pF-1µF	Digital, capacitance.
		HACS-Z	√		√														1pF-100µF	Digital, capacitance.
		PCS	√		√														100pF-100µF	Digital, capacitance, programmable, IEEE-488 compatible.
		SC-900	√		√														0.02pF-110pF	Analog, prec. air cap.
		SC																	100pF-10µF	Standard capacitor.
		LS	√		√														1µH-100H	Digital, inductance.
		PLS	√		√														1µH-100H	Digital, inductance programmable, IEEE-488 compatible.
		SL	√		√														100µH-10H	Std. inductor.
		V1-700	√	√		√												√	100µV-200V	Digital, programmable, IEEE-488 compatible.
		HSVR		√														√	1V-19V	
Japan Electronics	D•1274	Sensors																	1%-25%-Gas	
JFW Industries	D•1275																			RF switches and switching matrices.
Joslyn Jennings Corp.	D•1277															√	√	√		Analog, digital.
Julie Research Labs	D•1278	RD, PRS		√								√								Programmable, IEEE-488 compatible.
		Locost 106	√		√		√	√				√				√		√	6 1/2 digital readout	Digital, programmable, IEEE-488 compatible.
		VDR, HV, DV, KV, MVD																	0-100KV	
		SCO-106		√														√	1.01770V	Analog
		GTX, DVS, ZVR	√	√	√													√	0-1200V	Analog
		DCS-105, DCS-106			√		√												0-120A	
		ACS-106, ACV-106			√		√												0-12A	Programmable, IEEE-488 compatible.

CALIBRATORS, REFERENCES, STANDARDS, SOURCES (cont'd)

Manufacturer	Starting EEM Page No.	Model/ Series	Device Type: Calibrator	Device Type: Reference, DC	Device Type: Standard	Device Type: Source	Parameters: Current AC	Parameters: Current DC	Parameters: Frequency	Parameters: Phase Angle	Parameters: Power	Parameters: Resistance	Parameters: Signal Audio	Parameters: Signal Test	Parameters: Thermal Voltage AC/DC	Parameters: Voltage AC	Parameters: Voltage AC (RMS)	Parameters: Voltage DC	Parameter Range From-To Units	Readout Features
Julie Research Labs *(continured)*	D•1278	TNB-102			√														0.5-1000V, 50KHz	
		AVS106, RVD 10G																		Digital, programmable
		RVD 126, AVC 106		√		√												√	0 to 200V	
		NB, DMR, PRO, MRS			√							√							0 to 10 Megohm	
		BMR, DR																	1 PPM accuracy	
		AC-129 AC-104,	√			√										√			10nV to 1211.11V, 10Hz to 1.1MHz	Programmable, IEEE-488 compatible.
		AC50CAL AC50, AC153																	0 to 250 VA	
Krohn-Hite Corp.	D•1291				√					√										Analog, digital, programmable, IEEE-488 compatible.
MiNT Systems Corp.	D•1300	3100 Series								√		√							R, Q, Cp OR Cs, LP or LS; C, D, Q, ESR or EPR; L, 0.1% Basic accuracy, 100Hz-20KHz 50mV-1V Test Signals, 5 Digit Resolution R=0.0001 ohm - 9999Mohm L=0.0001µH-9999H C=0.0001pf-9999mF D=0.0001-9999 Q=0.0001-9999	Digital, programmable, IEEE-488 compatible.
National Instruments	D•1302	Workstation interfaces		√		√													DMA rates	Analog, digital, programmable.
		Comp. source interfaces	√	√	√	√	√	√	√	√	√	√				√	√	√	Various	Analog, digital, programmable, IEEE-488 compatible.
NH Research	D•1303	56000		√		√	√	√	√	√	√	√				√	√	√		Programmable, IEEE-488 compatible.
Nohau Corp.	D•1304	Microcontroller emulator		√		√													8 bit	
Noise Com Inc./ MDF	D•1310	7100				√											√		10Hz to 400GHz	Digital, programmable IEEE-488 compatible.
North Atlantic		7800	√														√		Linear Motion	Digital, programmable.
		540			√												√		Angular position	Analog.
		530			√												√		Angular postion	Analog.
		213			√												√		.003-300Vrms	Analog.
		800/8500/8800			√												√		Angular position	
		5310			√												√		Angular position	Programmable.
		2250								√							√			Digital, IEEE-488 compatible.
		VXI 5388			√												√			Programmable.
		VXI 227								√							√		.003-300 Volts	Programmable.
		VXI 7836				√											√		Linear motion	Programmable.
Ohio Semitronics	D•1313	WH, AH Series			√	√	√	√			√					√			AH-up to 10KA WH-up to 600V, 600A	
Omega Engineering	D•1314	Many	√		√	√		√	√			√			√			√		Digital, programmable.
PPM Inc.	D•1315	RX	√		√							√								Digital, programmable, IEEE-488 compatible.
Programmed Test Sources	D•1316	PTSS 040-x10				√			√											
Ross Engineering Corp.	D•1319	VMD/VD			√											√	√	√		Digital.
Shallco	D•1323	690/790																		
Shalltronix	D•1324	Series 6800		√									√			√				Decade box.
U.S. Digital Corp.	D•1327																			Digital incinerator, tilt angle sensor.

CALIBRATORS, REFERENCES, STANDARDS, SOURCES (cont'd)

Manufacturer	Starting EEM Page No.	Model/ Series	DeviceType				Parameters												Parameter Range From-To Units	Readout Features
							Current		Frequency	Phase Angle	Power	Resistance	Signal		Thermal Voltage AC/DC	Voltage				
			Calibrator	Reference, DC	Standard	Source	AC	DC					Audio	Test		AC	AC (RMS)	DC		
Valhalla Scientific	D•1328	2701C	√	√	√	√		√										√	200mV-1200V, 25mA; 120mA opt.	Digital, programmable, IEEE-488 compatible.
																			1.2mV-120V, 10Hz-100KHz	Digital, IEEE-488 compatible.
		2703	√		√	√			√	√						√			1.2mV-120V, 10Hz-100KHz	
		2705			√	√			√	√						√			1.2mV-1200V; 10Hz-100KHz	
		2724A	√		√	√						√							0-11H; 5pS-120mA	Digital, IEEE-488 compatible.
		2500	√				√	√											1µA-1A	
		2500EP	√				√	√											100µA-10A	Programmable; IEEE-488 compatible.
		2575A	√			√	√	√											100A-1mA; .001-100	
Walker Scientific	D•1334		√	√	√	√													Gauss-flux hysterisis	Analog, digital.
Xitron	D•1335		√	√	√	√				√			√			√				

INSULATION RESISTANCE TESTERS

Manufacturer	Starting EEM Page No.	Model/Series	No. of Digits	Maximum Readings					Accuracy (% Reading)	Remote Control	Type Display
				Voltage (V)		Current (A)					
				AC	DC	AC	DC	Resistance M			
AT & T Capital	D•1228	Equipment rentals and leasing.									
Cabletest International Inc.	D•1218	All	3 1/2	5000	2000	20		10 M	±.05	√	LCD
Cirris Systems	D•1244	1000H+		—	1000		6.5mA	5-500	10%		LCD
		CH+		1000	1500	6.5mA	6.5mA	5-500	10%		PC Monitor
Criterion Instruments	D•1248				√			1,000,000	2%		Analog
Davis Instruments Manufacturing Co.	D•1251	IRT2/ UN880125	4	0-200		0-200		0-200	±3%		Digital
Qualitec Technologies	D•1317	ACDC 560E	3 1/2	5000	0-1000	10		100,000	0.3	√	LCD
		ACDC 260E	3 1/2	1,500	0-1000	25		100,000	0.3	√	LCD
ROD-L Electronics	D•1320	M300 RT			2			.15	±.03	√	Analog, digital
Vitrek	D•1333				√			10M			

MEGOHMETERS

Manufacturer	Starting EEM Page No.	Model/Series	No. of Digits	Maximum Readings					Accuracy (% Reading)	Remote Control	Type Display
				Voltage (V)		Current (A)					
				AC	DC	AC	DC	Resistance M			
AT & T Capital	D•1228	Equipment rentals and leasing.									
Criterion Instruments	D•1248				√			1,000,000	2%		
Davis Instruments Manufacturing Co.	D•1251	918/5T00200	4	600	VAC			0-200	±2%		Digital
PPM Inc.	D•1315	RIM-A	3.5		500			200,000	10		LCD
Qualitec Technologies	D•1317	IR400P	3 1/2		0-1000			100,000	0.3	√	LCD
		IR350E	3 1/2		0-1000			100,000	0.3	√	LCD
ROD-L Electronics	D•1320	M300RT			√			15	±.03	√	Analog, digital
Slaughter Co.	D•1325	1727/205			1KV			10K	±10%	IEEE-488	LED
Vitrek	D•1333							10M			

TEST SYSTEMS, COMPUTER CONTROLLLED (ATEs)

Manufacturer	Starting EEM Page No.	Model/Series	Applications (passive/active components, EMI/RFI, power, ICs, etc.)	Modular, Standalone	Compatibility (MS Dos, VXI, GPIB, etc.)	Programmable	Compliance/ Approvals
Amplifier Research	D•1224	EMSCAN	EMC	Standalone modular	MS Windows	√	
AT & T Capital	D•1228	EZ-Pro	MPU In-circuit emulator				
AZ-Com.	D•1235		Electronic extenders		All	√	
Cabletest International Inc.	D•1240		Wire harness testing	√	GPIB, RS232	√	
Clarke-Hess	D•1246	5500/5050	120V/5A/Power Phase	Standalone	GPIB	√	NISD traceable
Cytec Corp.	D•1250	All	All	All	All	√	
Leader Instruments	D•1292	1605 408	Computer monitors Video	Standalone Rack mount	GPIB	√ √	
NH Research	D•1303	Powertest	Power supply ATE	All	VXI/GPIB	√	UL, CSA, VDE
Ohio Semitronics	D•1313						
Schaffner EMC Inc	D•1322	6500/m1000 Win 600 Powerstar	Power supply EMC immunity Power supply	Modular Modular Modular	DOS, VXI, GPIB DOS, VXI, GPIB DOS, VXI, GPIB	√ √ √	IEC IEC IEC
Vitrek	D•1333		All	All	All	√	
Voltech	D•1332	AT3500	Transform/coil tester	Standalone	RS232	√	

FUNCTION GENERATORS

Manufacturer	Starting EEM Page No.	Model/Series	Frequency Range		Functions	Sweep
			From	To		
AT & T Capital	D•1228				Equipment rentals and leasing	
Davis Instruments Manufacturing Co.	D•1251	3017A/BP447265	0.2Hz	2MHz	Generates sine, triangle and square wave forms (0.2 Hz to 2 MHz, 7 ranges)	√
Elgenco	D•1255	602A-200, 602A-1390, 603A, 610A, 624A	5Hz	5MHz	Gaussian noise.	
Hauman	D•1265	8100/8110 Series	0.1Hz	2.0MHz	Sine, square, triangle, pulse, ramp, AM, FM, frequency counter	
Keithley Instruments	D•1283	3940	0	20MHz	Trigger, burst, gate modes. Arbitrary waves.	√
Kikusui International Corp.	D•1289	4500A	0.001 Hz	10MHz	Sine, triangle, pulse	
Leader Instruments	D•1292	LFG-1300s	0.02 Hz	2MHz	Sine, tri., sq., sawtooth, pulse	Lin/Log Internal 1000:1
Marconi Instruments	D•1297	2382 2383 2386	10Hz 100Hz 100Hz	400MHz 4.2GHz 26.5GHz	Analyzers, spectrum Auto, GPIB, 3Hz resolution Bandwidth tracking generator	
Noise Com Inc./MDF	D•1310	NC6101 NC6013 NC6105 NC6107	10Hz 10Hz 10Hz 100Hz	20KHz 500KHz 10MHz 100MHz	Gaussian noise. Gaussian noise. Gaussian noise. Gaussian noise.	√ √ √ √
North Atlantic Industries Inc.	D•1312	5310 530	47Hz 50Hz	5KHz 11KHz	Synchro resolver Resolver synchro bridge	
PPM Inc.	D•1315	DS-100	30Hz	200KHz	Accurate, programmed freq. & amp	

DIGITAL DELAY GENERATORS

Manufacturer	Starting EEM Page No.	Model/Series	Time Increments	Time Range (ns)	Trigger Rate (MHz)	Input Sensitivity (V)	Features		
							IEEE-488 Compatible	Programmable	BCD Input
PPM Inc.	D•1315	EP-4	100µs	166 hrs.		TTL			

DIGITAL MULTIMETERS, NOT HANDHELD

Manufacturer	Starting EEM Page No.	Model/Series	No. of Digits	Maximum Readings					DC Accuracy (% Reading)	True RMS	Type of Display	Battery Operated	Plug-in	Remote Control (IEEE-488, RS-232)
				Voltage (V)		Current (A)		Resistance M						
				AC	DC	AC	DC							
AEMC	D•1223	Clamp-on current probes												
AT & T Capital	D•1228	Rent/lease												
Clarke-Hess	D•1246	255/259	4	1000	1000	50A	50A	—	.25%	.25%	LED			
Davis Instruments Manufacturing Co.	D•1251	82/FL193684	4 1/2		400Mv-1000V	45-200Hz		25-1000,000	.1%	√	10.999	√		
John Fluke Manufacturing Co.	D•1259	8840 Series 45 Series	5 1/2 5	700 750	1000 1000	2 10	2 10	20 300	0.005 0.02	√ √	VF VF	√	√	
IET Labs Inc.	D•1266	IMF-	3 1/2	750	1000	2	2	1000	0.1	√	LED	√	√	
Keithley Instruments	D•1283	2001	7 1/2	750	1100	2	2	1000	0.002	√	VFD		√	
Kikusui International Corp.	D•1289	DME1400	4 1/2	√	√	√	√	0-20M	±0.03%		LCD			
Millivac Instruments	D•1299	MV-714A	4	300						√	LED			
North Atlantic Industries Inc.	D•1312	2250	5 1/2	500						√	LED			
Ohio Semitronics	D•1313	AH Series					10kA			√	LED		√	
Ross Engineering Corp.	D•1319	VMD2A	4 1/2,	700	1000				0.01%	0.1	LCD	√	√	
Vitrek	D•1333													
Voltech	D•1332	PM3000 PM1000 PM1200	 4 1/2 4 1/2	2KV 1KV 1KV	2KV 1KV 1KV	200 110 175	200 110 175	9.999M	±0.1% ±0.25% ±0.1%	√ √ √	2-line matrix LED LED			

HANDHELD DIGITAL MULTIMETERS

Manufacturer	Starting EEM Page No.	Model/Series	No. of Digits	Maximum Readings					DC Accuracy (% Reading)	True RMS	Type Display
				Voltage (V)		Current (A)		Resistance M			
				AC	DC	AC	DC				
AT & T Capital	D•1228	Rent/lease									
F.W. Bell Inc.	D•1236	UM-790O CG-100D	3 1/2 3 1/2	90-660		1-1000 1-200	1-1400 1-200		±1.5 ±0.75	√	LCD LCD
Davis Instruments Manufacturing Co.	D•1251	33/FL192000				45-1000				√	
John Fluke Manufacturing Co.	D•1259	70 Series 10 Series 80 Series	3 1/2 3 3/4 3 3/4	750 600 1000	1000 1000	10 10	10 10	40 40 40	.3 0.9 0.1	 √	LCD LCD LCD
Leader Instruments	D•1292	300	3 1/2	750	1,000	0.32	0.32	32	0.5		LCD
LEM U.S.A. Inc.	D•1294	600 2000P	3 1/2 4 1/2	750 750	750 200/1000	600 200/600	600 200/600	2 4K, 40K, 400K	1 1	√ √	LCD LCD
Omega Engineering	D•1314	Many	3 1/2	750	1000	4	4	40MΩ	.25	√	LCD, LED, synthesized speech
Ross Engineering Corp.	D•1319	VMDP	4 1/2	300KV	400KV				0.1	0.5	LCD

ANALOG MULTIMETERS, HANDHELD

Manufacturer	Starting EEM Page No.	Model/Series	Maximum Readings					DC Accuracy (% Reading)
			Voltage-AC	Voltage-DC	Current-AC	Current-DC	Resistance M	
Ross Engineering Corp.	**D**•1319	VME						

ANALOG MULTIMETERS, NOT HANDHELD

Manufacturer	Starting EEM Page No.	Model/Series	Maximum Readings					DC Accuracy (% Reading)	Battery Operated	Plug-in
			Voltage-AC	Voltage-DC	Current-AC	Current-DC	Resistance M			
AT & T Capital	**D**•1228	Equipment rentals/leasing								
Electrical Instrument Service	**D**•1252		150V	140kV	50A			0.25		
Millivac Instruments	**D**•1299	MV-973A	300V	1000V	10mA	10mA	5000	1	√	

SIGNAL GENERATORS

Manufacturer	Starting EEM Page No.	Model/Series	Frequency Range (Hz)		Modulation (Hz)		Features	
			From	To	From	To	IEEE-488 Compatible	Programmable
AT & T Capital	**D**•1228	Equipment rentals/leasing						
Julie Research Labs	**D**•1278	RCD	1Hz	1MHz				
		AC	0.1Hz	99KHz				
Leader Instruments	**D**•1292	LAG-120B	10Hz	1MHz				
		3221	100kHz	2.7GHz	DC	100kHz	√	√
Marconi Instruments	**D**•1297	2030/2031	100kHz	2.7GHz	DC	10MHz	√	√
Noise Com Inc./ MDF	**D**•1310	NC6107	100Hz	100MHz			√	√
			NC6112	1MHz	2GHz			√ √
			NC6240	2GHz	40GHz			√ √
Quantum Data	**D**•1318	801GP/Video generator	4.7MHz	87MHz				√
		801GX/Video generator	4.7MHz	135MHz			√	√
		8701E-1 Video generator	3.125MHz	400MHz			√	√
		901/Video generator	1MHz	87MHz			Optional	√
		902/Video generator	2MHz	125MHz			Optional	√
		903/Video generator	1MHz	250MHz			Optional	√

PULSE GENERATORS

Manufacturer	Starting EEM Page No.	Model/Series	Frequency Range (Hz)		Optical Peak Power µW Pulse Amplitude (V)	Electronic	Optical
			From	To			
AT & T Capital	**D**•1228						
Avtech Electrosystems Ltd.	**D**•1234	AV Series	1Hz	50MHz		√	
Berkeley Nucleonics Corp.	**D**•1239	6040	.01Hz	100MHz	5V/ECL	√	
		6040/201E	.01Hz	500MHz	±5V	√	
		6040/203E	.01Hz	50MHz	±25V	√	
		6040/202H	.01Hz	1MHz	±300V	√	
		6040/085	.01Hz	CW	2mW		√
		6040/106H	.01Hz	2KHz	50mW		√
		6040/130	.01Hz	CW	1mW		√
		6040/155	.01Hz	CW	1mW		√
Schaffner EMC, Inc.	**D**•1322	NSG 200, NSG 600/625		200MHz	4000	√	
		NSG 1025		200MHz	4400	√	
		NSG 500B/11, NSG 500C			300	√	
		NSG 587			10000	√	
		NSG 650			6600	√	
		NSG 432		1GHz	25000	√	
		NSG 435		1GHz	16500	√	

HIPOT TESTERS (INSULATION, RESISTANCE & DIELECTRIC STRENGTH)

Manufacturer	Starting EEM Page No.	Indicators			Current Meter	Remote Control, Features	Power Source	Maximum Voltage	
		Audible	Visual					AC	DC
			Digital	Analog					
Associated Research	D•1226	√	√	√	√		115/230 VAC, 50/60 Hz		
AT & T Capital	D•1228						Equipment rentals/leasing		
Chatsworth Data	D•1243	√	√		√				
Cirris Systems	D•1244	√	√	√		PC based operation	AC, DC	1000	1500
Criterion Instruments	D•1248	√		√	√	Yes	0-75kV	√	√
Joslyn Jennings Corp.	D•1277	√		√	√			115-230	
Kikusui International Corp.	D•1289	√		√	√		AC & DC		
Qualitec Technologies	D•1317	√	√		√		AC & DC		
ROD-L Electronics	D•1320	√	√	√	√		AC & DC		
Ross Engineering Corp.	D•1319		√	√	√		AC		
Slaughter Company	D•1325	√		√			117VAC 50/60 Hz	3,000	
Torotron Corp.	D•1326	√		√			115 VAC		

MAGNETIC TEST EQUIPMENT

Manufacturer	Starting EEM Page No.	Type of Equipment	Range (Gauss)	Input		Output		Noise (Hz)	Accuracy (% Reading)	Readout Analog/ Digital	Type Display
				Voltage (V)		Current (A)					
				AC	DC	AC	DC				
AT & T Capital	D•1228	Rent/lease									
F.W.Bell Inc.	D•1236	4060 Gaussmeter 4048 Gaussmeter 9200 Gaussmeter 9640 Gaussmeter 9500 Gaussmeter 9900 Gaussmeter	.1G, 5G 200G 20KG 206-201kG .16-30kG 36-30kG 36-3mG						1.0% 2.0% .5% .3% .1% .075	Dig 3 1/2 Dig 31/2 Dig 3 1/2 Analog Dig 4 3/4 Dig 43/4	LCD LCD LCD LCD LCD
Davis Instruments Manufacturing Co.	D•1251	IMG4D/ WS94201	100						±.1 Gauss	Digital	
EMDS	D•1256	Fluxgate Magnetometer					±10 VDC	0.1 Int. P-P	.03%	Analog	
GMW	D•1260	Fluxgate nanoteslameter Hall effect teslameter NMR teslameter Integrator/ fluxmeter Laboratory electromagnet	to 20G to 30kG to 13.6T to 30kG						0.1%, 0.5% 0.05%, 0.01% 5ppm	Analog/digital Analog/digital Digital Digital	LCD LED LED
Magnetic Instrumentation	D•1295	All	0-100kG	110/220						Analog/digital	Analog/digital
Magnos	D•1296	HYSTERES-156RAPN Fluxmeter Gaussmeter	10-9999 10-100k						0.25 0.25 0.25	Digital Analog/digital Digital	LED LCD LCD
Shaffner EMC Inc.	D•1322	NSR8010 plus LISN's NSR 8030 plus Antenna NSR 8051 Portable field strength meters	9KHz - 30MHz 30MHz - 1GHz 1000V/m 1/2A/m	115V	12V	R52	32	20Hz-3GHz		Digital	LCD
Voltech	D•1332	AT3500		.01	500	2rms			1%	Digital	2 x 40
Walker Scientific	D•1334	Gaussmeters Fluxmeters									

eem

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

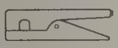
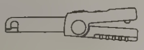
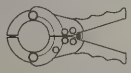
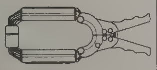
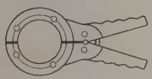
These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

	Argentina (IRAM) Instituto Argentino de Racionalization de Materiales
	Australia (SAA) Standards Association of Australia
ÖVE	**Austria (ÖVE)** Öesterreichischer Verband für Elektrotechnik
CEBEC	**Belgium (CEB)** Comité Electrotechnique Belge
ABNT	**Brazil (ABNT)** Associação Brasileira de Normas Teonicas
	Canada (CSA) Canadian Standards Association
	Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)
	Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)
EOS	**Egypt (EOS)** Egyptian Organization for Standardization and Quality Control
	Finland (SETI) Electrical Inspectorate
	France (UTE) Union Technique de l'Électricité
TGL	**Germany, Democratic Republic of (East) (ASMW)** Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)
	Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)
ELOT	**Greece** (ELOT) The Hellenic Organization of Standardization
	Hong Kong Hong Kong Standards & Testing Centre
	Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)
ISI	**India** (ISI) Indian Standards Institute "Manak Bhavan"
SII	**Indonesia** Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)
	Iran Institute of Standards and Industrial Research of Iran
	Ireland (IIRS) Institute for Industrial Research and Standards
SII	**Israel (SII)** Standards Institution of Israel
	Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)
	Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology
	Korea, Republic of (South) Industrial Advance Administration
DGN	**Mexico (DGN)** Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco
KEMA EUR	**Netherlands (NEC)** Nederlands Elektrotechnisch Comite
SANZ	**New Zealand (SANZ)** Standards Association of New Zealand
	Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)
	Pakistan Pakistan Standards Institution
	Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)
	Portugal (CEP) Comissão Electrotécnica Portuguesa
STAS	**Romania** Institutul Roman de Standardizare (Romanian Standards Institute)
	Singapore Singapore Institute of Standards and Industrial Research
SABS	**South Africa (SABS)** South African Bureau of Standards
	Spain (IRANOR) Instituto Nacional de Racionalización y Normalización
	Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)
	Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach
TSE	**Turkey (TSE)** Turk Standardlari Enstitusu (Turkish Standards Institution)
	United Kingdom (BSI) British Standards Institution
	United States Underwriters Laboratories Inc. Recognized Component Mark
UL	**United States** Underwriters Laboratories Inc.
	Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.
	Yugoslavia Federal Institute of Standardization

AEMC
INSTRUMENTS

AC & DC CLAMP-ON CURRENT PROBES

Current probes extend the current measuring capabilities of digital multimeters, power instruments, recorders or loggers; some models are designed specifically for use with oscilloscopes. The probes clamp around the current-carrying conductor to measure current without interrupting the circuit under test. The output of the probe is current or voltage, providing current measuring capabilities to instruments with low current or voltage inputs. AEMC has the widest selection of current probes available.

Series	Cat. #	Model*	Measurement Range		Output Signal		Output Connection	Ratio	Price
			AC	DC	Current	Voltage			
 Ø = 0.47" (12mm)	100.105	MN105	2 A to 150 A		1 mA AC/A AC		Jack	1000:1	69.00
	100.185	MN185	50 mA to 150 A		1 mA AC/A AC		Jack	1000:1	89.00
	100.270	MN170	2 A to 75 A		10 mA AC/A AC		Lead	100:1	129.00
	1031.02	MN103	1 mA to 15 A 1 A to 150 A			1 mV AC/mA AC 1 mV AC/A AC	Lead		119.00
	1031.17	MN106	2 A to 150 A		1 mA AC/A AC		Lead	1000:1	69.00
	1031.18	MN107	2 A to 150 A		1 mA AC/A AC		Lead	1000:1	69.00
 Ø = 0.46" (11.8mm)	1201.40	SL201	50 mA to 1.5 A 1 A to 120 A	50 mA to 2 A 1 A to 150 A		1mV/mA AC/DC 1 mV/A AC/DC	Lead		289.00
	1201.45	SL206	10 mA to 1.5 A 100 mA to 60 A	10 mA to 2 A 100 mA to 80 A		1 mV/mA AC/DC 10 mV/A AC/DC	Lead		319.00
 Ø = 1.18" (30mm) Ø = 2.5 x 2" (63 x 5mm)	100.402A	MD302	4 A to 500 A		1 mA AC/A AC		Lead	1000:1	69.00
	1201.03	MD500	1 A to 500 A	1 A to 500 A		1 mV/A AC/DC	Lead		179.00
	1201.04	MD400	1 A to 400 A	1 A to 400 A		1 mV/A AC/DC	Lead		155.00
	1201.07	MD301	4 A to 500 A			1 mV DC/A AC	Lead		109.00
	1201.11	MD510	1 A to 700 A	1 A to 1000 A		1 mV A AC/DC	Lead		249.00
	1201.21	MD303	4 A to 500 A		1 mA AC/A AC		Lead	1000:1	69.00
	1201.36	MD305	1 A to 600 A		1 mA AC/A AC		Lead	1000:1	139.00
	1201.37	MD304	1 A to 600 A		10 mA AC/A AC		Lead	100:1	149.00
 Ø = 2.13" (54mm)	100.101	SD601	50 mA to 1000 A		1 mA AC/A AC		Jack	1000:1	169.00
	100.101Y	SD602	50 mA to 1000 A		1 mA AC/A AC		Jack	1000:1	169.00
	1201.19	SD603	50 mA to 1000 A		1 mA AC/A AC		Lead	1000:1	169.00
	1201.20	SD604	50 mA to 1000 A		1 mA AC/A AC		Lead	1000:1	169.00
	1201.41	SD632	1 A to 1000 A		5 mA AC/A AC		Lead	1000:5	249.00
Oscilloscope Probe*	1201.49	SD661	10 mA to 1000 A			100 mV/A AC 10 mV/A AC 1 mV/A AC	Lead with BNC		299.00
 Ø = 2.56" (65mm) Ø = 1.97 x 5.31" (50 x 135mm) = 2.56 x 3.94" (65 x 100mm)	1201.06	JM810	1 A to 2000 A		1 mA AC/A AC		Lead	1000:1	295.00
	1201.24	JM825	1 A to 2000 A		2.5 mA AC/A AC		Lead	200:5	365.00
	1201.25	JM800	1 A to 1000 A		1 mA AC/A AC		Lead	1000:1	285.00
	1201.26	JM830	1 A to 3000 A		.33 mA AC/A AC		Lead	3000:1	485.00
	1201.27	JM840	1 A to 500 A 1 A to 1000 A 1 A to 1500 A		2 mA AC /A AC 1 mA AC/A AC .66 mA AC/A AC		Jack	500:1 1000:1 1500:1	515.00
	1201.28	JM850	1 A to 1000 A 1 A to 2000 A 1 A to 3000 A		1 mA AC/A AC .5 mA AC/A AC .33 mA AC/A AC		Jack	1000:1 2000:1 3000:1	545.00
	1201.29	JM815	1 A to 1000 A		5 mA AC/A AC		Lead	1000:5	295.00
	1201.30	JM835	1 A to 3000 A		1.6 mA AC/A AC		Lead	3000:5	585.00
	1201.31	JM845	1 A to 500 A 1 A to 1000 A 1 A to 1500 A		10 mA AC/A AC 5 mA AC/A AC 3.3 mA AC/A AC		Jack	500:5 1000:5 1500:5	545.00
	1201.32	JM865	1 A to 1000 A 1 A to 2000 A 1 A to 3000 A		5 mA AC/A AC 2.5 mA AC/A AC 1.67 mA AC/A AC		Jack	1000:5 2000:5 3000:5	595.00
 Ø = 3.94" (100mm)	1201.42	2610	500 µA to 6 A 500 mA to 200 A			1 mV/mA 1 mV/A	Lead		795.00

*** Contact AEMC for information on additional oscilloscope current probes and custom models.**

AEMC Corporation • 99 Chauncy St., Boston MA 02111
617/451-0227 • 800/343-1391 • Fax 617/423-2952

To make FCC Part 15 and European compliance easier, cheaper, and more nearly certain…

AMPLIFIER RESEARCH

Call toll-free direct to applications engineering: 1-800-933-8181
160 School House Road, Souderton, PA 18964-9990 USA • TEL 215-723-8181 • FAX 215-723-5688
In Europe, call EMV: Munich, 89-612-8054; London, 908-566-556; Paris, 1-64-61-63-29.

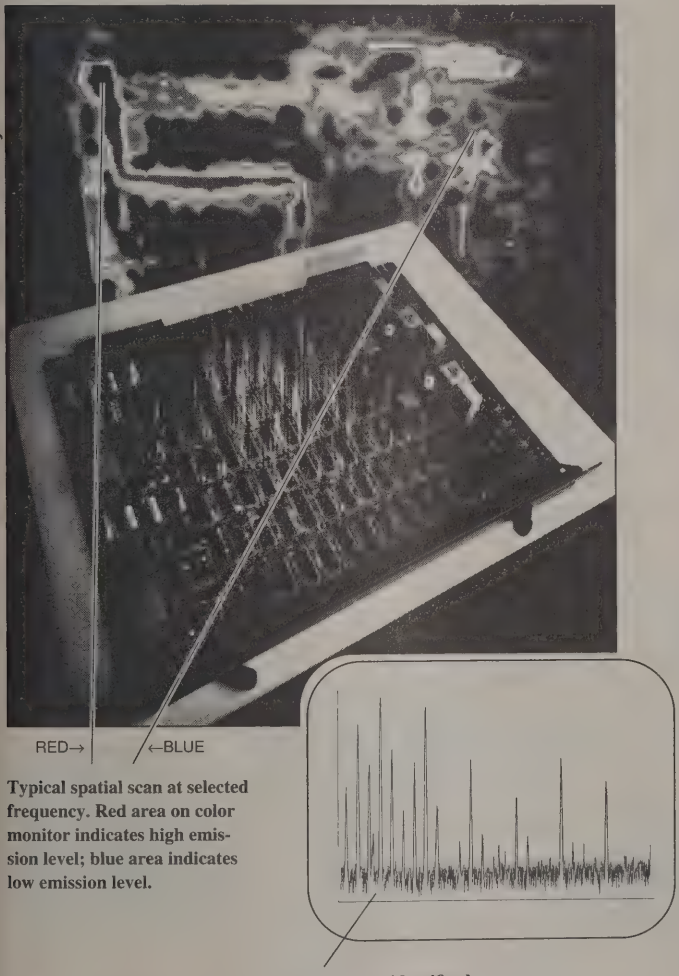
EMSCAN emissions scanner

- **Spectral scan identifies emission frequencies.**
- **Spatial scan locates and color-maps high-, medium-, and low-level emission sites at any selected frequency.**
- **Test results storable for later comparison after corrective design modifications have been made.**
- **Frequency range 10-750 MHz.**
- **Removable scanner plate can be placed between closely-spaced PCBs.**

The EMSCAN emissions scanner locates and quantifies magnetic-field activity on and near printed-circuit boards and other equipment that can be placed on its 9" x 12" scanner plate. The thin plate is also removable to be used in a rack of closely-spaced boards. Use of EMSCAN can reveal unacceptable emissions levels at an early stage of product development, thus greatly reducing the cost of redesign before compliance testing.

A scanning array of 1280 current probes under the surface of the EMSCAN board collects magnetic-field-level information which is processed by the user's spectrum analyzer or receiver and any of a wide range of 386- or faster PCs or workstations. The EMSCAN software, written under "Windows" 3.1, makes emissions analysis easy and reliable, even for a non-engineering-level operator.

The basic EMSCAN package consists of the scanner board with integral power supply and IEEE-488C interface, and the software for conducting all the scanning, storage, retrieval, and comparison tests. A receiver or spectrum analyzer and a computer with color monitor are required.



Typical spatial scan at selected frequency. Red area on color monitor indicates high emission level; blue area indicates low emission level.

Spectral scan identifies key frequencies for further study.

SPECIFICATIONS

RF Performance

Frequency response: 10-750 MHz

Sensitivity (typical): 1μA of current generates 0.5μV at 100 MHz when the PC board to scanner separation is <2.5 mm

Isolation: 30-35 dB (probe-to-probe)

Dynamic Range: Receiver/Analyzer-Dependent

RF Connector: BNC, 50 ohm

Physical Data

Scanning Array Area: 12 x 9.6 in. (30.4 x 24.4 cm)

Probe to Probe Spacing: 0.3 in. (7.6 mm)

Number of Probes: 1280

Package Dimensions (W x H x D): 50.8 x 6.3 x 30.5 cm (20 x 2.5 x 12 in.)

Interface: IEEE-488C (GPIB)

Computer/Workstation Requirements: Must have IEEE-488, color VGA display, DOS and WINDOWS 3.1. Will operate with any WINDOWS 3.1-compatible PC (386 or above is strongly recommended)

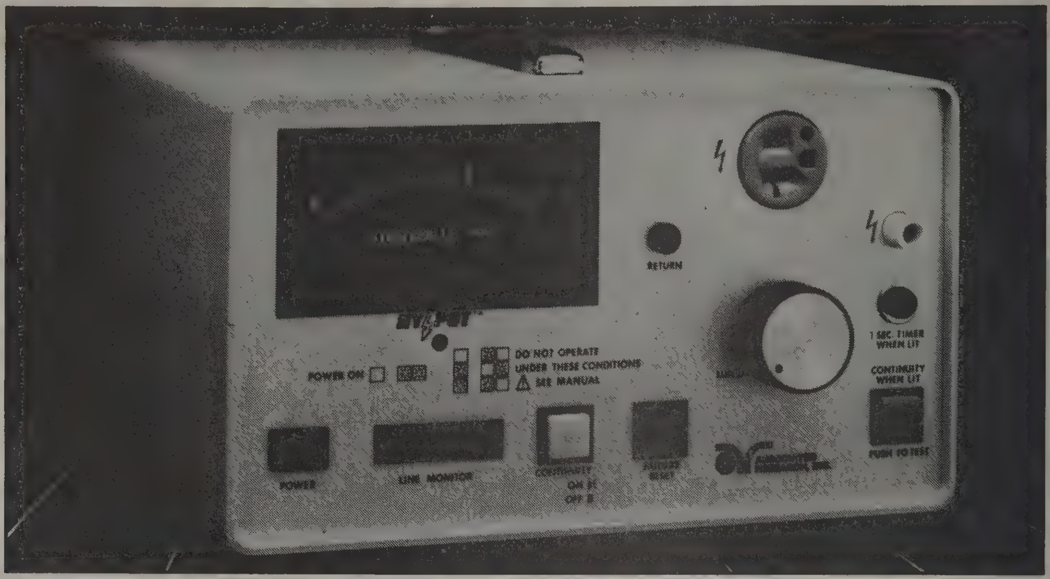
Power Requirements: +5V @ 1A, +12V @ .25A (120 Vac converter supplied)

ar AMPLIFIER RESEARCH

Call toll-free direct to applications engineering: 1-800-933-8181
160 School House Road, Souderton, PA 18964-9990 USA • TEL 215-723-8181 • FAX 215-723-5688
In Europe, call EMV: Munich, 89-612-8054; London, 908-566-556; Paris, 1-64-61-63-29.

6457

Associated Research's Broad Line of Hypot® Test Equipment



Assures that we have the dielectric withstand tester you need to meet your specific application.

A hipot (high potential) test checks for current leakage or electrical breakdown that can cause electric shock. Underwriter's Laboratory requires specific hipot test procedures for different product groups. Associated Research's full line of Hypot® testers meet UL and other agency requirements.

All Hypots from Associated Research feature:

- Operator Safety. Every Hypot has several built-in safety features, such as safety line monitor and test cables rated at 30KV, to protect your employees from electrical shock during hipot testing. Also available is our optional Safe-T-Probe,™ Model No. SP02.
- Easy to set-up and operate. Heavy-duty color coded switches for readability and durability.
- Clear indication of product failure. Your personnel will know when a product has failed to pass the required hipot test.
- Easy to read meters accurately monitor high voltage output during hipot testing.

Depending upon the product you manufacture, you may require one or more of the following features in your hipot tester. Check the table below to select the Hypot model that meets your needs.

- Visual Failure Indicator: Warning light that comes on whenever a product fails the hipot test.
- Audible Failure Indicator: Loud, distinctive alarm that automatically sounds when a product fails the hipot test.
- Manual Reset: When the visual and audible warnings are triggered, the Hypot must be manually reset to continue product testing.
- Built-in Current Meter: Measures the current leakage during testing.
- One Second Timer: Built-in timer circuit automatically maintains high voltage output for one second for consistent testing. One second output is required for some UL test procedures.
- 120K Ohm Resistance: Provides minimum sensitivity adjustment as required for some UL test procedures.

Additional test procedures may require a Hypot accessory such as a timer to maintain output voltage for 1 to 99 seconds, a foot switch for remote operation or a resistor bank for testing regulation and setting trip point.

Auxiliary relay contacts on some Hypots can be used to trigger an automatic reject mechanism to remove defective products from the production line.

Request our catalog for complete information on our Hypot testers and accessories.

Questions On Hipot Testing? Want Fast Order Service? Call our toll free service and sales number: 1-800-858-TEST.

HYPOT® QUICK SELECTION GUIDE

Model	*Output*	*Visual Ind.*	*Audible Ind.*	*Manual Reset*	*Current Meter*	*Built in 1 Second Timer*	*Continuity*	*Dimensions (Inches)*	*Dimensions (cm)*	*Weight (lb.)*	*Weight (Kg)*	*For UL Tests*	*For 120K Ω Test*
403AI	0-3000 VAC	▨	▨	▨				11 x 11 x 6½	27.94 x 27.94 x 16.51	13.50	6.12	▨	
411AI	0-2500 VAC	▨	▨					11 x 11 x 6½	27.94 x 27.94 x 16.51	13.00	5.90		
414AI	0-6000 VAC	▨	▨					11 x 11 x 6½	27.94 x 27.94 x 16.51	14.75	6.70		
422AI	0-10,000 VAC	▨	▨					11 x 11 x 6½	27.94 x 27.94 x 16.51	20.50	9.30		
4030A	0-4000 VAC				▨			13½ x 13½ x 8½	34.30 x 34.30 x 21.59	23.00	10.45		
4040AT	0-3000 VAC	▨	▨	▨		▨	▨	11 x 11 x 6½	27.94 x 27.94 x 16.51	14.50	6.58	▨	▨
4045AI	0-5000 VAC/DC	▨	▨					11 x 11 x 6½	27.94 x 27.94 x 16.51	13.00	5.90		
4050AT	0-5000 VAC	▨	▨	▨		▨	▨	11 x 11 x 6½	27.94 x 27.94 x 16.51	14.50	6.58	▨	▨
4450DT	0-4 KVAC/0-5 KVDC	▨	▨	▨	▨	▨	▨	12 x 12 x 7	30.48 x 30.48 x 17.78	14.25	6.46	▨	▨
5060AT	0-6 KVDC	▨	▨	▨		▨	▨	11 x 11 x 6½	27.94 x 27.94 x 16.51	14.50	6.58	▨	

115 VAC INPUT (230V AVAILABLE) AC ACCURACY 3% OF FULL SCALE, DC ACCURACY, 2% OF FULL SCALE.

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AC and AC/DC Models

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A revolution in digital testing technology . . .
Top quality equipment at an affordable price.

Now you can quickly, easily and safely perform any hipot test required by UL, CSA, VDE, IEC, TÜV and other agencies. Sophisticated yet simple, the HYPOTPLUS® is designed to test the electronic products of today. . .and tomorrow.

Features/Benefits

- Solid State Electronic Voltage Control
- Electronic Ramping
- Electronic Line & Load Regulation
- Posi-Test™ Current Sensing System
- Complete Remote Input/Output
- Computer Test Program Compatibility
- Monitor Panel
- High Voltage Indicator Light
- Heavy Duty Color Coded Controls
- Digital Metering
- Built-In Dwell Timer Circuit
- Sophisticated Arc Detection Circuit
- Selectable Input Voltage
- 10-Turn Leakage Adjust Control
- Built-In Digital Current Meter
- Continuity Circuit Test
- Bond Ground Testing, see our HYAMP™ 5002D
- Safety Grounding Circuit
- Real Current Test Option
- Bench Top or Rack Mount
- Shield Option

Functional Specifications

Models Available:	AC only: Model 5400DT	AC & DC: Model 5450DT
Input	115VAC, 50/60Hz, Single phase, .1A 230VAC, 50/60Hz, Single phase, .5A User selectable	
Fuse	1.6A, 250V 5 x 20mm, Slow-Blow	
Output Voltage	0-5kVAC, Continuously adjustable.	0-5kVAC & 0-5kVDC
	No transients exceeding 105% of peak value. 1% output regulation over line input range and 120K to 2M load. Automatic Output Shorting in DC mode to safely discharge test item.	
Output Current	0-20mA	0-20mA AC & 0-5mA DC
High Trip Current Range	.25-20mA adjustable with multi-turn potentiometer.	.25-20mA AC; .25-5mA DC adjustable with multi-turn potentiometer.
Low Trip Current Range	.1-10mA adjustable with multi-turn potentiometer.	.1-10mA AC; .1-5mA DC adjustable with multi-turn potentiometer.
Continuity Trip	1.1 Ohm maximum at .1A (HYAMP™ Model 5002D Ground Bond tester available for currents to 30A.)	
Failure Detector	Audible and Visual	
Ramp Timer	0-99 Seconds in 1 second increments	
Dwell Timer	0-99 Seconds in 1 second increments	
Kilovolt Metering	0-19.99 digital. Accuracy ±1% of reading, ±1 Least Significant Digit	
Milliamp Metering	0-19.99 digital. Accuracy ±1% of reading, ±1 Least Significant Digit	
Remote I/O	Inputs: Test, Reset, Select, Set Outputs: Test-in-Process, Pass, High Fail, Low Fail, Arc Fail, Continuity Fail, kV, MA	
Line Cord	Detachable 7½ft. (2.29m) power cable terminated in a three prong grounding plug.	
High Voltage, Return/Continuity Terminations	High voltage three prong isolated grounding type receptacle. Allows device under test to be plugged directly into the dielectric withstand tester. Also equipped with removable 5 foot (1.52m) high voltage Return/Continuity leads.	
Size	17W x 7.5H x 14.5D inches (431.8W x 190.5H x 368.3Dmm)	
Weight	23 pounds (10.43Kg)	

Product	Description	Catalog No.
Accessories		
Safe-T-Probe®	Allows operator to safely apply high voltage to product under test	SP02
Footswitch	Allows operator to test without touching tester	35822
Adjustable Resistor Bank	12 settings, 120k to 2,148k ohms. Helps verify regulation.	36956
Calibration Kit	120k ohm resistor for adjusting trip point.	35534
Options		
Shield Kit	Restricts operator from altering settings	HPP-01
Rack Mount Kit	Converts bench top cabinet to rack mount.	HPP-02
Meter Memory	Holds kV and mA after failure indication.	HPP-03
10-Turn Locking VC	Provides locking and multi-turn voltage control.	HPP-04
Real Current System	True leakage current when AC testing capacitive loads.	HPP-05
Rear Output Connections	Rear panel HV and Return connections for systems builders.	HPP-06

Specifications subject to change without notice.

The perfect companion to HypotPLUS

HYAMP™

High Current Ground Bond
CONTINUITY TESTER

The HYAMP™ tester connects directly to our HypotPLUS® dielectric voltage withstand tester to form an automated test system.

3 to 30 Amps Output!
For Testing Resistance of Safety Ground Circuits

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Instrument Services

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MINI PRODUCT GUIDE

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OUR COMMITMENT... ONLY THE BEST

Quality — Instrument Services is dedicated to offering our customers only the best. We make it easy for you to rent, rent with option to buy, lease or buy the finest electronic test and computer equipment available.

■ Quality Is Top Priority

As an industry leader and innovator for almost two decades, Instrument Services has the financial strength and expertise to provide you with the high level of quality service and support you have the right to expect.

Our inventory is unmatched in depth and selection of products. Our in-house calibration facility meets the most stringent specifications required by commercial and government users.

Instrument Services offers a wide variety of flexible financing options, whether you plan to rent, rent with option to buy, lease or buy. Additionally, we place an uncompromising emphasis on total customer service and satisfaction.

■ A Reputation For Leadership

Instrument Services was originally established to serve the rapidly growing demand for short-term rentals of electronic test and design equipment. Soon thereafter, we expanded our product line to include computer equipment and our services to include options for equipment leasing and purchasing.

In 1990, Instrument Services was purchased by AT&T Capital Corporation, an organization which is revolutionizing the equipment financing industry.

■ Centralized Distribution Means Faster Service

Our 100,000 square foot International Distribution Center (IDC) and calibration facility is located on the grounds of the Dallas/Fort Worth International Airport in Texas. It is perhaps the most efficient operation of its kind in the industry.

The IDC houses a testing and metrology lab staffed by more than 50 technicians, plus our 24-hour Customer Service Hotline operations. Instrument Services' shipping section operates 16 hours a day to speed your equipment to you immediately. Our on-airport location puts us hours (sometimes even days) ahead of our competitors.

■ We Know What You Want

When you call an instrument rental company, you expect an inventory of the latest electronic equipment, ready to ship.

Instrument Services continually refreshes our inventory with the latest models from the major manufacturers... we purchase more than $5 million every month to support growing demand. With a $150+ million inventory of more than 5,000 models, rest assured we'll have what you need when you call.

■ We Get It First So You Can Too

Instrument Services' strong relationships with manufacturers, along with our large-quantity orders, means we're often among the first to receive the hot new models you want. With such an extensive warehouse, we can maintain inventory depth in those popular, old reliable products, too.

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At the heart of Instrument Services' IDC is our Calibration Laboratory, staffed by more than 40 professional metrologists.

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Inside the environmentally-controlled facility, specialized metrology teams, working with $3 million in state-of- the-art lab standards, ensure that our calibrations meet or exceed both government and commercial standards.

■ Tough Audits — Top Quality

Instrument Services' Quality Assurance Manager, a Certified Quality Engineer (ASQC/CQE), oversees the auditing processes that verify that our Calibration Laboratory is in complete compliance with federal, defense and commercial standards:

- MIL-STD-45662A
- MIL-I-45208A
- 10 CFR Part 21
- 10 CFR Part 50 Appendix B
- ANSI/ASQC M1-1987
- ANSI/ASQC Q90-1987 through Q94-1987

Instrument Services' calibration intervals are computed to meet a 90% reliability target, and calibrations performed in our laboratory are directly traceable to the National Institute of Standards Technology (formerly the National Bureau of Standards).

■ One Call Does It All

Our on-line, computerized inventory tracking system gives us instant reports on the availability of all equipment in stock. When you call, an Applications Engineer gives you a prompt assessment of any instrument at that moment. You get answers fast — no long waits, no multiple phone calls. We verify availability of the equipment, you place your order, and it's on its way to you the very same day.

■ Ready To Go Right Out Of The Box

When your order arrives from Instrument Services, unpack it, plug it in, and it's ready to go. Since we've taken extra care to test and calibrate it properly, you can be assured that it is ready for immediate use.

Most instruments are shipped in reusable, customized transit cases or heavy duty, dual-wall cartons for extra safety.

Thanks to the care we take every step of the way, Instrument Services boasts an astounding 99% acceptance record for our equipment — unique and notable in our industry.

■ Rent, Rent With Option To Buy, Lease, Buy... And Sell

What you may not be expecting from a rental company are the extra programs that Instrument Services provides. We not only rent fully-calibrated and tested instruments at attractive low rates, we lease and sell equipment from our inventory too, and we can provide financing for equipment purchased from Instrument Services.

We continually sell our older inventory to make way for new products. Instrument Services accesses our world-wide customer network to regularly buy and sell used equipment. To meet this increasing resale demand, we will purchase your unused or under-utilized test equipment, allowing you to better control your test and measurement inventory.

■ For Information And To Place Your Order, Call: 1-800-874-7123

You'll be connected with an Applications Engineer who can answer questions, offer suggestions, verify equipment availability and shipping schedules, and take your order.

■ For Problem Resolution, Call The Service Hotline: 1-800-621-6354

Instrument Services' Customer Service Hotline is staffed 24 hours a day, 7 days a week. Customer Service Representatives can arrange for repair or replacement as required.

FINANCIAL OPTIONS: RENT, RENT WITH OPTION TO BUY, LEASE OR BUY

Every customer and every company has different needs and different requirements. At Instrument Services, you can choose the equipment financing option that's best for you.

■ The Benefits Of Renting From Instrument Services

Renting is quick and easy. You call Instrument Services, and we ship equipment to you the same day. Then, you make a single payment each month. When you no longer need the equipment, just return it to us.

Renting gives you control. You are never locked in. You can return rental equipment at any time, with no notice and no further obligation. Moreover, rental equipment is fully covered for service and repairs — if you have problems, we repair or replace the equipment promptly.

Renting lets you try before you buy. It's the perfect way to evaluate equipment before committing to a purchase or long-term lease.

Renting gets you the equipment you need when you need it. In emergencies, or when you're waiting for delivery of new equipment, renting what you need keeps you operating efficiently.

Renting lets you avoid obsolescence. If a newer model comes on the market, send in your old equipment and upgrade to a new rental unit.

Renting preserves your capital. You don't tie up your capital or credit lines when you rent, so you retain your full borrowing power.

■ The Benefits Of Leasing Or Renting With Option To Buy From Instrument Services

Renting With Option To Buy (Renting w/OTB) is flexible. Instrument Services can tailor your program to suit your needs. We offer low-rate leases with straight financing, as well as highly flexible Alternative Purchase Plans (APPs) and SWAP leases that allow an array of purchase and upgrade options. We can construct a financing plan just for you.

Renting w/OTB preserves your capital. You acquire the equipment you need, but you preserve your credit lines for other expenditures.

Renting w/OTB offers tax benefits. Lease payments are normally treated as operating expense, and costs are assigned to specific projects.

Renting w/OTB lets you enjoy full customer support from Instrument Services. We're just a toll-free phone call away when you need us.

Renting w/OTB lets you build up equity. If you think you might eventually buy the equipment, an APP lease is a wise alternative to renting — you build ownership as you use the equipment.

Renting w/OTB avoids hidden costs. This option includes maintenance, downtime rental costs, and obsolescence protection. There are no nasty surprises.

continued on page after product chart…

Rent, Rent With Option To Buy, Lease, Buy... And Sell

1992/1993 PRODUCT CHART

	Alltech	Ameritec	Anritsu	Apple	Applied Microsystems	APS	Associated Research	AST	Astro-Med	Atlantic Research	Belkin	Biddle	BMI	Boonton	Bruel & Kjaer	Buffalo	Campbell Scientific	Compaq	Data I/O	Digilog	Dranetz	EIP	Electro-Metrics	Elgar	ENI	Epson	Esterline Angus	Fluke	F.W. Bell	GenRad
AMPLIFIERS, COUNTERS & GENERATORS																														
Charge Amplifiers															●															
General Purpose Amplifiers																									●					
Microwave Amplifiers	●																													
Counters																						●						●		
Function Generators																														
Generators																														
Noise Generators															●															●
RF Signal Generators																												●		
Sweep Generators																														
Synthesized Generators																												●		
ANALYZERS																														
Acoustic and Vibration Analyzers															●															●
Frequency Response Analyzers																														
Network Analyzers																														
RFI/EMI Analyzers and Receivers																							●							
Spectrum Analyzers																														
Waveform and Distortion Analyzers																														
COMPUTERS & PERIPHERALS																														
Desktop Workstations																														
Dot Matrix Printers				●																						●				
Inkjet Printers																														
Laser Printers				●																										
Mice																														
Monitor Adapters				●				●																						
Color Monitors				●				●										●												
Monochrome Monitors				●				●										●												
Network Adapters																														
Personal Computers				●				●										●												
Portable & Laptop Computers				●				●										●												
Printer Sharing Devices											●					●														
Scanner & Data Tablets				●																										
Tape Backup Devices																														
DESKTOP CONTROLLERS																														
Computer Aided Testing																														
Desktop Controllers																														
Disk Drives																														
Plotters																														
Printers																														
DEVELOPMENT SYSTEMS																														
Device Programmers																			●											
Microprocessor Development Tools					●																									
LOGIC ANALYZERS																														
Digital Logic Analyzers																												●		
METERS																														
Analog Meters						●																								
Comfort Meters															●															
Digital Meters																												●		
Electrometers																														
Gaussmeters																													●	
LCRQ Impedence Meters																														●
Light Meters																														
Ohm Meters																														●
Power Meters														●																
Sound Level & Vibration Meters															●															●
Thermometers																												●		
Vector/Impedence & Phase Meters																														
MICROWAVE COMPONENTS																														
Directional Couplers & Power Splitters																														
Filters															●															
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Dedicated Calibration Equipment & Fixtures																														
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Oscilloscope Cameras																														
Oscilloscope Carts																														
Portable Conventional Oscilloscopes																														
Voltage Probes																														
POWER SOURCES																														
AC Calibrators																												●		
AC Line Conditioners																								●						
AC Power Supplies & Power Amplifiers																								●						
AC/DC Calibrators																												●		
DC Power Supplies																														
High Voltage Supplies, Hipots & Earth Testers							●					●																		
RECORDERS																														
Analog/Digital/Data Tape Recorders																														
Dataloggers & Event Recorders																	●											●		
Graphic Level Recorders															●															
Light Beam Oscillographic Recorders																														
Strip Chart Recorders									●																					
Temperature & Humidity Recorders																												●		
Transient & Power Line Recorders													●								●						●			
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XY/XYY Recorders & Displays																														
TELECOMMUNICATIONS																														
Carrier Test Equipment			●																											
Circuit & Transmission Test Equipment		●																												
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Protocol, Datacomm & LAN Equipment		●								●										●										
Video Equipment																														

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1992/1993 PRODUCT CHART

1992/1993 PRODUCT CHART	Gigatronics	Gould	Hewlett-Packard	Hipotronics	Honeywell/Metrum	Hughes	IBM	IFR	Intel	Iomega	Keithley	Kensington	Kontron	Krohn-Hite	Kyowa	LeCroy	Marconi	Microsoft	Microwave Radio Corp.	Mouse Systems	NEC	Network Comm. Corp.	Network General	Paradise	Philips	Potomac Instruments	Racal	Radius	Raytek	Rod-L Electronics
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Rent, Rent With Option To Buy, Lease, Buy... And Sell

Rohde & Schwarz	Schaffner	Scientific Atlanta	Solartron	Sophia Systems	Sorensen	Sound Technology	Spectral Dynamics	Spectronics	Sumagraphics	Sun Microsystems	Supermac Technology	Tau-Tron	TEAC	Tekelec	Tektronix	Telecomm. Techniques	3COM	Toshiba	Velonex	Video Seven	Wavetek	Wayne Kerr	Western Graphtec	Yokogawa	Zenith
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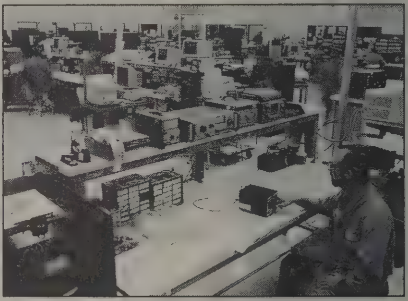
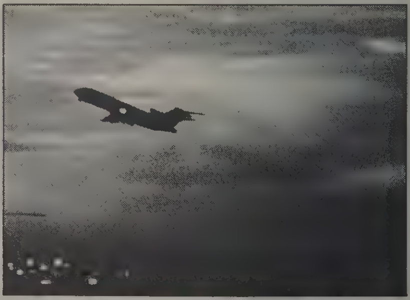
Instrument Services' 100,000 square-foot International Distribution Center houses an equipment inventory of more than $150 million — 5,000 models are available.

When you call, your equipment is pulled from the shelf and matched with the proper accessories for transfer to the experienced Metrologists in our Calibration Lab.



Instrument Services' Calibration Laboratory is the best in the business — check the testimonial letters from the dozens of companies who have audited our facility.



Within hours of placing your order, the equipment is carefully packed and on its way to you by your choice of air or motor freight carriers.

1-800-874-7123

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The Benefits Of Buying From Instrument Services

If you decide that you want to purchase your equipment, call us first. Instrument Services sells a wide variety of previously-owned electronic equipment made by the world's foremost manufacturers. We carry thousands of up-to-date models in our inventory, attractively discounted and immediately available.

Not only do you pay a lot less when you buy equipment from Instrument Services, but chances are we'll have just what you need, and we can get it to you fast — generally, shipment is same day. Plus, we offer you financing options, warranties and the full-service support of Instrument Services' technical team on every piece of equipment you buy.

When you buy previously-owned equipment from Instrument Services, you're way ahead of the game:

- Costs can be substantially less than the cost of new equipment — often as much as 50-75% less.
- We sell only high quality equipment that's been maintained or checked to original factory standards.
- We fully configure the equipment to your specifications.
- We refurbish, recondition and thoroughly test every unit.
- We warranty equipment for up to 90 days. Extended warranty plans are also available.
- We offer flexible financing.

TAX LAWS FAVOR RENTING AND LEASING

Several changes in the tax laws in recent years clearly penalize purchasers of capital equipment, making renting and leasing more attractive than ever. Consider these significant tax consequences when your company anticipates acquiring new assets:

The Alternative Minimum Tax (AMT)

The AMT ensures that all profitable companies pay income tax. The law requires that a company compute its taxes twice — once using the normal method and a 34% tax rate, and again using a 20% rate but adding certain tax preference items to the income. Tax preference items include accelerated depreciation taken on capital assets.

Renting or leasing equipment, rather than buying it, avoids the AMT, as rental and lease payment deductions are treated the same under AMT calculations as under normal tax computations.

Mid-Quarter Convention (MQC)

If you purchase more than 40% of your assets for the year in the last fiscal quarter, the MQC requires that you depreciate all assets from the middle of the quarter in which they were purchased. This normally causes a lower first-year depreciation write-off. To avoid the write-off loss and the administrative tracking difficulties that can result, many companies opt to rent or lease such assets until the following year.

Foreign Tax Credits

For multinational companies, renting or leasing may result in greater utilization of foreign tax credits. The foreign tax credit limitation calculation requires that a certain portion of the taxpayer's interest expense be assigned to foreign source income. This reduces the otherwise available foreign tax credits. Rental expense, however, is not considered foreign source unless the asset is located outside the United States.

ASSET MANAGEMENT

Instrument Services has been developing inventory management and analysis programs for the better part of two decades. We perfected a system of asset management long before corporations came to realize its importance. The utilization of existing inventory often has a strong impact on a company's profitability.

Today, progressive firms are out-sourcing more and more functions in order to concentrate on their core competency. This allows them to focus their resources on their basic product or service.

Instrument Services' asset management programs will enable you to reap the benefits of our technology, skills and experience.

For More Information On Asset Management, Call: 1-800-874-7123

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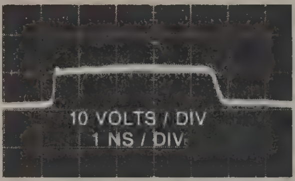
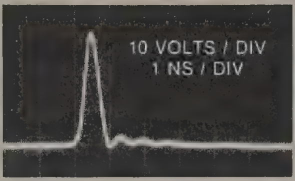
Instrument Services
1830 West Airfield Drive
P.O. Box 619260
DFW Airport, TX 75261-9260
(214) 456-4000
FAX (214) 456-4002

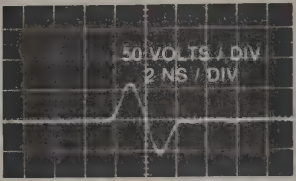
1-800-874-7123 AT&T Capital Corporation

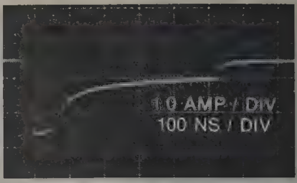
AVTECH

HIGH SPEED PULSE GENERATORS, DRIVERS & ACCESSORIES









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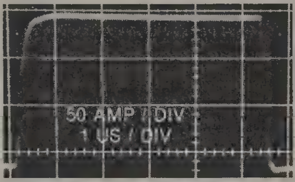

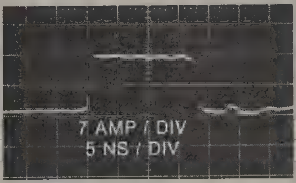

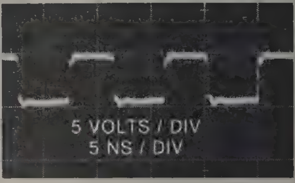

GENERAL PURPOSE LAB PULSE GENERATORS

MODEL	V_{OUT}	PRF	PW	t_r	DC OFFSET	JITTER	DELAY	PRICE (US)
AV-1000-C	± 10 V, TTL, ECL	1 kHz-50 MHz	10 ns-0.5 ms	5 ns-0.5 ms	0 to ± 10 V	± 15 ps	10 ns-0.5 ms	$2990
AV-1002-C	± 10 V, TTL, ECL	1 Hz-10 MHz	50 ns-0.5 sec	10 ns	0 to ± 10 V	± 50 ps	10 ns-0.1 sec	2190
AV-1010-C	± 100 V	10 Hz-1.0 MHz	50 ns-10 ms	15 ns	NA	≤0.1%	0-10 ms	4490
AV-1011-C	± 30 V	10 Hz-5.0 MHz	50 ns-10 ms	10 ns	NA	≤0.1%	0-10 ms	4490
AV-1015-C	± 50 V	10 Hz-10 MHz	20 ns-1 ms	7 ns	NA	≤0.01%	0-1.0 ms	4490

HIGH-SPEED PULSE GENERATORS

MODEL	t_r (ns)	V_{OUT}	PW (ns)	PRF (MHz)	PRICE (US)
AVP-2S	0.04	2	0.2-4.0	0-1	2571
AVP-AV-1	0.1	10	0.2-4.0	0-1	1456
AVP-AV-HV3-C	0.15	40	0.4-2.0	0-1	3128
AVM-2	0.1	15	0.2-2.0	0-25	2139
AVMM-2-C	0.3-2.0	5	0.5-10	0-25	3824
AVMP-2-C	0.1	10	5-100	0-1	3405
AVPP-1-C	0.1	10	0.2-100	0-1	4905
AVN-3	0.15	15	0.2-1.0	50-250	2903
AVNN-1-C	0.1	5	1-30	25-250	3793
AVMP-4	0.2	10	10 ns-10 us	0-1	2890
AVMR-2-C	0.3	20	20-200	0-10	3101
AVR-E2-W-C	0.5	50	0.1-5.0 us	0-10 kHz	3586
AVI-V	0.3	50	2-100	0-20 kHz	1158
AVI-V-HV3-C	0.2	100	5-100	0-5 kHz	3798
AVL-3A-C	0.5	300	5-100	0-5 kHz	4086

HIGH-POWER PULSE GENERATORS

MODEL	t_r (ns)	V_{OUT}	PW	PRF (kHz)	PRICE (US)
AVR-D2-C	1.0	30	0.2-20 us	0-5	4573
AV-1010-C	15	100	50 ns-10 ms	0-1000	4490
AVI-V-HV3-C	0.2	100	5-100 ns	0-5	3798
AVR-E3-W	0.5	100	0.1 us-5.0 us	0-5	2699
AVR-E4	0.4	100	1.0-5.0 ns	0-100	3106
AVR-A-1-S1-C	2	200	50-1000 ns	0-100	3850
AVR-1-PW-C	10	200	0.1-5.0 us	0-1	2589
AVR-3-PW-C	10	200	0.1-100 us	0-1	3550
AVR-G3-C	50	250	1 us-10 ms	0-5	5723
AVL-3A-C	0.5	300	5-100 ns	0-5	4086
AVL-2-C	2	350	5-100 ns	0-5	3351
AVR-4A-PW-C	20	400	0.1-5 us	0-1	4265
AVR-7A-PW-C	50	700	0.1-100 us	0-1	5975
AV-HVX-1000A	6	900	0.07-10 us	25	1295
AVRH-2-C	60	2000	0.2-5.0 us	0-1	6175

HIGH-SPEED LASER DIODE DRIVERS

MODEL	I_{OUT} (mA)	t_r (ns)	PW (ns)	PRF (MHz)	PRICE (US)
AVO-9A	200	0.2	0.4-4.0	0-1	1997
AVO-9B-C	200	0.2	5-100	0-1	3945
AV-155A-C	200	5	10-2000	0-10	3495
AVO-9E	400	0.3	20-200	0-5	2482
AVO-9F-C	100	0.2	3-30	25-250	4333
AVO-9G-C	1000	0.5	20-200	0-50 kHz	4125
AVO-6A1-C	1000	1	100-5000	0-0.01	4389
AV-155C-C	2000	50	0.1-10 us	0-1.0	3495
AVO-2W	10 Amp	2.0	2-50	0-20 kHz	1782
AVO-3A	70 Amp	1	2	0-20 kHz	1932

HIGH-POWER LASER DIODE DRIVERS

MODEL	I_{OUT} (Amps)	t_r (ns)	PW	PRF (kHz)	PRICE (US)
AVO-5-C	28	3	5-100 ns	5	3884
AVO-5B-C	48	10	25-500 ns	1	3884
AVO-5B1-C	75	15	40-500 ns	1	4490
AVO-1	100	8	25 ns	1	1505
AVO-7A-C	40	100	0.5-200 us	1	4265
AVO-6C-C	5	10	0.1-5 us	1	3839
AV-LDD1-C	100	20	0.07-1.0 us	5	2995
AVO-8B-C	100	1.0 us	1 us-1 ms	1	4190
AVO-8C-C	200	1.0 us	1 us-1 ms	1	4505
AVO-8D-C	500	2 us	5 us-10 ms	1	4905

IMPULSE GENERATORS

MODEL	V_{OUT}	PW (ns)	PRF (MHz)	PRICE (US)
AVH-S-1	0-10	0.130	0-1.0	1859
AVH-M1	30	1.0	0-1.0	437
AVMH-3-C	0-50	0.6	0-25	3407
AVH-HV1	0-100	1.0	0-0.1	1998
AVG-1	0-250	4.0	0-0.02	1652
AVG-4A	0-650	4.0	0-0.02	2890

MONOCYCLE GENERATORS

MODEL	V_{OUT}	F_0 (MHz)	PRICE (US)
AVD	20	400-1500	952
AVA	20	200-400	952
AVC	35	20-200	1036
AVB1-3	50	400-900	2190
AVB2-TA-C	400	25-50	4690
AVB3-TB-C	750	75-100	5850

PULSE AND CW AMPLIFIERS

MODEL	GAIN	BW (MHz)	t_r (ns)	V_{OUT} (max)	PRICE (US)
AV-131	40 db	1-500	1.0	1	512
AV-134	10 db	1-2000	0.3	1	668
AV-141	20 db	DC-2500	0.2	1	1140
AV-143	x10	DC-75	4.0	5	849
AV-146A	x3	DC-70	5	10	990
AV-146B	x5	DC-50	7	20	990

SAMPLE & HOLD AMPLIFIERS

- Sample gate widths variable from 0.2 to 4 ns and 4.0 to 20 ns
- For one shot or repetitive inputs
- Sampling rates to 1.0 MHz

HIGH VOLTAGE FUNCTION GENS

- ± 200 V_{OUT} (100 kHz)
- Sine, square, triangle, DC
- Useable as linear amplifiers
- High current models also

DELAY GENERATORS

- 30 to 150 ns delays
- 0.1 to 10 us delays
- 10 to 100 us delays
- Bit stream delay units

FREQUENCY DIVIDERS

- 10 & 100 MHz Dividers
- Division factors to 999
- TTL inputs (or sine)

ACCESSORIES & OPTIONS

IEEE 488.2 OPTION
- Available on 60 models

LOW IMPEDANCE LINES
- 1, 2, 3, 6 & 12 ohms

ATTENUATORS

SPLITTERS & COMBINERS
- Inverting & non-inverting
- 100 ps rise times

BIAS INSERTION UNITS
- PW from 0.2 ns to ?

SCOPE PROBES
- 5 GHz bandwidth
- 100 ps rise time

TRANSFORMERS
- Rise times as low as 60 ps
- Inverting & matching

SPECIALS

If you cannot find the perfect item in our 120 page catalog then call us and challenge us with your special requirement. Lower the costs on your next new product by relying on our OEM modules.

Over 300 models for device testing, optical communications, laser, radar, SAW, ultrasonic, ATE, nuclear and other OEM and lab applications are listed in our free 120 page catalog. 60 models now have the IEEE 488.2 option. For your special requirements, we excel at fast turn around special orders at near stock item prices. Avtech has defined the state-of-the-art for ultra-fast waveform technology since 1975.

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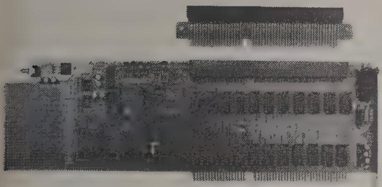

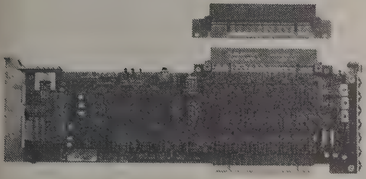

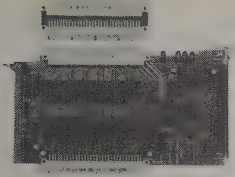

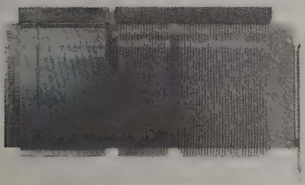

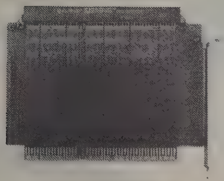

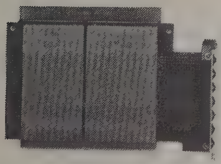

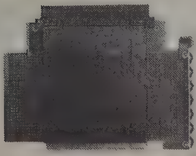

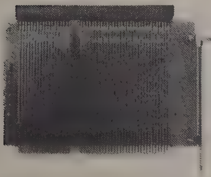

ELECTRONIC EXTENDERS

- Designed to allow you to insert and remove bus cards without turning your computer off.
- Save time when using computers for functional testing of bus cards.
- Protects computer's hardware from damage due to constant power ON/OFF cycling.
- Programmable overcurrent aids in detecting faulty bus cards.
- Optional software control aids in automating test procedures.
- Jumpers allow disabling of DATA and IRQ lines to aid in debugging or developing new products.
- Breadboard area for adding custom circuitry.
- Available for **ISA, NuBus, Micro Channel and EISA.**

ELECTRONIC EXTENDERS come with 1 year warranty (excluding socketed bus switches and top connector).
30 day money back for the first unit of given model.

MINI EXTENDERS

- Designed to protect top connectors of ELECTRONIC EXTENDERS from wear.
- When the connector of MINI EXTENDER shows wear, simply replace the MINI EXTENDER - no need to resolder new connector.

PLAIN EXTENDERS

- Classic extenders with all lines marked.
- Available for **XT, NuBus, ISA, EISA, VESA, MC16 and MC32.**
- Call for other types. If we don't have one, we will make it for you (minimum purchase required).

BURN-IN STATION

- Desktop BURN-IN station with programmable overcurrent detection.
- Replaceable adapters allow to BURN-IN variety of bus cards (ISA, EISA, NuBus, PCMCIA, MC16, MC32, VME and more).
- Holds up to 20 VME bus cards, more of smaller format.
- 99 hr timer
- Temperature programmable up to 70deg C.

AZ-COM 12 Rose Lane, Suite 104 Orinda, California 94563
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HALL-EFFECT GAUSSMETERS

DESCRIPTION

The 9000 Series, pioneered by F.W.Bell, is a major advancement in magnetic sensing technology, utilizing state-of-the-art circuitry and software. The 9000 Series Models display in either gauss or tesla and are microprocessor-based. The 9900 and 9500 are menu-driven.

In addition, F.W.Bell's proven line of 110 standard probes have been upgraded for increased accuracy. Probes for use with the 9900 are available up to 50 kHz.

9000 SERIES
GAUSSMETERS

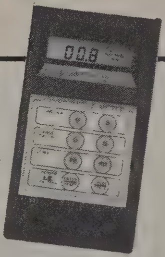
MODEL 4060 ELF METER

The 4060 Elf Meter is designed to measure Extremely Low Frequency magnetic fields produced by scores of electrical devices. Its large 3-1/2 digit readout indicates field strength in either milligauss or gauss. The Elf Meter is lightweight, battery-operated and completely portable. Available in 60 Hz and 50 Hz models.

MODEL 4060
ELF METER
F.W. BELL

MODEL 4048

A hand-held unit utilizing the basics of Bell technology to provide a fully portable, easy-to-use, easy-to-read digital gauss/tesla meter.



F.W. BELL

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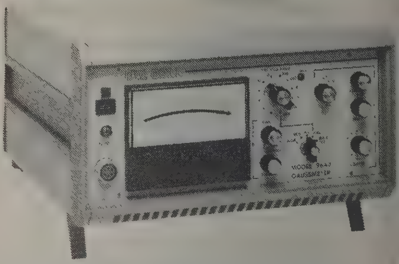
MODEL 9900

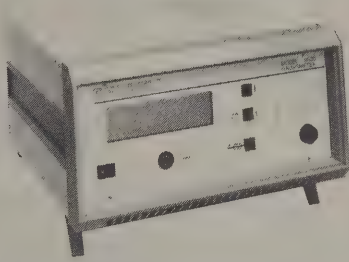
This top-of-the line series includes 3 models, providing up to three channels for continuous measurements. The display can give the user up to three channels with 4-1/2 digit displays, with or without bar graphs, simultaneously. Other special features are dc to 50 kHz, peak-hold, dynamic correction, self-diagnostics, probe compensation, IEEE-488 bus, RS-232 port, vector summation for multiple axis measurement, and a three-volt, full-scale output.

MODEL 9640

This, our latest addition to the F.W. Bell 9000 Series, featuring 1000X scale expansion with zero-center analog meter readout permitting direct measurement of very small incremental variations. The 9640 offers twelve ranges, overlapping from 0.1 gauss to 30 kilogauss. Analog ouputs of 1Vdc and an adjustable 5 Vdc are provided.

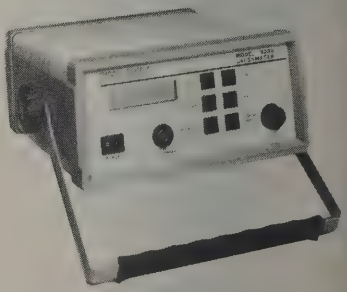


MODEL 9500



The 9500 is a single channel version of the 9900, which offers both IEEE-488 and RS-232 standard.

MODEL 9200



The 9200 offers a 3-1/2 digit LCD with auto ranging and peak-hold. Completely portable, it features a built-in battery, RS-232 (talker only) port, and recharging circuit.

SPECIFICATIONS

Model	Range (Decade Steps)	Accuracy (Basic)	Frequency	Output
9900	3 G to 3 MG	0.075%	dc to 50 kHz	Analog, IEEE-488 & RS-232
9640	0.1 G to 30 kG	0.3%	dc to 400 Hz	Analog only
9500	3 G to 300 kG	0.1%	dc to 10 kHZ	Analog, IEEE-488 & RS-232
9200	20 G to 200 kG	0.5%	dc to 10 kHz	Analog, RS-232
4048	200 G to 20 kG	2.0%	dc to 12 kHZ	None
4060	Low: 1 mG to 1.999 G High: 10 mG to 5 G	1.0%	* 60 Hz: 60Hz ± 0.1 Hz * 50 Hz: 50Hz ± 0.1 Hz	None

*All product specifications subject to change without notice. * Frequency depends upon choice of models*

FLUXMETERS, MAGNETIZERS, HYSTERESISGRAPHS & MORE!

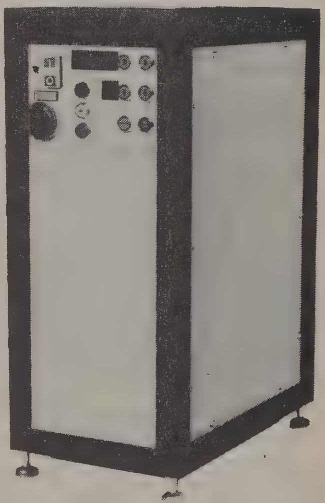
F.W.BELL Inc. is proud to represent **MAGNET-PHYSIK Dr. Steingroever GmbH** (MPS) in the United States and Canada. The MPS products exceed the performance and function of any equivalent product you have ever evaluated. With this cooperation, we offer you the best expertise in magnetic instrumentation and processing equipment in the world.

THE ELECTRONIC FLUXMETER

The Fluxmeters feature an electronic integrator with high sensitivity, extremely low drift and high input resistance. The use of digital technology affords the best drift compensation available. An optional IEEE-488 port lets the Fluxmeter be fully controlled by a computer. An extensive range of point, potential and moment measuring coils are available. Special measuring coils can also be designed for your application.

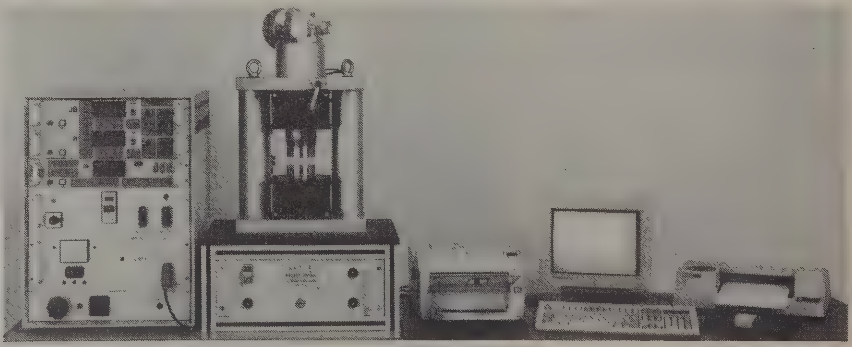
MAGNETIZERS

The MPS Impulse Magnetizer line offers a broad range of performance, functions and features. These magnetizers are equipped with Metal Paper capacitors, thyristor high-current switches and rapid charging circuitry resistant to short circuits. They can process permanent magnets and magnet systems of AlNiCo, Ferrite and Rare Earth Alloys. Some models offer demagnetizing capabilities, and full computer control, via the IEEE-488 port. A broad line of standard magnetizing fixtures are available, as well as specials made to meet your specific needs.



HYSTERESISGRAPHS

The MPS Hysteresisgraphs are computer controlled measuring stations for the measurement of magnetic characteristic quantities of both hard and soft magnetic materials. Electronic Fluxmeters and the control unit for the electromagnet are directed by personal computer using user-friendly menus, via the IEEE-488 interfaces. Measured results and curves are outputted on the monitor, plotter, printer and/or the results file which allows further processing by other software, like spreadsheet programs.



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Call today for details on these state-of-the-art high quality instruments!

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

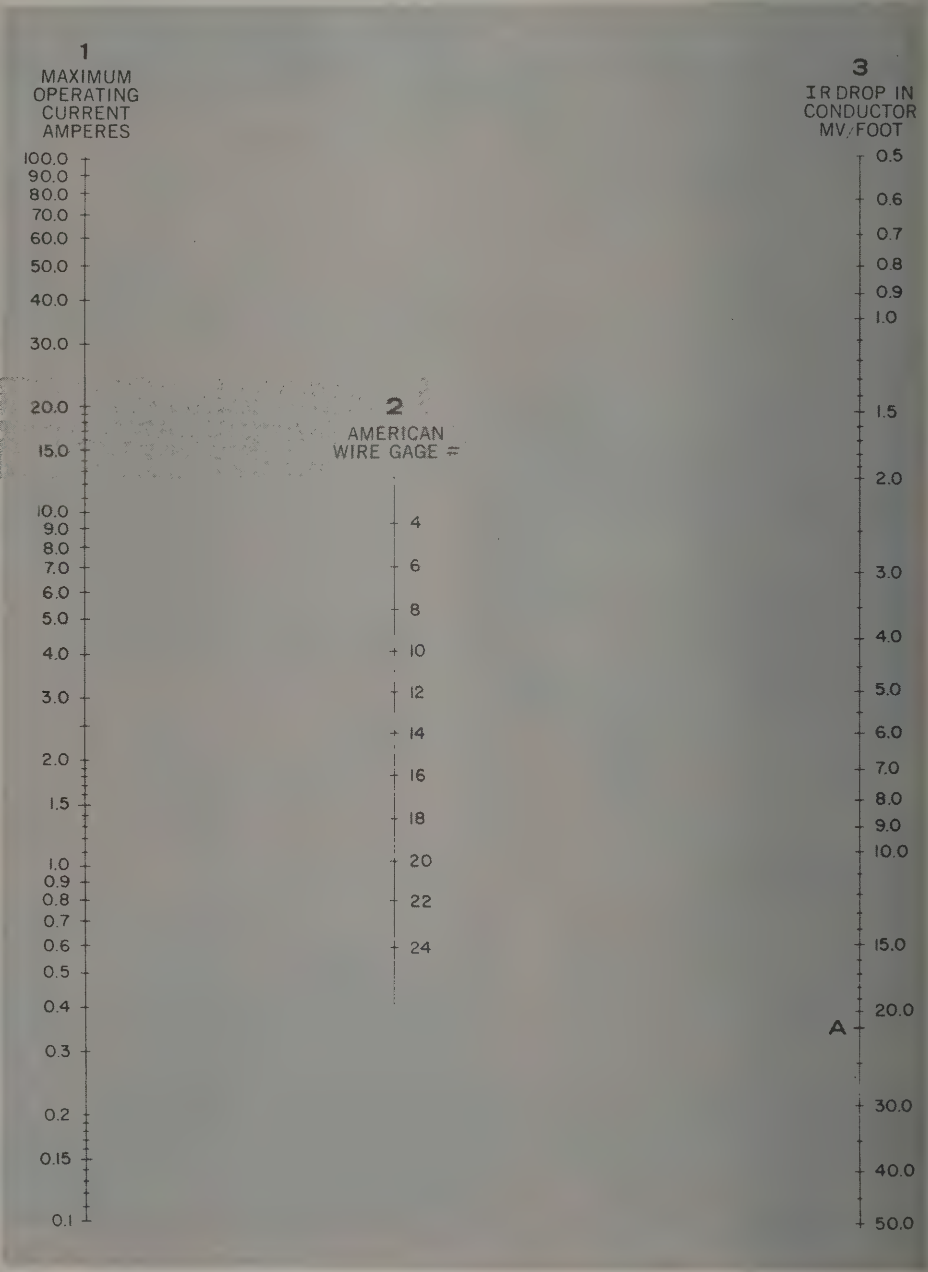
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

* *Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

Pulse Generators

• High Speed • Digital Delay • Optical Pulse • Fast Rise Time • High Voltage

Universal Pulse and Delay Generator System

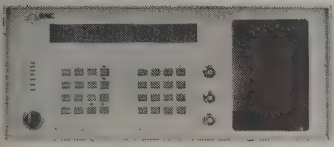
BNC's Model 6040 Pulse System consists of a 100 MHz mainframe pulse source and a series of plug-in modules that produces a variety of both electrical and optical pulses at rates to 700 MHz.

The 6040 mainframe alone serves as a general purpose 5 V and ECL pulse source and trigger-synchronized digital delay generator with up to 1 ns–step resolution. The family of plug-in modules adapts the instrument to an unprecedented choice of additional uses. They include 150 ps transition time logic level operation at rates to 500 MHz and other functions where amplitudes to ±20 V or ±950 V with fast rise times and rep rates are needed. By installing optical output modules, the 6040 can be quickly transformed into a light pulse generator of various wavelengths that can also be externally modulated or provide CW outputs.

Through use of a crystal-controlled time base, the 6040 System offers frequency accuracy of .01% and delay syncing performance with jitter as low as 25 ps. Both IEEE-488 GPIB and RS-232 programmability are provided along with internal memory storage of parameter settings. The Model 6040 System sets a new standard of pulse generating capabilities and instrument value. Principal specifications for the 6040 mainframe and plug-in modules follow.

MODEL	Output Pulses	Maximum Output	Maximum Frequencies Internal	Ext. Drive	Ext. Mod.	Transition Times Rise	Fall	Pulse Width	Delay* Range	Price (USA)
6040	**Electrical**	5 V/ECL	100 MHz	—	—	1/.7 ns	1.5/.7 ns	3 ns–640 s	0 ns–640 s	$4675
201E	**Electrical**	–5 V/5 V	100 MHz	500 MHz	—	150 ps	150 ps	1 ns–640 s	0 ns–640 s	$3190
202H	**Electrical**	–300 V/300 V	1 MHz	—	—	5 ns	5 ns	12 ns–2ms	0 ns–640 s	$4015
203E	**Electrical**	–20 V/20 V	50 MHz	50 MHz	—	1 ns	1 ns	3 ns–640 s	0 ns–640 s	$3850
310H	**Electrical**	–950 V/950 V	100 kHz	—	—	5ns	10ns	25ns–20μs	0 ns–640 s	$4765
085	**Optical 850 nm**	2 mW	100 MHz	300 MHz	400 MHz	1 ns	1 ns	500 ps–CW	0 ns–640 s	$6050
090	**Optical 904 nm**	40 mW	6 kHz	6 kHz	—	5 ns	10 ns	20 ns–150 ns	0 ns–640 s	$7100
106H	**Optical 1064 nm**	50 mW	2 kHz	—	—	1 ns	5 ns	5 ns–50 ns	0 ns–640 s	$15490
130	**Optical 1310 nm**	1 mW	100 MHz	300 MHz	700 MHz	1 ns	1 ns	400 ps–CW	0 ns–640 s	$7645
155	**Optical 1550 nm**	1 mW	100 MHz	300 MHz	700 MHz	1 ns	1 ns	400 ps–CW	0 ns–640 s	$9845

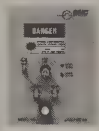
Refer to product data sheets for complete performance information and conditions. *See table below for additional delay specifications.

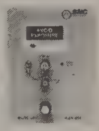

MODEL 6040

201E

202H

203E


085


106H

130

155

Digital Delay Generators

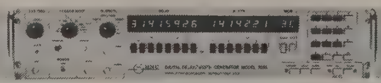
Digital Delay Generators provide accurate, repeatable control of time. DDGs are a source of stable intervals, pulses, impulses and gates produced as low-jitter outputs for precise triggering, gating, syncing, delaying, blanking, etc. Remote IEEE-488 or BCD programmability is available. Model AP-3 portable or TB-4 rack power supplies house the DC powered (NIM) models. Key specifications are below.

MODEL	Time Resolution	Time Range	Optional Range	Insertion Delay	Indeterminacy	Jitter (RMS)	Trigger Rate	Sensitivity	Oper. Modes	Power Requirements	Price (USA)
7095	50 ps	0–10 μs	0–10 ms[1]	65 ns	None	30 ps	0–5 MHz	200 mV	D,G,I	115/230 VAC	$8635
7030A	1 ns	0–100 μs	—	80 ns	None	50 ps	0–10 MHz	250 mV	D,G	±6, ±12, –24V	$4595
7065	1 ns	0–1 ms	0–1 s[1]	85 ns	None	50 ps	0–5 MHz	200 mV	D,G	115/230 VAC	$6225
7075	1 ns	0–1 ms	0–1 s[1]	85 ns	None	50 ps	0–5 MHz	200 mV	D,G	115/230 VAC	$7115
7085	1 ns	0–100 ms[2]	—	150 ns	None	50 ps	0–5 MHz	200 mV	D/W	115/230 VAC	$9380
7010	100 ns to 1 ms	0–10 ms to 0–100 s[3]		120 ns	±50 ns	500 ps	0–1 MHz	2V	D,G,P E,B[4]	115/230 VAC	$1800
6040	1 ns to 10 ms	0–10 μs to 0–640 s[2]	—	25 ns	None	25 ps[5]	0–100 MHz	100 mV	D/W, F,I[6],T	115/230 VAC	$4675

Operating Modes: D—Delay; G—Gate; I—Impulse; D/W—Delay/Width; F—Frequency; P—Period; E—Divide Events; B—Counted Burst; T—Double Pulse.

Notes: [1] Option A. [2] Width of Delayed Pulse also selectable in 1 ns or larger steps. [3] Selectable in 5 decade steps. [4] With Option B. [5] Or 10^{-4} x delay, whichever greater. [6] With installed appropriate module.

MODEL 7095


MODEL 7085

MODEL 7010

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CABLETEST MODEL 180

TESTS 2 AND 3 CONDUCTOR POWER SUPPLY CORDS AND CORDSETS! HELPS YOU MEET UL AND CSA TESTING REQUIREMENTS!

CHANGE CORD SETTINGS
COUNTER MENU
SELF TEST
SUPERVISOR MENU
(ENTER TO TEST CORDS)

THE MODEL 180 AUTOMATICALLY TESTS:

- ***CONTINUITY*** • ***SHORT CIRCUIT*** • ***POLARITY***
- ***HI-POT:*** (0 to 2.5 KVAC Programmable dwell time from 0 to 9.9 seconds. Features switch selectable automatic capacitance neutralization so that only resistive leakage will be measured.)

SPECIAL FEATURES OF THE MODEL 180:

- **LCD Display Screen:** Provides vital test data and prompts operator action.
- **Cord Diagnostics:** If there is a fault in the cordset, this tester will determine its type and whether it is located in the male end, female end, or in the cable.
- **Data Counters:** Counter information is stored in computer memory.There are operator viewable/erasable counters and permanent internal counters.
- **Receptacle Configuration:** Male side is for a standard NEMA 5-15P plug. Female side comes standard with CEE-22 business machine plug receptacle or NEMA5-15R plug receptacle. Polarity pad accommodates open end power supply cords.
- **External Printer** Available.
- **Rapid Shutdown** Of high voltage upon detection of failure.
- **Flex Test:** Flex type failures are clearly indicated when flexed.

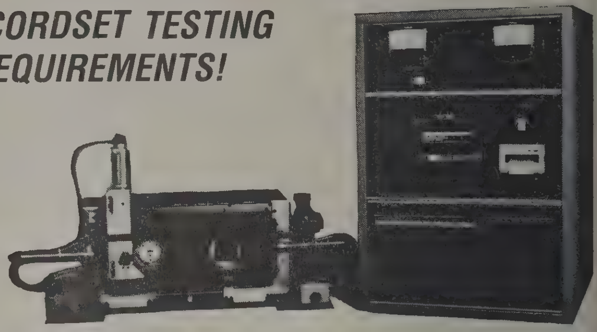
SPECIFICATIONS:

- **Power Requirement:** 120 Volts / 60 Hz / 2 Amps (Foreign voltages available.)
- **Dimensions:** 24" W x 14" H x 15" D

C.C.M.II

COMPREHENSIVE CORD MEASUREMENT SYSTEM II.

THE CCM II MEETS IBM'S CORDSET TESTING REQUIREMENTS!



THE CCM II AUTOMATICALLY TESTS:

- ***CONTINUITY*** • ***SHORT CIRCUIT*** • ***POLARITY***
- ***HI-POT:*** (0 to 3.5 KVAC Programmable dwell time from 0 to 9.9 seconds. Features switch selectable automatic capacitance neutralization so that only resistive leakage will be measured.)
- ***SKIN TEST:*** (Tests conductor to plug surface HI-POT as above.)
- ***CONDUCTOR RESISTANCE:*** (25 Amps at 12 VAC with variable trip level from .02 to .5 ohm sensitivity. Resistance test can be performed on ground conductor only or all 3 conductors.)

SPECIAL FEATURES OF THE CCM II

- **Cut-off Knife:** Automatically chops male plug off the rejected cord.
- **Acceptance Brander:** Automatically brands face of male plug on "good" cords.
- **Data Counters:** Counter information is stored in computer memory. There are operator viewable/erasable counters and permanent internal counters.
- **Printer:** Panel mount printer for "hard copy" of vital job statistics.
- **Cord Diagnostics:** If there is a fault in the cordset, the unit will determine whether it is located in the male end, female end or in the cable.
- **Machine Diagnostics:** Full diagnostics check all vital test functions upon "Power-up" and during each test cycle.
- **Zero Insertion Force Receptacles:** Prevent operator fatigue and assure proper electrical contact during testing.
- **Receptacle Configuration:** Male side is for a standard NEMA 5-15P plug. Female side has receptacles for CEE-22 business machine plug and also for power supply cords with stripped ends or non-insulated terminals. Additional receptacle configurations quoted on request.
- **Cycle Times:** The complete test cycle, excluding insertion and withdrawal of the test cord, requires 3 to 4.5 seconds, depending upon the number of tests and dwell times chosen.

Distributed by: HEYCO Heyco Stamped Products, Inc.
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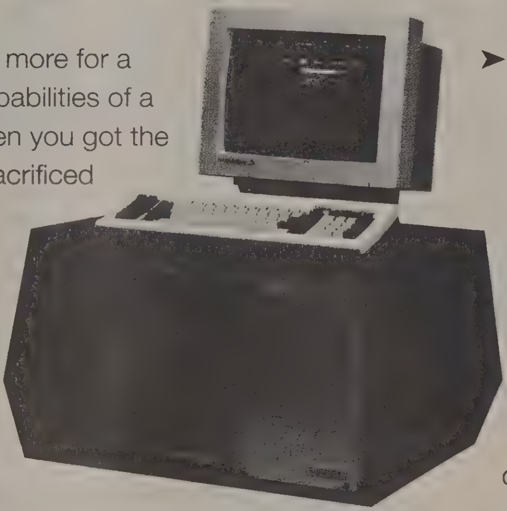
CABLETEST
Cabletest International Inc.
951 Denison Street East, Unit 21
Markham, Ontario, Canada L3R 3W9
Tel: (416) 475-2607 • Fax: (416) 475-2609

THE ONLY THING SMALL ABOUT THIS HARNESS TESTER IS THE SIZE AND PRICE.



It used to cost $40,000 or more for a harness tester with the capabilities of a high-end system. And when you got the power you needed, you sacrificed portability. Not any longer. Now you can have it all—power, portability and price. Introducing the revolutionary new Cabletest Multipoint Series 5000!

Check these features:

- ➤ resistance, capacitance and diode measurement
- ➤ high-voltage testing—up to **1.5 kV AC** and **2.0 kV DC**
- ➤ precise, complete diagnostics at your fingertips
- ➤ a time-saving, easy-to-use, menu-driven system—no computer knowledge required

And it's all in a unit that's amazingly compact. Take it right to where it's needed!

The price? It starts at less than $15,000. Why pay double that—for a system that doesn't do half as much?

So remember, big things *do* come in small packages. Our specs give all the details about this impressive harness-testing system. Call, write or fax today and we'll be pleased to send you more information.

CABLETEST

Put the Best to the Test

Cabletest International Inc.
400 Alden Road
Markham, Ontario, Canada L3R 4C1
Tel: (416) 475-2607
Fax: (416) 475-2609

eem

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (µF) 1 microfarad (µF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

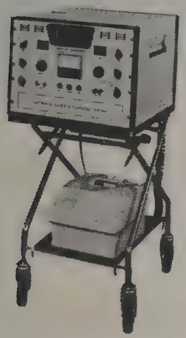
Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multi-plier	Tolerance			Temperature Coefficient ppm˚C	Signi-ficant Figure	Multi-plier
			Class 1					
			10pF or less	Over 10pF	Class 2			
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

CABLEMASTER DIVISION
(818) 341-9200

AUTOMATIC CABLE HARNESS AND CONNECTOR TESTERS

CABLEMASTER 400-C



The Cablemaster Model 400-C is a 400 point sequential tester which measures continuity, insulation resistance and dielectric strength (hipot) quickly — accurately — economically. It is ideal for use in receiving inspection, production, quality control, laboratories, field maintenance, operational sites and in a wide range of applications where complete and reliable cable or connector testing is desired with one compact unit. It is equipped with a removable mobile carrier. The 400-C sequences thru the 400 points at a rate of up to 120 steps per minute checking each point for the parameter under test.

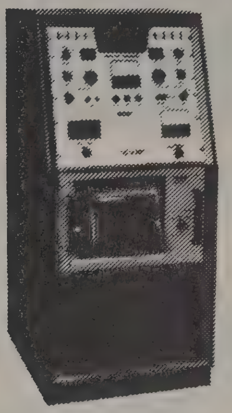
CHECK THESE OUTSTANDING FEATURES

- Continuity to 59 ohms, and to 3 amps
- Insulation resistance to 5K meg variable voltage
- Dielectric strength (hipot) AC and DC to 3000 volt
- Simplified multiple circuit testing. (More than 2 ends to each wire)

CABLEMASTER 400S

The Model 400-S Cablemaster is a modified Model 400-C, designed to test long, installed cables in ships, aircraft, launch facilities and nuclear plants where test points may be hundreds of feet apart. It contains a scanning feature for finding crossed wires which is used in making retrofits and troubleshooting new systems.

CABLEMASTER 1200-C

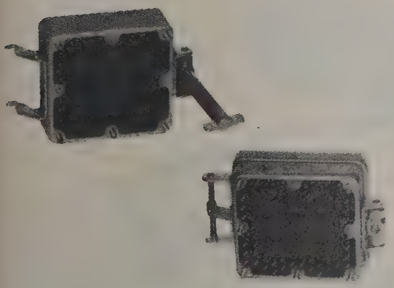


The Model 1200-C Cablemaster incorporates all of the features of the Model 400-C and functions identically except that it has the capability to test up to 1200 points. To accommodate the additional number of output modules it is mounted in a mobile console. When accessories such as a printer, low ohm analyzer, etc. are incorporated they are mounted within the same console. The 1200-C is modular in design and construction.

OPTIONS

- Printed record
- AC current monitor for actual current readings
- AC capacitance compensation
- Megohmmeter panel for exact resistance measurements
- Low ohms analyzer for discrete low resistance values
- Digital readout of discrete values for each of the above accessories
- Digital printout of measurement values
- Rise time control for application of high voltage
- 220 Volt units available

HIGH VOLTAGE CONNECTORS WITH QUICK DISCONNECT



High voltage, high current connector with hinge action mating; comes in 50 pin and 100 pin configurations. Will accommodate 50 or 100 No. 16 wires, and is nominally rated at 2000 volts at RMS 60 Hz at sea level. Available with various types of contacts.

IMPACT-O-GRAPH DIVISION
(818) 341-3000

IMPACT & VIBRATION INDICATORS, ACCELEROMETERS AND RECORDERS

IMPACT-O-GRAPH RECORDER

Impact-O-Graph recorders are available in sensitivities of 2g to 300g full scale deflection. Recording period of various models is from (1) one minute to (6) six months. Independent styli record time, direction and magnitude of impacts in (3) three separate axes. Lightweight and compact. Self-contained — no outside power necessary. Used to monitor shipping and handling abuse and to design packaging.

IMPACT INDICATOR

Resettable and non-resettable impact indicators (accelerometers) are used to monitor impacts accurately from all directions to give a visual indication that a specific "g" level has been exceeded. Used to monitor shipping and handling abuse. Available up to 300g.

CHATSWORTH DATA CORPORATION

DEPT. EM, 20710 LASSEN STREET/CHATSWORTH, CALIFORNIA 91311/(818) 341-9200
CABLEMASTER DIVISION (818) 341-9200/IMPACT-O-GRAPH DIVISION (818) 341-3000
FAX: (818) 341-3002

Cable/Harness Testing

Continuity / Resistance / Hipot / SCSI / Twisted Pair / Installed Cables

Signature™ Cable/Harness Testers

Cirris Systems Signature cable/harness quality assurance systems are easy to use, rugged and affordable. The systems feature self-programming, non-volatile memory, and the industry's widest choice of interchangeable adapters. Systems offer both audible and visual information to verify quality, and to direct guided assembly work.

Cirris's commitment to overnight service, customer support, and immediate availability is unmatched. All equipment carries a full 1-year warranty.

CH+ 1500VDC, 1000VAC PC-Based, expandable high-voltage test system

Specifications:

Capacity:	256 to 5376 points, in 256 point increments
Test Levels:	8-1500VDC, 100-1000VAC
Sensitivity:	Conductance: normal: .1 to 100KΩ 4-wire: .01 to 10Ω
Leakage:	5M to 500MΩ
Size (inches):	7 x 10 x 18 (rack mountable)

1000H+ 1000VDC Hipot, Tests Assemblies with Resistors & Diodes, Expandable

Specifications:

Capacity:	128 to 512 points with expansion boxes
Test Rate:	128 points per second
Test Levels:	5-1000 VDC
Sensitivity:	Conductance: normal: .1 to 100KΩ 4-wire: .01 to 10Ω
Leakage:	5M to 500MΩ
Size (inches):	5 x 6.5 x 13

1000R+ Resistance/Continuity Testing, Expandable, Tests Assemblies with Resistors & Diodes

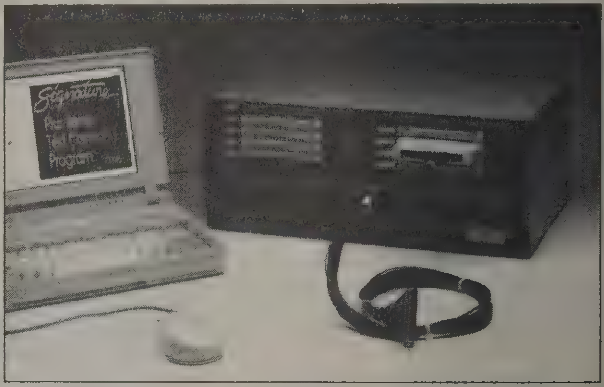
Specifications:

Capacity:	128 to 512 points with expansion boxes
Test Rate:	128 points per second
Test Levels:	5 VDC @ 3mA
Sensitivity:	.1 to 5MΩ
Size (inches):	2 x 6.7 x 10.5

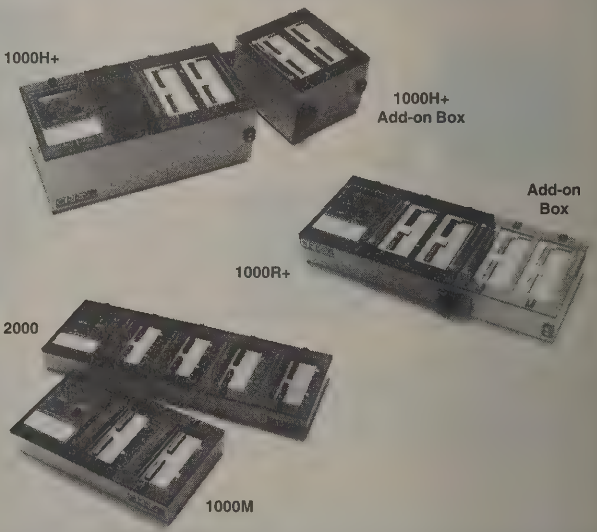
1000M/2000 Priced from $995

Specifications:

Capacity:	128 (1000M)/256 (2000) points
Test Rate:	.2 sec (128 points)
Test Levels:	5 VDC @ 1mA
Sensitivity:	shorts < 1KΩ, opens > 1.5KΩ
Size (inches):	2 x 7 x 12 / 2 x 7 x 19



The new 1500VDC, 1000VAC Signature CH+ Wiring Analyzer Base Unit (bottom) shown with a single CH+ Test Point Scanner module (top). System includes Windows™ -based software to run on your 386/486 PC-compatible.



Specifications subject to change without notice. Windows is a trademark of Microsoft Corporation.

CIRRIS®

Cirris Systems Corp.
1991 Parkway Boulevard,
Salt Lake City, Utah, USA 84119-2026
Phone: 801-973-4600 · FAX 801-973-4609

Free 7-day evaluation on any tester model.
Ask about our free informative video.

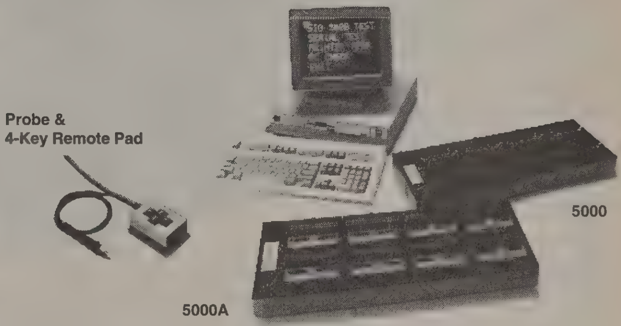
Made Easy. CIRRIS

Continuity / Resistance / Hipot / SCSI / Twisted Pair / Installed Cables

5000/5000A PC-based for Total Flexibility

Specifications:

Capacity:	512-16,384 points
Test Rate:	1000 points/sec.
Test Levels:	5 VDC @ 1mA
Sensitivity:	shorts < 6.5KΩ, opens > 8KΩ
Size (inches):	2 x 7 x 24



1000 LC Low Cost, Battery-Powered Continuity Testing

Specifications:

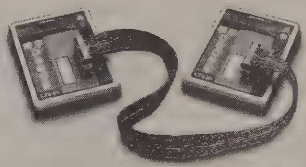
Capacity:	128 points (no adapter support)
Test Rate:	.5 sec. typical
Test Levels:	9 volts (current limited to 2 mA)
Sensitivity:	Connections < 4KΩ, opens > 4KΩ
Size (inches):	8.5 x 5.5 x 2.2

1000 LC, $495

500 Portable Testing of Installed Cables, Twisted Pair Testing

Specifications:

Capacity:	64 points per unit (2 units can be paired together for a total of 128 points- required for installed cable testing)
Test Rate:	.5 sec. (longer as cable length increases)
Test Levels:	9 volts (current limited to 2 mA)
Sensitivity:	Connections < 4KΩ, opens > 4KΩ
Size (inches):	8.5 x 5.5 x 2.2



The new Signature 500 offers remote testing of installed cables with a unit connected at each end of the cable. Single units offer 64-point continuity testing and twisted pair testing in a light weight, easy to use design.

SCSI Terminator Tester

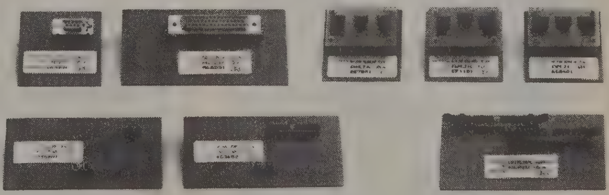
Specifications:

Capacity:	50 pin passive or active SCSI type terminators (will not test differential terminators)
Test Levels:	User selectable levels for ground continuity, resistance, output voltage, output current, term power, capacitance, and diode leakage.
Test Rate:	Passive: 30 secs. approx.. Active: 90 secs. approx. (test rates vary by PC-compatible speed)

The new SCSI Terminator Tester offers fast, easy to use testing of passive and active SCSI terminators. Includes software for use on PC-compatibles.

The Most Complete Line of Connector Adapters Available

Cirris offers immediate availability of most common connectors, including our special line of high-voltage connectors. We will also promptly assemble custom adapters for any connector you provide. Or use our printed circuit pattern boards to build your own cable/harness adapters.



Specifications subject to change without notice

CIRRIS

Cirris Systems Corp.
1991 Parkway Boulevard,
Salt Lake City, Utah, USA 84119-2026
Phone: 801-973-4600 · FAX 801-973-4609 · TELEX: 446786

Call toll-free in USA & Canada: 800-441-9910

VOLT-AMPERE-WATTMETERS

IEEE-488

MODEL 259

clarke-hess

VOLT-AMPERE-WATTMETERS are broadband digital instruments. They may be supplied to yield full scale current readings from 50.00μA to 500.0A; full scale voltage readings from 100.0 mV to 1000 V; and full scale power readings from 5000 nW to 500.0 kW. All of the 255-259 series of instruments may be equipped with an optically isolated IEEE-488 interface or with an optically isolated analog outputs. Different instruments are available that span the frequency range from DC to 1 MHz. Measurements down to 1 Hz are readily available from most instruments. All instruments are well suited to, and are calibrated for, the measurement of distorted and/or low power factor inputs.

Model 255/256	**Model 258**	**Model 259**	**Model 259HF**
DC Coupled	AC Coupled	DC Coupled	DC Coupled
I and V specified to 300 kHz	I, V and P specified	I, V and P specified	I, V and P specified
P specified to 100 kHz	from 50 Hz to 1 MHz	from DC to 50 kHz	from DC to 300 kHz
Accuracy 0.6%	**Accuracy 1%**	**Accuracy 0.25%**	**Accuracy**
Typical ranges	Typical ranges	Typical ranges	(for any power Factor)
CURRENT - mA	CURRENT - mA	CURRENT - mA	DC - 100 kHz 0.3%
5.000/50.00/500.0/5000	50.00/250.0/500.0/2500	5.000/50.00/500.0/5000	100 kHz - 200 kHz 0.5%
VOLTAGE - volts	VOLTAGE - volts	VOLTAGE - volts	200 kHz - 300 kHz 0.8%
20.00/200.0/1000	20.00/100.0/200.0	20.00/200.0/1000	
$1800	**$2735**	**$2245**	**$2595**
	(including current transformer)		

Model 2330 Sampling Digital Wattmeter measures CURRENT, VOLTAGE, POWER, POWER FACTOR, and VOLT-AMPERES. Simultaneous DISPLAY of THREE quantities. Either TRUE RMS or AVERAGE Current or Voltage outputs. Measurements from DC to 400 kHz. Isolated inputs. Built-in CURRENT ranges to 20 A and Voltage ranges to 500V. AUTO-RANGING or MANUAL range selection. IEEE-488 interface.

VOLT-AMPERE SOURCE

Model 828 AC/DC V-A Source is a light-weight truly portable device capable of calibrating analog and digital panel meters in the lab, on the production line or in field installations. Low cost, compact and highly accurate. Voltage Ranges of 1V, 10V, 100V, and 1000V. Current Ranges of 1mA, 10mA, 100mA, 1A, and 10A (5A max.). Resolution 0.1% of Range, Accuracy: DC voltage ±0.1%, AC voltage ±0.15%, AC/DC current ±0.2%.

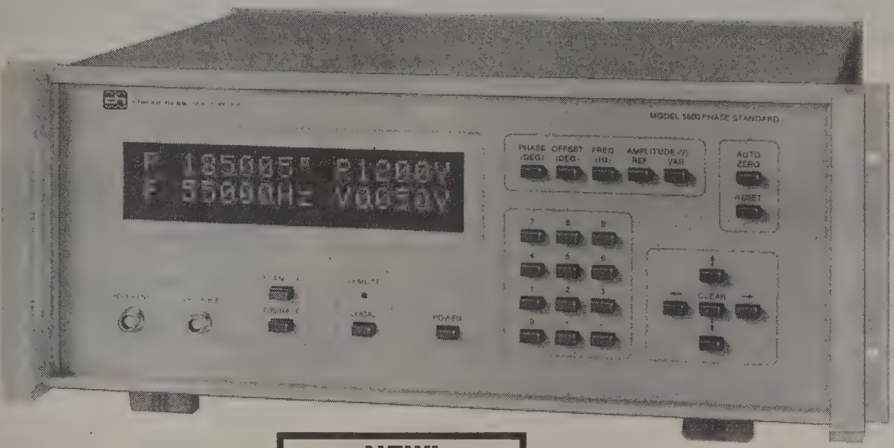
$3495

clarke-hess COMMUNICATION RESEARCH CORP
220 WEST 19th STREET, NEW YORK, N.Y. 10011 ■ (212) 255-2940

DIGITAL PHASE STANDARD

TRACEABLE TO
NIST

IEEE-488



NEW!
200kHz Option

$12,500

MODEL 5500

- High Phase Resolution of 1m°
- Outputs from 50mV to 120V RMS
- Frequency Range 1Hz to 200kHz
- High Phase Accuracy of 5m°
- Amplitude Accuracy of 0.1% Typically
- Frequency Accuracy of 25ppm Typically
- Low Distortion Sinewaves Typically below -80dB
- Phase Accuracy Maintained with Voltage Ratios up to 1000:1
- All Parameters Stable with Time and Temperature

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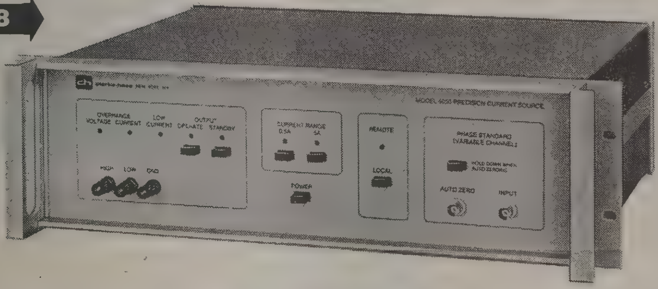
5 AMPERE CURRENT SOURCE

MODEL 5050

USED WITH MODEL 5500 AS A PHANTOM POWER SYSTEM

IEEE-488



$5,500

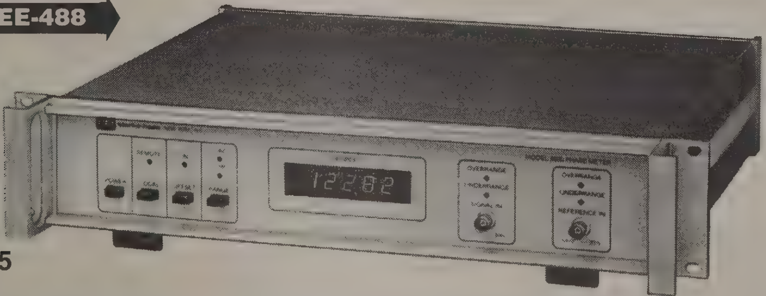
- Current up to 6.5A
- -70dB Typical Distortion
- Output Impedance >500KΩ
- Phase Error <2m°
- Useable to 20kHz
- 5A and 0.5A Ranges
- Phase Feedback to Model 5500

PHASE METER

MODEL 6000

EASY TO CALIBRATE EASY TO USE

IEEE-488



$3,295

- Complete Autoranging
- 10m° Resolution
- 20m° Typical Accuracy
- Waveshape Independent
- 10mV to 350V Input Voltages
- 10,000:1 Input Ratios
- 5 Hz to 500 kHz
- Analog Output

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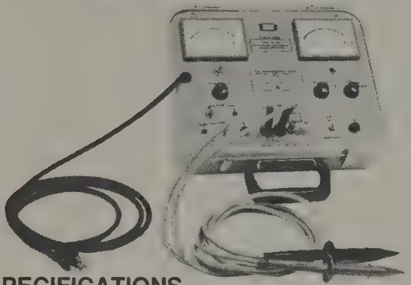
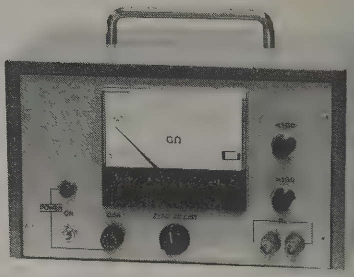
CRITERION

INSULATION RESISTANCE TESTERS

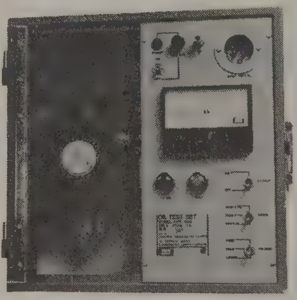




CONDENSED SPECIFICATIONS

MODEL NO.	TEST VOLTAGE	RESISTANCE RANGE	POWER SOURCE
BIRT-1000C	0-1000 V well regulated	2-2,000,000 MΩ	battery and ac line
BIRT-5000B	400-5000 V well regulated	1-1,000,000 MΩ	battery and ac line
BIRT-5000C	400-5000 V well regulated	100-100,000,000 MΩ	battery and ac line
BIRT-7500B	500-7500 V well regulated	1-1,000,000 MΩ	battery and ac line
BIRT-10000B	800-10000 V well regulated	1-1,000,000 MΩ	battery and ac line
IR-250	250 V nominal regulated	0-250 MΩ	ac line
IR-500	500 V nominal regulated	0-500 MΩ	ac line
IR-1000	1000 V nominal regulated	0-1000 MΩ	ac line
IR-500-100K	500 V regulated	1-100,000 MΩ	ac line

Higher-voltage testers or other special units can be designed to meet your particular specifications.

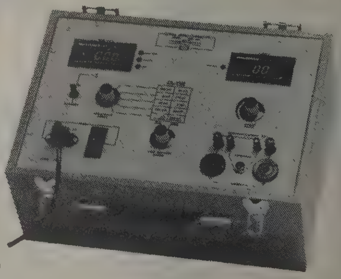


PORTABLE OIL TEST SET

AVO-600-A high voltage test set to establish dielectric breakdown of transformer and other insulating oils. This unit features 3 selectable motorized rates of voltage rise to a maximum of 60 kV. The voltmeter freezes at the breakdown voltage. The unit meets ASTM specifications.

MICRO-OHMMETER

- Four-Terminal Measurement
- Wide Resistance Range- 0.1μΩ to 2Ω
- Test Current to 100A- DC, Filtered
- Digital Current and Resistance Meters
- Computer-Calculated Resistance- Independent of Current
- Auto- Compensated Zero Adjustment
- Shielded Potential Leads
- Portable Steel Case with Carrying Handle and Removable Cover



MODEL DOT-100

OTHER PRODUCTS (Not illustrated)-

HEATER TEST SETS, CABLE TESTERS, DIELECTRIC STRENGTH TESTERS, HOT STICKS, DIGITAL OHMMETERS.

BATTERY DISCHARGE TESTERS, POWER SUPPLIES AC & DC, FREQUENCY GENERATORS, IMPULSE GENERATORS, HIGH- VOLTAGE TRANSIENT GENERATORS, RELAY TEST SETS, LINE-CORD TESTERS, CAPACITANCE AND KELVIN BRIDGES, TRANSFORMER RATIOMETERS, PORTABLE TOOL SAFETY TESTERS.

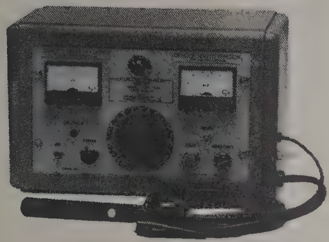
For further information on our STANDARD PRODUCTS, CUSTOM DESIGNS, or manufacturing to your own specifications, please contact:

CRITERION

CRITERION INSTRUMENTS LTD.
30 PROGRESS AVENUE, SCARBOROUGH, ONTARIO, CANADA MIP 4W8
TEL: 416/299-6666 FAX: 416/299-8398
FOR YOUR NEAREST REP/DIST. PLEASE SEE CRITERION INSTRUMENTS
IN THE YELLOW PAGES OF THIS VOLUME.

CRITERION

DIELECTRIC STRENGTH TESTERS

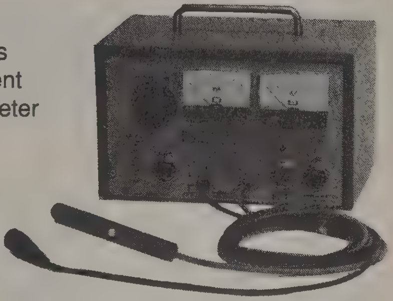


FEATURES AC, DC AND AC/DC OUTPUTS

- Adjustable output potentials to 15,000 volts
- Automatic cut-out– wide range of trip current
- Continuously indicating high-voltage voltmeter
- Voltage measured directly at output
- Optional milliammeter
- Indicator lamps

* Safety device for incorrectly wired outlet

- Heavy-duty retractable prod(to 5 kV)



FOR TESTING TO MEET U.L. AND CSA SPECIFICATIONS

CONDENSED SPECIFICATIONS

MODEL NO. WITH MILLIAMMETER	MODEL NO. WITHOUT MILLIAMMETER	OUTPUT VOLTAGE	TRIP CURRENT
AV-25VA-5	AV-25V-5	0-2.5 kV AC	5 mA
AV-25VA-5V	AV-25V-5V	0-2.5 kV AC	2-5 mA
AV-25VA-10	AV-25V-10	0-2.5 kV AC	10 mA
AV-25VA-10V	AV-25V-10V	0-2.5 kV AC	2-10 mA
AV-25VA-20V	AV-25V-20V	0-2.5 kV AC	2-20 mA
AV-25VA-40V	AV-25V-40V	0-2.5 kV AC	2-40 mA
AVC-25VA	AVC-25V	0-2.5 kV AC	95 mA
AV-50VA-5	AV-50V-5	0-5 kV AC	5 mA
AV50VA-5V	AV-50V-5V	0-5 kV AC	2-5 mA
AV-50VA-10	AV-50V-10	0-5 kV AC	10 mA
AV-50VA-10V	AV-50V-10V	0-5 kV AC	2-10 mA
AV-50VA-20V	AV-50V-20V	0-5 kV AC	2-20 mA
AVC-50VA	AVC-50V	0-5 kV AC	2-95 mA
AV-100VA-5V	AV-100V-5V	0-10 kV AC	2-5 mA
AV-100VA-10V	AV-100V-10V	0-10 kV AC	2-10 mA
AV-150VA-5V	AV-150V-5V	0-15 kV AC	2-5 mA
DV-25VA-5VE		0-2.5 kV DC	0.1-5 mA
DV-25VA-5	DV-25V-5	0-2.5 kV DC	5 mA
DV25VA-5V	DV-25V-5V	0-2.5 kV DC	2-5 mA
DV-25VA-10	DV-25V-10	0-2.5 kV DC	10 mA
DV-25VA-10V	DV-25V-10V	0-2.5 kV DC	2-10 mA
DV-25VA-20V	DV-25V-20V	0-2.5 kV DC	2-20 mA
DV-50VA-5	DV-50V-5	0-5 kV DC	5 mA
DV-50VA-5V	DV-50V-5V	0-5 kV DC	2-5 mA
DV-50VA-10	DV-50V-10	0-5 kV DC	10 mA
DV-50VA-10V	DV-50V-10V	0-5 kV DC	2-10 mA
DV-100VA-5V	DV-100V-5V	0-10 kV DC	2-5 mA
DV-100VA-10V	DV-100V-10V	0-10 kV DC	2-10 mA
DV-150VA-5V	DV-150V-5V	0-15 kV DC	2-5 mA
AV/DV-25VA-5	AV/DV-25V-5	0-2.5 kV AC/DC	5 mA
AV/DV-25VA-5V	AV/DV-25V-5V	0-2.5 kV AC/DC	2-5 mA
AV/DV-25VA-10	AV/DV-25V-10	0-2.5 kV AC/DC	10 mA
AV/DV-25VA-10V	AV/DV-25V-10V	0-2.5 kV AC/DC	2-10 mA
AV/DV-50VA-5	AV/DV-50V-5	0-5 kV AC/DC	5 mA
AV/DV-50VA-5V	AV/DV-50V-5V	0-5 kV AC/DC	2-5 mA
AV/DV-50VA-10V	AV/DV-50V-10V	0-5 kV AC/DC	2-10 mA
AV/DV-50VA-95/10V		0-5 kV AC/DC	2-95 mA AC / 2-10 mA DC

Other voltages and currents on special order up to 100 kV, up to 20 kVA.

For more information, please contact:

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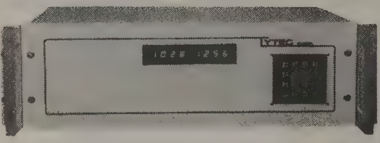
SWITCHING SYSTEMS

FOR AUTOMATIC TEST, INSTRUMENTATION, COMMUNICATIONS, AND CONTROLS

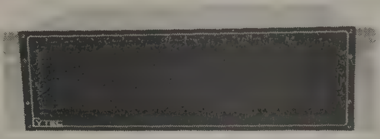
Cytec Corp., offers switching solutions for every need. Matrices, Multiplexers, Group Switches, combinations, or specialty products — all available with a variety of relays for virtually any types of signals. We offer computer control, manual control, or both in systems from 8 to over 8000 switch points. All of Cytec's products are backed by 30 years switching experience, proven reliability, and a three year warranty.

RACK AND STACK SYSTEMS

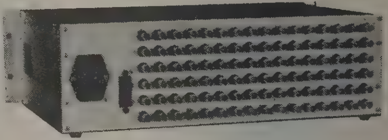
Matrices, Multiplexers, and Coaxial Switches are available in 19" rack mounting units controlled from IEEE488, RS232, or Parallel Port. Features include LED display and Status feedback of the selected relays.



MULTIPLEXERS



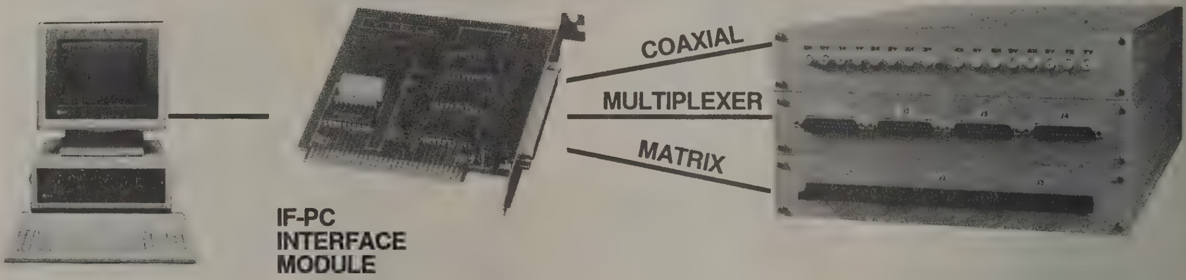
MATRICES



COAXIAL SWITCHES

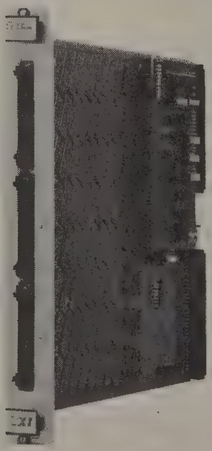
PC DRIVEN BENCH TOP UNITS

Separate Bench Top Units with up to 64 relays arranged as Matrices, Multiplexers, or Discrete Relays. Up to 8 Units can be driven from one PC Interface Module.



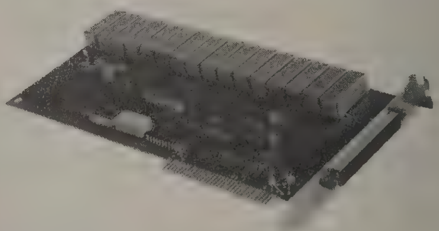
VXI BUS MODULES

Versatile, general purpose Message or Register Based, C sized Switch Modules.



PC BUS MODULES

PC/AT/XT BUS Compatible Switch Modules with 16 single or two pole relays.



STD BUS MODULES

STD BUS Compatible Switch Modules with SPST, SPDT, or Coaxial Relays.

FOR A COMPLETE CATALOG CALL 1-800-346-3117

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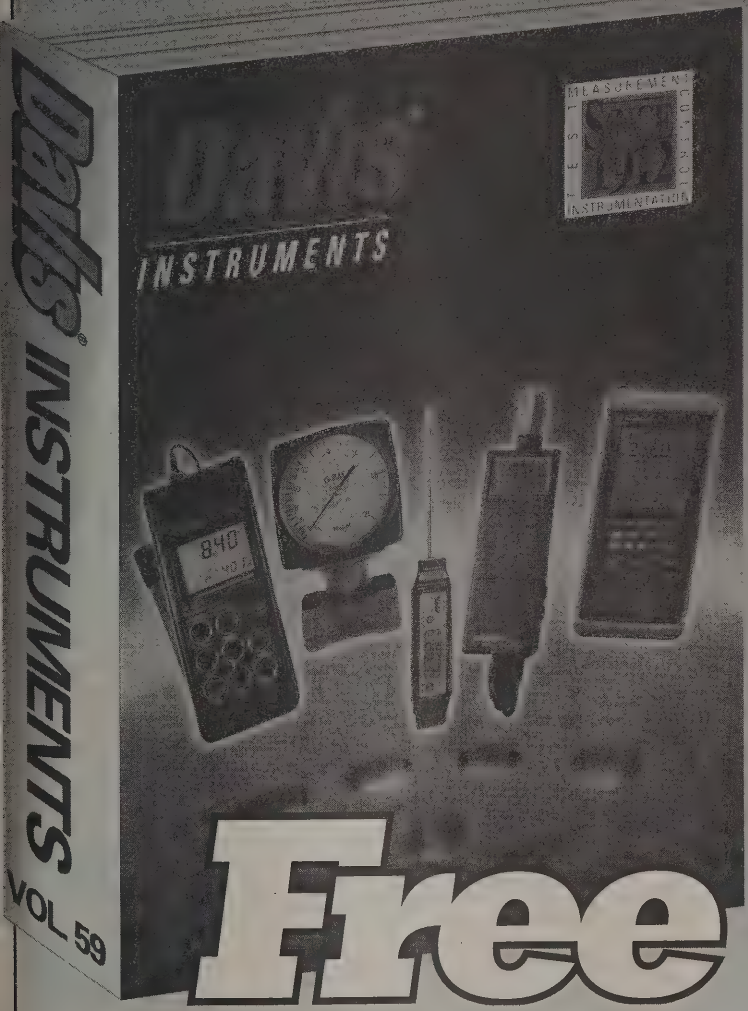
Instrumentation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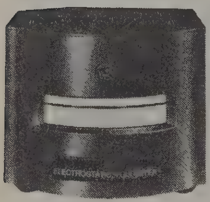
WESTON

HIGH VOLTAGE DIVIDER

Model PARK Voltage Divider is constructed to a design by J. H. Park (Ref: Journal of Research" of National Bureau of Standards, Engineering and Instrumentation Vol. 66C, No. 1, Jan. - Mar., 1962. Reprints available upon request.) It is similar to the NBS standard employed in their calibration of high voltage instruments. Each 100 kv divider consists of 100 individually shielded one-megohm resistors, matched to each other to achieve an approximate temperature coefficient of less than 1 ppm/°C, and connected in series to form a vertical helix between a ground plate and a high voltage electrode. Uniquely shielded, testing indicates that corona, heating and leakage errors are less than 10 ppm at less than 10 ppm at 50 kv and 50 ppm at 100 kv.

The divider's special "hat" is designed to give uniform gradients from the high voltage electrode to ground and allows stacking of additional 100 kv units for higher voltage measurements. Each unit is only 22 1/4" high! DC Ratio Accuracy: .05%, 100 kv to 1 v: .5%, 100 kv to 1 kv. AC Ratio Accuracy: ±.5%, 50 kv (max.) to 500 v. (60 cps only). Recommended readout instrument at 1 v output tap is a precision DC potentiometer, at 1 kv tap (.5 kv on AC) recommended instrument is a .5% accurate electrostatic voltmeter (Sensitive Research Model ESD described below).



ELECTROSTATIC VOLTMETER (high voltage)

Model ESH AC/DC. electrostatic voltmeter is available as a single range instrument up to 100 kv fs (140 kv DC only), or with as many as 4 switch-controlled ranges from 5 to 50 kv fs. DC input resistances to 5 x 10^{15} ohms. Capacitance varies from approx. 30 mmfd on 5 kv range to 10 mmfd on 50-100 kv ranges. Reads true RMS. Accuracy is ±1% fs (±.5% up to 50 kv) 6" scale length. Transit lock and brackets for panel mounting available.

ELECTROSTATIC VOLTMETER (portable)

Model ESD portable AC/DC electrostatic voltmeter is available as a singer or multirange instrument to measure from 120 to 6 kv fs. Insulation resistance is 1 x 10^{15} ohms. Capacitance varies from approx. 225 mmfd for a 120 v range to 20 mmfd for a 6 kv range. Multirange instruments are designed for AC/DC measurements on first range. AC only on higher ranges. ±.5% to 1% fs accuracy (±1.5% for ranges of 150 v and less). 5.2" scale length. Size: 7 3/4" x 7 1/2" x 6 1/16". Available as edgewise panel instrument with the same performance characteristics except insulation resistance approx. 1 x10^{13} ohms.

ELECTROSTATIC VOLTMETER (small portable)

University Model is a smaller, more economical version of the portable Model ESD. Single and multirange instruments available from 300 v to 5 kv fs. ±1% fs accuracy. 4" scale length. Molded bakelite case. Size 5 1/4" x 5" x 4 3/8".

SERIES 931 DC PORTABLES

0.5% Accuracy

Scale length: 4.04" (103mm) Self-shielded permanent-magnet moving-coil mechanism — a magnetic field created by a conductor carrying 7000 amperes at a distance of three feet from the instrument would cause a temporary error of less than 0.5%. Size: 5-1/4" x 5' x 3-1/4" (133 x 127 x 83mm). Approx. weight, 2 lbs. (0.9kg.).

SERIES 433 AC PORTABLES

0.75% Accuracy

Scale length: 4.04" (103mm) Iron-vane movement, shielded form external magnetic fields. Well-compensated for temperature changes. Power consumption: 150V range at 115V, 60Hz, 2.5 watts, 2.5 voltamperes.

Self-contained ranges: single, double, and triple up to 750 volts. Higher ranges obtainable with multipliers, or by using Model 311 Potential Transformer in connection with 150-volt range. Size: 5-1/4" x 5" x 3-1/4" (133 x 127 x 83mm). Approx. weight: 2-1/2 lbs. (1.1kg.).

AC AMMETERS

Power Consumption 5 amps, 60 Hz, 0.50 watt, 0.52 VA. Single, double and triple ranges cover frequencies 25-500 Hz. Higher frequency coverage available. Triple range instruments have internal current transformer. All have two binding posts, double and triple range instruments have range selector switch. For ranges above 50 amps, Model 461 Current Transformer, Type 2 with 5 amps instrument is recommended.

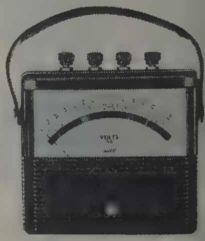
SERIES 901/904 WIDE-SCALE MULTI-RANGE PORTABLES

0.25% /0.5% Accuracy

A matched group of high-precision portable instruments with 5-1/2" (140mm) hand-calibrated, mirror-backed scales; wide-angle, non-breakable windows; high magnetic shielding against external fields. Size: 7-1/2" x 7-1/4" x 3-5/8" (190 x 184 x 92mm). Approx. weight: DC models, 3-3/4 lbs. (1.7 kg.); AC models, 4-3/4 - 7-1/3 lbs. (2.1 - 3.3 kb.).

Series 901 DC Instruments. Self-shielded, permanent-magnet moving-coil operation. Rated accuracy: 0.25 - .5% F.S.

Series 904 AC Instruments. Iron-vane movement, designed to withstand large overloads and abuse without damage or change in accuracy. Rated accuracy: 0.5% F.S.



SERIES 432 DC AND SINGLE-PHASE AC WATTMETERS

0.5% Accuracy

Electrodynamometer types, accurate within ±0.5% at 60 Hz; true-RMS indication. Power consumption: Potential circuit at 115V, 60Hz, 1.2 watts, 1.2 volt-amperes. Current circuit at 5 amperes, 60 Hz, 0.65 watt, 0.68 volt-amperes. Scale length: 4.04" (103mm); scale divisions: 75 unless otherwise noted. Size: 5 1/4" x 5" x 3 1/4" (133 x 127 x 83mm). Approx. weight: 3 1/4 lbs. (1.5 kg.).

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AC & DC Voltage, Current and Resistance
CALIBRATORS • REFERENCES • SOURCES • SUPPLIES

NOTICE: All instruments are traceable to the U.S. National Institute of Standards & Technology (N. I. S.T.). Certification is supplied with all new instruments. Instruments are available under G.S.A CONTRACT to authorized organizations. Request Page J-7.

APPLICATIONS: Design engineering, quality control, calibration, field service, imbedded standards and simulation for process control systems and data logging systems.

OPERATION: Remotely controlled, VIA GP-IB, and local control. Also available: Lower cost, manually operated instruments.

ACTIVE, OUTPUT SOURCES: from ±10 nV to ±1000 Vdc; ±10 nA to ±10 Adc/ac an d 1 A to 100 Aac; 1 mVac to 1000 Vac; 1 OHM to 10 MEG OHM.

FEATURES: Low noise, high stability, linearity, monotonicity, repeatability as well as accuracy.

SPECIALIZED INSTRUMENTATION: Watt-hour meter calibrator; flexible watt calibrator; power analyzer kit; large selection of digital multimeters.

LOW NOISE d.c. VOLTAGE & CURRENT CALIBRATOR - MODEL 522

INTEGRATED MICROPROCESSOR
IEEE-488 GP-IB INTERFACE

(MANUALLY OPERATED INSTRUMENTS ALSO AVAILABLE. REQUEST FULL CATALOG.)

Very low electrical noise.
IEEE-488 GP-IB INTERFACE is included.
Floating output. Optically isolated from the logic.
True bipolar. Balanced zero.

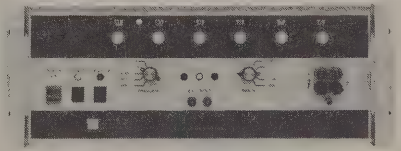
"Crowbar" zero reference.
100 Volts compliance in the current mode.
Output terminal sets on both front and rear panels, included.
Bench and rack mountable.

D.C. VOLTAGE MODE				D.C. CURRENT MODE		
Model 522	**100 mV range**	**10 V range**	**100 V range**	**10 mA range**	**100 mA range**	**Optional Ranges**
Output, d.c.	±100.0000 mV	±10.000.00 V	±100.000 0V	±10.000 00 mA	±100.000 0 mA	RA-5 ± 1000V
Resolution (1 ppm)	0.1µV	10µV	100µV	10 nA	100 nA	
Accuracy	±0.002%	±0.002%	±0.002%	±0.005%	±0.005%	RA-7 ± 1.0V
	Accuracies stated are of setting plus range residual, "worst case" method, valid for 12 months					
Noise	±0.0005% of range + 2µV			±0.0005% of range + 0.2µA		
Compliance	emf into 1 MΩ	100 mA	100 mA	100 V	100 V	

AC VOLTAGE STANDARD/CALIBRATOR - MODEL 4601

BURDEN UP TO 50 VA • HIGH RESOLUTION • HIGH STABILITY

PROGRAMMABLE GP-IB INSTRUMENTS ALSO AVAILABLE. REQUEST FULL CATALOG.

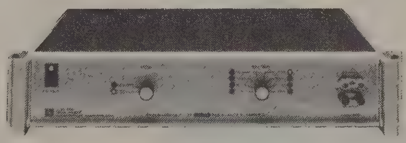


Ranges: 1kV, 100V, 10V, 1V, 100mV + 20%
Resolution: 1ppm, all ranges
Burden: 50 VA (2 A max.)
Accuracy: 0.05% of setting.
Frequency range: 45 Hz to 5 kHz.

Systems building blocks with auxiliary instruments: Current Calibrators 10 A or 1000 A, Phase Angle Controller, Watt Calibration Systems. (REQUEST FULL CATALOG.)

RESISTANCE CALIBRATOR - MODEL 621

PROGRAMMABLE GP-IB IEEE-488
MICROPROCESSOR BASED • HIGH ACCURACY

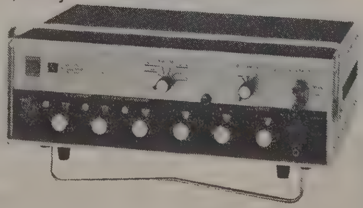


Ranges: 1 Ω to 10 MΩ and 1.9 Ω to 19 MΩ
(8 values in each range.)
Accuracies: 0.002% to 0.125%
Configuration: 2 wire or 4 wire

DC CURRENT AND VOLTAGE CALIBRATOR - MODEL CR-103/J

Calibration of and simulation for transducer, strain gauge and thermocouple instrumentation, data logging and process control systems. Cal and test A/D converters, amplifiers. Testing precision resistors, diodes, relays and other semi-conductors.

	Current Mode	Voltage Mode
DC Ranges	± 110mA ± 11mA	±11V ±1V ± 110mV
Resolution (1 ppm)	100nA 10nA	10µV 1µV 0.1µV
Compliance	100V	50mA
Accuracy	± 0.005% of setting	±0.003% of setting



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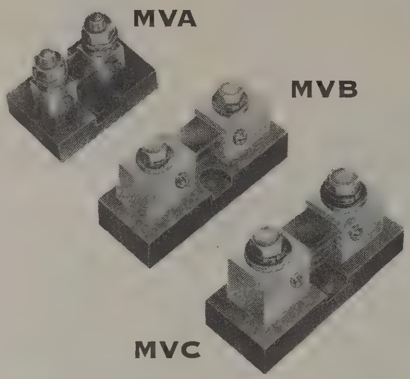
SERIES **MV**



MVA

EPC #	AMPS	MSA #
5 - 50	5	—
10 - 50	10	100
15 - 50	15	150
20 - 50	20	200
30 - 50	30	300
50 - 50	50	500
75 - 50	75	750
80 - 50	80	800
85 - 50	85	850
100 - 50	100	101
150 - 50	150	151

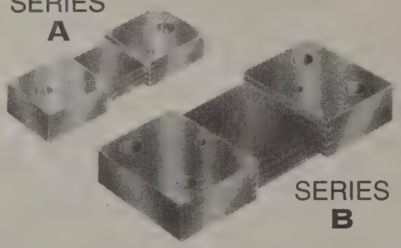
MVB

EPC #	AMPS	MSB #
170 - 50	170	171
200 - 50	200	201
250 - 50	250	251
300 - 50	300	301
400 - 50	400	401
450 - 50	450	451
500 - 50	500	501
600 - 50	600	601

MVC

EPC #	AMPS	MSC #
800 - 50	800	801
1000 - 50	1000	102
1200 - 50	1200	122

SERIES A



SERIES B

Available In 50 & 100mV

TYPE	AMPS
TYPE **A1**	50 A 75 100 150 200
TYPE **A2**	200 300 400

Available In 50 & 100 mV

TYPE	AMPS
TYPE **A3**	400 A 500 600 750
TYPE **B**	600 900 1200 1500

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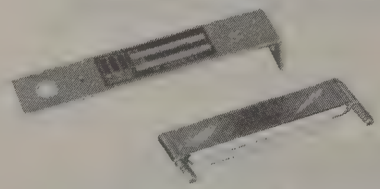
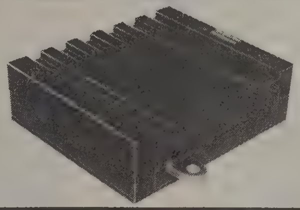
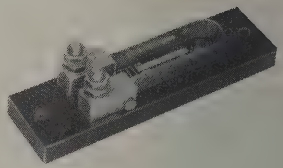
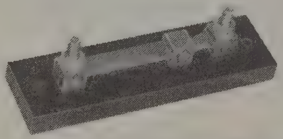
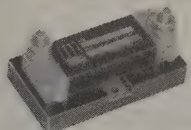
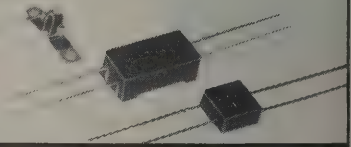
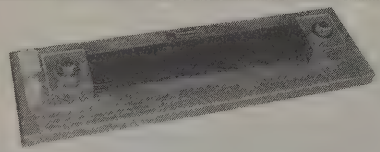

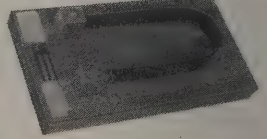

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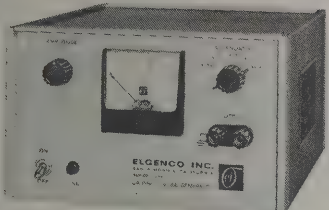
ELGENCO NOISE GENERATORS



SOLID STATE NOISE GENERATORS

MODEL 602A–1390 5 Hz to 5 MHz, 3 Ranges......$2,775
MODEL 602A–200 5 Hz to 5 MHz, 3 Ranges.......$2,875
MODEL 603A 5 Hz to 5 MHz, 3 Ranges...........$3,395
FREQ. RANGES: 5 Hz to 20 KHz, 5 Hz to 500 KHz, 5 Hz to 5 MHz

OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001;

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform all ranges.

OUTPUT METER: 0-5 volts rms.

ELGENCO INC.

Model 610A 5 Hz to 5 mHz, 8 Ranges $6,870

FREQ. RANGES: 10 Hz to 2 kHz, 10 Hz to 5 kHz, 10 Hz to 20 kHz, 10 Hz to 50 kHz, 10 Hz to 200 kHz, 10 Hz to 500 kHz, 10 Hz to 2 mHz, and 10 Hz to 5 mHz.

OUTPUT SPECTRUM: Uniform ±0.5 db from 10 Hz to 500 kHz and ±2.0 db from 500 kHz to 5 mHz.

OUTPUT LEVEL: 0 to 1 volt rms, adjustable by front panel amplitude control. A dynamic range of 5 to 1 peak to rms value is provided.

OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, X.0001. Accuracy ±0.25 db/step to 500 kHz; ±0.063 db/step to 5 mHz.

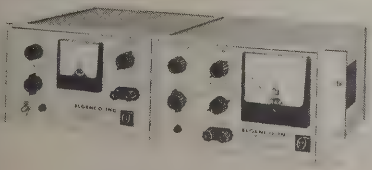
AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical Gaussian all ranges.

OUTPUT METER: 0 to 1 volt rms. Accuracy ±2% of full scale to 2 mHz; ±5% to 5 mHz.

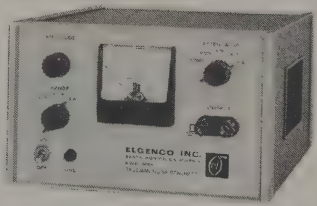
MAXIMUM LOAD: 500 ohms on direct output.

OUTPUT IMPEDANCE: 50 ohms

POWER REQUIREMENTS: 115/230 volts±10/20 volts, 50 to 1,000 Hertz. ac.



Models 602A and 610A combined by dual unit adapter kit.



SERIES 624 A FIXED FREQUENCY NOISE GENERATORS

OUTPUT LEVEL: (open circuit) 3 volts rms.

OUTPUT IMPEDANCE: 200 ohms ±10%.

MAX. LOAD: (on direct output) 700 ohms.

OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.
Output Impedance: 200 ohms ±1%.

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform.

OUTPUT METER: 0-5 volts rms.

POWER: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.

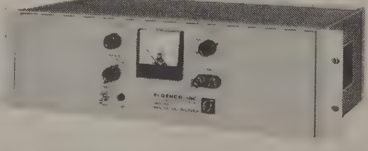
DIMENSIONS: 5¼" high × 8⅝" wide × 11" deep.
Some of the many frequency ranges available are listed below. Write for further information.

MODEL 624A

-12124 20 Hz to 20 kHz ±1db	$2,676.00
-11124 10 Hz to 20 kHz ±1db	$2,831.00
-12154 20 Hz to 50 kHz ±1db	$2,688.00
-11154 10 Hz to 50 kHz ±1db	$2,843.00
-12115 20 Hz to 100 kHz ±1db	$2,700.00
-11115 10 Hz to 100 kHz ±1db	$2,855.00
-12125 20 Hz to 200 kHz ±1db	$2,712.00
-11125 10 Hz to 200 kHz ±1db	$2,867.00
-12155 20 Hz to 500 kHz ±1db	$2,735.00
-11155 10 Hz to 500 kHz ±1db	$2,890.00
-22154 20 Hz to 50 kHz ±2db	$2,676.00
-21154 10 Hz to 50 kHz ±2db	$2,831.00
-22115 20 Hz to 100 kHz ±2db	$2,688.00
-21115 10 Hz to 100 kHz ±2db	$2,843.00
-22125 20 Hz to 200 kHz ±2db	$2,700.00
-21125 10 Hz to 200 kHz ±2db	$2,855.00
-22155 20 Hz to 500 kHz ±2db	$2,723.00
-21155 10 Hz to 500 kHz ±2db	$2,878.00
-32155 20 Hz to 500 kHz ±3db	$2,700.00
-31155 10 Hz to 500 kHz ±3db	$2,855.00
-52124 20 Hz to 20 kHz ± ½ db	$2,803.00
-51124 10 Hz to 20 kHz ± ½db	$2,980.00
-52154 20 Hz to 50 kHz ± ½db	$2,817.00
-51154 10 Hz to 50 kHz ± ½db	$2,994.00
-51125 10 Hz to 200 kHz ± ½db	$3,022.00
-52155 20 Hz to 500 kHz ± ½db	$2,874.00
-51155 10 Hz to 500 kHz ± ½db	$3,051.00

OPTIONS & ACCESSORIES FOR MODELS 602A, 603A, 610A & SERIES 624A

Full rack width cabinet and rack mounting hardware option add	$435
Adapter kit, dual unit and rack mountin ghardware	$101
Adapter kit, single unit rack mounting (includes blank panel to make dual unit)	$425



Model 602A with full rack width mounting option.

ELGENCO INC.

FIXED FREQUENCY NOISE GENERATOR CARDS

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform.

OUTPUT LEVEL: (open circuit) 3 volts rms.

AMPLITUDE CONTROL: Continuously variable.

SIZE: 4½×6½"×1".

POWER: −30 volts dc, −24 volts dc optional.
Some of the many frequency ranges available are listed below. Write for further information.

MODEL 3602A

-12224 200 Hz to 20 kHz ±1db	$733.00
-15124 50 Hz to 20 kHz ±1db	$769.00
-12124 20 Hz to 20 kHz ±1db	$834.00
-11124 10 Hz to 20 kHz ±1db	$989.00

MODEL 3603A

-12215 200 Hz to 100 kHz ±1db	$757.00
-15115 50 Hz to 100 kHz ±1db	$793.00
-12115 20 Hz to 100 kHz ±1db	$858.00
-11115 10 Hz to 100 kHz ±1db	$1,013.00
-11125 10 Hz to 200 kHz ±1db	$1,025.00
-11155 10 Hz to 500 kHz ±1db	$1,048.00

MODEL 3606A

-51124 10 Hz to 20 kHz ± ½db	$1,205.00
-51154 10 Hz to 50 kHz ± ½db	$1,219.00
-51125 10 Hz to 200 kHz ± ½db	$1,247.00
-51155 10 Hz to 500 kHz ± ½ db	$1,275.00

MODEL 3607A

-15316 5 kHz to 1 mHz ±1db	$1,029.00
-35316 5 kHz to 1 mHz ±3db	$762.00
-25356 5 kHz to 5 mHz ±2db	$1,348.00
-35356 5 kHz to 5 mHz ±3db	$1,172.00

MODEL 3609A Power Supply Card $367

(supplies power for up to 2 noise generator cards)

SIZE: 4½"×6½".
INPUT: 115/230 volts±10/20 volts, 50 to 1000 Hz.

ELGENCO INC.
SANTA MONICA, CALIF.
MODEL
PART
SERIAL

ENCAPSULATED NOISE SOURCE MODULES

SERIES 1600........................$643 to $1,258
5 Hz to 5 mHz
SERIES 1800........................$664 to $2,154
10 kHz to 100 mHz
Various frequency ranges and output flatness available. Contact Elgenco for details.

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ELECTRO MECHANICAL DESIGN SERVICES INC.

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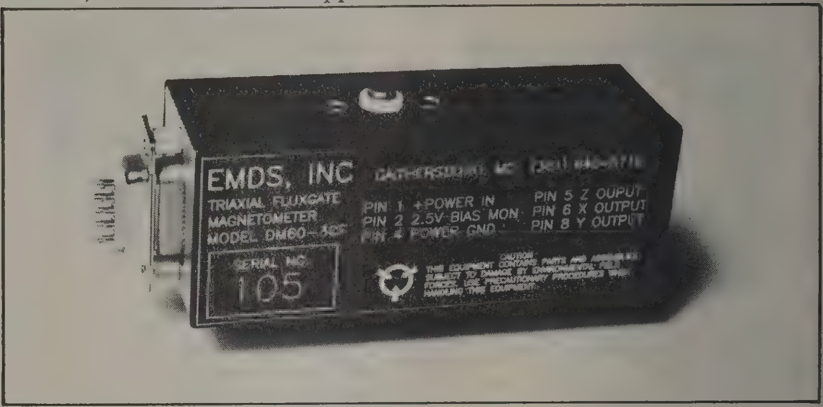
(301) 840-5710 Fax: (301) 840-8589

MAGNETIC FIELD INSTRUMENTATION

EMDS designs and builds high stability, low noise fluxgate magnetometers. These instruments can be configured for use as gradiometers or to meet special requirements for instrument packaging or electrical specifications. EMDS is capable of delivering magnetometers with noise levels of < .005 nanotesla* RMS/√Hz and zero offset drift of <± .5 nanotesla from -30° to +60°Celsius. We supply high reliability magnetometers for use in Aerospace, Remotely Piloted Vehicles, Naval and Scientific applications.



MAG100-MIL: MILITARY SPEC TRIAXIAL FLUXGATE MAGNETOMETER

Axial Alignment: ±1 Degree with Respect to baseplate
Input Voltage: 26 to 30 VDC (Power Converter isolated); Overvoltage to 35 V; Reverse Voltage Protected
Input Current: <50 milliamps
Field Measurement Range: ±0.7 Gauss
Accuracy: ±1.5%
Linearity: ±0.05%
Sensitivity: 14.286 Volts/Gauss
Scale Factor Temperature Shift: <.01% Full Scale/°Celsius
Noise: <0.5 nanotesla Peak to Peak
Output Ripple: <15 millivolts Peak to Peak 0 to 10 Khz
Analog Output @ Zero Field: 0.0 Volts ± 50 millivolts
Zero Shift with Temperature: <±30nT. -55°C to +85°C
Environmental: Operating Temperature Range -55°C to +85°C, Storage -62°C to +85°C
Susceptibility to Perming: <±20nT. shift with ±5 Gauss Applied
Output Impedance: <100 Ohms
Frequency Response: -3 Db @ ≥ 150 Hz
Random Vibration: 26.7 G RMS 20 Hz to 2 Khz
Acceleration: 30G
Calculated MTBF: ≥269,000 Hours
Weight: ≤545 Grams
Size: 23 cm x 6 cm x 2.2 cm

DM60-3CF: TRIAXIAL FLUXGATE MAGNETOMETER

Designed to NASA specifications: ultra-miniature Triaxial Fluxgate Magnetometer for general magnetic measurements in the laboratory or field applications such as remotely piloted vehicles, data buoys, sounding rockets, etc.

Axial Alignment: Orthogonality better than ± 1 degree
Input Voltage: +24 to 32 VDC
Input Current: ≤35 milliamps
Field Measurement Range: ±0.6 gauss
Accuracy: ±1.0% of full scale
Linearity: ±.05% of full scale
Sensitivity: 41.66 microvolt/nanotesla
Scale Factor Temperature Shift: ≤0.01% full scale/°celsius
Noise: ≤2 nanotesla peak to peak 0.1 to 10 Hz
Output Ripple: ≤5 millivolt RMS @ 2nd harmonic
Analog Output @ Zero Field: ≤2.5 Volts ± 25 millivolts
Random Vibration: 20G RMS 20 Hz to 2 Khz
EMI: CE03, RE02
Acceleration: 60G
Zero Shift with Temperature: ≤ ± 25 millivolt -25° to 70°C
Susceptibility to Perming: ≤ ± 5 nT. shift with ± 5 gauss applied
Output Impedance: 470 OHM ± 5%
Frequency Response: -3 DB @ >150 Hz
Weight: 91 grams
Size: 8.9 cm x 3.18 cm x 3.5 cm
Connector: Chassis mounted 9 pin male "D" type (mating connector supplied)
Connector Pins:

1. (Power In)
2. (N.C.)
3. (Floating Signal Ground)
4. (Power and Case Ground)
5. (Z Axis Out)
6. (X Axis Out)
7. (Redundant Ground)
8. (Y Axis Out)
9. (N.C.)

STANDARD MODEL INSTRUMENTS

Model	Range (Gauss)	Linearity % F.S.	Noise P-P .1Hz-10Hz	Zero Offset	Input Voltage /Power	Features	
MAG100-MIL	± .7	± .05	<.5nT	<25nT	26-32 V 50 ma.	Military/Spacecraft Applications	NEW PRODUCT
MDD-1	± 1.0	± 5	<2nT		5.2 V 1 ma.	Magnetic Change Detector for Intrusion Detection, Etc.	NEW PRODUCT
GR2-200KL**	± 2.0	± .005	<.1nT	<25nT.	16.5-26V	Gradiometric Measurements Very Low Long Term Drift	
HCCS-3**	± 1.0	± .005	<.15nT.	Adjustable to 0	115 VAC	3 Axis Helmholtz Controller with Additional Single Axis Calibration Probe	
MC-3	± 1.0	-	-	-	-	One Meter Triaxial Helmholtz Coil	
VLN-3**	± 1.0	± .002	<.005nT. Rms/√Hz	<10nT.	18-16 V 110 ma.	Very Low Noise, Low Power Magnetometer with 7.62 x 15.24 cm. Electronics Card	
DM60-3A	± .9	± .15	<.5nT.	<25mv.	28-20 V 50 ma.	Miniature Triaxial Sensor Magnetometer for RPVs, Buoys, etc.	
DM60-3CF	± .9	± .05	<.5nT.	<25mv.	24-32 V 35 ma.	ULTRA-miniature Triaxial Magnetometer 8.9 cm.x 3.18 cm.x 3.5 cm.	NEW PRODUCT
DM60-3UWH	± .9	± .15	<.5nT.	<25mv.	28-20 V 50 ma.	Submersible DM 60-3A Rated to a Depth of 300 Meters	NEW PRODUCT
SDI-3	± 1.2	± .01	<.15nT.	<25nT.	18-16 V 265 ma.	Single Card Triaxial Magnetometer with three 20 bit A/Ds & RS232 or RS485 Output	
SDM-3B**	± 1.0	± .005	<.1nT.	10nT.	115 VAC 3 Watts	Very High Stability Triaxial Magnetometer with Analog Output	
DM75K3	± .075 or ± .75	± .01	<.2nT.	<50nT.	± 28 VDC	Gimballed Sensor Magnetometer for Degaussing Ranges, Dual Range with Earth's Field Backoff	

*1 NANOTESLA (nT.) = 10^{5} Gauss = 1 Gamma

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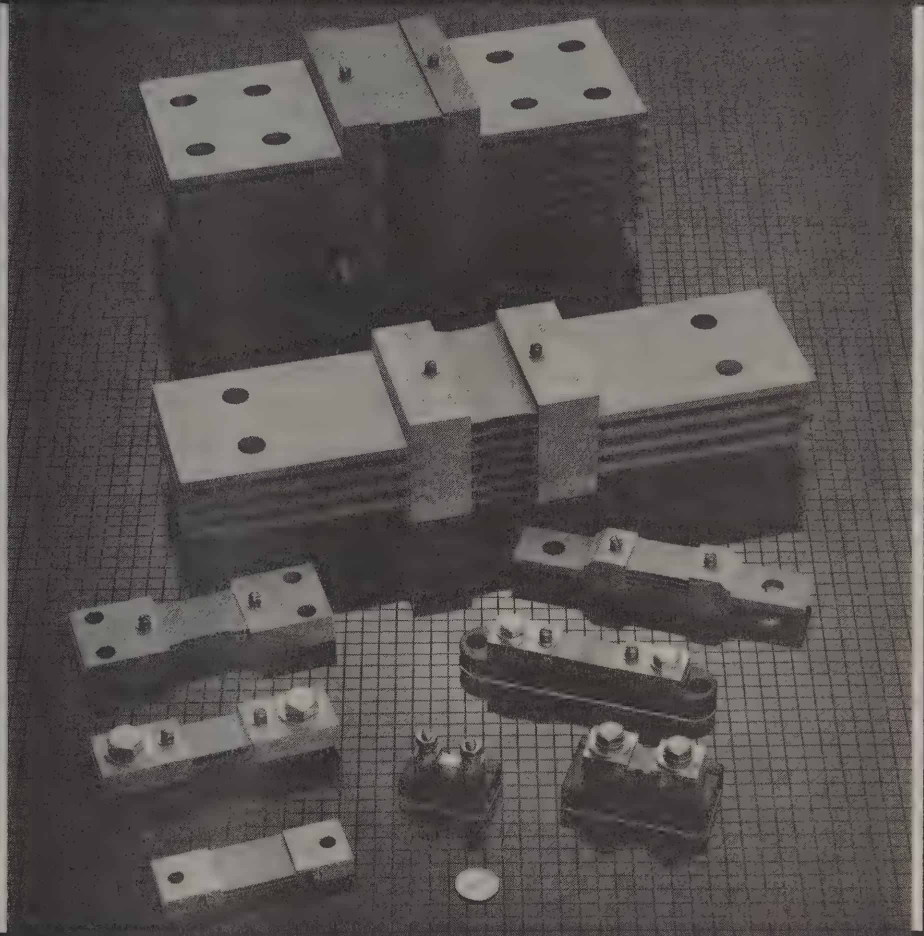

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- Sleep Mode
- Two-year warranty

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- Frequency measurement (Hz)
- Display Hold
- Combination Digital/Analog Display
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- Beeper provides audible feedback
- Smooth: 3 second running average of RMS current or frequency (33 only)
- One-year warranty

79

87

79/29 Series II Multimeters

- 4000 count digital display
- 63 segment analog bargraph
- 0.3% basic dc accuracy
- 1.0% basic ac accuracy
- Frequency Counter; Capacitance
- Lo-Ohms range w/zero calibration
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- Autoranging with manual ranging
- Sleep Mode; Smoothing™
- Holster/Flex-Stand™
- Three-year warranty

80 Series Multimeters

- 3$^{3}/_{4}$ digit, 4000 count
- 0.1% basic dc accuracy (85 & 87)
- Frequency & duty cycle
- Touch Hold® & Relative Mode
- 43 segment analog bargraph
- Additional for the Fluke 87 model:
  - 4$^{1}/_{2}$ digit mode
  - True-rms ac voltage & current
  - 1 ms Peak Min/Max
  - Back lit display
  - Three-year warranty

8842A

8840 Series 5$^{1}/_{2}$ Digit Multimeters

- Basic 1-year dc accuracies to 0.003%; ohms accuracy to 0.008%
- Ohms and dc current standard - ac voltage and current optional
- Full system capability with optional GPIB/IEEE-488 interface
- Vacuum fluorescent display; Up to 100 readings/second system speed
- Closed-case calibration; Comprehensive self-test built-in

45

45 Dual Display Multimeter

- Vacuum fluorescent dual display; Touch Hold®, Relative & Min/Max
- True-rms voltage and current, including ac + dc
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- Frequency measurement to 1 MHz
- dB measurements with selectable reference impedances of 2Ω to 8,000Ω
- 0.05% dc current accuracy for 4-20 mA current loop service

Also see our Oscilloscopes and ScopeMeters® in EEM Section 2975.

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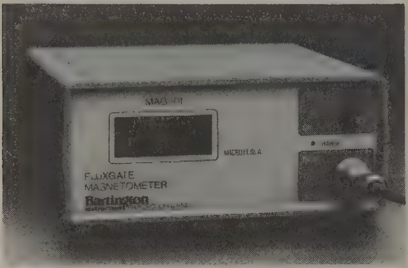
Bartington

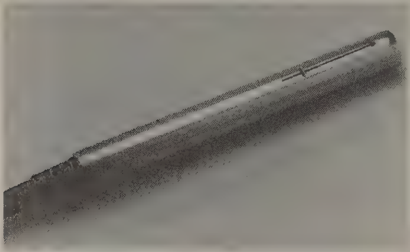
FLUXGATE NANOTESLAMETERS

High Sensitivity measurements of low-level magnetic fields

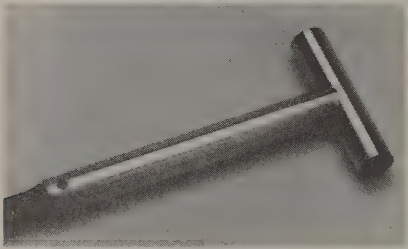
The Bartington Fluxgate Nanoteslameters allow high stability, high-reliability measurement of low-level dc and ac magnetic fields. Applications include mapping of magnetically shielded enclosures, monitoring installation sites for magnetically sensitive equipment, providing an input to active field cancellation systems, and measuring fringing fields from magnets, transformers and inductors.



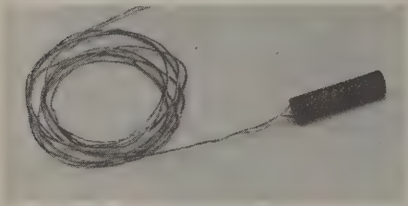
MAG-01



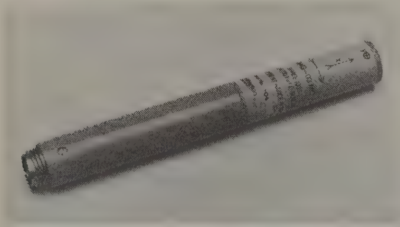
Probe B, Probe D



Probe C, Probe E



Probe F, Probe G



MAG-03MC

MAG-01 and MAG-01H Single-Axis Nanoteslameters

These are portable, lightweight instruments powered from an internal rechargeable battery or from the ac line. They are intended for the measurement of dc fields. The field reading is available as a digital display and analog output. Probes are individually calibrated and fully interchangeable without zeroing or recalibration. Probes are supplied with 5m cable length. Special lengths are available to 25m.

	MAG-01	MAG-01H
Liquid crystal display	4 1/2 digit (auto ranging)	4 1/2 digit (auto ranging)
Field range/resolution (x1/10)	- -	±2µT/0.1nT ±20µT/1nT
(x1)	±20µT/1nT ±200µT/10nT	±20µT/1nT ±200µT/10nT
(With Probe D or E x 10)	±200µT/10nT ±2mT/100nT	±200µT/10nT ±2mT/100nT
Analog output	±5V fs dc to 10Hz (-3dB) 1 kohm	±5V fs dc to 10Hz (-3dB) 1 kohm
Offset	-	±90µT in 10µT steps
Battery life	>16 hour	>16 hour
Recharging	12V or 115Vac	12V or 115Vac
Operating temperature	-10°C to +50°C	-10°C to +50°C
Dimensions (inch)	6.7Wx6.1Dx2.7H	6.7Wx6.1Dx2.7H
Weight (lb)	3.3	3.3

PROBES	Probe B	Probe C	Probe D	Probe E	Probe F	Probe G
Axial	●		●		●	●
Transverse		●		●		
Range 200µT fs	●	●			●	
Range 2mT fs			●	●		●
Cryogenic operation					●	●

MAG-03MC Three-Axis Fluxgate Sensors

Specifically developed as self-contained sensors for total description of magnetic fields from dc to over 1kHz for input to data loggers or chart recorders. Features very low current drain of +20mA, and -8mA (maximum) from nominal ±12V supply rails. Full-scale output is three ±10V full-scale signals corresponding to Bx, By, and Bz. Output impedance is less than 1ohm and cables may be up to 600m length.

	MAG-03MC100	MAG-03MC500
Scaling value	10µT/V	50µT/V
Measuring range (±12V supply)	±100µT	±500µT
Calibration accuracy	±0.5%	±0.5%
Angular alignment	±0.5°	±0.5°
Equivalent noise (1Hz to 1kHz)	<1.0nT rms	<1.0nT rms
Operating temperature	-40°C to +85°C	-40°C to +85°C
Dimensions (inch)	1.0Dx8.0L	1.0Dx8.0L
Weight (lb)	0.22	0.22

Field units: 0.1nT = 1µG, 100nT = 1mG, 100µT = 1G, 1mT = 10G, 1T = 10,000G

Refer to EEM Section 5500 for Precision Current Transducers

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Group3

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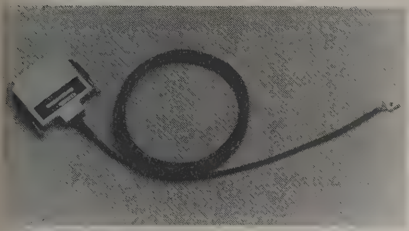
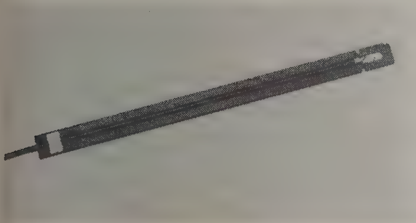
High accuracy measurements of magnetic fields

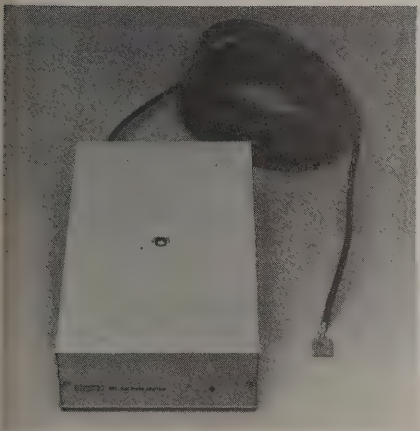
DTM-141



Probe LPT-141



Probe Holder



HPI

Group 3 Teslameters provide superior accuracy and long term measurement reliability combined with digital interfacing options not found on any other commercial instruments. All Group 3 Probes are precalibrated against an NMR (nuclear magnetic resonance) measured field. An EPROM in the probe cable connector stores the unique field and temperature characteristics of each probe.

DTM-132 and DTM-141 Single Axis Teslameters

Two field measurement resolution alternatives are offered in the same compact package with high visibility LED display. The DTM-132 has 12-bit resolution with a 4 1/2 digit display and the DTM-141 has 16-bit resolution with a 5 1/2 digit display. Field units may be tesla or gauss. Digital interfacing options are RS-232-C and serial fiber optic or IEEE-488. Since all probes are individually calibrated they may be interchanged without calibration.

	DTM-132	DTM-141
Display, high brightness LED	4 1/2 digit	5 1/2 digit
Field range/resolution with standard range probes	0.3T/0.05mT 0.6T/0.1mT 1.2T/0.2mT 3.0T/0.5mT	0.3T/0.005mT 0.6T/0.01mT 1.2T/0.02mT 3.0T/0.05mT
Measurement rate	30/sec	10/sec
Peak hold mode	digital	digital
Digital Filtering	selectable	selectable
Analog Output	±3V fs (not corrected) dc to 9kHz(-3dB)	±3V fs (not corrected) dc to 3kHz(-3dB)
Digital Interface options	RS-232-C, IEEE-488	RS-232-C, IEEE-488
Power	9V to 12V, 900mA 115Vac plugpack incl.	9V to 12V, 900mA 115Vac plugpack incl.
Operating temperature	0°C to 50°C	0°C to 50°C
Dimensions (inch)	4.9Wx8.5Dx2H	4.9Wx8.5Dx2H
Weight (lb)	2.6	2.6

PROBES	LPT-230	LPT-231	LPT-130	LPT-141
Ranges, full-scale (T)	0.03, 0.06, 0.12, 0.3		0.3, 0.6, 1.2, 3.0	
Precision (% of full-scale)	0.03	0.03	0.03	0.01
Temperature coefficient (ppm/°C)	500	25	100	10

HPI Hall Probe Interface

The HPI may be used to provide high-stability, high resolution interfacing of Hall probes to analog data acquistion systems. It provides a very stable 100mA, 19.2kHz control current and includes phase sensitive detection for the Hall voltage. Four gain settings may be selected. An analog output corresponding to temperature is also provided when used with Group 3 probes including temperature sensors. Calibration tables are offered as an option.

Magnetic field analog output	±3V, overange to ±6V dc to 3kHz (-3dB)
Temperature analog output	50mV/°C
Gain control	3 inputs to select 4 gains
Power	9 to 12V, 200mA, ac or dc
Operating Temperature	0 to 50°C
Dimensions (inch)	4.9Wx8.5Dx2H
Weight (lb)	2.0

Field units: 0.1nT = 1µG, 100nT = 1mG, 100µT = 1G, 1mT = 10G, 1T = 10,000G

Refer to EEM Section 5500 for Precision Current Transducers

GMW *P.O. Box 2578, Redwood City, CA 94064. Tel (415) 368-4884. Fax (415) 368-0816.*

METROLAB

NMR TESLAMETER AND DIGITAL VOLTAGE INTEGRATOR

Very high accuracy and stability measurements of magnetic fields

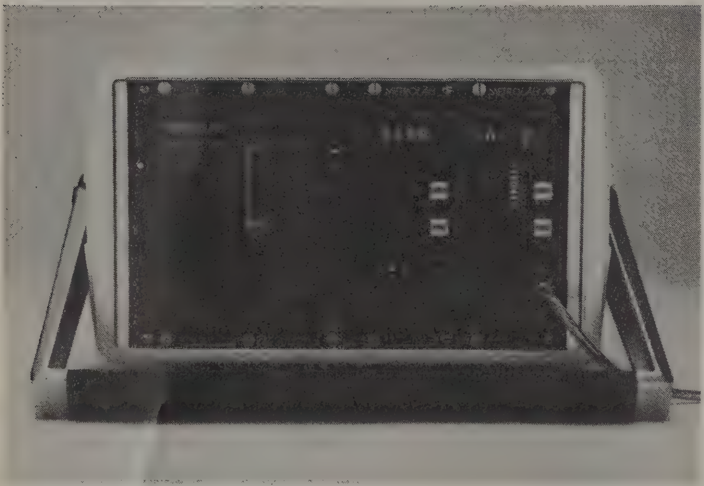
When absolute accuracy and high resolution magnetic field measurements are critical NMR (Nuclear Magnetic Resonance) Teslameters become the instrument of choice. Important applications are the calibration of magnetic sensors, mapping very uniform magnetic fields such as MRI (magnetic resonance imaging) magnets and to provide the the field input for closed-loop stabilization of magnet systems.

METROLAB PRECISION NMR TESLAMETER PT 2025
14546843

2025 NMR Teslameter

2025 NMR Teslameter	
High brightness LED	8 1/2 digit, tesla or MHz
Field range	0.043 to 13.6T
Resolution	0.1µT or 1Hz
Absolute Accuracy	±5ppm
Stability (10°C to 40°C)	<1ppm
Aging (1 year)	<2ppm
Reading rate	1/sec, 10/sec
Interfaces	RS-232-C & IEEE-488
Input power	110/220Vac, 50/60Hz,
Dimensions (inch)	10.2Wx13.3Dx5.7H
Weight (lb)	15

Measurements of magnetic flux change can be achieved by integration of the emf across the terminals of a sensing coil. Using appropriately configured coils the integrator can be used to map regions of magnetic field or to measure magnetic flux changes in magnetic material hysteresis measurements.



5025 Precision Digital Integrator

5025 Precision Digital Integrator	
Integration channels	1 or 2
Input voltage	±5mV to ±5V
Programmable gain	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000
Input impedance	2 Mohm
Integration interval	1ms to 10^{23}ms
External trigger	TTL
Motor drive (for mapping)	±12V or ±24V, 500mA
Encoder	2 up/down counter channels and 1 indexed channel.
Stability	1.5ppm/°C at gain of 100
Linearity	±20ppm at gain of 100
Noise	±3ppm at gain of 100
Resolution	2×10^{-7}V.s at gain of 100
Interfaces	RS-232-C & IEEE-488
Dimensions (inch)	10.2Wx10.2Dx5.7H
Weight (lb)	12

Field units: **0.1nT = 1µG, 100nT = 1mG, 100µT = 1G, 1mT = 10G, 1T = 10,000G**

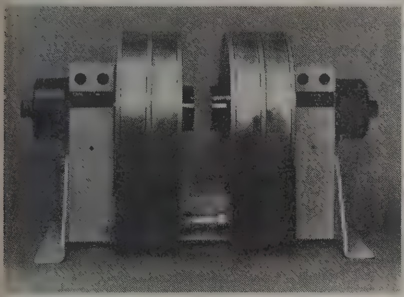
Refer to EEM Section 5500 for Precision Current Transducers

GMW *P. O. Box 2578, Redwood City, CA 94064. Tel (415) 368-4884. Fax (415) 368-0816.*

GMW

LABORATORY ELECTROMAGNETS

Variable-field electromagnet systems for magnetic property studies


5403

These variable-field electromagnets are suitable for Hall-effect studies, magneto-optics, ferromagnetic resonance, B-H curves, magnetic sensor calibration, magnetic separation and ESR/NMR spectroscopy. The smaller magnets (3470,5403,5403AC) have "C-frame" yokes for ease of access and simplicity. A rectangular "H-frame" yoke is used for the larger magnets to obtain mechanical stability and high field uniformity. All the magnets have changeable pole caps with different pole face diameters and all except the 5414 have continuously adjustable pole gaps. This enables optimization for the geometry and field requirements of a particular application. The 5403AC magnet is laminated for fast field ramp and rapid settling.

5414

Versatility. The yoke and coils are designed for maximum access to the working region and mounts are available for either horizontal or vertical field orientation. For the H-frame magnets, 45° Mounting Angles are available to incline the magnet yoke back at 45° from the vertical. This allows equipment to be inserted into the magnet gap from the horizontal or vertical directions. Provision is included for axial viewing or access holes in one or both Pole Caps.

Reliability. GMW magnet coils are the most reliable commercially available. They are wound from precision slit, high conductivity copper strip with mylar interturn insulation & a glass fiber outer wrap. Cooling is achieved by separately cooled heat sinks integrated with the coil. The complete coil assembly is vacuum impregnated with epoxy resin to produce a void-free structure which will not degrade with full power continuous or cycled operation. Protective overtemperature interlocks are mounted on all heat sinks and the H-frame magnets also have coolant flow interlocks.

Systems. Complete Electromagnet Systems can be configured to meet the specific application. Power Supplies can be unipolar, true bipolar or unipolar with reversing switch and stabilities from 500ppm to better than 1ppm. Digital Hall or NMR Teslameters provide field measurement capability and computer control is implemented using RS-232-C or IEEE-488 interfaces.

GMW also offers special electromagnet systems for ion beams, magnetic tape alignment, & semiconductor processing.

Model Number		3470	5403	5403AC	3472	3473	3474	5414
Yoke type		C	C	C	H	H	H	H
Pole diameter	(mm)	45	76	76	100	150	250	350
	(inch)	1 3/4	3	3	4	6	10	14
Pole gap	(mm)	0 to 75	0 to 76	12 to 76	0 to 115	0 to 125	0 to 160	25 to 125
	(inch)	0 to 3	0 to 3	1/2 to 3	0 to 4.5	0 to 5	0 to 6.3	1 to 5
		variable	variable	variable	variable	variable	variable	fixed
Pole face diameter(mm)		20, 40	38, 76	38, 76	25, 50, 75, 100	25, 50, 100, 150	25, 50, 100 150, 200, 250	as spec
Coil power (continuous)		5A, 44V	50A, 25V	50A, 25V	50A, 36V	50A, 41V	280A, 38V	212, 76V
Cooling water	(l/min)	1	2	2	3	3	15	30
Mass	(kg)	38	124	124	350	600	1800	3200
	(lb)	85	275	275	770	1320	3970	7000
Typical field	(T)	0.9	1.1	1.1	1.5	1.7	1.8	2.7
gap	(mm)	10	25	25	25	25	50	50
pole face	(mm)	40	76	76	100	100	200	230
Typical power supply								
Unipolar		10A, 60V	60A, 40V	60A, 60V	60A, 40V	60A, 60V	320A, 40V	240A, 80V
Bipolar		8A, 50V	40A, 20V	40A, 40V	40A, 40V	-	-	-
Reversing Switch		-	-	-	-	80A	400A	250A

Field units: 0.1nT = 1μG, 100nT = 1mG, 100μT = 1G, 1mT = 10G, 1T = 10,000G

Refer to EEM Section 5500 for Precision Current Transducers

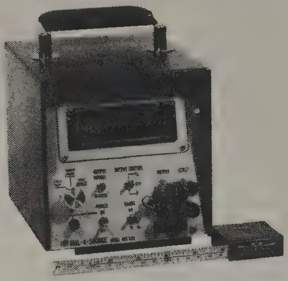
GMW *P.O. Box 2578, Redwood City, CA 94064. Tel (415) 368-4884. Fax (415) 368-0816.*

Portable Standards

GENERAL RESISTANCE

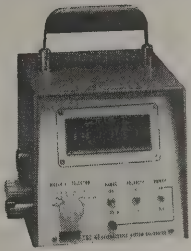
A PRIME TECHNOLOGY COMPANY

Dial-a-Source E/I Series



- For use in lab, plant or on-site.
- Programmable versions available.
- Battery operation available.
- Accuracies to ±15 ppm.
- "Zero" output Z.
- Outputs to ±100V.
- Resolution to 0.1µV.
- Simulates transducers and transmitters, 4-20 and 10-50mA loops.
- Checks and calibrates instruments and systems.
- Evaluates A/D and D/A converters.

Thermocouple Simulators



- Standards lab accuracy (±¼°C).
- Zero output impedance.
- Use with all thermocouple types.
- High accuracy V/I source.
- Temperature measurement capability.

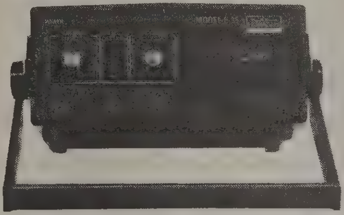
Resistance Decade Boxes

Resist-O-Stat Series

Dial-an-Ohm Series

- Resistance values to 111.111 Meg.
- Resolution to 0.01 ohms.
- Accuracies from ±1.0% to ±0.01%.
- 3, 4, 5, 6, and 7 decade models.
- OEM, console or bench models.

"Instant Lab" Battery-operated E/I/R Source

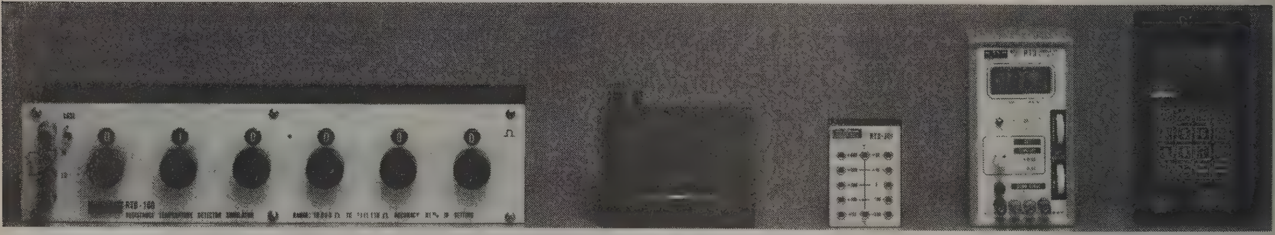


The portable "single box" that provides:

- Voltage: 10µV to 20V.
- Current: 10µA to 200mA.
- Resistance: 0.1Ω to 2111.0Ω.
- T/C simulation.
- RTD simulation.

. . . all accurate to ±0.1%.

The World's most Complete Line of RTD Simulators



RTD-100X Series

- Overall accuracy ±0.005%
- Resolution to 0.001Ω
- Range 10 to 1111.110Ω

RTD-100 Series

- Overall accuracy ±0.01%
- All other specs same as RTD-100X above

RTD-500/1000 Series

- Overall accuracy ±0.005%
- For use with high accuracy 1000Ω platinum RTDs.

RTD-200 Series

- Overall accuracy ±0.02%
- A combination of GR superiority and low cost

RTD-300 Series

- Shirt-pocket portable
- You pick the temperatures to suit your application

RTD-400 Series

- A compact, versatile RTD simulator/readout for DIN PT-100 and Cu 10Ω.

RTD-700 Series

- Simulator/readout for use with DIN 43760 PT-100 RTDs ($\propto = 0.00385$)
- Accuracies unmatched by any other handheld unit.
- Microprocessor control, keyboard entry.

NOW! GUARANTEED CALIBRATION/RECERTIFICATION SERVICE ON ALL PASSIVE RTD SIMULATORS AND RESISTANCE DECADE BOXES! CALL TODAY FOR DETAILS!

GENERAL RESISTANCE
P.O. Box 185, North Branford, Connecticut 06471
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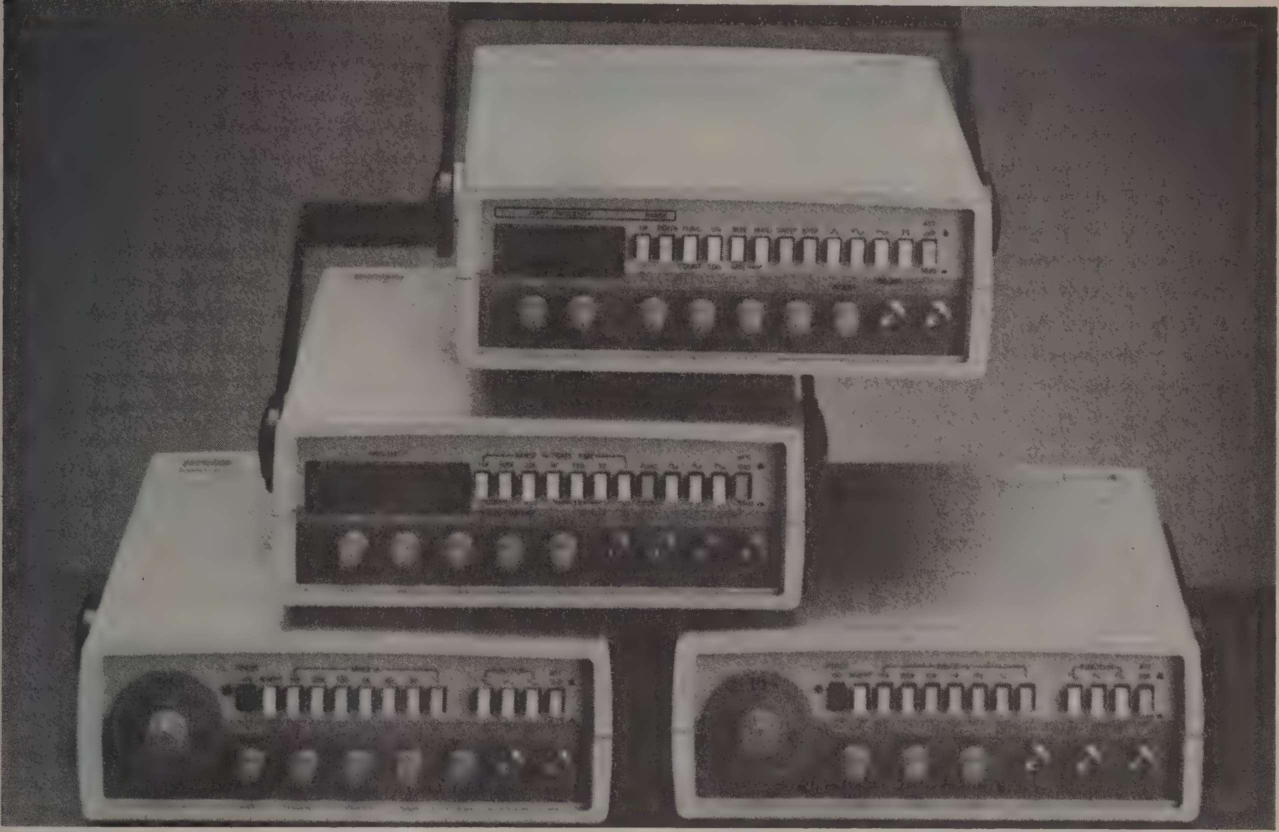
HauMan, Inc.

2031 Ringwood Ave., San Jose, CA 95131 • (408) 434-0888 • FAX: 408-434-9832

FUNCTION GENERATOR 8100/8110 SERIES



ITEM	8102	8105	8112
PRICE	**$220**	**$280**	**$350**
Waveforms	Sine, Square, Triangle, Pulse, Ramp		
Frequency	0.1Hz-2MHz 7 Ranges		
Freq. Error	±5% of Full Scale		Counter Accuracy
Impedance	50Ω ± 10%		
Output	5mVp-p ~ 20Vp-p (open)		
Attenuator	0dB, –30dB		
DC Offset	+10V ~ –10V, with Cal. SW		
Duty Cycle	20% ~ 80%, with Cal. SW		
Distortion	< 1%, 1 Hz ~ 100KHz		
Rise/Fall Time	< 100ns		
Sync. Out	3Vp-p (open), Tr< 25nS, 20TTL Load		
VCF	0 ~5V Control Freq. to 1000: 1		
Display			6 digits with Hz, KHz, Gate, OVLF
Sweep Width			
Sweep Rate			
Trigger/Gate			
AMPL. MODULATION			
Depth		0 ~ 100%	
Mod. Freq.		400Hz(Int) DC ~ 1MHz(Ext)	
Crrier BW		100Hz ~ 1MHz(–3dB)	
Ext. Sensitivity		5Vp-p for 100% Modulation	
FREQ. MODULATION			
Deviation		0 ~ ±10%	
Mod. Freq.		400Hz(Int) DC ~ 20KHz(Ext)	
Ext. Sensitivity		5Vp-p for ±10% Modulation	
COUNTER			
Range			10Hz ~ 100MHz
Gate Time			0.01S, 0.1S, 1S, 10S
Accuracy			±(1 Count + Time Base Accuracy)
Sensitivity			25mVrms(10MHz), 50mVrms(100MHz)
Attenuator			0dB, ~ 30dB
Max. Voltage			150Vrms(DC + Peak AC)
Impedance			1MΩ/10PF
Time Base			10 MHz, ±10ppm(0°C-40°C)
GENERAL			
Dimension	233(W) x 80(H) x 300(D)mm		
Weight	1.6 Kg		
Power	115V/230V ± 10%, 50/60Hz, 9.6VA		115V/230V ± 10%, 50/60Hz, 12VA
Accessory	ACS-003 x 1 BNC-Clip		

8100 Series

- Sine, Square Triangle, Pulse, Ramp, AM, FM
- 0.1Hz-2MHz 7 Ranges
- VCF (Voltage Control Frequency)
- Polarity Invert
- DC Offset Variable With Zero Switch
- Duty Variable With Calibrated Switch
- Attenuator 0dB, –30dB
- High Output Voltage 20Vp-p
- Amplitude Modulation 0–100%
- Frequency Modulation 0–±10%

8110 Series

- Function Generator and Frequency Counter in One Instrument
- Generator 0.1Hz ~2MHz Sine, Square, Triangle, Pulse, Ramp
- Counter 10Hz ~100MHz, Display 6 Digits
- With all Spec. of 8100

SEE OUR OTHER DATA PAGE IN SECTION 4000

IET LABS, INC.

DEPT. EM, 534 MAIN STREET WESTBURY, NY 11590, (516) 334-5959 (800) 899-8438 FAX: (516) 334-5988

PRECISION INSTRUMENTS FOR TEST AND MEASUREMENT
SELECTION GUIDE

DECADE SUBSTITUTERS · STANDARDS · DIVIDERS

RESISTANCE

SERIES	TYPE	BASIC ACCURACY	RANGE	MAX. RESOLUTION	FEATURES	PAGE
RS	General Purpose	0.1%(or better) -1%	0-1000 MΩ	0.01 Ω	General purpose; economical; thumbwheel switches	D•1267
HARS-X	High accuracy	0.01%	0-11 MΩ	0.001 Ω	Laboratory grade; high accuracy; high stability; low zero resistance; low temperature coefficient; suitable for RTD simulation.	D•1268
HARS-A	High accuracy	0.05%	0-11 MΩ	0.01 Ω		
HARS-Q	High accuracy	0.02%	0-11 MΩ	0.01 Ω		
HARS-L HARS-LX	Lab/cal grade	20-25 ppm	0.01 Ω-11 MΩ	20 μΩ		
HRRS	High resistance	0.1%(or better)-1%	0-1,110 MΩ	0.01 MΩ	High resistance	D•1268
HPRS	High power	1%	0-10 MΩ	0.01 Ω	High power, 25 W/step, 250 W max	D•1268
PRS	Programmable	0.05%-1%	0-100 MΩ	0.1 Ω (or lower)	IEEE-488 or BCD	D•1270
PRTD	Programmable RTD	0.05%-1%	10 Ω-10 MΩ	0.001 Ω	absolute accuracy	D•1270
HATS-LR	Transfer standard	1 ppm transfer	10 Ω-100 kΩ/step	1 Ω	High accuracy transfer standard	D•1269
HATS-Y		2 ppm transfer	100 kΩ-100 MΩ/step	10 kΩ		D•1269
KVD-600 KVD-700	Kelvin-Varley Divider	0.1 ppm linearity	10 kΩ, 100 kΩ	0.1 ppm	Voltage divider for calibration and test	D•1269
KVD-500		0.05%-1%	1 kΩ-100 kΩ	1 ppm	General purpose; suitable for OEM; thumbwheel switches	D•1269
DP-500	True digital pot.	0.05%-1%	0-50 MΩ	1 ppm	Suitable as component	D•1269
SR	Standards	2 ppm, 20 ppm	1 Ω-10 MΩ		Very low tempco., high stability	D•1271

CAPACITANCE

SERIES	TYPE	BASIC ACCURACY	RANGE	MAX. RESOLUTION	FEATURES	PAGE
CS	General Purpose	1%(or better)-4%	0-100 μF	1 pF	General purpose; economical; thumbwheel switches	D•1267
HACS	High accuracy	0.05%-0.1%	100 pF-1.111 μF	100 pF	Laboratory grade; high accuracy; high stability low temperature coefficient	D•1271-D•1272
HACS-Z	High accuracy; low zero capacitance	0.05%-0.1%	0-1000 μF	1 pF		
PCS	Programmable	1%(or better)-4%	0-100 μF	100 pF	IEEE-488 or BCD programmable	D•1270
SC-900	Precision variable air capacitor	0.04 pF-0.6 pF	10-1100 pF	0.02 pF	High resolution and stability; suitable for bridges	D•1272
SC	Standards	0.05% + 0.1 pF	100 pF-100 μF		Accurate; stable; economical	D•1271

INDUCTANCE

SERIES	TYPE	BASIC ACCURACY	RANGE	MAX. RESOLUTION	FEATURES	PAGE
LS	General Purpose	1%(or better)-2%	0-100 H	1 μH	General purpose; economical; thumbwheel switches	D•1267
PLS	Programmable	1% typical	0-100 H	0.1 mH	IEEE-488 or BCD programmable	D•1270
SL	Standards	0.25%	10 μH-10 H		Toroidal; stable; economical	D•1271

TEST INSTRUMENTS

SERIES	INSTRUMENT TYPE	FEATURES	PAGE
VI-700	Precision Voltage and Current Source	General purpose; programmable	D•1272
HSVR	High stability voltage reference	High stability; trimmable	D•1272
TRD-800	Transformer ratio divider	0.1 ppm resolution	Consult IET
IMF-600	Impedance and Multifunction Meter	Multipurpose; digital output	D•1273
LCR-500	Autoranging Handheld High Performance Digital LCR Bridge	Economical with "benchtop" features	D•1273
STS-1500	Component and Semiconductor Tester	Integrates with user's scope	Consult IET

IET DESIGNS & MANUFACTURES TO MIL-SPEC & COMMERCIAL CUSTOM REQUIREMENTS

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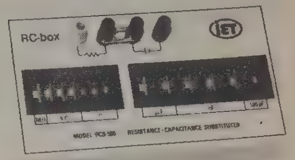
RS - CS - LS Series

Digital Decade Substituters for Resistance • Capacitance • Inductance



R-BOX
RS Series
Digital Resistance Substituter
Available from .01Ω to 999.9999999 MΩ

C-BOX
CS Series
Digital Capacitance Substituter
Available from 1 pF to 999.999999 μF

L-BOX
LS Series
Digital Inductance Substituter
Available from 1 μH to 99.99999 H

RC-BOX
RCS Series
Digital Resistance Capacitance Substituter

- **Direct reading — no fumbling with multiple slide or rotary switches**
- **Wide range**
- **Accurate**
- **Compact, convenient, and rugged**
- **Standard and custom models**
- **Error proof**
- **Color coded**
- **Options:**
  - **Shielded case with grounding post**
  - **Panel mounting**
  - **Low residual impedance switch**
  - **Protection fuse**
  - **Programmable and IEEE-488 option**

STANDARD MODELS — SPECIFICATIONS

MODEL	RS-200	RS-201	RS-200W	RS-201W	CS-300	CS-301	RCS-500	RCS-502	LS-400	LS-400A
TYPE OF SUBSTITUTER	Resistance	Precision Resistance	Wide Range Resistance	Wide Range Precision Resistance	Capacitance	Precision Capacitance	Resistance-Capacitance	Precision Resistance-Capacitance	Wide Range Inductance	Inductance
ACCURACY†	1%	0.1%	1%	0.1%	4%	1%	Combines the RS-200 and CS-300	Combines the RS-201 and CS-301	1.5% max, 1% typical	
DECADES	7		9		6				4	3
RANGE	1-9,999,999Ω		0.1-99,999,999.9Ω		100 pF — 99.9999 μF				1 mH-9.999 H	1 mH-999 mH
TYPE OF COMPONENTS	Metal Film Resistors (0.1-0.9Ω Wirewound Resistors)				100-900 pF: Mica .001-.009 μF: Polystyrene .01-0.9 μF: Polycarbonate 1-9 μF: Polyester 10-90 μF: Polarized Tantalum				Toroidal Inductors	
RATING	0.5 watt**				100 volts (20V 10-100 μF)				See table below	
RESIDUAL* IMPEDANCE	0.3Ω (.04Ω/decade)*, typ		0.4Ω (.04Ω/decade)*, typ		30 pF (5 pF/decade)*, typ				0.2Ω (.04Ω/decade)*, typ	
PHYSICAL	3.2x3.1x2.2 in, 6.5 oz (8.1x7.9x5.6 cm, 184 g)		4.7x3.1x2.2 in, 8.3 oz (12x7.9x5.6 cm, 235 g)		4.7x3.1x2.2 in, 8.3 oz (12x7.9x5.6 cm, 235 g)		7.4x4.3x2.4 in, 14 oz (18.8x11x6 cm, 410 g)		4.7x3.1x2.2 in, 8 oz (12x7.9x5.6 cm, 230 g)	
PRICE	$129.00	$249.00	$239.00	$429.00	$139.00	$269.00	$249.00	$489.00	$489.00	$369.00

† Accuracy = ±(Specified basic accuracy +.08 x Residual Impedance) after subtraction of Residual Impedance.

* Residual impedance is reduced to .04Ω or 5 pF for lowest decade with LR Option. This makes for more effective usage of low impedances. Lowest decade is isolated from the others with a switch when desired.

** Higher power resistance substituters (1 watt or higher) available; see below.

ADDITIONAL INFORMATION FOR INDUCTANCE SUBSTITUTERS

INDUCTANCE	FREQUENCY RANGE	MAX. Q	RATING
0.1-0.9 mH	300 Hz-2 MHz	100 at 800 kHz	700 mA
1-9 mH	300 Hz-1 MHz	80 at 40 kHz	500 mA
10-90 mH	300 Hz-800 kHz	80 at 40 kHz	300 mA
0.1-0.9 H	300 Hz-200 kHz	40 at 20 kHz	100 mA
1-9 H	200 Hz-20 kHz	30 at 8 kHz	20 mA
10-90 H	200 Hz-6 kHz	60 at 2 kHz	4 mA

LABORATORY STANDARD MODELS

See HARS and HACS Series data sheets for standards grade resistance and capacitance substituters

OPTIONAL MODELS

In order to satisfy any requirements for decade substituters, generate a part number from the table below.

RS — F — 4 — 0.1 — WC — ___ (Example: 0.1-999.9Ω, 1%, Resistance Substituter in a case)

TYPE OF SUBSTITUTER

RS	Resistance
CS	Capacitance
LS	Inductance

†ACCURACY

X	.01%
XA	.025%
A	.05%
B	0.1%
C	0.5%
F	1%
G	2%
H	4%

NO. OF DECADES

1 to 11

IMPEDANCE PER STEP FOR LOWEST DECADE

.01Ω to 100 MΩ
1 pf to 100μF
1 μH to 10H

PACKAGING

WC	Packaged in a standard case with binding posts
PM	Supplied without case for panel mounting or other applications

RATING

Nil	Standard rating
Other	Specify

OPTIONS

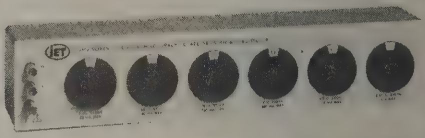
Option		Price
LR Option: Residual Impedance is reduced to .04Ω or 5 pF on lowest decade	Add	$49.00
SC Option: Shielded case with grounding terminal	Add	43.00
FP Option: Unit supplied with series 2A fuse for added protection (User may substitute other fuses; residual impedance will increase by .06Ω for 2A fuse)	Add	19.00
PM Option: Unit supplied without case for panel mounting	Subtract	$ 5.00
LP Option: Unit supplied with low profile binding posts	Add	4.00
Model CC-25 Lead Clip: Plugs into dual binding posts for convenient lead connections		12.00
Programmable Option:		See PZS Series

IET DESIGNS & MANUFACTURES TO MIL-SPEC & COMMERCIAL CUSTOM REQUIREMENTS

IET LABS, INC.

DEPT. EM, 534 MAIN STREET WESTBURY, NY 11590, (516) 334-5959 (800) 899-8438 FAX: (516) 334-5988

HARS Series High Accuracy Decade Resistance Substituter



Tight tolerance calibration grade decade substituter for applications requiring a cost effective high performance resistance unit for laboratory and test applications.

- **High accuracy**
- **High stability**
- **Low temperature coefficient**
- **Low zero resistance**

MAJOR SPECIFICATIONS

Accuracy:
LX: ±(20 ppm + 1 mΩ) absolute.
L: ±(25 ppm + 0.5 mΩ) absolute.
X: ±(0.01% + 2 mΩ) from zero setting.
A: ±(0.05% + 5 mΩ) from zero setting.

Zero Resistance:
L,LX: 10 mΩ ± 0.5 mΩ, at dc.
X: <1 mΩ per decade, at dc.
A: <3 mΩ per decade + 2 mΩ, at dc.

Resistance Temperature Coefficient:
LX: <±3 ppm/°C for 100 Ω steps and over;
<15 ppm/°C for 10 Ω steps;
<20 ppm/°C for 1 Ω steps and under.
L: <±5 ppm/°C for 100 Ω steps and over.
<±20 ppm/°C for 10 Ω steps and under.
X: <±10 ppm/°C for 100 Ω steps and over;
<±20 ppm/°C for 10 Ω steps and under.
A: <±20 ppm/°C.

Maximum Applied Voltage:
L,LX: 1000 V peak.
X,A: 2000 V peak.

Power per Step:
LX: 1 W up to 5 W.
L,X,A: 0.5 W for ≥ 1Ω steps;
0.25 W for 0.1 Ω step;
0.16 W for 0.01 Ω step.

Terminals:
Gold plated binding posts for low thermal emf; standard 3/4 inch spacing; one binding post connected to the case for shielding. Rear outputs are available as an option.

STANDARD MODELS

MODEL	TOTAL RES.	DECADES	RESOLUTION
HARS-X*-4-.01	111.1 Ω	4	0.01 Ω
HARS-X*-4-.1	1,111 Ω	4	0.1 Ω
HARS-X*-4-1	11,110 Ω	4	1 Ω
HARS-X*-4-10	111,100 Ω	4	10 Ω
HARS-X*-4-100	1,111,000 Ω	4	100 Ω
HARS-X*-4-1k	11,110,000 Ω	4	1 kΩ
HARS-X*-5-.01	1,111.1 Ω	5	0.01 Ω
HARS-X*-5-0.1	11,111 Ω	5	0.1 Ω
HARS-X*-5-1	111,110 Ω	5	1 Ω
HARS-X*-5-10	1,111,100 Ω	5	10 Ω
HARS-X*-5-100	11,111,000 Ω	5	100 Ω
HARS-X*-6-.01	11,111.1 Ω	6	0.01 Ω
HARS-X*-6-0.1	111,111 Ω	6	0.1 Ω
HARS-X*-6-1	1,111,110 Ω	6	1 Ω
HARS-X*-6-10	1,111,100 Ω	6	10 Ω
HARS-X*-7-.001	111,111.11 Ω	7	.001 Ω
HARS-X*-7-.01	111,111.1 Ω	7	.01 Ω
HARS-X*-7-0.1	1,111,111 Ω	7	0.1 Ω
HARS-X*-7-1	11,111,110 Ω	7	1 Ω
HARS-X*-8-.001	121,111.11 Ω	8	.001 Ω
HARS-X*-8-.01	1,211,111.1 Ω	8	.01 Ω
HARS-X*-9-.001	1,211,111.11 Ω	9	.001 Ω

ACCURACY
*: **X** for 0.01% accuracy
Substitute **A** for 0.05%
Substitute **L** for 25 ppm
Substitute **LX** for 20 ppm

OPTIONS
RM - Rack mount
RO - Rear output
Single decade units
programmable versions
20 μΩ resolution continuous

HRRS Series High Resistance Decade Substituter

The HRRS series provides a broad range of high performance resistance decade substituters for high resistance values, up to 11 GΩ, with a resolution of one to seven decades. Optimal specifications are achieved by state of the art, precision precious metal-oxide film resistors for high stability and low temperature coefficient.

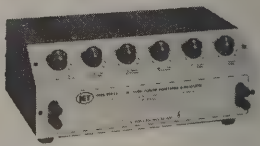
- **Broad selection of standard models**
- **High accuracy - 0.1% and 1.0%**
- **High stability - 0.01%/year shelf life**
- **Low zero resistance - 3 mΩ/decade**
- **Resistance from 10 kΩ to 11 kMΩ**
- **Low temperature coefficient - 20 to 50 ppm/°C**
- **High performance gold plated, solid silver contact switches for low current applications**

STANDARD MODELS

Accuracy 0.1%	Accuracy 1%	No. of Decades	Range
HRRS-B-3-1M	HRRS-F-3-1 M	3	0 to 1,110.0 MΩ, 1MΩ steps
HRRS-B-4-0.1M	HRRS-F-4-0.1 M	4	0 to 1,111.0 MΩ, 0.1 MΩ steps
HRRS-B-5-0.1M	HRRS-F-5-0.1 M	5	0 to 11,111.0 MΩ, 0.1 MΩ steps
HRRS-B-6-0.01M	HRRS-F-6-0.01 M	6	0 to 11,111.10 MΩ, 0.01 MΩ steps

HPRS Series High Power Resistance Substituter

Economical solution for applications that require more power than can be handled by conventional resistance boxes such as the IET Labs RS-200 series.



STANDARD MODELS

MODEL	TOT RES.	No. of DECADES	RESOLUTION
HPRS-150	999,999 Ω	6	1 Ω
HPRS-200	999,999.9 Ω	7	0.1 Ω
HPRS-200W	9,999,999.9 Ω	8	0.1 Ω

OPTIONS: RM - Rack mount; RO - Rear output; single decade units, programmable devices, and other combinations are available.

- **1000 volt rating**
- **Programmable version available**
- **1% accuracy**
- **Power of 25 watts/decade, 250 watts max.**
- **Resistance from 0.1 Ω to 10 MΩ.**
- **6 to 8 decades.**

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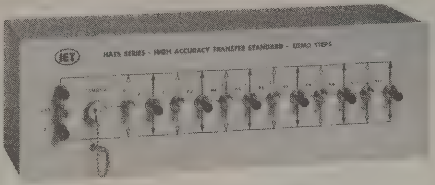
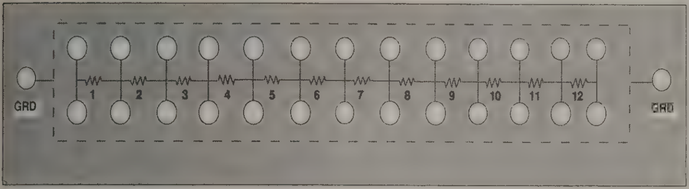
HATS - Series High Accuracy Transfer Standards

In order to make resistance transfer measurements with a high degree of accuracy, the HATS series may be employed. Consisting of matched, stable equal value precision resistors, calibration resistance values are transferred from a standard of one value to a resistance at a different value.

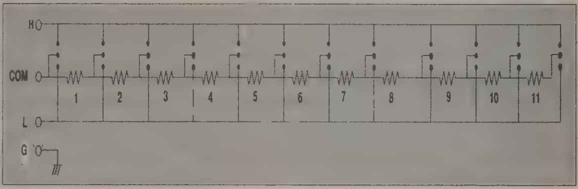


HATS-LR



10 Ω-100 kΩ steps, 12 matched resistors

HATS-Y



100 kΩ-10 MΩ steps, 11 matched resistors

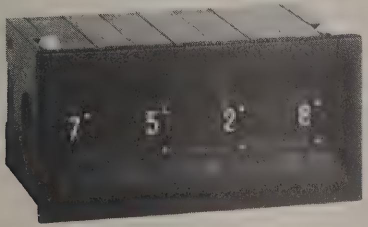
MAJOR SPECIFICATIONS

Step Size:	10 Ω, 100 Ω, 1 kΩ, 10 kΩ, or 100 kΩ	100 kΩ, 1 MΩ, or 10 MΩ
Accuracy:	Initial: ±20 ppm Initial data supplied with instrument Transfer: ±1 ppm, typical.	100 kΩ / 1 MΩ / 10 MΩ Initial: ±20 ppm / ±25 ppm / ±30 ppm Calibration: ±10 ppm / ±10 ppm / ±15 ppm Initial data supplied with instrument. Transfer: ±2 ppm, typical.
Long Term Stability:	±50 ppm for nominal value.	±50 ppm of nominal value.
Calibration Conditions:	Four-wire kelvin measurements, low power, at 23°C	3 terminal measurement, low power, at 23°C
Leakage Resistance:	Greater than 1 TΩ from terminal to case.	Greater than 10 TΩ from terminal to case.
Temperature Coefficient:	Less than ±5 ppm/°C.	Less than ±5 ppm/°C.
Power Coefficient:	±100 ppm/W.	±50 ppm/W per resistor.

KVD - Series Kelvin - Varley Voltage Divider

Precision decade voltage divider employing the Kelvin-Varley circuit, providing known voltage and current ratios for calibration, bridges, linearity determination, and other applications. The Models KVD 600 and KVD 700 provide 1 ppm long term linearity and 0.1 ppm resolution. The KVD 500 is suitable as an instrument component.

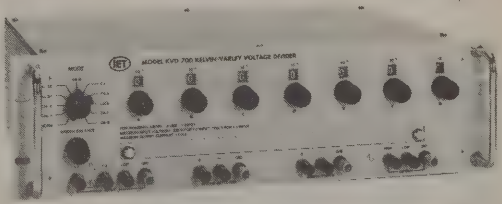
KVD-500



Thumbwheel style - economical - Component series

- **Update instruments with KVD-600 for any digital controls**
- **Eliminates the need for dials and multiturn potentiometers**
- **Precise repeatability of setting**
- **Unlimited choice of resistance values, 1 Ω to 50 MΩ**
- **In-line digital readout**
- **Convenient (snap in) panel mounting with bezel**
- **Excellent for meter calibration, linearity checking ratio measurement, synchro testing, etc.**
- **Number of decades: 1,2,3,4,5, 6 or higher**
- **Linearity temperature coefficient: 20 ppm/°C.**

KVD-600/KVD-700



High Accuracy Laboratory Series

LINEARITY	KVD-600	KVD-700
Absolute Initial:	±0.5 ppm	±0.1 (self calibrating)
Absolute long term:	±1 ppm	±1 ppm
Temperature Coefficient of Linearity:	±0.2 ppm/°C	±0.1 ppm/°C
Power Coefficient of Linearity:	±1 ppm/W	±0.2 ppm/W

INPUT RESISTANCE: 100 kΩ, accuracy of ±0.005%
NUMBER OF DECADES: 7, others optional
MAXIMUM INPUT: Power: 2.5 watts continuous, 5 watts intermittent
Voltage: 700 V rms

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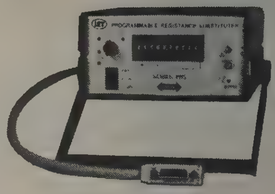
DEPT. EM, 534 MAIN STREET WESTBURY, NY 11590, (516) 334-5959 (800) 899-8438 FAX: (516) 334-5988

PZS Series Programmable Decade Substituters for Resistance • RTD • Capacitance • Inductance

- High resolution and wide range, up to 10 decades
- Constant "zero" residual impedance
- Special relays for low thermal emf and high stability
- Special RTD and other custom impedance combinations available
- Rack mounting available
- Programmable "open circuit" and "short circuit" states optional
- Manual thumbwheel operation or programmable digital input, parallel BCD or IEEE-488 interface
- Suited for calibration, automatic testing computer control and design, programmable loads, RTD simulation, and many other laboratory applications



IEEE-488

SPECIFICATIONS

Accuracy: Indicated accuracy applies after subtraction of "zero" setting residual impedance.

Accuracy (RTD): Absolute accuracy applies without need to subtract "zero" setting.

Min. setting (RTD): ≥ 10Ω customer specified.

Thermal emf: < 15 µV for 0.1% & 0.05% resistance units; < 50-100 µV (depending on setting) for 1% resistance units; due to relay contacts.

Switching time: < 4 ms per change: < 7 ms for 0.05% units.

Digital input: BCD parallel, TTL positive; IEEE-488 optional.

Power requirements: 105-125V or 210-250V; 50-60 Hz, W W

Dimensions: Bench: 8.5" W × 9.25" D × 4.44" H (22 × 24 × 12 cm). Rack: 19" W × 12" D × 7" H (43.2 × 30.4 × 19.8 cm)

STANDARD MODELS

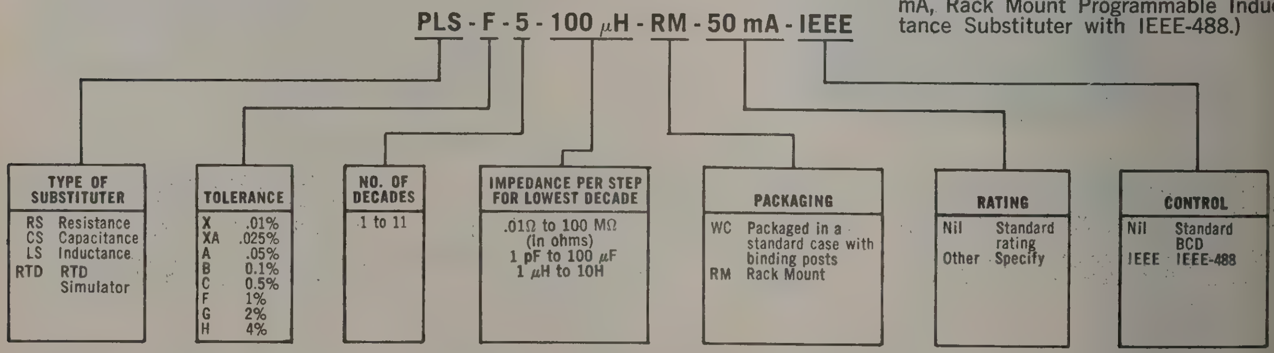
MODEL	PRS-200	PRS-201	PRS-200W	PRS-201W	PRS-202	PRS-202W	PCS-300	PCS-301	PLS400	PLS-400A
TYPE OF SUBSTITUTER	Resistance	Precision Resistance	Wide Range Resistance	Wide Range Precision Resistance	High Precision Resistance	Wide Range High Precision Resistance	Capacitance	Precision Capacitance	Wide Range Inductance	Inductance
ACCURACY *	1% ± 70mΩ	0.1% ± 30mΩ	1% ± 70mΩ	0.1% ± 30mΩ	0.05% ± 15mΩ		4% ± 5 pF	1% ± 1 pF	1.5% max, 1% typ. ± 20µH	
DECADES	7		9		7	9	6		4	3
RANGE	1-9,999,999Ω		0.1-99,999,999.9Ω		1-9,999,999Ω	0.1-99,999,999.9	100 pF-99.9999 µF		1 mH-9.999 H	1 mH-999 mH
TYPE OF COMPONENTS	Metal Film Resistors (0.9Ω & less wirewound)						100-900 pF: Mica .001-.009 µF: Polystyrene .01-0.9 µF: Polycarbonate 1-9 µF: Polyester 10-90 µF: Polarized Tantalum		Toroidal Inductors	
RATINGS	0.5 watt						100 volts (20V 10-100 µF)		See LS data sheet	
RESIDUAL IMPEDANCE	500 mΩ typical constant		800 mΩ typical constant		30 mΩ per decade constant		30 pF typical, constant		See LS data sheet	

* Accuracy for 10 M Ω and over (PRS 201W: 0.5%; PRS 202W: 0.2%)

OPTIONAL MODELS

In order to satisfy any requirements for programmable substituters, generate part number from the table below.

(Example: 100 µH-9999.9 mH, 1%, 50 mA, Rack Mount Programmable Inductance Substituter with IEEE-488.)



PLS - F - 5 - 100 µH - RM - 50 mA - IEEE

TYPE OF SUBSTITUTER	
RS	Resistance
CS	Capacitance
LS	Inductance
RTD	RTD Simulator

TOLERANCE	
X	.01%
XA	.025%
A	.05%
B	0.1%
C	0.5%
F	1%
G	2%
H	4%

NO. OF DECADES
1 to 11

IMPEDANCE PER STEP FOR LOWEST DECADE
.01Ω to 100 MΩ (In ohms) 1 pF to 100 µF 1 µH to 10H

PACKAGING	
WC	Packaged in a standard case with binding posts
RM	Rack Mount

RATING	
Nil	Standard rating
Other	Specify

CONTROL	
Nil	Standard BCD
IEEE	IEEE-488

ORDERING INFORMATION

—Select Standard or Special Model ...... Consult IET for price.
—IEEE Optional (IEEE-488 Remote Programming) $495.00
—IBM or Compatible PC IEEE-488 Controller Board .. 475.00
—IEEE-488 Cable 79.00

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SR Series Very Low Temerature Coefficient, High Stability, Resistance Standard

- **Extremely low temperature coefficient - Requires no oil bath**
- **Cost effective**
- **Optional nonstandard values**

SRL Series

Extremely high precision, sealed on site resistance standard requiring no oil or other temperature bath.

Standard Model Specifications:

Model	Nominal Value (Ω)	Adjustment to Nominal Value (ppm)	Stability 12 months (ppm)	Calibration Accuracy (ppm)	Resistance Change* (18°C - 28°C)	Max. Power Rating (milliwatts)
SRL-1	1	± 2	8	1.0	3	250
SRL-10	10	± 2	8	1.5	5	100
SRL-100	100	± 2	8	1.5	5	100
SRL-1k	1 k	± 2	5	1.0	2.0	100
SRL-10k	10 k	± 2	4	1.0	1.5	100
SRL-100k	100 k	± 3	6	2.5	2.0	100
SRL-1M	1 M	± 4	8	5.0	3	10
SRL-10M	10 M	± 5	9	10.0	5	10

Temperature Range:
18°C to 28°C.

Retrace:
Permanent shift in resistance is <2 ppm for 23°C to 0C to 23°C cycle, and 23°C to 40°C to 23°C cycle.

Calibration Report:
Initial calibration data provided in 0.5°C increments for temperature range of 18°C to 28°C.

IET RESISTANCE STANDARD
MODEL SRL-1
CURRENT
SENSE
HI
1 Ω
LO
GND

$959

SRX/SRA Series

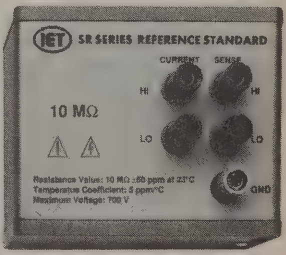
Designed for use as a standard in industrial, research, and educational laboratories; also available as discrete compomnents for the user's own instruments.

Standard Model Specifications:

Model SRX- SRA-	Nominal Value (Ω)	Adjustment to Nominal Value (ppm) SRX	Adjustment to Nominal Value (ppm) SRA	Stability 12 months (ppm) SRX	Stability 12 months (ppm) SRA	Tempco (ppm/°C) SRX	Tempco (ppm/°C) SRA	Power Coefficient (ppm/W)	Wattage (max in W) SRX	Wattage (max in W) SRA
0.1	0.1	100	500	20	50	20	20	200	0.1	0.1
1	1	20	100	20	50	10	20	200	0.25	1
10	10	10	30	10	18	3	5	50	0.1	1
100	100	10	20	10	15	1	5	50	0.1	1
1k	1 k	10	20	10	15	1	5	50	0.1	1
10k	10 k	10	20	10	15	1	5	50	0.1	1
100k	100 k	10	20	10	15	1	5	50	0.1	1
1M	1 M	20	50	15	20	3	10	50	0.1	0.1
10M	10 M	20	50	15	50	5	10	50	0.01	0.01

Temperature Range:
SRX: 15 to 30°C
SRA: 10 to 40°C

Calibration Report:
Initial calibration data is provided.



SRX from $459 SRA from $239

SL • SC SERIES Capacitance • Inductance • Standards

- **High stability low temperature coefficient fixed mica and air capacitors**
- **High stability low temperature coefficient toridal inductors**

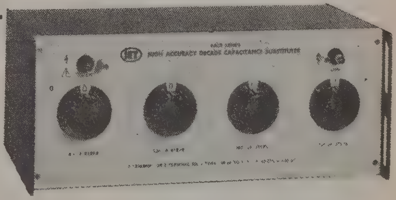
CAPACITANCE

Nominal Value:	100 pF to 100 µF.
Adjustment to Nominal:	(0.05% + .5pF) to 0.1%.
Initial Accuracy:	0.05% + 0.05 pF to at 23°C.
Stability:	0.01% + 0.1 pF per year.

INDUCTANCE

Nominal Value:	100 µH to 10 H.
Adjustment to Nominal:	0.25% to 0.1%.
Initial Accuracy:	0.05%, at 23°C.
Stability:	0.05% per year.

HACS Series High Accuracy Decade Capacitance Substituter



4 Decade Model with Double Shielded Construction

- **High accuracy: 0.1% or 0.05%**
- **Broad range of user choices**
- **Programmable version available**
- **Special and custom configurations available**
- **Optional double shielded construction for virtually equivalent 2- or 3-terminal measurement**
- **Trimmable capacitors for lower decades**

MAJOR SPECIFICATIONS

Accuracy:
A: ±(0.05%+ 0.05 pF)
B: ±(0.10%+ 0.50 pF) at 1kHz, at 23°C, (measured with 3-terminal connection for optional double shielded construction)

Dissipation Factor at 1kHz:
<.0010 for 100 pF to 1000 pF
<.0005 for 1100 pF to 2000 pF
<.0003 for 2100 pF to 1.2 µF

Range:
100 pF to 1000 µF, 100 pF steps

Stability:
A: better than ±(100 ppm+ 0.05 pF) per year.
B: better than ±(250 ppm+ 0.10 pF) per year.

Rating:
500 V peak up to 10 kHz

Temperature Coefficient:
A: < +30 ppm/°C between 10-50°C.
B: < +75 ppm/°C between 10- 50°C.

Insulation Resistance:
>50,000 MΩ to 0.1 µF and
>5,000 MΩ from 0.1 µF to 10 µF.

Operating Temperature Range:
10 to 50°C.

Shielding:
Standard: single shielded construction
Optional : double shielded construction

Dimensions:
43.2 cm W x 17.8 cm H x 23.9 cm D (17" x 7.0" x 9.4"), for 4 decade models.

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HACS-Z Series High Accuracy Low Level Decade Capacitance Substituter

Whenever low capacitance or small capacitance increments are required, the HACS-Z series may be used. It provides very low zero capacitance with high accuracy and excellent stability.

- Basic accuracy of 0.1% or 0.05%
- Capacitance from 1 pF to 1000 μF
- High stability
- Very low zero capacitance < 0.1 pF
- 3- Terminal shielded construction
- Optional BCD output.

SC-900 Series Precision Variable Capacitor

The IET SC-900 series capacitors are stable and precise variable air capacitor intended for use as a continuously adjustable primary standard of capacitance. In addition to general purpose applications, the SC-900 is ideally suited for ac bridge measurements. It can also be used to verifiy phase acuracy of phase angle calibration standards.

MODEL	SC-900-110	SC-900-1100	SC-900-D (Dual)
Range	10-110 pF	50-1100 pF	35-115 pF (Range 1) 100-1150 pF (range 2)
Accuracy, Initial	±0.1 pF	±0.6 pF	±0.1 pF (Range 1)
Accuracy, Corrected	±0.04 pF or better	±0.3 pF or beter	±0.04 pF (Range 1) ±0.03 pF (Range 2)

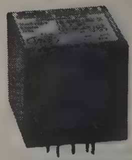
- High accuracy
- High stability
- High resolution
- Precision worm gear drive
- Low temperature coefficient
- Calibrated vernier scale indicator

HSVR Series High Stability Voltage Reference

The HSVR is a highly stable compact voltage reference with a very low temperature coefficient. It is suitable for printed circuit board mounting and may be used whenever precision voltages are required, for test, calibration, digital and analog conversions, etc..

Model	Input Voltage	Output Voltage Max.	Output Current
HSVR-1.01	9-15 V	1.01 V	1 mA
HSVR-6.3	15-20 V	6.3 V	1 mA
HSVR-12.6	18-25 V	12.6 V	1 mA
HSVR-18.9	25-35 V	18.9 V	1 mA

Output Voltage Stability:	1 ppm per 24 hours; 10 ppm per month; 25 ppm per 6 months.
Temperature Coefficient:	< 1 ppm/°C for temperature range of 0°C to 50°C.



VI-700 Precision Manual or Programmable Voltage and Current Source

- Voltage output range of 100 μV to 20V
- Current output range of 0.1 μA to 20 mA
- 3½ digit resolution
- High accuracy and low noise
- Manual thumbwheel operation or programmable digital input—parallel BCD or IEEE-488 interface
- High output current
- Battery operation optional
- Suitable for calibration—testing of A/D-D/A converters—gain & linearity evaluation—waveform synthesis with digital input

SPECIFICATIONS

VOLTAGE	**OUTPUT RANGES:**	200 mV, 2V, 20V
	RESOLUTION:	100 μV, 1 mV, 10 mV
	ACCURACY:	0.0075% ±0.5 LSD (least significant digit) @ 25°C, nominal line voltage, no load, after warmup; worst case error <0.75LSD
	OUTPUT CURRENT:	70 mA, maximum load; with LED overload indicator
	OUTPUT IMPEDANCE:	5 mΩ typical, 40 mΩ for 20V range
	NOISE AND RIPPLE:	50 μV on 200 mV & 2 V ranges, 100 μV rms on 20 V range
	TEMPCO:	±10 ppm/°C typical, ±15 ppm/°C max
CURRENT	**OUTPUT RANGES:**	200 μA, 2 mA, 20 mA
	RESOLUTION:	0.1 μA, 1 μA, 10 μA
	ACCURACY:	0.0075% ±0.75 LSD (least significant digit) @ 25°C, nominal line voltage, after warmup; worst case error <1 LSD
	COMPLIANCE:	0-20V; with LED overload indicator
GENERAL	**DIGITAL INPUT:**	3½ digit parallel BCD or IEEE-488 interface; front panel pushbuttons select range and REMOTE OR LOCAL operation
	POWER REQUIREMENTS:	105-125V or 210-250V; 50-60 Hz; 5W
	BATTERY OPERATION: (Optional)	NiCd rechargeable batteries; up to 8 hours operation; low battery warning indicator and automatic shutoff
	DIMENSIONS:	8.5″ W x 2.8″ H x 9.0″ D (7.1 x 12.6 x 22.9 cm); 8.5″ W x 9.25″ D x 4.4″ H (22 x 12 x 24 cm) for IEEE option.
	WEIGHT:	5 lbs. (2.3 kg)

IEEE-488

ORDERING INFORMATION:

Model VI-700 Precision Voltage and Current Source	$545.00
—B Option (Rechargeable Battery Operation)	425.00
—BCD Option (Parallel BCD Remote Programming)	195.00
—IEEE Option (IEEE-488 Remote Programming)	495.00
—IBM or Compatible PC IEEE-488 Controller Board	475.00
—IEEE-488 Cable	79.00

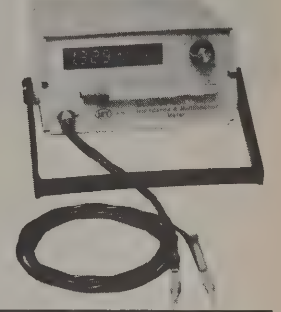
IET DESIGNS & MANUFACTURES TO MIL-SPEC & COMMERCIAL CUSTOM REQUIREMENTS

IET LABS, INC.

DEPT. EM, 534 MAIN STREET WESTBURY, NY 11590, (516) 334-5959 (800) 899-8438 FAX: (516) 334-5988

IMF-600A Digital Impedance and Multifunction Meter

Combines most of the commonly needed laboratory measurements



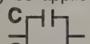
- **Automatic measurements**
- **Analog & digital outputs**
- **Dissipation for capacitors & 1/Q for inductors**
- **Comanion comparator unit**
- **Wide range**
- **Protected circuitry**
- **4-Terminal shielded kelvin test terminals**

• Voltage (dc or rms) • Current (dc or rms) • Resistance • Capacitance • Inductance • Conductance • Dissipation for Capacitors • 1/Q for Inductors • Comparator option

SPECIFICATIONS

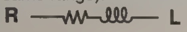
CAPACITANCE (C)

Number of ranges: 8 (7 for IMF-600A).
Full scale ranges: 200.0 pF to 2000 µF; up to 20,000 µF may be measured using the inductance function.
Accuracy: ±(0.25% + 1 LSD + 1% of G reading in absolute digit counts on same range).
Bias: Up to 100 Vdc may be applied in series with unknown impedance.
Impedance model:



INDUCTANCE (L)

Number of ranges: 7.
Full scale ranges: 200.0 µH to 200.0 H.
Accuracy: ±(0.25% + 1 LSD + 1% of R reading in absolute digit counts on same range).
Impedance model:



RESISTANCE (R)

Type of measurement: 1 kHz ac resistance
Number of ranges: 7.
Full scale ranges: 2.000 Ω to 2,000 kΩ; up to 1,000 MΩ may be measured using the conductance function.
Accuracy: ±(0.25% + 1 LSD + 1% of L reading in absolute digit counts on same range).

CONDUCTANCE (G)

Type of measurement: 1 kHz ac conductance.
Number of ranges: 7.
Full scale ranges: 2.000 µS to 2000. mS (S=1/Ω)
Accuracy: ±(0.25% + 1 LSD + 1% of C reading in absolute digit counts on same range)
Impedance model: See CAPACITANCE.

DISSIPATION (D or 1/Q)

Full scale range: 2.000; higher values may be computed from readings.
Basic accuracy: ±(1% + 2 LSD) for C or L > 500 counts; ±(1% + 4 LSD) for C or L 200-500 counts.

DC VOLTAGE (V DC)

Number of ranges: 5.
Full scale ranges: 200.0 mV to 1000. V.
Basic accuracy: ±(0.1% + 1 LSD).
Input impedance: 10 MΩ.

DC CURRENT (I DC)

Number of ranges: 5.
Full scale ranges: 200.0 µA to 2000. mA.
Basic accuracy: ±(0.2% + 1 LSD).

TRUE RMS VOLTAGE (V True rms), ac COUPLED
Number of ranges: 5.
Full scale ranges: 200.0 mV to 750. V.
Basic accuracy: ±(1% + 2 LSD).
Input impedance: 10 MΩ.
Maximum input: Same as DC VOLTAGE

TRUE RMS CURRENT (I True rms), ac COUPLED
Number of ranges: 5.
Full scale accuracy: 200.0 µA to 2000. mA.
Basic accuracy: ±(1% + 2 LSD).
Burden voltage: Same as dc CURRENT.
Maximum input: Same as dc CURRENT.

TEST CONDITIONS

Performance specifications apply
1) after correction for test lead zero reading;
2) after a 10 minute warm-up;
3) between 15°C-35°C.

GENERAL SPECIFICATIONS

Test frequency: 1 kHz for impedance functions.
Reading rate: 4 measurements per second.
Display: 3½ digit 1.2 cm (0.5") LCD (LED for IMF-600), with corresponding annunciator showing units. All decimal points on indicate overrange or illegal condition.
Autoranging: Optional.
Analog outputs: L,C,R, or G scales at 1 V/1000 counts (0.1 V/1000 counts for IMF-600A); output impedance: 900 Ω.
Digital output(optional): BCD parallel output representing 3½ digit reading for any quantity.
Test terminals: 4-terminal shielded Kelvin test leads, 50" (127 cm) long.
Dimensions: 22 cm W x 24 cm D x 12 cm H (8.5" x 9.25" x 4.44").
Weight: 2.7 kg (6 lb).

ORDERING INFORMATION:

Model IMF-600A Impedance Meter (without voltage and current functions)	$1089.00
Model IMF-600 Impedance and Multifunction Meter (with voltage and current functions)	1579.00
-K Option (Autoranging)	199.00
-DO Option (Digital Output)	189.00
-HSC Option (High Sensitivity 20.00 pF)	109.00
-HSL Option (High Sensitivity 20.00 µH)	109.00
Model LC-603 Single Channel Digital Limits Comparator (Requires DO option; may be cascaded)	429.00
-10 kHz Option	Consult IET

LCR-500 Autoranging Handheld High Performance Digital LCR Bridge

Economical powerful handheld LCR meter with features rivaling expensive benchtop systems.

- **Broad measurement range: 1mΩ to 10 MΩ; 0.1 pF to 10 mF; 0.1 µH to 10,000 H**
- **Autoranging and manual ranging**
- **Large easy to read 4 digit LCD display with annunciators and status indicators**
- **Automatic statistical recording**
- **Two frequency operation: 120 Hz and 1 kHz**
- **Sorting capability with selectable tolerances**
- **Relative mode to eliminate "zero"**
- **Auto power off; standard 9 V battery**

9955
LCR-500

The LCR-500 is an excellent value of features and performance

MAJOR SPECIFICATIONS

CAPACITANCE (C)

Full scale ranges: 1,000 pF to 10 mF, in 8 ranges.
Resolution: 0.1 pF - 0.01 mF
Accuracy: ±0.7% basic
D (Dissipation): ±(0.7% + 100/C rdg + 5 LSD), basic accuracy

INDUCTANCE (L)

Full scale ranges: 1 mH to 10,000 H, in 8 ranges.
Resolution: 0.1 µH - 1 H
Accuracy: ±0.7% basic

RESISTANCE (R)

Full scale ranges: 10 Ω to 10 MΩ, in 7 ranges.
Resolution: 1 mΩ - 0.001 MΩ
Accuracy: ±0.5% basic

GENERAL SPECIFICATIONS

Displays:
L/C/R: Maximum display of 9999 except at 10 mF (120 Hz) and 1 mF (1 kHz) measurement ranges which have a maximum display of 1999.
D/Q: 3 digits, maximum display 999 (auto range).
Status: Annunciators for units, low battery, frequency, open fuse; audio tone for tolerance testing, and other test conditions.
Ranging mode: Auto and manual.
Test frequency: 1kHz and 120 Hz.
Test signal level: 0.9 Vrms approximately.
Measurement rate: 1 measurement/second, nominal.
Measurement terminals: 2 banana jacks and 2 easy-insert component strips.
Operating modes: Relative, calibration, tolerance sorting, and max/min/avg recording.
Input protection: 70 mA fast-blow 250 V fuse.
Auto power-off time: Approximately 5 minutes; may be disabled.
Power Requirements:
1) Battery,dc 9V battery
2) External adapter, 12-15 Vdc, 50 mA
Dimensions: 19.2 cm L, x 9.0 cm W x 3.7 cm H (7.56" x 3.54" x 1.46")
Weight: 390 g (3 oz).

ORDERING INFORMATION

Model LCR-500 Autoranging LCR meter	299.00
Model LCR-500 ac adapter	21.00
Model LCR-5002 Carrying case	19.00
Model CC-25 Component clip for axial components	15.00

IET DESIGNS & MANUFACTURES TO MIL-SPEC & COMMERCIAL CUSTOM REQUIREMENTS

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\,\pi\,fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\,\pi\,fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta$ (loss angle) $= \frac{ESR}{X_c} = (2\,\pi\,fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\,\delta$ (loss angle) $= \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\,\pi\,fC)$

XII. Power Loss (watts)

Power loss $= (2\,\pi\,fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\,\pi\,fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \quad \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

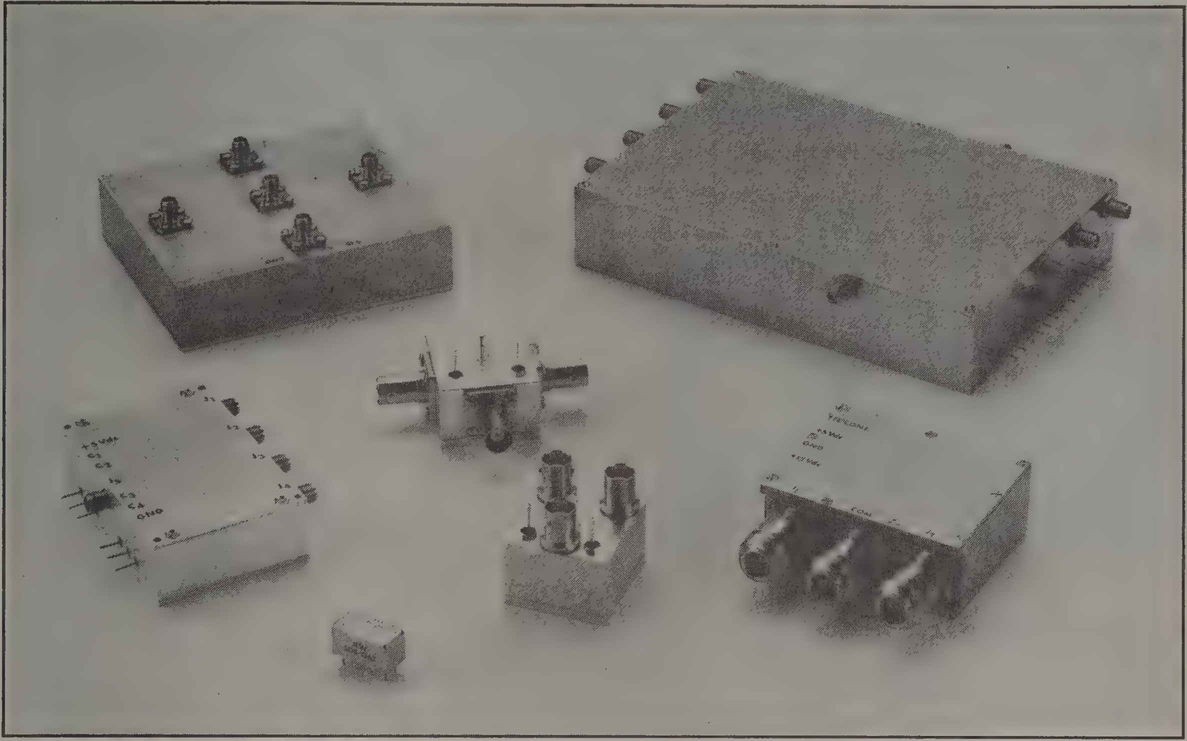
Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

Symbols:

K = Dielectric Constant
A = Area of electrode overlap
t_D = Dielectric thickness
V = Voltage (volts)
t = time (hours)
R_S = Series Resistance (ohms)
f = frequency (Hertz)
L = Inductance (henries)
δ = Loss angle

ø = Phase angle
x+y = Exponent effect of voltage and temperature
L_O = Operating life (hours)
L_t = Test life (hours)
V_t = Test voltage (volts)
V_o = Operating voltage (volts)
T_t = Test temperature (°C)
T_o = Operating temperature (°C)



50 & 75 Ohm RF Switches

Model #	Config.	Frequency	Switching Speed
50 Ohm			
50S-348	1P2T	5-2000 MHz	5 Microseconds
50S-349	1P3T	5-2000 MHz	5 Microseconds
50S-381	1P8T	100-1250 MHz	1 Microsecond
50S-534	1P2T	20-1000 MHz	5 Microseconds
50S-535	1P3T	20-1000 MHz	5 Microseconds
50S-536	1P4T	20-1000 MHz	5 Microseconds
50S-597	1P2T	DC-2000 MHz	10 Milliseconds
75 Ohm			
75S-012	1P2T	.5-500 MHz	20 Microseconds
75S-027	1P4T	.5-1000 MHz	20 Microseconds
75S-029	1P2T	.5-500 MHz	20 Microseconds
75S-072	1P2T	DC-1450 MHz	10 Milliseconds
75S-087	1P3T	DC-1450 MHz	10 Milliseconds
75S-073	1P4T	DC-1450 MHz	10 Milliseconds

JFW Industries, Inc.
5134 Commerce Square Drive
Indianapolis, IN 46237
Tel: (317) 887-1340 • Fax: (317) 881-6790

Specialist in Attenuation and RF Switching

eem

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

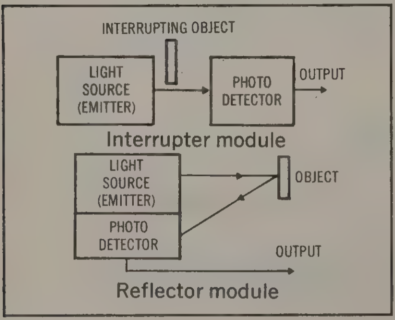
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

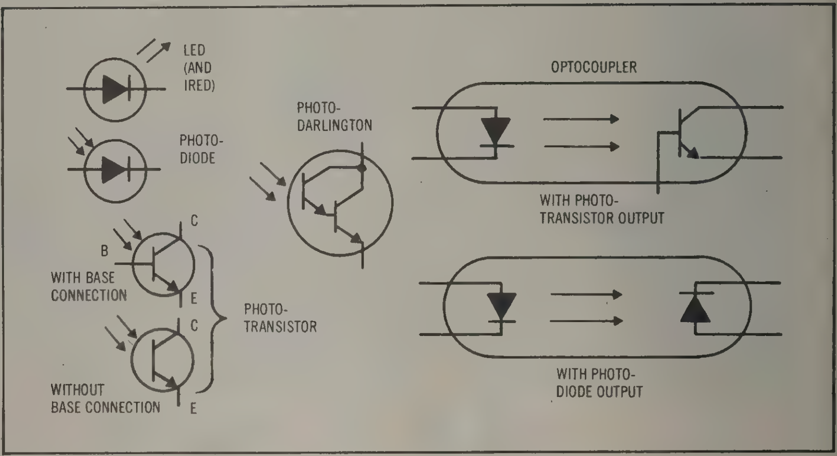
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

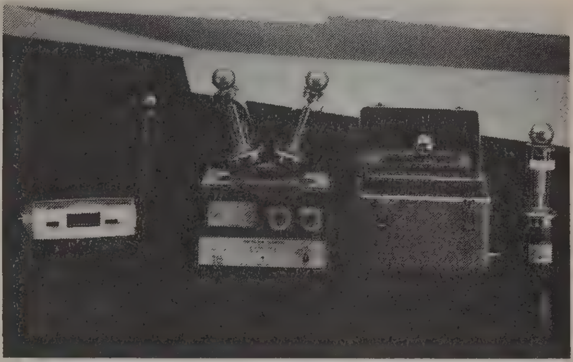
Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

JENNINGS

HV TEST EQUIPMENT

Jennings high voltage instruments allow direct measurement of the most important voltage parameters that apply to all AC waveforms, whether sinusoidal, pulse, repetitive transient or combination signals. The instruments are small, easily portable, and operate directly from line voltages. The instruments are versatile in a variety of applications including — production processing on continuous monitoring of voltage withstand, use in laboratories for verification of design capabilities, and troubleshooting for onsite installations.

Comprehensive data sheets on individual instruments are available upon request. Our sales engineers can provide an on-site demonstration if requested.



Photo, left to right: 12500, J-1005, JHP-70A (transformer), 13200

50KV AC/DC DIGITAL KILOVOLTMETER

Model Number	12500
Output Voltage (Two Ranges)	0–20KV DC or AC RMS; 0–50KV DC or AC RMS
Digital Display	Three and 1/2 digits automatically display correct DC polarity
Accuracy	± 1% of full range
Frequency Range	0 Hz to 20 KHz
Input Impedance	10^{10} ohms, less than 10 pF
Oscilloscope Jack Output	0–20KV : 3,000 to 1; 0–50KV : 30,000 to 1
Power Requirements	117 VAC or 230 VAC, 50/60 Hz
Weight	Instrument: 3½ pounds Probe: 3½ pounds
Size (Inches)	Instrument: 3.5 × 8.5 × 9 Probe: 1.5 (D) × 13.5 (H)

SOLID STATE AC VOLTMETER

Model Number	J-1005
Voltage Ranges	Peak Kilovolts (single-ended) 0–2.5, 0–5, 0–10, 0–25, 0–50 Peak Kikovolts (double-ended) 0–2.5, 0–5, 0–10, 0–25, 0–50, 0–100
Frequency Response	10 Hz to 30 MHz at full rate voltage
Accuracy	3% of full scale on all voltage ranges
Oscilloscope Connection	600 to 1 division ratio (approx.)
Meter Calibration	The meter is calibrated in peak kilovolts with linear voltage scales of 0–2.5, 0–5, 0–10, 0–25, 0–50
Input Impedance	Greater than 2 × 10^{12} ohms and approx. 4 pf single-ended to ground, 2 pf double-ended
Power Supply	117/230 volts ± 10%, 50/60 Hz, 5 watts, or rechargeable battery
Dimensions	Height, 16″; width 10¾″; depth, 8″
Net Weight	12 pounds (approx.)

PORTABLE AC HIGH VOLTAGE TESTER

Model Number	JHP-70A
Maximum Output Voltage	70 kV Peak
Maximum Continuous Current	21 ma RMS
Short Circuit	100 mA RMS
Power Requirements	105–125 Volts RMS*
Frequency	50–60 Hz
Current	15 Amps
Surge Current	20 Amps
Weight:	
Control Cabinet	28 lbs.
Transformer	43 lbs.

*NOTE: 230 volt version available upon special request.

HIGH VOLTAGE AC DIVIDER

Model Number	13200
Voltage	50 kV peak
Current	12.5 amperes RMS
Input Impedence	Above 10^{12} ohms, 4 pfd.
High Frequency Response	Flat to 10 MHz at 50 kV peak; maximum frequency 50 MHz at 20 kV peak
Division Ratio	As requested, 325:1, 1000:1 or 2000:1
Low Frequency Response when operated into shunt resistance of:	
1 megohm	1000 Hz
10 megohms	100 Hz
Weight	2 lbs. 4 oz.

50 KV AC/DC Digital Kilovoltmeter
Model 12500

The smallest AC/DC kilovoltmeter available. The 12500 measures to 50 KV DC or AC RMS in 2 ranges. Applications include cathode ray tube display systems, electrostatic smoke precipitators, contamination monitors for radioactivity, and virtually any metering requirements in the 50 KV range. True RMS measurements as well for applications such as power line and substation equipment, x-ray and neon sign transformers, and TV scan and flyback circuits.

Solid State AC Voltmeter
Model J-1005

A compact, portable instrument for the accurate, direct reading of very high voltages at rf, audio and power frequencies... determination of the amplitude of pulses with oscilloscope connections for viewing wave shapes...removable high voltage input circuit for remote panel mounting of the meter...internal battery and ac line operation.

Portable AC High Voltage Tester
Model JHP-70A (Not shown)

The smallest and lightest instrument available at its power level the JHP-70A will generate and measure 70,000 volts peak for on-site testing of high voltage components such as capacitors, switches, transformers, bushings, vacuum tubes, etc.

High Voltage AC Divider
Model 13200

These dividers can be used with an oscilloscope to measure and observe voltages up to 50 kv at frequencies up to 20 MHz. Their low circuit loading design and shielding construction make them particularly suitable for rf measurement applications including tank circuit and transmission line voltages, pulse parameters, modulation voltages, and transient wave characteristics.

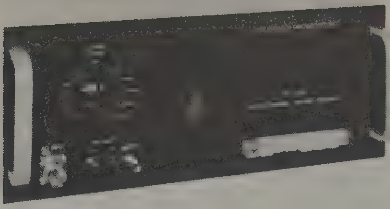
JOSLYN JENNINGS CORPORATION

A Joslyn Company

970 McLaughlin Ave., San Jose, CA 95122 (408) 292-4025

JRL JULIE RESEARCH LABORATORIES INCORPORATED **PRECISION MEASURING & REFERENCE EQUIPMENT**

TRS-104 HIGH PRECISION AC/DC PROGRAMMABLE THERMAL TRANSFER STANDARD



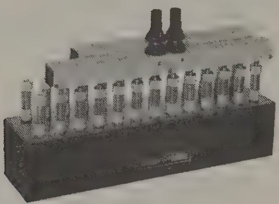
JULIE RESEARCH has been a leading manufacturer and innovator in the field of high accuracy calibration equipment for 40 years, introducing computerized 1 part per million products such as the DM-1000 Digital Multimeter and LOCOST-106 AC/DC Precision Automated Calibration System at a time when automated testing was virtually unheard of. The new TRS-104 Programmable AC/DC Thermal Transfer Standard combines the accuracy and stability of the JRL primary standard DM-1000 Digital Multimeter, TNB-102 Thermocouple/Multiplier Set and BA-108 Precision Nanovolt Amplifier in a single instrument at a fraction of the size and cost of these standards.

The TRS-104 is a high accuracy AC/DC thermal transfer standard which is programmable over the IEEE-488 bus. It is especially designed to have the lowest possible frequency errors from DC up to 1 Megahertz and can provide extremely accurate AC calibration from below 0.25 Volts to 1100 Volts. The front panel display provides direct digital readout of AC calibration with 1 PPM resolution.

The TRS-104 has 12 voltage ranges with accuracy better than 0.01% in the low to mid-frequency ranges. DC reversal error is better than 0.005%. Because its circuitry consists of thermocouples and multiplier resistor sets identical in stability and frequency response to the TNB-102 Primary Transfer Standard, the TRS-104 is uniquely capable of self-calibration. This feature makes it an extremely convenient and reliable laboratory standard; recertification and the resultant downtime are less frequently necessary than with other AC transfer standards.

The TRS-104 is ideally suited for calibration of other transfer standards, and precision AC voltage sources. It can function as a high-productivity "smart" AC calibrator with 6 1/2 digit display and 0.0001% resolution. The calibrator can automatically compute and display calibration data in linear units of either % of reference or % deviation from reference, eliminating the need for error-prone thermocouple data conversion by the operator. Its IEEE-488 programmability also allows computer-controlled operation using standard IEEE programming aids or standard programming languages such as BASIC and HPL. For further details, contact Julie Research Laboratories.

DTR-100A RESISTANCE TRANSFER STANDARDS



Each individual Model of the DTR-100A Series contains eleven ultra-precise, ultra-stable JRL resistors, ten of which are permanently connected in series. An optional set of shorting bars is available to connect groups of these resistors in parallel or series-parallel. Many different ratios can be obtained, including 1:1, 10:1. 1:9 and 1:10. Outstanding features of the DTR-100A include ratio accuracy as low as 0.01 PPM (0.000001%), long term stability within 5 PPM/year, temperature coefficient better than 5 PPM/°C, and quick easy conversion of resistors from series to parallel using compact, lightweight shorting bars.

The DTR-100A Series are available in sets of 10 ohm, 100 ohm, 1K ohm, 10K ohm or 100K ohm resistors. These models are primarily used as resistance standards, providing a statistical set for ratio determination, and can also be used as measurement type volt boxes, sensing resistors, or as adjustable precision resistors. For additional information, contact Julie Research Laboratories.

LOCOST-106 PRECISION AC/DC AUTOMATED CALIBRATION SYSTEM

BASIC COMPONENTS

6½ Digit, 1 PPM Programmable DC Digital Multimeter, Model DM-1060
Ratio and DC Volts: 0.000000 to 1.199999V; 4 ranges to 1199.999V F.S. *DC Current:* 0.000000 to 1.199999mA; 5 ranges to 11.99999A F.S. *Resistance:* 1.000000 to 119.9999 ohms; 6 ranges to 11.99999 Megohms F.S.

AC Voltage/Current ranges provided by compatible AC/DC converter accessories. Kilovolt ranges to 119.9999 kilovolts using compatible voltbox accessories. Other standard accessories extend resistance ranges by 1000:1 (up or down), and voltage ranges to nanovolt region.

Programmable Absolute DC Current/Voltage Sources, Models ACS-106 and AVS-106
Up to 12 A (in 5 ranges) @ 10V compliance; up to 1200V (in 3 ranges) @ 0-34mA. 6-digit resolution (1nA, 10uV). Accuracy better than 0.0005% (current) and 0.0003% (voltage). Extended current and voltage ranges on special order. Both sources incorporate separately accessible programmable 0.0001% dividers.

Programmable Absolute AC Calibrator, Model AC-129
10 Hz to 1.099 MHz. 6 decades. Up to 121.110 Vrms in 5 ranges (1nV resolution). Output current to 200mA (depends on range). Inphase and precise fixed quadrature outputs for broadband programmable phase generation. Standard options extend output capabilities to 1200V and 120A.

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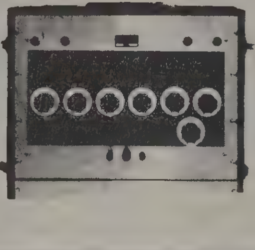
JRL JULIE RESEARCH LABORATORIES INCORPORATED PRECISION MEASURING & REFERENCE EQUIPMENT

VOLTAGE DIVIDERS

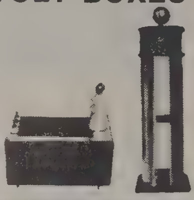


Model	Accu. (ppm)	Lin. Resol. (ppm)	Stability (ppm/ yr.)	Resistance (Kohms)	Max. Volts	Mode of Operation
VDR-106/7H	1 (5 yr.)	1	1	100	700	Manual
VDR-106/7	1 (5 yr.)	.1	.2	100	300	Manual
VDR-307	1	.1	1	100	700	Manual
VDR-307H	1	.1	1	100/120	700	Manual
VDR-307J	1	.1	1	100/110/120	700	Manual
*RVD-106	1	1	.5	100	200	Prog./Manual
*RVD-126	1	1	.5	100/110/120	200	Prog./Manual

*BCD input/output standard, IEEE-488 Interface available.

HIGH VOLTAGE DIVIDERS/VOLT BOXES

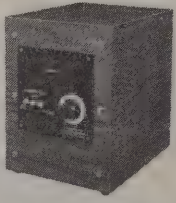
The Julie High Voltage Dividers and Volt Boxes on the table below are used to "drop" high voltages to a level that traditional precision potentiometers and high impedance electronic voltmeters can safely measure (such as the Julie models PVP-1000S and PVP-1000C).



AC/DC Model	Input Ranges Lowest	Input Ranges Highest	Input Imped.	Output Taps	Acc. (%) DC	Acc. (%) AC	1 Year Stab. (%)
DV-1500	1 v	1500 v	1 Kohm/v	1/1.5 v	.001	—	.001
DV-1000	1 v	1000 v	1 Kohm/v	1/1.5 v	.001	—	.001
DV-1000B	1 v	1000 v	1 Kohm/v	1 v	.001	—	.001
HV-100/w	100 Kv	100 Kv	1 Kohm/v	1 v	.05	—	.005
HV-100	100 Kv	100 Kv	4 Kohm/v	1 v	.05	—	.1
HVA-50	50 Kv	50 Kv	1 Kohm/v	0.5/5 v	.01	.05	.005
HVA-100	100 Kv	100 Kv	1 Kohm/v	1 v	.01	.05	.005
KV-50/.01	50 Kv	50 Kv	1 Kohm/v	1/10 v	.01	—	.0015
KV-25/.01	25 Kv	25 Kv	1 Kohm/v	1/10 v	.01	—	.0015
KV-10/.01	10 Kv	10 Kv	1 Kohm/v	1/10 v	.01	—	.0015
KV-10R	10 Kv	10 Kv	1 Kohm/v	1/10 v	.01	—	.0015
KV-VB-10	10 Kv	10 Kv	2 Kohm/v	10 v	.05	—	.005

VOLTAGE REFERENCES

SATURATED STANDARD CELL OVENS



The best voltage reference possible must meet two basic critical requirements —

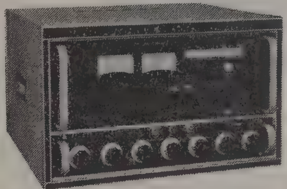
1. Time performance; the three saturated cells used must have minimum output voltage change with time.
2. The enclosure must maintain its nominal temperature with time.

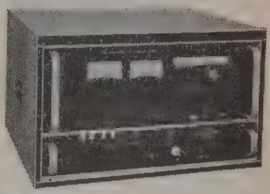
Stability Specs		Temperature	Time
SCO-106	cells	.64 ppm/.01°C	1 ppm/yr. max.
	oven	.01°C/day max.	.05°C/yr. max.

DIALABLE PRECISION DCV SOURCES

The GTX-300 Series is a high quality, compact, portable voltage source. Output settings on this 1 ppm resolution instrument range from 1 microvolt to 10 volts DC and can be made simply by dialing the desired value. Accuracies of from 0.001% to 0.005% can be ordered. Loads requiring up to 25 mA can be tolerated without accuracy deterioration. An output stability of ±3 ppm/24 hours is standard on all units.

DC VOLTAGE AND CURRENT SOURCES, MANUAL AND PROGRAMMABLE





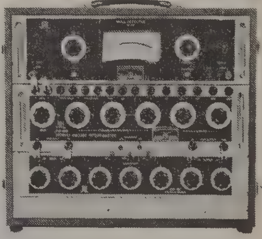
Model	Outputs	
*AVS-106	0 to ±12, 120, 1200V, 6 digits	
DVS-106	0 to ±12, 120, 1200V at 35 ma, 7 digits	
DVS-106D	0 to ±12, 120, 1200V at 35 ma, 6 digits	
*ACS-106	0 to ±1.2, 12, 120 ma; 1.2, 12 Amps	
DCS-105	0 to ±1.2, 12, 120 ma; 1.2, 12 Amps	
DCS-106	0 to ±1.2, 12, 120 ma; 1.2, 120 Amps	
*ACV-106	0 to ±1.2, 12 ma; 0-12V, 120 Volts	
Accuracy	**Stability**	**Linearity**
To 2 ppm	To 5 ppm/30 days	To 1 ppm

* Compliance Programmable

POTENTIOMETERS

Through the use of POTENTIOMETER Plug-ins, the Multivider system is made into various precision voltage measuring systems. (Systems listed in the table below include null detector and voltage divider.)

Range Volts	PVP-1000S Accuracy (w/self cal.)
1000	8 ppm +1 ppm f.s.
300	8 ppm +1 ppm f.s.
100	8 ppm +1 ppm f.s.
30	8 ppm +1 ppm f.s.
12	—
10	5 ppm +1 ppm f.s.
3	5 ppm +1 ppm f.s.
1.2	—
1.1	+1 µv (cell compar.)
1.0	2 ppm +1 ppm f.s.
.12	—
.012	—
.0012	—



PVP-1000C Potentiometer/Voltbox Plug-in with ranges to 1000 volts and with accuracy as shown below for PVP-1000S:
PVP-1001J Universal Potentiometer Plug-in is used.

SOLID STATE REFERENCES — ZENERS

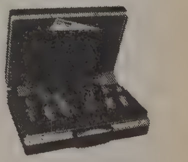
Line Regulation: 1 ppm for 10% line change for all models.
Output: +1.018, +1.0 and −5.0 volts all models except ZVR-500 Series.
Room Temp. Efficiency: 0.3 ppm/°C (20°C to 30°C) for ZVR-106 Series and 0.2 ppm/°C (20°C to 30°C) for ZVR-500 Series.

Model	MM	Size
ZVR-106B ZVR-106MV (10v, 1v, .1v, .01v)	152.4 x 152.4 x 101.6 152.4 x 152.4 x 101.6	6″ x 6″ x 4″ 6″ x 6″ x 4″
ZVR-506 (6.3v) ZVR-512 (12.6v) ZVR-518 (18.9v)	21.3 x 21.3 x 19.1 21.3 x 21.3 x 19.1 21.3 x 21.3 x 19.1	.84″ x .84″ x .75″ — —
ZTS-106	1.000, 1.018 + Delta; + Delta VDC 0 to 1000 µV (Delta); ±2 ppm Accur.; 1 µV Resol.: ±3 ppm/Mo. Stable	

AC-DC THERMAL VOLTAGE TRANSFER STANDARDS

TNB-102 Series

This set of two Thermoelement Modules (2.5 ma and 5 ma) and six Resistor Modules provide highest available transfer accuracy from 0.5 v to 1000 v up to 1 MHz.



Model TNB-102 Series Coaxial AC/DC Transfer Standards

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JULIE RESEARCH LABORATORIES INCORPORATED PRECISION MEASURING & REFERENCE EQUIPMENT

BUFFER AMPLIFIERS

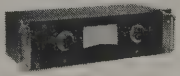
BA106

BA107, BA108

Line Operated High Performance Floating Amplifier

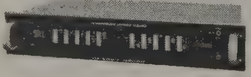
Specification	BA106	BA107	BA108
Gain	1.0 ±1.5 PPM 10.0 ±1 PPM	100 ±1 PPM	1000 ±1 PPM
Max. Output	±12 Volts	±12 Volts	±12 Volts

NULL DETECTORS



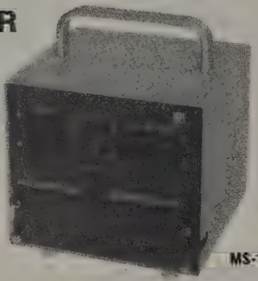
Model	Ranges	Sensitivity	Dimensions
ND-106	(9) 3 µv to 30 mv	.1 µv	19 x 5¼ x 8

AUTOMATIC RANDOM ACCESS SCANNER



Features: Random bussing capabilities, will not degrade 1 ppm measurements, up to 10 individually Addressable Decades, 2-Pole 100-Position and most combinations in-between. Programmable, sequential, or manual modes. Thermal EMF of 0.2 µV max. Please call us for custom applications.

MINI SCANNER


MS-106

(1) Only .1 to .2 µV thermals, (can be used in 1 PPM accuracy systems)
(2) Manual and complete on line (computer) capabilities
(3) 10 test positions plus 2 mutually exclusive dual form A closures
(4) Random or sequential access
(5) Manually settable or programmable lower limit and manually settable upper limit in the sequential mode
(6) I/O, standard positive BCD code, TTL levels
(7) Illuminated test position display
(8) Automatic stop and hold position or repeat previous scan pattern capabilities.

MINIDIVIDER

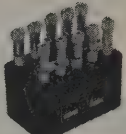
MVD306

6 Reading Switches — Ratios from .000001 to .999999 — Over Range Switch to 1:100000 Ratio

Enclosure	3½″ x 4″ x 6″
MVD306	2.5 PPM Accuracy
MVD306	5 PPM Accuracy
MVD306	10 PPM Accuracy

RESISTANCE REFERENCES

DMR


MRS-106

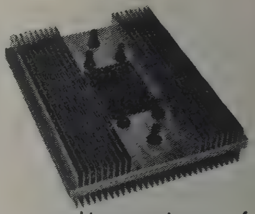
Model	Absolute Resistance Values	Accuracy (ppm)	Room Temp. Eff. (ppm/°C)	Approximate Size (inches)
PRO-106	10 ohms to 1 Meg.	8	.1(0-28°C)	10 × 14 × 15
PRO-106L	.001 ohms to 10 ohms	50-100	.1(0-28°C)	10 × 14 × 15
MRS-106	100 ohms to 1 Meg.	15	2.5/°C	4 × 2 × 4
MRS-105	.1 ohms to 100 ohms	30-100	2.5/°C	4 × 2 × 4
DMR Series	10 ohms to 1 Meg.	15	2.5/°C	5 × 4 × 3
BMR Series	29,996,131,071 ohms	15-50	5/°C	5 × 4 × 3
BDR Series	100,000 ohms Max.	15	5/°C	5 × 4 × 3
DTR Series	10 ohms to 100K	15	2/°C	9½ × 2½ × 2

PRECISION RESISTANCE MEASURING SYSTEMS

PRB-205C PLUG IN	
0-1000Ω	±1 ppm Setting ±1 ppm f.s.
0-10K	±1 ppm Setting ±1 ppm f.s.
0-100K	±1 ppm Setting ±1 ppm f.s.
0-1 Meg.	±2 ppm Setting ±1 ppm f.s.
0-10 Meg.	±3 ppm Setting ±1 ppm f.s.

PRB205L & PRB205H available extending resistance range from .01 ohms to 100 K Meg.

CURRENT SHUNTS



Our CS-105 and CS-106 Series Current Shunts are high precision, ultra-stable 4-terminal resistors specially designed to operate at relatively high current levels without suffering appreciable resistance change. Maximum current ranges from 0.005 A to 50 A for CS-105 and 0.001 A to 200 A for CS-106. Accuracies range from 0.05% to 0.01%, stability is ±0.01%/year, and temperature coefficient is 5 ppm/°C or better. Finned heat-sinks are used to reduce heat in high current models. CS-105 Series is specially designed for use with our TNB-102 Thermocouples. Call J.R.L. for data sheets.

DECADE BOXES

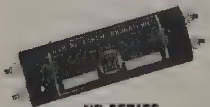
Manual and Programmable Boxes Available — DR100, RD100 Series:

Ranges: 1 Ohm to 11 Meg.
Accuracy to 0.01%

Max. Res.	11, 111, 100Ω
Min. Ohms Per Step	1mΩ
Decade Ranges	6
Enclosure	3 1/2" x 4" x 9" Metal Case

IEEE-488 option available for RD-100 Series.

PRIMARY RESISTANCE AND RATIO STANDARDS


HB SERIES

These ultra-stable oil-immersed resistors, provide absolute accuracy and stability heretofore unattainable in conventional precision components (See JRL Bulletins B-5 and B-6)

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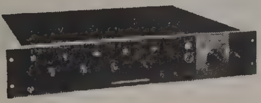
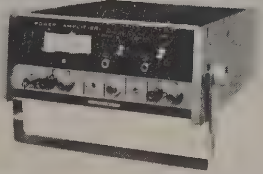
JRL JULIE RESEARCH LABORATORIES INCORPORATED

OPTIMATION Division





PRECISION OSCILLATORS

Model	Frequency Range	Frequency Accuracy	Output Voltage	Output Current	Frequency Response	Features
RCD-10	.1 Hz-100 kHz	1%	0-5		±.5%	General Purpose Oscillator
RCD-902	10 Hz-1 MHz	1.0%	0-5			Wide Band
RCD-904	10 Hz-1 MHz	0.1%	0-11.11 absolute	100 MA	±.05%	Remote Sensing

POWER OSCILLATORS

Model	Power VA	Frequency Range	Voltage*	Features
AC-50	50	0.1 Hz to 100 kHz	15	Precision High Power

* Options are available to extend V+1 ranges of all power oscillators and amplifiers.

PRECISION POLYPHASE OSCILLATORS/POWER OSCILLATORS

Model	Phases Power/ϕ	Output V/ϕ	1/ϕ	Regulation	Frequency Range	Amplitude Stability	Distortion	Features
AC-153	2/3 45	150	2a	adj. to Zero	10 Hz to 10 kHz	100 ppm	.05%	Switchable 2 or 3ϕ
RCD-11	2/3	5			.01 Hz to 10 kHz	100 ppm	.02%	General Purpose Oscillator

PRECISION POLYPHASE OSCILLATORS/POWER OSCILLATORS

- High Power — to 50 VA per phase
- Low Distortion — to less than 0.02%
- Fixed or Variable Stable Frequency
- Adjustable Load Regulation
- Perfectly Suited for Gyro Testing

POWER OSCILLATORS

- Accurate Digital Frequency Selection
- Stable Amplitude — less than 0.01% variation
- Stable Frequency — 10 ppm available
- Low Distortion — less than 0.05%
- Wide Frequency Range — up to 110 kHz
- Absolute Stability Regardless of Load
- Up to 50 VA Output

POWER AMPLIFIERS

- Low Distortion — under 0.05%
- Stable Voltage Gain — to 1 ppm
- Wide Frequency Ranges — DC to 2 Mhz
- Adjustable Output Impedance
- Absolute Stability Regardless of Load
- Voltage or Current Regulation

PRECISION SOURCES

- Stable Amplitude — less than 20 ppm variation
- Low Distortion — under 0.05%
- High Power Output — up to 200 VA
- Stable Frequency — less than 0.01% variation
- Wide Frequency Range — to 100 kHz at 1000 V
- Constant Voltage/Current—to 1500 V: to 40 Amps

PRECISION OSCILLATORS

- Absolute Amplitude Accuracy — ±0.05%
- Amplitude Stability — ±0.01% month
- Output — from 11 Volts to 100 Milliamperes
- Remote Sensing Available
- Quadrature Phase Accuracy — 0.05°
- Frequency Range — 10 Hz to 1 MHz
- Frequency Accuracy — to 0.1%

ABSOLUTE CALIBRATORS FOR:

Ammeters - Voltmeters - Wattmeters - Phasemeters - Digital Multimeters

- Programmable Models
- Highest Accuracy Available
- 10 Hz to 1 MHz
- Compact and Lightweight
- Complete Systems Available

ABSOLUTE CALIBRATORS

Model	Output Range	Accuracy DC	Accuracy AC*	Frequency Range	Features
AC125/PA225	10 NV to 1211.11V		0.02%	10 Hz to 1.1 MHz	Fixed Amplitude Quadrature Output
AC129/PA225	10 NV to 1211.11V		0.02%	10 Hz to 1.1 MHz	Fully Programmable
AC160	0-600V		0.05%	25 Hz to 10 kHz	Calibrates Volt, Amp and Watt Meters — Variable Phase
CS112	0-10 Amps 1 μa to 2.2 Amp	.005%	0.05% 0.02%	10 Hz to 100 kHz	Absolute Power Factor Bi-polar DC
CS129	1 μa to 2 Amp		0.02%	10 Hz to 100 kHz	Programmable
QCS110	1 μa to 1.1 Amp		0.02%	10 Hz to 100 kHz	Phase Calibrated From 0-360° ±0.05°
PA270	1 Amp to 110 Amp		0.02%	10 Hz to 100 kHz	High Current — Self Calibrating
RCD709	0 to 5V RMS			10 Hz to 100 kHz	Absolute Phase Standard ±.05°

* Typical Midband

PRECISION SOURCES

Model	Voltage	Current	Resolution	Frequency Range	Distortion	Stability	Features
AC50CAL	500V	10A	10 ppm	10 Hz to 100 kHz	<.05%	±20 ppm	High Performance at Low Cost
AC104	1500V	20A	10 ppm	10 Hz to 100 kHz	<.05%	±20 ppm	Full Power Output From 45 Hz to 100 kHz

POWER AMPS

Model	Power (VA)	Voltage	Current	Band Width Full Power	Band Width Extended	Distortion	Features
PA25	25	150		DC - 1 MHz	DC - 2 MHz	<.02%	Sine/Pulse—1500V μS
PA50	50	15		DC - 20 kHz	DC - 100 kHz	<.05%	Wide band
PA50T	45	150		45 Hz - 20 kHz	10 Hz - 100 kHz	<.05%	Voltage Regulated
PA50T/10A	45		10 Amps	45 Hz - 2 kHz	10 Hz - 100 kHz	<.05%	Current Regulated
PA50T/500	45	500	10 Amps	55 Hz - 10 kHz	10 Hz - 100 kHz	<.05%	High Voltage
PA250AC	250	150	10 Amps	25 Hz - 20 kHz	15 Hz - 40 kHz	<.05%	Adjust. Output Imped.
PA250H	250	300	5 Amps	45 Hz - 60 kHz	20 Hz - 100 kHz	<.05%	Absolute Load Stability

OPTIMATION

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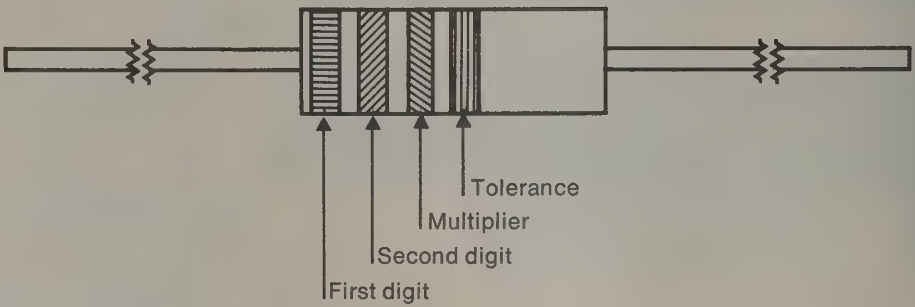
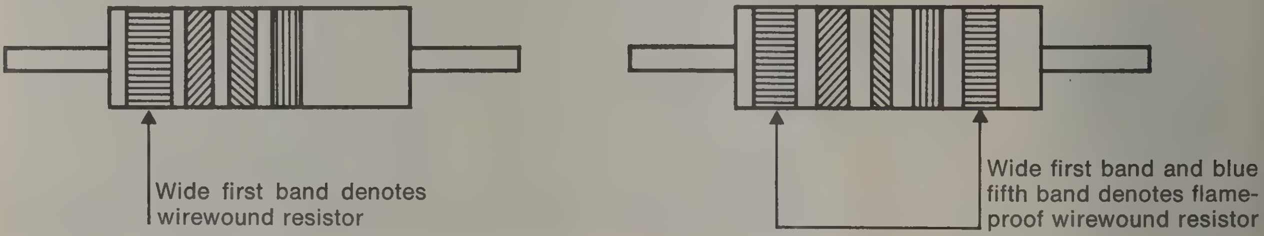
eem

MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes


Tolerance
Multiplier
Second digit
First digit

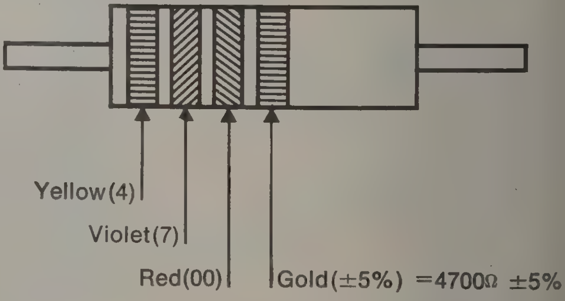
Color code for general-purpose industrial resistors


Wide first band denotes wirewound resistor
Wide first band and blue fifth band denotes flame-proof wirewound resistor

Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:


Yellow(4)
Violet(7)
Red(00)
Gold(±5%) =4700Ω ±5%

It used to be a bit more than you needed.

Unique DC in-circuit current measurement.

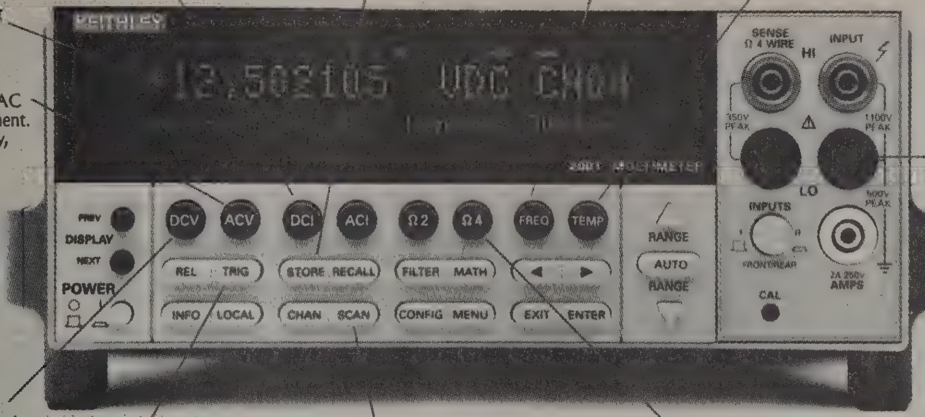
Data storage of up to 30,000 readings with timestamp.

Frequency measurements to 15MHz with fully adjustable trigger level.

Direct temperature measurement of thermocouples and RTDs.

Bright, 52-character multiple measurement display.

True RMS, peak, and average ACV. Direct AC crest factor measurement. 0.03% ACV accuracy, 2MHz bandwidth.


KEITHLEY
12.502105 VDC CH01
2001 MULTIMETER
PREV
DISPLAY
NEXT
POWER
DCV
ACV
DCI
ACI
Ω2
Ω4
FREQ
TEMP
REL
TRIG
STORE
RECALL
FILTER
MATH
INFO
LOCAL
CHAN
SCAN
CONFIG
MENU
EXIT
ENTER
RANGE
AUTO
RANGE
SENSE Ω 4 WIRE
INPUT
HI
350V PEAK
1100V PEAK
LO
500V PEAK
INPUTS
FRONT/REAR
2A 250V AMPS
CAL

1100V measurement protection with fast overload recovery.

7½-digit resolution. 2000 readings/second. 18ppm basic 90-day accuracy.

Unique Trigger-Link provides higher speeds and tighter control.

Built-in, easy-to-control 10-channel scanner option.

Low ohms source current keeps self-heating down.

Just a few years ago, you probably didn't need a DMM as fast, as accurate, or as flexible as the **2001.**

You do now.

You're being challenged to consistently improve product quality. And reduce development and production cycle times. Demands on your instrumentation have increased dramatically. Ordinary DMMs simply won't do the job.

Keithley's Model 2001 DMM easily meets today's increased measurement requirements. With high accuracy. High speed. Many built-in functions. Plus an informative multi-line display.

It's ruggedized to MIL, VDE, UL, ANSI, IEC, CSA and FCC standards. Then backed by a solid three-year warranty.

Check the specifications and features above. Then call us for a demonstration.

KEITHLEY

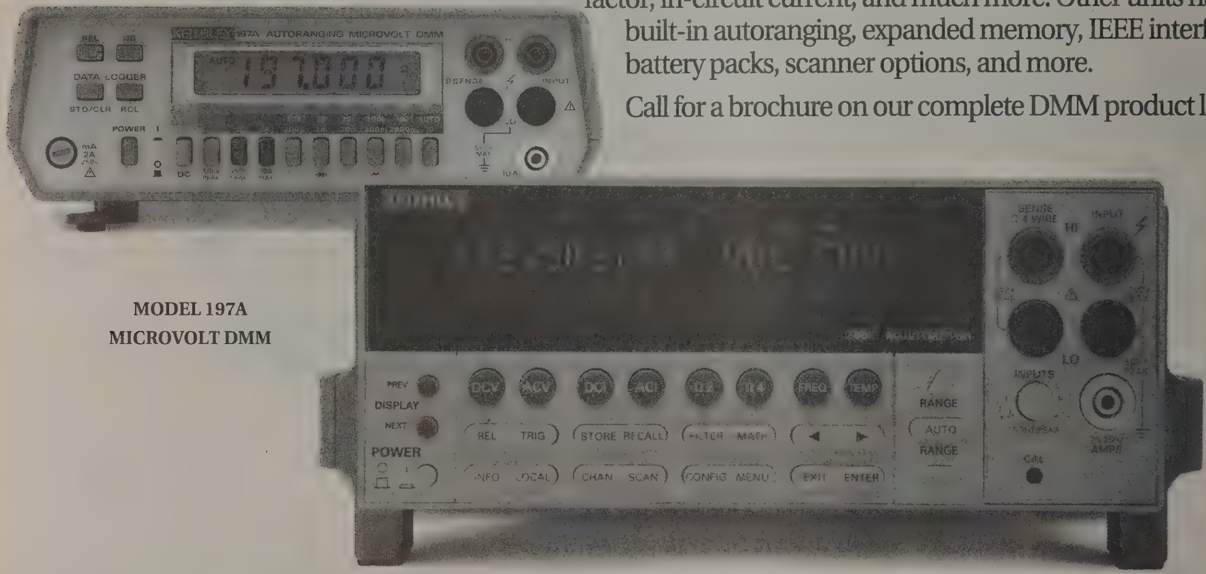
(800) 552-1115 • Fax: (216) 248-6168

Accurate Measurements

Keithley Digital Multimeters

Keithley offers a wide range of bench and system DMMs with excellent resolution, speed and accuracy. The new Model 2001 features 18 measurement functions and the best speed and accuracy in its class. Its multi-line display allows simultaneous measurements, plus peak spikes, AC crest factor, in-circuit current, and much more. Other units have built-in autoranging, expanded memory, IEEE interfaces, battery packs, scanner options, and more.

Call for a brochure on our complete DMM product line.



MODEL 197A
MICROVOLT DMM

MODEL	175A	195A	196	197A	199	2001
Digits Display	4½ LCD	5½ LED	6½ LED	5½ LCD	5½ LED	7½ VFD
DC VOLTS						
Sensitivity	10 µV	100 nV	100 nV	1 µV	1 µV	10 nV
Accuracy	0.03%	0.025%	0.003%	0.011%	0.006%	0.002%
AC VOLTS						
Sensitivity	10 µV	1 µV	1 µV	1 µV	1 µV	100 nV
Accuracy	0.5%	0.3%	0.15%	0.35%	0.15%	0.03%
OHMS						
Sensitivity	10 mΩ	100 µΩ	100 µΩ	1 mΩ	1 mΩ	1µΩ
Accuracy	0.05%	0.025%	0.005%	0.018%	0.008%	0.003%
DC AMPS						
Sensitivity	10 nA	100 pA	1 nA	1 nA	100 nA	10 pA
Accuracy	0.15%	0.09%	0.05%	0.1%	0.05%	0.03%
AC AMPS						
Sensitivity	10 nA	1 nA	1 nA	1 nA	100 nA	100 pA
Accuracy	0.8%	0.6%	0.6%	0.8%	0.6%	0.5%

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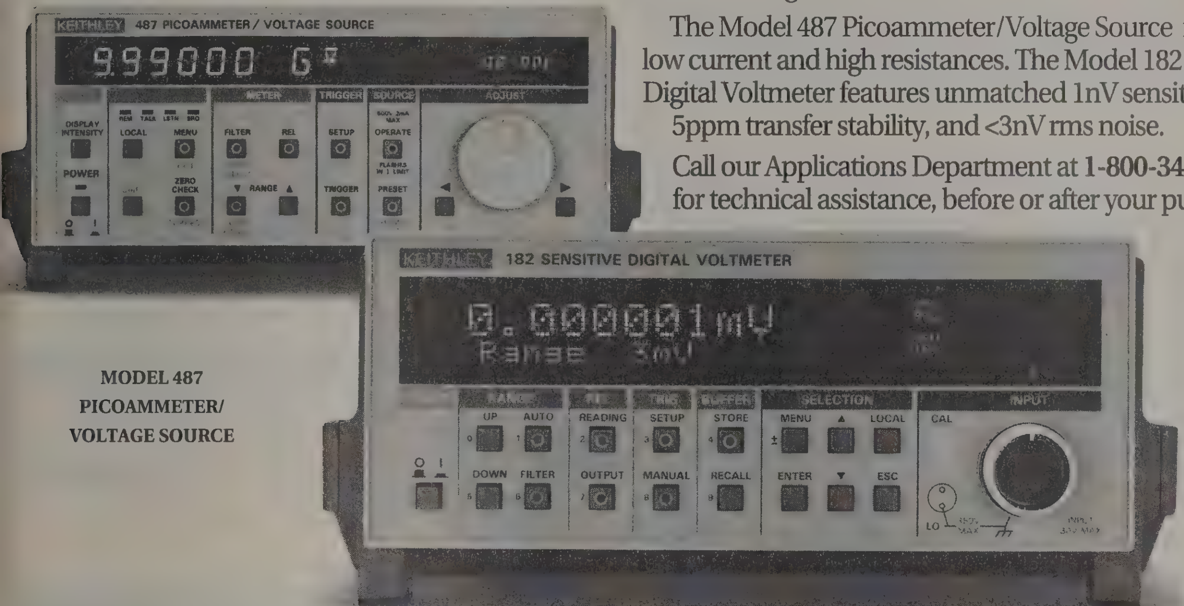
Sensitive Measurements

Keithley Electrometers, Picoammeters and Voltmeters

When extremely low level measurements are required, Keithley electrometers and picoammeters are the instruments of choice. Found in universities and research facilities around the world for more than 45 years, Keithley instrumentation is recognized as the standard of the industry.

The Model 487 Picoammeter/Voltage Source measures low current and high resistances. The Model 182 Sensitive Digital Voltmeter features unmatched 1nV sensitivity, 5ppm transfer stability, and <3nV rms noise.

Call our Applications Department at **1-800-348-3735** for technical assistance, before or after your purchase.


KEITHLEY 487 PICOAMMETER / VOLTAGE SOURCE
9.99000 G
DISPLAY INTENSITY
LOCAL
MENU
FILTER
REL
SETUP
OPERATE
POWER
ZERO CHECK
RANGE
TRIGGER
PRESET
ADJUST
KEITHLEY 182 SENSITIVE DIGITAL VOLTMETER
0.000001mV
Range 3mV
UP
AUTO
READING
SETUP
STORE
MENU
LOCAL
CAL
DOWN
FILTER
OUTPUT
MANUAL
RECALL
ENTER
ESC
SELECTION
INPUT
LO

MODEL 487
PICOAMMETER/
VOLTAGE SOURCE

MODEL 182 SENSITIVE DIGITAL VOLTMETER

ELECTROMETERS		602	610C	614	617	642	236, 237, 238
CURRENT	From	1 fA	1 fA	10 fA	100 aA	10 aA	10 fA
	To	300 mA	300 mA	2 mA	20 mA	100 nA	100 mA, 1 A
VOLTAGE	From	10 µV	10 µV	10 µV	10 µV	20 µV	10 µV
	To	10 V	100 V	20 V	200 V	11 V	110 V, 1100 V
RESISTANCE	From	10 Ω	1 Ω	1 Ω	100 mΩ	N/A	100 µΩ
	To	10 TΩ	100 TΩ	200 GΩ	10 PΩ		10 TΩ, 100 TΩ
CHARGE	From	1 fC	1 fC	10 fC	10 fC	800 aC	N/A
	To	1 µC	10 µC	20 nC	20 nC	100 pC	
Input Connection		Triax	UHF	Triax	Triax	BNC, special sapphire adapter	Triax

PICOAMMETERS	480	485	486	487
From	1 pA	100 fA	10 fA	10 fA
To	2 mA	2 mA	2 mA	2 mA
Input Connection	BNC	BNC	3-lug triax	3-lug triax

VOLTMETER	182
Sensitivity	1 nV
Basic Accuracy	0.005%
Input Connection	Special low thermal

KEITHLEY

(800) 552-1115 • Fax: (216) 248-6168

I-V and C-V Measurements

Keithley Semiconductor Measurements

Keithley offers a comprehensive line of sensitive instrumentation and flexible software for a complete range of I-V and C-V testing. Whether you need a single instrument for rack and stack configurations or a complete analysis workstation, Keithley has a solution that's right for you. Our new Source-Measure Units will measure current from 10fA to 1A and voltage from 10µV to 1100V with 0.03% accuracy. Our I-V test software adds powerful acquisition and graphical analysis capabilities to your PC environment. And our complete line of C-V instruments, systems and accessories offers superior solutions to Simultaneous, Quasistatic and High Frequency C-V.

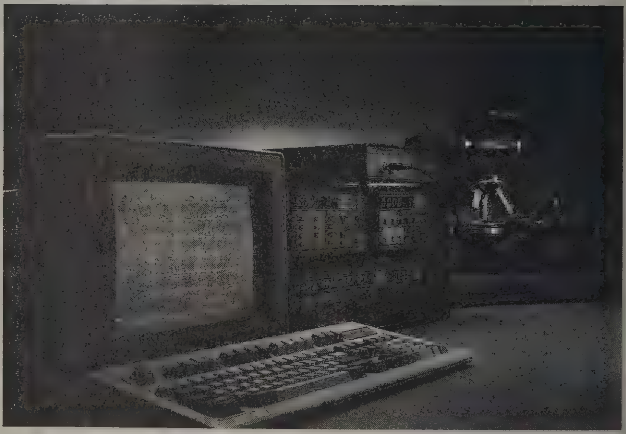
+06000 V +00000 mA
+06000 V -00003 nA
+1.0000 A +0.37997 V
DATA ENTRY

MODELS 236, 237, 238 SOURCE-MEASURE UNITS

	236	237	238
V_{MAX}	110 V	1100 V	110 V
V_{SENS}	10 µV	10 µV	10 µV
I_{MAX}	110 mA	110 mA	1 A
I_{SENS}	10 fA	10 fA	10 fA

I-V Test Software

Interactive testing of current vs. voltage is easily controlled from a PC for complete characterization of semiconductor devices. This software uses fast and sensitive Source-Measure Units to measure and display I-V curve families, breakdown voltage, leakage current, DC or differential gain and resistance. A library of standard tests is supplied, and there is no GPIB programming or knowledge required.



Model 82 C-V System

Menu-driven software steps through the process for fast and accurate C-V analysis. It corrects for system leakages and cabling effects, finds oxide capacitance and equilibrium sweep rate, makes simultaneous high frequency and quasistatic C-V measurements, and analyzes and plots the data. All calculations and graphs commonly used for C-V analysis are included, such as Dit, doping profiles and band bending.

KEITHLEY

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System Switching

Keithley Switching

Automate your test systems with a versatile Keithley system switch. The Model 7001 is an 80-channel, 2-slot mainframe, the Model 7002 is a 400-channel, 10-slot mainframe, and the Model 707 is a 6-slot switching matrix with 576-channel capacity. All units have interactive programming and front panel status display.

Choose from over 45 switching cards – the largest selection available anywhere – to fit any application. A sampling is listed below.

SELECT CHANNELS
INFO
LOCAL
POWER
OPEN ALL
STEP
OPEN
CLOSE
MEMORY
CONFIGURATION

MODEL 707 SWITCHING MATRIX

MODEL 7001 HIGH DENSITY SWITCH SYSTEM

	No. of Channels	Card Configuration	Contact Configuration	Maximum Voltage	Maximum Current	Maximum Power	Contact Potential	Connection Type
HIGH DENSITY								
7011-C	40	Multiplexer	2 Form A	110V	1A	60VA	<500nV	Connector
7012-C	4×10	Matrix	2 Form A	110V	1A	60VA	<500nV	Connector
7013-C	20	Isolated Switch	2 Form A	110V	1A	60VA	<500nV	Connector
GENERAL PURPOSE								
7052	4×5	Matrix	3 Form A	200V	200mA	10VA	<5μV	Screw term.
7056	10/20	Multiplexer	2 Form A	150V	250mA	10VA	<100μV	Screw term.
7156-D	10/20	Multiplexer	2 Form A	150V	500mA	10VA	<100μV	Connector
7166	10	Isolated switch	2 Form A	300V	750mA	30VA	75μV typ.	Connector
LOW VOLTAGE								
7067	10	Multiplexer	4 Form A	150V	350mA	10VA	<1μV	Screw term.
7168	8	Multiplexer	2 Form A	10V	50mA		<30nV	Screw term.
HIGH VOLTAGE								
7154	10	Multiplexer	2 Form A	1100V	500mA	10VA	<35μV	Screw term.
7169	20	Isolated switch	1 Form C	500V	500mA	10VA	<30μV	Connector
LOW CURRENT								
7158	10	Multiplexer	1 Form C	30V	100mA		<200μV	BNC
7153	4×5	Multiplexer	2 Form A	1300V	500mA	10VA	<50μV	Connector
HIGH CURRENT								
7053	10	Multiplexer	2 Form C	300V	5A	100VA	<1mV	Screw term.
THERMOCOUPLE								
7014	39	Multiplexer	2 Form A	110V	1A	60VA	<1μV	Screw term.

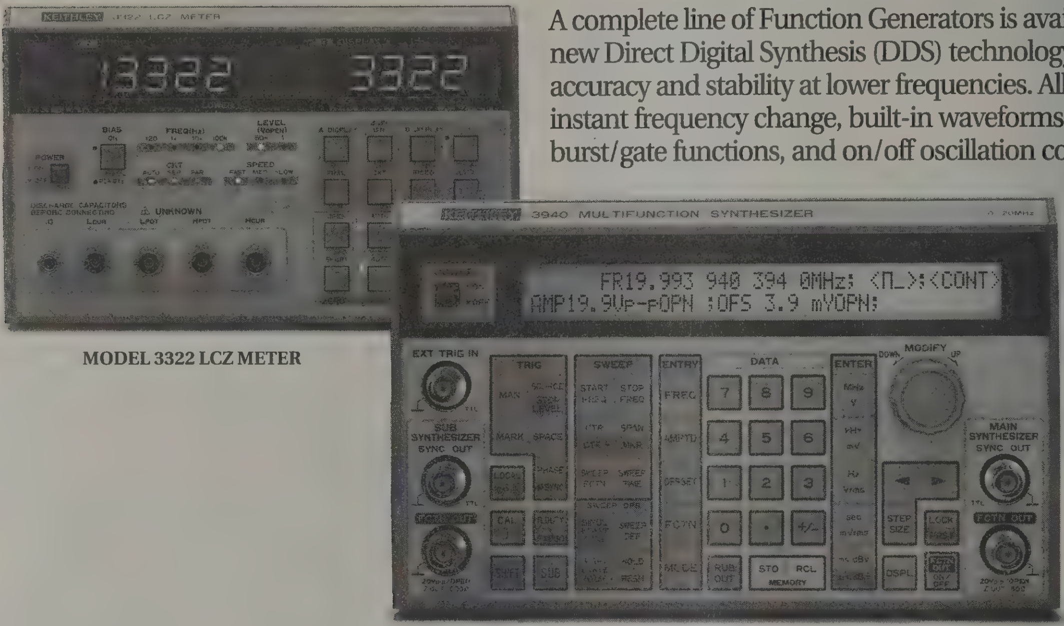
KEITHLEY

(800) 552-1115 • Fax: (216) 248-6168

LCZ Meters and Function Generators

Keithley offers three LCZ Meters with a range of test frequencies up to 100kHz. They feature automatic circuit selection for instant readings, plus manual or automatic triggering.

A complete line of Function Generators is available with the new Direct Digital Synthesis (DDS) technology for superior accuracy and stability at lower frequencies. All units feature instant frequency change, built-in waveforms, trigger/burst/gate functions, and on/off oscillation control.



MODEL 3322 LCZ METER

MODEL 3940 MULTIFUNCTION SYNTHESIZER

New LCZ Meters*

Model	3321	3322	3330
Test Frequencies	4	11	201
Resolution	4½-digit	4½-digit	4½-digit
Accuracy	0.1%	0.1%	0.1%
D and Q Resolution	0.0001	0.0001	0.0001
Phase Resolution	0.1°	0.1°	0.1°
AC Test Voltages	50mV–1V	50mV–1V	10mV–1.1V
Reading Rates:			
Slow (480ms)	•	•	•
Medium(150ms)	•	•	•
Fast (64ms)		•	•
% Deviation Binning		•	•
Handler Interface			•

*Measurement Parameters: L, C, R, |Z|, Q, D, ESR, G, X and θ.

New Function Generators

Model	3910	3930A	3940
Range	0–1.0MHz	0–1.2MHz	0–20MHz
Resolution (Hz)	0.1mHz	0.1mHz	0.1mHz
Resolution (Digits)	11	11	12
Accuracy	30ppm	5ppm	5ppm
Output Voltage	20V p-p	30V p-p	20V p-p
IEEE-488 Interface	Option	Built-in	Built-in
Sweep Capability		•	•
Arbitrary Waveform Capability			•
Dual Synthesizer Capability			•

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KIKUSUI

KIKUSUI INTERNATIONAL CORP.

KIKUSUI HI-POT TESTERS

TOS 9000 -- Automatic, fully programmable tester is GPIB or front-panel controllable. With options, provides up to 16 channels for hands-off operation (shown). Can be teamed with Kikusui's TOS 6100 30-amp continuity tester for a total safety test system.

Versatile, affordable Kikusui hi-pot testers meet worldwide safety requirements for testing new ISO 9000, UL, CSA, CEE, BS, and VDE applications.

- ☐ Zero cross turn-on for uniform waveforms with no transients
- ☐ Manual or timed, GO/NOGO testing
- ☐ Window comparator for low limit/high limit testing
- ☐ Multiple interlock protector circuits for easy integration into manual or automatic test systems
- ☐ Options include hands-off remote operation, warning lamps, and remote buzzers

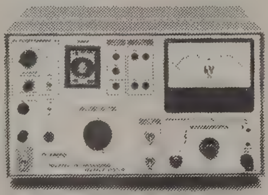
AUTOMATIC, HANDS-OFF SAFETY TEST SYSTEM

Model	Description
TOS 9000	0.2-5kV, 500VA AC leakage, 50-1000VDC, 1-9999MΩ
TOS 9010	Digital I/0 for robotic interface
TOS 9020	4 signal/4 trn HV switch matrix

AC & DC HI-POTS

TOS 8750 -
AC or DC, 0-5kV, 100mA AC, 25mA DC, 500VA

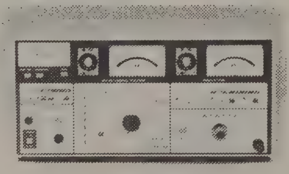
TOS 8700 -
AC or DC 0-10kV, 50mA AC, 10mA DC, 500VA



HI-POT & INSULATION RESISTANCE

HI-POT- AC only, 0-5kV, 100mA,500VA

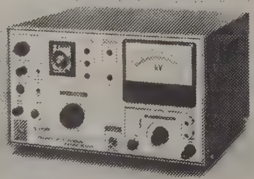
I/R - 500/1000VDC, 1-2000MΩ



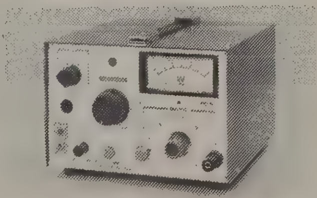
LOW COST MANUAL HI-POTS

TOS 8650 -
AC test only, 0-5kV, 100mA, 500VA

TOS 8651 -
AC test only, 0-5kV, 100mA, 500VA



TOS 8630 -
AC test only, 0-3kV, 10mA, 30VA

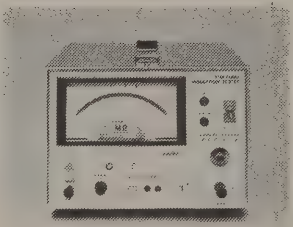


INSULATION RESISTANCE

TOS 7100L -
500/1000VDC, 0.1-200MΩ

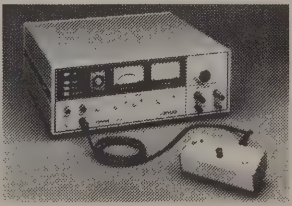
TOS 7100M -
500/1000VDC, 1-2000MΩ

TOS 7010L -
50/100VDC, 0.1-200MΩ



GROUND CONTINUITY TESTER

TOS 6100 -
Two ranges 0-0.12Ω & 0-0.6Ω, 3-30A AC



For manufacturer's sales offices, see yellow pages. Also see our ads under Oscilloscopes and Power Supplies.

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eem

MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

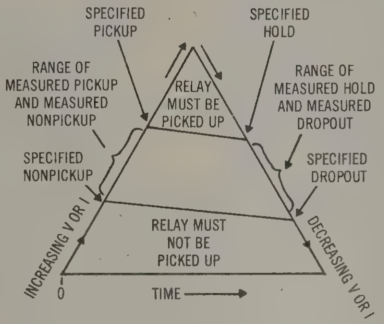
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

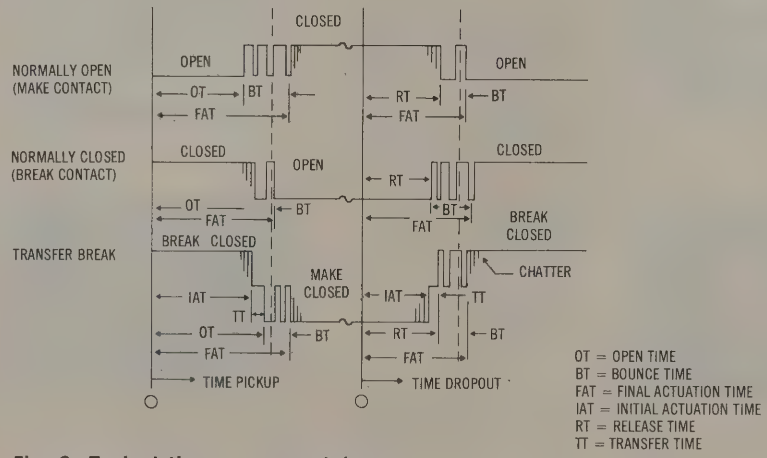

CLOSED
OPEN
NORMALLY OPEN (MAKE CONTACT)
OT
BT
FAT
RT
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
TIME PICKUP
TIME DROPOUT
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

KH KROHN-HITE
CORPORATION
255 Bodwell Street • Avon • Massachusetts 02322
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SIGNAL SOURCES

MODEL	FREQUENCY RANGE	FREQUENCY ACC. %	CONT	GATE	TRIG	SWP	PULSE	BURST	ARB	MAX. OUTPUT	FREQ. RESP. (dB)	SALIENT FEATURES	RACK MOUNT KIT ($50)	PRICE $
1000A	0.2Hz-3MHz	5	●							20Vp-p	0.1	1500:1 Tuning Dial, High/Lo Main Outputs	RK-39	650
1200A	0.2Hz-3MHz	5	●			●				20Vp-p	0.1	DC Offset, Lin Sweep, Ramp and TTL Outputs	RK-39	695
1400A	0.2Hz-3MHz	5	●	●	●	●	●	●		20Vp-p	0.1	Calibrated Sweep Start/Stop, Linear Sweep	RK-314	1095
1600A	0.2Hz-3MHz	5	●	●	●	●	●	●		20Vp-p	0.1	Linear and Log Sweep, Frequency Marker	RK-314	1195
2000	0.003Hz-30MHz	5	●				●			30Vp-p	0.1	Calibrated CV Output, Fixed and Variable DC Offset, 1/2 Watt Output Power	RK-58	1495
2100A**	0.03Hz-31.16MHz	0.5* ppm	●	●	●	●	●	●		30Vp-p	0.1	Synthesized, Data Modifier Knob, Non-Volatile Memory, Opto-Isolation	RK-516	4495
2100A-7 **	0.03Hz-31.16MHz	0.5* ppm	●	●	●	●	●	●		30Vp-p	0.025	Synthesized, Flat Response, Data Modifier Knob Non-Volatile Memory, Opto-Isolation	RK-516	4750
2200	0.003Hz-30MHz	5	●	●	●	●	●	●		30Vp-p	0.1	Fixed and Variable DC Offset Controls, Frequency Marker, Ramp and TTL Outputs, Lin/Log Sweeps (up or down)	RK-519	1895
2400	0.003Hz- 30MHz	5	●	●	●	●	●	●		30Vp-p	0.1	AM, FM, Phase Lock, Two Independent Generators	RK-519	1995
4100B	0.01Hz-1MHz	0.5	RC OSCILLATORS Low Distortion from 0.1% to as low as <0.001%							10Vrms	0.05	Pushbutton Freq. Tuning, 0.02% Distortion, Squarewave Output	RK-58	1850
4200B	10Hz-10MHz	2								10Vrms	0.025	<0.1% Distortion, Aux. 1Volt Output, Calibrated Attenuator	RK-58	1095
4300B	10Hz-10MHz	2								10Vrms	0.025	<0.1% Distortion, Selectable Squarewave, Calibrated Attenuator	RK-58	1150
4400A	1Hz-110kHz	0.5								7Vrms	0.05	Quadrature and Inverted Outputs, <0.001% Distortion	RK-39	1095
4500	1Hz-100kHz	10								7Vrms	0.05	Continuous Frequency Tuning, Inverted Output, Selectable Squarewave, <0.001% Distortion	RK-39	1050
5400C	0.002Hz-5MHz	1	●				●			30Vp-p	0.05	Calibrated Attenuator, Symmetry Control, Aux. Squarewave	RK-58	1495
5600 †	0.002Hz-2MHz	3	●							15Vp-p	0.1	Balanced 600 Ohm Output, Battery Operated, DC Offset	N/A	1250
5900C **	0.0001Hz-5MHz	0.5	●	●	●	●	●	●		30Vp-p	0.05	Frequency Stabilized, 1000 Step Auto-Programmer	RK-516	2445
5920 **	0.0001Hz-10MHz ‡	0.5	●	●	●	●	●	●	●	30Vp-p	0.05	Arbitrary Waveforms, Frequency Stabilized, 1000 Step Auto-Programmer, Z-Axis, 30k Bytes Non-Volatile Memory	RK-516	2995

‡5MHz Function Generator; *Option 006: High Stability Reference of 0.01ppm add $800; **IEEE-488 Programmable † Option BK-560, Battery Kit, add $300

PRECISION PHASEMETERS

MODEL	FREQUENCY RANGE	PHASE ACCURACY	RESOLUTION	INPUT WAVEFORMS	INPUT VOLTAGE RANGE	DISPLAY RANGE	BCD OUTPUT OPTION 001 ($225)	RACK MOUNT KIT ($50)	PRICE $
6200B	10Hz-1MHz	0.5°	0.1°	∿ ⊓	0.1-120Vrms	−180°/+180°	●	RK-38	1250
6600	10Hz-10MHz †	0.1°	0.1°	∿ ⊓ ∿ ⎍	0.01-320Vrms	0°-360°	●	RK-316	2295
6610	10Hz-10MHz †	0.05°	0.01°	∿ ⊓ ∿ ⎍	0.01-320Vrms	0°-360°, ±180°	●	RK-316	2995
6620 *	10Hz-10MHz †	0.05°	0.01°	∿ ⊓ ∿ ⎍	0.01-320Vrms	0°-360°, ±180°		RK-316	3695

†Option 002: 1Hz operation add $250; *IEEE-488 Programmable; option 004, RS232 replaces IEEE-488 interface

DISTORTION ANALYZERS

MODEL	FREQUENCY RANGE	INPUT SENSITIVITY (Vrms)	DISPLAY	DISTORTION RANGE %	VOLTMETER RANGE (Vrms)	OSCILLATOR OUTPUT	ADDITIONAL FEATURES	RACK MOUNT KIT ($50)	PRICE $
6880A	10Hz-110kHz †	0.1-130	3 Digit	%: .003 to 50.0 dB: −6 to −90	0.01-130	1kHz 5Vrms	Frequency Counter 10Hz to 500kHz IEEE-488 Programmability	RK-519	3500
6900B ‡	5Hz-1MHz	0.1-130	3 Digit	.005 to 19.0	1-130	1kHz 5Vrms	Auto Leveling Auto Ranging	RK-319	2400

†Option 001: 1Hz operation add $300; ‡Optional BCD Output add $300

WIDEBAND POWER AMPLIFIERS

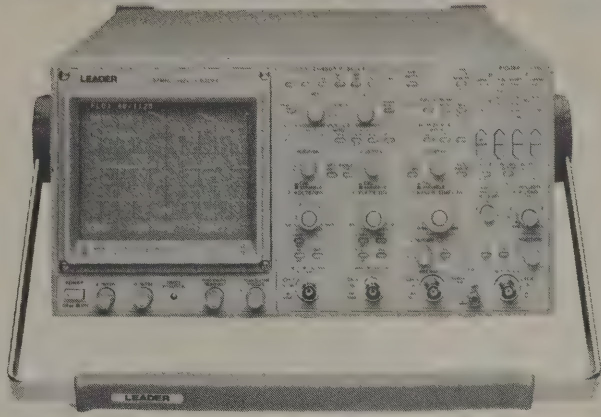
MODEL	FREQUENCY RANGE	OUTPUT POWER (WATTS)	DIST. %	FREQUENCY RESPONSE (dB)	INPUT VOLTS (rms)	MAXIMUM VOLTAGE GAIN	MATCHED LOAD (ohms)	MAXIMUM OUTPUT VOLTS	MAXIMUM OUTPUT CURRENT	RACK MOUNT KIT ($50)	PRICE $
DCA-10A	DC-1MHz	10	0.1	±0.1	10	10	600 to 1k	105rms	130mA	RK-519	2695
7500	DC-1MHz	75	0.1	±0.1	1.25	100	200	140rms	625mA	RK-519	2295

MATCHING TRANSFORMER

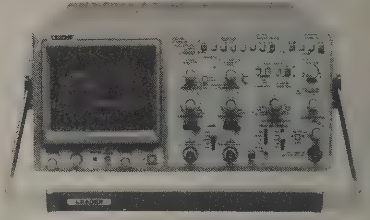
MODEL	FREQUENCY RANGE	OUTPUT POWER (WATTS)	INPUT VOLTS (rms)	TURNS RATIO	MATCHED LOAD (ohms)	MAXIMUM OUTPUT VOLTS	MAXIMUM OUTPUT CURRENT	PRICE $
MT-56R	30Hz-1MHz	75	125	10, 5, 2.5, 1.25	2 to 1k	100rms	6.5A	895

LEADER

Model 2250 250-MHz 4-Channel Oscilloscope

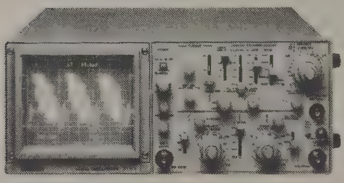


The Model 2250 combines the high accuracy of automatic calibration and precise interchannel time matching with extreme ease of use afforded by menu-driven setup choices, automatic sensitivity and time base setup, four digit on-screen frequency counter display and full cursor operations. Wide ranging trigger options include sync sourcing from one of the four channels, and P-P AUTO sync to maintain positive triggering despite wide amplitude changes.



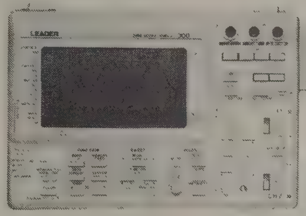
Model 3100D CRT Readout Digital Storage Oscilloscope

The Model 3100D full-featured digital/analog oscilloscope offers 100-MHz bandwidths in both DSO and analog modes. It features complete 2-channel operation, dual time base with calibrated delayed sweep, X100 expansion at pre-post trigger point, alternate sweep and triggering. It also offers separate display and reference memories.



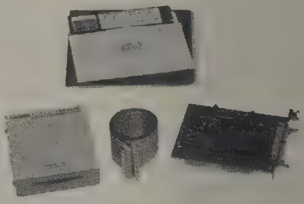
Model 8101 100-MHz Two Channel Oscilloscope

The Model 8101 features four trace operation with on-screen readout of basic settings and cursor measurements of voltage, time, frequency, voltage ratio and phase. Sensitivity ranges from 1 mV/div to 5 V/div in twelve steps with bandlimiting to 20 MHz in the 1 and 2 mV/div settings. Sweep speeds ads high as 5 ns/div are offered, and built-in CH-1, CH-2 delay lines allow observation of fast trigger edges.



Model 300 Combination DSO/DMM Data Logger/Logic Analyzer

The Model 300 is a handheld multi-function unit. The DSO features auto setup, on-screen readouts of frequency and channels 1 and 2 V p-p, separate A/D converters, 10-MHz repetitive and 3-MHz single shot bandwidths, 7-bit vertical resolution, 180 or 1.8 k user selectable word length. The time base ranges from 0.1 μs to 200 s per div.



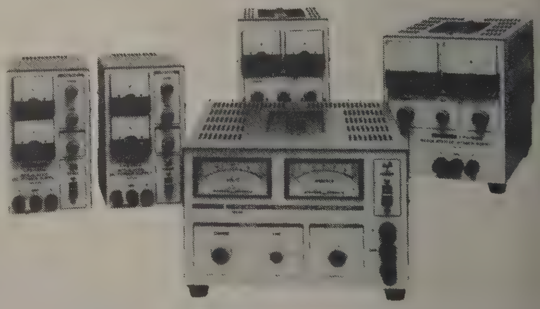
Model 300-PC Data Acquisition Kit

The Model 300-PC offers a total system solution for the uploading and downloading of waveforms and data between the memory card used with the Model 300 handheld DSO/DMM and personal computer. The software enables computer control of stored waveforms. Waveform data can be used for processing, analysis and statistics, and can be incorporated into word processing or spread sheet reports.

Model 326 100-MHz Attache Case Oscilloscope

Latest in the series of full-featured oscilloscopes small enough to fit in a 3" attache case, the Model 326 extends bandwidth to 100 MHz, and offers dual-channel PDA operation, alternate triggering with calibrated delayed sweep, and extensive triggering options.

LPS-160A Series Regulated DC Power Supplies



To meet a growing demand for bench dc power supplies, Leader offers the LPS-160A through LPS-164A. Each of the 5 models has a voltage range of 0-32 Vdc. Load currents of 0.5 to 5A are available, depending on the model selected. They feature excellent regulation and control facilities and can be stacked electronically for higher voltage output. A tracking facility permits parallel operation for greater load currents. Outputs are fully isolated so that two or more supplies may be stacked for additional output voltage. The supplies also track an externally-applied reference voltage to allow parallel connections of outputs, and permit two supplies to share total load current.

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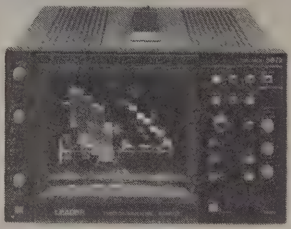
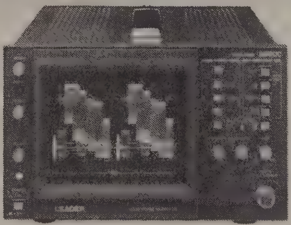
LEADER

Model 5870
Combination Waveform Monitor/Vectorscope w/SCH Phase



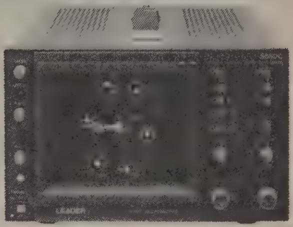
Model 5872/5872A
Combination Waveform Monitor/Vectorscope

The Model 5870 combination Waveform Monitor/Vectorscope provides alphanumeric readout of SCH phase, dual channel and dual filter display, R-Y mode and full line selection capability with 9 presets all in a half-rack mount AC/DC powered portable configuration. The Model 5872 provides all of the advanced features of the 5870 except for SCH phase measurement and full line selection. The 5872A includes full line select.



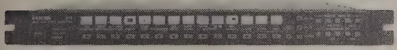
Model 5860C
Waveform Monitor

One of Leader's wide selection of waveform monitors, the Model 5860C provides differential step capability for luminance linearity measurements – a feature typically found only on full-rack waveform monitors.



Model 5850C
Vectorscope

A companion vectorscope to the Model 5860C Waveform Monitor, the 5850C provides a unique patented technique which electronically displays the error limit boxes. This improves the accuracy of phase and amplitude adjustments.



Model 411
NTSC Sync/Test Signal Generator

An ideal choice as the master sync and test signal generator for production, post production, component and systems maintenance and the engineering lab.

Model 408
Multi-Format NTSC Test Signal Generator

The Model 408 offers video test patterns and U.S. and foreign broadcast and cable channels. The 408 is genlockable and features both multiburst and sweep to 15 MHz.

Model 5864A Two-Channel EFP/ENG Waveform Monitor
Model 5854 EFP/ENG Vectorscope

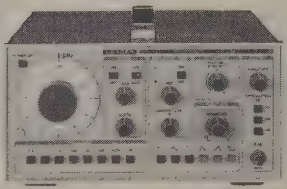
The Model 5864A and Model 5854 bring all the important capabilities of half-rack waveform monitors and vectorscopes into easy-to-use handheld, battery-powered units. Careful thought have been given to the reduction of operating controls to facilitate the maximum in monitoring options with the operating simplicity demanded in field work.

Model 1605
Programmable RGB Generator

Designed to test and evaluate CRT displays used in high-resolution computers, CAD/CAM stations and military displays, the Model 1605 advances the maximum pixel-clopck frequency to 300 MHz. Among the advances over previous models is a new concept called GUI, Graphic User Interface, that combines on-screen displays of menus and graphics with mouse control.

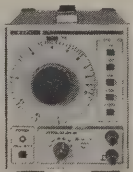
Model 3221
2.7-GHz Synthesized Signal Generator

The Model 3221 offers 100 kHz - 2.7 GHz range, 10/20 Hz resolution, 0.05 ppm accuracy, ≤ -120 dBc SSB phase noise, 7 modulation modes, 14 combination modulation modes with GAas FET pulse modulation and GPIB standard.



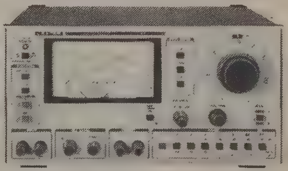
LFG-1300S
2-MHz Sweep/Function Generator

The LFG-1300S is a general urpose signal source with a broad range of research, design, educational and service applications. Outputs include sine, square, triangle, ramp and pulse signals.



LAG-120B
Audio Generator

The LAG-120B audio generator is used for designing, testing and servicing audio equipment. It features 3% dial accuracy of frequency and 50 dB step attenuators in 10 dB steps with a -20 dB continuously variable control.



LDM-171
Semi-Automatic Distortion Meter

With the LDM-171, distortion measurements on audio equipment have been made faster. This versatile instrument incorporates an auto-nulling feature below 1% THD + N and S/N ratio of 80 dB below the reference level.

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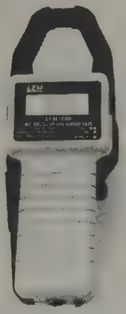
. . .use Hall Effect technology to accurately measure current, power factor, frequency and resistance for diagnostic and analytic applications.

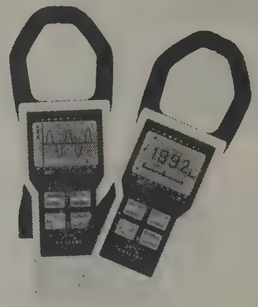


LEM Ammeters
For the Electrical Engineer

Measure to 2000A; DC to 1kHz. True RMS capability. Accuracy ±1%, 3-$^1/_2$ Digit Display, Hold facility, Auto Zero, Auto Ranging, Jaw size 22mm x 60mm. Output can be displayed on oscilloscopes and chart recorders.

New!

THE ANALYST 2000P



LEM Power Meter 2000P
For the Electrical Engineer.

Ideal for investigating complex waveforms. A large LCD graphically displays both current and voltage signals in alphanumeric, bar graph and wave forms. Provides multimeter and oscilloscope functions. DC & AC to 2kA; 750V.

LEM 600 Multimeters
For the Electrician.

Measures to 600 Amperes and 750 Volts, both AC and DC with frequency range to 1000Hz. plus resistance to 2000 ohms. Jaw size is 48mm circular.

CLAMP-ON AMMETERS

Current Ranges	Readout	Model	Frequency	Auto Ranging	Hold	Surge	Outputs①
20A/100A DC or AC	True RMS	LEM100	DC to 1kHz	Yes	Yes	Yes	1mV/A
200A/1000A DC or AC	True RMS	LEM1000	DC to 1kHz	Yes	Yes	Yes	1mV/A
200A/1000A DC or AC	Average	LEM 1000AV	DC to 1kHz	Yes	Yes	Yes	1mV/A
200A/2000A DC or AC	True RMS	LEM 2000	DC to 1kHz	Yes	Yes	Yes	0.4mV/A
200A/2000A DC or AC	True RMS	LEM 2000L	DC to 1kHz	Yes	Yes	No	No
20A/200A/ 2000A AC	True RMS Responding	LEM 2000AC	15Hz to 3kHz	20A/200A	Yes	No	No

①Output can be displayed on Oscilloscopes and Chart Recorders

CLAMP-ON PROBES

Current Ranges	Measures	Model	Frequency	Outputs②
20A/200A	DC or AC	PR 200	DC to 10kHz	10mV/A at 20A, 1mV/A at 200A
400A	DC or AC	Auto 400	DC to 10kHz	1mV/A
500A	DC or AC	PR 500	DC to 3kHz	2mV/A
1000A	DC or AC	PR 1000	DC to 3kHz	1mV/A

②For use with Multimeters and Oscilloscopes.

CLAMP-ON MULTIMETERS and POWER METERS

Current Ranges ③	Volts ③	Resistance Range	Active Power	Apparent Power	Power Factor	Frequency	Continuity Check	Hold	Ranging	Surge	Outputs ④	Insulation
LEM 600 Multimeter												
200A/600A DC or AC RMS Responding	200V/1000VDC 750VAC RMS Responding	2000 Ohms	No	No	No	15Hz. to 400kHz.	Buzzer	Yes	Manual	No	No	6kV
LEM ANALYST 2000P Power Meter												
40A/400A 2000A DC, Average, True RMS, or Peak.	0 to 1000VDC 750VAC DC, Average, True RMS, or Peak	4k Ω 40k Ω 400kΩ	4kW 40kW 400kW 2000kW DC, AC or True RMS	4kVA 40kVA 400kVA 2000kVA True RMS	0.3 Capacitive, Inductive	5Hz. to 1kHz.	0 to 1000 Ohms Buzzer	Yes	Auto	Yes	Yes	6kV 50Hz. 1 Min.

③ Model 2000-P provides both digital and graphical display in Current and Voltage settings. ④ Output can be displayed on Oscilloscopes and Chart Recorders

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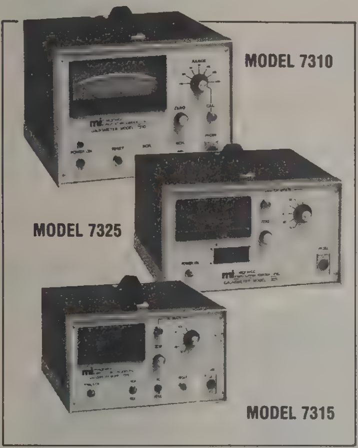
HALL EFFECT GAUSSMETERS

The wide line of Magnetic Instrumentation, Inc. Gaussmeters shares the following features:

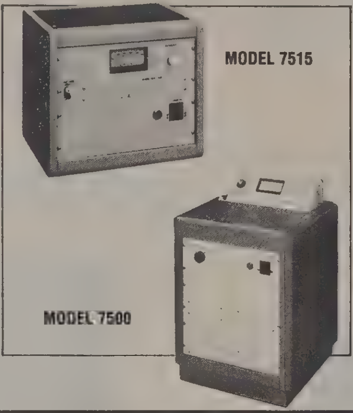
- Magnetic field measurements from 1 Gauss to 100,000 Gauss.
- Output voltage accurate to 10X over range.
- Simple setup and operation with front panel controls.
- Accurate internal calibration.
- Wide range of high linearity Hall probes.



MAGNETIZERS

The Magnetic Instrumentation Capacitive Discharge type Magnetizer line features the following:

- High speed production operation.
- Energy levels from 300 to 5400 Joules.
- Low voltage — 425 volts maximum.
- Saturation of all Alnico, Barium Ferrite, Rare Earth Cobalt magnetic materials.
- Continuous meter readout of capacitor voltage.
- Wide variety of fixtures including multi-pole fixtures.
- Control prevents firing below preset level.



INTEGRATING FLUXMETERS

Fluxmeters by Magnetic Instrumentation, Inc. provide:

- Very low drift rate.
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- Up scale and down scale push button drive.
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- Solid state circuit design.

MODEL 7386
MODEL 7383

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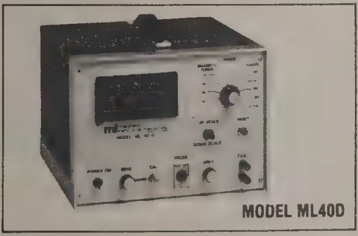
Magnetic Instrumentation's perfect answer for a dual-purpose test instrument for use where an Integrating Fluxmeter and a Hall Effect Gaussmeter are needed . . . but not simultaneously.



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The 8000 Series Magnechargers are half cycle type magnetizers designed for use in high volume production situations.

- High speed operation to 3000 charging cycles per hour.
- Controllable output currents to 6000 amps.
- Safe, heavy-duty NEMA 12 type construction.
- Manual or automatic operation.
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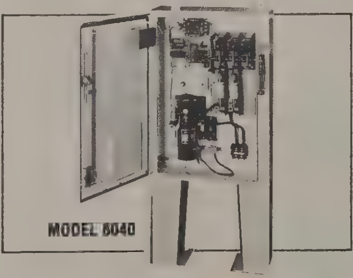

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Magnetic Instrumentation, Inc., can meet your every need from a flexible range of existing designs, modified designs, and custom designs. Our innovative and experienced engineers can provide magnetizing, measuring, stabilizing and demagnetizing systems built to NEMA 12/JIC specifications. These systems, including automatic parts feeding, are designed to your specifications.

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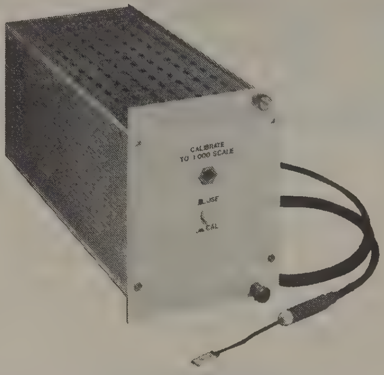
MAGNETIC TEST EQUIPMENT

Model 1607 Field Monitor



- High stability field to volts transducer for O.E.M. applications.
- Sensitivity 0.1V/kG standard Other scale factors available
- Includes pre-calibrated low temperature coefficient probe
- Bare-board version available

Model 1246L-2 B, H Tape Test

- Digital readout of ϕm, Hm, ϕr, Hci
- Peak drive 100–3000 Oe
- Flux sensitivity .1 maxwell to 2×10^3 maxwells
- Accommodates single tape samples as well as loose powder in tubes
- Complete test in less than 10 seconds
- 50 Hz operation available

Model 1600 Hall Effect Gaussmeter

- Scale ranges from 10–100k gauss for standard probes
- DC, AC (to 1k Hz), PEAK modes of operation
- Instrument scales automatically coordinated with probe sensitivity
- Compact rugged case

Model MXM-5 Fluxmeter

- DC and AC flux measurement
- Scale range 1.000 to 9.999 kilomaxwells times 10^1 to 10^3
- DC drift less than 100 Mx turns per minute. No AC drift.
- Digital meter for measurement
- Analog meter for drift control

MAGNOS, Incorporated supplies complete test systems for magnetic analysis and quality control for hard and soft materials, laboratory electromagnets and power supplies, coil test sets, and a complete line of magnetic measuring instruments.

Custom design and assembly of electronic equipment is also available. Manufacturing services include circuit board, chassis, and harness assembly, and are fully supported by in-house facilities for short-run machining, sheet metal fabrication and coil winding.

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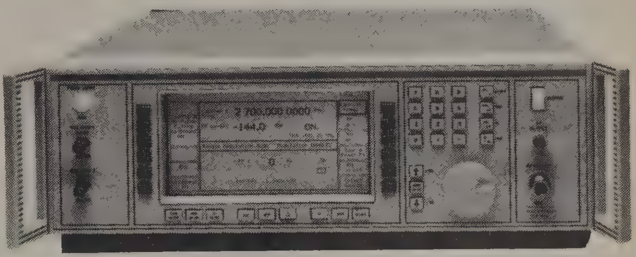
Marconi
Instruments

SIGNAL GENERATORS:

Model 2030/31 AM/FM/ΦM/PULSE Signal Generators Combine RF generator, sweep generator, and dual LF source in one unit with RF coverage 10 kHz to 1.35 GHz (2030) or to 2.7 GHz (2031) and 5.4 GHz (2032), LF coverage 0.1 Hz to 500 kHz. Step size 0.1 Hz at all frequencies. Computer-like LCD screen shows all functions & readouts within each measurement task. Wideband FM, DC to 10 MHz, Pulse option, 5 ns rise/fall time, 70 dB on/off ratio. IEEE.488.2 interface.



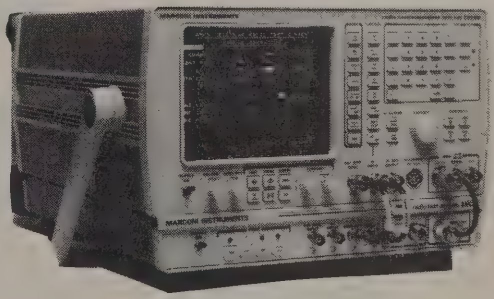
Model 2040/41/42 Low-Noise Signal Generators are the same as models 2030/31/32 except, in low noise mode, phase noise is –140 dB/Hz and residual FM is 0.3 Hz (both specified at 1 GHz).

Model 2022D AM/FM/ΦM Signal Generator is a small (half-rack) lightweight high-performance instrument with RF coverage 10 kHz to 1.0 GHz. Optional GPIB.

Avionics Option for 2030/40 series Signal Generators: This option provides internal generation of waveforms suitable for testing Instrument Landing Systems (ILS) and VHF Omnidirectional Radio Range (VOR) systems.

RADIO COMMS. & CELLULAR TEST-SETS:

Model 2955B with option 1 has 1μV off-air sensitivity. Makes menu selected tests of radios under simplex, duplex and cross-band duplex (including cross mode) conditions. Most versatile POCSAG, DTMF and CDCSS encode/decode facilities available. Tests systems from audio through RF with incredible ease & speed. AC and DC operation.



Model 2957B Cellular Test Set performs pass-fail and in-depth testing of cellular telephones to AMPS and N-AMPS standards. Full cell-site simulation. Custom routines via optional disk drive Parallel printer output.

Model 2957D Digital Cellular Test Set tests TDMA (D-Amps) dual standard mobiles as defined in TIA documents IS-54. It also tests mobiles using current analog AMPS channels plus the new N-AMPS narrow bandwidth channels using either the anolog or digital standards.

MICROWAVE TEST SET:

Model 6200 Microwave Test Set is an innovative instrument engineered to combine many measurement functions in a compact and portable package. The high accuracy specification and its portability make it equally suitable for both bench and field applications.

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It is more than just an instrument however, it is a total test system. In a single unit the facilities of a precision synthesized sweep generator, four input scalar anlyzer with color display, power meter, frequency counter programmable voltage/current source, and transmission line fault location are combined.

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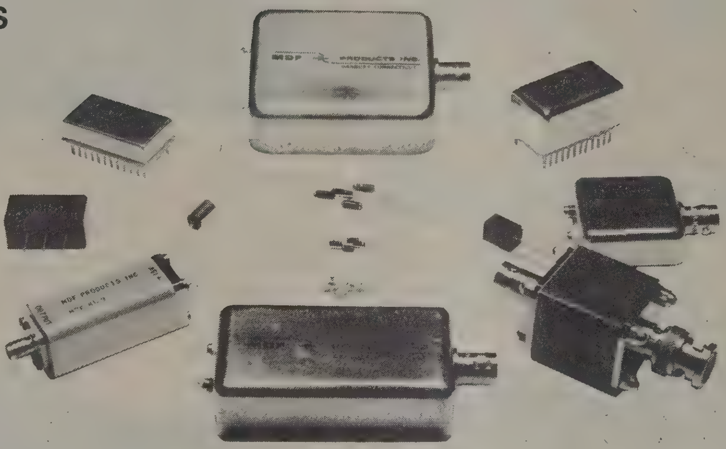
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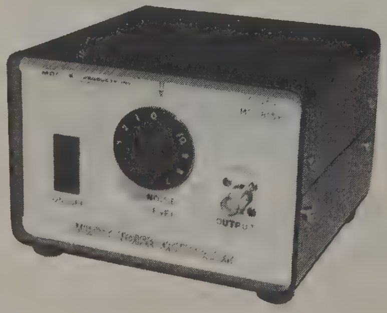
NOISE LEVEL
OUTPUT

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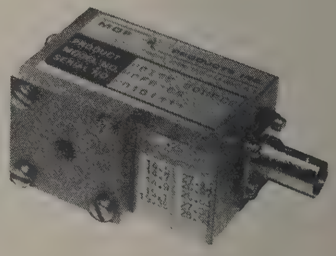
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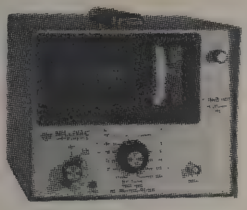
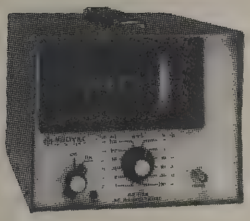
NEW



AC MILLIVOLTMETER TRUE RMS MODEL MV-714A

1μV to 300V
-71dB to +52dB
10Hz to 20MHz

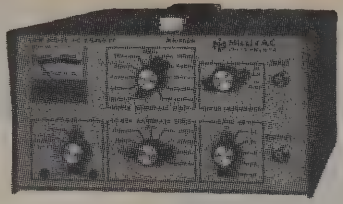


AC MILLIVOLTMETER MODEL MV-712A

10μV to 300V
-71dB to +52dB
5Hz to 15MHz

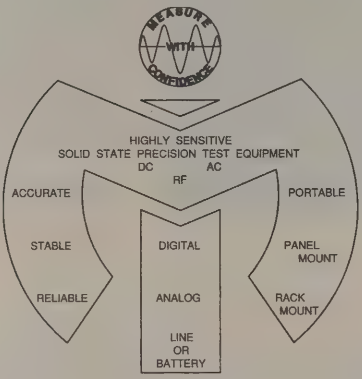
RF MILLIVOLTMETER MODEL MV-723B A

10KHz to 1.5GHz
50μV to 300V
True linear response
True RMS indication
Programmable
Autoranging



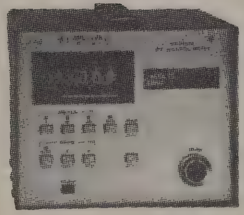
LOW NOISE AC AMPLIFIER MODEL MA-168A

10dB to 60dB variable gain
5Hz to 500KHz variable bandpass limits
10KΩ or 10MΩ input impedance



MEASURE
WITH
CONFIDENCE
HIGHLY SENSITIVE
SOLID STATE PRECISION TEST EQUIPMENT
DC
AC
RF
ACCURATE
STABLE
RELIABLE
DIGITAL
ANALOG
LINE OR BATTERY
PORTABLE
PANEL MOUNT
RACK MOUNT

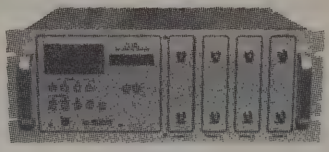
NEW



RF MILLIVOLTMETER MODEL MV-1023A

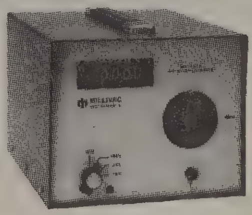
10KHz to 1.5GHz
50μV to 300V
-60db to +63dB
True linear response
True RMS indication
Microprocessor controlled
Autoranging
IEEE 488.2 Interface
SCPI Language
Option - MATE Compatible

NEW



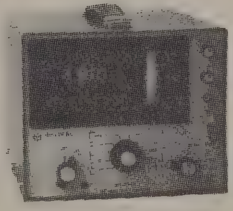
LOW NOISE 4 CHANNEL AC AMPLIFIER MODEL MA-168A

1dB to 60dB variable gain
5Hz to 500KHz bandpass limits
10KΩ or 10MΩ input impedance
IEEE 488.2 Interface
SCPI Language



DC KILOVOLTMETER MODEL MV-731A

1V to 10,000V
4.5 Digit Readout
.05% Accuracy
100MΩ Input Impedance



DC NULL METER MODEL MV-753A

±.1μV to ±1,000V
±.1pA to ±10mA
Null from ±.1μV to ±300mV
Floating or chassis ground

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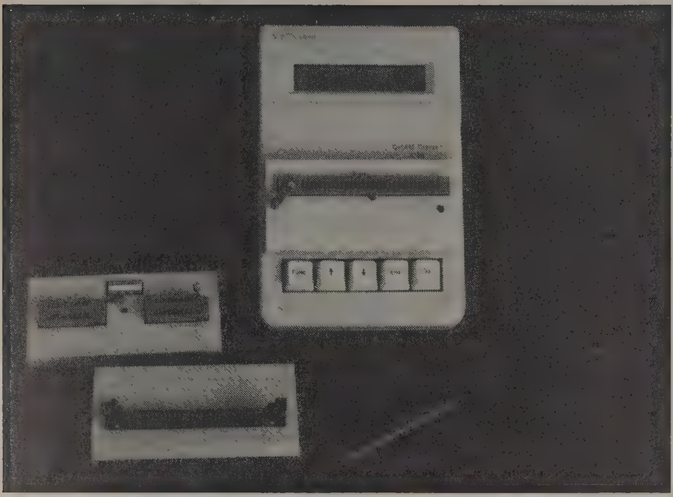
PHONE: (518) 355-8300 FAX: (518) 356-5161

MiNT Systems®

Designed for Versatility



3200 Dram Tester

3200 SERIES

- **State-of-the-Art Palm-Size, Portable Instrument**
- **Test DRAM's from 16-pin DIP to 72-pin SIMM**
- **Cost Effective**
- **Access Time 20nS to 500nS**
- **Hard copy Test Results and Statistics Reports**
- **Wide Variety of Data Patterns.**

Special Functions

☑ Chip heat test to check device reliability under accelerated life test environment.
☑ Cycling among three test voltages or bouncing between the extreme levels to insure the memory devices endure worst operating condition.
☑ Selectable test modes: QUICK for IQC sampling; NORMAL for production testing; LOOP for reliability testing: BIT-BY-BIT for sorting failed chips from SIMM/SIP.
☑ The statistics mode shows each of the accumulated error counts of the tested devices for further analysis.
☑ Printer interface offers hard copy test results and statistics reports.
☑ The auto search mode precisely locates actual access time, refresh time level and memory configuration.

Technical Specifications

Memory Type
Single Chip: 64Kx1, 256Kx1, 1Mx1, 4Mx1
64Kx4, 256Kx4, 1Mx4

SIMM/SIP:
30-Pin: 64Kx8, 256Kx8, 1Mx8, 4Mx8,16Mx8
64Kx9, 256Kx9, 1Mx9, 4Mx9,16Mx9
72-PIN: 256Kx32, 512Kx32, 1Mx32, 2Mx32, 4Mx32, 256Kx36, 512Kx36, 1Mx36, 2Mx36, 4Mx36

Access Time Tested
20, 25, 30 , 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 120, 150, 500ns

DUT Test Voltage
4.5V, 5.0V, 5.5V, fixed, cycling, or bouncing

Test Mode
Quick, Normal, Loop

Special Routine
Pre-Heat Up, Bit-By-Bit

Auto Search
Access Time, Refresh Time Reference, Configuration

Test Result
PASS/FAIL, ERROR Message, Statistics Summary

User Interface
Keypad, 20x2 LCD, Buzzer, Parallel Printer Port

General Information

Temperature:	0° to 50°C operating -40°to 70°C storage
Relative Humidity:	0 to 85% operating
AC Adapter:	110V or 220V to DC 9V at 1A
Size:	7.1"(L) x 4.7"(W) x 2.6"(H)
Weight:	21 oz.

Ordering Information

Model:
MiNT Systems 3200 DRAM Tester

Warranty:
One year standard product warranty

Accessories:

Test Fixture Adapters:
3201-01 for 64Kx8 to 16Mx9, 30-pin SIMM
3201-02 for 64Kx8 to 16Mx9, 30-pin SIP
3201-03 for 64Kx1 to 4Mx1, 16 to 20-pin DIP
3201-05 for 256Kx32 to 4Mx36, 72-pin SIMM

***Please see other MINT Systems' products in section 4050 on page D•2283 of this catalog.
To place an order or to obtain more information on any of our products
call (408) 262-7171 or fax (408) 262-5387***

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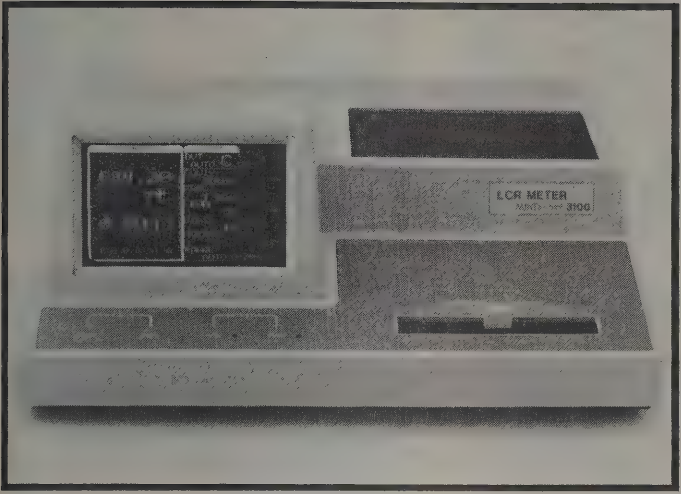
MiNT Systems Corporation 1633 S. Main Street, Milpitas, California 95035 USA

MiNT Systems®

Designed for Versatility



3100 LCR Meter

- Easy menu-driven operation
- 0.1% basic accuracy
- 5-digit resolution
- Wide measurement range
- 100 Hz to 20 KHz;
  50 mv to 1 V test signals
- Self test and calibration
- Complete parameter CRT display

Specifications

Parameters Measured
Resistance: R, Q, Cp or Cs, Lp or Ls
Inductance: L, Q, ESR or EPR

Display
A 5-inch CRT display

Display Resolution
Dut equivalent values (R, L, C):
5 digits
Dissipation/Quality factors (D, Q):
4 digits

Equivalent Circuit
Series or Parallel selectable for all ranges

Test Frequency
7 menu selectable test frequencies:
100 Hz, 120 Hz, 400 Hz, 1 KHz, 5 KHz, 10 KHz, and 20 KHz

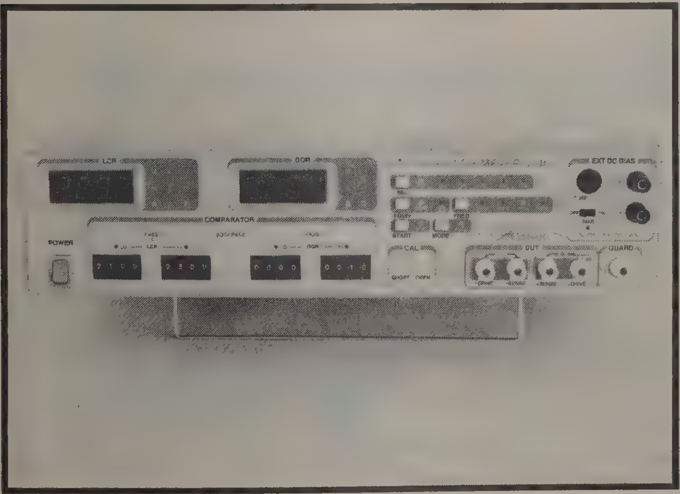
Test Signal Level
5 test signal RMS voltage levels:
50 mV, 100 mV, 250 mV, 500 mV, and 1 V

DC Bias
Internal Bias: Selectable from 0.6 V or 2 V
External Bias: 0 V to 60 V

Display Range
R: 0.0001 ohm to 9999 Mohm
L: 0.0001 uH to 9999 H
C: 0.0001 pF to 9999 mF
D: 0.0001 to 9999
Q: 0.0001 to 9999

Accuracy
L, C, R basic accuracy: 0.1%
D or Q accuracy: 0.1% + 1 digit @ D or Q = 1

Data Averaging
Average reading, selectable from 1, 3, 5, 10, 10, and 100 test sequences



3140 LCR Meter

- Easy to use
- 0.2% basic accuracy
- 4-digit resolution
- Wide measurement range
- 100 Hz to 10 KHz;
  250 mV test signal
- Self test and calibration
- Optional Pass-Fail comparator
- Low cost

(Please see also page D•2283 in 4050.)

To order or obtain more information about the above products or other product lines, such as the standalone **Digital Storage Oscilloscope (DSO)**, **Signal Generator/Synthesizer**, or **LCR Meter**, call (408) 262-7171 or fax (408) 262-5387.

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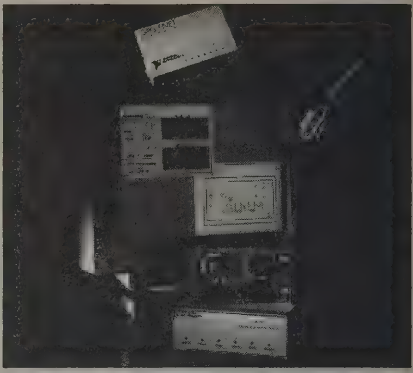
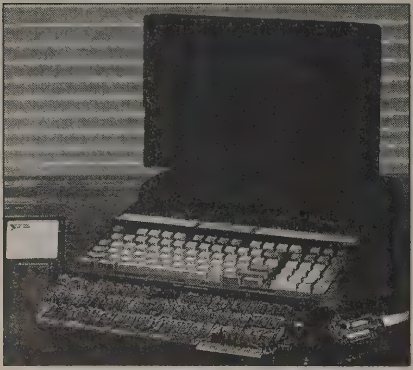
NATIONAL INSTRUMENTS
GPIB-130
Bus Extender
Power
Link
Talk
Listen

Bus extenders and expander/isolator

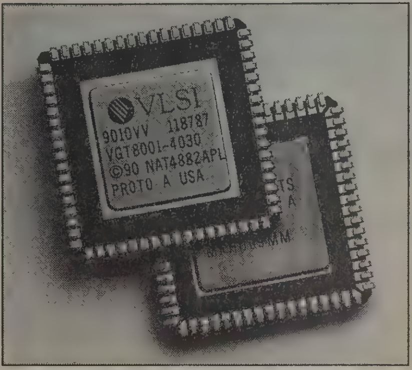
Embedded VXI controllers



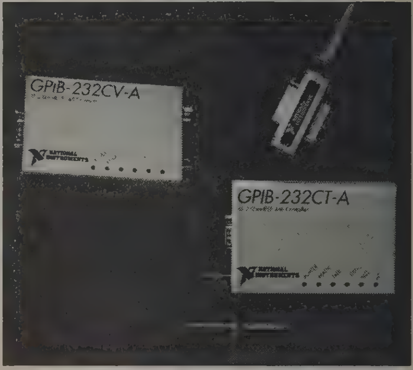
IEEE 488.2 interfaces for desktop workstations



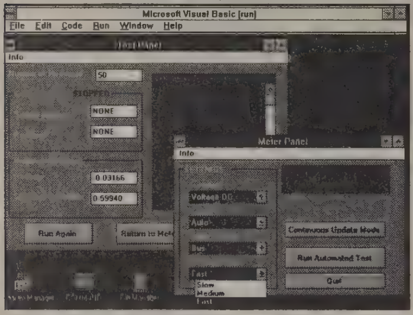
Bus analyzer


VLSI
9010VV 118787
VGT8001-4030
©90 NAT4882APL
PROTO A USA

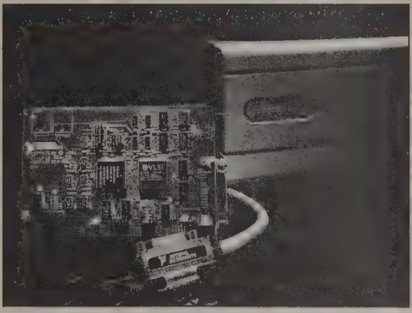
Custom GPIB chips – NAT4882™ and Turbo488®


GPIB-232CV-A
NATIONAL INSTRUMENTS
GPIB-232CT-A
NATIONAL INSTRUMENTS

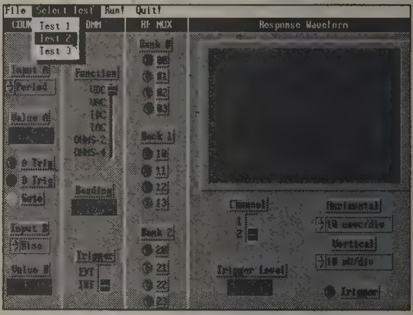
RS-232 to GPIB converter and controller


Microsoft Visual Basic [run]
File
Edit
Code
Run
Window
Help
Test Panel
Meter Panel
Run Again
Continuous Update Mode
Run Automated Test
Quit

NI-488.2™ software



IEEE 488.2 interfaces for PC/XT/AT/EISA, PS/2, and Macintosh


File
Select Test
Run!
Quit!
Test 1
Test 2
Test 3
DMM
RF MUX
Response Waveform
Function
Channel
Horizontal
Vertical
Trigger Level

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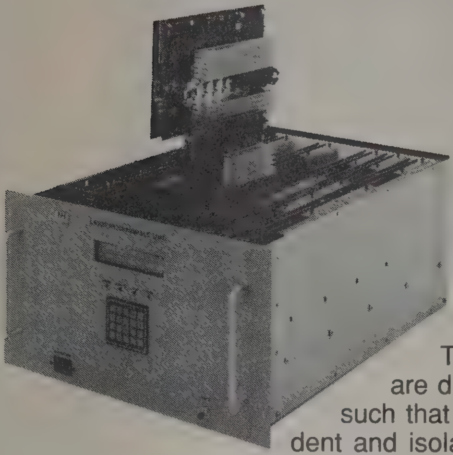
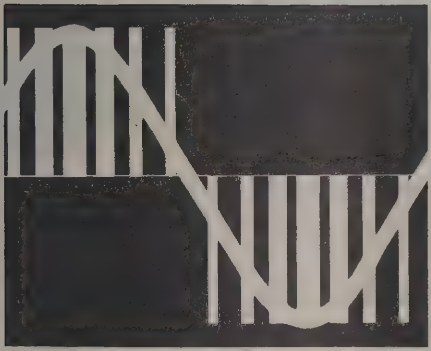
Dynamic Load Subsystem
L4000 SERIES



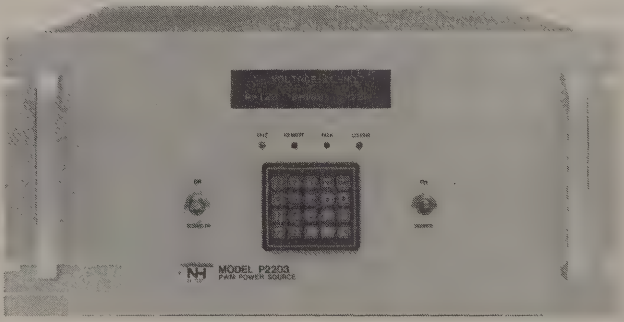
- ***Modular high density packaging saves rack space and simplifies maintenance.***
- ***Sophisticated diagnostics and software calibration specifically for use in ATE applications.***
- ***IEEE-488, MATE (CIIL) or front panel keyboard control.***
- ***Loads may be used in parallel up to 80KW, 3840 Amps.***

The L4000 SERIES Dynamic Load Subsystems are designed using instrument-on-a-card load modules such that a single controller can control up to 32 independent and isolated load modules. The product is configured to match specific load requirements by selecting from a number of standard load modules. Each load module is programmable for 1.5V to 400V, constant current, constant resistance, constant voltage, constant power or pulse modes.

Programmable AC Power Sources
P-SERIES



- ***High efficiency PWM design reduces size, weight and waste heat.***
- ***High peak in-rush current for testing switching power supplies and other non-linear loads.***
- ***Sophisticated diagnostics and software calibration designed specifically for use in ATE applications.***
- ***Modular high density packaging saves rack space and simplifies maintenance.***



The key to the 85% efficiency of our PWM Series power sources in pulse-width modulation. The diagram shows how the sine wave output of our AC sources is created electronically, by a series of pulses whose widths vary according to the amplitude they represent.

For you, that means cooler operation, smaller size and less weight than conventional AC sources. With our PWM sources, you can save on the power that's producing wasted heat as well as the cooling power required to get rid of it.

Call today for more information 714/**474-3900**

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8051 Family In-Circuit Emulator

The EMUL51-PC is a high performance in-circuit emulator specifically designed to give an optimized environment to develop your 8051 family microcontroller hardware and software. The EMUL51-PC consists of a board which plugs directly into the IBM PC/XT/AT bus. The optional Trace board features an advanced trace function with sophisticated trigger capabilities.

The POD, which plugs into the target system, is connected with a 5 ft. ribbon cable to the emulator board to provide a flexible operating range.

Optionally an RS-232 box can be used. It communicates with the PC at up to 115K baud.

User friendly

The friendly user interface is one of the key features of the EMUL51-PC. Pull-down menus, mouse support and on-line help make the infrequent user feel instantly at home. The more experienced user will appreciate the fast command line interpreter and the comprehensive command set with powerful macros.

The data windows on the screen contain up-to date information on symbols and memory areas. All commands are supported with context sensitive help information. If more help is needed the whole manual is on-line, available with a key stroke.

As an alternative, a Borland key press compatible user interface is available from ChipTools.

High level debugging

Using a high-level language for code generation is a way to cut development time. EMUL51-PC gives full support for debugging directly in C or PL/M source code. This eliminates tedious symbolic debugging in assembler.

With the EMUL51-PC you can mark breakpoints directly in the source code window, and it's easy to follow the program execution on the screen listing. All C variables, both local and global, can easily be displayed or altered in one of the dedicated windows. All variables are displayed in the form they were declared in your software. This way you can work directly with floats, arrays, pointers, structures, etc.

Real time Trace

The EMUL51-PC offers trace features not found in other emulators. For instance the trace buffer can record up to 256K bus cycles with 64 bits of data. The trace can be operated "on-the-fly" which means that it can be viewed, programmed and retriggered without disturbing program execution. With the trace set-up menu you can define exactly what events are to be stored in the trace buffer. The real-time trace can be stopped (triggered) at a selected event or after a combination of multiple events. By aligning the trigger point anywhere in the trace buffer you have a full choice of pre- and post triggering.

Nohau Corp. 51 E. Campbell Avenue Campbell, CA 95008 (408) 866-1820 FAX: (408) 378-7869

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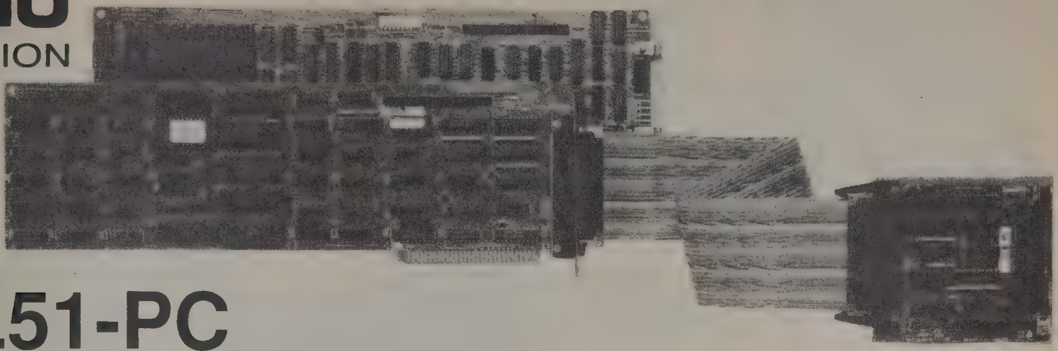

EMUL51-PC

Saves time on all 8051 family projects.

EMUL51-PC is an in-circuit emulator dedicated to the 8051 family. The EMUL51-PC truly emulates the microcontrollers from all manufacturers of 8051 derivatives. This means that your EMUL51-PC will work just like your microcontroller when it is plugged into your target.

System Specification

Host
IBM PC/XT/AT, PS/2 or compatible.
Minimum 640K of RAM.
Monochrome, CGA, EGA or VGA in 25, 43 or 50 line mode.

External Box
The emulator boards can be installed in an external box with serial communication to PC. Up to 115K baud supported.

Languages supported
Third party assemblers, PL/M-51 and C-51 compilers.

High level debugging
Window for source level debugging. Single Step or Line Step with breakpoints marked directly in the code. Full support for local or global variables in C-51.

In-line Assembler and disassembler
Full instruction set and symbols supported.

Symbolic Support
Full symbolic debugging and type checking. Same symbols can be used in different modules.

File formats Supported
Intel HEX/OBJ/OMF/SYM, Avocet, Archimedes/IAR Franklin/Keil, BSO/Tasking, Intermetrics/Whitesmiths.

Real time Emulation
Full speed emulation up to 40 MHz.
No wait states and no intrusion on memory, stack, I/O or Interrupt pins.

Emulation Memory
64K XDATA memory and 64K CODE memory. Up to 256K with bankswitch option.

Memory Mapping
Mappable in 4K pages.

Macros
Test session automation and macro command definition. IF/ELSE, REPEAT/WHILE structures.

Debug Session Logging
Record emulation session and all setups to a file.

Breakpoints
64 K program breakpoints.
64 K data read and write breakpoints.
Break on external signal.
Break on direct access to internal bit or byte memory.
Break on a range of addresses.

With the trace board option you can break on any 48 bit combination of address, data, RD, WR, OP code fetch, interrupt level, ports of external signals.

Single Stepping
Single or multiple instruction stepping. Step over calls and interrupts.
Line stepping in high level languages.

Execution timer
Resolution down to half a cycle.

Real Time Trace (optional)
256K deep by 64 bits wide with time stamp.

Trace operation
At each cycle of execution 48 bits of address, data, ports and external signals are compared with eight independent "48 bit registers" to produce eight "condition signals". These eight conditions are then combined with six bits from a "64 state state-machine". The combination of these 14 signals creates a new state (or retains the old state). It also produces a TRIG and a FILTER signal that are used to control what is saved in the trace buffer. If the eight condition signals are named A, B, C, D, E, F, G and H an example of how this could be used follows:

A THEN B THEN C THEN D THEN E THEN F THEN G THEN H where A - H could be code addresses.

The trace buffer can be viewed, reprogrammed and restarted without affecting emulation.

Trigger Breakpoint
The 48 bit trace trigger qualifiers can be used to define complex breakpoints also on program execution.

Trace Display
Display trace in disassembled symbolic or binary/hex form, or as high level source code. Display can be saved to a file.
Trace can be started, stopped and displayed independent of program execution.

Program Performance Analyzer
Histogram and statistical information of program execution in real time.

Supported chips

Intel
8051, 8052, 8031, 8032, 80C51, 80C52, 80C31, 80C32, 8751, 87C51, 8344, 8051SL, 80C152, 80C452, 8XC51FA, FB, FC, 80C51GB

OKI
80C31, 80C51, 80C154

Siemens
8051, 8031, 8031A-20, 80532, 80535, 80C535, 80C515, 80C537, 80C517, 80C515A, 80C517A, SAB501/502/503

Philips, Signetics
8051, 8031, 80C451, 83C451, 80C552, 80C562, 80C652, 83C652, 83C654, 83C751, 83C752/87C752, 80C851, 83C851, 80C528, 80C52, 80C550, 83CL580, 83CL410, 80C592, 8X053/54, 83CL781/782, 8XC575

AMD
8051, 8031, 80C51, 80C31, 80C321, 8751, 87C51, 8053, 8753, 80535, 80C52T2, 80C32T2

MHS
80C31, 80C315, 80C32, 80C154

Dallas
DS5000, DS5000T, DS5001FP, DS5000FP, DS5002FP

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68HC11
In-Circuit Emulator

The EMUL68-PC is a high performance in-circuit emulator specifically designed to give an optimized environment to develop your 68HC11 microcontroller hardware and software. The EMUL68-PC consists of a board which plugs directly into the IBM PC/XT/AT bus. The optional Trace board features an advanced trace function with sophisticated trigger capabilities. The POD, which plugs into the target system, is connected with a 5 ft. ribbon cable to the emulator board to provide a flexible operating range. Optionally an RS-232 box communicating with the PC at up to 115K baud can be used.

User friendly

The friendly user interface is one of the key features of the EMUL68-PC. Pull-down menus, mouse support and on-line help make the infrequent user feel instantly at home. The more experienced user will appreciate the fast command line interpreter and the comprehensive command set with powerful macros.

The data windows on the screen contain up-to date information on symbols and memory areas. All commands are supported with context sensitive help information. If more help is needed the entire manual is on-line, available with a key stroke.

High level debugging

Using a high-level language for code generation is a way to cut development time. Therefore, the EMUL68-PC gives full support for debugging directly in C or Modula-2 source code. This eliminates tedious symbolic debugging in assembler.

With the EMUL68-PC you can mark breakpoints directly in the source code window, and it's easy to follow the program execution on the screen listing. All variables, both local and global, can easily be displayed or altered in one of the dedicated windows. All variables are displayed in the form they were declared in your software. This way you can work directly with floats, arrays, pointers, structures, etc.

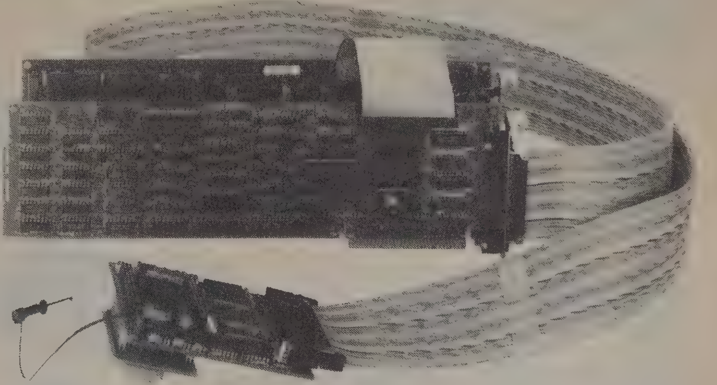
Real time Trace

The EMUL68-PC offers trace features not found in other emulators. For instance the trace buffer can record over 16,000 bus cycles with 64 bits of data. The trace can be operated "on-the-fly" which means that it can be viewed, programmed and retriggered without disturbing program execution.

With the trace set-up menu you can define exactly what events are to be stored in the trace buffer. The real-time trace can be stopped (triggered) at a selected event or after a combination of multiple events. By aligning the trigger point anywhere in the trace buffer you have a full choice of pre- and post triggering.

Nohau Corp. 51 E. Campbell Avenue Campbell, CA 95008 (408) 866-1820 FAX: (408) 378-7869

nohau
CORPORATION



EMUL68-PC

The smart solution for 68HC11 development

The EMUL68-PC offers you complete control of your 68HC11 hardware or software project at a very attractive price level. The EMUL68-PC gives you more features than any other system, regardless of price.

System Specification

Host
IBM PC/XT/AT, PS/2 or compatible.
Minimum 640K of RAM.
Monochrome, CGA, EGA or VGA.

External Box
The emulator boards can also be installed in an external box with serial communication to PC. Up to 115K baud supported.

Languages supported
Third party C and Modula-2 compilers and assemblers.

Source level debugging
Window for source level debugging. Single Step or Line Step with breakpoints marked directly in the code. Support for typed local and global variables.

In-line Assembler and disassembler
Full instruction set and symbols supported.

Symbolic Support
Full symbolic debugging and type checking. Same symbols can be used in different modules.

File formats Supported
Motorola S1, Avocet, Archimedes, IAR, Intermetrics, Introl, Microtec, Microtek and more.

Real time Emulation
Full speed emulation up to 16 MHz.
No wait states and no intrusion on memory, stack, I/O or interrupt pins.

Emulation Memory
Full 64K of emulation memory.
Bankswitch option up to 512K.

Memory Mapping
The memory is mappable in 4K (optionally 64 byte) pages either to emulator or target. Memory areas can be write protected.

Macros
Test session automation and macro command definition, IF/ELSE, REPEAT/WHILE structures.

Debug Session Logging
Record emulation session and all setups to a file.

Breakpoints
64 K program breakpoints.
64 K data read and write breakpoints.
Break on address ranges and external signal.
With the Trace board it's possible to break on any 48 bit combination of address, data, RD/WR, OP code fetch, ports and external signals.

Single Stepping
Single or multiple instruction stepping.
Line stepping in high level languages.

Execution timer
Resolution down to 250 ns.

Real Time Trace Memory (optional)
16 K deep by 64 bits wide.
Trace address, data, ports, control signals, time stamp and a maximum of 18 external signals.

Presently supported chips

68HC11A0, A1, A7, A8, 811A8, E0, E1, 811E2, E8, E9, 71E9, E20
68HC11D0, D3, 711D3
68HC11F1
68HC11G5, 711G5, G7
68HC11J6, 711J6
68HC11K0, K1, K3, K4, KA4, 711K4
68HC11L0, L1, L5, L6, 711L6
68HC11P2, 711P2, 68HC11N4, 68HC11C0, 711N4
Support for new chips added as they become available.
Call for more information.

Trace Filter
16 qualifiers of 48 bits to filter tracing.
Post view filtering can record up to 15 frames after a match.

Trace Trigger
Two sets of triggers with 8 qualifiers each.
Trigger on combinations of the qualifiers including sequential combinations and loop counter.
Qualifiers can be AND/OR combinations of address, data, ports, op-code fetch, RD/WR, EXT0, EXT1 and interrupt levels.
Trigger point can be selected anywhere within the 16 K buffer to give pre/post trigger alignment.
Trigger can be modified without stopping emulation.

Trace Display
Display trace in disassembled symbolic or binary/hex form, or as high level source code.
Display can be saved to a file.
Trace can be started, stopped and displayed independent of program execution.

Trace Time Stamp
The Time Stamp can be used to display exact execution time or time from last frame in the trace memory.

Program Performance Analyzer
Histogram and statistical information of program execution in real time. Exact timing information on execution time in each program routine.

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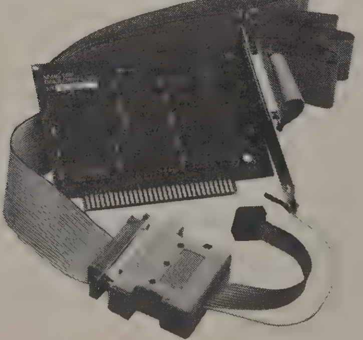
68HC16 68300 Family In-Circuit Emulator

EMUL16/300-PC is a high performance emulator for two families of microcontrollers, the 68HC16 family and the 68300 family. Develop hardware faster, debug software faster with EMUL16/300-PC. More than just a glorified serial connection, full-speed emulation, an optional Trace board, and up to 1 Megabyte of Shadow RAM on the emulator give you the control you need to get your job done quickly and easily.

User Friendly

The EMUL16/300-PC software is a *Microsoft Windows* application, is consistent with other *Windows* applications, is easy to learn, and easy to use. Windows or editing variables, RAM, registers, and for editing instructions offer a single, simple look and feel.

Through the Dynamic Data Exchange interface, other *Windows* applications can receive automatic updates about changes in the target data without slowing the target.



High level debugging

Using a high-level language for code generation is a way to cut development time. EMUL16/300-PC fully supports debugging C source from several vendors. With EMUL16/300-PC, you can mark breakpoints directly in the source code window, execute a single source statement, or step over a single C function or library call. All variables, both local and global, are displayed and edited using their declared type, including structures, unions, arrays, and floats.

Low cost alternative

While the EMUL16/300-PC is a full blown in-circuit emulator, the EMUL16/300-PC/BDM is a low cost "Background Debug Mode" emulator that uses the same windows based user interface as EMUL16/300-PC.

Real-time Trace

EMUL16/300-PC offers instruction tracing, a feature not available from simpler, serial-based emulators. The trace is up to 512K records deep and 104 bits wide, including a 40 bit time stamp. Full pipeline decoding prevents false triggers on non-executed code. Triggers can test a combination of address and data. The trace can also provide hardware breakpoints.

The trace buffer can be viewed, reprogrammed, and restarted without affecting emulation.

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EMUL16/300-PC

System Specification

Host
386 or 486 based AT compatible.
Minimum of 1 Meg. of RAM.
One free 8-bit slot.
One slot for Trace board, if needed.
Microsoft Windows in Standard or Enhanced 386 Mode.

Languages Supported
All third party assemblers that produce Motorola S-records are supported.
"C" compilers from Intermetrics, Introl, Microtec, Sierra, HiWare, and others are also supported. Call for the current list of supported high-level languages and vendors.

High Level Debugging
EMUL16/300-PC has separate windows for source display and variable display. Global, static, and local (automatic) variables, arrays and structures are all supported and displayed in their declared format.

In-line Assembler
Point and click to choose an instruction to change. The full instruction set and all configuration registers are supported. Changes to the program can be saved to an S-record file.

High Level Symbol Support
Variable are displayed and edited by name in their declared type.
Name scopes correctly preserved across modules and functions.

File formats Supported
Motorola S record files and object files from Introl, Intermetrics, Sierra, HiWare, P & E, MASM, Microtec and others.

Real-time Emulation
Full-speed emulation up to maximum chip speed.
0 wait-state Emulation RAM.

Board support for fast termination bus cycles.

Shadow RAM
64 Kilobytes to 1 Megabyte.
Updated without slowing emulation.
Shadow RAM Window display updated continuously.
RAM can be displayed in 8 bit, 16 bit, or 32 bit words as either hexadecimal words, unsigned integers, or signed integers.

DDE Interface
Automatically updates other Windows applications as target conditions change. Up to 50 simultaneous RAM addresses or variables can be exported. EMUL16/300-PC includes a DDE Interface status window that indicates the number of connections, and the status of each.

Emulation Memory
Up to 4M of 0 wait-state static RAM.

Breakpoints
Set breakpoints by clicking on a C source line, an assembly line or by typing an address in a dialog box.
Once created, breakpoint may be active or inactive without being deleted.

Single Stepping
A step can be one assembly instruction, one C source line, or one function call.

Real-time Trace (optional)
EMUL16/300-PC Trace Board features supports both 683XX and 68HC16 families. Each captured bus cycle includes the 24 bit address, a 40 bit time stamp, 16 data bits, 16 status bits, and 8 external bits.

Detailed Trace Control
User can specify the addresses that are captured (filtering). Sampling can be qualified by the type of access: data read, data write, or opcode.
A trigger event can consist of virtually any number of addresses in combination with data where each can be qualified as a data read, data write, or first opcode fetch.
Two tracing modes are provided. The normal mode allows you to specify up to three trigger events. Each event can consist of virtually any number of addresses or address ranges. The second mode, window mode, uses one trigger to turn on recording and one to turn off recording.
A centering counter allows positioning of the trigger point anywhere in the trace buffer. This allows you to trace before, after, or around the trigger.

Trace Capacity
Depending upon the configuration purchased, the trace board contains enough RAM to capture 32K records, 128K records, or 512K records.

Trace Trigger
The Trace trigger has three levels and a 16 bit counter on the last level.

Code Coverage
The code coverage feature can monitor up to 1Mb of addresses. The specified addresses do not have to be continuous. All accesses, including data and opcode prefetches, are captured.

Trace Display
"Start of Instruction" decoding makes disassembly show only executed code and keeps the display synchronized with what actually happened.

Pipe Line Support
Full pipe line decoding prevents false triggers on non-executed addresses and capturing records for discarded instructions.

Trace Input/Output
A trigger can be input through a BNC connector on the trace board. The other BNC connector carries a trigger output signal. The 25 pin "D" connector carries both of those plus 8 input signals recorded with every bus cycle.

Currently Supported 68HC16 Family Chips:
68HC16Z1, 68HC16Z2, 68HC16Y1

Currently Supported 68300 Family Chips:
68330, 68331, 68332, 68F333, 68340

Call for the latest information.

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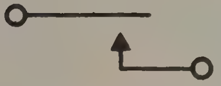
eem

MINIGLOSSARY
RELAY CONTACT FORMS

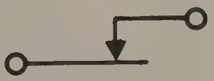
A

Make
SPST-NO



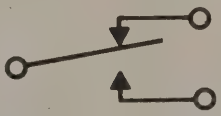
B

Break
SPST-NC



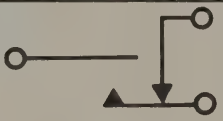
C

Break, Make
(Transfer)
SPDT



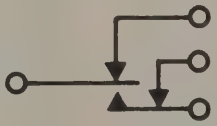
D

Make, Break
(Continuity
Transfer)



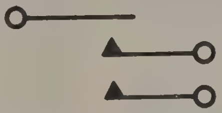
E

Break,
Make,
Break



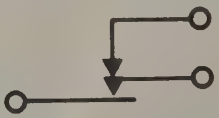
F

Make,
Make



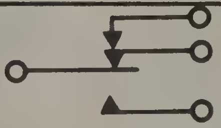
G

Break,
Make



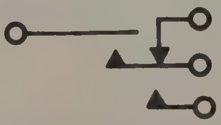
H

Break,
Break,
Make



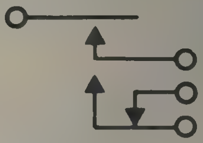
I

Make,
Break,
Make



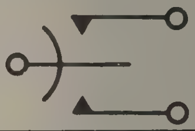
J

Make,
Make,
Break



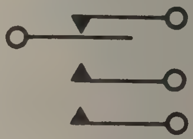
K

Center off
SPDT



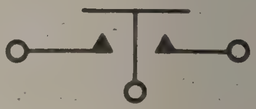
L

Break,
Make,
Make



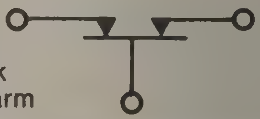
U

Double
make
Contact
on arm



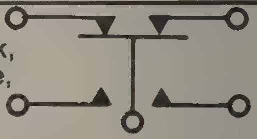
V

Double break
Contact on arm



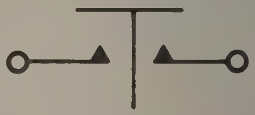
W

Double break,
Double make,
Contact
on arm



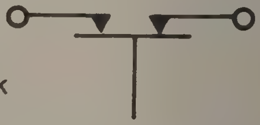
X

Double
make



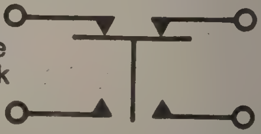
Y

Double break



Z

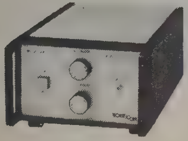
Double make
Double break
SPDT-DB



Noise Com: Quality. Performance. Service.

From the leader in noise sources.

Wideband noise-generating instruments for the bench



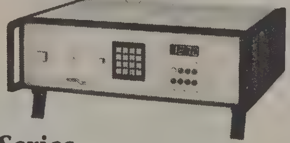
NC 6000 Series

DC to 18 GHz

- Rugged design
- Precision attenuator
- Crest factor 5:1
- Excellent flatness

The NC 6000 Series are rugged noise generating instruments designed for applications on the test bench, or in test stations in which an NC 6000 Series unit is incorporated with other equipment to provide a wide variety of functions.

Programmable broadband noise-generating instruments



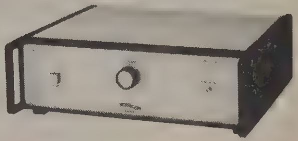
7000 Series

DC to 40 GHz

- Completely programmable—from front panel or IEEE-488 bus
- Non-volatile memory for measurement parameters
- Front panel display
- Fast-switching 127-dB attenuator
- +13 dBm or +30 dBm (1 W) white Gaussian noise output

The 7000 Series can be used alone to perform a programmed series of noise measurements, or they can be bus-controlled, for running a battery of tests automatically via any instrument controller.

High-power, broadband noise-generating instruments



NC 8000 Series

500 Hz to 1 GHz

- High power—up to 1 W (30 dBm)
- Uniform response—±-2 dB
- Precision attenuator—100 dB in 10-dB steps (10 dB in 1-dB steps optional)
- Can be configured for custom requirements

The NC 8000 Series offers 1 W (+30 dBm) power output for applications such as ECM testing, broadband jamming, jamming simulators, in secure communications channels, and any other area requiring high-level noise.

Custom noise subsystems

Special products for unique applications

- Custom combinations of connectors, operating voltages, electrical performance, and packaging, VXI
- Multiple outputs
- Instruments for NPR and BER testing
- Switched noise sources
- Multipath channel emulators
- Space-qualified noise sources
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- Noise sources with filtering, and adjustable power level and clipping

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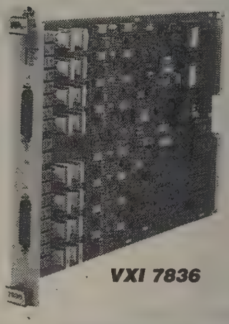
AC/Synchro/Resolver/LVDT Instrumentation

VXI Synchro/Resolver and LVDT Test:

VXI 227 Phase Angle Voltmeter:
- Wideband—10 to 100kHz with 0.08% voltage accuracy.
- Phase angle accuracy— 0.10 degrees.
- Signal input autoranging, fully isolated inputs.

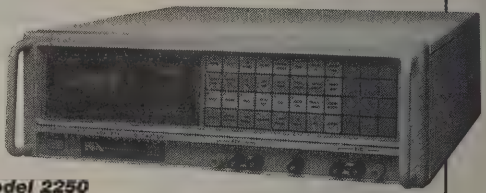
VXI 5388,VXI 5390,VXI 5393 Synchro/Resolver Processors:
- High accuracy—up to 0.003 degrees.
- Up to 3 independent transformer isolated output channels.
- Reference frequency —50Hz to 10kHz.

VXI 7836 LVDT/RVDT Simulator:
- Eight channels.
- Wideband—400Hz to 10kHz.
- Linearity— 0.02% with 16 bit position resolution.


VXI 7836

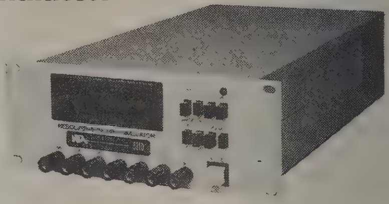
Model 2250 Digital Analyzing Voltmeter:

- Measures: Total, Fundamental, in Phase, Quadrature, Phase Angle, Harmoniccs, THD.
- Transformation ratio.
- Wideband—10Hz to 100kHz.
- Null meter.


Model 2250

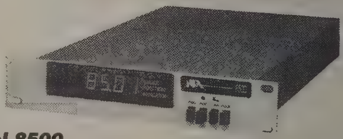
Model 5310 Programmable Synchro/Resolver Simulator:

- 18 bit resolution.
- Variable programmable rate.
- Synchro/Resolver output.
- Accuracy —36 arc/second.
- Output—3.0 VA.


Model 5310

Models 800/801 Synchro Panel Meters and 8500/8800/8810 Angle Position Indicators:

- 800/801: Resolution—0.1 to 0.01 degree.
- 8500: Resolution— 0.01 degree, with 0.03 accuracy.
- 8800/8810: Resolution—0.001 degree with 0.004 degree accuracy.
- IEEE-448, MATE available.



Model 8500

Model 213C Phase Angle Voltmeter: (not shown)

- Single frequency—30 Hz to 10kHz.
- Range—30µV to 300V.
- Large, simple, user friendly analog meter.

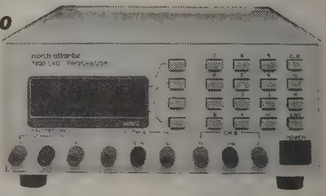
Model 530, 530/20 Synchro/Resolver Simulators: (not shown)

- Frequency— 50Hz to 11kHz.
- Accuracy —2 arc/seconds.
- Resolution— up to 0.0001 degree.

Model 800 **Model 801**

Model 540/10 Synchro/Resolver Bridge: (not shown)

- Constant Null gradient output.
- Accuracy —2 arc/second.
- Resolution —0.0001 degree.

Model 7800


Model 7800 LVDT/RVDT Universal Processor:

- Processes/simulates up to 4 LVDT/RVDT's simultaneously.
- Wideband—400Hz to 10kHz with 0.01% linearity.
- Programmable transformation ratios and full math functions.

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CONSOLES AND EQUIPMENT

TEST/MEASUREMENT CONSOLES

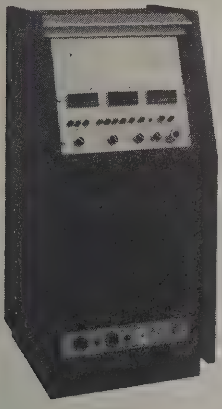
CUSTOM DESIGNED FOR SPECIFIC APPLICATIONS

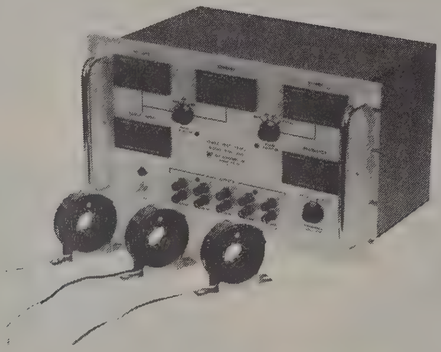
FEATURES

- Measure any combination of:
  - AC/DC voltage
  - AC/DC current
  - Power (Watts)
  - Watthours
  - Ampere-hours
- Modular or free-standing configuration
- Local and/or remote indication
- Single or poly-phase power systems

APPLICATIONS

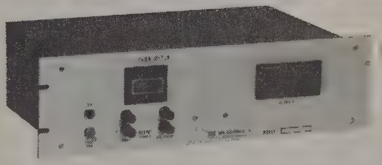
- Quality testing of appliances
- Core loss testing
- Battery monitoring
- Transient power measurement
- Drive motor monitoring
- Sub-station monitoring
- Motor efficiency quantification
- Traction motor monitoring
- Multi-range testing





WATTHOUR AND AMPERE-HOUR EQUIPMENT

OSI manufacturers several types of watthour and ampere-hour instrumentation for use on dc. or ac. power systems. These units are used to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy input.



- The WH30 AC Watthour Meter Series measures and displays watts and watthours consumed in single-phase or three-phase ac. applications. Full-scale current ranges from 5 to 1,000 amperes are available from 50 to 70 hertz operation.
- The WH70 DC to100Hz Watthour Meter Series measures and displays watts and watthours from dc. to 100 hertz. Full-scale current ranges from 5 to 2,000 amperes are available. Units are particularly recommended for dc. systems with ac. components present or pure dc. systems.
- The AH70 DC Ampere-Hour Meter Series measures and displays amperes and ampere-hours in dc. systems. Current ranges are available to 10,000 amperes.
- The WH50 AC Watt/Watthour Meter Series provides 0.25% accuracy in single-phase and three-phase systems operating at 60 hertz. Voltage ranges to 600 volts and current ranges to 600 amperes are available. Units can be readily interfaced with computers or other data acquisition equipment.

Consult factory for information on over 100 standard models, or ask to have a special model quoted for your application. Rack- mounted options are available.

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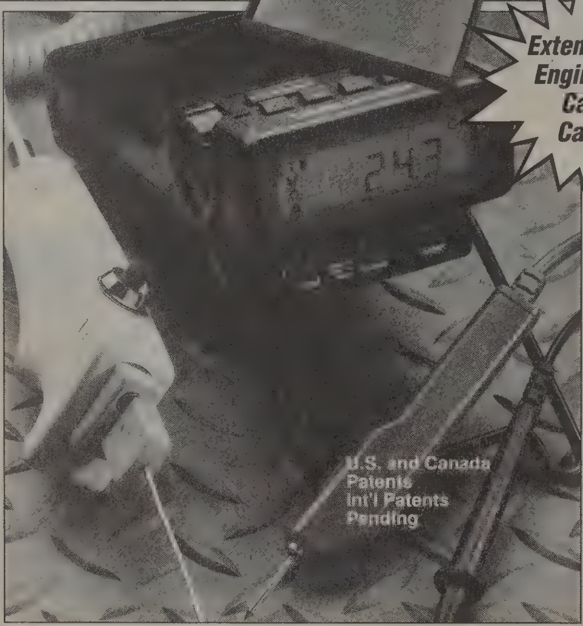

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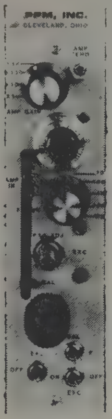
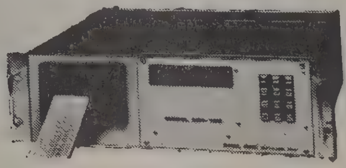


SIGNAL CONDITIONERS

PPM SIGNAL CONDITIONERS AND AMPLIFIERS PROVIDE ULTRA-STABLE EXCITATION, BRIDGE BALANCE, AND CALIBRATION CIRCUITS FOR USE WITH STRAIN-GAGE AND RTD TRANSDUCERS.

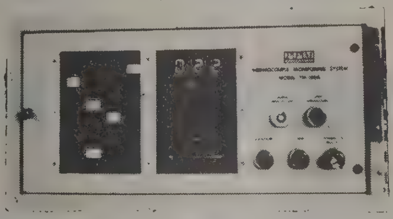
MODEL SG-16-3 (SHOWN) CONTAINS A STABLE, LOW-NOISE, EXCITATION POWER SUPPLY, A PRECISION, ADJUSTABLE-GAIN, WIDE-BAND AMPLIFIER, A 4-STEP, TWO-POLE, LOW-PASS FILTER, A HIGH-RESOLUTION AUTOBALANCE CIRCUIT, AND 4-STEP, BIPOLAR CALIBRATION CIRCUITRY. TEN UNITS FIT INTO A 19-INCH RELAY-RACK MOUNTING CABINET. THE MODEL SG-16-3A IS A SIMILAR UNIT WITH IEEE-488 COMPUTER-CONTROL.

MODEL SG-16-4 FEATURES INPUT ISOLATION AS HIGH AS 1500 VOLTS. MODEL SG-16A IS A TWO-CHANNELS PER BOARD UNIT WITH COMMON POWER SUPPLY PRICED BELOW $300 PER CHANNEL.



SEQUENTIAL EVENT RECORDERS

MODEL SER-100 SEQUENTIAL EVENTS RECORDERS PROVIDE A PRINTED RECORD OF THE TIME AND SEQUENCE OF INDEPENDENT ON/OFF EVENTS OCCURRING AT A NUMBER OF POINTS. THEY MAY BE SET TO RECORD EITHER THE TURN-ON OR THE TURN-OFF TIME, OR BOTH, ALONG WITH THE POINT IDENTIFICATION. UNITS TO SCAN THOUSANDS OF POINTS IN AS LITTLE AS FIVE MICROSECONDS ARE AVAILABLE.



THERMOCOUPLE MONITOR

THE MODEL TM-100A SCANS UP TO 100 THERMOCOUPLES, DISPLAYING TEMPERATURE DIGITALLY. A HIGH/LOW LIMIT CIRCUIT COMPARES THE TEMPERATURE WITH PRESET SWITCH SETTINGS; A LAMP MATRIX DISPLAYS ALL OUT-OF-LIMIT CHANNELS. INTERFACES PROVIDE FOR PRINTOUT OR COMPUTER ENTRY OF DATA.

THERMOCOUPLE AMPLIFIERS

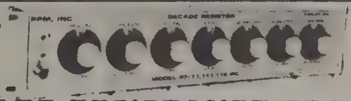
MODEL TA-20 THERMOCOUPLE AMPLIFIERS PROVIDE REFERENCE JUNCTION COMPENSATION, AMPLIFICATION, AND LINEARIZATION, AND LOW-PASS FILTERING FOR MOST THERMOCOUPLE TYPES.

FREQ.-TO-VOLTAGE CONVERTER

THE MODEL FVI-5 FREQUENCY-TO-VOLTAGE CONVERTERS ARE USED TO CONVERT THE FREQUENCY OF AC SIGNALS FROM TURBINE TYPE FLOW-METERS, OR SIMILAR INSTRUMENTS, TO DC VOLTAGES FOR MEASUREMENT OR CONTROL APPLICATIONS. A NEW TECHNIQUE PROVIDES ZERO RIPPLE IN THE OUTPUT FOR CONSTANT INPUT FREQUENCY.

ELECTRONIC LOAD

THE MODEL EL-1 ELECTRONIC LOAD PROVIDES A DYNAMIC PROGRAMMABLE CURRENT LOAD FOR TESTING OF POWER SUPPLIES AND OTHER POWER SOURCES. UNITS ARE AVAILABLE TO 500V AND 50KW DISSIPATION.



DECADE RESISTANCE STANDARDS

PPM'S PRECISION DECADE RESISTANCE STANDARDS ARE AVAILABLE IN SEVERAL DIFFERENT CONFIGURATIONS, FROM ONE TO TEN DECADES. RESISTANCE VALUES ARE AVAILABLE FROM ONE MILLIOHM TO 100 MEGOHMS PER STEP. MOST MODELS FEATURE 0.01% ACCURACY; 0.001% ACCURACY IS AVAILABLE ON SOME MODELS; VERY HIGH AND VERY LOW RESISTANCE RANGES HAVE REDUCED ACCURACY. THESE UNITS ARE DESIGNED FOR USE AS SECONDARY RESISTANCE STANDARDS.

DIGITAL OHMMETERS

MODEL R1L-B IS A DIGITAL MICRO-OHMMETER USING FOUR-WIRE MEASUREMENTS TO MEASURE RESISTANCES AS LOW AS ONE MICRO-OHM; KELVIN CLIP LEADS ARE INCLUDED.

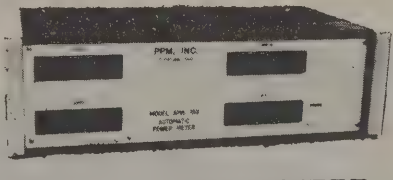
MODEL R1M-A IS A DIGITAL MEG-OHMMETER TO MEASURE RESISTANCES AS HIGH AS 200 GIG-OHMS. TEST VOLTAGES FROM 50 TO 500V ARE SELECTABLE.

DATA LOGGERS

THE MODEL DL-3 IS A COMPLETE DATA ACQUISITION SYSTEM IN A COMPACT, PORTABLE PACKAGE. IT SCANS UP TO 256 INPUTS, DIGITIZES THEM, AND PRINTS OUT THE VALUES BY MEANS OF A BUILT-IN THERMAL PRINTER. OPTIONS INCLUDE: FLOATING DECIMAL POINT, INTERNAL CALENDER-CLOCK, STRAIN-GAGE OR THERMOCOUPLE CONDITIONING, COMPUTER INTERFACE, LIMIT COMPARATOR, AND ENGINEERING UNITS CONVERSION.

DIGITAL TIMERS-PROGRAMMERS

THE EP-SERIES OF DIGITAL ELECTRONIC PROGRAMMERS PROVIDE RELAY OR SOLID-STATE SWITCH OPERATION AT DIGITALLY-PRESET START AND STOP TIMES. EACH CHANNEL OPERATES INDEPENDENTLY. UNITS RANGE FROM 1 TO 1000 CHANNELS WITH TIMING FROM MICROSECONDS TO HOURS.



AUTOMATIC POWER METER

THE MODEL APM-100 AUTOMATIC POWER METER DISPLAYS "TRUE RMS" VOLTS, AMPERES, KW, AND POWER FACTOR SIMULTANEOUSLY ON FOUR 3.5 DIGIT DISPLAYS. FULL-SCALE RANGES ARE 1000 OR 199.9 VOLTS, 19.99 AMPS, 19.00 OR 1.999 KW, AND 1.000 POWER FACTOR. RANGE CHANGING IS AUTOMATIC. THE MODEL APM-10 PROVIDES THE SAME READINGS ON A SINGLE, SWITCHED, DISPLAY. THREE-PHASE MODELS ARE ALSO AVAILABLE.

DIGITAL SYNTHESIZER

MODEL DS-100 DIGITAL SYNTHESIZER GENERATES SINUSOIDAL AND OTHER ARBITRARY WAVEFORMS WITH FREQUENCY AND AMPLITUDE PROGRAMMED VIA FRONT-PANEL KEYBOARD OR IEEE INTERFACE.

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PTS 040

Range: 0.1-40 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −75dBc
Phase Noise: −75dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $5,125.00*

PTS 120

Range: 90-120 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +10dBm; 50ohm
Spurious Outputs: −75dBc
Phase Noise: −75dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $5,125.00*

PTS 160

Range: 0.1-160 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −75dBc
Phase Noise: −63dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $6.245.00*

PTS 250

Range: 1-250 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −70dBc
Phase Noise: −63dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $7,155.00*

PTS 310

Range: 0.1-310 MHz
Resolution: 1Hz
Switching: 1-20μs
Phase Continuous: 1Hz-100KHz steps

Output: +3 to +13dBm; 50ohm
Spurious Outputs: Type 1 −70/65 (typ/spec); Type 2 −65/60dBc
Phase Noise: −68dBc (0.5Hz-15KHz); Type 2 −63dBc

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: Type 1 $6,175.00*; Type 2 $5,625.00*

PTS 500

Range: 1-500 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −70dBc
Phase Noise: −63dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $8,385.00*

PTS 620

Range: 1-620 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 1-20μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −70dBc
Phase Noise: −63dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $9,255.00*

PTS 1000

Range: 0.1-1000 MHz
Resolution: 0.1Hz-100KHz (opt)
Switching: 5-10μs

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −70dBc (0.1-500 MHz),
−65dBc (500-1000 MHz)
Phase Noise: −60dBc (0.5Hz – 15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $11,375.00*

PTS x10

Range: 10 MHz band, selected decade 0.1-100 MHz
Resolution: 1Hz
Switching: 1-5μs
Phase Continuous: 2 MHz band, even or odd steps

Output: +3 to +13dBm; 50ohm
Spurious Outputs: −65/−60dBc (typ/spec)
Phase Noise: −70dBc (0.5Hz-15KHz)

Freq. St'd: OCXO, TCXO, Ext.
Interface: BCD par. or GPIB
Price: $2,575.00*

OTHER OPTIONS

Programmable Attenuator 0-90dB (or 0-99dB with GPIB)
n x 10 MHz output (20-140 MHz) or any 10 MHz line

*Prices are US only, and include manual & remote (BCD) control, 1 Hz resolution, OCXO std.

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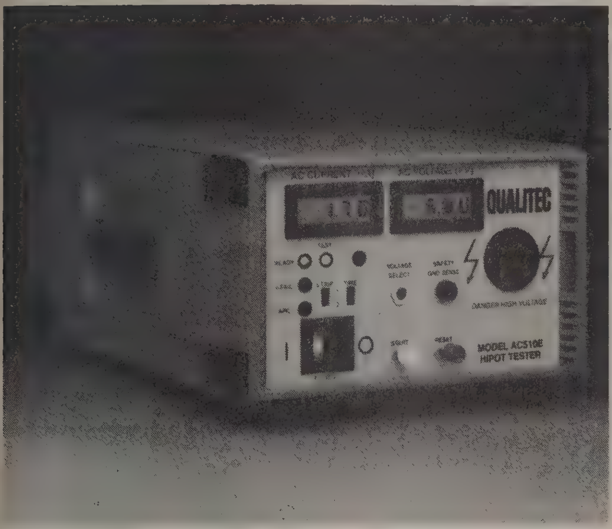


DIGITAL AUTOMATIC

- HIPOT TESTERS
- ATE SYSTEMS
- MEGOHMMETERS
- 10, 25, 30, AMP GROUND CONTINUITY TESTERS
- REMOTE CONTROLS
- IEEE-488
- MANY OPTIONS

GPIB
HPIB

FEATURES

- Variable High Voltage Insulation Testing
- Leakage Current Testing
- Ground Continuity Testing
- Automatic Test Cycle
- Solid State Controls
- Super Sensitive Arc Detection (Less Than 3 μsec)
- Super Fast Shutdown (Less Than 2 msec)
- Zero Crossing Ramp Control
- Switch Selectable and Continuously Adjustable Voltage Ramp Rates
- Remote Controls
- IEEE-488 Programmable (GPIB & HPIB)
- Digital Panel Meters
- Compact and Lightweight
- Safety Ground Interlock
- User Adjustable Ground Resistance Monitor Levels
- Separate Audible and Visual Failure Alarms for Arcs, Excessive Leakage Current and Ground Continuity Failures
- Usable on products with 2 or 3 Wire Power Cords
- Usable also on products without Power Cords
- Visual "Ready" and "In Test" Status indicators
- Switch Selectable and Continuously Adjustable Leakage Current Monitor Levels
- Switch Selectable and Continuously Adjustable Test Dwell Times
- Operates on both 115VAC and 240VAC, 50Hz and 60Hz Line Power Sources
- Made in USA

SIMPLE and ACCURATE

QUALITEC testers are easy to use. They can be operated accurately and consistently by low skilled personnel who have no prior experience with High Voltage testing. QUALITEC testers incorporate several non-destructive tests in one test cycle, including ARC detection, LEAKAGE CURRENT monitoring, INSULATION RESISTANCE measurement, and GROUND CONTINUITY monitoring with separate audible and visual failure alarms for each type of test; and indicates exactly which type of failure occurred for quick, easy, accurate troubleshooting of the device under test.

VERSATILE

QUALITEC testers have many features which allow versatile use by design engineers, test engineers, reliability engineers, quality control inspectors, production operators and others. A QUALITEC tester is versatile enough to be operated even by your personal computer which will allow you to record, analyze and print out test results. All of QUALITEC's AUTOMATIC Hipot Testers, Insulation Resistance Testers, Meghometers, and 10, 25, 30 Amp Ground Continuity Testers have DIGITAL PANEL METERS and are available with Remote Controls. QUALITEC testers have every feature you need...just **ASK US**.

COMPLIANCE

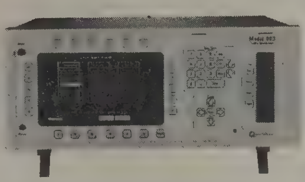
QUALITEC testers test in compliance to virtually all regulatory agency requirements including UL, CSA, VDE,IEC,BSI, BABT, TUV, FCC, JIS and MIL-SPECS.

Video test generator selection guide

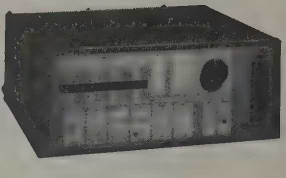
...for businesses involved in:

- Display Manufacturing
- Video Projectors
- Engineering Workstations
- Personal Computers
- Medical Imaging
- Military Imaging
- Video Monitor Service
- Flat Panels

801 GP
801 GX



900 Series



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Model Number	801GP *	801GX	901 *	902 *	903	8701E-3	8701E-6*	8701E-1
Price	$2,495	$4,995	$4,950	$8,500	$11,500	$10,500	$15,150	$22,700
Analog Outputs MHz	75	150	87	135	250	135	285	400
Pulse RiseTime	3 nS	2.5 nS	3.5 nS	2.5 nS	1.5 nS	2.5 nS	800 pS	500 pS
Displayed Colors	16	16	256	256	256	256	256	256
Color Palette Size	16.7 Million	16.7 Million	16.7 Million	16.7 Million	16.7 Million	16.7 Million	16.7 Million	16.7 Million
Gray Levels	256	731	256	256	256	256	256	256
Output Protection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Connectors	BNC.VGA,MAC, PGA	BNC.VGA,MAC, 13W3 (SUN)	BNC	BNC	BNC	BNC	SMA	SMA
Color Subcarrier (burst)	No	NTSC,PAL,S-VID	No	No	No	No	No	No
Self Calibrating Outputs:	No	Yes	No	No	No	No	No	No
Digital Outputs TTL / ECL (MHz)	75	55	1 - 50	1 - 50 /135	1 - 50 /250	1 - 135	(opt) 2- 285 ECL	(opt) 2 -400 ECL
TTL outputs	6	6	8	8	8	8	None	None
ECL Differential Outputs	None	None	None	4	4	8	3 (opt)	3 (opt)
Colors	16	16	256	256	256	256	8 (opt)	8 (opt)
Output Protection	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Connectors	EGA	EGA	24 Pin Micro	24 Pin Micro	24 Pin Micro	DB-25	SMA	SMA
Graphic Video Memory	1K x 1K x 4	2K x 1K x 4	2K x 2K x 1	2K x 2K x 1	2K x 2K x 1	8,4,2,1 bit / pel	8,4,2,1 bit / pel	8,4,2,1 bit / pel
Horizontal Timing (KHz)	1-100	1 -130	1 -250	1 -250	1 -250	8 - 250	8 - 250	8 - 250
Resolution	1 Pel	1 Pel	1 Pel	1 Pel	1 Pel	1 Pel	1 Pel	1 Pel
Active Video	1- 1024 Pels	16 - 2048 Pels	1 - 2048 Pels	1- 2048 Pels	1 - 2048 Pels	1 - 16384 Pels	1- 16384 Pels	1- 16384 Pels
Connectors	BNC.VGA,MAC, EGA	BNC.VGA,MAC, 13W3 (SUN),EGA	BNC	BNC	BNC	BNC	BNC	BNC
Vertical Timing (Hz)	1 - 650	1 - 650	1 - 650	1 - 650	1 - 650	061 - 125,000	061 - 125,000	.061 - 125,000
Resolution	1 Line	1 Line	1 Line	1 Line	1 Line	1 Line	1 Line	1 Line
Active Video Lines	1-1024	1 - 2048	1 - 2048	1 - 2048	1 - 2048	1 - 65535	1 - 65535	1 - 65535
Serrations	Yes	Yes	On / Off	On / Off	On / Off	On / Off	On / Off	On / Off
Equalizing Pulses	Yes	Yes	0 - 100	0 - 100	0 - 100	Yes	Yes	Yes
HDTV Sync (tri-level)	No	No	Yes	Yes / Prb	YES / Prb	No	No	No
Connectors	BNC.VGA,MAC, EGA	BNC.VGA,MAC, 13W3 (SUN),EGA	BNC	BNC	BNC	BNC	BNC	BNC
Format Storage EPROM	43	56	None	None	None	None	None	None
CMOS / Battery	150	300	None	None	None	None	None	None
3 1/2" Floppy Disk	None	None	500 per disk	500 per disk	500 per disk	99	99	99
Test Images Built-in	26	26	35	35	35	56	56	56
Custom Image Storage	Factory	Factory	Unlimited	Unlimited	Unlimited	99 per disk	99 per disk	99 per disk
Circle Drawing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Test Sequence Storage	Factory	Factory	Unlimited	Unlimited	Unlimited	99 per disk	99 per disk	99 per disk
Interfaces RS-232	Yes	Yes	Option	Option	Option	Yes	Yes	Yes
IEEE-488	No	Yes	Option	Option	Option	Option	Option	Option
Printer	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Novell Network	No	No	Option	Option	Option	No	No	No
Features Front Panel Display	LCD 16x2 Char	LCD 16 x 2 Char	CRT 720 x 348	CRT 720 x 348	CRT 720 x 348	LCD 40 X 2 Char	LCD 40 X 2 Char	LCD 40 X 2 Char
User Defined Buttons	None	None	22	22	22	None	None	None
HDTV Formats Included	None	None	4	4	4	None	None	None
External Keyboard	No	No	Yes	Yes	Yes	No	No	No
Keyboard Lockout	No	No	Software	Software	Software	No	No	No
Clock Output	No	No	Yes	Yes	Yes	Yes	No	No
Font Editor	None	None	Included	Included	Included	None	None	None
Expansion Slots	None	None	6	6	6	None	None	None
Convergence Probe Option	No	No	CP-1 / CP-2	CP-1 / CP-2	CP-1 / CP-2	No	No	No
Upgrade Option Available	Yes *	No	Yes *	Yes *	No	No	Yes *	No

* An upgrade option is available for this model. You pay the difference between your original sales price and the price of any upgraded model in the same product series. This offer is available anytime within 12 months of your original purchase.

Prices and specifications subject to change without notice.

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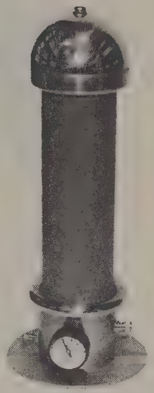
WIDEBAND HIGH VOLTAGE VOLTAGE DIVIDERS AND PROBES

DC-10MHz • 1KV TO 900KV PK

300KV PK-900KV PK
INDOOR

1KV PK-5KV PK

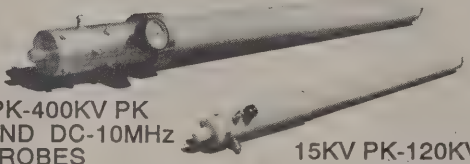
10KV PK-30KV PK



30KV PK-240KV PK

30KV PK-240KV PK
SHIELDED

OUTDOOR
15KV PK-900KV PK



15KV PK-400KV PK
WIDE BAND DC-10MHz
PROBES

15KV PK-120KV PK
DC, 50/60 Hz
PROBES

ROSS ENGINEERING CORPORATION'S HV wideband DC to over 10 megahertz voltage dividers can be made to match most instrument impedances and sensitivities. Most units are hermetically sealed with a low pressure non-toxic insulating gas. They can also be ordered for use in oil. Accuracies 0.01% to 0.2% DC, 0.5% to 1%, 50-400Hz, wide band DC-1MHz 3%, 5-10 MHz 3DB.

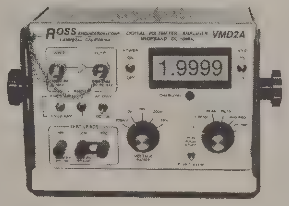
Power class dividers and probes are capable of accurate measurement and wide-band transient recording with full Basic Impulse Level withstand capability, 600V to 500KV RMS class to 1300KV PK BIL.

Also available are ***weatherproof outdoor models*** for use up to 900 KV DC or AC PK. They are compensated resistance-capacitance wide-band DC to 10MHz and are balanced to provide safe voltage gradients with less loading capacitance, better high frequency accuracy and low corona.

Applications include use with *panel meters, recorders, digital multimeters, oscilloscopes or computers* to measure, view and record DC, AC, transient pulse or pulse train and modulated CW. Also operates with Ross Engineering Corporation's analog fiber-optic amplifiers and transmission systems wide band DC to 1MHz.

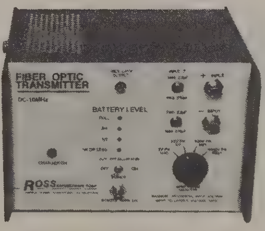
*See our additional products in **Volume B,** Fiber Optic Equipment & Accessories – Sect. 2475, Relays – Sect.. 4500, abd Switches – Sect. 5100.*

DIGITAL MULTIMETER
VMD2A

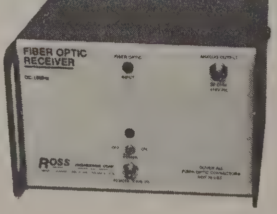


High voltage digital multimeter designed to supplement high voltage probes and HV voltage dividers.

FIBER OPTIC TRANSMISSION SYSTEMS AVAILABLE! ANALOG DC-1MHz



TRANSMITTER



RECEIVER

±0.1V PK TO 1000V PK INPUT ±10V PK OUTPUT
115V/230V AC, 12V DC BATTERY POWERED

ROSS *ENGINEERING CORP.*

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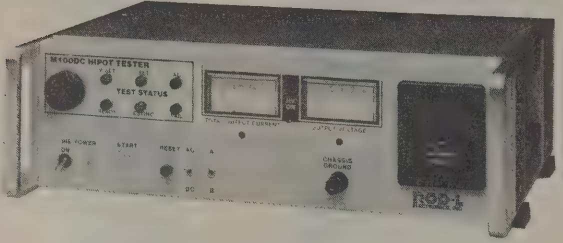
ROD-L

ELECTRONICS, INC.

TOLL FREE
1-800-548-6305
Fax: (415) 326-1993

ROD-L Is The First Manufacturer Of UL Listed Hipot And Ground Continuity Testers.

MODELS M100DC, M100 and M500 HIPOT TESTERS



SAFE, FAST AND EFFICIENT

With a ROD-L Hi-Pot Tester you get these standard features:

- electronically controlled voltage rate-of-rise to ensure gradual, smooth and consistent rise time (eliminates harmful voltage spikes).
- electronically controlled voltage shutdown. Fast shutdown (2 ms) prevents harm to operator and protects the device under test.
- electronic, adjustable timing circuit to provide accurate, reliable test time (1 sec to 90 seconds).
- front panel receptacle, rated to withstand 5000 VAC, for direct plug-in of device under test or for plug-in of test fixture; provides maximum safety and dramatically reduces the time required to perform the test.
- front panel voltmeter to indicate hipot output voltage; front panel ammeter to indicate current drawn by the device under test.
- concurrent dielectric withstand and ground continuity tests in a single operation. Security chassis ground test to ensure operator safety.
- completely solid state for reliability, TTL logic allows computer interface. Rack mountable. Performs all U.L., C.S.A., I.E.C., V.D.E. and F.C.C. etc., test requirements.
- detects arcs of minimum 10 microseconds duration

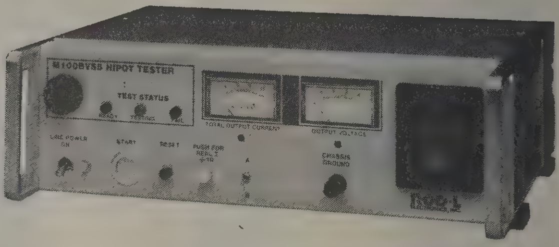
SPECIFICATIONS

PARAMETER	MODEL M100/M500	MODEL M100DC
Input	115/230 VAC, 44-66 Hz	115/230 VAC, 40-70 Hz
Output Voltage	0-5KVAC	0-5.5KVDC
Voltage Ramp	1-30 Sec.	1-30 Sec.
Output Current	0-500 mA	0-10mA
Test Duration	1-90 Sec.	1-90 Sec.
Voltage Shutdown	2mS	2mS
Arc Detection Sensitivity	≥ 10 MicroSec.	10 MicroSec.
Ground Sense	.1 ohm or .5 ohm	.1 ohm or .5 ohm
Failure Indicator	Visual & Audible	Visual & Audible
Dimensions (43 x 13 x 34 cm)	16¾″ x 5¼″ x 13¼″ (43 x 13 x 34)	16¾″ x 5¼″ x 13¼″ (43 x 13 x 34)
Weight	24 lbs. (11 Kg)	23 lbs. (10.4 Kg)

* Ammeter indicates total current on all units. The ROD-L model M100-BVS5 ammeter on switch selection, also indicates real (Resistive) current.

** Voltage shutdown with complete discharge of DUT with no voltage—transient generation.

*** Ground Resistance threshold standard is .1 ohms, .5 ohm may be specified at time of purchase.



Perform safe, rapid testing for dielectric withstand and ground continuity in one simple operation.

The ROD-L Hi-Pot Testers are designed to perform the tests specified by U.L., I.E.C., C.S.A., V.D.E. and F.C.C. The hipot test is a potentially dangerous operation, so the ROD-L product line has been designed with emphasis on safety, on efficiency and on speed with which the test can be made.

SIMPLE OPERATION

The hipot tester applies the test voltage to the device being tested for a duration of time preset from 1 second to 90 seconds. The device under test simply plugs into the front panel outlet, rather than being attached with clip leads. Clip leads can be used, however, for devices without a power cord.

Test limits for leakage current are preset by the user. In the event of failure, automatic circuitry turns off the high voltage within 2 ms, lights the "failure" lamp and sets off an audible alarm. This audible and visual alarm must be reset by the user. (Meets U.L. requirements).

Use a ROD-L Hi-Pot Tester for production line testing, incoming inspection, and in-product development.

OPTIONS

OPT. NO.	NAME	M100/M500	M100DC
01	Remote Control	✓	✓
02	Front Panel Test Time Control	✓	
03	Front Panel Voltage Ramp Control	✓	
*05	Hands Off Control	✓	✓
06	Rear Panel Lockout Cover	✓	✓
08	Switch Selected Failure Point	✓	✓
*09	100 μA Full Scale		✓
10	Audible Test Tone	✓	✓
*14	Special Pin Assignment of Rear Panel Connector	✓	✓
15	Rack Mount Kit	✓	✓
16	Divide By 10 Front Panel Switch Current Trip Point	✓	
*18	Ohms Sense	✓	
19	Remote Control (Programmable)		✓
*20	Ohms Sense		✓
22	Front Panel Voltage Control	✓	
23	Digital Panel Meters	✓	✓
24	Blank Front Panel Receptacle & Start	✓	✓
27	"No Load" Trip Point Setting	✓	
28	Two-switch Selectable Current Scales	✓	

* Not Available when M25 required.

ROD-L ELECTRONICS ■ 923 Hamilton Avenue, Menlo Park, California 94025 ■ (415) 322-0711 ■ **Toll Free: 1-800-548-6305** ■ Fax: (415) 326-1993

ROD-L
ELECTRONICS, INC.

TOLL FREE
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Fax: (415) 326-1993

ROD-L Is The First Manufacturer Of UL Listed Hipot And Ground Continuity Testers.

IEEE-488 BUS-COMPATIBLE HIPOT TEST SYSTEM MODEL M150AC

IEEE—488 BUS PROGRAMMING

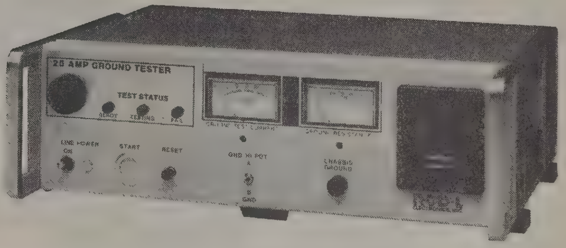
The Model M150AC Hipot Test System, when operated via the Model M1088 IEEE-488 BUS INTERFACE, functions as both a "Talker" (T) and a "Listener" (L) in conjunction with the following signals:

- Output Voltage (T / L) 100-5,000 VAC
- Output Voltage Ramp Rate (L) 50V/Sec-5000V/Sec
- Test Time (L) 1 sec. to 100 sec.
- Total Current Trip Point (L) 50mA
- Total Current Magnitude (T)
- Real Current Trip Point (L) 5mA
- Real Current Magnitude (T)
- Under Current Trip Point (L) 5mA
- Test Status
  - Ready (T)
  - In-Progress (T)
  - Passed (T)
  - Failed (T)
- Type of Failure (T)
- Start (L)
- Stop (L)
- Reset (L)

OTHER ROD-L PRODUCTS:

M900 —	International Receptacle Adaptor Unit adapts Rod-L Hipot/Resistance Testers with 7 standard international and special domestic receptacles.
M915 —	Remote High Voltage Adaptor A half-sized unit for remote control of Rod-L Hipot Testers with Hands-Off Operation.
M950 —	Hands-Off Controller A unit that controls the operation of a Rod-L Ground Tester and Hipot Tester with the Operator's hands occupied, i.e., OFF the Device Under Test.
M1088 —	IEEE 488 Bus Interface Adaptor A unit that interfaces between computers/controllers and Rod-L Hipot/Resistance Testers.

MODEL M25 GROUND CONTINUITY TEST INSTRUMENT



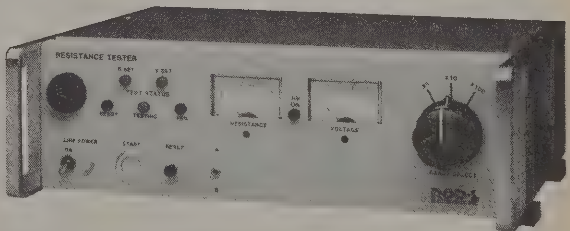
FEATURES:

- Interface enables interconnecting to any ROD-L Hipot Test Instrument to form an automatic test system

SPECIFICATIONS:

Output: 2.5 volts, up to 30 amperes (30 amps full scale ±5%, F.S.)
Voltage Rise: Instant on at first sinusoidal zero crossing — initiated with START button
Test Time: 1 second to 90 seconds (5 to 7 seconds — standard factory setting)
A-C Resistance: 0 to 0.15 ohm, accurate to ±5%, F.S.
Power Requirements: 115/230 vac, 44-66 Hz
Dimensions: 16¾″ x 5¼″ x 13¼″ (43 cm x 14 cm x 34 cm)
Weight: 30 lbs. (13.6 Kg) Net, 35 lbs. (15.9 Kg) Shipping

MODEL M300RT INSULATION RESISTANCE TEST INSTRUMENT



SPECIFICATIONS:

Insulation Resistance Detection: Up to 4000 MEGOHMS
Output Test Voltage: 500 VDC
Voltage Ramp: User adjustable from 50V/Sec to 500V/Sec
Test Cycle: 1 second to 180 seconds, adjustable
Shutdown: 2 milliseconds after any failure
Power Requirements: 115/230 VAC, 44-66 Hz, 300-watts maximum
Dimensions: 16¾″ x 5¼″ x 13¼″ (43 cm x 13 cm x 34 cm)
Weight: 24 lbs. (11 Kg) Net
Color: Mint gray/Olive gray
Option 25 available: Two-voltage switch (250V/500V normal)

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IEC 801-2: NSG 435 ESD Simulator. Microprocessor controlled gun with fiber optic interface measures actual tip voltage at instant of discharge.

IEC 801-4, 5: NSG 600 Modular Interference Simulator Mainframe. Configure or upgrade this flexible test system to your exact requirements. Plug-in modules as needed for 801-4, 801-5, AC/DC transient/dropouts, power quality testing, etc.

IEC 801-5: High Energy Pulse Generators. NSG 650 for hybrid surge pulse and Ring wave (required by ANSI). NSG 651 for surge pulse and CCITT telecom pulses (meets new 801-5 draft).

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ATTENUATION NETWORKS

AUDIO FREQUENCY/MODEL NO. 690 & 693 SERIES

- **Decade Type—Direct Reading** • **Selectable Input and Output Impedance** • **Usable to 50 KC**
- **0 to 111 DB in 1 DB Steps or 0 to 110 DB in 0.1 DB Steps** • **"T" and Balanced "H" Versions Available**
- **Portable or Rack Mounted**

690

Models 690 and 693 Series Attenuation Networks are decade type, direct reading units providing reliable performance throughout the audio frequency spectrum.

Used as secondary attenuation standards, they are especially useful in the performance of general laboratory or production tests where extreme accuracy is secondary. They are used for low level testing at audio frequencies, and can be used at frequencies up to 50,000 cycles with very little decrease in accuracy.

An outstanding feature of these attenuation networks is flexibility; input and output impedances may be changed by means of convenient plug-in pads, available in a broad range of values. Both "T" and Balanced "H" versions of the 690 and 693 series are available as standard units.

They are available as portable or rack mounted units.

Input and output impedance adjusting pads are conveniently located and removable from the front panel.

Series 690 networks come with either balanced (Balanced "H") or unbalanced ("T") networks. The two dial models have a range of 0 to 110 db in steps of 1 db. The three dial models have a range of 0 to 111 db in steps of 0.1 db. The models with balanced networks are arranged so they may be used as unbalanced networks with the same attenuation range, but with one-half the base impedance.

SPECIFICATIONS:

Specifications shown are standard. Variations to fit individual customer requirements are available on request.

MODEL DESCRIPTION

Portable	Rack Mounting	Basic Imped.	Circuit	Range
T-690-C	T-690-CR	600/600	T	0-110 db in 1 db steps
H-690-D	H-690-DR	600/600	Bal. H	0-110 db in 1 db steps
T-693	T-693-R	600/600	T	0-111 db in 0.1 db steps
H-693	H-693-R	600/600	Bal. H	0-111 db in 0.1 db steps

STANDARD IMPEDANCE MATCHING PADS

INPUT		OUTPUT		IMPED	LOSS
T	Bal H	T	Bal H	(ohms)	(db)
6811	6831	6851	6871	500	3.77
6812	6832	6852	6872	500	5.00
6813*	6833**	6853*	6873**	600	0
6814	6834	6854	6874	250	8.74
6815	6835	6855	6875	250	10.00
6816	6836	6856	6876	200	9.96
6817	6837	6857	6877	200	10.00
6820	6840	6860	6880	50	16.63
6821	6841	6861	6881	50	20.00

*Standard in "T" models unless otherwise specified. **Standard in Balanced "H" models unless otherwise specified.
Other impedances available upon request.

	Model 690	Model 693
Attenuation Range:	0-110 db	0-111 db

Impedance: 600/600 ohms
Input and output impedances may be changed by changing plug-in pad.
±1% at 1,000 cps ±2% 0 to 20,00 cps
Range may be extended to 50,000 cps with small decrease in accuracy

Power Input: 28 dbm (0.6 watt)

Switches: Heavy duty silver alloy contacts, multi-leaf rotor and slip ring return, positive wiping with individually sprung switch arm leaves

Terminals: Jack-top binding posts

Construction: All metal, two-tone cabinet. Also available for rack mounting

---

AUDIO VIDEO FREQUENCY/MODEL NO. 790 & 795

- **Decade Type—Direct Reading** • **Wide Frequency Range: 0 to 10 MC** • **600 Ohms Impedance**
- **0 to 111 DB in 1 DB Steps or 0 to 110 DB in 0.1 DB Steps** • **Positive Detent—Silver Alloy Switch Contacts**
- **Portable—Rugged** • **Both "T" and Balanced "H" Units Available**

795

Model 790 and 795 Attenuation Networks are portable, ruggedly constructed, decade type, direct reading units providing accurate performance into the low radio frequency spectrum.

The instruments cover a range from 0 to 10 mc. They have positive detent action and mechanical stops incorporated into each decade.

Stray capacitance and frequency discrimination are minimized through precision design. Silver alloy switch blades and contacts guarantee reliable long term operation.

These attenuator networks are general purpose instruments for use in laboratories, quality control departments and test facilities. They are particularly useful for making accurate measurements of gain or loss on filters, transformers, amplifiers and other equipment.

Both models are equipped with jack-top binding posts.

SPECIFICATIONS:

Variations to fit individual customer requirements are available on request.

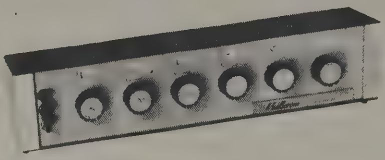
	Model 790	Model 795
Attenuation Range:	0-110 db in 1 db steps	0-111 db in 0.1 db steps
Weight:	10¾ lbs	15½ lbs
Impedance:	600 ohms	600 ohms
Resistor Accuracy:	±0.25%	±0.25%
Attenuation Accuracy:	±0.1 db at 1000 cps when terminated in a resistive load	
Frequency Characteristics:	0.1 db per step and 1 db for step decades—±0.2 db, 0 to 10 mc 10 db per step—±0.5 db, 0 to 0.5 mc (with 90 db setting ± 0.5 db at 1 mc Lower values within this tolerance up to 10 mc	

Power Input:	30 dbm (1 watt)
Switches:	Heavy duty solid silver alloy contacts and multi-leaf switch rotor. Each leaf of the switch arm is individually sprung to provide self alignment and equalized pressure, assuring low and uniform contact resistance
Terminals:	Jack-top binding posts, ¾" spacing. Common terminal of "T" units grounded to chassis Common terminal of "H" units floating
Construction:	All metal two-tone cabinet
	Rack mounting available on special order

PRECISION INSTRUMENTS

PRECISION RESISTANCE DECADES

SERIES 6800



SPECIFICATIONS

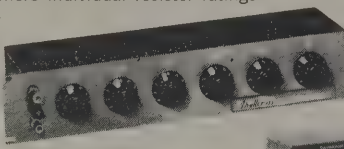
DC Accuracy at Terminals
±.02% 10 ohms and above
±.003 ohms below 10Ω

Zero Resistance
2 milliohms ±2 milliohms per decade (approximate). Each instrument is supplied with exact reading.

Wattage Rating per Step
½ watt above 1 ohm, ¼ watt for .1 ohm steps, .16 watt for .01 ohm steps.

Maximum Voltage
1500 volts DC where individual resistor ratings are not exceeded.

SERIES 800



SPECIFICATIONS

Resistor DC Accuracy
±.05% 10 ohms and above
±1% .1 ohm to 10 ohms
±5% .01 ohm to .1 ohm

Stability per Year
±.01% when operated within rated wattages over 10°C – 40°C range.

Temperature Coefficient
Less than ±20 PPM 20°C – 30°C.

Maximum Wattage
½ watt per resistor.

Maximum Voltage
2000 volts DC if wattage rating for resistors is not exceeded.

6800 SERIES BENCH AND RACK MOUNTED DECADE MODELS

Bench Model No.	Rack Model No.	No. Dials	Resistance Step Increments (Ohms)	Total Resistance (Ohms)	Bench Size (Inches)
6840	6840 RM	4	.01	111.1	17⅓ x 5 x 5
6841	6841 RM	4	.1	1,111	17⅓ x 5 x 5
6842	6842 RM	4	1	11,111	17⅓ x 5 x 5
6843	6843 RM	4	10	111,110	17⅓ x 5 x 5
6844	6844 RM	4	100	111,000	17⅓ x 5 x 5
6845	6845 RM	4	1,000	110,000	17⅓ x 5 x 5
6850	6850 RM	5	.01	1,111.1	19½ x 5 x 5
6851	6851 RM	5	.1	11,111	19½ x 5 x 5
6852	6852 RM	5	1	111,110	19½ x 5 x 5
6853	6853 RM	5	10	111,100	19½ x 5 x 5
6854	6854 RM	5	100	111,000	19½ x 5 x 5
6860	6860 RM	6	.01	11,111.1	19½ x 5 x 5
6861	6861 RM	6	.1	111,111	19½ x 5 x 5
6862	6862 RM	6	1	111,110	19½ x 5 x 5
6863	6863 RM	6	10	111,100	19½ x 5 x 5

800 SERIES BENCH AND RACK MOUNTED MODELS

Bench Model No.	Rack Model No.	No. Dials	Resistance Step Increments (Ohms)	Total Resistance (Ohms)	Bench Size (Inches)
817-A	817 ARM	4	.01	111.1	9⅝ x 7¼ x 5¼
819	819 RM	4	.1	1,111	9⅝ x 7¼ x 5¼
825	825 RM	4	1	11,110	9⅝ x 7¼ x 5¼
826	826 RM	4	10	111,100	9⅝ x 7¼ x 5¼
827	827 RM	4	100	1,111,000	9⅝ x 7¼ x 5¼
828	828 RM	4	1,000	11,110,000	9⅝ x 7¼ x 5¼
817-B	817 BRM	5	.01	1,111.1	10⅞ x 6¼ x 5¼
8285	8285 RM	5	.1	11,111	10⅞ x 6¼ x 5¼
829	829 RM	5	1	111,110	10⅞ x 6¼ x 5¼
830	830 RM	5	10	1,111,100	10⅞ x 6¼ x 5¼
831	831 RM	5	100	11,111,000	10⅞ x 6¼ x 5¼
817-C	817 CRM	6	.01	11,111.1	10⅞ x 6¼ x 5¼
8315	8315 RM	6	.1	111,111	10⅞ x 6¼ x 5¼
832	832 RM	6	1	1,111,110	10⅞ x 6¼ x 5¼
833	833 RM	6	10	11,111,100	10⅞ x 6¼ x 5¼

6800 AND 400 SERIES UNMOUNTED DECADES – SPECS EQUAL TO 800 AND 6800 SERIES

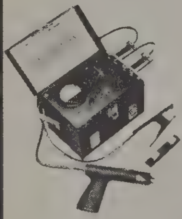
Dials	Ohm Steps	Total (Ohms) Resistance	Weight (Lbs.)	Model No.	Dimensions (Inches)	Model No.	Dimensions (Inches)
1	.01	.1	½	6800	2⅞ x 3	435	3 x 3
1	.1	1	½	6801	2⅞ x 3	436	3 x 3
1	1	10	½	6802	2⅞ x 3	437	3 x 3
1	10	100	½	6803	2⅞ x 3	438	3 x 3
1	100	1,000	½	6804	2⅞ x 3	439	3 x 3
1	1,000	10,000	½	6805	2⅞ x 3	440	3 x 3
1	10,000	100,000	½	6806	2⅞ x 3	441	3 x 3
1	100,000	1,000,000	½	6807	2⅞ x 3	442	3 x 3
1	1,000,000	10,000,000	½	6808	2⅞ x 3		

VALUE IN RESISTANCE MEASUREMENT

GALVANOMETER SYSTEMS WITH INTERNAL MAGNET CONSTRUCTION

Part No.	Sensitivity/ Div. in Micro-amps	Period Seconds	Coil Resistance	External Critical Damping Resistance
1961-A	1.0	3	250	950
1961-B	0.5	3	1000	2400
1961-C	2.0	3	50	125
1961-D	4.0	3	20	50
1366-B	0.25	4	1000	2000
1966-C	1.0	4	50	100
1964-D	1.5	4	30	40

670 SERIES LOW RESISTANCE TEST SETS



Six portable test sets offering the facility and operating speeds necessary for efficient production line testing of low resistances. Applications include the testing of welding bond resistances, welding cable resistances, switch contact resistances, etc. Six different measurement ranges (see chart below) with accuracies of ±5% of full scale values are available. A pistol grip probe and fixed clamp are standard accessories to facilitate production line tests.

657B pistol grip probe

676 fixed clamp

271 test standard 0.0025 ohm ±2%

Shallcross Type	No. of Ranges	Ranges in Ohms – Reading From 0 to Full Scale Value Indicated					
670-A	6	0.001	0.005	0.01	0.05	0.10	0.50
673-D	5	0.005	0.01	0.50	1.0	5.0	

638-R KELVIN WHEATSTONE BRIDGE

A portable Kelvin Wheatstone Bridge offering exceptional versatility and practicality. Wide measurement range is afforded by integrated Kelvin (.001 ohm to 10 ohms) and Wheatstone (1 ohm to 11 megohms) circuits. Internal galvanometer and compartment for 3 (1.5 volt) flashlight batteries supply portable operation in 0.1 ohm to 50,000 ohm range. Binding posts to connect external galvanometer (.005MA/MM sensitivity) and power supply (1 to 45 volts) supplied for higher resistance measurements. Limits of error are ±.75% (Kelvin circuit) and ±.2% (Wheatstone circuit). Rheostat arm is brought out to two binding posts to provide resistance decade operation (11,110 ohms on 1 ohm step increments) with ±.1% accuracy above 10 ohms and ±.25% for 1 ohm steps. Separate current and potential terminals are available for low resistance measurements.

6100 WHEATSTONE-FAULT LOCATION BRIDGE

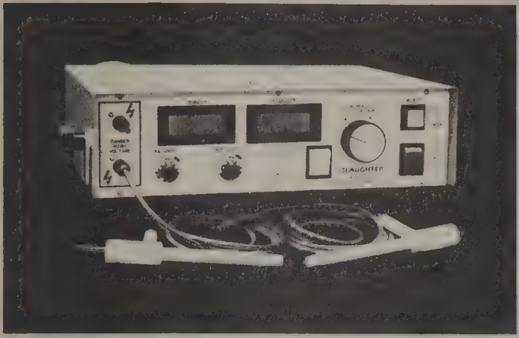
All purpose portable instrument for laboratory and field resistance measurements. Fault location capabilities of wires and cables performed with, Murray, Varley, Hilborn and Fisher loop tests. DC resistance from 1 ohm to 1.011 megohms with ±2% limit of error. Built-in galvanometer and compartment for 3 (1.5 volt) flashlight batteries permit portable measurements to 50,000 ohms – binding posts to connect external galvanometer and power supply available for testing of higher resistances. Rheostat arm of bridge connects to two binding posts for decade resistance operation. Available housed in weatherproof metal case and removable lid or with wooden case and removable lid.

ELECTRO TECHNIK

SHALLTRONIX CORPORATION
421 Cornwall Rd., P.O. Box 1090 • Sanford, FL 32772 FAX (407) 321-9410 Phone (407) 321-3800

For repetitive production/inspection applications

Go, No-Go Masterless Operations Do Not Depend on Operator Judgement

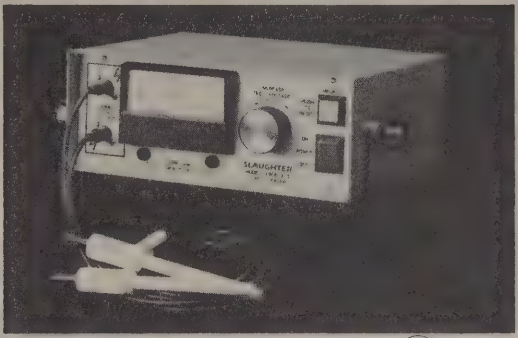


Battery Element Testers

Models Available For Both Moist and Dry Charged Cells

Briefly, these testers subject the battery elements to a high voltage which appears between all plates and across all separators. If everything is normal — that is, if there are no defects in the separators, no runs, no trees, etc. — the battery element will withstand the test voltage and only a normal amount of leakage current will be registered by the test instrument.

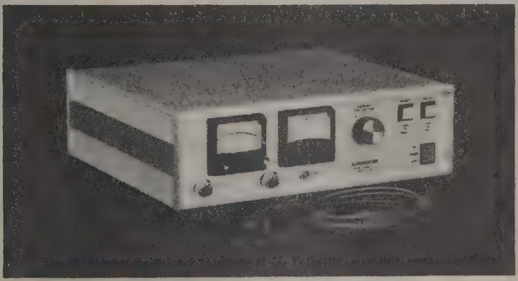
Proper test voltage for any particular battery element must be established by the user. Generally this will be in the range of 1,000 to 1,500 volts for elements with separators of less than .045", unless some marginal defects can be tolerated. For separators in the range of .045" to .065", a voltage in the range of 2,000 to 3,000 is normally required.



"Fail-Safe" 120 K Insulation Testers

The Series 2300 Testers are specifically engineered to conform with regulations first instituted in 1983 which are commonly referred to as "120 K Requirements". Additionally, this series is U.L. Listed.

Test voltage is continuously variable and monitored by a single built-in voltmeter. Sensitivity may be adjusted over a load current range. The 120-K ohm resistor terminals on the front panel allow the operator to check instrument calibration quickly and easily at any time. Audible and visual signals are locked in upon reject and must be manually reset before testing can be resumed. In the unlikely event that the Reject/HV Cut-off Circuit should fail, the instrument will go into the reject mode on the next bad part and will not reset. This protects the operator from shock hazard and from passing bad parts while unaware the Reject/HV Cut-off Circuit is inoperative.

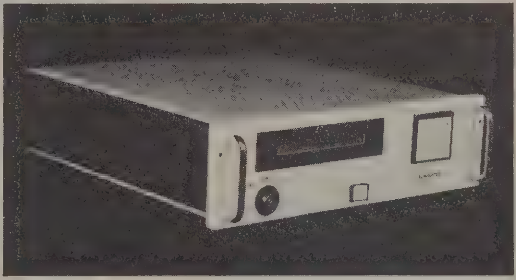


Coil & Winding Testers

- Tests Solenoids, Chokes, Transformers, Stators, Armatures, Etc.
- Exposes Shorted Turns as Well as Opens and Grounds

The surge test is without question the most comprehensive single test used to check coils and windings. In addition to shorts, opens, and grounds, the surge test can also expose latent defects such as shorted turns which will not show up on other types of tests. From simple solenoids through chokes, transformers, stators, and armatures, the surge test is a necessary step in the manufacture of all high quality wound products.

Though the instantaneous energy is high, average energy levels are low. Therefore, the high voltage stresses required to conduct a good test are produced without damaging good parts.



Programmable Testers

IEEE-488

- AC INSULATION TESTER
  - DC INSULATION TESTER
    - MEGOHMMETER
      - SWITCHING MATRIX

The basic purpose of the Series 1727 testers is to provide a fully programmable high voltage source with current sensing capabilities for use in a computer controlled system. Additionally, most are programmable from the front panel.

- PROGRAMMABLE FOR
  - Voltage Amplitude
  - Voltage Rate Rise/Fall
  - Reject Threshold
  - Dwell Time
  - Real/Total Current
  - Charge Time

801 Hailey St.
Ardmore, OK 73401

SLAUGHTER
The ProTesters

Telex - 6975577
FAX 405/226-5757

Phone - 405/223-4773
or 800/421-1921

TOROTRON CORP. DEPT. EM, 519 SOUTH FIFTH AVE., MOUNT VERNON, NY 10550, (914) 664-2050

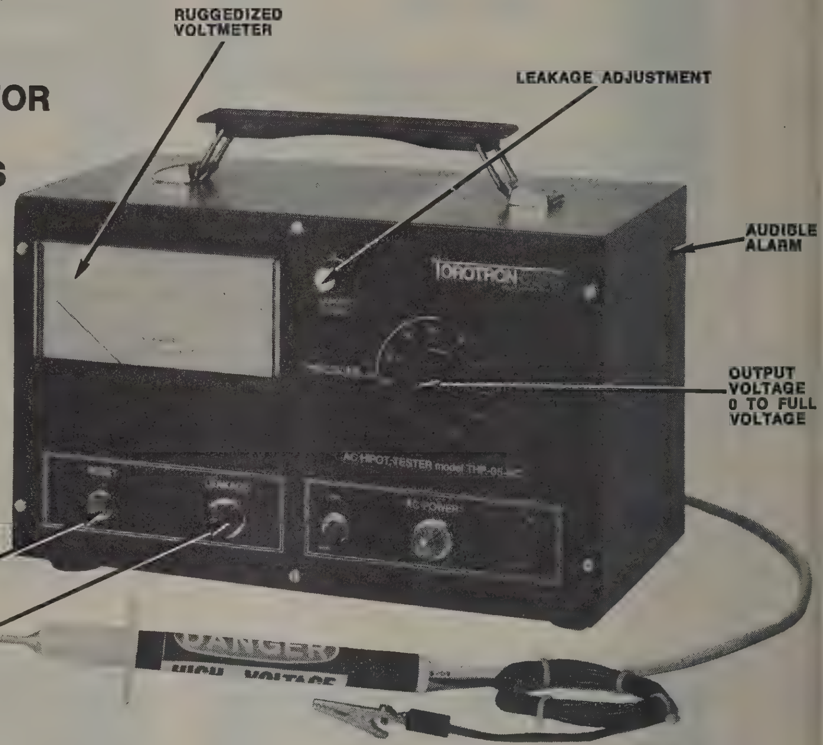
AC & DC Hipot Insulation Testers

Application: • Production testing for insulation resistance. Dielectric withstand, etc. • Motors • High Voltage Capacitor • Wire & Cable • Dielectric Materials • Transformers & Coils • Bushing & Insulators • High Voltage Rectifiers • **UL Listed Electrical Hi Pot Tests.**

THP-AD Hipot Series

AC OR DC DIELECTRIC WITHSTANDING TESTER FOR MAKING U.L. LISTED ELECTRICAL HIPOT TESTS

Model THP-AD Series of High Quality, Low Cost, AC & DC High Voltage Insulation Tester. Makes fast, accurate dielectric withstanding tests of Appliances, Motors, Coils, Transformers, Electronic Components, Insulation Materials, etc.



FEATURES:

- **High Voltage Output Control**
  Continuously variable from zero to full voltage.
- **Solid State Visual and Audible Alarm**
  Adjustable from 500 μA to 5 mA breakdown current.
- **Latching Relay**
  Shuts off power when breakdown current exceeds preset limit: keeps audible alarm on until defective part is removed and tester reset.
- **Voltage Monitoring**
  Actual output voltage monitored by rugged, 4½″, mirror scale taut band kilovoltmeter.
- **Output Cable**
  Cable insulated for three times rated voltage with attached High Voltage Probe; separate ground leads.
- **Polarity**
  DC models: Probe output voltage negative with respect to ground.

SPECIFICATIONS:

Input	115 Vac, 60 Hz, 3A Max., 120W at full load
Size and Weight	7″H x 12″W x 6″D. Approx. 18 lb
Meter	Accuracy ±2% of full scale
Output Voltage	0 to full voltage, see table
Short Circuit Current	Transformer output capability 18 mA at full voltage

AC SERIES

Model	Output Voltage	Price 1 to 5
THP-03-AD	0-3 KVAC	$450.00
THP-05-AD	0-5 KVAC	$475.00
THP-10-AD	0-10 KVAC	$1200.00

DC SERIES

Model	Output Voltage	Price 1 to 5
THP-03D-AD	0-3 KVDC	$450.00
THP-04D-AD	0-4 KVDC	$475.00
THP-07D-AD	0-7 KVDC	$900.00
THP-12D-AD	0-12 KVDC	$1500.00

Note: Discount 5% 6 to 10. For larger quantities request quote.

ALSO AVAILABLE FROM TOROTRON: A Complete Line of Custom High Voltage Power Supplies, Regulated or Unregulated. CONTACT FACTORY DIRECT FOR INFORMATION.

Specifications and price subject to change without notice

US DIGITAL

T2 Tilt sensor Incremental Inclinometer

The T2 inclinometer is a low cost digital tilt transducer used to report the angle of an object with respect to gravity.

Optical shaft encoder technology provides unlimited range and virtually eliminates linearity errors.

Internally, an optical encoder disk is suspended between two micro-ball bearings. A weight placed on one side of the wheel assembly causes it to follow the source of gravity.

A beam of collimated light generated by a lensed LED projects the codewheel image onto an array of photodiode detectors on a monolithic chip. As the housing moves relative to the codewheel, the moving image of radial lines is converted to realtime TTL outputs.

Features

- Low cost
- Fast response
- Rugged and simple
- 2-channel quadrature outputs
- 3rd channel index option
- TTL compatible
- -40 to +100°C operating temperature
- Single +5v supply
- 360 degree range
- 1440 codes/rev. = 0.25° resolution
- 3600 codes/rev. = 0.1° resolution
- 7200 codes/rev. = 0.05° resolution
- 2 year warranty

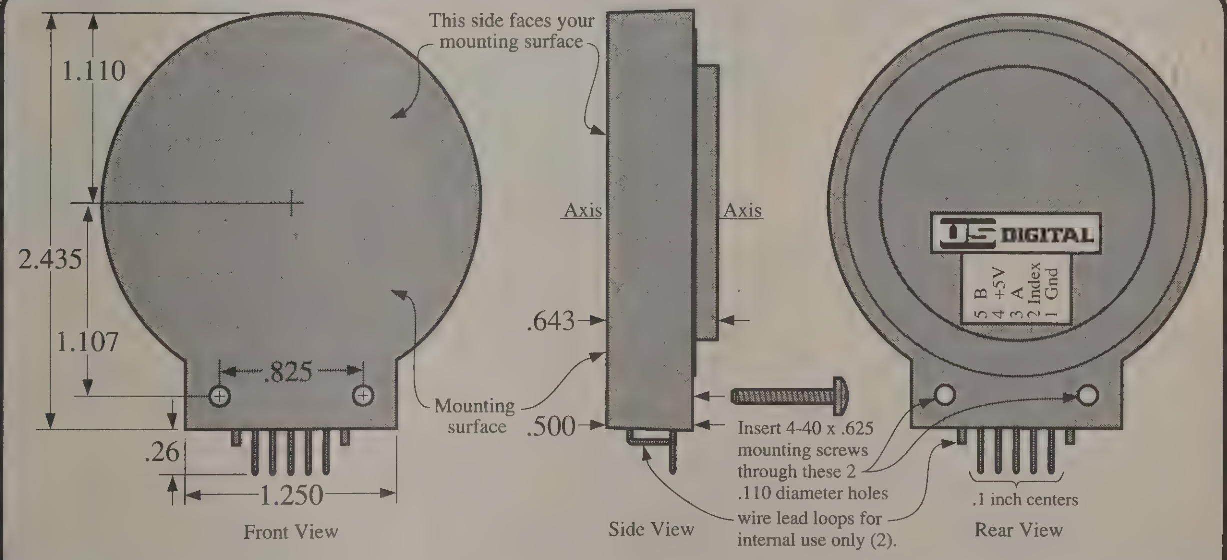
Damping:
Internal magnetic damping is a balance between response time and ringing. The standard damping will fit many applications. Typical settling time for standard damping appears to be less than 200 milli-seconds. Double damping slows the settling time by several hundred milli-seconds, not by ringing, but by more slowly approaching the final position. Some applications may not require any damping, such as motion detectors. Others may require double damping to average out cyclic motion such as found in moving vehicles. Damping options can be specified when ordering.

Index:
The optional index can serve as an absolute reference to reset an external counter. For standard orientation, the index will go high when the connector pins point toward gravity. Other orientations can be specified.

Digital displays:
Several digital counters with LCD displays are available which will connect directly to these inclinometers. Check with us about models, price and availability.

Absolute Inclinometer:
Ask about our true absolute digital inclinometer.

Price	Cost Modifiers
$41.00 / 100's	Add $4.00 for 7200 codes/rev. or index.
$44.00 / 50's	Deduct $4.00 for no damping (N-option).
$48.00 / 10's	Add $4.00 for double damping (D-option).
$55.00 / 1's	Add $2.00 for transfer adhesive (T-option).


1.110
2.435
1.107
.825
.26
1.250
This side faces your mounting surface
Axis
Axis
.643
Mounting surface
.500
Insert 4-40 x .625 mounting screws through these 2 .110 diameter holes
wire lead loops for internal use only (2).
US DIGITAL
5 B
4 +5V
3 A
2 Index
1 Gnd
.1 inch centers

Front View Side View Rear View

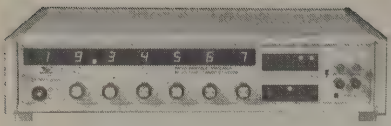
(206) 260-7451 **(800) 736-0194** **Fax (206) 260-7452**

U.S. Digital Corp. • 17401 Stoney Meadows Dr. • Vancouver, WA 98682

VALHALLA SCIENTIFIC

Instrument Short Form Catalog

CALIBRATORS, STANDARDS, & POWER ANALYZERS



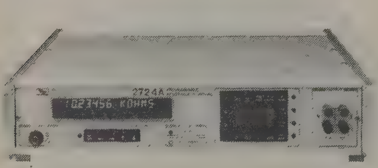
VALHALLA 2701C
DC VOLTAGE CURRENT STANDARD

The Valhalla 2701C DC Voltage Standard is ideally suited for 7 1/2 digit DMM calibration, thermocouple simulation, A/D converter linearity tests, and virtually any accurate direct voltage application.

The 2701C features 2- or 4- wire remote sensing available at the touch of a button for automatic sense correction of lead resistance.
For ultra-low noise applications (i.e. A to D converters) option "LNF" provides an extremely quiet output level (this option limits output to 40 VDC maximum.)

- Automatic Bi-Polar Output
- 0.5 ppm Resolution, GPIB optional
- 120mA Current Option (ie 4 - 20mA)
- Two/Four Terminal Output (one touch)
- "Covers on" Automatic Calibration
- 25 mA Compliance Current

Ranges: 200mV, 2V, 20V, 120V, 1200V
Accuracy: (23°C ±5°C) 8 ppm ±20μV, 20V range/ 30 days
Stability: 1.5 ppm/24 hrs.±1°C ambient change

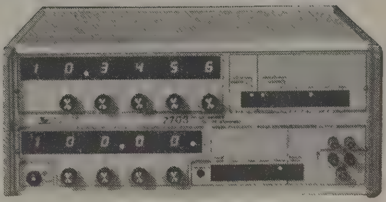


VALHALLA 2724A
VARIABLE RESISTANCE STANDARD

This unique GPIB controllable resistance standard provides over 10 million resistance values ranging from 100 micro-ohms to 11 gigohms.

The Valhalla 2724A Programmable Resistance Standard is ideal for a variety of applications including, DMM calibration and simulation of RTDS. Product performance is best in applications at resistance values of 10 ohms and above.
Precision aged oil filled hermetically sealed wire-wound reference resistors provide 10 ppm annual stability.

- 1 ppm Resolution, 7 ppm Accuracy

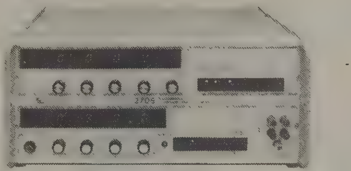


VALHALLA 2703
AC VOLTAGE STANDARD

The 2703 AC Voltage Standard is an AC voltage source whose frequency and amplitude can be varied, either manually or remotely, to produce precision sinewaves for AC voltmeter calibration applications.

- Built-in Kilovolt Amplifier(1200 VAC)
- IEEE-488 GPIB Compatible
- Remote 4 terminal sensing
- Crystal controlled frequency(10.00Hz - 100 KHz)
- Digitally Synthesized Sinewave stability
- Economically priced

Ranges RMS (full scale): *1.2mV, *12mV, 120mV, 1.2V, 12V, 120V, 1200V
Accuracy: 0.02% to 20 KHz, 0.05% to 0.1% to 100KHz
Stability: 15 ppm low to midband to 50 ppm @ 100 KHz
Frequency Accuracy:±0.01%
*Divider optional

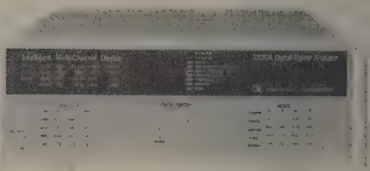


VALHALLA 2705
AC PHASE STANDARD
WATTMETER CALIBRATION

The 2705 combines with a 2703 AC Voltage Standard and a Valhalla current source to provide phase controllable voltage/current system for wattmeter calibration. Increments of 0.1° to 360° with current up to 100 amps is available.

The 2705 may be used to act as a voltage reference for a transconductance amplifer (ie Valhalla 2555A 100 Ampere Current Calibrator.) A single phase or three phase Watts calibration system using 2703, 2705 and 2555A is a common configuration. An economical package price combined with the Valhalla 2703 makes it a very affordable system.

- **Accuracy** ±0.25 degrees
- **Resolution** ±0.1 degrees
- GPIB optional

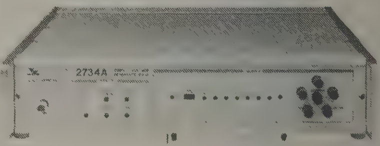


VALHALLA 2330
POWER ANALYZER

The Valhalla 2330 is the next generation microprocessor based 2300 series power analyzer. Using the unit's intelligent multichannel display the user can simultaneously track power related parameters such as Amps RMS, Volts RMS, VA, VARs, P.F., Hz, Watts, KWHrs, AHrs, phase, distortion, individual harmonics (1-50th) and more. The 2330 is available in single and three channel (i.e. 3 phase 4 wire) versions.

Basic measurement accuracy is 0.1% to 5 KHz and bandwidth to 50 KHz. Current ranges include nine levels from 200 mA t 100Amps per phase. Higher current and voltage levels are easily measured using external shunts, current transformers (CT) and potential transformer (PT). The 2330 Power Analyzer directly displays actual high voltage or current primary levels when provided with the proper CT and PT ratios.

The Valhalla 2330 is available with optional GPIB I/O, RS232C, or Centronics parallel printout capabilities. The 2330 features direct print capability for unattended power parameter data logging (i.e. Watt Hours, P.F. etc.) applications. The 2330 can be user configured to automatically output reports with clock-time programming. For a complete 2330 product brochure with features and specifications contact the sales dept. at Valhalla.



VALHALLA 2734A
DIRECT VOLTAGE REFERENCE

Four ovened, ultra stable reference zeners, operating in parallel, offer a NIST traceable DC volt to an uncertainty of 0.4 ppm. Unit may be shipped with optional 72 hour battery case. Outputs of 1 V, 1.018 V, 7V and 10V are provided.

The 2734A is ideal for any high accuracy DC Voltage calibration requirement (ie 8 1/2 digit DMMs). The unit is truly a 4 reference system with any and all combinations (ie ref 1 and ref 3) of references selectable. Low Thermal EMF Gold-Copper Tellurium terminals provide <0.1μ volt offset.

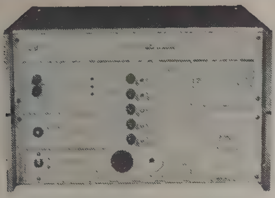
- 4 Individually Selectable References (3ppm/yr)

CALL TOLL FREE
1-800-548-9806
VALHALLA SCIENTIFIC
9955 Mesa Rim Road, San Diego, CA 92121
Phone 619/457-5576 Fax: 619/457-0127

VALHALLA
SCIENTIFIC

Instrument Short Form Catalog

AC-DC CURRENT SOURCES, SHUNTS, ANALYZERS

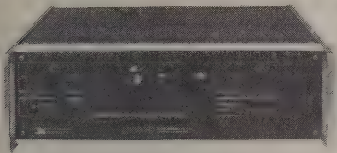


VALHALLA 2555A - 100 AMP AC-DC CURRENT CALIBRATOR

Capable of delivering 1mA to 100A DC or RMS AC precise, constant current with 4 volts compliance to 1 kHz for direct calibration of ammeters, wattmeters, DMM's, shunts, current transformers and Hall Effect devices.

- Parallel output expandable to 1000 Amps
- Capable of driving a 10 turn coil to simulate 1000 Amps AC or DC

Features include output compliance and standby/operate mode indicators.
DC Accuracy: ±0.02% output
AC Accuracy: ±.15% output



VALHALLA 2500EP 12 AMP AC-DC CURRENT CALIBRATOR

- Calibrates the 10 Amp range on Handheld DMM's
- Transconductance Amplifier based design
- Highly stable AC-DC current from 100µA.

2500 SERIES PRECISION AC-DC CALIBRATORS

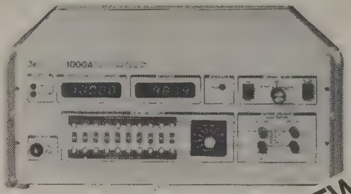
This series of constant current source instruments provides precision levels, of both AC and DC current, up to 100 amperes, for calibration of DMMs, shunts, wattmeters, and current transformers. The 2500 series current modules may be added to existing laboratory voltage standards to create precision, N.I.S.T traceable current from 100 pA to 100 amperes.

SPECIFICATIONS

Model	Range
2500	7 Ranges 2µA-2A DC to 10KHz
2500EP	6 Ranges 200µA-10A DC to 5KHz
2555A	6 Ranges 2mA-100A DC to 1KHz
DC Accuracy	±0.02% approx.
AC Accuracy	±0.05% approx.

VALHALLA 2575A AC-DC ACTIVE CURRENT SHUNT

The unit is a working standard providing six ranges of internal shunts covering from 2mA (10 nA) through 100 amperes. The unit features a built in gain of 10, chopper stabilized DC-wideband amplifier capable of driving thermal transfer standards.



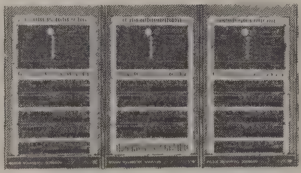
VALHALLA 1000A AC-DC CURRENT ANALYZER

NEW

- 0.02% DC - 0.05% AC accuracy to 1000 Amperes
- Wideband performance DC to 10 KHz
- Ideal for pulsed energy waveform analysis
- Fast 1 microsecond transient response
- Transient Analyzer and Harmonic Analyzer compatible
- Peak "in-rush" current display mode
- RMS maximum and HOLD reading modes
- Optional GPIB and RS232C interface

As an active AC-DC shunt based system, the unit has tremendous accuracy, amplitude linearity, phase response, and bandwidth advantages over conventional clamp-on current probes and current transformer (CT) based instrumentation. A CT based current measurement lacks DC response, has 2° to 3 ° phase shift errors, nonlinear response to increasing amplitudes, poor bandwidth, subject to stray magnetic field pickup and accuracies are typically 2-5%.

Applications include calibration of clamp-on CTs, DC probes, current sensors, ammeters and Hall Effect devices. The unit is also an excellent engineering tool for evaluation of industrial devices such as circuit breakers, arc welders, electroplating, large AC or DC motors, Power Distribution Consoles, batteries, UPS, Power Sources, and pulsed energy measurements.

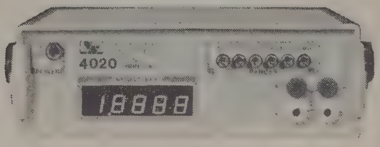


27000 AUTOMATED METER/OSCILLOSCOPE CALIBRATION SYSTEM

Valhalla Scientific offers a fully integrated, ultra-precision calibration system for DVM's, oscilloscopes, wattmeters, current meters, shunts, power supplies, etc.

Valhalla calibration systems can be custom configured to the most demanding applications. Single phase, three phase Watts calibration systems, 1000 Ampere High Current Systems are just an example of Valhalla's system capabilities. Valhallas automated calibration, "PC-CAL" software is menu driven, MIL STD 45662A compatible and will operate on any IBM compatible 286,386 or 486 based instrument controller.

OHMMETERS



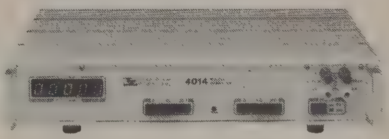
VALHALLA 4020 LOW COST DIGITAL OHMMETER

- Economically priced (under $500)
- Battery Pack Portability
- 4 Wire Remote Sensing
- 4 1/2 Digit Display (19999)
- 1 mΩ resolution on 20Ω range

This model is Valhalla's most economical digital ohmmeter. The meter offers four terminal measurement capability designed around a low noise high resolution A/D converter driving a 4 1/2 digit display.

As an added convenience in field applications, the 4020 is available with an an optional heavy-duty 6 VDC rechargeable battery pack.

Ranges: 20Ω, 200Ω, 20kΩ,200kΩ,2MΩ
Test Currents: 10mA, 1mA, 100µA, 10µA, 1µA, 100nA



VALHALLA 4014 WIDE RANGE DIGITAL OHMMETER

The Model 4014 contains nine ranges covering from 100µ Ω resolution on the 2Ω range to 200 MΩ on the highest range. The wide measurement capability of the 4014 makes it ideal for a great variety of low level and general purpose resistance applications. Packaged in a sturdy, aluminum enclosure, the 4014 is tough and built to last.

- 100 micro-ohm resolution to 200 MΩ full scale
- Sturdy aluminum case built to last
- 4 wire Remote Sensing to eliminate lead resistance and contact resistance errors.
- 2 volt preamp provides high stability for 200 MΩ readings
- Optional "BCD" output allows the meter to work with a BCD comparitor (ie parts sorting)
- Ideal for receiving inspection for screening incoming resistive components.

CALL TOLL FREE
1-800-548-9806

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9955 Mesa Rim Road, San Diego, CA 92121
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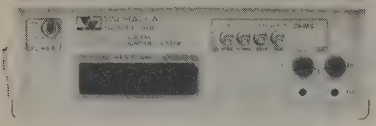
IGNITER TESTERS



VALHALLA 4314 SERIES DIGITAL IGNITER TESTERS

These Valhalla Digital Ohmmeters are battery powered, portable, ultra fail-safe instruments designed specifically for military and aerospace igniters. When utilizing these instruments to test the continuity and integrity of firing circuits, absolute safety is assured. Dual, redundant fail safe current limiting guarantees that under any internal instrument catastrophic failure condition, the resulting current flow into the igniter will not exceed a prespecified safe level.

Model	Ranges
4314A	20Ω, 200Ω, 2000Ω, 20000Ω
*F/SI	15mA, 1.5mA, 150μA, 15μA
4314AN	20Ω, 200Ω, 2KΩ, 20KΩ
F/SI	15mA, 1.5mA, 150μA, 15μA

4314H	200Ω, 2000Ω, 200KΩ, 2MΩ
F/SI	150μA, 15μA, 150nA, 15nA
4314 UK	20Ω, 200Ω, 2000Ω, 20000Ω
F/SI	8mA, 1.5mA, 150μA, 20μA

*F/SI = Fail Safe Current

Range	Res.	Acc.%	Range	Res.	Acc.%
20Ω	0.001Ω	±0.04%	200KΩ	10Ω	±0.04%
200Ω	0.01Ω	±0.04%	2MΩ	100Ω	±1.00%
2000Ω	0.1Ω	±0.04%	20MΩ	1KΩ	±2.4%
20KΩ	1Ω				

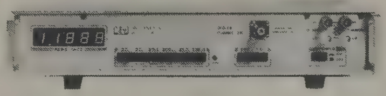
Inquire about our systems compatible Igniter tester model 4650A

VALHALLA 4165 CONTACT RESISTANCE MICRO-OHMMETER

Special features and considerations have been designed into the basic Model 4165 to satisfy MIL-S-83504, MIL-S-22710 and MIL-STD-1344 for measuring contact resistance for connectors and relays. An active electronic clamp limits the open circuit voltage associated with the test leads to insure compliance with the "dry" contact resistance determination in accordance with the applicable Military Specifications. Reversal of test voltage and current is incorporated to insure that thermal EMF's are not adversely influencing the test.

- 20 mV open circuit voltage
- 10 μ ohm resolution
- Ranges 200 mΩ to 20 KΩ

DIGITAL OHMMETERS



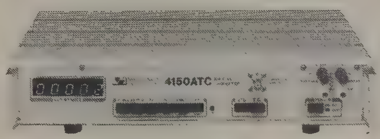
VALHALLA 4100 ATC DIGITAL MICRO-OHMMETER

Combines 10μΩ resolution with Automatic Temperature Compensation (ATC) to create an economical low level ohmmeter to help determine temperature rise or base line resistance in motors, transformers, and copper wire. This ATC feature has been pioneered by Valhalla, resulting in hundreds of thousands of dollars in savings for customers who manufacture inductive based products using copper wire.

The unit uses 1 ampere of test current with a 200 millivolt preamp to provide 10μΩ resolution on the 200 milliohm range. Four terminal measurement capability insures an accurate low level measurement independent of cable and contact resistance. There are several cable and probe options available.

Resolution: 10 μΩ on 200 mΩ range
Accuracy: 0.02% of reading
Display: 4 1/2 digits (20,000 counts)

- Optional "BCD" output to Hi-Lo limit comparator
- Optional Kelvin clips, mini-probes and surface probes



VALHALLA 4150 ATC DIGITAL MICRO-OHMMETER

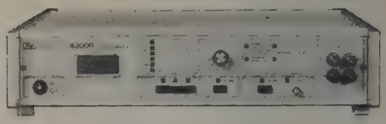
Combines all of the neat features of the 4100 with a high gain preamp, 20mV full scale, to provide higher resolution measurements with one hundred times less power dissipation in the test item. This model is ideal for testing thermistors, RTD's, strain gages, Balco sensors and other transducers where minimizing self-heating is critical during calibration.

Resolution: 1μΩ/20 mΩ range
Accuracy: 0.02%
Display: 4.5 Digits(19999)

- Low self heating test current
- Option "CU" copper compensator
- Option "K" Gold 4 wire Kelvin Clips
- 4 Terminal Resistance Capability
- Packaged in sturdy aluminum enclosure
- Optional "BCD" output capability

The lower range and resolution also makes it valuable for component testing, matching, sorting of resistors, strain gauges, small motors, transformers, chokes, coils, heating elements, printed circuits board clad resistance, plated thru holes and more.

DIGITAL OHMMETERS

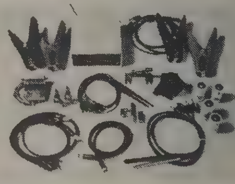


VALHALLA 4300B DIGITAL MICRO-OHMMETER

Valhalla's top of the line digital micro-ohmmeter. The 4300B has six selectable current levels (0.1mA to 10 Amps.). The lowest range is 2 milliohms with 0.1μohm resolution. The 4300B is ideal for testing low bonding resistance, winding resistance, heat rise determination and any low resistance characteristic related to motors, KVA transformers, fuses, circuit breakers, generators, ballasts, weld joints, utility switchgear and more.

When measuring winding resistance on large inductors, the meter has a charging inductor/boost mode and safety status disconnect L.E.D.s for user convenience. The user also has test current on/off push button control.

- 2 mΩ range with 0.1 μΩ resolution
- Selectable test currents to 10 Amps
- Optional GPIB capability
- Copper and Aluminum ATC capability
- Charging inductor and safe to disconnect status LEDs.
- BCD data outputs available



DIGITAL OHMMETER ACCESSORIES

All of Valhalla's Digital Micro-Ohmmeters are designed for four terminal lead resistance compensation. Consequently, there are seven different four lead cable sets available, including miniature, spring loaded micro-probes and gold-plated component clips.

Temperature compensation for ATC models are available for Copper (Option CU) 3931 ppm/°C and for Aluminum (Option AL) 4030 ppm/°C referenced to 20°C. Other reference temperature and temperature coefficients are available on special order. BCD data outputs are available on moust models. IEEE-488 is available on the 4300B.

Vahalla offers a series of microprocessor based "smart interfaces" for a variety of sample tracking applications. For **ISO 900 customers** all Valhalla "smart interfaces" use an on-board real time clock feature (user selectable) to time date stamp the resistance printout, increment the test sample number along with a statistical sample summary report including standard deviation, and mean value. The GPIB talker interface offers a high speed 12 readings per second.

CALL TOLL FREE
1-800-548-9806

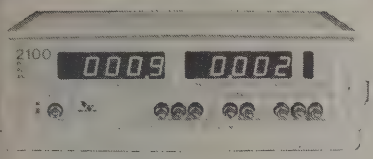
VALHALLA SCIENTIFIC

9955 Mesa Rim Road San Diego, CA 92121
Phone: 619/457-5576 Fax: 619/457-0127

Instrument Short Form Catalog

VALHALLA SCIENTIFIC

DIGITAL WATTMETERS



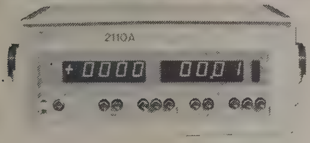
VALHALLA 2100 & 2101
1Ø DIGITAL POWER ANALYZERS

Valhalla's 2100 series Digital Power Analyzers are designed to measure the instantaneous power EI CosØ , the true RMS voltage and current associated with a source or load power measurement. The 2100 offers DC to 50 KHz wide band performance with 20 amperes of TRMS current capability which is ideal for measuring power consumption of switching mode power supplies, SCR controls, pulsed DC devices, lamp ballasts.

Model	Volts	Current	Watts
2100	150,300,600	.2, 2, 20A	30 to 12000
2101	30,150,300	.2, 2, 20A	6 to 6000

Accuracy: DC to 5KHz: ±0.1% ±6 digits
5KHz to 10KHz ±0.5% ±10 digits
10KHz to 50KHz ±1% of rdg/10 KHZ.
Display: Watts and Volts/Amps 4 1/2 digit LEDs
- Expandable to 1000 Amperes
- Accurate Power regardless of waveform
- BCD and Analog output options

POWER FACTOR METERS



VALHALLA 2110A & 2111A
DIGITAL POWER FACTOR METERS

The Valhalla 2110 series directly measures and displays Power Factor, True Watts, True RMS Current, and True RMS Voltage.

The 2110 series (4 1/2 digits 20000 counts) high accuracy circuitry provides 0.1% ± 6 digits basic accuracy. True RMS Voltage and RMS Current capability provides DC, plus AAC to 50 KHz frequency response. This unit is ideal for power measurements on motors, transformers or switching power supplies with distorted harmonic waveforms.

Model	Volts	Current	Watts
2110A	150,300,600	.2, 2 ,20A	30 to 12000
2111A	30,150, 300	.2, 2, 20A	6 to 6000

- DC, 40 Hz to 5 KHz: 0.1% ± 6 digits
  Power Factor (PF): 0 to 1 - 0.001 PF resolution PF leading and lagging indication.
- BCD and Analog Output options
- Expandable to 1000 Amperes (CT)

WATTMETER ACCESORIES

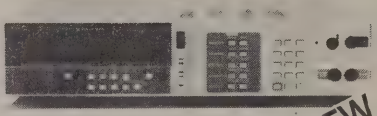
The following accesories are compatible with all Valhalla Digital Power Analyzers.

- Current transformers with 1000:1 ratio with 2% accuracy include option "I-1000" (1000 Amps) and option I-150 (150 Amps)
- Rack mount Adapters for 19" enclosures
- Load extension cord "X-21" for easy load connections.

For 2100 and 2110 Series compatible accessories include the following

- Isolated Analog Output (0-5VDC) capability scaled directly to the display of the appropriate Valhalla DPA, option "2190D".
- Isolated BCD (option 2191D) for use with a High-Lo limit comparitor.

HARMONIC ANALYZER



VALHALLA 2150 FFT NEW
WAVE FORM POWER ANALYZER

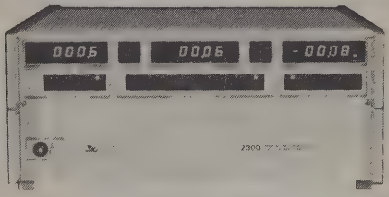
The Valhalla 2150 FFT is the ultimate in DSP based Harmonic Power Analyzers. The 2150 FFT offers DC to 400KHz bandwidth, Harmonic Analysis-fundamental to the 50th, plus high accuracy (0.01%) and resolution (5 digits/99999 counts)

The user may select any 3 parameters for display simultaneously (ie amp-hours, power factor, and True Watts).

The Valhalla 2150 FFT has many features too numerous to list, however the abbreviated capabilities include the following:

- Input directly up to 100 Amps RMS, 1000 V RMS
- Displays **V** and **A** data in RMS, peak, or p/p
- Integration features Amp-hrs, Watt-hrs, KWatt-hrs.
- Bandwidth DC to 400 KHz
- Harmonic Analysis-Fundamental to 50th
- Optional GPIB, RS232C or printer interfaces
- Autoranging and autoscaling of CT and PT Ratios
- Time set data-logging, (ie every 10 min.), wavestore and download
- Displays Watts, P.F., VA, Phase (ie 45.05°), VARs, Frequency (DC to 400 KHz)
- IEC 555.2 Pass/Fail measurement status

POLYPHASE WATTMETERS



VALHALLA 2300 SERIES
SINGLE & THREE PHASE WATTMETERS

Three simultaneous displays of Watts, TRMS Voltage and TRMS Current on large, easy to read LEDs for each individual phase. Each phase contains 3 wideband current shunts 100A, 10A and 1A with 3 preamp gains to provide a total of 9 current ranges from 10uA resolution to 100 Amps full scale. The 2300 will accommodate 3Ø 3-wire delta, 3Ø 4-wire Wye, or 3 simultaneous channels of 1Ø power measurements.

TRMS CURRENT:
(9 Ranges) .2A, .5A, 1A, 2A, 5A,10A, 20A,50A,100A
Bandwidth: DC 20Hz to 50KHZ
Accuracy: ±0.1% ±6 digits DC to 5 KHz
Displays: Simultaneous V:A:W. with 5 LEDs each
Power (EI CosØ) 1Ø has 36 Ranges 10.000W to 60.00KW
3Ø-3 Wire 36 Ranges 20.00W to 120.00KW
3Ø-4 Wire 36 Ranges 30.00W to 180.00KW
- Up to 100 Amps/phase direct
- GPIB optional (TL-4)
- Analog outputs (IOX)
- Expandible to 1000 Amps
- Economical price

HIGH VOLTAGE DVM

VALHALLA 4600 NEW
HIGH VOLTAGE VOLTMETER

This meter offers high accuracy 0.05% and eliminates the need for using a 2% 40 KV probe for voltage levels up to 20 KV direct. The Valhalla 4600 battery operation eliminates shorts to ground and can measure high voltage True RMS AC(15KV) or DC (20KV) on devices such as high voltage power supplies, CRTs, coils, transformers, capacitors, calibrates Hi-Pot testers and more.
- Ranges - 200mV, 2V, 20V, 200V, 2KV, 20KV.
- Resolution 4 1/2 digits (20000 counts)
- Includes 20 KV High Voltage Lead Set
- Accuracy ± 0.05% DC to 20 KV, ± 0.25%AC to 15 KV
- Safety Input terminal for 20 KV range
- Economically priced
- Optional 40 KV probe lead set

CALL TOLL FREE
1-800-548-9806

VALHALLA SCIENTIFIC

9955 Mesa Rim Road, San Diego, CA 92121
Phone: 619/457-5576 Fax: 619/457-0127

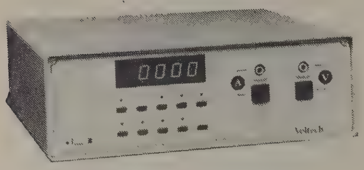
Voltech

200 Butterfield Drive • Ashland, MA 01721
(508) 881-7329 • FAX: (508) 879-8669

Power Analyzers
Frequency Response Analyzers
Transformer Testers

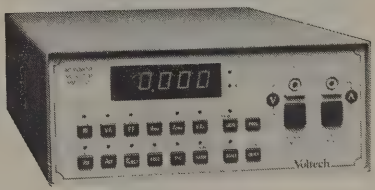
Power Analyzers

PM1000



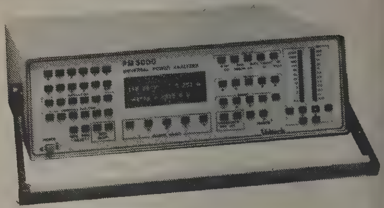
- 0.2% basic accuracy
- Fully autoranging for voltage, current and frequency
- Accurate measurements of real power (W) and apparent power (VA) even with distorted waveforms
- Displays real power factor
- True RMS measurement of voltage (2V to 700V RMS) and current (20mA to 20A RMS)
- Crest factor (Pk/RMS) of input voltage wave forms including THD
- Wide frequency range from DC to 20 KHz
- Determines peak inrush current up to 110A

PM1200



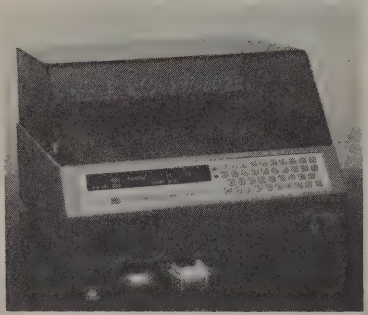
- 0.1% basic accurancy
- Accurate with distorted waveforms
- Displays real power fadtor
- Autoranging input - 2V to 1000Vpk, 10mA to 175Apk
- Wide frequency range DC to 50kHz
- Harmonic analysis of voltage and current to the 50th harmonic
- Fully isolated floating inputs
- IEEE-488 and RS232 interfaces, plus Centronics printer and analog chart recorder outputs
- Integrator
- Software for IEC-555.2 verification included
- PWM motor drive and ballast algorithm

PM3000A



- .05% basic accuracy
- Universal application: single phase, three phase and dc rectifier measurements
- Harmonic analysis of voltage and current on each phase and neutral to 99th harmonic in <3 sec!
- Accurate with distorted waveforms and poor power factors
- Full system capability with IEEE, RS232 and Centronic interfaces as standard
- Exceptionally wide input ranges on voltage (0.2 to 2000Vpk) and current (20mA to 200 Apk)
- * Wide frequency range: DC to 1MHz
- PWM motor drive and ballast algorithm
- Integrator
- Real time analog outputs
- Optional torque and speed inputs for efficiency measurements

Transformer Testers - AT3500

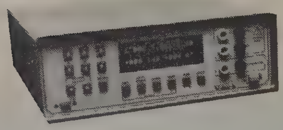


Hi-speed automatic testing of:

- Turns ratio and phasing
- Inductance
- Leakage Inductance
- Magnetizing current
- Hi pot to 5k Vac
- Insulation resistance
- No load power loss
- DC Winding resistance
- Interwinding Capacitance
- Interturn stress test

Fully programmable
Statistical data collection
Built-in printer
Complete operator safety

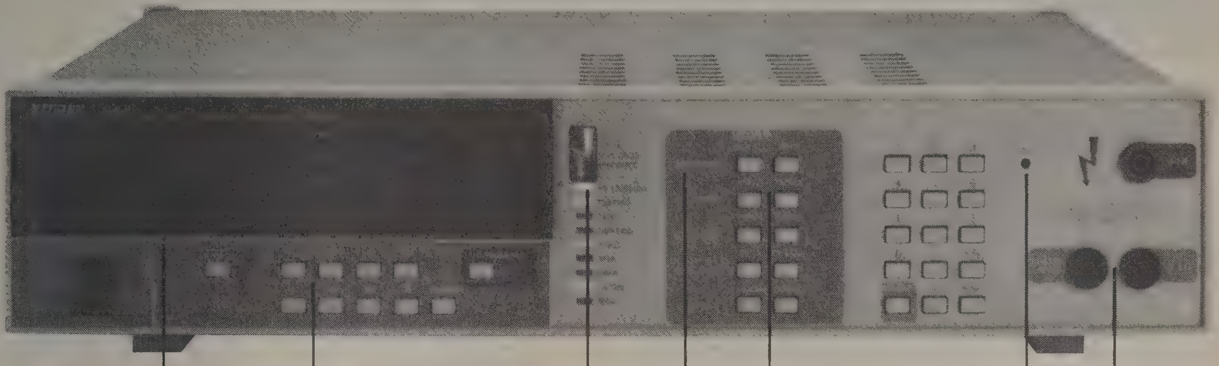
Frequency Response Analyzer - TF2000



- Wide frequency range (0.01 Hz-100kHz)
- True fourier analysis and autointegration for accurate results with noisy and distorted signals
- Harmonic analysis to the 39th harmonic
- Easy to operate: accurate results within minutes of first use
- Fully autoranging, isolated inputs (3uV - 300 v rms)
- Built-in sinewave generator for single frequency analysis or automatic linear or logarithmic sweep
- Graphic plot of results on standard 80 column printer
- Serial and parallel I/O ports for a printer or for computer control

944i AC & DC Hipot Plus

insulation resistance and earth continuity all in one GPIB automated tester.



Bar Graph
Shows output voltage during ramp-up and displays leakage currently proportional to upper limit in test mode.

Multi-function Dielectric Capability
AC & DC dielectric strength, insulation resistance and earth continuity can all be tested automatically in any sequence without stopping or changing test set-ups.

Visual & Audible Alarms
Brilliant L. E. D.s illuminate the lightning bolt whenever the output exceeds 100V.

Memory
On-board user memory allows for storage of up to 100 test routines. Recall and edit capability make it easy to run or change a stored program.

Auto Print Mode
Obtain direct hard-copy test results on a parallel printer using the 944i's remote interface option.

Automatic Calibration
Unsurpassed accuracy and measurement confidence is yours at the touch of a button. No covers to remove or potentiometers to adjust.

Safety Sensing
Chassis sense and voltage return terminals are monitored by an on-board "watchdog" circuit to insure safe operating conditions.

The Vitrek 944i

A new benchmark in Dielectric Analyzer performance, safety and value.

If you need one unit that does the work of a multitude of test instruments, consider the speed, power and flexibility of the Vitrek 944i.

The Vitrek 944i combines AC dielectric strength testing (AC Hipot) with DC dielectric strength testing (DC Hipot), insulation resistance (to 65 Gigohms) and earth continuity measurement all in one feature-rich automated instrument. This compact dielectric analyzer lets you measure four electrical safety test parameters from a single test connection–all with the touch of a button.

The Vitrek 944i delivers top performance and versatility for manufacturing test, product safety engineering, component evaluation, as well as research and development applications. You'll find that the multifunction 944i is loaded with features that even the larger more expensive dedicated testers don't offer. Powerful features including-Automatic calibration, built-in diagnostics, internal "watchdog" safety monitor, user memory for up to 100 test routines, arc detection and available interface package with IEEE-488.2, RS-232 and direct test results printout capability.

The intelligent choice for operator safety

At Vitrek, operator safety is not just a concern, it is a relentless commitment. So we engineered the 944i with a high-impact injection molded front-end with no exposed metal parts to present a potential user shock hazard. We put in an internal "watchdog" safety monitor which automatically shuts down the output in the event of an inadvertent disconnect. And the Vitrek 944i boasts an impressive user programmable "Arc Detection" circuit, capable of shutting down the high voltage system within microseconds.

For added peace of mind the on-board diagnostics of the 944i execute a complete check of all safety systems every time you power up.

World Class technology means reliability you can depend on

The Vitrek 944i provides increased performance and reliability when compared to discrete testers. Extensive use of ASIC, PAL and built-in test technologies make possible this high level of functionality with far fewer components than existing instruments.

944 Performance Specifications

AC Dielectric Mode - AC Voltage

Range	Current	Accuracy
100 to 500 VAC	20 mA	0.3% of output + 7.5V
500 to 5000 VAC	35 mA	0.3% of output + 25V

Output Frequency: 50 Hz to 400Hz with 1Hz resolution independent of line power. Output Waveform: Digitally synthesized, low distortion sinewave.

AC Current Sensing (AC Leakage)

Range	Resolution	Accuracy
500nA	1nA	1.0% of reading + 5nA
2.00μA	10nA	0.5% of reading + 15nA
2.00mA	10μA	0.3% of reading + 10μA
40.0mA	100μA	0.3% of reading + 200μA

Current Sensing: Resistive current (in-phase), reactive current (out-of-phase) or total current.

DC Current Sensing (DC Leakage)

Range	Resolution	Accuracy
500nA	1nA	0.4% of reading + 2nA
2.00μA	10nA	0.2% of reading + 10nA
2.00mA	10μA	0.2% of reading + 10μA
40.0mA	100μA	0.2% of reading + 100μA

Reading Rate: 3000 readings per second. Display updated 3 times per second.

High Resistance Mode

Resistance Range	Minimum Resistance	Test Voltage
2.6GΩ	50 KΩ	100 VDC
13GΩ	250 KΩ	500 VDC
26GΩ	500 KΩ	1000 VDC
65GΩ	1.25 MΩ	2500 VDC

Accuracy: 1.5% of reading for minimum resistance value linearity decreasing to 5% of reading for full scale.

DC Dielectric Mode - DC Voltage Output

Range	Current	Accuracy
100 to 500 VDC	20 mA	0.2% of output + 5V
500 to 5000 VDC	35 mA	0.2% of output + 15V
5000 to 7000 VDC	5mA	0.2% of output + 25V

Output above 5000 VDC requires option DC-7.

Low Resistance Mode (Earth Continuity)

Full Scale: 8.5 ohms maximum including lead resistance.
Resolution: 4 mill-ohms
Test Current: 100 mA
Lead Compensation: Automatic offset circuit "nulls" out two wire lead resistance.
Accuracy: 0.3% of reading + 30mΩ

General

Arc Detection Sensitivity: User selectable 3 microseconds to 30 microseconds.
Display: 40 Character alphanumeric vacuum fluorescent.
High Voltage Indicator: Lightning bolt illuminated by independent output voltage monitor. Audible alarm sounds prior to and during high voltage output.
Safety Lead Sensing: Output automatically shuts down if V Lo or chassis terminal is disconnected.
Voltage Resolution: 1 volt AC or DC.
Slew Rate: 10 Volts/second to 5000 volts/second, user selectable.
Limits: Test automatically aborts when digitally stored minimum or maximum limit is exceeded.

930i Automatic Ground Continuity Tester

Alternating Current Output

Range: 5 to 30 amperes RMS, programmable
Resolution: 1 amp
Output Frequency: Power line frequency
Compliance Voltage: 3 volts RMS
Regulation: ±0.25% no load to full load

Resistance Measurement

Resistance Limit: Digitally displayed, user programmable
Maximum Resistance: 600 mΩ at 5 amps linearly decreasing to 100mΩ @ 30A
Resistance Resolution: 10 mΩ
Measurement Accuracy: ±1.0% of reading ±10 mΩ

General

Test time: Digital count down timer, programmable 1 to 99 seconds
Terminal Configuration: True four-wire or two wire
Isolation: Output isolated to 500MΩ for dielectric testing
Remote Interface: VICL serial communications port for control via 944i
Display: 6 character seven segment L.E.D. display
Indicators: L.E.D. status indicators
Alarm: Audible and visual alarms provide pass/fail indication
Limits: Test is automatically aborted when programmed max value is exceeded

VITREK **Vitrek Corporation**
7576 Trade Street, San Diego, CA 92121
FOR MORE INFORMATION CALL: ***(619) 586-1695 or Fax: (619) 586-0802***

Magnetic Measuring Instrumentation
Laboratory Magnet Systems
Magnetic Charging & Conditioning Equipment
Nondestructive Test (NDT) Equipment

RESUME

Walker Scientific Inc. is part of the Walker Magnetics Group which has been in magnetics since the late 1800's.

Our dedication to the science of magnetics has enabled us to develop product lines which have advanced the state-of-the-art in many disciplines: Magnetic Measuring Instrumentation for analyzing magnetic fields and Laboratory Magnet Systems for producing magnetic fields, have made us a leader in magnetic systems and instrumentation throughout the world.

In addition, two new product lines have been added to further broaden our instrumentation base; Magnetic Charging and Conditioning equipment and instrumentation to meet the ever increasing demands of quality for Nondestructive Testing (NDT) of materials

Our products are also finding application in the growing field of biomagnetics. NMR technology is being used in an advanced technique of diagnostic body scanning that offers many advantages over conventional X-ray Tomography. Methods for magnetically controlling gastric bleeding without surgery and for stretching the esophagus in infants born with a congenital malformation known as esophageal artresia have also produced encouraging results.

MAGNETIC MEASURING INSTRUMENTATION

- Gaussmeters
- Fluxmeters
- Coercivity Meters
- Hysteresisgraphs
- Reference Magnets
- Custom Measuring Systems

LABORATORY MAGNET SYSTEMS

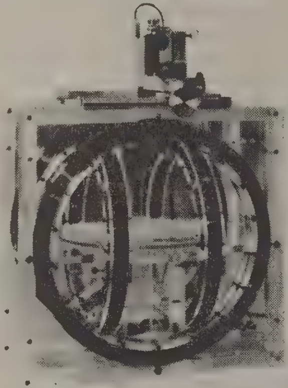
- Electromagnets 4″–15″
- Solenoid Systems
- Computer Designed Coil Systems
- Power Supplies:
  - Current Regulated
  - Field Regulated
- Field Control Systems
- Custom Electromagnet Systems

MAGNETIC CHARGING & CONDITIONING EQUIPMENT

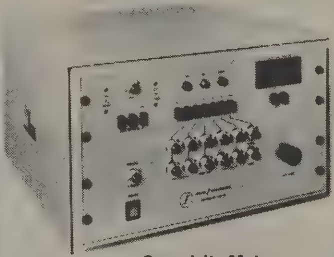
NONDESTRUCTIVE TEST (NDT) EQUIPMENT

- Eddy Current Metal Comparator
- Alloy Identification & Classification
- Ultrasonic Thickness Gauge
- Material Inspection Microscope

TYPICAL SYSTEMS

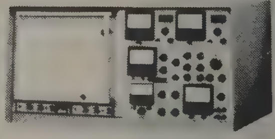


Computer Designed Coils

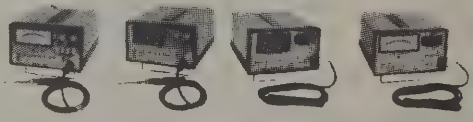


Coercivity Meter

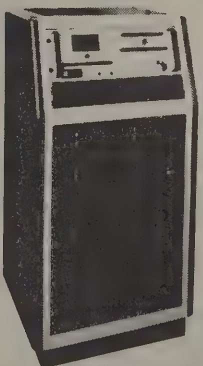
Solenoid System



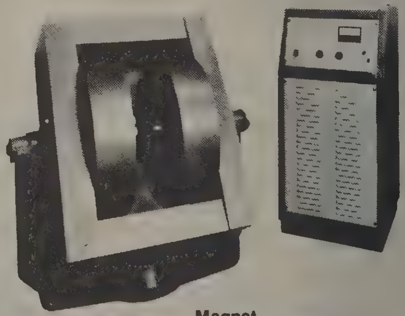
Hysteresisgraph



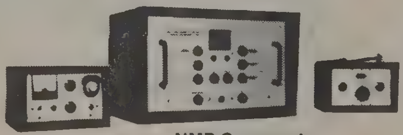
Hall Gaussmeter/Fluxmeters



Field Controlled Power Supply



Magnet and Power Supply



NMR Gaussmeter

WALKER MAGNETICS GROUP

WALKER SCIENTIFIC INC.

Rockdale Street, Worcester, MA 01606 U.S.A.
Telephone (508) 852-3674 / 853-3232
Toll Free: 1-800-962-4638
FAX (508) 856-9931

XITRON Power Supplies

2000 *Portable DC Voltage/Current Calibrator & Thermocouple Measurement/Simulation*

- **10ppm Dc Voltage Accuracy, 10nV/1ppm Resolution**
- **30ppm Dc Current Accuracy, 10pA/1ppm Resolution**
- **0.1°C Accuracy Active Cold Junction Compensation**
- **15mA Drive Capability from DC Voltage Outputs**
- **18V Drive Capability from DC Current Outputs**
- **0.1°C Thermocouple Measurements**

General Specifications

Battery

Discharge Time: 8 hours min. following full charge(Output <10% load, interface disabled)

6 hours min. following full charge (Output fully loaded, interface disabled)

3 hours min. following full charge (Ieee488 interface enabled)

Charge Time: 6 hours max. to full charge (with unit OFF).

12 hours max. to full charge(with unit ON, interface disabled); may be continuously charged if desired

Charging Input: Rear panel mounted DC charging connector, 9 to 16V DC input at 900mA max.

Charging Input: Rear panel mounted Dc Charging connector, 9 to 16V DC input at 900mA max.

Charging Module: T1: 115VAC 50/60Hz Wall socket type (US);T2:115VAC 50/60Hz free standing with power cord; T4: Automobile "Cigarette :lighter" charging adapter

Battery Type: Sealed Lead Acid

Data Storage

All calibration data, power on default output level data, user equation and units data and thermocouple simulation type data are stored in internal non-volatile EERAM independently of the battery, battery discharge does not affect data integrity.

Physical

Size: 4.1"(104mm) W x 6.3" (160mm) H x 9.7" (246mm) deep

Weight: 3 lbs.(1.4Kg) in use, 5 lbs. (2.3Kg) shipping.

Environmental

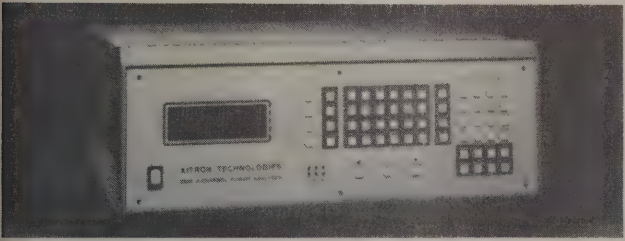
Operating: 0°C to +50°C, less than 70% R.H. at 40°C (non-condensing)

Storage: -30°C to +65°C, less than 95% R.H. at 40°C (non-condensing)

Isolation

Output to Chassis, Ground or Interface: 1500 pk max.

2503/2505/2501 *3/2/1 -Channel Power Analyzer Systems*



- **Wide Bandwidth (DC-200KHz)**
- **0.1% Basic Accuracy**
- **Power Factor with +/- & Lead/Lag Indications**
- **Total & Individual Harmonic, and Spectrum Analysis**
- **Frequency Measurement**
- **Built-in Efficiency & Power Loss Calculations**
- **Display Setup Memory**
- **Optional Isolated RS232 or IEEE488 Interfaces**

Performance Specifications

All accuracy specifications given below are valid throughout the specified operating temperature range of the instrument, for 1 year, following a 5 minute warmup period.

Frequency Range: DC to 2000KHz (typical performance to 1MHz).

Fre. Measurement: DC to 150KHz, within 0.05% (for a 1 second measurement period).

Measurement Period: User specified, 0.05s min., 20s max.

Optionally synchronized to phase A voltage or current input waveform.

Low Pass Filters: 20KHz, 10KHz, 5KHz, 2KHz, or 1 KHz to 50 Hz upper cutoffs frequencies.

Band Pass Filter: 120Hz-5KHz, or 800KHZ-10KHz pass band

Other Filter: DC only, AC only, or the total AC+DC content, may be displayed.

Filter Frequency: Upper and lower frequencies accurate to within 0.1%

Physical Specifications:

Power Input: 105 to 130V or 210 to 260V(switch selectable) RMS AC 50/60Hz @ 45V a max.

Size: 17" W by 7"H by 14" D

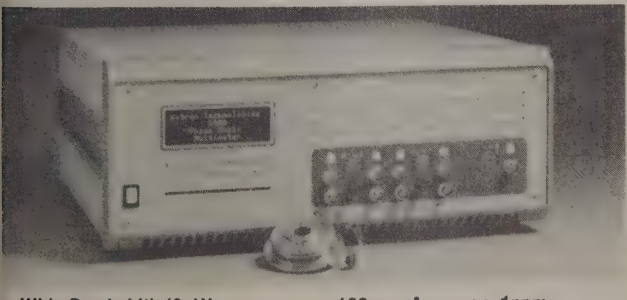
Weight: 15lbs. in use, 25 lbs (11.4Kg) shipping.

Operating RAnge: 0°C to 50°C. less than 85% RH @ 40°C (non-condensing).

Storage Range: -30°C to +65°C, less than 95% RH at 40°C (non-condensing).

Configuration: Bench or 19" mount.

6000 *Phase Angle Multimeter*



- **Wide Bandwidth (0.1Hz-1000KHz)**
- **2 Year Warranty**
- **0.05% Basic Amplitude Accuracy**
- **Total & Individual Harmonic Analysis**
- **100ppm Accuracy, 1ppm Resolution, Freq. Measurements**
- **4-line Display and 101 element Nullmeter**
- **Ten Setup Memories**
- **Isolated RS232 and IE488 Interfaces**

Voltage Inputs

Amplitude: 0.05% + 0.0005%/KHz for any single input and for matching between any inputs. Multiply by 2 for voltages in excess of 300Vpk.

Phase:0.05° + 0.0005°/KHz between A & B or C &D on same range, +0.0025°/KHz per range when differing ranges, + 0.06°/KHz between unpaired inputs (e.g., A and C), multiply by 2 for voltages in excess of 300V pk.

Noise:(20nV + 0.00001% of full-scale range)/ Hz of measurement bandwidth.

DC Offset: 100µV +0.03% of full-scale range.

Distortion: -80dB at any harmonic.

Voltage RAnge: 10mV to 1000Vpk full-scale (10V RMS max. for 50Ω input) in 3:1 steps. Trigger Level: Zero. TTL, ECL, CMOS or Variable. 1% of input range accuracy.

Bandwidth: >2.5MHz or user defined upper limit in the range 5Hz to 100KHz(-3B)

Physical

Power: 105 to 130V or 210 to 260V (switch selectable) RMS AC 50/60Hz @ 25VA.

Size: 17" W by 7" H by 14" D

Weight: 20lbs. in use, 30lbs. (13.5Kg) shipping.

Operating Range: 0°C to 50°C° less than85% RH @ 40°C (non-condensing).

Xitron Technologies Corporation • 10225 Barnes Canyon Rd., Suite A102, San Diego, CA 92121 • (619) 458-9852

DIGITAL PANEL METERS

Manufacturer	Starting EEM Page No.	Model/Series	Number of Digits (Number of Counts)						Function							Type of Display	Power Requirements		
			3 (999)	3½ (1999)	3¾ (3999-5999)	4 (9999)	4½ (19999)	4¾ (39999-59999)	Gen. Purpose	Temperature	Pressure	Weight	RPM	Process Control	Other		AC Line	+5 VDC	BCD Output
Datel Corp.	D•1340	DM-9200		√			√		√					√	√	LED	√	√	
		DM-4100					√		√					√	√	LED/LCD	√	√	
		DM-3100		√					√	√				√	√	LED/LCD	√	√	
		DMS-LM	√												√	LED	√		
		DMS-20LCD		√					√	√			√	√	√	LCD		√	
		DMS-20PC		√					√	√	√	√		√	√	LED		√	
		DMS-40PC					√		√	√			√	√	√	LED	√	√	
		DMS-40LCD					√		√	√	√	√	√	√	√	LCD	√	√	
		DMS-30LCD		√					√	√	√	√	√	√	√	LCD	√	√	
		DMS-30PC		√					√	√	√	√	√	√	√	LED	√	√	
DCI Inc.	D•1344			√		√	√		√	√	√	√	√	√		LED/LCD	√	√	√
Electro-Numerics Inc.	D•1345	All DPMs		√		√	√		√	√	√	√	√	√	√	LED	√		√
Fox Meter	D•1346	F100		√			√		√	√	√	√		√	√	LED	√	√	
		F200				√			√						√		√	√	
		F300	√			√		√	√						√	LED	√	√	√
		F400	√			√		√	√					√	√	LED	√	√	√
		F500	√			√		√	√	√	√	√	√		√	LED	√	√	√
		F600	√			√		√	√	√	√	√	√	√	√	LED	√	√	√
Gralex Ind.	D•1353			√	√		√		√					√		LED/LCD	√	√	√
Laurel Electronics	D•1355	Laureate		√			√	√	√	√	√	√	√	√		LED	√		
Newport Electronics	D•1358	205/305		√						√	√	√		√		LED Red/Green	√	√	
		269				√				√						-LED Red	√		
		L2Q		√		√			√	√	√	√	√	√	√	2 1/4" LED Red/Green	√		
		L4Q		√		√			√	√	√	√	√	√	√	4" LED Red/Green	√		
		NCT				√				√				√		LED Dual Red/Green	√		
		NM						8 dig.					√		Totalize	LCD			
		81 PID				√				√						LED Green	√		
		Infinity						6 dig.	√	√	√	√		√	√	LED Red	√		√
		INFC				√			√	√	√	√		√	√	LED Red	√		
		INFPT						6 dig.						√	Timer	LED Red	√		√
		INF7						6 dig.			√		√	√	√	LED Red	√		√
		Q2000/Q3000		√					√	√	√	√	√	√		LED/LCD	√	√	√
		Q9000/Q8000				√			√	√	√	√	√	√	√	LED	√	√	√
		P6000/P5000						6 dig.			√		√	√		LED Red/Green	√		√
Omega Engineering	D•1362	Many	√	√	√	√	√	√	√	√	√	√	√	√	√	LED, LCD Flourescent	√	√	√
OTTOTEK	D•1364	100, 200, 350, 400, 500, 700 6000	√	√		√	√	√	√	√	√	√	√	√	Watts	LED/LCD	√	√	√
Texmate	D•1372	Du Series		√		√	√		√	√	√	√	√	√		LED	√	√	
		DI Series					√	5 dig.	√	√	√	√	√	√		LED	√	√	√
		PM Series		√			√		√							LED/LCD	√	√	√
		SM Series		√					√							LED/LCD		√	
		RP Series		√			√		√							LED	√		
		PC Series				√		6 dig.						√	Counters	LED/LCD	√	√	
		LT Series				√		5 dig.							Tach.		√		
		LD Series	√	√	√	√	√	√							Tach.	LED	√	√	
		CM Series		√					√							LCD			
		TM Series		√						√						LED/LCD	√	√	
		BN Series		√					√							LED	√	√	
		DVM-5 Series		√					√							LED		√	
		UM Series		√		√			√	√	√	√	√	√		LED	√		
Velonex	D•1388		√	√		√	√		√							LED		√	
Weschler Instruments	D•1389	7000		√			√		√	√			√	√	√	LED	√	√	√
		2000		√			√		√	√				√		LED	√	√	√
		40000						√	√				√	√	√	LED	√		
		3000													√	None	√		
		1000											√		√	LED	√	√	

ANALOG PANEL METERS

Manufacturer	Starting EEM Page No.	Model/Series	Type			Size (inches)									Edgewise	Illuminated	Custom
			Moving Coil	Moving Iron	Taut Band	<1½	2	2½	3	3½	4	4½	5	>5			
Beede Electrical	D•1339				√	√		√		√		√					√
International Instruments	D•1354	Full Line	√		√	√	√	√	√	√	√	√	√	√	√	√	√
Omega Engineering	D•1362	Various	√							√		√			√		
OTTOTEK	D•1364	590						√		√		√			√	√	√
Selco Products	D•1368	Presentor			√	√	√	√	√	√	√	√	√				√
Shurite	D•1371	750, 850, 7000/8000	√	√			√	√	√	√					√		√
Texmate	D•1372	AN Series	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Weschler Instruments	D•1389	300			√			√		√		√		√			√
		200	√		√							√		√	√		√
		Airpax	√			√		√		√		√			√		

BARGRAPH PANEL METERS

Manufacturer	Starting EEM Page No.	Model/Series	Number of Digits for a Digital Display	Function						Outputs			Type of Display	Power Requirements
				General Purpose	Frequency	Temperature	Process	Power (Watts/VARs)	Other	Analog	BCD	Other		
International Instruments	D•1354	"Q" Series	4	√	√	√	√	√	√	√	√		LED	5VDC@380mA
Omega Engineering	D•1362	Various												
OTTOTEK	D•1364	HIQTBEE & HIQTEE 560, 570, 580, 120, 121	3 1/2, 4 1/2, 6	√	√	√	√	√	√	√	√	RS 232-485	LCD/LED	Signal, 5V, 12V 24VDC or 100-250VAC Tricolor LED
Texmate	D•1372	AM Series	3 & 4	√	√	√	√	√		√			LED	AC & SVDC
Weschler Instruments	D•1389	Weschler BG241, 251, 252 261, 281, BH252	Scalable 3 1/2, 4 1/2	√	√	√	√	√	PF, PA	√	√	Dig. Com 24 Vdc Relay	LED	5-125 Vdc 110/240 Vac
		PC101/202	3 1/2, 4	√	√	√	√			√	√			
		PG101/202	3, 4	√	√	√	√	√		√	√			
		ML202	3, 4	√		√	√			√				
		Bowmar	3 1/2, 4									Relay o.c.	LED	5 Vdc
		BG100, 600					√							
		BGD100		√			√							
		APM100, 500, 600, 800		√			√		VU					
		APM200	3 1/2	√			√							
		NES											Tri-Color LED's	120 Vac
		Model 51	4 3/4	√		√	√			√				
		Model 57	4 3/4	√		√	√			√				

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	**D**•2221
Batteries, Product Selection Guide	**D**•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C**•1003
Capacitors, Product Selection Guide	**A**•1003
Coils, Chokes, Inductors, Product Selection Guide	**A**•1179
Connectors, Terminals & Sockets, Product Selection Guide	**C**•1139
Cores, Magnets & Ferrites	**A**•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A**•1326
DC-DC Converters	**D**•2049
DC Power Supplies, Product Selection Guide	**D**•1488
Delay Lines, Product Selection Guide	**A**•1513
Discrete Semiconductors, Product Selection Guide	**A**•2130
Displays, Readouts, & CRTs, Product Selection Guide	**B**•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C**•1557
Fiber Optics, Product Selection Guide	**B**•1200
Filters, Power, Product Selection Guide	**A**•1584
Filters, Signal, Product Selection Guide	**A**•1617
Instruments, Test & Measuring, Product Selection Guide	**D**•1215
Interconnection Systems, Product Selection Guide	**C**•1670
Keyboards & Keypads, Product Selection Guide	**B**•1818
Lamps, Lights, & Indicators, Product Selection Guide	**B**•1131
Microwave Components, Product Selection Guide	**A**•1719
Military Qualified Products List	**B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide	**B**•1231
Oscilloscopes, Product Selection Guide	**D**•1402
Panel Hardware, Product Selection Guide	**C**•1522
Panel Meters, Analog & Digital, Product Selection Guide	**D**•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A**•2053
Power Supplies, AC, Product Selection Guide	**D**•2221
Power Supplies, DC, Product Selection Guide	**D**•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B**•1341
Relays, Product Selection Guide	**B**•1401
Resistors, Product Selection Guide	**A**•1859
Solenoids, Product Selection Guide	**B**•1626
Switches, Product Selection Guide	**B**•1658
Thermal Components, Product Selection Guide	**B**•1857
Transducers & Encoders, Product Selection Guide	**B**•1911
Transformers, Product Selection Guide	**A**•2229
Wire & Cable, Product Selection Guide	**C**•1701

BEEDE **ELECTRICAL INSTRUMENT COMPANY, INC.**
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603/753-6362 1-800-451-8255 FAX 603/753-6201

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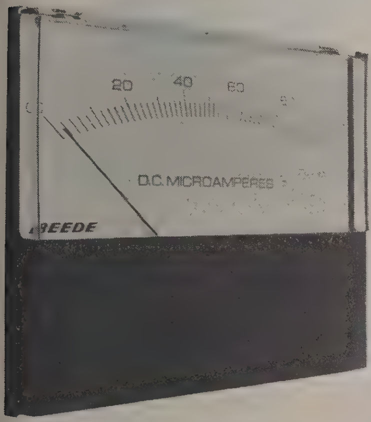
U • S • A

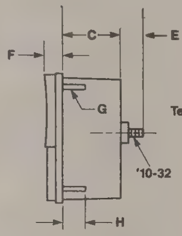
A complete selection of sizes and meter types
is available to meet your needs.
Other features available:

- 90°, 100°, 120° and 250° meter types and movements
- pivot & jewel and taut baud types
- 1 1/2 inch through 8 inch sizes
- edgewise configurations to save panel space
- meter relays for process control applications
- standard or customized dials/scales and electrical sensitivities

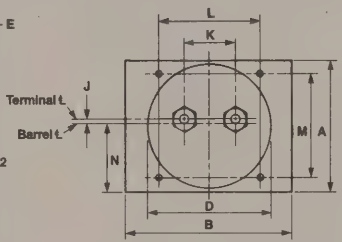
Shown below are two of our more popular styles.


20
40
60
D.C. MICROAMPERES
BEEDE

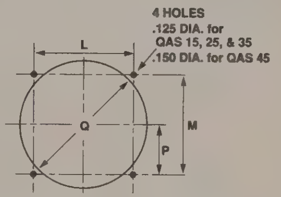
QAS (Surface Mount)



SIDE


L
K
J
Terminal ℄
Barrel ℄
M
A
N
D
B

BACK


4 HOLES
.125 DIA. for
QAS 15, 25, & 35
.150 DIA. for QAS 45
L
Q
M
P

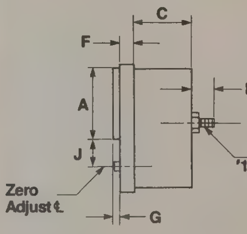
PANEL CUT-OUT

Dimensions

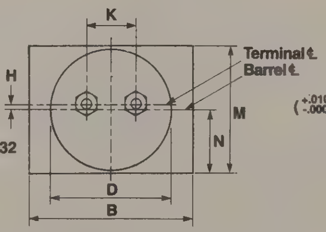
Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	Standard Dial Angle
QAS-15	1.750	2.240	1.294	1.530	.477	.345	#4-40	.444	.156	.936	1.312	1.312	.835	.656	1.550	100°
QAS-25	2.272	2.990	1.300	2.125	.455	.400	#4-40	.424	.200	1.124	1.880	1.880	1.136	.940	2.180	100°
QAS-35	2.880	3.710	1.300	2.650	.449	.410	#4-40	.415	0	1.124	2.250	2.250	1.440	1.125	2.750	100°
QAS-45	3.970	5.100	1.300	2.635	.443	.515	#6-32	.556	0	1.124	4.000	3.562	1.745	1.541	2.750	100°

20
40
60
80
100
D.C. MICROAMPERES
BEEDE

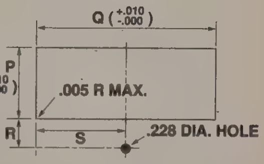
QAW (Window Mount)


C
F
A
J
E
H
'10-32
Zero Adjust ℄
G

SIDE


K
Terminal ℄
Barrel ℄
M
N
D
B

BACK


Q (+.010 -.000)
P (+.010 -.000)
.005 R MAX.
R
S
.228 DIA. HOLE

PANEL CUT-OUT

Dimensions

Model	A	B	C	D	E	F	G	H	J	K	M	N	P	Q	R	S	Standard Dial Angle
QAW-15	.925	2.256	1.294	1.530	.477	.275	.145	.156	.539	.936	1.770	.845	.930	2.150	.535	1.075	100°
QAW-25	1.258	3.006	1.300	2.125	.455	.295	.145	.200	.637	1.124	2.290	1.145	1.265	2.900	.633	1.450	100°
QAW-35	1.585	3.730	1.300	2.650	.449	.320	.145	0	.808	1.124	2.900	1.450	1.590	3.598	.804	1.799	100°
QAW-45	2.335	5.180	1.300	2.635	.443	.370	.145	0	.860	1.124	4.060	1.790	2.340	5.010	.856	2.505	100°

For a full line catalog call 800-451-8255.

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INNOVATION and EXCELLENCE
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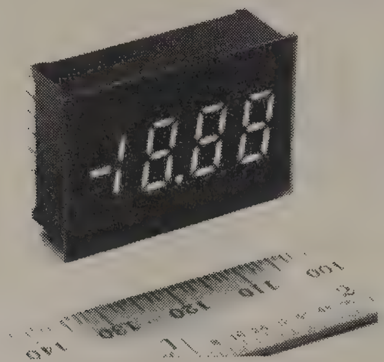
For immediate assistance: **1-800-233-2765**

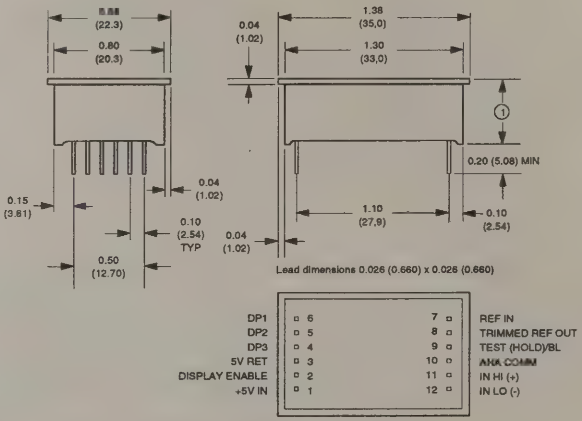
DMS-20 SERIES 3½ DIGIT
Miniature LED & LCD Digital Panel/Voltmeters



Features

- 0.37 in. (9.4mm) high LED, 0.350 in. (9.0mm) high LCD
- Low power LED models (<10 mA)
- Panel or board mountable
- Hold feature (LED models)
- 4 standard input ranges: ±200mV, ±2V, ±20V, ±200V
- Built-in Filter/Bezel
- ±0.05% Accuracy
- Moisture and vibration resistant encapsulated package
- Backlit LCD models available
- 5Vdc for LED, 5Vdc or 9Vdc for LCD

MECHANICAL



MECHANICAL DIMENSIONS: Inches (mm)
TOLERANCES : 2 PL DEC ±0.02 ±(0.51)
3 PL DEC ±0.010 ±(0.254)

① LED height 0.475 (12,0)
LCD height 0.425 (10.8)

RECOMMENDED PANEL CUTOUT DIMENSIONS: 1.336 (33.93) W x 0.836 (21.23) H
INTERNAL CORNER RADII: 0.062 (1.57) MAX

ORDERING GUIDE

DMS-20PC - 1 - R S - H

- DMS-20PC: LED Model
- 1: **Input Range**
  - 0 ±200mV dc
  - 1 ±2Vdc
  - 2 ±20 Vdc
  - 3 ±200Vdc
- R: **LED Color**
  - Y Yellow
  - O Orange
  - A Amber
  - R Red
  - G Green
- S: **Power/Intensity**
  - S Standard
  - H High Intensity (Red LED only)
  - L Low Power (Red LED only)
- H: **Hold Model** (Red Std. only)

DMS-20LCD - 1 - 5 B

- DMS-20LCD: LCD Model
- 1: **Input Range**
  - 0 ±200mV dc
  - 1 ±2Vdc
  - 2 ±20 Vdc
  - 3 ±200Vdc
- 5: **Power Supply**
  - 5 5Vdc
  - 9 9 to 12V Battery
- B: Add B for Backlit

MADE IN USA

SPECIFICATIONS Typical @ +25°C and +5V supply unless noted

PERFORMANCE	
Accuracy	
±200mVdc, ±2Vdc models	±1 Count
±20Vdc, ±200Vdc models	±2 Counts
Zero Reading (V_{IN} = 0V)	000
Temperature Drift of Gain	±0.2 Counts/°C
INPUT	
Full Scale Input	See ordering guide
Input Impedance	
±200mVdc, ±2Vdc models	1000MΩ
±20Vdc, ±200Vdc models	1.0MΩ
Overvoltage Protection (max)	±250Vdc (LED) ±100Vdc (LCD)
Sampling Rate	2.5 Samples/Second
PHYSICAL/ENVIRONMENTAL	
Display Height	LED: 0.370" / LCD: 0.350"
Polarity Indication	Autopolarity
Overrange Indication	–1--- for $-V_{IN}$, 1--- for $+V_{IN}$
Operating Temperature	0 to +60°C
Storage Temperature	–40 to +75°C (LED) –20 to +75°C (LCD)
Humidity	0 to 95% non-condensing
POWER REQUIREMENTS	
DMS-20PC-X-RS	5Vdc, 60mA
DMS-20PC-X-RL	5Vdc, 7mA
DMS-20PC-X-RS-H	5Vdc, 60mA
DMS-20PC-X-RH	5Vdc, 60mA
DMS-20PC-X-AS	5Vdc, 90mA
DMS-20PC-X-GS	5Vdc, 90mA
DMS-20PC-X-OS	5Vdc, 90mA
DMS-20PC-X-YS	5Vdc, 90mA
DMS-20LCD-X-5	5Vdc, 350µA
DMS-20LCD-X-9	9Vdc, 350µA
DMS-20LCD-X-5B	5Vdc, 35mA
DMS-20LCD-X-9B	9Vdc, 35mA

ACCESSORIES

DMS-EB2	Multipurpose application board (4-20mA, gain/offset adjust)
DMS-20-CP	Panel cutout punch
DMS-BZL3	DMS-20PC bezel
DMS-BZL4	DMS-20PC bezel, NEMA 4 rated

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For immediate assistance: **1-800-233-2765**

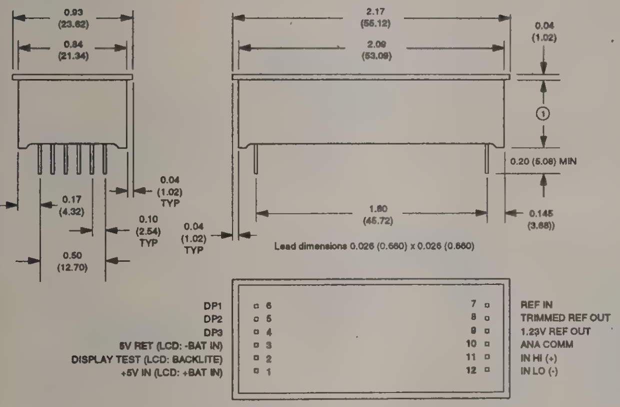
DMS-30 SERIES 3½ DIGIT

LED & LCD Digital Panel/Voltmeters

Features

- 0.56 in. (14.2mm) high LED, 0.400 in. (10.2mm) high LCD
- Low power LED models (<15 mA)
- Panel or board mountable
- LED and LCD models are pin-compatible
- 3 standard input ranges: ±200mV, ±2V, ±20V
- Built-in Filter/Bezel
- ±0.05% Accuracy
- Moisture and vibration resistant encapsulated package
- Backlit LCD models available
- 5Vdc for LED, 5Vdc and 9Vdc for LCD

MECHANICAL



MECHANICAL DIMENSIONS: Inches (mm)
TOLERANCES : 2 PL DEC ±0.02 ±(0.51)
3 PL DEC ±0.010 ±(0.254)

① LED height 0.52 (13.21)
LCD height 0.39 (9.91) Standard Models
0.52 (13.21) Backlit Models

RECOMMENDED PANEL CUTOUT DIMENSIONS: 2.118 (53.80) W x 0.878 (22.30) H
INTERNAL CORNER RADII: 0.032 (0.813) MAX

ORDERING GUIDE

DMS-30PC - 1 - R S

LED Model

Input Range
- **0** ±200mVdc
- **1** ±2Vdc
- **2** ±20Vdc

LED Color
- **Y** Yellow
- **O** Orange
- **A** Amber
- **R** Red
- **G** Green
- **B** Blue
- **Q** Aqua

Power/Intensity
- **S** Standard
- **H** High Intensity (Red LED only)
- **L** Low Power (Red, orange, and green LED's only)

DMS-30LCD - 1 - 5 B

LCD Model

Input Range
- **0** ±200mVdc
- **1** ±2Vdc
- **2** ±20Vdc

Power Supply
- **5** 5Vdc
- **9** 9 to 12V Battery

Add B for Backlit

MADE IN USA

SPECIFICATIONS Typical @ +25°C and +5V supply unless noted

PERFORMANCE	
Accuracy	
±200mVdc, ±2Vdc models	±1 Count
±20Vdc model	±2 Counts
Zero Reading (V_{IN} = 0V)	000
Temperature Drift of Gain	±0.2 Counts/°C
INPUT	
Full Scale Input	See ordering guide
Input Impedance	
±200mVdc, ±2Vdc models	1000MΩ
±20Vdc model	1.0MΩ
Overvoltage Protection (max)	±250Vdc (LED) ±100Vdc (LCD)
Sampling Rate	2.5 Samples/Second
PHYSICAL/ENVIRONMENTAL	
Display Height	LED: 0.56" / LCD: 0.400"
Polarity Indication	Autopolarity
Overrange Indication	–1--- for –V_{IN}, 1--- for +V_{IN}
Operating Temperature	0 to +60°C
Storage Temperature	–40 to +75°C (LED) –20 to +75°C (LCD)
Humidity	0 to 95% non-condensing

POWER REQUIREMENTS

DMS-30PC-X-RS	5Vdc, 150mA	**DMS-30PC-X-GL**	5Vdc, 60mA
DMS-30PC-X-RL	5Vdc, 12mA	**DMS-30PC-X-OL**	5Vdc, 60mA
DMS-30PC-X-RH	5Vdc, 150mA	**DMS-30PC-X-BS**	5Vdc, 400mA
DMS-30PC-X-AS	5Vdc, 150mA	**DMS-30LCD-X-5**	5Vdc, 800µA
DMS-30PC-X-GS	5Vdc, 150mA	**DMS-30LCD-X-9**	9Vdc, 350µA
DMS-30PC-X-OS	5Vdc, 150mA	**DMS-30LCD-X-5B**	5Vdc, 35mA
DMS-30PC-X-YS	5Vdc, 150mA	**DMS-30LCD-X-9B**	9Vdc, 35mA
DMS-30PC-X-QS	5Vdc, 150mA		

ACCESSORIES

RN-DMS	Gain /offset potentiometer kit for DMS-EB
DMS-30-CP	Panel cutout punch
DMS-BZL1	DMS-30 bezel assembly
DMS-BZL2	DMS-30 bezel assembly, NEMA 4 rated

ADD-ON APPLICATION BOARDS

DMS-EB	Multipurpose (4-20mA, gain/offset adjust)
DMS-EB-HTB	Accurate temperature probe sensing for 200mV models
DMS-EB-DC/DC	Provides isolated +5V power
DMS-EB-TCJ	J-type thermocouple inputs for ±2V models
DMS-EB-TCK	K-type thermocouple inputs for ±2V models
DMS-EB-RMS	For true RMS measurements of AC voltages
DMS-EB-AC/DC	For AC line-powered applications
DMS-EB-LP	For 4-20mA loop-powered applications

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For immediate assistance: **1-800-233-2765**

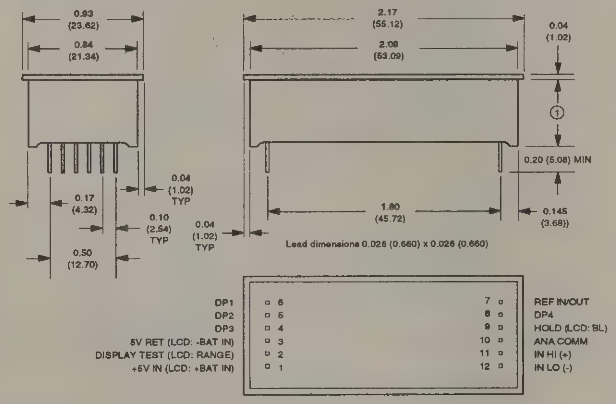
DMS-40 SERIES 4½ DIGIT

LED & LCD Digital Panel/Voltmeters

Features

- 0.52 in. (13.2mm) high LED, 0.400 in. (10.2mm) high LCD
- Low power LED models (<40 mA)
- Panel or board mountable
- Hold feature standard
- 4 standard input ranges: ±200mV, ±2V, ±20V, ±200V
- LCD models are dual input range
- Built-in Filter/Bezel
- ±0.01% Accuracy
- Moisture and vibration resistant encapsulated package
- Backlit LCD models available
- 5Vdc for LED, 5Vdc and 9Vdc for LCD

MECHANICAL



BCD MODELS:
Consult DATEL for detailed mechanical specifications

MECHANICAL DIMENSIONS: Inches (mm)
TOLERANCES : 2 PL DEC ±0.02 ±(0.51)
3 PL DEC ±0.010 ±(0.254)

① LED height 0.52 (13.21)
LCD height 0.39 (9.91) Standard Models
0.52 (13.21) Backlit Models

RECOMMENDED PANEL CUTOUT DIMENSIONS: 2.118 (53.80) W x 0.878 (22.30) H
INTERNAL CORNER RADII: 0.032 (0.813) MAX

ORDERING GUIDE

DMS-40PC - 1 - R S - BCD

- DMS-40PC: LED Model
- 1: Input Range
  - 1 ±2Vdc
  - 2 ±20Vdc
  - 3 ±200Vdc
- R: LED Color
  - Y Yellow
  - O Orange
  - A Amber
  - R Red
  - G Green
- S: Power/Intensity
  - S Standard
  - H High Intensity (Red LED only)
  - L Low Power (Red LED only)
- BCD: Optional BCD output (Red LED, standard model only)

DMS-40LCD - 0/1 - 5 B

- DMS-40LCD: LCD Model
- 0/1: Input Range
  - 0/1 ±200mV/±2Vdc
  - 1/2 ±2Vdc/±20Vdc
  - 2/3 ±20Vdc/±200Vdc
- 5: Power Supply
  - 5 5Vdc
  - 9 9 to 12V Battery
- B: Add B for Backlit

MADE IN USA

SPECIFICATIONS Typical @ +25°C and +5V supply unless noted

PERFORMANCE	
Accuracy	
±200mVdc/±2Vdc models	±2 Count
±2Vdc/±20Vdc models	±3 Counts
±20Vdc/±200Vdc models	±3 Counts
Zero Reading (V_{IN} = 0V)	0000
Temperature Drift of Gain	±0.2 Counts/°C
INPUT	
Full Scale Input	See ordering guide
Input Impedance	
±200mVdc,/±2Vdc models	1000MΩ
±2Vdc/±20Vdc models	1.0MΩ
±20Vdc/±200Vdc models	1.0MΩ
Overvoltage Protection (max)	±250Vdc (LED) ±100Vdc (LCD)
Sampling Rate	2.5 Samples/Second
PHYSICAL/ENVIRONMENTAL	
Display Height	LED: 0.52" / LCD: 0.400"
Polarity Indication	Autopolarity
Overrange Indication	
LED models	–0000 (flashing for $-V_{IN}$)
LED models	0000 (flashing for $+V_{IN}$)
LCD models	–1---- for $-V_{IN}$
LCD models	1---- for $+V_{IN}$
Operating Temperature	0 to +60°C
Storage Temperature	–40 to +75°C (LED) –20 to +75°C (LCD)
Humidity	0 to 95% non-condensing

POWER REQUIREMENTS

DMS-40PC-X-RS	5Vdc, 100mA
DMS-40PC-X-RL	5Vdc, 40mA
DMS-40PC-X-RS-BCD	5Vdc, 100mA
DMS-40PC-X-RH	5Vdc, 100mA
DMS-40PC-X-AS	5Vdc, 100mA
DMS-40PC-X-GS	5Vdc, 100mA
DMS-40PC-X-OS	5Vdc, 100mA
DMS-40PC-X-YS	5Vdc, 100mA
DMS-40LCD-X/X-5	5Vdc, 2.5mA
DMS-40LCD-X/X-9	9Vdc, 1.5mA
DMS-40LCD-X/X-5B	5Vdc, 35mA
DMS-40LCD-X/X-9B	9Vdc, 35mA

ACCESSORIES

DMS-30CP	Panel cutout punch
DMS-BZL1	DMS-40 bezel
DMS-BZL2	DMS-40 bezel, NEMA4 rated
DMS-EB	Multipurpose board (4-20mA, gain/offset adjust)

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11 Cabot Boulevard, Mansfield, MA 02048
Tel: (508) 339-3000 FAX: (508) 339-6356
For immediate assistance: **1-800-233-2765**

AC LINE MONITOR

Miniature, 3-Digit LED, Self-Powered

- ***Plugs directly into wall outlet***
- ***Screw terminals for panel mounting***
- ***Subminiature size***
- ***Large, easy-to-read display***
- ***Fully encapsulated for ANY environment***
- ***85 to 264 VAC operation (47-63 Hz)***
- ***Half wave averaging, RMS calibrated***
- ***Very low cost***

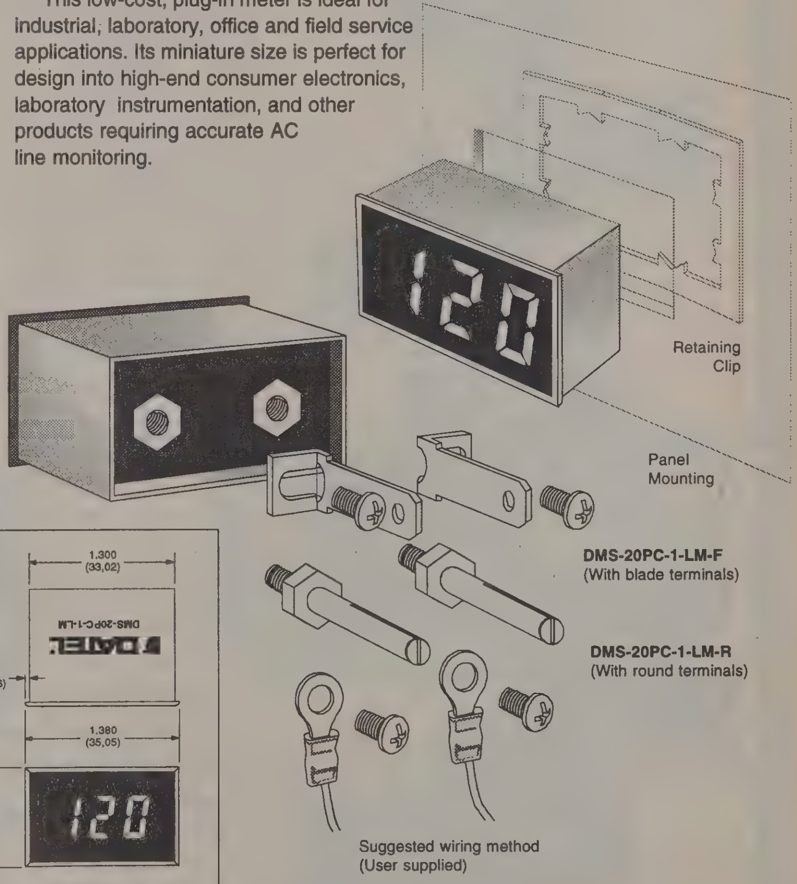
DMS-20PC-1-LM is a component size, self-contained, low-cost AC voltmeter for true line measurements. It requires no additional components or auxiliary power. Simply plug it into any wall outlet and instantly read line voltages from 85 to 264 VAC (47-63 Hz). The large (0.37") bright red LED display is a DATEL exclusive making the DMS-20PC-1-LM easily readable in virtually any lighting condition.

DMS-20PC-1-LM employs half-wave sinusoidal averaging techniques (RMS calibrated) and has a display resolution of 1 VAC over the full range input span of the meter. Packaged in a red filter case with integrated bezel, the DMS-20PC-1-LM is fully encapsulated for ruggedness. Reliable, trouble-free operation is assured with low parts count and SMT assembly. All units are overvoltage protected to 300 VAC. The operating temperature range is a wide –25°C to +60°C.

This low-cost, plug-in meter is ideal for industrial, laboratory, office and field service applications. Its miniature size is perfect for design into high-end consumer electronics, laboratory instrumentation, and other products requiring accurate AC line monitoring.

SPECIFICATIONS

INPUT	
Overvoltage Protection	300 VRMS
Voltage Range	85 - 264 VRMS
Frequency Range	47 - 63 Hz
Power Consumption	0.5 Watts (max)
PERFORMANCE	
Sampling Rate	2.5 Samples/Second
Measurement Type	Half-wave average RMS calibrated for Sinusoidal input
Measurement Accuracy	±1V (typ), ±2V (max)
Temperature Drift of Gain (–25°C to +60°C)	±0.15 Volts/°C
PHYSICAL	
Dimensions	0.88" x 1.38" x 1.00"
Display	3 digit LED, 0.37" H
Weight	1.0 oz. (28 grams)
Case Material	Polycarbonate
ENVIRONMENTAL	
Operating Temperature	–25°C to +60°C
Storage Temperature	–40°C to +75°C
Humidity	0 to 95% rH (non-condensing)


120
Retaining Clip
Panel Mounting
DMS-20PC-1-LM-F
(With blade terminals)
DMS-20PC-1-LM-R
(With round terminals)

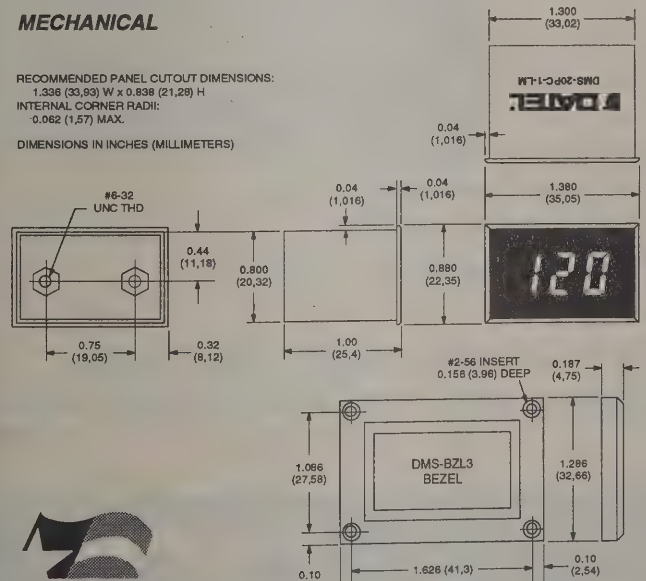
Suggested wiring method
(User supplied)

Recommended Screws	
Panel mount	0.25 inch, 6-32 stainless steel or brass
PC mount	0.50 inch, 6-32 stainless steel or brass

MECHANICAL

RECOMMENDED PANEL CUTOUT DIMENSIONS:
1.336 (33,93) W x 0.838 (21,28) H
INTERNAL CORNER RADII:
0.062 (1,57) MAX.

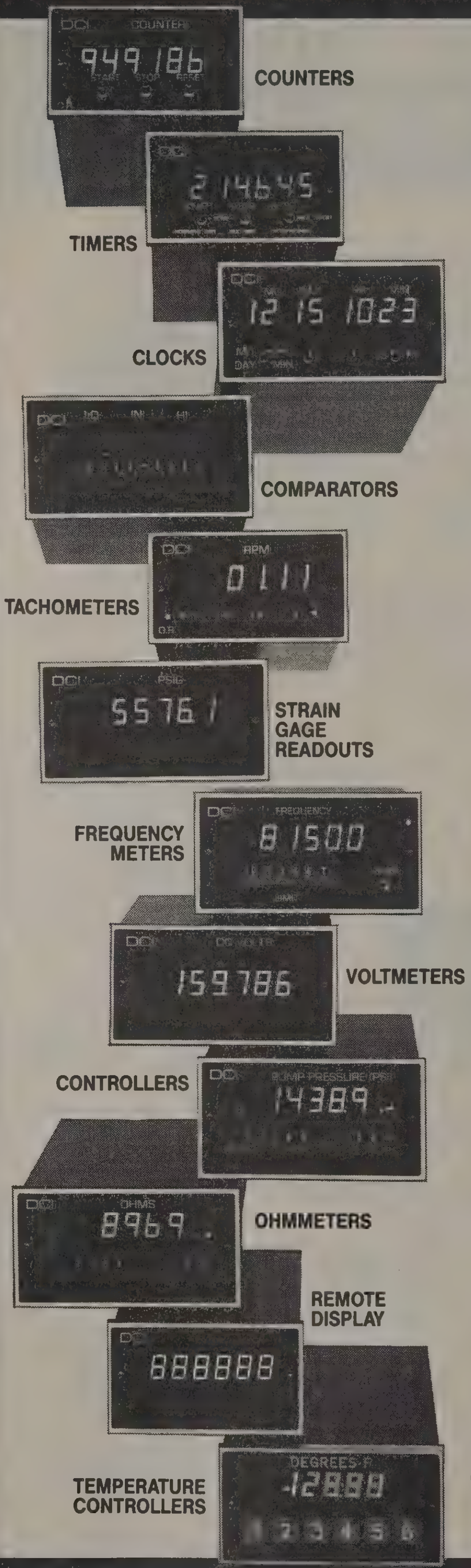
DIMENSIONS IN INCHES (MILLIMETERS)


1.300
(33,02)
DMS-20PC-1-LM
DATEL
0.04
(1,016)
#6-32
UNC THD
0.04
(1,016)
0.04
(1,016)
1.380
(35,05)
0.44
(11,18)
0.800
(20,32)
0.880
(22,35)
120
0.75
(19,05)
0.32
(8,12)
1.00
(25,4)
#2-56 INSERT
0.156 (3.96) DEEP
0.187
(4,75)
1.086
(27,58)
DMS-BZL3
BEZEL
1.286
(32,66)
0.10
(2,54)
1.626 (41,3)
0.10
(2,54)
1.826 (46,38)

MADE IN USA

ORDERING GUIDE

DMS-20PC-1-LM	With panel-mount retaining clip
DMS-20PC-1-LM-F	With blade terminals and screws
DMS-20PC-1-LM-R	With round terminals
DMS-20-CP	Panel cutout punch
DMS-BZL3	Panel mount bezel
DMS-BZL4	Panel mount bezel, NEMA4 rated


COUNTERS
TIMERS
CLOCKS
COMPARATORS
TACHOMETERS
STRAIN GAGE READOUTS
FREQUENCY METERS
VOLTMETERS
CONTROLLERS
OHMMETERS
REMOTE DISPLAY
TEMPERATURE CONTROLLERS

MEASURE, COMPARE, CONTROL, ...and COMMUNICATE.

AVAILABLE OPTIONS:

- Communication Interface
  - RS232
  - RS422
- Driver Outputs
  - BCD
  - ASCII Printer
- Analog Outputs
  - 4-20 mA
  - up to ±10V
- Excitation Outputs
  - +10 VDC
  - ±15VDC
  - +25VDC
- Logic Outputs
  - limits
  - end of conversion
- Relay Outputs
  - form C relay closure
- Up to 8 Digits of Display
- Special Scaling
- Sunlight Readable LED Displays
- DC Input Power
- High Speed Sampling
- Power Loss Protection

STANDARD FEATURES:

- Heavy Duty Aluminum Case
- Gold Plated I/O Contacts
- Non Glare Lens
- .56" High Efficiency LED Display
- 115VAC Power Input
- Direct Replacement for ERC/ITC Units

For more information or application assistance, call Larry Shelton or Bill Cook
913-782-5672

DIGITAL PANEL INSTRUMENTATION FOR INDUSTRY
14812 WEST 117TH STREET / OLATHE, KANSAS 66062 / (913) 782-5672 • FAX (913) 782-5766

DCI

ELECTRO-NUMERICS, INC.
42213 Sarah Way, Temecula, CA 92590
Tel: (909) 699-2437, Fax: (909) 695-7246

DIGITAL INDICATORS

ULTRA Series

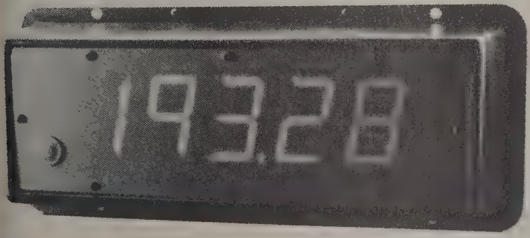
- 3 1/2 and 4 Digit Versatile Modular Meter
- 1/8 DIN with LED Displays
- Inputs: DC and AC Voltage & Current, Temperature, Frequency, Process Loops, Strain Gauge
- Setpoints and Analog Outputs
- Excitation Output
- AC and DC Powered

DIN Series

- Low cost 3 1/2 and 4 1/2 Digit Meters
- 1/8 DIN with LED Displays
- DC Voltage and Current & Process Loop Inputs
- Broad Range User Scalable
- Excitation Output
- AC and DC Powered

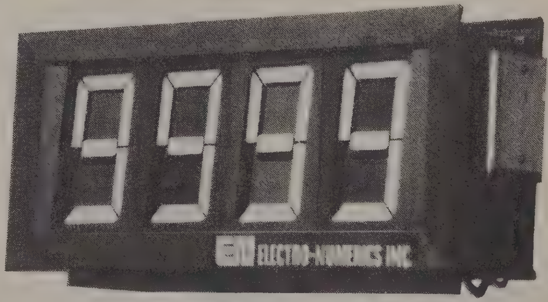
MICRO-P Series

- Universal Microprocessor Meter at Dedicated Meter Price
- 5 Digit, Red or Green, LED Display
- Scalable by Front Panel or Computer
- 60 Conversions Per Second
- Auto Tare and Peak Hold
- Dual Setpoints with Relays
- Inputs: DC and AC Voltage and Current, Thermocouple, RTD, Load Cell, Process Loops
- RS232, RS485, BCD and Analog Outputs
- Automatic, Adaptive Digital Filter
- 1/8 DIN with Front Panel Designed to NEMA 4
- 10 and 24 Vdc Excitation Outputs
- AC and DC Powered



2 1/4 Inch LED Indicators

- 4 1/2 Digit (19999 Counts)
- 2 1/4 Inch Bright LED Displays
- Current and Voltage Loop Inputs
- Broad Range User Scalable
- Excitation and Analog Outputs
- Counter Input (4 Digit)
- Sealed Surface Mount Case



Big Digit Indicators

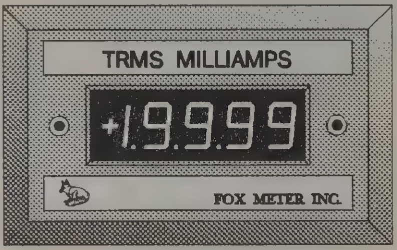
- 4 Digit Analog Input Models
- 4 and 6 Digit UP/DOWN Counters
- 4, 5, and 6 Digit ASCII Input Models
- 4 Digit Timers
- 4", 6" and 9" Reflective Digits
- Microprocessor Design
- Rugged, Weather Resistant Metal Case
- Optional NEMA 4 Case
- AC or DC Powered

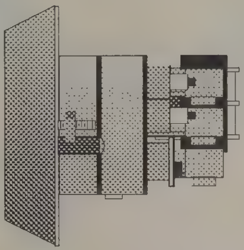
CUSTOM DESIGNS** and **MANUFACTURING
*are available from **ELECTRO-NUMERICS, INC.***

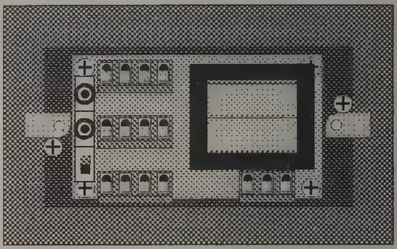
FOX

FOX METER INCORPORATED
DIGITAL PANEL METERS FOR INDUSTRIAL APPLICATIONS

- *NEMA 4X STANDARD*
- *SIMPLE MOUNTING*
- *SOCKETED SCREW TERMINALS*
- *HIGH VISIBILITY LED DISPLAY*
- *EXTENSIVE I/O CAPABILITY*
- *CUSTOM REQUIREMENTS WELCOME*

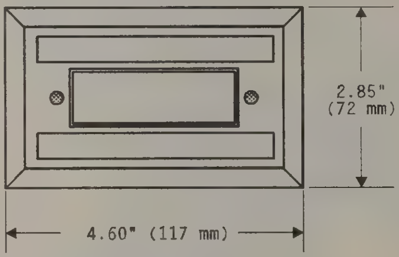




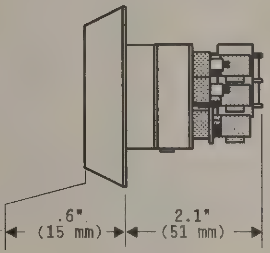


PHYSICAL DIMENSIONS AND MOUNTING :

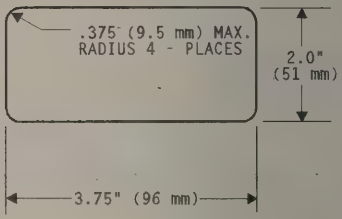
FRONT VIEW



SIDE VIEW



PANEL CUTOUT



- ☐ MOUNTING DEPTH WILL VARY FROM 1.5" TO 4.0" DEPENDING UPON METER SERIES, FUNCTION AND COMPLEXITY. FUNCTION MODULES (SEGMENTS) ARE ADDED IN 1/2" INCREMENTS.
- ☐ ALL FOX METERS WILL MOUNT INTO A STANDARD 1/8th DIN CUTOUT, WHAT IS SHOWN ABOVE IS THE SUGGESTED CUTOUT FOR NEW INSTALLATIONS.

FOX METER FUNCTION SELECTION GUIDE

SIGNAL INPUTS / METER FUNCTIONS	FOX METER SERIES DESIGNATIONS									
	F100	F200	F300	F400	F500	F600	FC600	FD200	FD400	FD600
DC VOLTS / AMPS	■				■	■	■			
AC VOLTS / AMPS	■				■	■				
TRMS VOLTS / AMPS	■									
RESISTANCE / OHMS	■				■	■				
POWER WATTS / VARS	■									
TRANSDUCER / 4-20 mA	■				■	■	■			
TEMPERATURE TC / RTD	■				■	■	■			
STRAINGAGE / BRIDGE					■	■	■			
TIMERS / CLOCKS		■	■	■						
RATE / FREQ. / TACH		■	■	■			■			
COUNTERS PULSE / QUAD		■	■	■			■			
DATA DISPLAY			■	■				■	■	■
ASCII COMMUNICATIONS			■	■	■	■	■	■	■	■
PARALLEL DATA			■	■	■	■		■	■	■
SETPOINTS / RELAYS	■			■		■	■			
ANALOG OUTPUTS	■		■	■	■	■	■			
SPECIAL FUNCTION	■		■	■	■	■	■	■	■	■

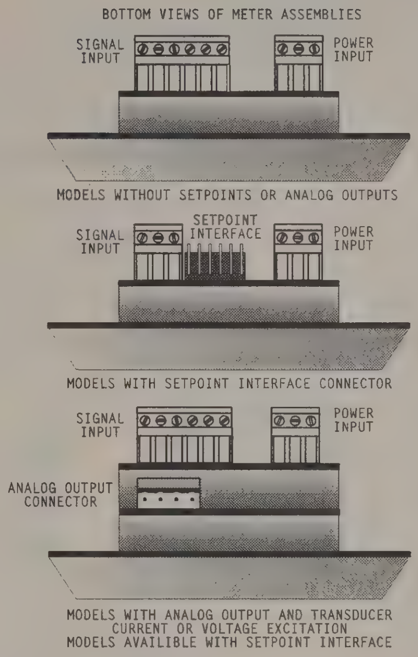
PAGE 1 ***FOR APPLICATION ASSISTANCE CALL: (815) 758-7000***

333 Dietz Avenue, Unit B, DeKalb, IL 60115-2672 - Phone 815-758-7000 - *Fax 815-758-1640*

FOX

F 100 SERIES PANEL METERS

- ☐ FOX EXCLUSIVE - Flexible 1/8th DIN or "BELL BOX" mounting with NEMA 4X sealing.
- ☐ FOX EXCLUSIVE - Less than 2" behind panel depth without sacrificing performance or capabilities.
- ☐ PLUS - Socketed screw terminal connections, flexible power supply


BOTTOM VIEWS OF METER ASSEMBLIES

MODELS WITHOUT SETPOINTS OR ANALOG OUTPUTS

MODELS WITH SETPOINT INTERFACE CONNECTOR

MODELS WITH ANALOG OUTPUT AND TRANSDUCER CURRENT OR VOLTAGE EXCITATION
MODELS AVAILIBLE WITH SETPOINT INTERFACE

To build a model number, make selections from tables A, B and C and combine as shown in the box at right. Total prices.

A B - C

TABLE "A" - BASE METER SELECTION

CODE	DESCRIPTION/SPECIFICATIONS	PRICE
F11	3 1/2 DIGIT LED (+/-1.9.9.9)	$ 180
F12	4 1/2 DIGIT LED (+/-1.9.9.99)	$ 220
F13	3 1/2 DIGIT LED (+/-1.9.9.9) WITH ISOLATED ANALOG OUT	$ 298
F14	4 1/2 DIGIT LED (+/-1.9.9.99) WITH ISOLATED ANALOG OUT	$ 358
F16	3 1/2 DIGIT LED (+/-1.9.9.9) WITH SETPOINT INTERFACE	$ 190
F17	3 1/2 DIGIT LED (+/-1.9.9.9) WITH SETPOINT/ANALOG OUT	$ 308
F18	4 1/2 DIGIT LED (+/-1.9.9.99) WITH SETPOINT INTERFACE	$ 240

TABLE "B" - METER POWER SELECTION

CODE	DESCRIPTIONS/SPECIFICATIONS	PRICE
1	120 VAC, 50/60 Hz	$ 4
2	6 TO 10 VAC, 50/400 Hz	$ 0
3	240 VAC, 50/60 Hz	$ 12
4	5.0 VDC WITH ISOLATION	$ 47
5	4.8 TO 12 VDC	$ 0
7	10 TO 30 VDC	$ 25

TABLE "C" - SIGNAL INPUT SELECTION (PARTIAL LISTING)

CODE	DESCRIPTION	PRICE
	DC VOLTS	
100	+/- 200.0 mVDC	$ 13
101	+/- 2.000 VDC	$ 13
102	+/- 20.00 VDC	$ 5
103	+/- 200.0 VDC	$ 5
	DC VOLTS - SCALEABLE	
110	+/- 100 mVDC	$ 13
112	+/- 2 VDC	$ 13
113	+/- 5 VDC	$ 5
114	+/- 10 VDC	$ 5
115	+/- 20 VDC	$ 5
116	+/- 100 VDC	$ 5
	DC AMPS / INT. SHUNT	
170	+/- 2.000 mADC	$ 19
171	+/- 20.00 mADC	$ 19
172	+/- 200.0 mADC	$ 19
173	+/- 2.000 ADC	$ 21
	DC AMPS EXTERNAL SHUNT	
234	+/- 2.000 ADC	$ 45
235	+/- 20.00 ADC	$ 45
236	+/- 200.0 ADC	$ 50
	DC AMPS ISOLATED	
237	+/- 2.000 ADC	$ 173
238	+/- 20.00 ADC	$ 173
239	+/- 200.0 ADC	$ 178
	AC VOLTS	
303	200.0 mVAC	$ 28
304	2.000 VAC	$ 28
305	20.00 VAC	$ 28
306	200.0 VAC	$ 28
307	600 VAC	$ 38

CODE	DESCRIPTION	PRICE
	AC VOLTS - SCALEABLE	
313	200.0 mVAC	$ 43
314	2.000 VAC	$ 43
315	20.00 VAC	$ 43
316	200.0 VAC	$ 43
317	600 VAC	$ 43
	AC AMPS	
353	200.0 mAAC	$ 68
354	2.000 AAC	$ 68
356	20.00 AAC	$ 68
357	200.0 AAC	$ 93
	TRMS VOLTS	
333	200.0 mVAC	$ 43
334	2.000 VAC	$ 43
335	20.00 VAC	$ 43
336	200.0 VAC	$ 43
	TRMS AMPS	
383	200.0 mAAC	$ 93
384	2.000 AAC	$ 93
386	20.00 AAC	$ 93
387	200.0 AAC	$ 108
	RESISTANCE	
242	20.00 OHMS	$ 71
243	200.0 OHMS	$ 71
244	2.000 K OHMS	$ 71
245	20.00 K OHMS	$ 71
246	200.0 K OHMS	$ 71
	DC POWER	
400	+/- 30 VDC / +/- 200 mA	$ 303
401	+/- 30 VDC / +/- 2.00 A	$ 303
402	+/- 30 VDC / +/- 20.0 A	$ 308

CODE	DESCRIPTION	PRICE
	AC TRUE POWER	
394	300 VAC / 200 mA	$ 326
395	300 VAC / 2.00 A	$ 326
396	300 VAC / 20.0 A	$ 326
	AC APPARENT POWER	
390	300 VAC / 200 mA	$ 228
391	300 VAC / 2.00 A	$ 228
392	300 VAC / 20.0 A	$ 228
	TRANSDUCER DC VOLTS	
140	+/- 100 mVDC	$ 19
143	1 to 5 VDC	$ 11
144	+/- 10 VDC	$ 11
145	+/- 20 VDC	$ 11
146	+/- 100 VDC	$ 11
	TRANSDUCER DC CURRENT	
210	+/- 1 mADC	$ 25
211	+/- 10 mADC	$ 25
212	4 to 20 mADC	$ 25
213	10 to 50 mADC	$ 25
214	+/- 100 mADC	$ 25
	TEMPERATURE	
420	"J" +32 to +1400 F	$ 75
421	"J" 0 to +760 C	$ 75
422	"K" +32 to +2000 F	$ 75
423	"K" 0 to +1100 C	$ 75
440	RTD -50.0 to +200.0 C	$ 45
443	RTD -55.0 to +200.0 F	$ 45
444	RTD -55 to +1110 F	$ 45
	SPECIAL FUNCTION	
341	THD 60 Hz VOLTAGE	$ 188
342	THD 60 Hz CURRENT	$ 240

DESIGNED and MANUFACTURED IN THE U.S.of A.

PAGE 2

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FOX

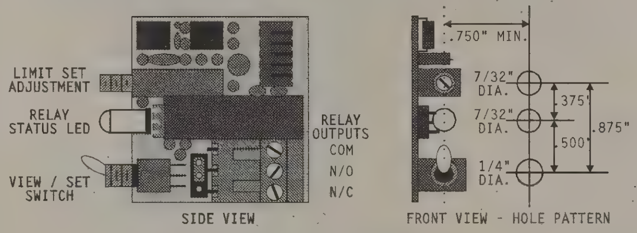
F 100 SERIES GENERAL SPECIFICATIONS

- ☐ POWER DISSIPATION - Typically less than 1 Watt total Power dissipation.
- ☐ DISPLAY - Full .6" tall, high-efficiency LEDs.
- ☐ 3 1/2 DIGIT ACCURACY - Less than 0.05% error.
- ☐ 4 1/2 DIGIT ACCURACY - Less than 0.02% error.
- ☐ ANALOG OUTPUT - Internaly sourced from 10VDC.
- ☐ OPERATING TEMPERATURE - 0 to 70 Degrees C.
- ☐ TEMPERATURE DRIFT - 0.1% per 20 Degrees C.
- ☐ DISPLAY UPDATE - 2.5 readings per Second.
- ☐ METER TO PANEL - 300 Vrms maximum.
- ☐ ACCESSORIES - All accessories are included except Temperature probes.

F 100 SERIES SETPOINT MODULES

SETPOINT MODEL SELECTIONS		
MODEL #	DESCRIPTION	PRICE
F000-900	SETS LIMIT FROM -2000 TO +2000	$ 68.00
F000-901	SETS LIMIT FROM -300 TO +2000	$ 68.00
F000-902	SETS LIMIT FROM -2000 TO +300	$ 68.00

PHYSICAL DIMENSIONS AND MOUNTING



DESCRIPTION / SPECIFICATIONS

- ☐ Setpoint modules are ordered seperately from the meter but should be referenced to a particular meter so that the proper interface cable can be supplied. There is no additional charge for the cable.
- ☐ Any F160 series meter can support from 1 to 5 setpoint modules.
- ☐ Setpoint modules can be mounted on the front panel near the meter or inside users box. Controls are provided to set the limit and view the limit. Any of the limit modules may be set to latch. A reversable bi-color LED signals relay status.
- ☐ All setpoint modules have a form "C" relay contact output rated at 1 Amp @ 120 Vac.

F 200 SERIES PANEL METERS

- ☐ LARGE BRIGHT DISPLAY OF PULSED SIGNALS
- ☐ RATE METERS HAVE A SCALEABLE TIME BASE

To build a model number, make selections from tables A, B and C and combine as shown in the box at right. Total prices.

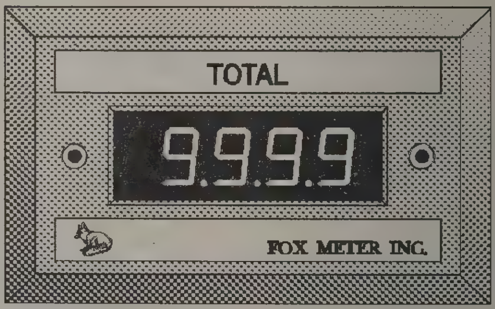
A	B	-	C

TABLE "A" - BASE METER SELECTION

CODE	DESCRIPTION / SPECIFICATIONS	PRICE
F23	4 DIGIT LED (9.9.9.9) COUNTERS, RATE & DECADE TIMERS	$ 180
F24	4 DIGIT LED (59:59 MIN/SEC) -540 TIMER ONLY	$ 180

TABLE "B" - METER POWER SELECTION

CODE	DESCRIPTION / SPECIFICATIONS	PRICE
1	120 VAC, 50/60 Hz	$ 4
2	6 TO 10 VAC, 50/60 Hz	$ 0
3	240 VAC, 50/60 Hz	$ 12
4	5.0 VDC WITH ISOLATION (NOT WITH TIMERS)	$ 47
5	4.8 TO 12 VDC (NOT WITH TIMERS)	$ 0
7	10 TO 30 VDC (NOT WITH TIMERS)	$ 25



FRONT VIEW OF A F230 COUNTER

TABLE "C" - METER FUNCTION AND INPUT / RANGE CHOICES

CODE	DESCRIPTION / SPECIFICATIONS	PRICE
	COUNTERS	
500	2 TO 30 V PULSE INPUT	$ 14
501	5 VDC SOURCING FROM PNP OUTPUT	$ 14
502	5 VDC SINKING FROM NPN OUTPUT	$ 14
503	DRY SWITCH CONTACT	$ 14
	DIVIDE BY N (1 TO 256) COUNTERS	
510	2 TO 30 V PULSE INPUT	$ 27
511	5 VDC SOURCING FROM PNP OUTPUT	$ 27
512	5 VDC SINKING FROM NPN OUTPUT	$ 27
513	DRY SWITCH CONTACT	$ 27

CODE	DESCRIPTION / SPECIFICATIONS	PRICE
	LINE SYNC (60 Hz) TIMERS	
540	9999 SECONDS WITH F230 BASE METER	$ 23
540	59:59 MIN:SEC WITH F240 BASE METER	$ 23
541	999.9 SECONDS	$ 23
542	99.99 MINUTES	$ 23
	RATE / FREQ / TACH	
580	2 TO 30 V PULSE INPUT	$ 27
581	5 VDC SOURCING FROM PNP OUTPUT	$ 27
582	5 VDC SINKING FROM NPN OUTPUT	$ 27
583	DRY SWITCH CONTACT	$ 27

2 YEAR WARRANTY ON ALL PRODUCTS

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F 300 SERIES METERS

- ☐ REMOTE DISPLAYS - SERIAL ASCII AND PARALLEL INPUTS.
- ☐ COUNTERS - UP / DOWN, QUADRATURE, DUAL SCALES.
- ☐ RATEMETERS - PERIOD CALCULATION WITH SCALED DISPLAYS AND .5 SECOND UPDATE ON RPM WITHOUT GEARS!
- ☐ TIMERS - CRYSTAL TIME BASE FROM .01 mSEC TO .01 HOURS WITH 11 DIFFERENT CONTROL MODES.
- ☐ CLOCKS - BATTERY POWERED PERPETUAL TIME AND DATE.

To build a model number, make selections from table A and tables B and C on page 5 and combine as shown in box at right.

A	B	-	C

TABLE "A" - F300 BASE METER SELECTION

CODE	DESCRIPTION / SPECIFICATIONS	PRICE
F31	6 DIGIT LED (9.9.9.9.9.9) REMOTE DISPLAY	$ 240
F32	6 DIGIT LED (99:99:99) REMOTE / CLOCK DISPLAY	$ 240
F34	6 DIGIT LED UNIVERSAL UP / DOWN COUNTER, QUADRATURE	$ 305
F35	6 DIGIT LED UNIVERSAL RATE / FREQ / TACH / PERIOD METER	$ 310
F37	6 DIGIT LED (99.9.9.9.9) UNIVERSAL TIMER (SEC, MIN OR HR)	$ 275
F38	6 DIGIT LED (99:59:59) UNIVERSAL TIMER (HR : MIN : SEC)	$ 275
F39	6 DIGIT MASTER CLOCK (99:59:59) WITH DATE & TIME ZONES	$ 260

F 400 SERIES METERS

- ☐ F400 METERS ARE F300 METERS THAT ARE SETUP FOR SETPOINTS AND INCLUDE A 20 PIN RIBBON CONNECTOR. SETPOINT MODULES ARE ORDERED SEPARATELY ON PAGE 6.

To build a model number, make selections from table A and tables B and C on page 5 and combine as shown in box at right.

A	B	-	C

TABLE "A" - F400 BASE METER SELECTION

CODE	DESCRIPTION / SPECIFICATION	PRICE
F41	6 DIGIT LED (9.9.9.9.9.9) REMOTE DISPLAY / SETPOINTS	$ 295
F44	6 DIGIT UP / DOWN COUNTER, QUAD. / SETPOINTS	$ 325
F45	6 DIGIT RATE / FREQ / TACH / PERIOD METER / SETPOINTS	$ 330
F47	6 DIGIT LED (99.9.9.9.9) TIMER (SEC, MIN OR HR) / SETPOINTS	$ 330
F48	6 DIGIT LED (99:59:59) TIMER (HR : MIN : SEC) / SETPOINTS	$ 330

F 500 SERIES METERS

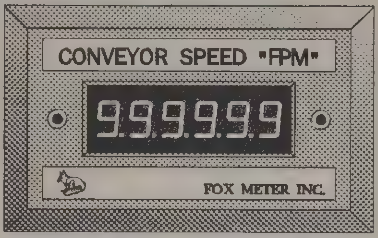
- ☐ VOLTMETERS - 30 mV TO 300 V SCALED TO SPECIFIC INPUT RANGES FOR MAXIMUM RESOLUTION (65536 COUNTS).
- ☐ AMMETERS - uADC TO AMPS WITH AN EXTERNAL SHUNT, 4 TO 20 mA WITH DIGITAL SCALING AND OFFSET.
- ☐ NON-LINEAR FUNCTIONS - SINE, COSINE, ROUND TANK LINE-

To build a model number, make selections from table A and tables B and C on page 5 and combine as shown in box at right.

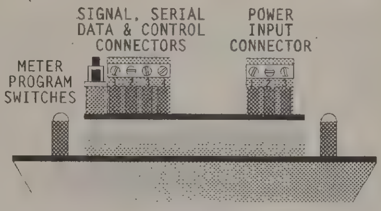
A	B	-	C

TABLE "A" - F500 BASE METER SELECTION

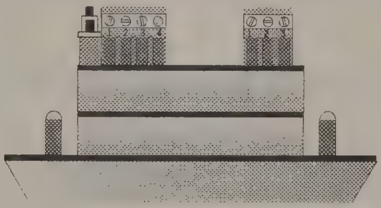
CODE	DESCRIPTION / SPECIFICATION	PRICE
F51	6 DIGIT LED UNIVERSAL DC SPECIFY VOLTS OR CURRENT	$ 393
F52	6 DIGIT LED UNIVERSAL DC WITH CURRENT EXCITATION	$ 418
F53	6 DIGIT LED UNIVERSAL DC WITH VOLTAGE EXCITATION	$ 418
F54	6 DIGIT LED UNIVERSAL AC SPECIFY VOLTS	$ 408
F56	6 DIGIT LED UNIVERSAL DC NON-LINEAR	$ 408
F57	6 DIGIT LED UNIVERSAL THERMOCOUPLE SPECIFY J, K OR T	$ 418
F58	6 DIGIT LED UNIVERSAL RTD THERMOMETER 100 OHM Pt	$ 408



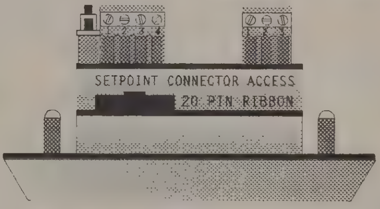
FRONT VIEW F300 AND F400 METERS



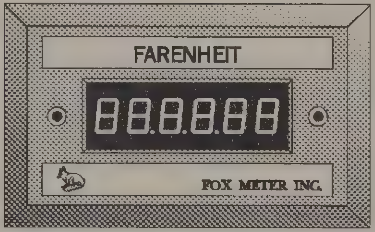
BOTTOM VIEW F300 REMOTES & CLOCKS



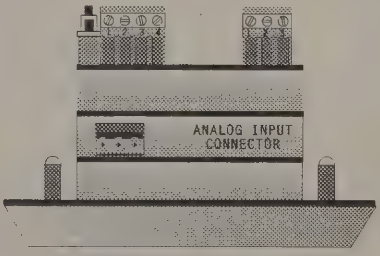
BOTTOM VIEW F300 COUNTERS & TIMERS



BOTTOM VIEW F400 METERS FOR SETPOINTS



FRONT VIEW F500 AND F600 METERS



BOTTOM VIEW F500 METERS

F500 METERS PROVIDE AN EXCELLENT PLATFORM FOR OEM's

PAGE 4

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F 600 SERIES METERS

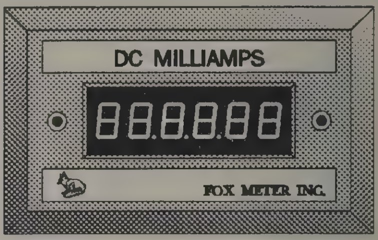
- ☐ F600 METERS ARE F500 METERS THAT ARE CONFIGURED FOR SETPOINTS. SETPOINT MODULES ARE ORDERED SEPARATELY ON PAGE 6 AND INCLUDE THE SETPOINT CABLE.
- ☐ USER SELECTABLE UPDATE RATES & AVERAGING.
- ☐ EASILY CUSTOMIZED TO FIT OEM APPLICATIONS.

To build a model number, make selections from tables A, B and C and combine as shown in the box at right. Total prices.

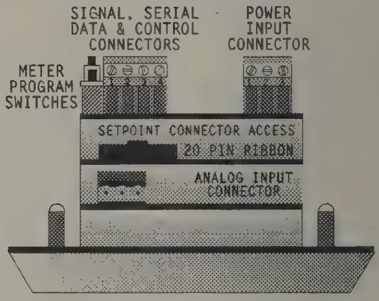
A B - C

TABLE "A" - F600 BASE METER SELECTION

CODE	DESCRIPTION / SPECIFICATION	PRICE
F61	6 DIGIT LED UNIVERSAL DC SPECIFY VOLTS OR CURRENT	$ 428
F62	6 DIGIT LED UNIVERSAL DC WITH CURRENT EXCITATION	$ 453
F63	6 DIGIT LED UNIVERSAL DC WITH VOLTAGE EXCITATION	$ 453
F64	6 DIGIT LED UNIVERSAL AC SPECIFY VOLTS	$ 443
F66	6 DIGIT LED UNIVERSAL DC NON-LINEAR	$ 443
F67	6 DIGIT LED UNIVERSAL THERMOCOUPLE SPECIFY J, K OR T	$ 453
F68	6 DIGIT LED UNIVERSAL RTD THERMOMETER 100 OHM PT	$ 443



FRONT VIEW F600 METERS



BOTTOM VIEW F600 METERS

F 300 - F 600 TABLES B & C

TABLE "B" - F300 - F600 METER POWER SELECTION

CODE	DESCRIPTION / SPECIFICATION	PRICE
1	120 VAC, 50/60 Hz	$ 20
2	6 TO 10 VAC, 50/400 Hz	$ 0
3	240 VAC, 50/60 Hz	$ 20
4	5.0 VDC WITH ISOLATION	$ 47
5	4.8 TO 12 VDC	$ 0
6	12 VDC WITH BATTERY PACK	$ 63
7	10 TO 30 VDC	$ 25
8	120 VAC WITH BATTERY BACKED DATA	$ 37
9	10 TO 30 VDC WITH BATTERY BACKED DATA	$ 42

TABLE "C" - INPUT AND OUTPUT SELECTIONS

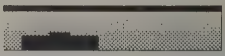
CODE	DESCRIPTION / SPECIFICATION	PRICE
651	RS232C SERIAL DATA I/O	$ 29
652	RS422 / RS485 SERIAL DATA I/O	$ 20
655	CURRENT LOOP SERIAL DATA I/O	$ 60
657	RS232C PRIMARY PORT / RS232C AUXILLARY PORT	$ 149
658	RS232C PRIMARY PORT / RS422 AUXILLARY PORT	$ 140
659	NO DATA	$ 0
661	RS232C AND ANALOG OUTPUT	$ 194
662	RS422 AND ANALOG OUTPUT	$ 185
665	CURRENT LOOP AND ANALOG OUTPUT	$ 225
671	RS232C AND PARALLEL DATA OUTPUT	$ 116
672	RS422 AND PARALLEL DATA OUTPUT	$ 107
675	CURRENT LOOP AND PARALLEL DATA OUTPUT	$ 147
681	RS232C AND PARALLEL DATA INPUT	$ 116
682	RS422 AND PARALLEL DATA INPUT	$ 107
685	CURRENT LOOP AND PARALLEL DATA INPUT	$ 147
691	ANALOG OUTPUT	$ 165
692	PARALLEL DATA OUTPUT SINKING	$ 87
693	PARALLEL DATA INPUT SINKING	$ 87
694	PARALLEL DATA OUTPUT SOURCING	$ 87
695	PARALLEL DATA INPUT SOURCING	$ 87

I/O SEGMENTS

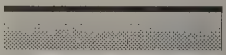
ANALOG OUTPUT SEGMENT
WITH 4 POSITION SCREW TERMINAL

PARALLEL DATA OUTPUT SEGMENT
WITH 20 PIN RIBBON CONNECTOR

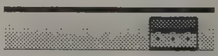
AUXILLARY SERIAL PORT SEGMENT
WITH 4 POSITION SCREW TERMINAL



PARALLEL DATA INPUT SEGMENT
WITH 20 PIN RIBBON CONNECTOR



ADDRESS EXPANSION SEGMENT FOR
USE WITH THE MULTI CHANNEL SEGMENT



ADDRESS EXPANDER WITH TEMPERATURE
INPUT FOR JUNCTION COMPENSATION

4 CHANNEL ANALOG INPUT SEGMENT
MAXIMUM OF 16 CHANNELS PER METER
CONSULT FACTORY FOR DETAILS

A FREE ENTERPRISE OWNED AND STAFFED BY US CITIZENS

FOX

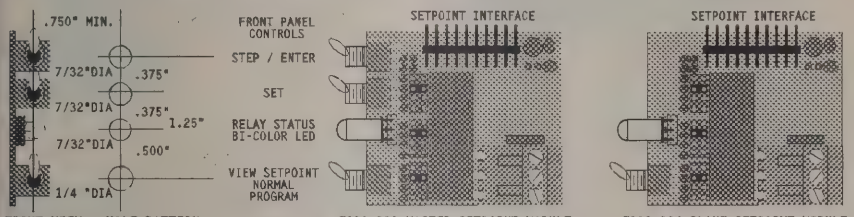
F 300 - F 600 GENERAL SPECIFICATIONS

- ☐ Typical power consumption is less than 1.5 watts.
- ☐ .4 inch tall high-efficiency red LED displays.
- ☐ Isolated constant current excitation factory set from 10 uADC to 10 mADC with 12VDC or 24VDC open circuit voltage.
- ☐ Isolated voltage excitation factory set at 10.0 VDC or 24 VDC.
- ☐ DC voltage and current inputs are factory set at the calibration that best suits a particular application.
- ☐ RTD thermometers are linearized to DIN 43760 (10/80) stds.
- ☐ Counters and Ratemeters will accept voltage pulse signals from 1.5V to 30V.
- ☐ All meters except for Thermometers are fully scaleable and include programming steps for averaging, offset, update rate, display resolution, modes of operation and data communications.
- ☐ T/C thermometers are ice point compensated and linearized to NIST tables.

SETPOINT MODULES FOR F400 and F600 METERS

MODEL #	DESCRIPTION / SPECIFICATIONS	PRICE
F000-920	MASTER SETPOINT MODULE (1 REQUIRED PER METER)	$ 105
F000-924	SLAVE SETPOINT MODULE (3 MAXIMUM PER METER)	$ 75

PHYSICAL DIMENSIONS AND MOUNTING



FRONT VIEW - HOLE PATTERN F000-920 MASTER SETPOINT MODULE F000-924 SLAVE SETPOINT MODULE

- ☐ Setpoint modules are ordered seperately from the meter but should be referenced to a particular meter so that the proper interface cable can be supplied. There is no additional charge for the cable.
- ☐ Any F400 or F600 meter can support up to 4 setpoint modules. One master setpoint module must be used with each meter. The remaining setpoint modules should be slave units.
- ☐ The master setpoint module can be used as a front panel control in

ACCESSORIES and CUSTOM SERVICES

MODEL #	DESCRIPTION	PRICE
SHUNTS		
R400-0002	6" PANEL BOARD 2.000 AMP / 100 mV	$ 36
R400-0020	6" PANEL BOARD 20.00 AMP / 100 mV	$ 36
R400-0030	6" PANEL BOARD 30.00 AMP / 100 mV	$ 36
R400-0200	6" PANEL BOARD 200.0 AMP / 100 mV	$ 36
SHUNT ISOLATOR		
SHUNT ISOLATORS ARE SMALL MODULES THAT PROVIDE 750 VOLTS OF ISOLATION BETWEEN THE SHUNT AND THE MEASUREING INSTRUMENT. THE MODULE PROVIDES FINE SPAN AND ZERO ADJUSTMENTS.		
F000-956	DC CURRENT WITH 100 mV SHUNTS	$ 128
F000-958	AC CURRENT WITH 100 mV SHUNTS	$ 137
AC CURRENT TRANSFORMERS		
F000-950	200.0 AC mA TO 200.0 ACV	$ 52
F000-951	2.000 AC AMPS TO 1.000 ACV	$ 52
F000-952	5.000 AC AMPS TO 1.000 ACV	$ 52
F000-953	20.00 AC AMPS TO 1.000 ACV	$ 52
R450-0200	200.0 AC AMPS TO 5.0 AC AMPS TORROID	$ 35
TEMPERATURE PROBES		
DUE TO THE WIDE RANGE OF APPLICATIONS INVOLVING TEMPERATURE MEASUREMENT, FOX METER WILL PROVIDE PROBES MATCHED TO A PARTICULAR APPLICATION, CONSULT FACTORY FOR PRICING.		
4 - 20 mA REMOTE SETTING MODULE		
THIS MODULE IS SIMULAR TO THE F000-900 SETPOINT MODULE EXCEPT THAT IT PROVIDES AN INDEPENDANT, ADJUSTABLE 4 - 20 mA SIGNAL.		
F000-943	4 - 20 mA @ 12 VDC, ISOLATED	$ 205

MODEL #	DESCRIPTION	PRICE
CABLE ASSEMBLIES FOR SETPOINTS		
R850-0101	F100 SERIES SETPOINTS / 1 LIMIT	$ 6
R850-0102	F100 SERIES SETPOINTS / 2 LIMIT	$ 8
R850-0103	F100 SERIES SETPOINTS / 3 LIMIT	$ 10
R850-0104	F100 SERIES SETPOINTS / 4 LIMIT	$ 12
R850-0105	F100 SERIES SETPOINTS / 5 LIMIT	$ 14
R850-0111	F400 & F600 SERIES SETPOINTS / 1 LIMIT	$ 9
R850-0112	F400 & F600 SERIES SETPOINTS / 2 LIMIT	$ 11
R850-0113	F400 & F600 SERIES SETPOINTS / 3 LIMIT	$ 13
R850-0114	F400 & F600 SERIES SETPOINTS / 4 LIMIT	$ 15
ENCLOSURES		
R700-0100	1 METER PVC BOX / NO FEEDTHRU	$ 8
R700-0101	1 METER PVC BOX / 1 FEEDTHRU	$ 10
R700-0102	1 METER PVC BOX / 2 FEEDTHRU	$ 12
R710-0100	NON-MET.,NEMA 4X, COVER/PNL.,1 METER	$ 105
R710-0101	NON-MET.,NEMA 4X, COVER/PNL.,2 METER	$ 125
R710-0102	NON-MET.,NEMA 4X, COVER/PNL.,3 METER	$ 145
R710-0103	NON-MET.,NEMA 4X, COVER/PNL.,6 METER	$ 205
R710-0104	NON-MET.,NEMA 4X, COVER/PNL.,8 METER	$ 235
R755-0100	DESK ENCLOSURE 1 METER, WIRED	$ 98
CONNECTOR INTERFACE MODULES		
R650-0100	9 PIN D-SUB TO SCREW TERMINAL	$ 35
R650-0101	25 PIN D-SUB TO SCREW TERMINAL	$ 35
R650-0110	20 PIN RIBBON TO SCREW TERMINAL	$ 35
R650-0500	SUPPORT FOR 4 - FOOO-900 SETPOINTS	$ 78

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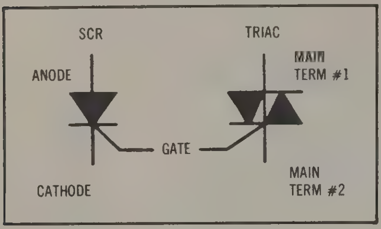
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

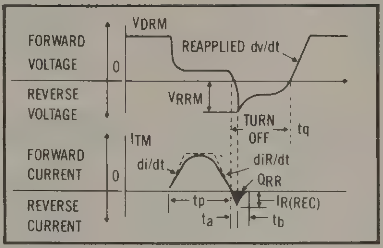


Fig. 1. Concurrent voltage and current waveforms

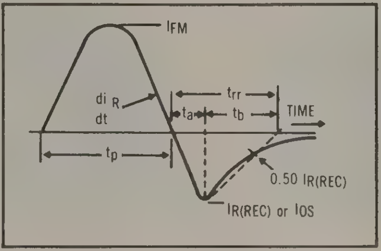


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp*.

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

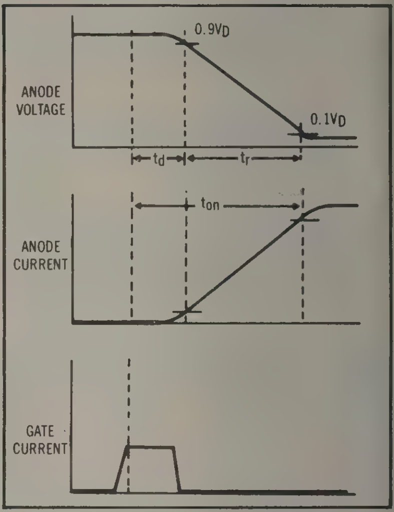


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time*. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

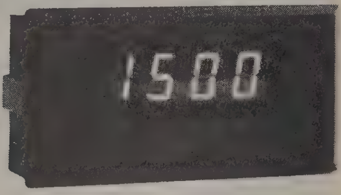
V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

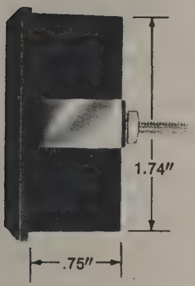
GRALEX
DIGITAL PANEL METERS

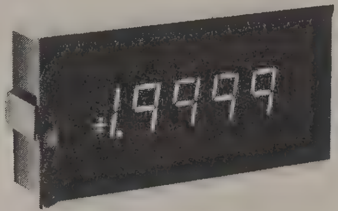
VOLTS DC / VOLTS AC / VOLTS RMS
MICROVOLTS / CURRENT LOOPS
RATE / FREQUENCY / RPM / TIME
INTEGRATION / AMPERE-HOUR
COUNTING / CALIBRATORS / RATIO

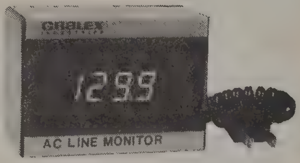
MODEL 50/51 3½ Digit Vacuum—Fluorescent Display 5 VDC Power
MODEL 25/26 4 Digit Event Counter with BCD Output 5 VDC Power
MODEL 10 Low Cost Plug In Line Monitor 80-150 VAC
SERIES 2000 mV or TC Type Process Controller with Programmable High and Low Setpoints



MODEL 50







MODEL 10

AVAILABLE FROM STOCK

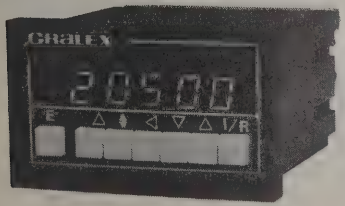
MODELS 25/30/32/40/50

1 YEAR WARRANTY

MODEL	12/13	30/31	32/33	35	38	40/41	435	48	50/51
F.S. Range	1.999 V ac	± 1.999 V dc	± .1999 V dc	± 1.999 V dc	± 1.999 V dc	± 1.9999 V dc	± 1.9999 V dc	19.99 mV RMS	± 1.999 V dc
Input Imp. (megohms)	1	1000	1000	1000	1000	1000	1000	1	1000
Conv. rate (nom.)	3/sec.	3/sec.	3/sec.	3/sec.	3/sec.	3/sec.	3/sec.	3/sec.	3/sec.
Autozero	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ext. hold	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ext. blanking	yes	yes	yes	yes	yes	yes	yes	yes	yes
Pwr. requirement (V)	5 DC	5 DC	5 DC	117 AC	117 AC	5 DC	117 AC	117 AC	5 DC
Display type	LED	LED	LED	LED	LED	LED	LED	LED	Vac. Fl.
Case dimensions	I	I	I	II	III	I	II	III	I
BCD Option	no	no	no	no	yes	yes	yes	yes*	no

*Tristate, isolated.

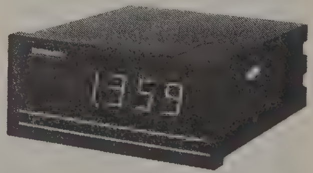
SERIES 2000 PROCESS CONTROLLER



The series 2000 meter/controllers are the GRALEX Industries new generation, microprocessor based digital panel instruments. The model 2000 is the basic 400 mV or 4 Vdc full scale meter. The model 2020 is a Thermocouple type temperature controller with front panel selectable Celsius or Farenheit indication. The model 2050 measures and performs Ampere/Time integration, accumulating or decrementing the total count, depending on input polarity. All 2000 series meters have programmable HIGH and LOW setpoints. Programming is maintained during power interruptions.

7 SEGMENT PLANAR GAS DISCHARGE, 0.55", 3½ AND 3¼ DIGIT.

MODEL	36-3	36-4	37SC( )A2	37SD( )A2
F.S. Range (± V)	.1999-19.99	.1999-199.9	.1999-199.9	.3999-399.9
Input Imp. (megohms)	>1000	1000	>100/>1	>100/>1
Conv. rate (nom.)	var. to 100	3	6	6
Autozero	no	no	no	no
Ext. hold	yes	yes	yes	yes
Ext. blanking	yes	yes	yes	yes
Pwr. requirements (V AC)	117-237	117-237	117-237	117-237
BCD output	standard	standard	optional	optional
Case dimensions	IV	IV	III	III



MODEL 37/38/48

CASE	HEIGHT	WIDTH	DEPTH
I (DIN)	1.74"	3.59"	0.75"
II (DIN)	1.65"	3.58"	3.30"
III (NEMA)	1.68"	4.00"	4.04"
IV (PROP)	2.03"	3.53"	2.82"

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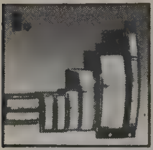

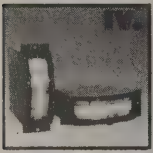

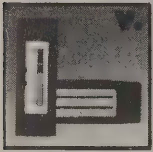

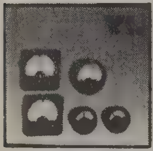

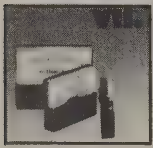

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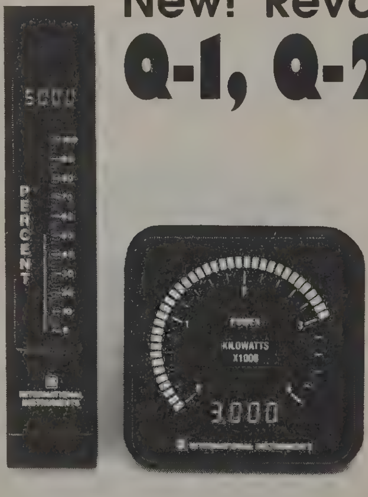

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- DC Volts and Millivolts
- DC Amps and Milliamps
- Process Signal - Voltage and Current
- Thermocouples
- RTD's
- Strain Gauges
- Load Cells
- True RMS Volts
- True RMS Amps

BENEFITS

- Simple meter setup by pushbuttons or computer
- 4 1/2 Digit Resolution at 3 1/2 Digit price
- High read rate for fast control response and true peak display
- Adaptive filter eliminates digit bounce yet rapidly responds to signal changes
- Isolated 12 and 24 VDC excitation eliminate the need for external supplies
- Wide range of input power for worldwide use
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- Standard 1/8 DIN case allows easy replacement of existing meters
- Can be washed down with high pressure when mounted in panel
- Quick hookup with safety rated connectors

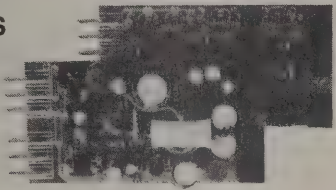
OPTIONS

- Dual Relay or Isolated Open Collector Output for Alarm and Control
- Isolated. Linearized Analog Output of 0 to 10V and 4 to 20 mA
- Isolated Multipoint RS-485, RS-232-C or Parallel BCD Output
- Low Voltage Power Supply –8 to 28 VAC and 9 to 32 VDC
- Screw Terminal Plug-in Connectors for Power and Signals

THE LAUREATE SERIES

The Laureate is a modular design consisting of a main board plug-in power supplies, signal conditioners, dual setpoint controllers, analog output and digital interfaces. This allows the Laureate to be customized for a broad range of applications from simple monitoring functions to control and computer interface.

POWER SUPPLIES



Input Power of 85 to 264 VAC and 90 to 370 VDC or 8 to 28 VAC and 9 to 32 VDC

SIGNAL CONDITIONERS

3 Input Boards: 1. DC, Strain, Process, Thermocouple, RTD
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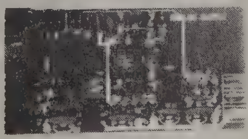
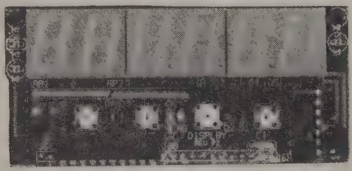


Isolated Outputs of 4 to 20 mA and 0 to 10V

MAIN BOARDS



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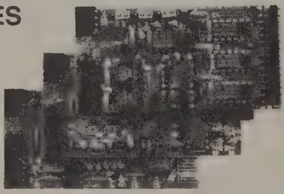

Isolated RS-232-C or RS-485 Computer Interfaces or Parallel BCD Output

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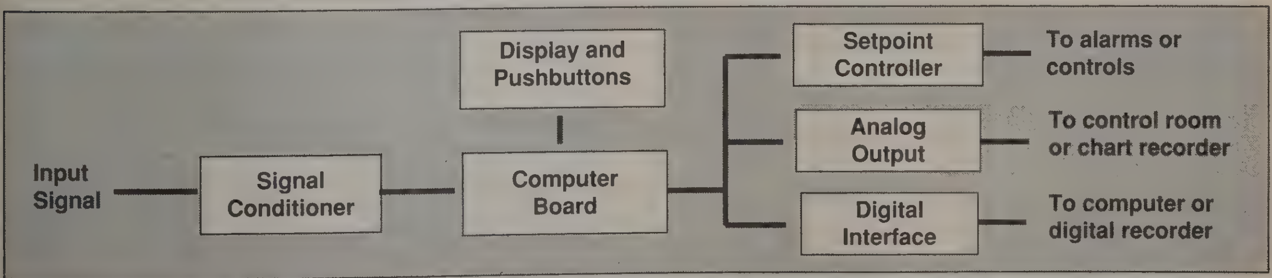

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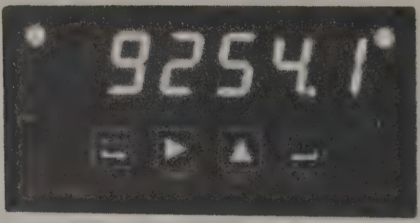

The Laureate series provides accurate display and control of analog signals such as DC and AC voltage and current, thermocouples, RTD's, process signals, strain gauges and load cells. Input type and scaling of the input signal to display directly in engineering units to 99,999 counts may be selected by the front panel pushbuttons or via RS-232-C or RS485. The patented method of analog-to-digital conversion allows the meter to make up to 60 conversions per second for fast response in control applications and true peak reading capability. Adaptive filtering provides high noise rejection while responding rapidly to step inputs. Outputs may operate from either the filtered or nonfiltered signal. The meter operates from 85 to 264 Vac and 90 to 370 Vdc to allow use worldwide. Optional alarm outputs, analog output and digital interface convert the Laureate from indicator to system control and interface.

DC VOLTS AND DC AMPS PROCESS, STRAIN GAUGES

DC VOLTS

VOLTAGE RANGE	RESOLUTION	INPUT R	ERROR AT 25° C
200.00mV	10uV	1G	.01% of reading +/-1Ct.
2.0000V	100uV	1.1M	
20.000V	1mV	1M	
200.00V	10mV	1M	
660.0V	100mV	10M	

DC AMPERES

CURRENT RANGE	RESOLUTION	INPUT R	ERROR AT 25° C
2.0000mA	0.1uA	100 Ohms	.01% of reading +/-1Ct.
20.000mA	1.0uA	10 Ohms	
200.00mA	10uA	1 Ohms	
5.000A	.25mA	10 mOhms	

TRUE RMS VOLTS AND AMPS

VOLTS

VOLTAGE RANGE	RESOLUTION	INPUT R	ERROR AT 25° C
50.00mV	2.5uV	100M	.05% of reading +/-2ct. from 10Hz to 10kHz
200.00mV	10uV	100M	
2.0000V	100uV	1M	
20.000V	1mV	1M	
200.00V	10mV	1M	
660.0V	100mV	10M	

AMPERES

CURRENT RANGE	RESOLUTION	INPUT R	ERROR AT 25° C
2.0000mA	0.1uA	100 Ohms	.05% of reading +/-2ct. from 10Hz to 10kHz
200.000mA	1.0uA	10 Ohms	
200.00mA	10uA	1 Ohm	
2.0000A	100uA	0.1 Ohms	
5.000A	.25mA	10 mOhms	

THERMOCOUPLE PT 100 OHM RTD

THERMOCOIUPLES

TC TYPE	RANGE	CONFORMITY ERROR
J	-210°C to +760°C -247°F to +1400°F	0.09°C 0.16°F
K	-244.0°C to +1372°C -408°F to +2501°F	0.1°C 0.17°F
T	0°C to +400°C -257°C to 0°C +32°F to 752°F -430°F to +32°F	0.03°C 0.2°C 0.05°F 0.36°F
E	-270°C to +1000°C -450°F to +1830°F	0.18°C 0.32°F
S	-46°C to +1768°C -51°F to +3213°F	0.12°C 0.22°F
R	-45°C to +1768°C -49°F to +3214°F	0.17°C 0.31°F

RTD'S

TC TYPE	RANGE	CONFORMITY ERROR
DIN 0.00385	-202°C to +850°C -331°F to +1562°F	0.09°C 0.16°F
ANSI 0.003925	-202°C to +850°C -331°F to +1562°F	0.1°C 0.17°F

LOAD CELL METER / MICROVOLT METER

LOAD CELL INPUTS

INPUT RANGE	RESOLUTION	OUTPUT ZERO RANGE	OUTPUT SPAN RANGE	ERROR AT 25°C
20.000mV	1uV	-99,999 to +99,999	0 to +/-99,999	.01%R +/-1Ct.
50.000mV	2.5uV			
100.00mV	5uV			
250.00mV	12.5uV			
500.00mV	25uV			

STANDARD SPECIFICATIONS

Display

Type	5 LED, 7-segment, 14.2mm (.56") high digits & LED indicators
Color	Red or Green
Range	–99,999 to +99,999 and –99,990 to +99,990

A to D Conversion

Technique(pat. Pend)	Concurrent Slope™
Rate	60/sec. for 60 Hz NMR 50/sec. for 50 Hz NMR
Output Update Rate	56/sec. at 60 Hz 47/sec. at 50 Hz
Display Update Rate	3.5/sec. at 60 Hz 3/sec. at 50 Hz

Accuracy

Span Tempco	0.003% of span/°C
Zero Tempco	0.2 uV/°C

Noise Rejection

CMV from DC to 60 Hz	1500 Vp
CMR from DC to 60 Hz	130dB
Filtering	90 dB at 50/60 Hz with minimum filtering

Environmental

Operating Temperature	0°C to 55°C
Storage Temperature	–40°C to 85°C
Relative Humidity	95% at 40°C, noncondensing

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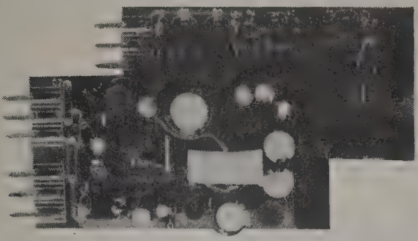
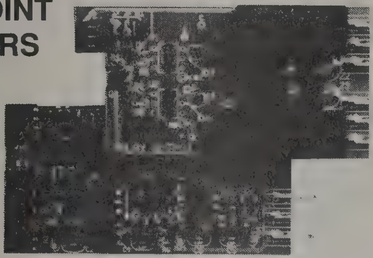
POWER SUPPLIES



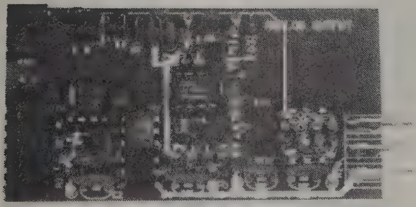
The Laureate series uses high frequency, switching power supplies to provide stable, isolated power for meter operation. Switching power supplies substantially reduce weight of the meter while providing outputs over a broad range of input voltage and frequency. +5 Vdc and –5 Vdc outputs and two isolated excitation power sources are available. The standard power supply operates on power inputs from 85 to 264 Vac, 47 to 440 Hz and from 90 to 370 Vdc. Hence, units may be operated worldwide with the same power supply. The optional low voltage power supply operates from 8 to 28 Vac, 47 to 440 Hz and 9 to 32 Vdc. This allows Laureate to be operated from a variety of batteries or 28 Vac, 400 Hz aircraft power. The isolated excitation supplies provide 12 Vdc at 120 mA and 24 Vdc at 30 mA. These supplies may be used to power the analog output and RS-232-C options or external transmitters and strain gauges. The Load Cell meter converts the 12 V output to a highly stable, accurate 10 Vdc excitation for up to 4 350 Ohm load cells. The supplies are designed to meet UL/VDE safety standards and FCC/VDE EMI requirements.

DUAL SETPOINT CONTROLLERS



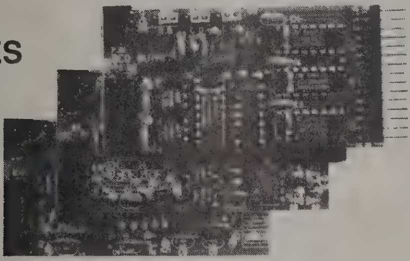
The setpoint control option adds control and alarm capabilities to the Laureate. Two versions are available; the relay board has two Form C, 10 A @ 250 Vac relays and the optically isolated board provides two open collector outputs rated at 30 Vdc and capable of sourcing 30 mA. Outputs may be set to operate above or below the setpoint or disabled. Open collector or relays may be individually programmed to operate in a latching or automatic mode. In the latching mode, when an alarm or shutdown condition is reached, the output remains in the alarm condition until it is manually reset by the front panel pushbuttons or through the rear connector. The output is automatically reset in the nonlatching mode when the alarm condition no longer exists. When operating from the unfiltered input, output response to an alarm occurs within 20 milliseconds. The filtered input reduces the chance of alarms triggering due to noise. Setup selection of 2 to 128 readings prior to updating the output provides a time delay and reduces relay chatter. Setpoint values are entered by front panel pushbuttons or serial interface.

ANALOG OUTPUT



The analog output produces an isolated signal of 4 to 20 mA and 0 to 10 Vdc for chart recorders, computers or transmission to a central control room. The output for thermocouples and RTD's is linearized with the same accuracy as the basic meter. A 12-bit D-to-A converter updates the output 57 times per second with a resolution of .025%. Accuracy of the analog output is .05%. The high update rate allows the output to closely track the input signal. The output may be operated from either the filtered or nonfiltered input. Power is provided by the meter 12 or 24 Vdc excitation supply. Using the 12 V supply, the 4 to 20 mA output can drive loads up to 400 Ohms and up to 1000 Ohms with 24 V. The output is isolated to 500Vp from signal ground and 1500 Vp to power ground, eliminating errors due to ground loops. Scaling of hte output is easily entered by the front panel pushbuttons or RS-232-C or RS-485 interface. The low and high output signals may be set to equal any value from –99,999 to +99,999. This allows the low output to be set to a displayed value either above or below the high output.

DIGITAL INTERFACES



The Laureate offers isolated full duplex RS-232-C or RS-485 communications or 3-state, stored, parallel BCD to interface with computers, PLC's or other digital devices. Laurel provides IBM compatible software with the RS-232-C and RS-485 interfaces to allow simple menu-driven setup of the meter. The information transmitted via RS-232-C and RS-485 includes present signal value, peak signal value and alarm values and status. The RS-485 allows transmission over long distances in noisy electrical environments and is addressable, allowing multiplexing with up to 30 other devices. Baud rates are selectable from 300 Hz to 19,200 Hz. The Laureate may be used as a remote display vai the digital interface; no signal conditioner is required. The parallel BCD has 3-state outputs to allow multiplexing with other meters for data logging. A single line enable is used to address each meter. BCD Hold and Data Ready output simplify interface. Outputs are isolated to 500 Vp from signal ground and 1500 Vp to power ground. The BCD board may be powered by the meter 5 Vdc if no isolation is required.

ORDERING GUIDE

THE COMPLETE LAUREATE SERIES	
LC	Crimp-on terminals
LS	Screw terminals
Display Color	
1	Green LED
2	Red LED
Power	
0	85 to 264 Vac 90 to 370 Vdc
1	9 to 32 Vdc 8 to 28 Vac
Setpoint Output	
0	None
1	Dual 10 A relays
Analog Output	
0	none
1	4 to 20 mA, 0 to 10V
Digital Interface	
0	None
1	RS-232-C
2	RS-485
3	BCD
Input Type	
DC Volts	
DCV1	200.00mV
DCV2	2.0000V
DCV3	20.000V
DCV3	20.000V
DCV4	200.00V
DCV5	660.0V
DC Amperes	
DCA1	2.0000mA
DCA2	20.000mA
DCA3	200.00mA
DCA4	5.000A
RMS Volts	
RMV1	50.000mV
RMV2	200.00mV
RMV3	2.0000V
RMV4	20.000V
RMV5	200.00V
RMV6	660.0V
RMS Amperes	
RMA1	2.000mA
RMA2	20.000mA
RMA3	200.00mA
RMA4	2.000A
RMA5	5.000A
Process Signals (4 to 20 mA, 0 to 5 V, etc.)	
P1	-99,999 to +99,999
Load Cells	
SG1	-99,999 to +99,999
Thermocouples	
JC	-210 to 760°C
JF	-347 to 1400°F
KC	-244 to 1372°C
KF	-408 to 2501°F
TC	-257 to 400°C
TF	-430 to 752°F
EC	-270 to 1000°C
EF	-450 to 1830°F
RC	-45 to 1768°C
RF	-49 to 3213°F
SC	-46 to 1768°C
SF	-51 to 3214°F
100 Ohm Platinum RTD's	
DIN	-202 to 850°C
DIN	-331 to 1562°F
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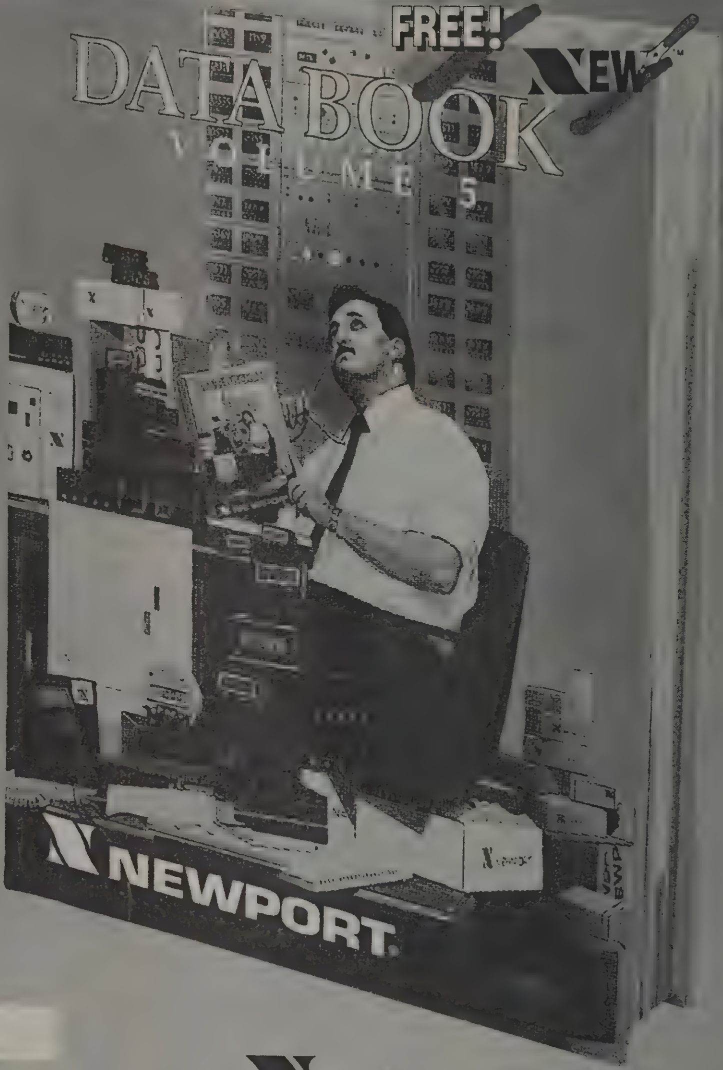

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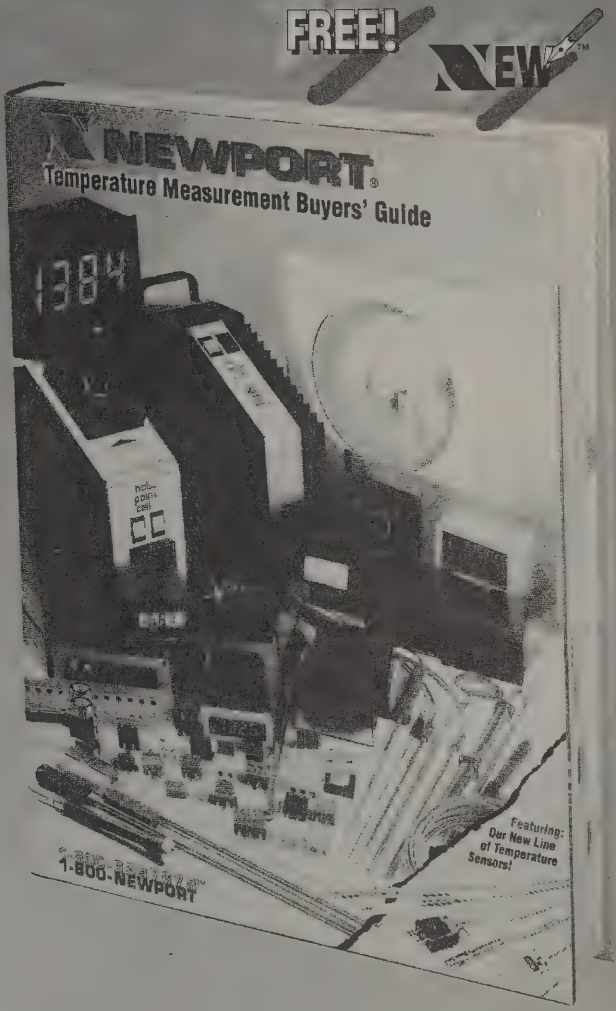
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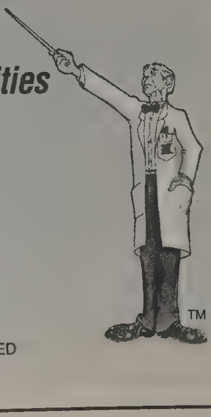

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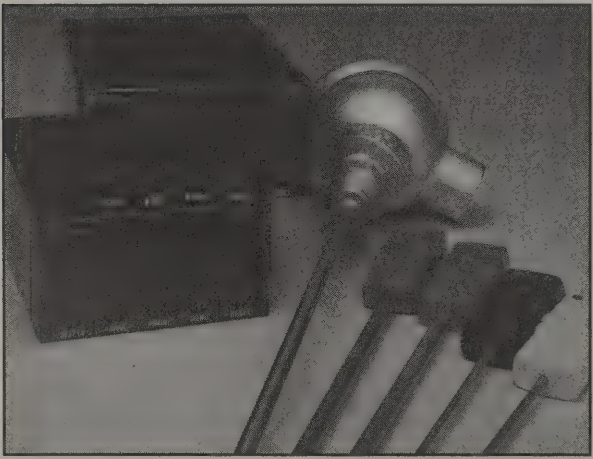

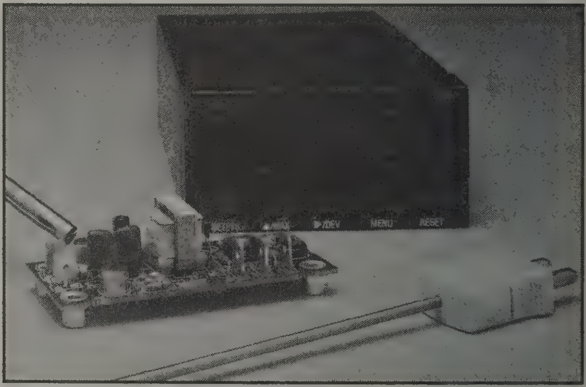

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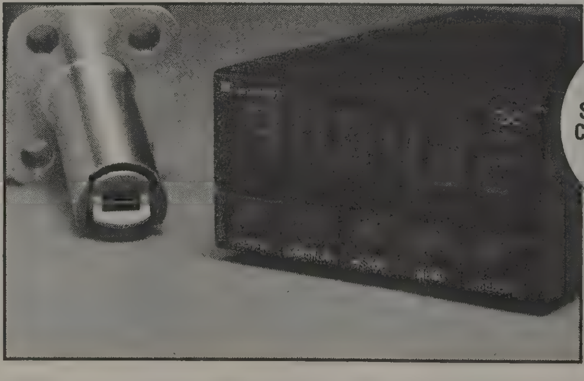

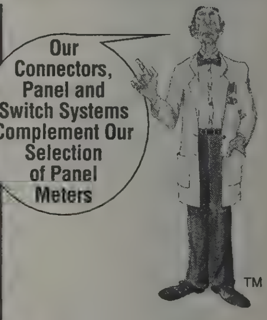

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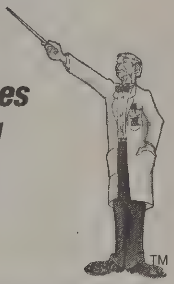

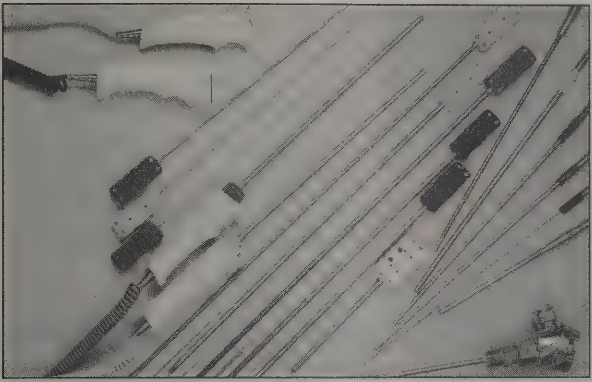

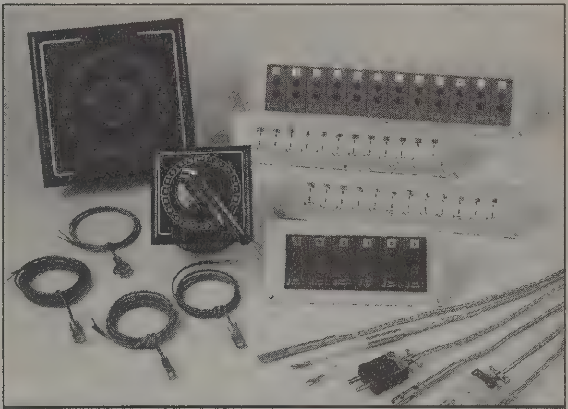

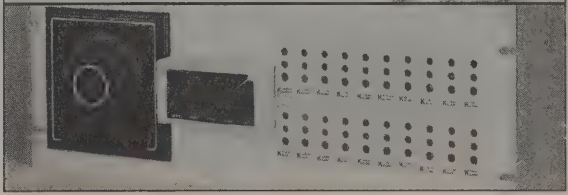

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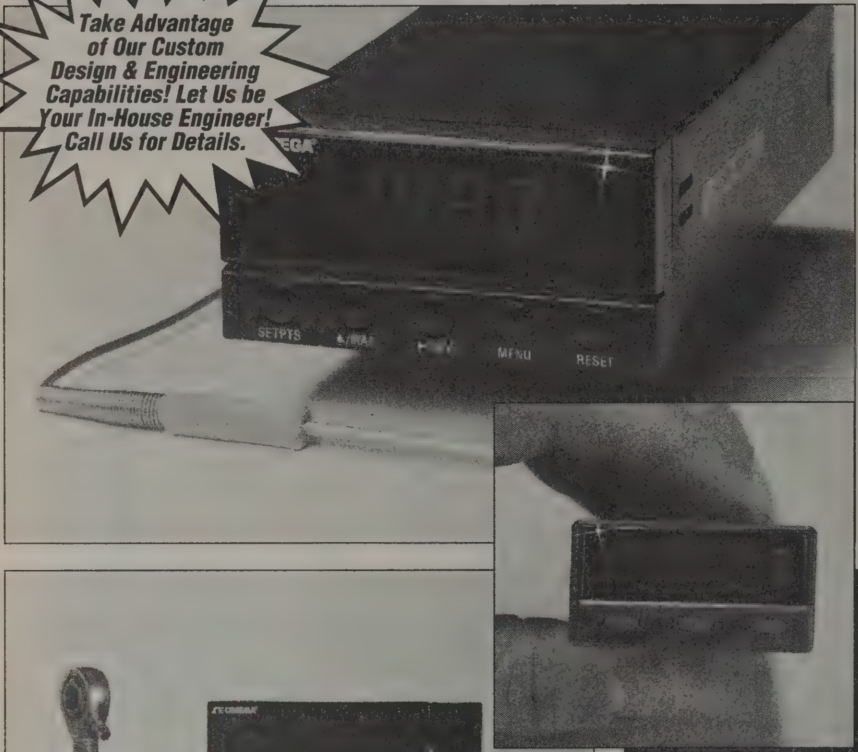

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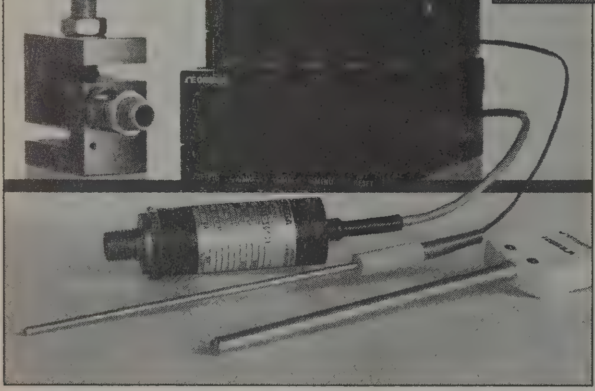

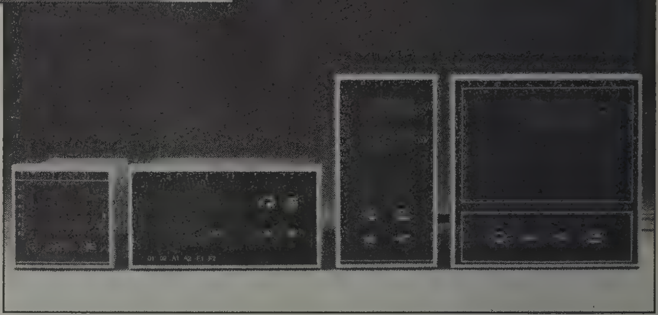

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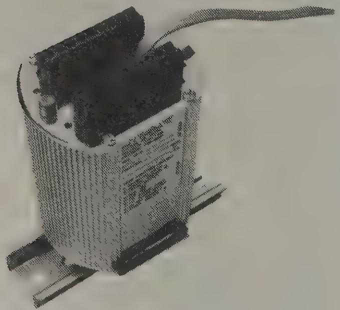

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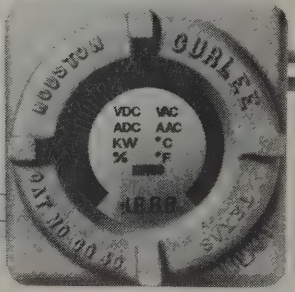

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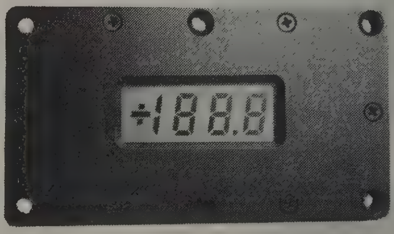

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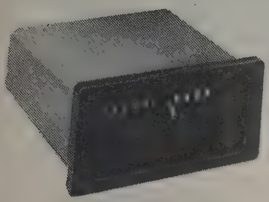

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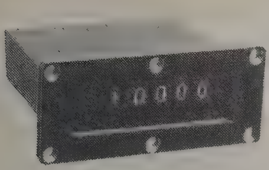

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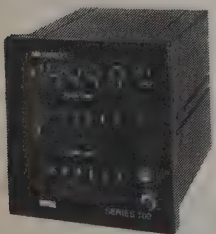

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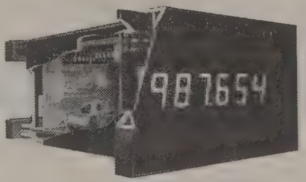
SERIES "400" STANDARD CASE UP/DOWN COUNTERS, TIMERS

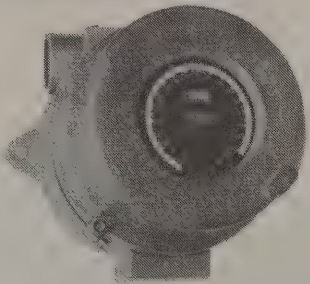
High Noise Immunity Logic (12V) Up/Down Counter/Timer, Quadrature Input , Frequency, Clock



*High Noise Immunity Logic
*Digital Limit
*Presetable
*Parallel or MUX BCD Output
*12VDC/120/240VAC Powered
*Separate Connector for Power Input
*Case Replacement for Datel's
& Texmate's Counters

SERIES"500&50"TRANSMITTERS&TRANSMETERS™

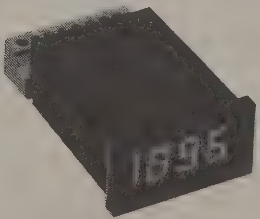
Current Loop, Transceivers and Transmitters for RTD, Strain-Gage, TC, mV & ΩInputs, Digital/Bar-Digital & Current Output



*101 Segments+3½ , Bar-Digital
Digits
*Loop Powered Transmitter
*Explosion Proof
*Thermowell
*DIN Rail or Snap Track Mounted
*3½ or 4½ Digits
*Indicating Process Transmitters

SERIES "800" LOW COST MINIATURE DPM

1/32 DIN (48 x 24mm) 3½ Digit LED DPMs for:VDC-mADC - Thermocouple - RTD - Solid State Sensor, Screw Terminal Connector - "Snap-On" Mounting



*Bright 0.4" Display
*Standard Cut Out
*No Tools Required
*J or K Thermocouples
*PT 100 RTD
*Included S.S. Sensor
*200mV-1KV & 200μ A-2ADC
Ranges

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FSCM (CAGE#):57861

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Tucson, AZ 85714

FLAT PACK DPM ™

NO PANEL CUT OUT REQUIRED!

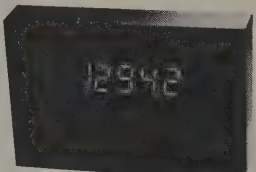
JUST DRILL A 3/8" HOLE, PASS WIRES THROUGH IT, STICK THE "FLAT PACK"TO THE PANEL & MAKE CONNECTIONS TO IT! NO CONNECTOR REQUIRED! ONLY 3"W x 2" H x 0.6" DEEP! ALSO AVAILABLE IN "NAKED" VERSION!!

3 ½ DIGIT LED

MODEL	FUNCTION
516	V/mADC
519	RPM/Hz/Speed
525	Current Loop
526	RTD Temp.
515	Thermocouple
543	Strain-Gage
413	Up/Dn Counter, Timer

3 ½ DIGIT LCD

MODEL	FUNCTION
518	V/mADC
520	Integrator
521	Current Loop
522	Timer, Counter
527	RTD Temp
536	Thermocouple
528	AAC Powerless
538	VAC Powerless
568	Frequency Powerless



4 ½ DIGIT LED & LCD

MODEL	FUNCTION
523	V/mADC 200mV-500V ±0.005%
524	V/mADC 200mV-500V ±0.005%

6 & 8 DIGIT LED

MODEL	FUNCTION
411	6 Digit Up/Down Counter, 12 V Logic
412	8 Digit Universal Counter, Timer, Interval, Period, Event Frequency & Ratio

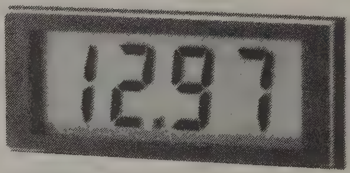
---

GREAT LITTLE™ & GIANT LITTLE™
LOW COST "GENERIC" DPMS

PANEL MOUNT

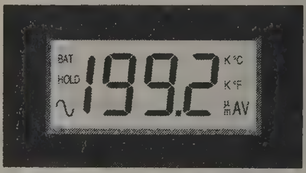
MODEL GL 177
- 3 ½ Digit LCD
- Only 2.37x1.2x0.275
- 0.1" Plug in Header
- ±200mVDC Range for Flexibility
- Superior Quality Second Source For Modutec's Models

WINDOW OR SURFACE MOUNT



MODEL GL 100
- 3 ½ Digit LCD
- Only 2.37x0.96x0.25
- 0.1" Plug in Header
- ±200mVDC Range for Flexibility
- Superior Quality Second Source For Modutec's Models

SNAP IN MOUNTING



ACTUAL SIZE

MODEL GL 150
- 3 ½ Digit LCD
- Annunciators
- PC Mount or Panel Mount
- Only 1.74x0.94x0.42"
- ±200mVDC Range
- No Hardware Required

Most OTTOTEKS' Models Offer:

INPUT: V/mADC - V/A RMS - Current Loop - Strain Gage - Microvolts - Frequency - Phase - Watts - Integrators - Flow - Temperature (RTD, TC, TH, SS) - Ohms - Mho - Sample & Hold - Peak & Hold - Rate - RPM - Clocks Timers - Quadrature - RS232 - RS422 - Serial BCD - MUX BCD - Parallel BCD

OUTPUTS: Current Loop (4-20mA) - 1-5VDC - RS232 - RS422 - RS485 - BCD (MUX, Parallel, Tristate & Serial) Alarms - Relays - Excitation - Compliance

DISPLAYS: Bargraph - Bar-Digital - 3½, 4½, 5, 6 & 8 LED & LCD **PACKAGES:** From 1/32 to 1/4 DIN

From "Generic" to Mil-Spec *OTTOTEK* is Your Source!!

FREE NEW 300+PAGE DATA BOOK

WITH TABLES, FORMULAS, CHARTS, TERMINOLOGY, ABBREVIATIONS AND SPECS!

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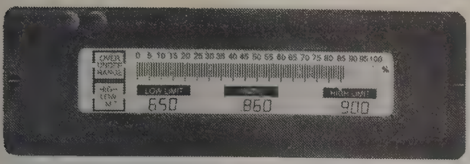
LCD BAR-DIGITAL FLAT PACK INSTRUMENTS

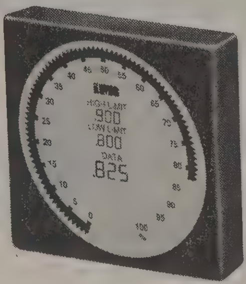
V&A DC & AC,CURRENT LOOP, STAIN-GAGE, RTD,THERMOCOUPLE,Hz & WATTS

SERIES "560"



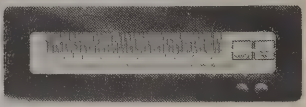
- *101 Segments for 1% & 0.1% Accuracy
- *Tripple 3½ Digit Display for Data & 2 Alarms
- *Standard Edgewise Size

SERIES "580"



- *101 Segments for 1% & 0.1 % Accuracy
- *Tripple 3½ Digit Display for Data & 2 Alarms
- *Standard Switchboard Size

SERIES "570"



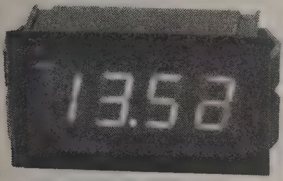
- *Vertical or Horizontal
- *101 Segments Bargraph
- *3 Alarms Annunciators
- *Standard Edgewise Size
- *Large 0.6" Segments

COMMON FEATURES: *Flush Panel Mount *Only 1" Thick *NEMA 4 Metal or Plastic Case *Optional Backlight *Screw or Flat Ribbon Connector, Powerless™ (Signal Powered) For : Current Loop, VAC, VDC, mADC, Hz & Watts

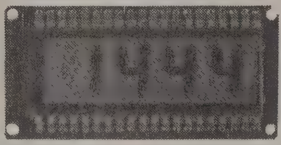
LED & LCD MINIATURE ALARM DPMS (Series "6000")

V & mADC, TRUE RMS, CURRENT LOOP, STRAIN-GAGE, RTD & THERMOCOUPLE

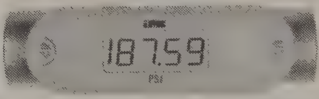
"SNAP ON"



"NAKED"



"CONDULET"

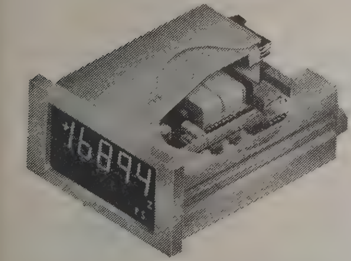


"EXPLOSION PROOF"

COMMON FEATURES: 3½ or 4½ LCD or LED *Alarm with Relay *Very Low Power *Large Display (0.6" & 0.5") *Screw or Plug in Connector *Powerless™ for Current Loop *Built in Compliance & Excitation to Power Your Transducers

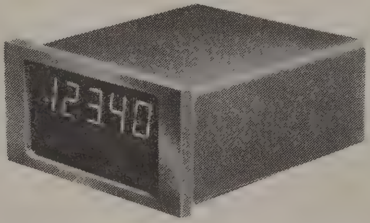
1/8 DIN DPMS WITH EIA 232, LARGE DISPLAYS, ALARMS, WIDE POWER INPUT, BCD, P&H & MORE

"ULTIMA 200"



"OJ 2000"

SERIES "260"



"ULTIMA 200": 3½ & 4½ LED or LCD Display INPUTS: V/mADC, True RMS, Strain-Gage, Current Loop, RTD, Thermocouple OHMS, Autorange VDC, Hz, Peak & Hold, Watts & Integration.
OUTPUTS: 4-20mA & 0-5VDC, EIA232/422 ,Opto-Isolated, BCD, Digital Limit with Relays, Excitation & Compliance, Metal or Plastic Case, Screw Connector, The Ultimate DPM

"OJ 2000": 0.8" Large Red or Green LED or 1/2 " LCD with Backlight, Heavy Duty Case with NEMA 4 Gaskets & Screw Connector
INPUTS: V/mADC, True RMS, Strain-Gage with Excitation, Current Loop Powerless or with Compliance, RTD & Thermocouple

SERIES "260": Low Cost 3½ LED or LCD Display, Relay Outputs For Alarm, Spare Isolated Voltage to Power Transducers, Wide Zero & Span.
INPUTS: V/mADC, Strain-Gage & Current Loop

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Selco/Asahi Digital Panel Meters

DC VOLTMETERS AND AMMETERS

AP-101

FEATURES

- Low Cost
- Bright LED 14.2mm (Red)
- AC180 ~ 264V, 90 ~ 132V, DC5V, DC24V

AP-101

Model	Range	Maximum Resolution	Input Impedance	Input Protection
AP-101-11	±199.9mV	100µV	100MΩ	±250V
AP-101-12	±1.999V	1mV	100MΩ	±250V
AP-101-13	±19.99V	10mV	10MΩ	±250V
AP-101-14	±199.9V	100mV	10MΩ	±500V

Accuracy: ±0.1% rdg ±1 digit (23°C±5°C)

Model	Range	Maximum Resolution	Internal Resistance	Input Protection
AP-101-21	±199.9µA	100nA	1KΩ	±10mA
AP-101-22	±1.999mA	1µA	100Ω	±50mA
AP-101-23	±19.99mA	10µA	10Ω	±150mA
AP-101-24	±199.9mA	100µA	1Ω	±500mA
AP-101-25	±1.999A	1mA	0.1Ω	±3A

Accuracy: ±0.2% rdg. ±1 digit (23°C±5°C)
±0.3% rdg. ±1 digit only for AP-101-25

AP-141

FEATURES

- Low Cost
- Bright LED 14.2mm (Red)
- AC180 ~ 264V, 90 ~ 132V, DC5V

AP-142

FEATURES

- BCD option
- Bright LED 14.2mm (Red)
- AC180 ~ 264V, 90 ~ 132V, DC5V

AP-141

Model	Range	Maximum Resolution	Input Impedance	Input Protection
AP-141-12	±1.9999V	100µV	100MΩ	±100V
AP-141-13	±19.999V	1mV	1MΩ	±250V
AP-141-14	±199.99V	10mV	1MΩ	±500V

Accuracy: ±0.03% rdg ±1 digit (23°C±5°C)

AP-142

Model	Range	Maximum Resolution	Input Impedance	Input Protection
AP-142-11	±199.99mV	10µV	100MΩ	±250V
AP-142-12	±1.9999V	100µV	100MΩ	±250V
AP-142-13	±19.999V	1mV	1MΩ	±250V
AP-142-14	±199.99V	10mV	1MΩ	±500V

Accuracy: ±0.03% rdg. ±1 digit (23°C±5°C)

AP-202

FEATURES

- BCD option
- DC5V (Isolated)
- Bright LED 10.2mm (Red)
- Conversion Rate 2.5/sec or 12.5/sec (50Hz), 15/sec (60Hz)
- 200mV ~ 200V Measurement

AP-202

Model	Range	Maximum Resolution	Input Impedance	Input Protection
AP-202-11	±199.9mV	100µV	100MΩ	±100V
AP-202-12	±1.999V	1mV	100MΩ	±100V
AP-202-13	±19.99V	10mV	10MΩ	±250V
AP-202-14	±199.9V	100mV	10MΩ	±500V

Accuracy: ±0.1% rdg ±1 digit (23°C±5°C)

Model	Range	Maximum Resolution	Internal Resistance	Input Protection
AP-202-21	±199.9µA	100nA	1KΩ	±10mA
AP-202-22	±1.999mA	1µA	100KΩ	±50mA
AP-202-23	±19.99mA	10µA	10Ω	±150mA
AP-202-24	±199.9mA	100µA	*1Ω	±500mA
AP-202-25	±1.999A	1mA	*0.1Ω	±3A

Accuracy: ±0.2% rdg. ±1 digit (23°C±5°C)
±0.3% rdg. ±1 digit only for AP-202-25

*These resistors are connected to the outside of the unit.

AP-502

FEATURES

- Low Cost
- Bright LED 14.2mm (Red)
- Serial Data Output
- Thin Case (Depth 32mm)
- DC5V (Isolated)
- 200mV ~ 200V, 200µA ~ 2A Measurement

AP-502

Model	Range	Maximum Resolution	Input Impedance	Input Protection
AP-502-11	±199.9mV	100µV	100MΩ	±250V
AP-502-12	±1.999V	1mV	100MΩ	±250V
AP-502-13	±19.99V	10mV	10MΩ	±250V
AP-502-14	±199.9V	100mV	10MΩ	±500V

Accuracy: ±0.1% rdg ±1 digit (23°C±5°C)

Model	Range	Maximum Resolution	Internal Resistance	Input Protection
AP-502-21	±199.9µA	100nA	1KΩ	±10mA
AP-502-22	±1.999mA	1µA	100Ω	±50mA
AP-502-23	±19.99mA	10µA	10Ω	±150mA
AP-502-24	±199.9mA	100µA	1Ω	±500mA
AP-502-25	±1.999A	1mA	0.1Ω	±3A

Accuracy: ±0.2% rdg. ±1 digit (23°C±5°C)
±0.3% rdg. ±1 digit only for AP-502-25

SET POINT COMPARATOR

AM-122

FEATURES

- Loading Zero Suppression • Digital zero
- Peak Valley Hold
- Easily adjustable offset and full scale
- Bright LED 10mm (Red)

AVAILABLE INPUTS

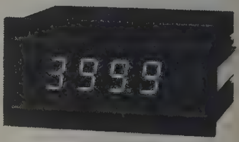
±199.9mVDC – ±199.9VDC
1-5VDC
4-20mADC
Accuracy: ±0.1% rdg ±2 digit (23°C±5°C)

±199.9uADC – ±1.999 ADC
Accuracy: ±0.2% rdg ±1 digit (23°C±5°C)
±0.3% rdg ±1 digit only for Model AM-122-25

HI
GO
LO
HI SET
1.999
PH
DZ
LO SET

AC VOLTMETERS AND AMMETERS

AP-106



FEATURES

- Average type
- Display, 3999 (3¾- digit) (Red)
- With hold
- Screw terminal

Model	Range	Frequency Range	Input Impedance	Input Protection
AP-106-11	399.9mV	40Hz ~ 10KHz	10MΩ	100V
AP-106-12	3.999V	40Hz ~ 10KHz	10MΩ	100V
AP-106-13	39.99V	40Hz ~ 4KHz	10MΩ	300V
AP-106-14	399.9V	40Hz ~ 1KHz	10MΩ	700V

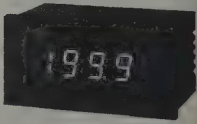
Accuracy: ±0.3% rdg. ±3 digits (23°C±5°C)

Model	Range	Frequency Range	Internal Resistance	Input Protection
AP-106-21	399.9µA	40Hz ~ 1KHz	1KΩ	10mA
AP-106-22	3.999mA	40Hz ~ 1KHz	100KΩ	50mA
AP-106-23	39.99mA	40Hz ~ 1KHz	10Ω	200mA
AP-106-24	399.9mA	40Hz ~ 1KHz	1Ω	1A

Accuracy: ±0.5% rdg. ±3 digits (23°C±5°C)

PROCESS MONITORS

AS-103



FEATURES

- Easily adjustable for offset-fullscale from the front (Span 2000 counts)
- Bright LED, 14.2mm (Red)
- Screw terminals for input and power supply
- DIN size 48(H) x 96(W)mm
- Parallel BCD output (Open collector)
- Analog output (0.1mV/digit)
- Variable conversion rate (option) 0.5sec ~ 3sec

AVAILABLE INPUTS

±199.9mV – ±199.9VDC
1-5V
4-20mA
Accuracy: ±0.1% rdg. ±2 digits (23°C±5°C)

±199.9µA– ±1.999ADC
Accuracy: ±0.2% rdg ±2 digits (23°C±5°C)

11 different ranges available

AS-203

FEATURES

- Easily adjustable for offset-fullscale from the front (Span 2000 counts)
- Bright LED, 8mm (Red)
- DIN size 24(H) x 48(W)mm
- Power supply DC5V or DC24V (Isolated)

AVAILABLE INPUTS

±199.9mv – ±199.9VDC
1-5V
4-20mA
Accuracy: ±0.1% rdg. ±2 digits (23°C±5°C)

±199.9µA – ±1.999ADC
Accuracy: ±0.2% rdg ±2 digits (23°C±5°C)
±0.3% rdg ±1 digit only for Model AS-203-25

11 different ranges available

Many Other Models Available • For More Information Contact Selco/Asahi at 800-257-3526

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Selco Products Co.
7580 Stage Road • Buena Park, CA 90621
Tel: (310) 921-0681 • (714) 521-8673 • 1-800-257-3526 • FAX 714-739-1507

"PRESENTOR" Range of Analog Meters

There are four sizes in the Sifam 'Presentor' range, designated types 19, 29, 39, and 49. The uniquely versatile design enables each size to be displayed in four different modes:

Style 'W' is for back-of-panel mounting with only the scale and pointer visible (types 19W, 29W, 39W and 49W)

Style 'WF' is also for back-of-panel mounting but with a clip-on black bezel (types 19WF, 29WF, 39WF and 49WF)

Style 'M' is for front-of-panel mounting with a snap-on mask in black (types 19M, 29M, 39M and 49M)

Style 'B' is also for front-of-panel mounting but with a snap-on bezel in black (types 19B, 29B, 39B and 49B)

Effective illumination can be provided by back-lighting through the translucent body on types 29, 39 and 49.

APPLICATION

The Presentor Range of meters is suitable for both DC and AC with self contained ranges as follows:

VDC	VAC
50μA — 2A	60μA — 100mA
50mV — 250V	1V — 250V

A NEW SMALL-SPACE MOVEMENT

The taut-band (ligament suspended) movement has a powerful all-new core-magnet incorporating advance materials chosen for high technical performance. The design insures that the calibration of the meters is unaffected when mounted on a steel (ferrous) panel.

The movement is contained within a barrel of minimal volume to reduce the amount of space required behind the panel (please see dimensional drawings).

CONSTRUCTION

The body (or base) is molded from translucent high impact polystyrene with a transparent acrylic front. Mask and bezels are in A.B.S.

SCALES

Standard dial markings are as shown on the meter photographs but special markings can be supplied to customers' requirements.

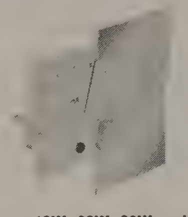
The meters can be supplied with left-hand, center or right-hand zero. Mirror dials are available on types 29, 39 and 49. The zero adjuster, normally located on the front face, can be located at the rear if required.

ACCURACY

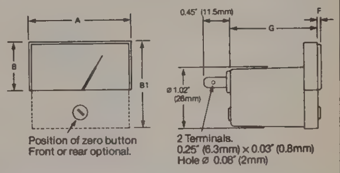
Sifam 'Presentor' meters are supplied in accordance with ANSI C39.1 and BS89: 1977, IEC51.

TYPE	DC	AC RECTIFIER
19	±2.5%	±2.5%
29	±1.5%	±2.5%
39	±1.5%	±2.5%
49	±1.5%	±1.5%

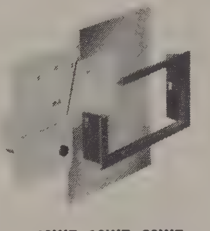
STYLE W: BACK OF PANEL


Types 19W, 29W, 39W and 49W

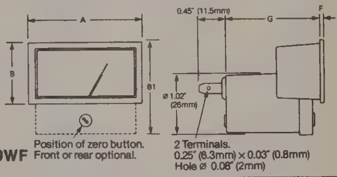
Types 19W, 29W, 39W and 49W
(Back of panel mounting)


A
B
B1
0.45" (11.5mm)
G
F
ø 1.02" (26mm)
Position of zero button
Front or rear optional.
2 Terminals.
0.25" (6.3mm) x 0.03" (0.8mm)
Hole ø 0.08" (2mm)

STYLE WF: BACK OF PANEL, WITH BEZEL


Types 19WF, 29WF, 39WF and 49WF

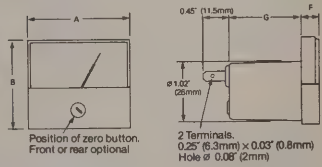
Types 19WF, 29WF, 39WF and 49WF
0.16" (4mm) Max. Panel
(Back of panel mounting with bezel)


A
B
B1
0.45" (11.5mm)
G
F
ø 1.02" (26mm)
Position of zero button.
Front or rear optional.
2 Terminals.
0.25" (6.3mm) x 0.03" (0.8mm)
Hole ø 0.08" (2mm)

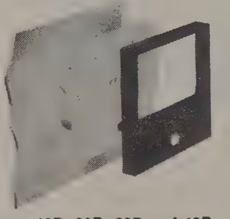
STYLE M: FRONT OF PANEL, WITH MASK

Types 19M, 29M, 39M and 49M

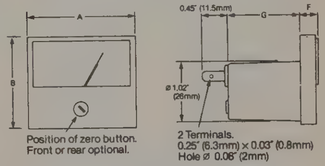
Types 19M, 29M, 39M and 49M
0.24" (6mm) Max. Panel
(Front of panel mounting with mask)


A
B
0.45" (11.5mm)
G
F
ø 1.02" (26mm)
Position of zero button.
Front or rear optional
2 Terminals.
0.25" (6.3mm) x 0.03" (0.8mm)
Hole ø 0.08" (2mm)

STYLE B: FRONT OF PANEL, WITH BEZEL


Types 19B, 29B, 39B and 49B

Types 19B, 29B, 39B and 49B
0.24" (6mm) Max. Panel
(Front of panel mounting, with bezel)


A
B
0.45" (11.5mm)
G
F
ø 1.02" (26mm)
Position of zero button.
Front or rear optional.
2 Terminals.
0.25" (6.3mm) x 0.03" (0.8mm)
Hole ø 0.08" (2mm)

NOTE: Do not solder to appliance type terminals. If required screw terminals are available.

	BACK-OF-PANEL MOUNTING				BACK-OF-PANEL MOUNTING, WITH BEZEL				FRONT-OF-PANEL MOUNTING, WITH MASK				FRONT-OF-PANEL MOUNTING, WITH BEZEL			
	19W	29W	39W	49W	19WF	29WF	39WF	49WF	19M	29M	39M	49M	19B	29B	39B	49B
WIDTH 'A'	1.73" (44)	3.00" (76)	3.70" (94)	4.88" (124)	1.93" (49)	3.26" (83)	3.97" (101)	5.15" (131)	1.73" (44)	3.00" (76)	3.70" (94)	4.88" (124)	1.81" (46)	3.13" (79.5)	3.83" (97.5)	5.03" (128)
HEIGHT 'B'	0.82" (21)	1.32" (33.5)	1.65" (42)	2.24" (57)	1.06" (27)	1.63" (41.5)	1.98" (50.5)	2.57 (66.5)	1.53" (39)	2.38" 60.5)	2.91" (74)	3.73" (95)	1.57" (40)	2.44" (62)	3.01" (76.5)	3.81" (97)
HEIGHT 'B1'	1.49" (38)	2.32" (59)	2.85" (72.5)	3.66" (93)	1.59" (40.5)	2.44" (62)	3.00" (76)	3.80" (96.5)	—	—	—	—	—	—	—	—
FRONT 'F'	0.06" (1.5)	0.08" (2)	0.08" (2)	0.08" (2)	0.06" (1.5)	0.06" (1.5)	0.06" (1.6)	0.07" (1.7)	0.29" (7.5)	0.39" (10)	0.43" (11)	0.47" (12)	0.29" (7.5)	0.39" 10)	0.43" (11)	0.47" (12)
BODY DEPTH 'G'	1.46" (37)	1.53" (39)	1.53" (39)	1.59" (40.5)	1.61" (41)	1.69" (43)	1.71" (43.5)	1.75" (44.5)	1.22" (31)	1.22" (31)	1.22" (31)	1.22" (31)	1.22" (31)	1.22" (31)	1.22" (31)	1.22" (31)
SCALE LENGTH	1.34" (34)	2.36" (60)	3.07" (78)	3.94" (100)	1.34" (34)	2.36" (60)	3.07" (78)	3.94" (100)	1.34" (34)	2.36" (60)	3.07" (78)	3.94" (100)	1.34" (34)	2.36" (60)	3.07" (78)	3.94" (100)
MAX PANEL THICKNESS	—	—	—	—	0.16" (4)	0.16" (4)	0.16" (4)	0.16" (4)	0.24" (6)	0.24" (6)	0.24" (6)	0.24" (6)	0.24" (6)	0.24" (6)	0.24" (6)	0.24" (6)

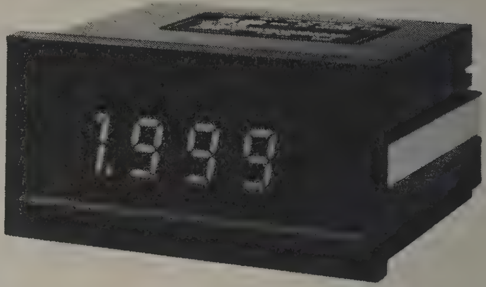
selco/ASAHI

Selco Products Co.
7580 Stage Road • Buena Park, CA 90621
Tel: (310) 921-0681 • (714) 521-8673
1-800-257-3526 • FAX 714-739-1507

Miniature Modular Meter — AW-3000/A-3000

FEATURES

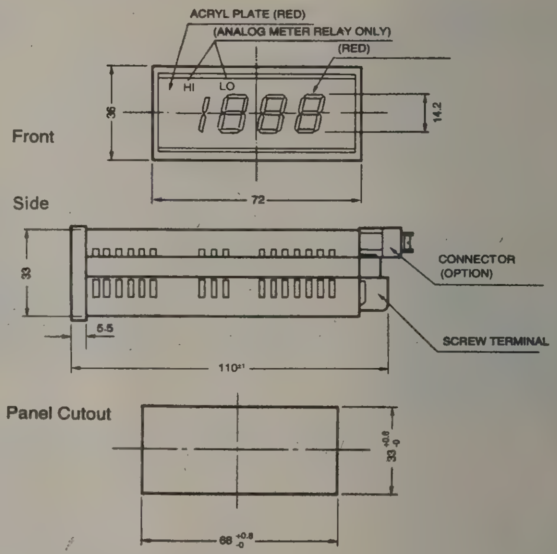
- Input Board (8 type), Output Board (4 type)
- Leading Zero Suppression
- Bright LED: 14.2 mm (Red)
- Power Supply: AC90 ~ 132V, AC180 ~ 264V
  DC9 ~ 30V (free)
- Dimensions: A-3000 36 (H) x 72 (W) x 110 (D) mm
  DIN size
  AW-3000 48 (H) x 96 (W) x 110 (D) mm
  DIN size



COMMON SPECIFICATIONS

Operating Method	Dual-Slope, Auto zero
Conversion Rate	2.5/sec or 12.5/sec (50 Hz), 15/sec (60 Hz)
Normal Mode Rejection	NMR 40 dB (50/60 Hz)
Display	LED 14.2 mm, 3-1/2 digit
Polarity	A " - " is displayed automatically
Overrange Indication	When inputs exceed the maximum display, 1999 flashes
Zero Display	Leading zero suppression
Decimal Point	Settable to any digit position by socket
Hold	COM and HOLD terminals short or 0V
Operating Temperature	0 ~ 50°C
Power Supply	AC90 ~ 132V 2VA AC180 ~ 264V DC9 ~ 30V
Dielectric Strength	For AC type; Between input and earth (E), DC±500V Between power supply terminal and input or case or COM, AC1500V/min For DC type; Between input (Lo) and power supply (0V), DC±1000V
Insulation Resistance	DC500V 100MΩ at above terminals
Dimensions	36 (H) x 72 (W) x 110 (D) mm
Weight	230g

DIMENSIONS (Also available in 1/8 DIN)



SIGNAL-INPUT

A: DC VOLTAGE (A3 □ □ □-A-□ □)
B: DC CURRENT (A3 □ □ □-B-□ □)
C: AC AVERAGE VOLTAGE (A3 □ □ □-C-□ □)
D: AC AVERAGE CURRENT (A3 □ □ □-D-□ □)
E: AC TRUE RMS VOLTAGE (A3 □ □ □-E-□ □)
F: AC TRUE RMS CURRENT (A3 □ □ □-F-□ □)
H: FREQUENCY (A3 □ □ □-H-□ □)
J, K, T: THERMOCOUPLE (A3 □ □ □-J,K,T-□ □)
M, R: RTD (PT 100Ω) (A3 □ □ □-M,R-□ □)
O: RESISTANCE (2 or 4 wires) (A3 □ □ □-O-□ □)
P: PROCESS SIGNAL (A3 □ □ □-P-□ □)
S: STRAIN GAUGE (with Peak Hold) (A3 □ □ □-S)

SIGNAL OUTPUT

1. **Hi, Lo Setpoint** A3 □ □ 1-□-□ □
2. **Parallel BCD** (Open Collector) A3 □ □ 2-□-□ □
3. **4 Analog** A3 □ □ 3-□-□ □, A3 □ □ 4-□-□ □

MODEL CODE

AW3/A3 □ □ □ - □ - □ □

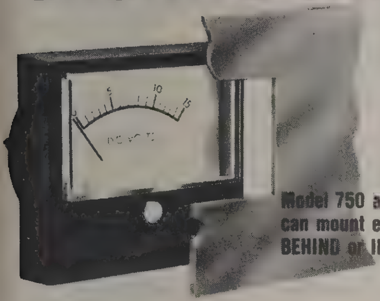
- Range Code
- Signal Inputs: A ~ S
- Output:
  - 0. None
  - 1. Dual set points
  - 2. B.C.D.
  - 3. Analog 0 ~ 10V
  - 4. Analog 1 ~ 5V, 4 ~ 20 mA
- Analog Output:
  - 0. None
  - 1.0 ~ ±2V
- Power Supply:
  - 1. AC90 ~ 132V
  - 2. AC180 ~ 264V
  - 3. DC9 ~ 30V

Shurite METERS

Rugged, Low-Cost Indicating Meters and Testers...since 1904

A PRIME TECHNOLOGY COMPANY

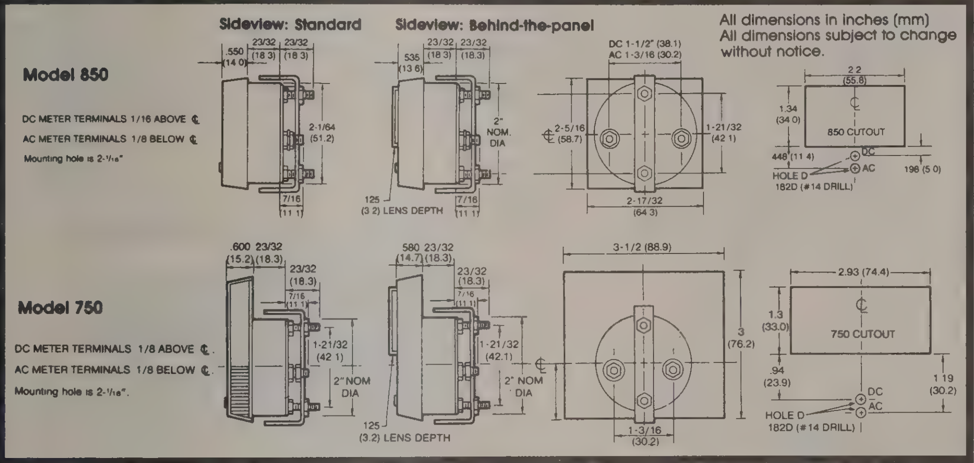
SHURITE WINDOW MOUNT PANEL METERS



Model 750 and Model 850 Meters can mount either way — BEHIND or IN FRONT of the panel!

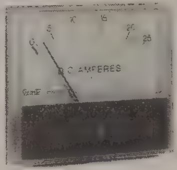
These fine meters provide the same reliable performance for which Shurite has been known since 1904... *plus* new mounting flexibility... *plus* that new "textured black" look. Both models are, of course, still available with standard case fronts. Order the "new look" meters as Model 750BP and Model 850BP.

- The redesigned case front provides mounting flexibility and smart "textured black" finish.
- Two sizes — 3½″ (Model 750BP) and 2½″ (Model 850BP).
- Available either with or without front-access zero adjuster.


Sideview: Standard
Sideview: Behind-the-panel
Model 850
DC METER TERMINALS 1/16 ABOVE ℄
AC METER TERMINALS 1/8 BELOW ℄
Mounting hole is 2-1/16"
.550 (14.0)
23/32 (18.3)
23/32 (18.3)
2-1/64 (51.2)
7/16 (11.1)
535 (13.6)
2" NOM. DIA
125 (3.2) LENS DEPTH
DC 1-1/2" (38.1)
AC 1-3/16 (30.2)
2-5/16 (58.7)
1-21/32 (42.1)
2-17/32 (64.3)
2.2 (55.8)
1.34 (34.0)
850 CUTOUT
448 (11.4)
DC
AC
196 (5.0)
HOLE D
182D (#14 DRILL)
Model 750
DC METER TERMINALS 1/8 ABOVE ℄.
AC METER TERMINALS 1/8 BELOW ℄.
Mounting hole is 2-1/16".
.600 23/32
(15.2) (18.3)
23/32 (18.3)
7/16 (11.1)
1-21/32 (42.1)
2" NOM DIA
580 23/32
(14.7) (18.3)
125 (3.2) LENS DEPTH
3-1/2 (88.9)
3 (76.2)
1-3/16 (30.2)
2.93 (74.4)
1.3 (33.0)
750 CUTOUT
.94 (23.9)
1 19 (30.2)
DC
AC
HOLE D
182D (#14 DRILL)

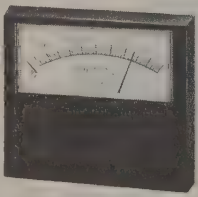
All dimensions in inches (mm)
All dimensions subject to change without notice.

Models 750 and 850 also in Standard Case



Designed with black polystyrene back and clear polystyrene front.

FREQUENCY METER SERIES 7000/8000



Ruggedly designed for lasting performance and engineered for mounting flexibility — either in-front-of-the panel or behind-the-panel

- Expanded scale, lance pointer, zero adjust.
- Off-scale zero position.
- Two convenient sizes — 3½″ and 2½.″
- High reliability at low cost.
- DIMENSIONS: Refer to engineering drawings of Model 750/850 meters immediately above. Dimensions are identical except for barrel depth which measures 1-13/16″ (46.0mm) for both Series 7000 and 8000 instead of 23/32″ (18.3mm).

This new low cost approach to frequency measurement employs solid state components ...thereby completely eliminating problems caused by waveform distortion. Line frequencies are monitored and displayed on an expanded scale analog panel meter. Complete system monitoring, of course, requires an appropriate voltmeter and ammeter as companion instruments. Both instruments can be ordered from Shurite and are available from stock.

THRU-PLUG LINE VOLTAGE TESTER

Pocket-size Model 79406-LT. Test the outlets you use in seconds. Simply push in plug, read voltage, and then plug the appliance into the Thru-Plug.

FIVE DIFFERENT SERIES OF SHURITE METERS offer choice of more than 260 standard-range, ±5% accuracy instruments — stocked by your local distributor, backed by complete factory inventories. Moving Magnet DC types or double-vane repulsion, jeweled bearings AC types.

SHURITE METERS
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CALL **203 481-5721**

TEXMATE PANEL METERS: DIN Switchboard and Process Indication

DU-Series of Dedicated-Use DIN LED Meters

199.9 psi
480.0 VAC

Features:

- 3½, 4 and 4½ digit LED displays
- Optional factory scaling on all models
- Measures AC, DC, and process signals
- Header-selectable multiple ranges
- Easy scaling to most engineering units of read-out
- Quick disconnects (N/C) or optional screw terminal input connector ($6.00)
- 110/220/240 VAC or 5-36VDC/9-24VAC powered, with internal isolation
- Red LED's standard, green and super-bright red LED's optional
- International 96x48mm DIN 43 700 metal sheathed cases
- Accuracy ±0.05% of reading + 2 digits
- Optional NEMA-4 lens cover available. Call for details.

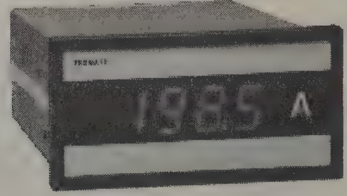
MADE IN USA

AC Line Voltages

Optimized, low cost, utility AC voltage measuring meters designed primarily to measure power line voltages • Unique input circuit allows safe phase-phase voltage measurement in 3 phase circuits • Two header selectable ranges of 199.9 and 700VAC in 3½ digit meters; one 700VAC range in 4-digit meter • Additional features include easy-to-use screw terminals, multi-turn, infinitely adjustable Span potentiometer, and provision to "Hold" the display reading indefinitely • The DU-35ACRMS is a AC true RMS voltage measuring meter with all the features mentioned above.

3½ digit	(average reading)	DU-35AC	$129
4 digit	(average reading)	DU-40AC	$169
3½ digit	(True RMS)	DU-35ACRMS	$189

AC Current Using 1A or 5A CTs



Available in either 3½ digit average reading, 3½ digit true RMS reading or 4 digit average reading, the DU-ACI series are designed for direct connection to a 1A or 5A current transformer • Built in shunt allows for direct connection without adding any other external components • Infinitely scalable from 0 to full scale with span pot to match the CT primary current • Zero offset pot is provided as standard • Please specify when ordering whether the end use will be with a 1A or 5A current transformer.

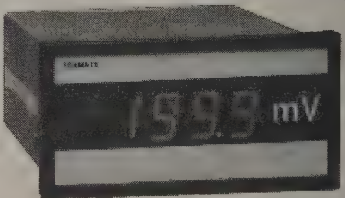
3½ digit	(average reading)	DU-35ACI	$139
4 digit	(average reading)	DU-40ACI	$179
3½ digit	(True RMS)	DU-35ACIRMS	$199

DC Voltages

Three selectable ranges of 2V/20V/200V full scale • Infinitely scalable from 0 to full scale with span pot to read in engineering units • Zero offset pot is optional on DU-35 and standard on DU-45.

3½ digit meter	DU-35	$89
4½ digit meter	DU-45	$189

DC mV for DC Current Shunt Outputs



Designed to measure low DC voltages or be directly connected to the output of all popular DC current shunts • Three header selectable ranges of 50/100/200mV full scale are available • Scalable from 0 to full scale with span pot.

3½ digit meter	DU-35MV	$109
4½ digit meter	DU-45MV	$209

4-20mA Current Loop Signals

Streamlined 4 to 20mA current loop meters specifically designed to be easily user-scaled and calibrated to almost any conceivable engineering unit, such as temperature, pressure, level or flow rates, etc. without requiring component changes • On-site scaling and recalibration is facilitated by multiturn potentiometers that provide continuous adjustment together with header programmable full scale ranges for span and zero offset • Readout to 1999 or 19999 engineering units.

3½ digit meter	DU-35CL	$105
3½ digit meter (with excitation for transmitter)	DU-35CLX	$Call
4½ digit meter	DU-45CL	$199

ALSO SEE TEXMATE IN EEM UNDER INDUSTRIAL COMPUTERS; DATA ACQUISITION; AND LABORATORY POWER SUPPLIES

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TEXMATE PANEL METERS: DU-Series Temperature and Pressure Meters

Temperature: Thermocouple Sensor Input

DU-35J (J thermocouple) and DU-35K (K thermocouple) are utility temperature meters with resolution of 1°C or 1°F • Factory calibrated for °C or °F readout • On-site user rescaling from °C to °F readout (or vice versa) by readjusting the span and zero pots • Header changeable °C/°F readout available • Other features: thermocouple break detection and indication, display test, display hold and automatic reference junction compensation • DU-35J measurement range: 0°C to 760°C/0°F to 1400°F • DU-35K measurement range: 0°C to 1260°C/0°F to 1999°F • J and K thermocouples available

3½ digit	(J thermocouple, °C or °F)	DU-35J	$169
	(J thermocouple, header selectable °C or °F)		Add $30
3½ digit	(K thermocouple, °C or °F)	DU-35K	$169
	(K thermocouple, header selectable °C or °F)		Add $30

Temperature: 3 or 4-wire RTD Sensor Input

Designed to accept 3 wire 100 platinum RTD sensors • Factory calibrated for a °C or °F readout with 0.1 or 1°resolution • On-site user rescaling from a °C to a °F readout (or vice versa) by readjusting the span and zero trimpots • Header selectable °C/°F readout and header selectable 3-wire/4-wire inputs available as option • 0.1° resolution ranges: -190.0°C to +199.9°C and -199.9°F to +199.9°F • 1° resolution ranges: -190°C to +800°C and -199°F to +1470°F • RTD 100 sensors available.

3½ digit	(3 wire, Pt100 , °C or °F)	DU-35RTD	$179
	(3 wire, Pt100 , header selectable °C or °F)		Add $30

AC Line Frequency

Designed to measure line frequency • Accepts input voltages from 80V to 700VAC • One range of 40.0 to 199.9Hz is provided • Last digit may be disabled by user • Optional factory configured 40 to 500Hz range available • Unique input circuit allows safe phase-phase measurement in 3 phase circuits.

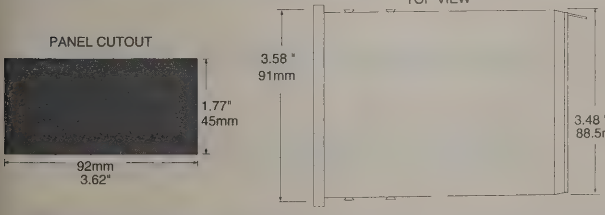
3½ digit meter	DU-35HZ	$145

Optional Power Supplies for DU-Series

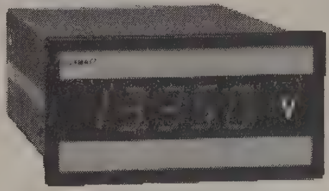
For the convenience of the end-user, Texmate provides the DU-Series with optional power supplies. You must specify when ordering the meter which power supply is required.The standard power supply is 110/220VAC.

Isolated	5-36VDC/9-24VAC	VO-DC/ISO	$49
Non-isolated	7-36VDC/12-24VAC	VO-DC/NON	$29
24VAC transformer		VO-24V	$15

DIN 96x48 Case Dimensions



Pressure Measuring Meters with Transducers



Accepts input from transducers with 2mV/V to 20mV/V outputs • Provides 5V excitation voltage to transducer • Infinitely scalable from 0 to full scale with span pot to read in engineering units • Zero offset pot is provided as standard • Readout is optional in psig, bar, kbar, kpa, feet, lbs, and tons • Header selectable two position filter is provided to smooth noisy signals.

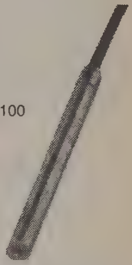
3½ digit meter (to 1999 psi)	DU-35P	$179

Pressure Transducers

MP-40A

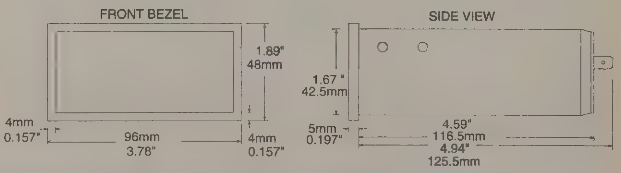
MP-50A

MP-100



Optional all-welded, titanium pressure transducers are available, flush or port mounted, with ranges from 25 to 10,000psig • Also a small diameter hi-stability (water/liquid) pressure transducer model MP-100. This transducer is made of corrosive resistant titanium in an all-welded body. The MP-100 utilizes high reliability bulk type semiconductor strain gages that are bonded directly to the inside surface of the machined diaphragm. With a diameter of only 0.375 inches, the MP-100 transducer can easily be installed in holes of 0.5 inches or greater.Optional 4-20mA output available.

Flush mount transducer	MP-40A	$165
Port mount transducer	MP-50A	$195
Liquid level transducer	MP-100	$625
High pressure transducer	SP-97	$350
Pressure transmitter (4-20mA)	SP-976	$995
1/4 NPT fitting for MP-40	MP-1/4NPT-40	$60
Gas/Pressure Transducer	SP-63	$850



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TEXMATE PANEL METERS: Modular Intelligent Digital Panel Meters

Multi-Use Meters that Utilize Plug-In Signal Conditioning Modules

(see next page)

Intelligent Microprocessor Meters

with plug-in signal conditioning modules

DI-45C

DIN 96x48 Case

TEXMATE
19870 A

See input/output modules on next page

4½ digit LED, microprocessor controlled, DPM for precision measurements of input signals • Modular, plug in signal conditioning boards (see next pg) • Peak Value • RS-232 • Digital linearization • Trend indication, auto-taring, rounding off, avging, conversion spd, set point/actual comparison, offsetting zero, variable scale factor, display brightness adjust & saving MAX/MIN values, programmable front panel keys • Pwr:110VAC 50/60Hz, or 220VAC or 18V-36VDC/24VAC • Green LEDs optional • RS-485 Serial output. • Available with single or dual 5 amp relays.

5-Digit Intelligent Digital Panel Meter

monitors, scales, records, communicates and alarms

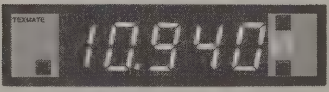
DI-50

5-digit red or green LED, microprocessor based, precision DPM with selection of inputs: AC/DC volts/current, RTD, 6 thermocouples, 4-20mA, 4/6 wire strain gage for load cells and pressure • AC or DC power • Isolated 10VDC and 24VDC excitation sources • Peak Hold • NEMA 4 front • Optional triple outputs: analog, dual 10A relays, and digital • 60 readings per second • Adaptive digital filter • Autotare • Accuracy 0.01% FS • Resolution to 99,999 • computer software supplied • Call for price and data sheet.

Microprocessor Meter in ½-Height Case

DH-45C

DIN 96x24 Case



See input modules on next page

4½ digit LED microprocessor controlled meter with front panel key programmability and input signal flexibility as DI-45C but in a half height case & without the availability of output options • Powered from 110VAC 50/60Hz, or 220VAC or 18V to 36VDC/24VAC • Green LEDs optional • DIN 96x24x112mm case.

DS-45D: 5VDC powered version, available in short depth case 96x24x56mm but only with dedicated inputs 2 to 200VDC, 4-20mA DC & 200µA to 2A DC.

0.8" LEDs

The Giant

High visibility meter with optional multiple outputs

DI-45G

DIN 144x72 Case

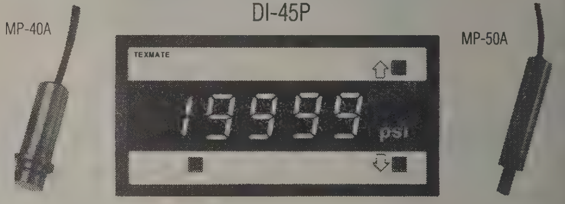
TEXMATE
10070 A
P

4½ digit 0.8" high LEDs, microprocessor controlled, DPM for precision measurements of input signals • Programmable nonlinear function display • Modular, plug in signal conditioning boards (see next pg) • Digital linearization • Multiple outputs • Relays • BCD • Serial • Analog • Trend indication, auto-taring, rounding off, averaging, conversion speed, 4 set points/actual comparison, offsetting zero, variable scale factor, display brightness adjust & saving MAX/MIN values, programmable front panel keys • Pwr:110VAC 50/60Hz, or 220VAC or 18V-36VDC/24VAC • Green LEDs optional

Superior Strain Gauge Pressure Meter

with optional pressure transducers

DI-45P



0.5% accuracy with 4½ digit (19999 counts or PSI) of resolution and transducer sensor of 20/50/100mV • DIN 96x48 case • Standard input 200mV • Red or green LEDs • Standard power 110VAC, 50/60Hz • Chart recorder output 0-1 or 0-2VDC • Optional printer/computer interface BCD or RS-232C • Digital linearization • Auto-tare.

PRESSURE TRANSDUCERS TO SUIT DI-45P

See previous page for pressure transducer information.

AC Powered Modular Meter in ½-Height Case

DL-35B

3½ digit LED modular panel meter in half height case • Accepts most plug-in input signal conditioning modules • Power 110 or 220VAC 50/60Hz or 18V-36VDC/24VAC • DIN 96x24x112 mm case

ALSO SEE TEXMATE IN EEM UNDER INDUSTRIAL COMPUTERS; DATA ACQUISITION; AND LABORATORY POWER SUPPLIES

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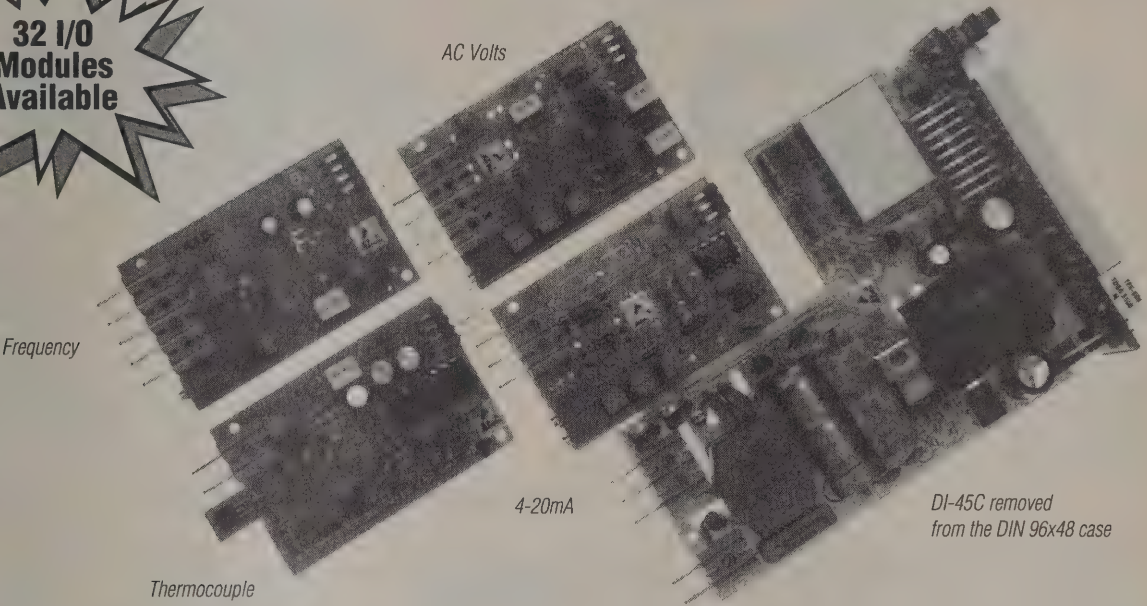
TEXMATE PANEL METERS: Modules for Process, Temperature, Pressure, etc.

Plug-In Signal Conditioning Modules

Plug-in signal conditioning modules to suit almost any input signal, control, or data output, can be easily inserted through the rear of the meter without disassembly of the case or removal from the panel. These modules are exclusively designed for **DI-45C, DI-45G, DH-45C, DL-35B, and AM-100D.**

32 I/O Modules Available



DI-45C removed from the DIN 96x48 case

Input Modules

MI-ACARMS-1	AC - AMPS True RMS 1A	$155
MI-ACARMS-5	AC- AMPS True RMS 5A	155
MI-ACMARMS	AC - mA RMS Universal Divider 2mA - 500mA AC	155
MI-ACVOLT	AC - Volts Average Measuring, calibrated to read RMS	60
MI-ACVRMS-H	AC - Volts True RMS high 200/700 VAC	155
MI-ACVRMS-L	AC - Volts True RMS low 200mV/2V/20V	155
MI-CL/4-20MA	Zero offset, 4-20mA, Scaleable ± fs in engineering units	45
MI-DCMVOLT	DC - Millivolts Universal Divider 0 to 200mV	55
MI-DCVOLT	DC - Volts Universal 2/20/200/600 VDC	50
MI-DCV/OFFST	DC - Volts Universal,2/20/200/600VDC, with ±20% offset	60
MI-FREQ1	Frequency/RPM - 20VAC 20Hz/200Hz/2K/20K/200KHz	70
MI-FREQ2-H	AC Line Frequency - 80/500 VAC High 50Hz to 500Hz	70
MI-FREQ2-L	AC Line Frequency - 80/500 VAC Low 10.0Hz to 199.9Hz	70
MI-PEAKVALUE	Peak Value Hold (0-20VDC)	70
MI-PRESSURE	mV input & excitation output. Use with press. transducers.	70
MI-PROTO	Prototype bare board for customer design and build	15
MI-RESIS	Resistance (2-3-4 wire) 200 /2K /20K /200K	70
***MI-RTD/OHM**	Pt.100 (2-3-4 wire)0 to 200.0C (32 to 392F) -200 to 800C	70
MI-RTD-FC	Pt. 100 - Analog linearization	70
***MI-THERM**	Thermocouple-Universal/JKRS, 30pt. μ-processor linearization	70
MI-THERM-JC	Thermocouple-J, Analog 4 pt linearization (0 to 760°C)	70

* MI-RTD/OHM and MI-THERM are not available for the DL-35B meters.

Output Modules

NOT AVAILABLE FOR DH-45C & DL-35B

MO-ANALOG-C	Current Output (4-20mA)	$140
MO-ANALOG-V	Voltage Output (0-5 VDC)	140
MO-BCD	Parallel BCD Output	140
MO-RELAY	Single 5A Relay	80
MO-RELAY-D	Dual 5A Relay	95
***MO-RS232C**	RS232C Serial Output w/opto coupler. See connector and cable below. Requires software	140
***MO-RS485**	RS485 Serial Output w/opto coupler. See connector and cable below. Requires software.	140
MO-CABLE232	For RS-232: DB-9 male/DB-25 female connectors with 6 ft. cable	40
MO-CABLE485	For RS-485: DB-9 male/DB-25 female connectors with 6 ft. cable	40
MO-CABLEBCD	For BCD: prewired 6 ft. ribbon cable with two 96-pin connectors	40

The personality output modules come standard with spade lug connectors and insulated quick disconnects.

*NOTE: Requires software for computer interface. Call Texmate for further information.

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TEXMATE PANEL METERS: Data Outputs, Set Points, Slave Displays, Power Supplies

MADE IN USA

Professional Series

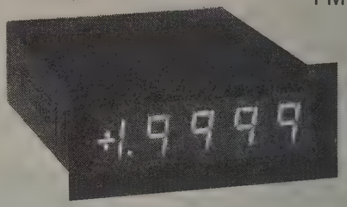
4½ Digit LCD & LED Differential Meters

Versatile design for a wide variety of applications including multiplexed/parallel BCD output

PM-45X $125 PM-45XU $105

4½ digit 0.48" LCD DPM • Super-stable temp-compensated ref • Accuracy 0.01% rdg + 1 digit (PM-45XU accuracy ±0.015% rdg + 2 digits) • True differential & single-ended inputs • Rgs: 200mV, 2V, 20V,200V, and 1200V • Programmable decimals • Scaling in engineering units w/ offset capability • Over-range/under-range output • Busy output • Clock output • Run/Hold • Ultra-low power requirements 3-5mA at +4.5V to +5.5VDC (25mW) • Parallel BCD output **PM-45XBCD or PM-45XUBCD** compatible w/ CP-45 • MUX BCD output **PM-45XMUXBCD or PM-45XUMUXBCD** compatible w/ RD-Series • Stackable Slim Bezel case. See dimensions on next page.

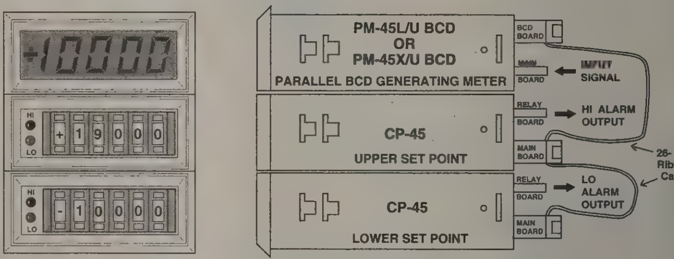
PM-45L $110 PM-45LU $90



High accuracy LED meter, 10μV resolution • Accuracy 0.01% rdg + 1 digit (PM-45LU accuracy ±0.015% rdg + 2 digits) • True differential & single-ended inputs • Rgs: 200mV, 2V, 20V,200V, and 1200V • Programmable decimals • Scaling in engineering units w/ offset capability • Over-range/under-range output • Busy output • Clock output • Run/Hold • Ultra-low pwr requirements 225mA at +4.5V to +5.5VDC • 0.4" LED's • Parallel BCD output **PM-45LBCD or PM-45LUBCD** compatible w/ CP-45 • MUX BCD output **PM-45LMUXBCD or PM-45LUMUXBCD** compatible w/ RD-Series • Stackable Slim Bezel case. See dimensions on next page.

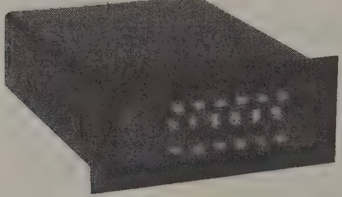
Professional Series System Design and Application Notes

Up to five CP-45 meters may be connected in parallel to a single PM-45LBCD, PM-45LUBCD, PM-45XBCD, or PM-45XUBCD meter, creating a multiple set point controller which can be easily configured. Interface boards are also available to interconnect the CP-45 to the Texmate meters RP-4500BCD and the RP-4500DBCD. The point at which each CP-45 relay is activated is user programmable with the internal mode select switch. The changeover contacts of the CP-45 relay can be configured for fail safe operation. For noisy signals, a relay activation delay may be introduced.



BCD Comparator Controller

CP-45 $95



Single set point, 4½ digit BCD comparator controller • Up to 4 units may be connected to parallel BCD outputs of PM-45XBCD/XUBCD & PM-45LBCD/LUBCD meters to create any control configuration • Relay w/ 1 form C changeover contacts has 5 selectable modes to activate when signal is: greater than, equal to, less than, greater than or equal to, less than or equal to, the set point • Adjustable activation delay to prevent relay chatter for noisy input signals • Relay also operated in latched mode w/ manual Reset • Stackable Slim Bezel case for multiple set points • 5V DC power

Remote Slave Displays

RD-45MUX4I $45 RD-45XMUX4I $54

RD-45MUX4I: 4½ digit, 0.4" high LED remote slave display • 5VDC powered at 200mA • RD-45XMUX4I: 4½ digit, 0.48" high LCD remote slave display • 5V DC powered at 3mA • Both meters directly connect to the PM-45LMUXBCD, PM-45LUMUXBCD, PM-45XMUXBCD, PM-45XUMUXBCD meters • Available in stackable Slim Bezel case.

100-125/208-250VAC to 5VDC Power Supplies

PS-505 $22 PS-510 $25

The PS-505 with a 500mA output and the PS-510 with a 1 amp output are general purpose low ripple regulated power supplies suited for +5VDC powered DPM's • Both units provide user selectability for 100 - 125 VAC or 208 - 250 VAC operation. Texmate also has many other power supplies some of which are UL/CSA/VDE approved.

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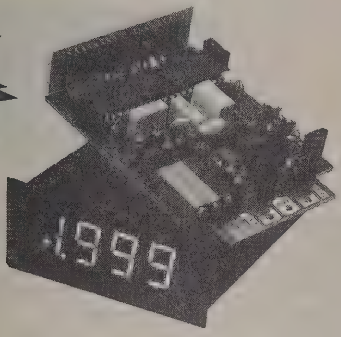
TEXMATE PANEL METERS: Easy-to-Scale, Single Ended, 5VDC Powered DPM's

MADE IN USA

3½ Digit LCD and LED Meters with Screw Terminals

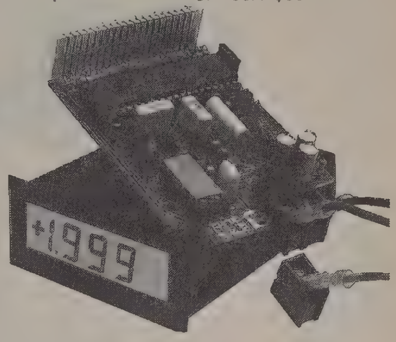
LED	LCD
SM-35MV $69	SM-35XMV $79

20mV to 2V Full Scale



LED	LCD
SM-35 $49	SM-35X $59

2V to 200V Full Scale



Millivolt Input Models Feature

Constant current 5V power input circuit to eliminate ground loop noise often encountered with low voltage signals

20mV, 200mV, 2V header-selectable ranges • Fine and coarse scaling adjustment to 100% of FS range • Bipolar zero reading offsetability • Suitable for most DC current shunt applications • Auto-polarity with header-selectable polarity disable & reversal • Programmable decimals • Reading Hold • Programmable decimals • Non-active trailing zero on LCD version

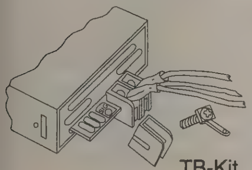
Volt Input Models Feature

Low cost • Ease of Use • High ESD Immunity

2V, 20V, 200V header-selectable ranges • Fine and coarse scaling adjust controls • Offset option available for most 4-20mA or 1-5V scalings • Auto-zero • Auto-polarity with header-selectable polarity disable & reversal • Programmable decimals • Reading Hold • Non-active trailing zero header-selectable on LCD version

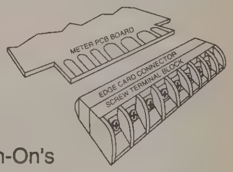
---

NEW! Push-On's™ Texmate's Exclusive Connector Design



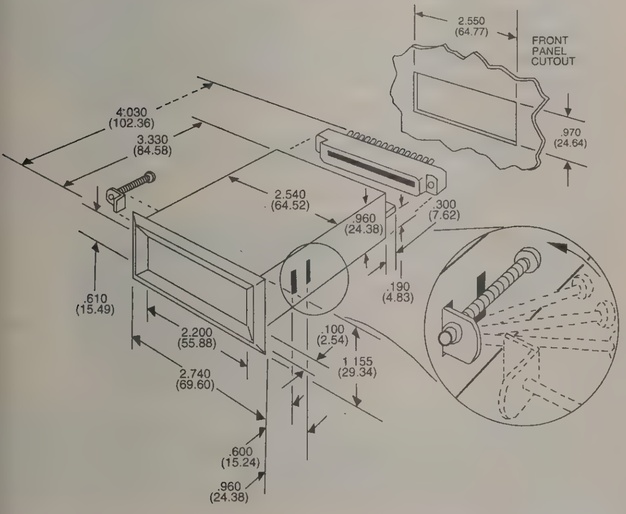
TB-Kit

TB-Kits consists of individual screw terminal blocks and come free with SM-Meters. As an option, Texmate offers Push-On's — our exclusive design of screw terminal blocks and push-on edge connectors that provide a convenient alternative for many applications, allowing complete installation, configuration and calibration without the need for soldering.


METER PCB BOARD
EDGE CARD CONNECTOR
SCREW TERMINAL BLOCK

Push-On's

Slim Bezel Case Dimensions

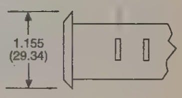

2.550 (64.77)
FRONT PANEL CUTOUT
4.030 (102.36)
3.330 (84.58)
.970 (24.64)
2.540 (64.52)
.960 (24.38)
.300 (7.62)
.190 (4.83)
.610 (15.49)
2.200 (55.88)
.100 (2.54)
1.155 (29.34)
2.740 (69.60)
.600 (15.24)
.960 (24.38)

Optional Slim Bezel Cases

Standard Slim Bezel Low Profile Case

SLIM BEZEL CASE

Standard black ABS case with matte finish bezel for single unit mounting.
Part No.
SL-CASERED for LED's
SL-CASECLR for LCD's

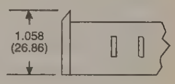


Optional Twin Mounting or Multiple Array Cases

+1.9990
+1.9990

END MOUNT CASE

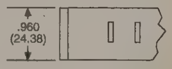
Same styling as Slim Bezel case but with bottom edge of bezel removed. Two End Mount cases can be twin mounted in a single cutout.
Part No.
EM-CASERED for LED's
EM-CASECLR for LCD's



+1.9990
+1.9990
+1.9990

CENTER MOUNT CASE

Any number of Center Mount cases may be fitted between two End Mount cases for multiple arrays.
Part No.
CM-CASERED for LED's
CM-CASECLR for LCD's



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TEXMATE PANEL METERS: Classic General Purpose Meters and BCD Printer

5V DC Powered Digital Panel Meters

See Slim Bezel Case dimensions on previous page

PM-35U $39

Low cost, quality 3½ digit DPM • Bright 0.3" LED's • Differential inputs • Bipolar • Auto-zero • Ratiometric • Ohms • Current • Programmable decimals • 200mV, 2V, 20V, 200V, & 1200V ranges • TC 100 ppm typical 200 max. • +5VDC power • Available in stackable Slim Bezel case.

PM-35A $65

3½ digits, 0.56" high LED's • Differential inputs • Programmable current & ohmmeter capability • Ratiometric • 200mV, 2V, 20V, 200V & 1200V ranges • Scaling in engineering units • Display test • Low TC 50 ppm typical • Auto-zero • Bipolar • Programmable decimals • +5VDC power at 200mA • Stackable Slim Bezel case.

PM-35AR $92

Autoranging DPM • Features of PM-35A except without ratiometric & ohms measurement • Autoranges between any two adjacent ranges from 200mV-2V, 2V-20V, 20V-200V, or 200V-1200V • 1000M input impedance on 200mV-2V range, 10M on others • +5VDC power • Stackable Slim Bezel case

PM-35X $79

÷1,999
KΩ
mA
mV
ACDC

3½ digit low power LCD meter • Can be configured to a particular voltage in range of 3.5V-40VDC w/ external resistors • Differential inputs • Programmable current & ohmmeter capablility • Ratiometric • 200mV, 2V, 20V, 200V & 1200V ranges • Scaling in engineering units with offset • Stackable Slim Bezel case

PM-35XAC $94

115/230VAC line operated DPM, fully isolated with internal transformer • PM-35XAC has all the features of the PM-35X but with AC power

PM-45 $85

4½ digit DPM • Single ended input • 0.3" LEDs • 200mV, 2V, 20V, 200V, 1200V ranges • Max. res. 10μV over ±19999 counts

MADE IN USA

Replacer Series 115/230VAC Powered DPM's

See Replacer Series Case dimensions with UM-Meters

RP-35A $79

3½ digit 115/230V AC line powered DPM • Single ended & differential inputs • Configurable current & ohmmeter capability • 4-20mA • Scaling in engineering units with offset • DC outputs • Display test • 200mV full scale to 1200V ranges • Precision meter, stable readings • 10 sec warm up • Accuracy ±0.05% of reading +1 digit • Replacer Series case

RP-35U $69

115/230VAC line powered DPM • 3½ digits • True differential inputs • 200mV-1200V full scale • Accuracy ±0.05% of reading +1 digit • 2 min warm up • TC 100 ppm typical • Replacer-Series case

RP-35AR $110

2-decade autoranging AC powered • Same as RP-35A except ratiometric ohms measurement • Auto-ranges any 2 adjacent rgs from 200mV-2V to 200V-1200V • Replacer-Series case

RP-3500 $105 RP-4500 $125

RP-3500 3½ digit & RP-4500 4½ digit are 115/230V AC line powered • Single-ended inputs • On board MUX BCD • Remote control sample/hold • Display blanking • Leading zero blanking • Autorange outputs • Display test • Auto-zero • Bipolar • 200mV to 1200V • 0.56" LED's • Replacer-Series case • Tri-state parallel BCD output available in RP-3500BCD & RP-4500BCD.

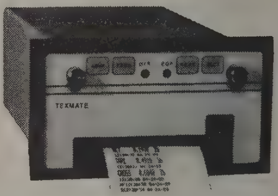
RP-3500D $135 RP-4500D $165

RP-3500D 3½ digit & RP-4500D 4½ digit 115/230AC powered • Hi normal mode noise rejection at 50/60 Hz of120dB w/ internal 200kHz quartz clock • Single ended & differential inputs • On board MUX BCD • 200mV to 1200V range • 0.56" extra bright LED's • Replacer-Series case • Tri-state parallel BCD output RP-3500DBCD & RP-4500DBCD.

BCD Panel Mounted Impact Printer

NEW!

PR-MMXX60



16 parallel BCD addressable columns • 8-bit interface • Texmate compatible BCD output meters:RP-3500 and 4500 Series, PM-45LBCD, PM-45LUBCD, PM-45XBCD, PM-45XUBCD, & DI-45CBCD

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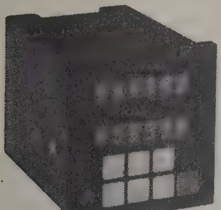
TEXMATE PANEL METERS: Counters, Totalizers, Tachometers, Message Center

High Quality, Low Cost Counters, Totalizers, and Tachometers

Preset Counters/Totalizers



4-Digit, 1 Preset Counter	PC-40/1	$179.00
6-Digit, 1 Preset Counter	PC-60/1	189.00
4-Digit, 2 Preset Counter	PC-40/2	219.00
6-Digit, 2 Preset Counter	PC-60/2	249.00
4-Digit, 1 Preset Counter/Totalizer	PC-40/T1+1	199.00
6-Digit, 1 Preset Counter/Totalizer	PC-60/T1+1	249.00

Count Input: CP1 count up, CP2 count down, or CP1 count, CP2 Hi/up, Lo/down • Trigger Level: TTL= Hi 3.5V, Lo 1V; CMOS= Hi 7.5V Lo 4V for NPN/PNP sensor • Operation Modes: 16 modes of operation for single preset • Output: Relay form C contacts rated 3A/220V, solid state current sinking NPN open collector transistor • Totalizer: Totality or Batch can be selected • 110V/220V (±10%) 50/60Hz or AC/DC 24V • DIN 72x72mm case. For dimensions see chart in next column • • 12VDC at 30mA provided for sensor excitation. Call factory for information.

Total Counters

TAT-400 Series

Single display counters also available. Call factory for more information.

Event Counters/Totalizers

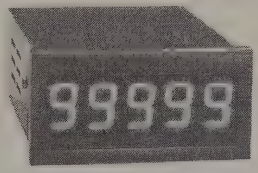
PC-45 $49

A versatile event counter/totalizer featuring 19999 counts with over-range indication or 9999 counts with cascade output • Contact closure, AC or logic signal inputs • High brightness 0.4" LED display • +5VDC power • Outputs for user supplied Ni-Cad battery back-up • Internal debouncing circuit • Available in stackable Slim Bezel case.

PC-45X $59: High contrast 0.48" LCD version of PC-45 described above.

PC-45XAC $65: 110VAC powered version of PC-45X described above.

Tachometers and Linespeed Meters



3-Digit Tachometer	LT-30	$139.00
4-Digit Tachometer	LT-40	144.00
5-Digit Tachometer	LT-50	149.00
3-Digit Linespeed/Tachometer	LT-T30	154.00
4-Digit Linespeed/Tachometer	LT-T40	159.00
5-Digit Linespeed/Tachometer	LT-T50	164.00

Display: 0.56" (14mm) or 0.8" (20mm) height red LEDs depending on number of digits • Input Level: TTL= Hi 3.5V, Lo 1V; CMOS= Hi 7.5V Lo 4V for NPN/PNP sensor • Scale Factor: 0.01 to 99999rpm decimal point auto-change • Detection: 1, 10, 60, 120 pulses per rotation select by DIP switch • 110V/220V (±10%) 50/60Hz or AC/DC 24V • DIN 72x36mm • 12VDC at 30mA provided for sensor excitation. Call factory for information.

Case Dimensions of above meters

Case	Width	Height
DIN 72 x 36	2.66" (67.57mm)	1.27" (32.29mm)
DIN 72 x 72	2.56" (65.30mm)	2.65" (67.20mm)
Max Depth	**Panel Cutout Size**	**Bezel**
4.41" (112mm)	2.68 x 1.30" (68 x 33mm)	2.83 x 1.42" (72 x 36mm)
3.70" (94mm)	2.64 x 2.68" (67 x 68mm)	2.83 x 2.83" (72 x 72mm)

Large Numerical Linespeed/Tachometer

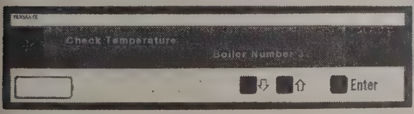
LD-Series Call for pricing

4" High LED's

3 to 8-digit, 4" high red LED large numerical linespeed tachometer • Measures linespeed/RPM • 12 to 24V AC/DC power • Provides 12VDC at 20mA to power proximity sensors • DIP switches set number of pulses/rotation, TTL or CMOS inputs, NPN/PNP type proximity sensor, high/low frequency for contact sensors • Switches set up diameter of roller for linespeed measurements • Case dimensions: 24" Wx5.75"Hx2"D • Wt: 2.8 lbs. Optional inputs available.

Intelligent Message Center/Annunciator

AN-01 Call for pricing



Alpha-numeric displays (2 lines) 40 characters each • RS-232C interface (also parallel) • Stores multiple messages (up to 255) • Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19.2k • Power: 115VAC or 230VAC or 18-36VAC • Dimensions 288mmW x 72mmH x 123.5mmD • 31 units on same bus (RS-485) • Each character 5mm high • User selectable messages, microprocessor based • Optional printer output - RS-232C • Optional relays (2) for • Software included • Different languages available.

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TEXMATE PANEL METERS: Temperature Meters, Loop Indicators, and Calibrators

4-20mA Loop Powered Process LCD Meters

CM-35XT $86

Normally shipped in standard Slim Bezel Cases but may be ordered in any combination of End Mount and Center Mount cases as pictured.

+19990
+150.9°C
-18.42F

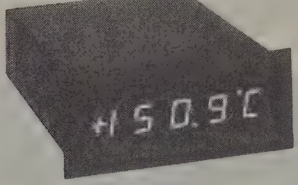
Powered by 4 to 20mA signal loop power •3½ digit LCD meter • 0.48" LCD display • No additional power supply required • 4 to 20mA input user-scaleable to read engineering units directly • Auto-polarity with header selectable polarity disable & reversal •Programmable decimals• Header-programmable for non-active trailing '0' digit or 'F' and 'C' descriptors • Reading/Hold • Edge connector or screw terminal connections • TC 100 ppm typical • Available in stackable cases as shown • Insertion drop 6.5V.

CM-35XTL $110

Low insertion drop (2.5V) version of CM-35XT above. All other specs the same.

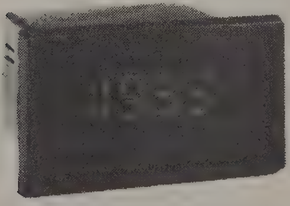
Semiconductor Transducer and RTD Input Temperature Meters

TM-150 Series from $55



LED and LCD 3½ digit temperature measuring meters for use with LM-135 or AD590 semiconductor transducer inputs or with 100 RTD platinum input. Factory calibration available • °C or °F • 110V and 220V powered • Call for specific model numbers and pricing

Field Scaleable Weatherproof Ruggedized Process Indicator

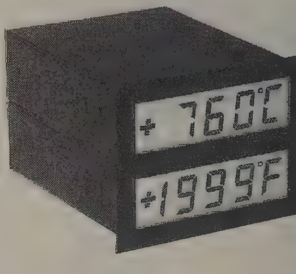


Call Texmate
for more
information

'J' or 'K' T/C Temperature Measuring Meters

in stackable Slim Bezel Case

TM-35X *LCD version* $104 TM-35 *LED version* $94

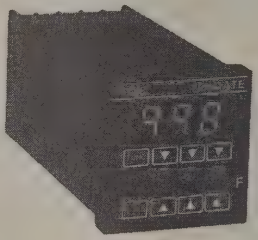


Low cost LCD (TM-35X) or LED (TM-35) meter for 'J' or 'K' thermocouples • +5VDC powered • User-selectable °C/°F descriptor • Thermocouple break detection and indication • Display Hold • Display Test • Auto-Polarity indication • Edge connector or screw terminal connections • Differential Input which facilitates operation with both grounded and ungrounded probes • Available in Slim Bezel stackable cases as shown.

Mini-Controller™

for Temperature Control

TC-48 $199



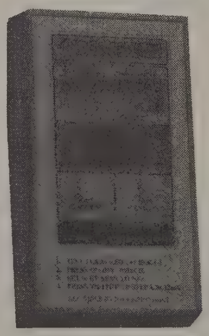
Mini-controller™ 48x48mm case • PID auto-tune temperature controller • Accuracy ±0.5% of full scale • Multiple user selected ranges from 0-999°C/°F • Sensors RTD, thermocouples J or K • PV and SP are displayed simultaneously • Alarm • Output options 3 amp relay or SSR driver • On/Off control for heating or cooling • Power 100-240VAC, 50/60Hz • Dual 3-digit displays.

For additional controller information, consult factory.

NEW!

4-20mA Calibrator

PLC-420 $395



The PLC-420 is a 4-20mA current loop Calibrator/Indicator • Reads and simulates milliamp signals • Internal DC power supply for loop-power operation • Reads in mA • Easy to use pushbutton electronic switching • Push wheel digit switch for percent mid-point (10% to 90%) • Input range 0 to 25mA • Output range 0 to 25mA • 9VDC battery operated • Rugged Lexan case with moisture and dust tight keypad • High accuracy • The PLC-240 will control loops that are externally powered up to 60VDC.

ALSO SEE TEXMATE IN EEM UNDER INDUSTRIAL COMPUTERS; DATA ACQUISITION; AND LABORATORY POWER SUPPLIES

TEXMATE

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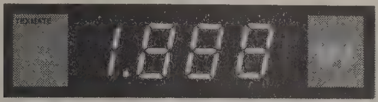
TEXMATE PANEL METERS: Short Depth, Signal Powered, and Mini-meters™

Exciting New Products to Fit In Small Spaces

Pin for Pin Functional Replacement for Newport 215 plus more features!

BN-35	DC Voltage Measuring, Non-Isolated	$99
BN-35I	DC Voltage Measuring, Isolated 24V	$129
BN-35CL	4-20mA Current Loop	$139



Short Depth DIN 96x24 Case

BN-35
- Functional replacement for Newport 215
- International standard DIN 96x24mm case
- Short Depth Case 2.83" (72mm) behind panel
- Red, green, or extra bright red LEDs available
- 3 ½ digit, true differential input
- Display Hold and Test
- 3-wire ratio reference
- Auto zero and polarity
- Accuracy ±0.05% of reading + 1 digit

BN-35I
- BN-35 with 24VDC isolated power supply
- Isolated supply gets rid of ground loop noise
- Optional 5V, 9V, 12V, or 15V isolated power supplies
- International standard DIN 96x24mm case
- Other features same as BN-35 above

BN-35CL
- 4-20mA process loop receiver
- 24VDC isolated power supply
- Optional 5V, 9V, 12V, or 15V isolated power supplies
- Easy scaling for readout in engineering units
- Other features same as BN-35 above

LCD Signal Powered Voltage Meters

SP-35X $89 and SP-35XRMS $105

The SP-35X & SP-35XRMS are two-wire signal powered meters • SP-35XRMS measures RMS volts in two ranges of 15.0V-199.9V & 15V-250V AC/DC • SP-35X measures DC volts 3.5VDC-199.9VDC • 0.48" hi-contrast LCD display • Screw terminal or PCB edge connector termination • Stackable Slim Bezel case • Requires no power supply other than signal input

LED Digital Mini-Meter™

World's First LED Current Loop Powered Meter!

4-20mA, 2V and 200mV models

DVM-5	Volts	$79
DVM-5/MV	Millivolts	$79
DVM-5/4-20	4-20mA Input	$99
DVM-5/CL	Current Loop Powered	$99

5VDC Powered or Current Loop Powered

One of the world's smallest voltmeters/loop powered LED digital panel meters • Three ranges: 200mV, 2V, and 4 to 20mA full scale • Designed for OEM's in medical & scientific instrument field where small size and exceptional performance are important • 5VDC/70mA power over range of -30 to +85°C or from loop power. No separate power supply required • Factory installed special scaling option • Standard scale is 0 to 1000 full scale • Adjustable brightness as an option • Spring loaded panel mounting • All surface mount technology • Dimensions: 1.378"W x 0.5"H x 1.77" (D) • The front bezel is 37 x 15mm (0.6"H) • 3½ digit, 7mm (0.29") high LED display • Unit weights 0.64 oz.• Meter is supplied with matching 9-pin make connector • Loop drop on DVM-5CL is approximately 8V • Red or green LED's.

Snap-In Flush Mounting DPMs 3½ or 4½ digits

This series of LED and LCD panel meters are designed to mount nearly flush with the panel and be installed with an easy snap fit into the international standard 60x36mm panel cutout.

SI-35 *LED version* or SI-35X *LCD version*

Call for pricing

3½ digit LED or LCD Standard/Backlit Snap-In meter • Bezel 62x38 mm • Depth 26.5mm • 5VDC power • Optional 115VAC power supply doubles the depth to approx. 2" • Current consumption < 3 watts on LCD version • Operating temp. 32° to 122°F • Isolated to 500 V • Connectors: 14-pin rear connector or screw terminals • Zero Offset and full scale adjustment • Available in 4½ digit versions, the SI-45 (LED) and the SI-45X (LCD)

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TEXMATE PANEL METERS: UM-Series Switchboard and Process Utility Meters

MADE IN USA

High Quality, Low Cost AC/DC Powered Meters for Switchboard & Process Indication

MADE IN USA

The UM-Series of Utility Meters Deliver the Best Value for the Money in Digital Panel Instruments

Features:

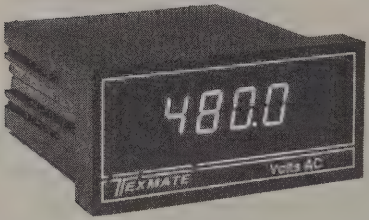
AC Voltage, 4 digit	**UM-40AC**: 700VAC full scale, 0.1V resolution
AC Voltage, 3½ digit	**UM-35AC**: 700VAC and 199.9VAC full scale
AC Current from CT's	**UM-35ACI**: Specify for 1 amp or 5 amp current transformers
AC Power Line Frequency	**UM-35HZ**: 40Hz to 199.9Hz or 40Hz to 500Hz
DC Voltage	**UM-35**: ±2VDC and ±20VDC or optionally ±2VDC and ±200VDC
DC Current	**UM-35MV:** ±50mV and ±100mV FS to suit standard DC current shunts
4-20mA Current Loop	**UM-35CL:** 1.4V loop drop, scaleable in engineering units from -1999 to +1999
Pressure Measuring	**UM-35P:** Accepts input from transducers with 10mV or 20mV per volt output
Thermocouple Compatible	**UM-35J and UM-35K:** Designed for J or K thermocouple input
RTD (100)	**UM-35RTD:** Accepts inputs from 3-wire, 100 Pt. RTD's

General Specifications For All UM-Series Meters:

Display	3½ digits and 4 digits, 14.2mm (0.56") red, green, or super-bright red LED's. Optional 0.8" large LEDs
Accuracy	±(0.05% of reading + 2 digits), 100ppm/°C temperature coefficient
Power Requirements	110/220 and 220/240VAC, 50/60Hz approx. 4.5 watts. See power options on next page.
Operating Temperature	Range -10°C to +50°C
Warm Up Time	One minute to specified accuracy
Case Type	Replacer series case. For dimensions see next page.
Pin-Out	All UM-Series meter are pin-out compatible.
Connector	Edge connector or screw terminals. Optional Push-On connector. See next page.

AC Voltage, 4-Digit

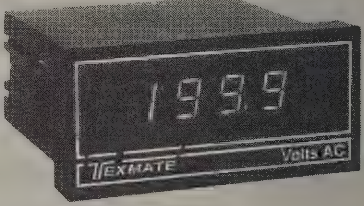
UM-40AC $109



Measures power line voltages up to 700.0VAC with 0.1V resolution • 4 digits, 0.56" high efficiency LED's • Infinitely adjustable span potentiometer • Display Hold • Unique input circuit allows safe phase to phase measurement in 3-phase circuits.

AC Voltage, 3 ½ Digit

UM-35AC $79



AC power line voltage measuring meter • Two header selectable ranges of 199.9VAC and 700V AC full scale • Max. resolution 100mVAC over 1999 counts • Unique input circuit allows safe phase to phase measurement in 3-phase circuits.

AC Current Using 1 Amp or 5 Amp CT's

UM-35ACI $85

AC current measuring meter • Designed to be used with 1 Amp or 5 Amp Current transformers

Frequency 40 to 199.9Hz

UM-35HZ $89

Power line frequency measuring meter • Designed for input voltages from 80V AC to 700V AC • Unique input circuit allows safe phase to phase measurement in 3-phase circuits • 40 Hz to 199.9Hz or 40Hz to 500Hz.

ALSO SEE TEXMATE IN EEM UNDER INDUSTRIAL COMPUTERS; DATA ACQUISITION; AND LABORATORY POWER SUPPLIES

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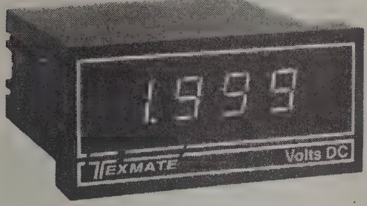
TEXMATE PANEL METERS: UM-Series Switchboard and Process Utility Meters

2V/20V or 2V/200V DC Input

UM-35 from $64

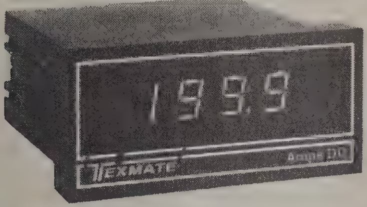
4-digit model available



DC voltage measuring meter • Two header selectable ranges of 2/20V and 2/200V full scale • Scalable from 0 to full scale for a 2V or 20V input or optionally 2V and 200V • See general specifications on previous page • 4-digit series available

DC Current from 50mV, 100mV Shunts

UM-35MV $75



DC low voltage measuring meter • Two header selectable ranges of 50mV and 100mV full scale • Scalable from 0 to full scale for a 50/100mV input, for direct connection to popular current shunts • Max. resolution 100µV over ±1999 counts • With shunts read out to 1999 DC Amps • See general specifications on previous page.

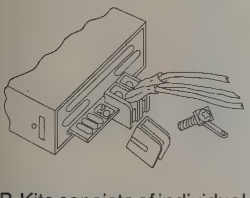
4-20mA Current Loop

UM-35CL $72

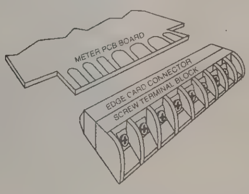
4 to 20 mA current loop meter • 4 to 20mA input is easily user-scalable to read engineering units directly without component changes • Zero and Span adjust potentiometers • Read out to ±1999 engineering units • 1.4V loop drop • See general specifications on previous page.

NEW! Push-On's™
Texmate's Exclusive Connector Design

TB-Kit



Push-On's

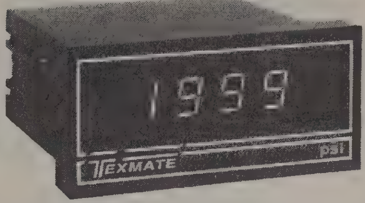


TB-Kits consists of individual screw terminal blocks and come free with UM-Meters. As an option, Texmate offers Push-On's — our exclusive design of screw terminal blocks and push-on edge connectors that provide a convenient alternative for many applications, allowing complete installation, configuration and calibration without the need for soldering.

MADE IN USA

Pressure Transducer Compatible

UM-35P $174



Pressure measuring meter • Provides transducer excitation voltage • Accepts inputs from transducers with 10mV or 20mV per volt output • Scalable to display most engineering units • Available with optional all welded, titanium pressure transducers. See page 3 for transducer information • See general specifications on previous page.

RTD 100 Meters

UM-35RTD $154

Designed to accept 3-wire 100 RTD sensors • Available in two factory calibrated ranges of ±199.9 °C or±199.9 °F and -190° to 800°C or-199° to +1470°F • Provides excitation to sensors • See general specifications on previous page.

Thermocouple Meters

UM-35J and UM-35K $144

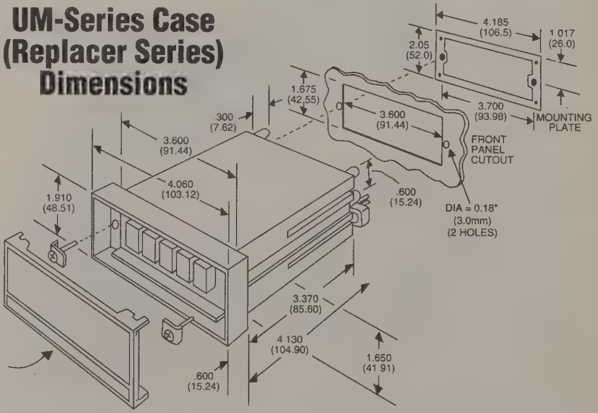
Designed to accept thermocouple sensor inputs • UM-35J has a range of 0 to 760°C or 0 to 1400°F with J thermocouple • UM-35K has a range of 0 to 1260°C or 0 to 1999°F with K thermocouple • Automatic reference junction compensation • See general specifications on previous page.

Optional Power Supplies for UM-Series

For the convenience of the end-user, Texmate provides the UM-Series with optional power supplies. You must specify when ordering the meter which power supply is required. The standard power supply is 110/220VAC.

Isolated 5-36VDC/9-24VAC	VO-DC/ISO	$49
Non-Isolated 7-36VDC/12-24VAC	VO-DC/NON	$29
24VAC Transformer	VO-24V	$15

UM-Series Case (Replacer Series) Dimensions



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TEXMATE PANEL METERS: Bargraphs, Digital Display/Bargraphs and Meter Relays

Bargraphs for Measurement and Control

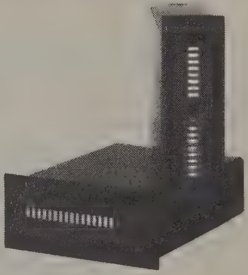
30-Segment Bargraph Meter Single or Dual Setpoints

AM-30	Standard meter, no setpoints	$99
AM-30R1	AM-30 with one setpoint	$129
AM-30R2	AM-30 with two setpoints	$159

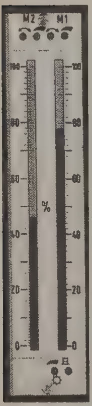
30-segment bargraph in DIN 96 x 24mm short depth (72mm) case • Optional single or dual setpoints • Setpoints adjustable from front of meter • Setpoints may be individually selected to be high or low alarms • 5VDC powered @ 300mA • Seven header selectable ranges of 50mV/100mV/200mV/1V/5V/10V/4 to 20mA • Standard meter uses red LEDs and is calibrated for a 0 to 1V input with 0 to 100% scale • Custom scale and options for customer logo on front • Green, amber, or mixed displays (where each block of 10 LED's is a different color) are available as options • A dot mode or center zero dot mode for bipolar inputs is also offered • No setpoints available with dot mode options • A longer depth model, powered from 110/220VAC will be available by late 1993.

LED 20-Segment Bargraph Meter

AM-20 $49



Single-ended positive inputs only • Ranges 200mV, 2V, 20V, 200V and 1200V • Selectable Dot or Bar mode and scale indicators • Custom scaling available • Operates as a center-zero meter with isolated 5V power supply • 0.15" segments • 5V DC powered • Available in Slim Bezel stackable cases.



LED Single or Dual Channel Bargraph

AM-100 $600 (dual) or $570 (single)

AM-100-R Dual relay version $740

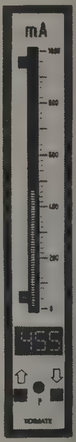
The AM-100 is a single or dual, microprocessor controlled, 101 segment LED 4" bargraph • 1200 baud serial output is standard • 110/240VAC 50/60Hz or optional 18 to 36VDC/24VAC power • Measures DC voltage and current with 1% resolution • Dual bargraph with optional dual setpoints and changeover relay contacts available • Horizontal or vertical • Optional green LEDs • Case size is DIN 144x36mm • Dedicated inputs: 4-20mA or 0-1VDC standard. 0-60mV or 0-100VDC scaled to read 0-99.9 or 0-999 also available

Bargraph Meters with Digital Display

AM-20D $290

20-segment 2" LED bargraph with 3 digit numerical display • Input ranges 150mV to 250VDC & 4-20mA DC • Separate inputs so bargraph & digital display can be read separately • Analog zero isolated from power supply voltage • 110~240V AC or optional 18-36VDC/24VAC power • Vertical or horizontal formats • Optional green LEDs • DIN 96x24 mm case

AM-100D from $565



101-segment, microprocessor controlled, adjustable brightness, 1% resolution, LED 3.35" bargraph with 3 digit numerical display • 110/240VAC 50/60Hz or optional 18 to 36VDC/24VAC power • Modular plug-in input signal conditioning boards available to measure AC/DC voltage/current, resistance, frequency & temperature 100 ohms RTD or T/C • Max and min values saved & displayed • Bar display zero left hand, right hand, center or offset • Auto-tare function • Logarithmic scale • Horizontal or vertical formats • Optional dual set points & changeover relay contacts • Adjustable averaging for noisy input signals • DIN 144x24mm case • Optional green LEDs.

Input/Output Modules for AM-100D

See Plug-In Signal Conditioning Modules for more information on I/O modules for the AM-100D

Color LCD Bargraph/Digital Meter/Controller

with optional two or four setpoints

AM-101 from $595

Microprocessor controlled 41-segment bargraph with 4-digit readout adjustable brightness in DIN 96x96mm case • 4-digit LCD display each with 7 segments and five color bargraph • Cold fluorescent backlighting • Excellent visibility with vivid colors against a black background • Standard input 4-20mA. Other ranges on request • 110VAC or 220VAC powered

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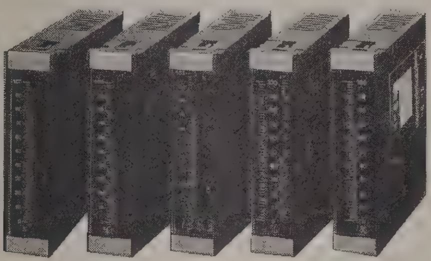
TEXMATE PANEL METERS: Bargraphs, Power Monitor, and CT's

LED Microprocessor-based Bargraph Meters

101-segment bargraphs with optional 4-digit LED display

NEW!



F-Series Bargraph Indicators

Features:

- 51 and 101 segment bargraphs
- Optional 4-digit LED display
- Available with 2 or 4 relays
- Single or dual bar displays
- Vertical or horizontal mounting
- Low power consumption
- 88,000 hour MTBF (10 yr.)
- Shock and vibration resistant
- End or center zero
- Compact DIN case size
- AC or DC power supply
- Current or voltage inputs

The F-Series bargraphs are red or green LED bargraph indicators with optional 4-digit display. They provide a bright, clear display in a compact, easy-to-mount DIN case. Available in both single and dual channel displays, these microprocessor based meters are attractive, rugged and durable.

All 101-segment bargraphs are powered by 110 or 220VAC. 24VAC optional. Other bargraphs available with AC input and 100 ohm RTD input.

Options include: Green or yellow display; custom scaling; multiple phase options

Applications include: flow, level, temperature, and pressure indication; Power monitoring; Depth indicators for mine hoists and ship cranes; Utilities/cogeneration plants/boiler rooms; Testing/monitoring; Wastewater treatment.

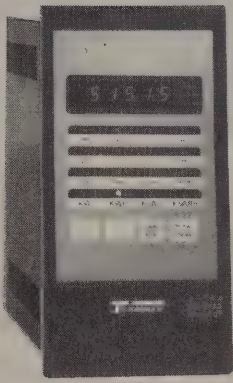
Models to Choose From:

Single-bargraph, no setpoints	FG-101	$275
Dual-bargraph, no setpoints	FG-102	$395
Single-bargraph, 2 setpoints	FRG-121	$495
Single-bargraph, 4 setpoints	FRG-141	$595
Single-bargraph, 4-digit display, no setpoints	FDG-101	$395
Single-bargraph, 4-digit display, 2 setpoints	FDG-121	$595
Single-bargraph, 4-digit display, 4 setpoints	FDG-141	$695
Single-bargraph, 51 segment, 5V or 24VDC	FG-501	$225

Instruments for AC Power Measurement

Digital Wattmeter and Power Monitor

PW-3S-123 $1995



Displays AC voltage, AC current, frequencies, power factor, kilowatts, kilowatt hour, kiloVARS, kVAR hour, for 3 or 4 wire, 3 phase systems • Easy to program and operate • Internal battery retains KWH and KVARH data even when power is turned off • User friendly - all functions displayed by an LED to indicate the selected function • Easy to read 6-digit LED display • Various PT/CT ratios are set up with DIP switches • Unit is powered from 85-264VAC, 47 to 440Hz • Compact size; mounts in standard instrument panel • Weight: 2.7kg (6 lbs)

The PW-3S-123 is designed to measure various inputs through PT's and CT's. A built in microprocessor calculated the final displayed value using a direct sampling method for optimum accuracy. The voltage and current burden are less than 1VA per input. The unit is rated to withstand voltage of 2000V between any terminal and the case. RS-485 outputs are provided for power management or central control. Built in PT's to 600VAC. Call Texmate for CT's.

Current Transformers

Call for quote on your specific application

Available for AC current measurements with 1 amp or 5 amp output. One required for each phase. When ordering please furnish: a) ratio; b) input current; c) output: 1 or 5 amp; d) burden in VA; e) accuracy desired; f) frequency; g) number of phases; h) wire size; i) ID; j) OD; k) insulation or voltage; l) lead length; and m) temperature. Photo shown for reference only. Outputs to power monitor, AC ammeter (analog or digital) and power transducers. Priced from $20.

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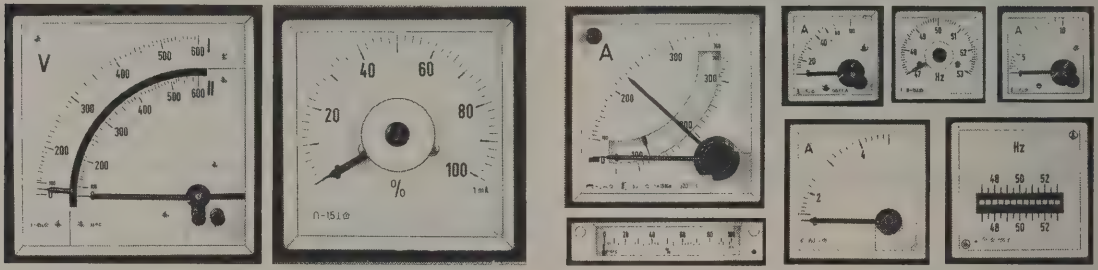
TEXMATE PANEL METERS: Switchboard and Analog Panel Meters

GOSSEN International DIN Standard Analog Meters and Meter Relays

As a result of an affiliation and collaboration agreement with Gossen-Metrawatt, the leading German and European meter manufacturer, Texmate now offers an extensive range of finely crafted analog meters and meter relays in square and edgewise configurations, all of which meet the international DIN 43 700 standard. This world class range of analog meters includes moving-coil, moving iron, power factor meters, bimetal ammeters, frequency meters as well as special-application meters. Write or call now for pricing information and the latest literature on these and other quality instrumentation products from Texmate.

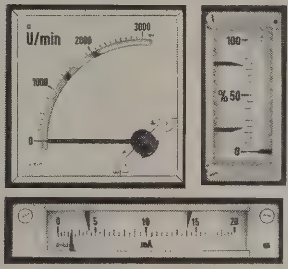
Switchboard Meters

(See also digital switchboard meters DU- and UM- Series)

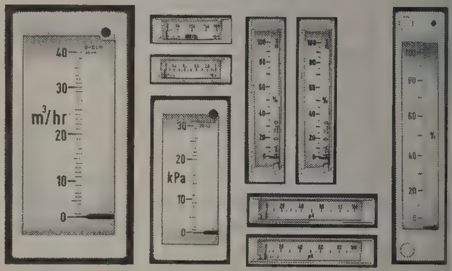


Analog Panel Meters with Changeable Scales

Meter Relays



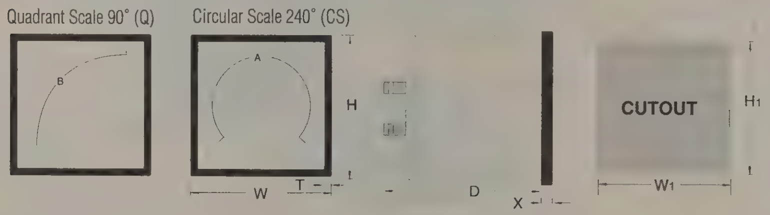
Edgewise Analog Meters



Analog Case Dimensions

Square Case (S)

Sizes 48mm, 72mm, 96mm, and 144mm. Dimension 'D' varies with meter type.

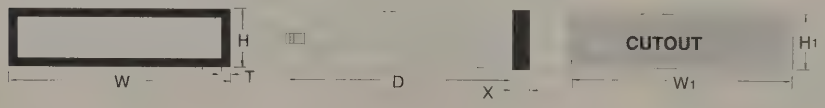


Square Case Dimensions (mm)

	S48	S72	S96	S144
H & W	48	72	96	144
T	3	4	4	5
X	5	5	5	8
H_1 & W_1	45	68	92	138

Edgewise Case (ES)

Sizes 72mm, 96mm, and 144mm. Horizontal or vertical formats available.
Other sizes available, please call.



Edgewise Case Dimensions(mm)

	ES72	ES96	ES144
W	72	96	144
H	36	48	72
T	4.0	4.0	5.0
D	95	120	175
X	5.0	5.0	8.0
W_1	68	92	138
H_1	33	45	68

ALSO SEE TEXMATE IN EEM UNDER INDUSTRIAL COMPUTERS; DATA ACQUISITION; AND LABORATORY POWER SUPPLIES

TEXMATE

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TEXMATE PANEL METERS: Analog Meter Types, Power Transducers, Transmitters

Analog Meters Offered by Texmate

AC Ammeter/AC Voltmeter
- Direct Reading and 1A or 5A CT operated
- True RMS or Rectified RMS

DC Ammeter/DC Voltmeter
- Direct Reading or Shunt Operated (60mV, 100mV, 150mV)

Frequency
- Moving Coil or Vibrating Reed
- Dual Vibrating Reed

Temperature
- Type J, K, L, U, T, E, S, R, B

Maximum Demand
- Bi-Metallic or Combination Bi-Metallic/Moving Iron

Wattmeter/Varmeter
- Electrodynamic for KW (Active) or KVAR (Reactive)
- Single Phase or 3 Phase for 3 wire or 4 wire, bal or unbal.

Power Factor
- Electrodynamic for Single Phase or 3 Phase

Meter Relays
- Single or dual set points

Other Special Order Meters
- Synchroscope
- Double Voltmeter/Double Measuring
- Operating Hour
- Phase Rotation

Special Mount or Environment
- Splashproof Covers or Complete Tropical Proof Cases
- Mosaic Mount
- DIN Rail Mount
- Marine Applications

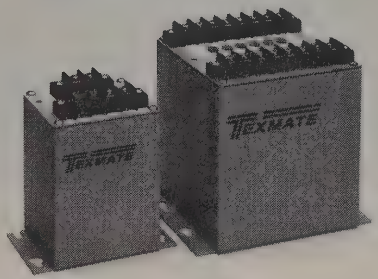
Signal Transmitters

Texmate offers a wide range of transmitters ranging from $250 • Request data sheets for ranges and accuracy specifications • All units have various outputs including 0-1mA and 4-20mA.

Transmitters to choose from include:

DC Voltage TR-DDV Series
DC Current TR-DDC Series
Temperature (RTD Input) TR-RTD Series
Temperature (Thermocouple) TR-TC Series
Summation (A+B=Total) TR-MFS Series
Differential (A-B=Total) TR-MFD Series
Potentiometric Position TR-RP Series
DC to Frequency TR-VF Series
Frequency to DC TR-FV Series

Power Transducers



Texmate's line of power transducers have accuracies of 0.25% and/or 0.5%. Standard inputs as noted below, other inputs available • Outputs of 0-1mA, 0-5V, 0-10V, 0-20mA, 4-20mA and pulses are available • All models available in single phase or three phase • Two metal shielded case sizes available. Case A: 57mm(W) x 77mm(L) x 108mm(H); Case B: 95mm(W) x 110mm(L) x 126mm(H)

Transducers to choose from include:

Current (0-5A AC Input)
- T-A Series (Avg. or RMS) from $80

Frequency (120VAC Input)
- T-F Series from $250

Power Factor (5A, 120VAC Input)
- T-PF Series (ranges 45-65 Hz) from $300

Voltage (0-150VAC Input)
- T-V Series (Avg. or RMS) from $80

Volt-Amp (Apparent Power)
- T-VA Series from $340

Vars (Reactive Power: 5A, 120VAC Input)
- T-VAR Series from $280

Var Hour (5A, 120VAC Input)
- T-VARH Series from $295

Var/Var Hour (5A, 120VAC Input)
- T-VARHQ Series from $400

Phase Angle (Range:-0.5 to 1 to +0.5, 60 degrees, 5A, 120VAC Input)
- T-VI Series from $290

Volt-Volt (120VAC)
- T-VV Series from $420

Watt (Active Power: 5A, 120VAC Input)
- T-W from $260

Watt Hour (5A, 120VAC Input)
- T-WH Series from $295

Watt/Watt Hour (5A, 120VAC Input)
- T-WH Series from $375

Watt/Var Combined (5A, 120VAC Input)
- T-WV Series from $490

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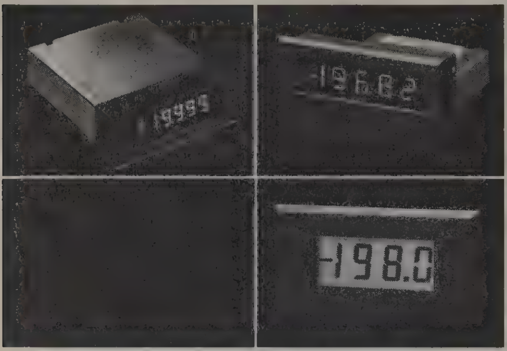


VELONEX Digital Panel Meters

VELONEX Digital Panel Meters are one of the small wonders of the world for applications requiring high reliability, low power consumption and sharp, readable displays. Accurate measurement capabilities are designed into the Meters, including dual-slope conversion circuitry, high quality components, and 100% burn-in and testing on all models. VELONEX Meters feature auto-zero, display test, display blanking and moveable decimal point. BCD sign and overrange outputs are standard on LED Models.

Ruggedized meters are encapsulated to protect against moisture and corrosive fumes and other harsh environments such as vibration, shock and acceleration.

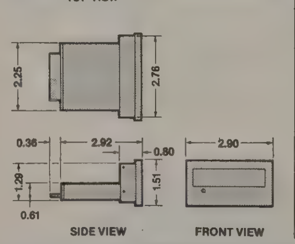
LED DIGITAL PANEL METERS					**LED CONTROL PROCESS**	**LCD DIGITAL PANEL METERS**	
Commercial Model	**31LB**	**36LB**	**41LB**	**46LB**	**32LB**	**37J**	**37K**
Ruggedized Model	**V-2362L**	**V-2363L**	**V-2364L**	**V-2365L**	**V-2667L**		
Display	0.33 in.	0.33 in.	0.33 in.	0.33 in.	0.33 in.	0.5 in.	0.5 in.
Commercial Model	**31LD**	**36LD**	**41LD**	**46LD**	**32LD**		
Ruggedized Model	**V-2901L**	**V-2902L**	**V-2903L**	**V-2904L**	**V-2864L**		
Display	0.3 in.	0.3 in.	0.3 in.	0.3 in.	0.3 in.		
Digits	3	31/2	4	41/2	3	31/2	31/2
Input Ranges					**Display (000-999)**	**Display (000-999)**	**Display (000-999)**
-1	±99.9mV	±199.9mV	±99.99mV	±199.99mV	+1 to +5mA	±199.99mV	±199.99mV
-2	±999mV	±1.999V	±999.9mV	±1.9999V	+4 to +20mA	±1.999V	±1.999V
-3	±9.99V	±19.99V	±9.999V	±19.999V	+10 to +50mA	±19.99V	±19.99V
-4	±99.9V	±199.9V	±99.99V	±199.99V	+1 to +5V	±199.9V	±199.9V
Accuracy[1]	+0.1% RDG+ +0.1% FS	+0.1% RDG+ +0.05% FS	+0.05% RDG+ +0.02% FS	+0.05% RDG+ +0.01% FS	+0.01% RDG+ +0.01% FS	±0.05% RDG+ +0.05% FS	±0.05% RDG+ +0.05% FS
Sample Rate[3]	2.5/s	2.5/s	2.5/s	2.5/s	2.5/s	2.5/s	2.5/s
Conversion Time[3]	400ms	400ms	400ms	400ms	400ms	400ms	400ms
Response Time	400ms	400ms	400ms	400ms	400ms	400ms without filter, 2sec with filter	
Input Impedance[4]							
-1	>1000MΩ	>1000MΩ	>1000MΩ	>1000MΩ	30Ω	>1000MΩ	>1000MΩ
-2	>1000MΩ	>1000MΩ	>1000MΩ	>1000MΩ	7.5Ω	>1000MΩ	>1000MΩ
-3	>1MΩ	>1MΩ	>1MΩ	>1MΩ	3Ω	>10MΩ	>10MΩ
-4	>1MΩ	>1MΩ	>1MΩ	>1MΩ	>300kΩ	>9MΩ	>9MΩ
Common-Mode Noise Rejection	Typical 86dB from DC to 400Hz, 1kΩ imbalance				N/A	Typical 80dB from DC to 400Hz, 1kΩ imbalance	
Normal Mode Rejection	>40dB at 50, 60 and 400Hz					>50dB at 50, 60 and 400Hz (w/filter)[6]	
Temperature Range	Operating: 0°C to +50°C; Storage: −20°C to +85°C (Commercial) Operating: −10°C to +70°C; Storage: −40°C to +85°C (Ruggedized)					Operating: 0°C to +50°C; Storage: −20°C to +65°C	
Temperature Coefficient	0.01%/°C, from 0°C to +50°C (Commercial) 0.01%/°C from +10°C to +40°C (Ruggedized)				0.03%/°C from 0°C to +50°C (Com.) 0.03%/°C from −10°C to +70°C (Rug.)	0.01%/°C from 0°C to +50°C	
Voltage	+4.8 to +6.0V_{DC} (+7.0V_{DC} maximum without damage)					4.5 to 15V_{DC}	4.5 to 15V_{DC}
Current (Typical)	100mA	110mA	115mA	120mA	110mA	500µA typical @ 5V	500µA typical @ 5V

SPECIFICATIONS, POWER CONVERTERS

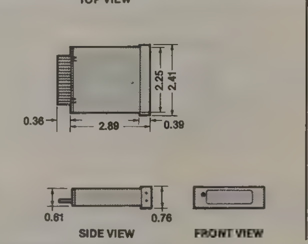
	AC to DC Converters			DC to DC Converters	
Standard Model	**P22**	**P26**	**P27**	**P24**	**P29**
Ruggedized Model	**V-2408**	**V-2405**	**V-2406**	**V-2785**	**V-2786**
Input Voltage	105-125 V_{AC}, 50-420 Hz	105-125 V_{AC}, 50-420Hz	210-253 V_{AC}, 50-420 Hz	24-32V_{DC}	11-13V_{DC}
Input Current[8] Typical	25mA	85mA	40mA	100mA	200mA
Output Voltage	4.85 to 5.5V_{DC}	4.85 to 5.5 V_{DC}	4.85 to 5.5 V_{DC}	4.85 to 5.5V_{DC}	4.85 to 5.5V_{DC}
Output Current Maximum	125 mA	450mA	250mA	125 mA	125 mA
Ripple, Peak To Peak Maximum	500mV	30mV	30mV	500mV	500mV
Input Regulation	±1.0%	±0.5%	±0.5%	±1.0%	±1.0%
Load Regulation	±1.0%	±0.8%	±0.8%	±1.0%	±1.0%
Operating Temperature	0 to +50°C Standard, −10 to +70°C Ruggedized Models				
Storage Temperature	−20 to +85°C Standard, −40 to +85°C Ruggedized Models				
Input To Output Isolation	500V_{AC} RMS	500V_{AC} RMS	500V_{AC} RMS	250V_{DC}	250V_{DC}
Weight, Ounces	<6	<11	<11	<3	<3
Dimensions Code	B	C	C	A	A

Specifications subject to change without notice.
Note 1. RDG=Reading, FS=Full-Scale
Note 2. Other rates or times available on special order.
Note 3. Refers to DC signal input.
Note 4. Internal input filter is selectable at the rear connector.
Note 5. The counter will continue to count normally when these controls are actuated.
Note 6. Specified at Nominal Input Voltage and Full Load.

B Series

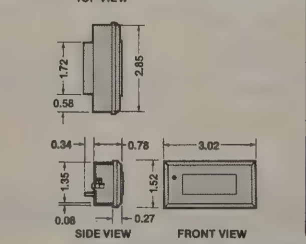


D Series



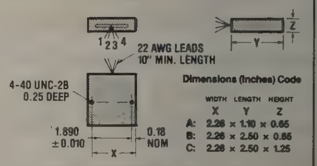
Weight: DPM <3.5oz.; Mounting Clamp <1.0oz.

LCD



Weight: <2.0oz.

Power Converter



Dimensions (Inches) Code

	WIDTH X	LENGTH Y	HEIGHT Z
A:	2.26 ×	1.10 ×	0.65
B:	2.26 ×	2.50 ×	0.65
C:	2.26 ×	2.50 ×	1.25

VELONEX

- HIGH-POWER PULSE GENERATORS
- SURGE TRANSIENT GENERATORS
- VOLTAGE SPIKE GENERATORS
- NOISE GENERATORS
- COMMERCIAL AND RUGGEDIZED DIGITAL PANEL METERS
- PROCESS CONTROL METERS
- EVENT COUNTERS

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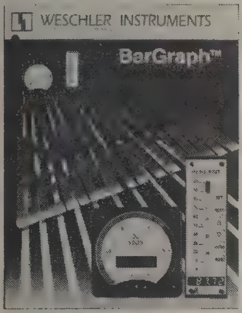
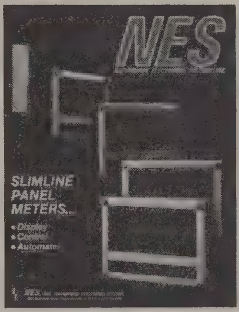


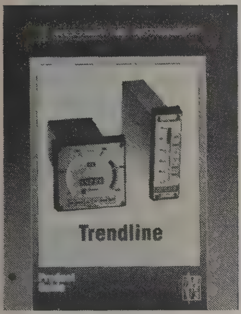
- Monitors most analog signals.
- Bright LED Bar/Digital displays.
- Programmable functions.
- Digital/analog retransmit.
- Communication: RS232/422/485.
- Setpoints, Trend, Peak/Valley.
- Powered from AC/DC voltages.
- Retrofit sizes for Bailey, Foxboro, Westinghouse, GE, Dixson, YEW, Ashcroft, and other meters.
- Military and Nuclear qualified.
- Watts, Vars, Power Factor.

Digital Panel Instruments



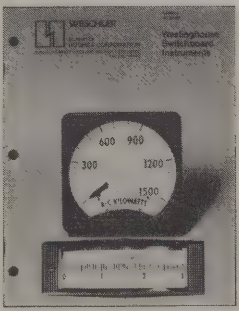
- Formerly **NES**.
- Over 4,000 Combinations of inputs/outputs.
- Bright, Large 6-digit LED Displays.
- Behind-the-door scaling, adjustments and controls, use of plug-in resistors for easy input change.
- Measure AC/DC volts, amps, power, rate, time, totals, temperature and more.
- 3.65" x 4.65" meters require behind panel depth of 0.60".
- Optional NEMA-4X bezel.

Trendline Panel Instruments



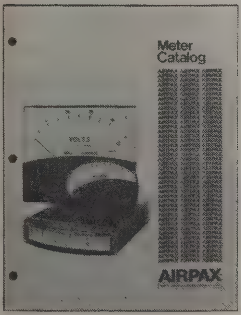
- Formerly NES.
- Designed to replace vertical and circular switchboard meters.
- 4-3/4 digit display.
- Entire BarGraph changes color (green, red or amber) at user determined set points.
- Accepts most analog signals.
- Provides a variety of outputs, including serial ASCII.
- Programmable functions.
- Catalog includes specs, applications and display formats.

Analog Switchboard Instruments



- Formerly **Westinghouse**.
- Edgewise & circular scales.
- High accuracy, full view design.
- High overload capacity.
- Taut band suspension.
- Meets ANSI Std. C39.1.
- Military and Nuclear versions.
- Volts, amps, watts, vars, speed, frequency and power factor.
- Permanent magnet moving coil mechanisms.
- Ultimate in reliability and performance.

Specialty Meters



- Formerly **Parker/Airpax**.
- Rugged, shock resistant, lightweight design.
- 7/16" 'thin'.
- Can withstand 1000% electrical overload.
- Can be surface mounted with 2-3/8" holes through panel.
- Edge reading meters can be stacked on 1/2" centers.
- Solid state switching without physical contacts.

Analog Panel Instruments

WESCHLER
INSTRUMENTS
Panel
Instruments

- Formerly **Westinghouse**.
- Meets ANSI Std. C39.1.
- Maximum readability.
- Excellent repeatability.
- Special scales and calibration.
- Lance pointers.
- High torque-to-weight ratio.
- Minimal frictional effect.
- Accuracy class 2%.
- Center and suppressed zero.
- Front or rear of panel mounting.

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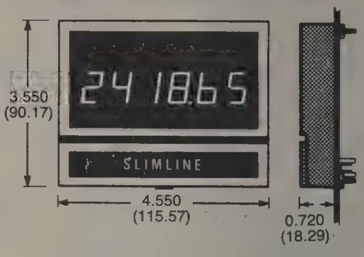
SLIMLINE (Formerly NES) SURFACE MOUNT PANEL INSTRUMENTS

QUALITY

ACCURACY and LONGEVITY are our primary concerns.

FLEXIBILITY

- Surface mount package 4.62″W × 3.64″H × 0.79″D
- Front panel access to controls
- Switchable noise filtering for use in noisy environments
- Quick and easy set-up
- Plug-in resistors for signal input range changing on process inputs
- Set points, relay outputs, open collector outputs and transducer excitation available
- Red LED display 0.56″ high
- Optional stainless steel NEMA 4-X Bezel, for the toughest environments
- Standard low voltage power at 7-10 Vac, 5 Vdc, 7-12 Vdc or 24 Vdc
- 120 Vac, power with plug-in transformer or optional support module
- Available 12 Vdc isolated automotive powering



Surface Mount Slimline Meter

Rear Mount Optional Support Module

METERING SYSTEMS FLEXIBILITY

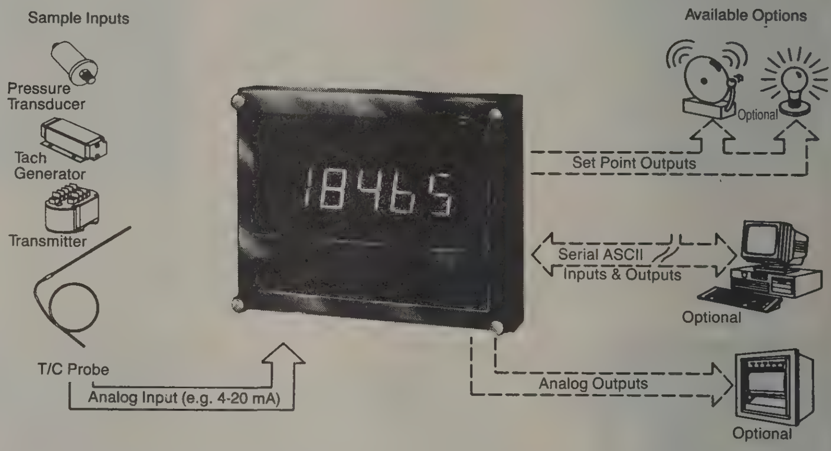
COMMUNICATION

Serial ASCII:

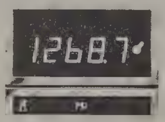
- RS232, RS422 or 20/60 mA current loop
- Interface to computers, PLCs, robots or any processor based device with a serial port
- User programmable character string
- Addressable to 100 units

Parallel BCD:

- Individual digit or meter enable capability allows multiplexing of several meters on the same data bus.
- Open collector BCD data permits interfacing with high voltage logic (up to +48 Vdc).
- Internal socketed pull-up resistors mean no external components and mounting problems.
- Optional optical isolation provides better noise immunity and communication over longer distances.



SLIMLINE (Formerly NES) INSTRUMENTS



Process/Transducer Meters

These meters take most standard DC process signals such as 4-20 mA, 0.5 V, 0-1 mA, etc. and displays them in any desired process units, i.e. a 4-20 mA loop can be read in PSI, gal/min, °F, %, etc. Models with set point outputs. Outputs; BCD to 48 V, RS232C, etc.

- 3½ & 4½ digit models
- Open collector or tri-state BCD data
- DC voltage or current inputs
- Plug-in range changing resistor
- Multi-turn coarse & fine pots
- Serial ASCII, RS232, RS422 or current loop

Voltmeters

Measure AC or DC volts from 0-300mV dc to 0-300 Vdc. Units are available with 2 or 3 set points and open collector set point outputs. Serial ASCII units have peak and valley storage and an ASCII controllable latching output.

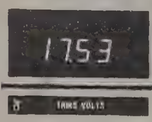
- 3½ & 4½ digit models
- Auto zero & high stability circuitry
- Switchable response time & noise filtering
- High input impedance
- Open collector & tri-state BCD data
- Serial ASCII, RS232, RS422 or current loop
- Switch selectable decimal point position

23.45
AC AMPS

Ammeters

AC or DC current measurement from microamps to kiloamps. 5 A scaleable units allow fast and easy custom field scaling. Two or four set point output units allow system control. Serial ASCII units have peak and valley storage and an ASCII controllable latching output.

- 3½ & 4½ digit models
- Auto zero & high stability circuitry
- Bi-polar, auto polarity operation
- Low input impedance
- High common mode rejection
- Serial or parallel BCD communication available



TRMS Ammeters & Voltmeters

Allows proper reading of non-uniform waveforms, such as circuits with coils, capacitors and SCR's. Great for motor controller circuitry, fluorescent lighting circuits, etc. Switch selection of the DC components allows reading TRMS or DC.

- 3½ & 4½ digit models
- Frequency response - 30 Hz to 5 kHz
- Auto zero & high stability circuitry
- Switchable response time & noise filtering
- High common mode rejection
- Crest factor to 6

Continued on Next Page

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SLIMLINE (Formerly NES) INSTRUMENTS

1965
KILOWATTS

Power Measurement Meters

Reads True AC Watts directly, available in either single or 3-phase models. Either Delta or Wye connections available for 3-phase. Also VAR, Power Factor and Watthour Meters to cover most any range. Models are available with set points, BCD, ASCII, etc.

- Serial ASCII or parallel BCD communication available
- 3½ & 4½ digit models
- Auto zero & high stability circuitry
- Minimum circuit loading
- Compensates for power factor
- Two or four set point outputs available

999999
TOTAL

Counters & Totalizers

Units are available to: (1) count up, (2) count up and down, (3) count up or down to or from a preset limit, and (4) to divide the count by any 4-digit switch-selected number. Available with permanent count store and scaling for watthour transducers.

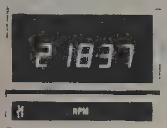
- Serial or parallel BCD communication available
- 2, 3, 4, 5 or 6 digit models
- Manual or remote control ■ Differential 0.2 to 80 Vdc
- Variable switch-selectable noise filtering
- Easy direct connection onto rotary encoder
- Prescaling, Divide-by-N & preset units

38745
PARTS/MINUTE

Ratemeters

Field scaleable to measure machine rate directly in any desired unit. For example, one pulse per bottle can be read out in six packs/minute, cases/hour, etc. Powerful microprocessor-based circuitry allows flexibility.

- 4, 4½ or 6 digit models ■ TTL parallel BCD data
- 2.9 to 41 Vdc variable threshold input
- Variable switch-selectable noise filtering
- Four pulses per hour minimum
- Remote control capability



Tachometers

Scaleable to monitor RPM from a wide range of gears and input signals. Units can accept external time base signals for ratio measurements. Microprocessor-based unit does not require 60-tooth gears. Serial ASCII meter displays English prompts for easy set-up.

- 4, 4½ or 6 digit models
- 2.9 to 41 Vdc, switch input standard
- Four pulses per hour minimum
- Remote control capability
- High accuracy crystal time base
- Serial ASCII or parallel BCD communication available

60000
HERTZ

Frequency Meters

Measures from 0.001 to 30 kHz by gated counter or calculation mode techniques. Selectable input averaging. Can be easily scaled to monitor frequency, ratio, deviation, percentage or period. Serial ASCII meter displays English prompts for easy set-up.

- Serial ASCII or parallel BCD communication available
- 4 or 6 digit models
- Two or four set point outputs
- Switchable input filtering
- High accuracy crystal time base
- Digital preset scaling ■ Digitally scaled time bases

3 10.0
TEMPERATURE

Remote Displays

Provide a large, bright readout from BCD, octal or hexadecimal data. Flexible addressing capabilities. Optional latches for use with programmable controllers, computers, etc. Units available to accept serial ASCII input and provide open collector outputs for control.

- 3, 4, 5 or 6 digit models
- Parallel, strobe, RS232, RS422/423/485, 20/60 mA loop modes
- Normal or inverted strobe capability
- Data input operate from 5 to 48 Vdc
- LCD units available

99999
SECONDS

Interval Meters

Use Interval meters to measure on-time, off-time, time between pulses or duration. These fully automatic timers resolve to 0.001 seconds. Connects directly to AC or DC control circuits. Easy 2-wire hook-up. Available with serial ASCII, parallel BCD or set point outputs.

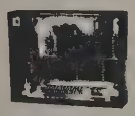
- No external control needed ■ 0.005% accuracy
- Holds last interval reading until next reading
- 2.9 to 41 Vdc; 120, 240 Vac or switch input
- High electrical noise immunity

9999
SECONDS

Timers & Stopwatches

Manually or automatically time events. Control events after a countdown, countup or at regularly recurring cycles. For timing events from 1 microsecond up to 99:59:59 hr/min/sec. We offer the widest variety of ranges anywhere. Available with serial ASCII, parallel BCD or set point outputs.

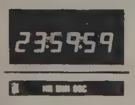
- High noise immunity filtering
- Range 999999 microsecond to 999.999 hours
- Continuously updated or single cycle timing
- 2, 4 or 6 digit models
- 50/60 Hz or 0.005% crystal time base
- Remote control standard
- Start, stop, run, hold inputs



Data Converters

Meter interface via serial ASCII port of programmable controllers, computers, printers, etc. Excellent for transmitting contact status. User specific protocol up to 31 characters. Works with Slimline meters or other BCD source.

- RS232, RS422 or 20/60 mA
- Selectable baud rate - 110 to 9600
- High electrical noise immunity
- Receiver & transmitter models
- Selectable ID to address 100 units



Clocks

Give accurate day and time-of-day for control panels, clock systems, programmable controllers, computers, etc. Can be expanded into battery back-up, master-slave and variable time zone clock systems. Available with serial ASCII, parallel BCD or set point outputs.

- 12/24 hr, hr/min, hr/min/sec & time zone formats
- 10/50/60 Hz or 0.005% crystal time base
- Remote control capability standard
- Day-of-year or automatic month/day
- Automatic leap year

3 10.0
TEMPERATURE

Thermometers

Thermocouple types J, K, T, R, S, E to cover from −328° to 3092°F (−200° to 1700°C). Platinum 100Ω RTD from −58° to 1112°F (−50°F to 600°C). Thermistor from +32.0° to 212.0°F (0.0° to 100.0°C). Available with serial ASCII, parallel BCD or set point outputs.

- Open collector or tri-state BCD data
- Dual range models to display °C or °F
- 0.1° resolution available
- Long lead length compensation circuitry
- Ideal junction sensing
- Continuous linearization over entire range

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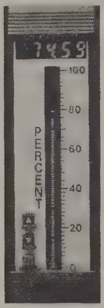
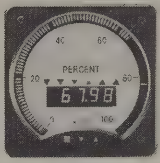
WESCHLER INSTRUMENTS

DIVISION OF HUGHES CORPORATION

DIGITAL BARGRAPH INSTRUMENTS





- Direct Replacements
- Completely Programmable by User
- Setpoint Control using Internal Relays
- Communication on RS232, RS422, RS485
- Retransmit Measured Signal as Analog or Digital
- Powered from a Variety of AC and DC Voltage Sources

FEATURES

- **High Resolution** 101 segment LED BarGraph™ displays 1% resolution.
- **4½ or 3½ Digit Digital Display** scaled to match the BAR process or other related engineering units. All digital displays have a negative sign.
- **Two or Four Set Points** are available all having form C relay outputs for use as a simple on/off or differential gap controller. Set point levels are easily programmed as HI-HI, HI, LO and LO-LO to the exact numeric value required. Set points have selectable hysteresis 0.5%, 1% or 2% of FS. Two fail safe set points.
- **Bar Form** meter bar start position (zero point) can be set anywhere on or off the BarGraph scale.
- **Real-time Visual Trend Indication** of measured signal for easy recognition of system status.
- **True Peak Hold** stored in memory of the highest value of the process signal.
- **Thermocouples** J, K, T, R, S & E and input signals that are nonlinear are linearized through a **50 point or greater** algorithm.
- **Square root extraction** for flow and **strapping tables** for tank applications are available.
- BarGraph is **powered** directly from 120 Vac/240 Vac or 5 Vdc, 12 Vdc, 24 Vdc, 28 Vdc, 48 Vdc or 125 Vdc.
- **Communication** on RS232, RS422 and bi-directional on RS485. RS485 can operate as a two wire LAN with up to 32 other units at 9600 baud.
- The measured parameter can be **retransmitted** as a standard process signal (4-20 mA, 0-1 mA, 1-5 volts or BCD). The signals are input isolated at an accuracy of 0.3%.
- **Connection** to each instrument is easily accomplished via **Terminal Block** style connectors. The connectors will accept up to a 14 gauge wire.
- **Easy Set-up** of system parameters from the front panel. Features such as zero adjust, gain, set points and meter scaling are all set with a touch of a button.
- AC current and AC voltage measurements are **true RMS** readings to the 7th harmonic.
- Visual safety **overrange** indication is provided whenever the measured signal exceeds the bar full scale value. In this condition, the full scale LED will flash, the **digital display** will flash and continue to read to the full meter count.
- **Colored LED Displays:** standard is red, optional–green and amber.
- The BarGraph's inherent solid state circuitry provides excellent **high shock** and **vibration** characteristics.

APPLICATIONS

- DC Voltage measurements from 50 mV dc to 250 Vdc directly. Higher voltages can be measured and displayed with an external divider network.
- DC current from 50 μA dc to 5 Adc can be measured directly. Higher ranges are measured with an external current shunt.
- AC Voltage measurements are true RMS readings up to 250 Vac directly.
- AC Current are true RMS readings up to 5.0 A directly.
- Thermocouple - J, K, T, R, S & E are accepted. Ice point reference and cold-junction compensation is internal. Linearization tables are pre-programmed and stored for each thermocouple type. The BarGraph can be calibrated and scaled in degrees C or F.
- 100 ohm platinum RTD with DIN 43760 standard temperature coefficient alpha = 0.00385/°C is linearized within the instrument. The meter can be configured for a 2 or 3 wire system and can be calibrated in C or F. Linearity for other RTD's can be compensated.
- Frequency or rate indication from Magnetic Pickups, mechanical counters or optical sensors. The BarGraph accepts signals from 5 to 250 V over the frequency range of 10 Hz to 20 kHz directly.
- Power-watts for single phase, three-phase three wire and four wire sinusoidal signals are directly measured (no external transducer required). Transformer input isolation. Power is calculated $EI \cos \Theta$ and displayed on the bar and digital display or can be retransmitted as a standard process signal.
- Reactive power is measured and displayed (VARS) for single phase and three phase, three and four wire systems. No external transducer required; input from CT's (5 A) and PT's (120 V or 240 V) directly to meter. Reactive power is calculated $EI \sin \Theta$.
- Power factor is measured and displayed on a center zero scale with center scale equal to 1.0 power factor. Meter input is transformer isolated. Power factor is calculated: $\cos \Theta = P\text{ (watts)} / \sqrt{P^2 + Q^2(\text{VARS})}$
- Phase angle of sinusoidal voltage and the start of sinusoidal current. The BarGraph is center zero and calibrated (Neg.) LAG/LEAD (Pos.) in degrees. Measurements are made on voltages up to 250 Vac directly, 50 to 400 Hz.
- Conventional process signals are easily displayed on all BarGraph meters. Flow, pressure, speed, position, temperature and level can be measured and displayed in the appropriate engineering units.

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WESCHLER INSTRUMENTS
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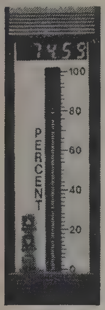
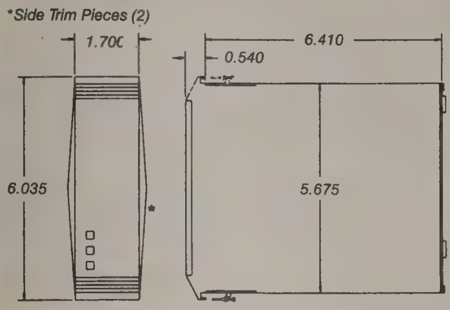
SWITCHBOARD BARGRAPH™ METERS

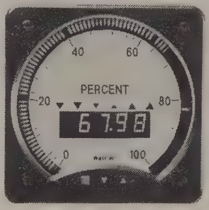
BG252 6" VERTICAL
BH252 6" HORIZONTAL BARGRAPH

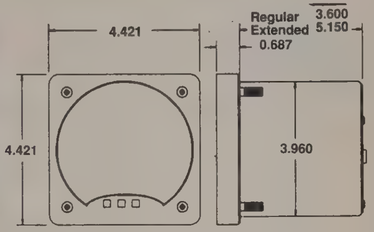

74.5.9
100
80
PERCENT
60
40
20
0


*Side Trim Pieces (2)
1.700
6.410
0.540
6.035
5.675
*

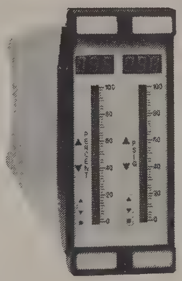
13.9.2
KILOAMPERES
0
5
10
15
20

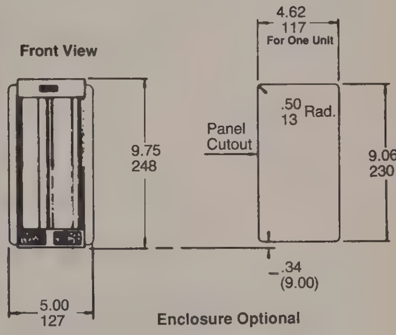
BG241 4½" SQUARE BARGRAPH


40
60
PERCENT
20
80
67.98
0
100

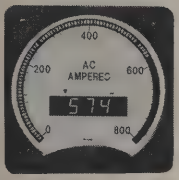

4.421
Regular 3.600
Extended 5.150
0.687
4.421
3.960

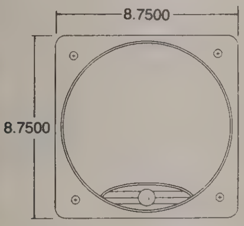
PG101 & 202 9" BARGRAPH
(BAILEY PG REPLACEMENT)

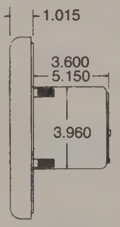



Front View
4.62
117
For One Unit
.50
13
Rad.
Panel
Cutout
9.75
248
9.06
230
.34
(9.00)
5.00
127
Enclosure Optional

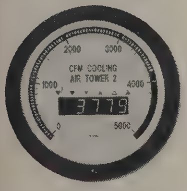
BG261 8½" SQUARE BARGRAPH
BG281 8" CIRCULAR BARGRAPH
BG251 6" CIRCULAR BARGRAPH


400
200
AC
AMPERES
600
57.4
0
800

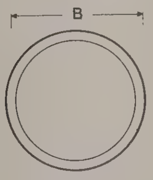

8.7500
8.7500


1.015
3.600
5.150
3.960

Side View


2000
3000
CFM COOLING
AIR TOWER 2
1000
4000
3779
0
5000

BG281

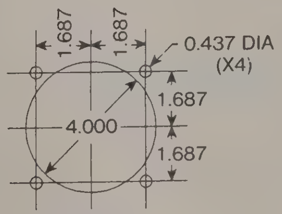


Front View

PERCENT
64.50

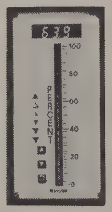
BG251

Type of Instrument	A Inches	B Inches
Regular	3 600	——
Extended	5 150	——
BG251	——	7 562
BG281	——	10 062

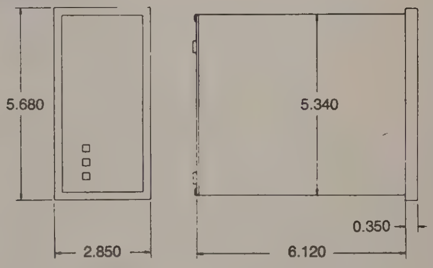

1.687
1.687
0.437 DIA
(X4)
1.687
4.000
1.687

Panel Cutout

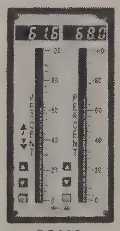
PC101/202 (72 × 144 mm)
VERTICAL BARGRAPH


63.9
100
80
PERCENT
60
40
20
0

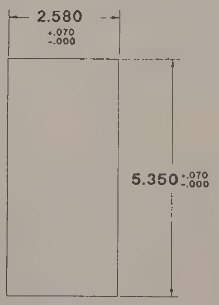
PC101


5.680
5.340
0.350
2.850
6.120

Front View Side View


61.6
68.8
PERCENT

PC202


2.580
+.070
-.000
5.350 +.070 -.000

Panel Cutout

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WESCHLER ACP2 POWER SERIES BARGRAPH INSTRUMENTS

NEW!

- Improved Accuracy
- True RMS
- Single and Polyphase Inputs
- RS232/422/485 Communication
- Relay Outputs
- High Reliability
- Switchboard Retrofits
- 101 Segment LED Array
- Retransmit via 4/20mADC, 0-1 mADC, 0-1VDC or 1-50DC
- Watts, Vars, Power Factor, Phase Angle or Synchroscope Meters

GENERAL SPECIFICATIONS

Response Time	1.5 seconds, 0-full scale Contact factory for faster response times
Input Values	Voltage 0-120 VAC, 0-240 VAC Current 0-5 Amps AC
Accuracy	< 0.5% - 0.1% (optional)
Overload Voltage	Up to 250 VAC
Current Saturation	6.25 Amps
Burden (per element)	CT < 1 ohm PT 604 ohms
Hysteresis	0.5, 1.0, or 2.0% of FS, selectable
Relay Contacts	120 VAC @ 5AAC 28 VDC @ 3ADC
Retransmit	4-20mADC (sink) 0-1mADC (sink) 0-5VDC 1-5VDC
Communication	RS232/422/485 @ 9600 baud
Power	120, 240 VAC 50/60 Hz, (7VA) 5, 12, 24, 28, 36, 48, 125 VDC
Resolution	1.0% (bar only) 0.1% (3-1/2 digit display) 0.01% (4-1/2 digit display)

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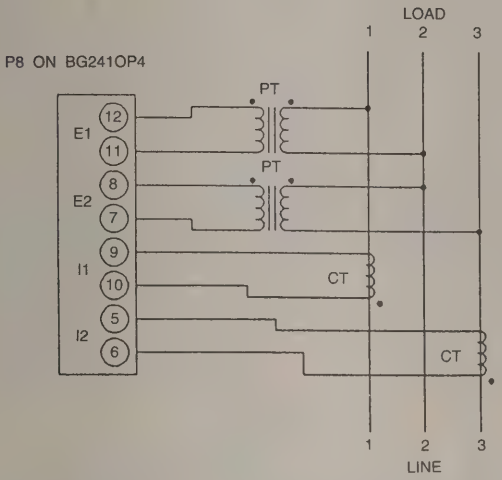
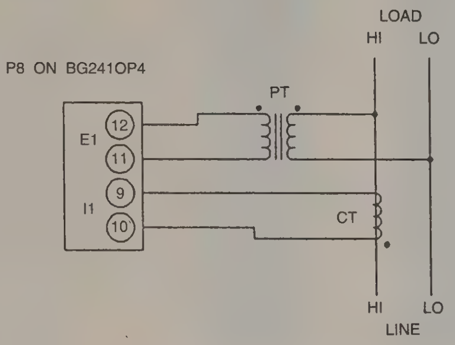
ACP2 Power Series Bargraph Instruments Source Control Drawings

3ø BALANCED, 2 ELEMENT

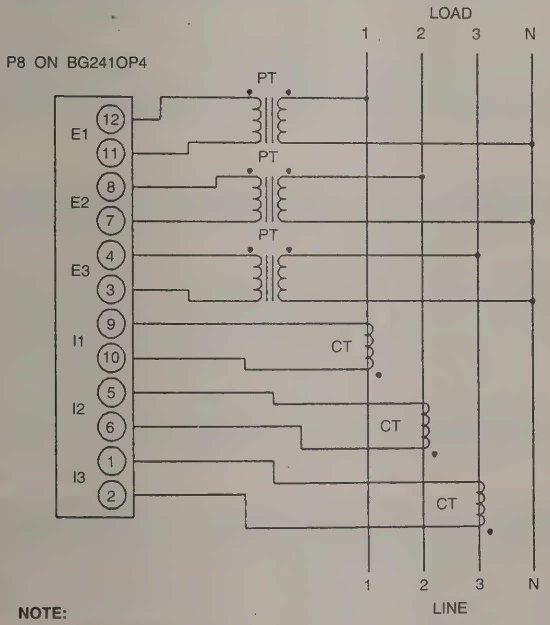

LOAD
1
2
3
P8 ON BG241OP4
E1
12
11
E2
8
7
I1
9
10
I2
5
6
PT
PT
CT
CT
1
2
3
LINE

NOTE:
1. PHASE SEQUENCE: 1-2-3

1ø 2 WIRE


LOAD
HI
LO
P8 ON BG241OP4
PT
E1
12
11
I1
9
10
CT
HI
LO
LINE

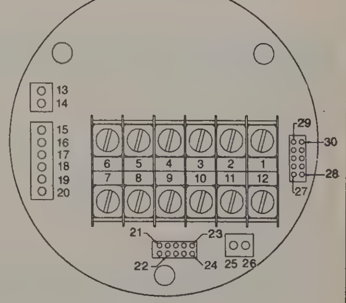
3ø UNBALANCED, 4 WIRE, 3 ELEMENT


LOAD
1
2
3
N
P8 ON BG241OP4
PT
PT
PT
E1
12
11
E2
8
7
E3
4
3
I1
9
10
I2
5
6
I3
1
2
CT
CT
CT
1
2
3
N
LINE

NOTE:
1. PHASE SEQUENCE: 1-2-3

BG241 ACP2 BACK PLATE

PIN	DESCRIPTION
1	PHASE 3 CURRENT (-)
2	PHASE 3 CURRENT (+)
3	PHASE 3 CURRENT (-)
4	PHASE 3 CURRENT (+)
5	PHASE 2 CURRENT (-)
6	PHASE 2 CURRENT (+)
7	PHASE 2 VOLTAGE (-)
8	PHASE 2 VOLTAGE (+)
9	PHASE 1 CURRENT (-)
10	PHASE 1 CURRENT (+)
11	PHASE 1 VOLTAGE (-)
12	PHASE 1 VOLTAGE (+)
13	AC HI
14	AC LO
15	RLY1 N.O.
16	RLY1 C
17	RLY1 N.C.
18	RLY2 N.O.
19	RLY2 C
20	RLY2 N.C.
21	485 COMM (+)
22	485 COMM (-)
23	DIGITAL GND
24	DIGITAL GND
25	ANALOG GND
26	ANALOG RETRANSMIT
27	ACP TXD
28	ACP RXD
29	DIGITAL GND
30	DIGITAL GND


13
14
15
16
17
18
19
20
6
5
4
3
2
1
7
8
9
10
11
12
29
30
28
27
21
23
22
24
25
26

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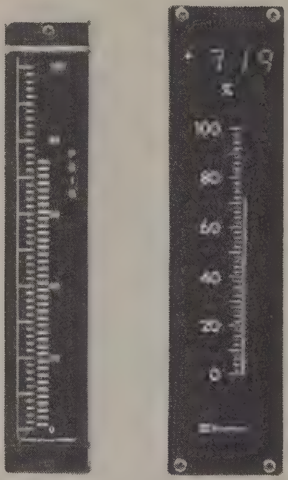
DIGITAL BARGRAPHS (Formerly Bowmar)



- 3"-10" LED Bar/Digital Displays
- Vertical or Horizontal mounting
- BCD output, hold function and 2.5 ms response
- End zero or center zero
- Standard or custom input ranges and scales
- Dual setpoints with relay output (Visible or non-visible)
- 51 or 101 segment LED displays
- Dimming capabilities
- Military or Nuclear qualified

BOWMAR BARGRAPH FEATURES AND OPTIONS

	APM 100	APM 200	APM 500	APM 600	APM 800	BG 100	BG 600	BGD 100
FEATURES								
DC Input	●	●	●	●	●	●	●	●
AC Input	●	●	●	●	●	●	●	●
Digital Input	●	●	●	●	●	●	●	●
VU Input	●		●	●	●			
End-reading Display	●	●	●	●	●	●	●	●
Center-zero Display	●	●			●			●
Digital Display		●						●
Resolution	1%	1%	2%	2%	1%	1%	2%	1%
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Mounting (Front/rear)	f/r	f/r	f/r	r	r	f/r	r	r
5 Volt Power	●	●	●	●	●	●	●	●
Bar or Point display	●	●	●	●	●	●	●	●
Brightness Control	●	●	●	●		●	●	●
Full Range of Inputs	●	●	●	●	●			●
OPTIONS								
Auto-polarity	●	●	●	●	●	●	●	●
BCD Output	●		●	●	●	●	●	●
Bezel: Black Metal	●					●		
Bezel: NEMA-4				●			●	
Custom Input Range	●	●	●	●	●	●	●	●
Custom Scales	●	●	●	●	●	●	●	●
Differential Input	●	●	●	●	●	●	●	●
Green, 3″ Bargraph Display	●	●				●		●
High Input Impedance Voltmeter	●		●	●	●	●	●	●
Hold Function	●		●	●	●	●	●	●
Increased Input Damping	●	●	●	●	●	●	●	●
Line Power Supply	●	●	●	●	●	●	●	●
Mixed Color LEDs			●	●	●		●	
Non-visible Set Point(s)	●		●	●	●	●	●	●
Red Filter		●		●	●		●	
Solderless Connector	●	●	●	●	●			
Solder Type Connector						●	●	●
Switch Options (Visible set point)	●		●	●	●	●	●	●
Visible Set Point(s)	●	●	●	●	●	●	●	●

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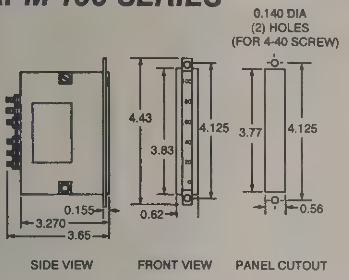
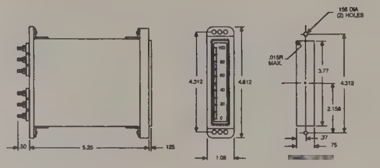
BOWMAR BARGRAPHS (Con't.)

APM 100 SERIES


0.140 DIA
(2) HOLES
(FOR 4-40 SCREW)
4.43
3.83
4.125
3.77
4.125
0.155
3.270
3.65
0.62
0.56
SIDE VIEW
FRONT VIEW
PANEL CUTOUT

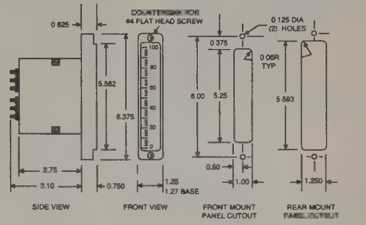
The most popular Bowmar meter provides the maximum features in the smallest package of any 100-segment bargraph. The excellent visibility of this meter permits a greater number of variables to be presented in less space than by conventional means. Two basic designs are available: End-reading (bar grows from one end) and Center-zero (bar grows in either direction from the center). 100 segments (0.55″×3.75″)

APM 200 SERIES


.156 DIA
(2) HOLES
.015R
MAX.
4.312
4.812
3.77
4.312
2.158
.50
5.25
.125
1.06
.37
.75

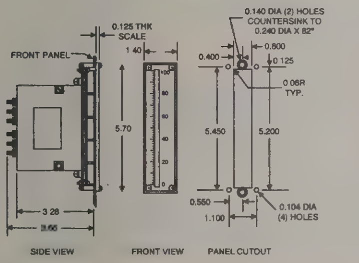
The military version of the APM 100 series is qualified for a number of military standards and features a watertight case. This meter is ideal for harsh and unusual environments in industrial plants, equipment, jet engine test instrumentation, ships, and aircraft. The rugged construction and all-metal case of this 100-segment bargraph holds up to the worst possible abuse. Specialized military versions include a digital display, lighting mask and custom ranging among other options. 100 segments (.75″×3.75″)

APM 500 SERIES


#4 FLAT HEAD SCREW
0.625
0.125 DIA
(2) HOLES
0.375
0.06R
TYP
5.562
6.375
6.00
5.25
5.593
2.75
3.10
0.750
1.25
1.27 BASE
0.50
1.00
1.250
SIDE VIEW
FRONT VIEW
FRONT MOUNT
PANEL CUTOUT
REAR MOUNT

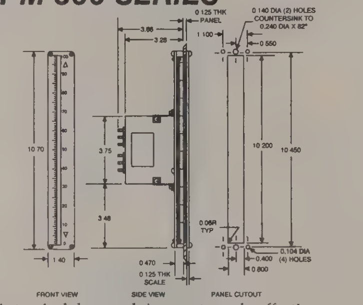
This thin-lined 50-segment meter permits easy replacement of edge-reading analog meters. The wide viewing angle of this bargraph permits the operator to work anywhere within the vicinity of the meter and still read the variable. The meter mounts from the front (or optionally from the rear) of the panel. 50 segments (1.25″×6.375″)

APM 600 SERIES


0.125 THK
SCALE
FRONT PANEL
1 40
0.140 DIA (2) HOLES
COUNTERSINK TO
0.240 DIA X 82°
0.400
0.800
0.125
0.06R
TYP.
5.70
5.450
5.200
0.550
1.100
0.104 DIA
(4) HOLES
3 28
3.66
SIDE VIEW
FRONT VIEW
PANEL CUTOUT

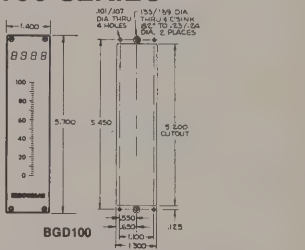
This flush mount meter projects only 0.125″ in front of the panel - just the thickness of the scale. Visible at greater than fifty feet, the APM 600 has a clean look. An optional NEMA-4 bezel provides a watertight panel for use in harsh environments. 50 segments (1.40″×5.70″)

APM 800 SERIES


0 125 THK
PANEL
0 140 DIA (2) HOLES
COUNTERSINK TO
0.240 DIA X 82°
3.66
3.28
1 100
0 550
10 70
3.75
3 48
10 200
10 450
0.06R
TYP
0.104 DIA
(4) HOLES
0.400
0.800
1 40
0 470
0 125 THK
SCALE
FRONT VIEW
SIDE VIEW
PANEL CUTOUT

This ten-inch bargraph is an extremely effective communicator at any distance. The meter electronics mount from the rear of the panel while the scale mounts from the front, in similar fashion to its shorter cousin, the APM 600. You can see the strong visual impact of this bargraph meter. 100 segments (1.40″×10.70″)

BGD 100 SERIES


1.400
.101/.107
DIA THRU
4 HOLES
.133/.139 DIA
THRU & C'SINK
82° TO .23/.24
DIA. 2 PLACES
8888
5.700
5 450
5 200
CUTOUT
.550
.650
1.100
1 300
.125
BGD100

The BG100 and BG600 are low-cost versions of the APM Series. These meters are available in a limited number of standard ranges. The available ranges are designed to work with off-the-shelf transducers to measure virtually any phenomenon. The BGD Series effectively communicates information more directly and at greater distances than a simple digital display. The bar display provides relative information such as percentage or level while the digital display provides absolute value or quantity.

MODEL	***BG100***	***BG600***	***BGD100***
DESCRIPTION	3″ display 100 LED element bargraph (0.55″ × 3.75″) Use APM 100 Dimensions	5″ display 50 LED element bargraph (1.40″ × 5.70″) Drip-proof bezel (optional) Use APM 100 Dimensions	5″ display 100 LED element bargraph with 3½ or 4 digits (1.40″ × 5.70″)
SIGNAL RANGES	Standard: 0-1 Vdc; 0-5 Vdc; 0-10 Vdc; 4-20 mA. Custom: 50 mV to 100 Vdc; 10 µA to 10 Adc.	Standard: 0-1 Vdc; 0-5 Vdc; 0-10 Vdc; 4-20 mA. Custom: 50 mV to 100 Vdc; 10 µA to 10 Adc.	Standard: 0-1 Vdc; 0-5 Vdc; 0-10 Vdc; 4-20 mA. Custom: 50 mV to 100 Vdc; 10 µA to 10 Adc.
Absolute Maximum	250% overrange 150% reverse polarity	250% overrange 150% reverse polarity	250% overrange 150% reverse polarity
LINEARITY	±1.0%	±1.0%	±1.0%
Gains Temperature Coefficient	±0.15%/°C maximum	±0.15%/°C maximum	±0.15%/°C maximum
Zero Temperature Coefficient	±0.01%/°C maximum	±0.01%/°C maximum	±0.01%/°C maximum
Resolution	1%	2%	0.1%
INPUT IMPEDANCE	100K ohms or greater for voltmeters. 100 mV shunt for current meters.	100K ohms or greater for voltmeters. 100 mV shunt for current meters.	100K ohms or greater for voltmeters. 100 mV shunt for current meters.
METER RESPONSE TIME (zero to full scale)	2.5 milliseconds	2.5 milliseconds	2.5 milliseconds
POWER SUPPLY			
Voltage	5.0 Vdc, ±0.25 V – 6 Vdc absolute maximum	5.0 Vdc, ±0.25 V – 6 Vdc absolute maximum	5.0 Vdc, ±0.25 V – 6 Vdc absolute maximum
Typical current	50 mA point 380 mA full bargraph	50 mA point 380 mA full bargraph	60 mA point 450 mA full bargraph and digits
REAR CONNECTOR	Card edge connector supplied. Optional Phoenix #MKDSF 3/3-5.08 connector solderless applications.	Card edge connector supplied. Optional Phoenix #MKDSF 3/3-5.08 connector solderless applications.	Card edge connector supplied. Optional Phoenix #MKDSF 3/3-5.08 connector solderless applications.

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TRENDLINE (Formerly NES) TRI-COLOR BARGRAPHS

Why you Need Color...

Color-changing bargraph calls your attention!

Green* = **SAFE**
Indicates normal operating conditions.

Yellow* = **CAUTION**
Indicates that a problem is developing.

Red* = **WARNING**
Indicates that a problem exists.

The ENTIRE bar changes color!

*NOTE: WARNING, CAUTION and SAFE zone colors are user selectable as red, yellow or green.

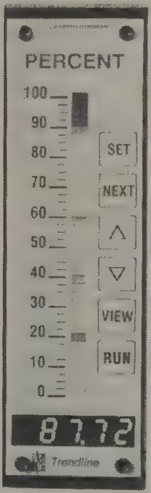
FEATURES

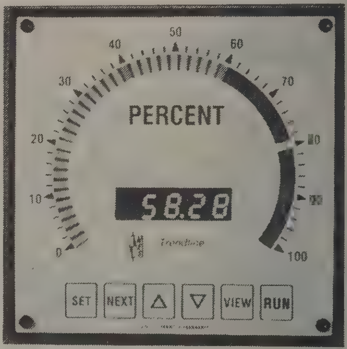
- 115 Vac powered
- Front panel access to set-up controls
- Bar display is 3.7″ (high) × 0.20″ (wide)
- Digital display has 5 green, 7-segment LED characters, 0.30″ in height
- 3 user-selectable bar colors, 4 user-selectable color-change set points
- User-selectable bar display intensity level, decimal point location, center/bottom zero format
- Fully scaleable digital display and bar display
- A socketed scaling resistor can be used to convert a 4-20 mA meter to nearly any analog input
- Various levels of input signal filtering are selectable
- Accuracy: ±0.01% of full scale ±0.3°F (Thermocouple Inputs)

The complexity of modern control rooms can hide problems that occur during a process. The quickest way to spot a problem is to have instrumentation that calls it to your attention. **Color** is the best way to do this. Color has always been used to convey information, such as color coded wires, signal corp flags, stoplights, maps, etc.

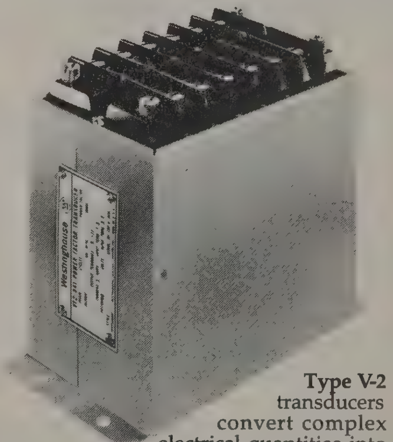
Trendlines are the first meters to offer a color-changing bargraph for immediate problem recognition. Whether you have 2 meters or 2000, the color-changing bargraph allows your operators to spot developing or existing problems immediately.

The time saved through immediate recognition will help prevent equipment damage, reduce down-time and maintenance overhead, and help improve operational safety.





TYPE V2 TRANSDUCERS (Formerly Westinghouse)



Type V-2 transducers convert complex electrical quantities into direct currents which can be measured by conventional indicating instruments. While these devices were designed primarily for combination with Westinghouse panel instruments, they can be used with any other manufacturer's instrument.

Types Available

WATTS

Type VP2-840
Input: 5 amps, 120 volts, 40 50, 60 or 400 Hz and 240 volts, 60 Hz.
Output: 50 mv across 50 ohms, linear.
Response Time: Full output within 0.05 sec.
Single Phase, 500 Watts: 1 element.
Three Phase 3 Wire, 1000 Watts: 2 elements.
Three Phase 4 Wire, 1500 Watts: 2½ elements.
Case: 3.0″ × 5.75″.

FREQUENCY

Type VC2-841
Input: 120 volts with ranges of 59-61, 58-62, 55-65, 50-70, 45-55, 45-65, 390-410, 380-420, 350-450 Hz.
Output: 50 ua per Hz on either side of null, linear. Null at 30% of range upscale from low frequency end. Null may be at a lower value of the listed range, if so specified when ordered.
Case: 3.0″ × 5.75″.

VARS

Type VV2-840
Input: 5 amps, 120 volts, 60 or 400 Hz and 240 volts, 60 Hz.
Output: 50 mv across 50 ohms, linear.
Response Time: Full output within 0.05 sec. 3 Phase cross connected, 1 phase internal phase shift.
Single Phase, 500 Vars: 1 element.
3 Phase 3 Wire, 1000 Vars: 2 elements.
3 Phase 4 Wire, 1500 Vars: 2½ elements.
Case: Single phase, 5.5″ × 5.75″, 3 ph 3w and 3 ph 4 wire, 3.0″ × 5.75″.

POWER FACTOR

Type VF2-841
Input: 5 amps, 120 volts, 60 Hz, 0.5-1-0.5 power factor.
Output: −0.5-0+.5 ma into 110 ohms, linear with respect to phase angle.
Response Time: Full output within 0.1 sec.
Case: 3.0 × 5.75″.
Not applicable for use with VF2-876 filter unit.

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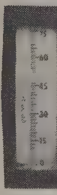
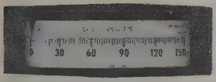
SWITCHBOARD INSTRUMENTS (Formerly Westinghouse)

TYPE 252
4½" Scale Length
1½% Accuracy


Vertical Type (Grouped)


Horizontal Type

APPLICATION

Type 252 edgewise instruments were designed specifically for the nuclear power industry for use on control panels. However, they are well suited to any use where high reliability and efficient use of space are important considerations.

These instruments incorporate into edgewise instruments the same taut-band suspension system which is used in the highest quality Westinghouse portable and switchboard instruments.

They are available in types for direct measurement of standard electrical quantities, or in combination with transducers for measuring any other electrical or mechanical quantity capable of being converted into a proportional electrical quantity.

STANDARDS

The Type 252 instruments meet the flamability requirements of IEEE Standard 420-1973 and they pass the seismic qualification tests under IEEE Standard 344-(1975).

RATINGS (Self-Contained)

Dc: 20 microamperes to 50 amperes
50 millivolts to 800 volts

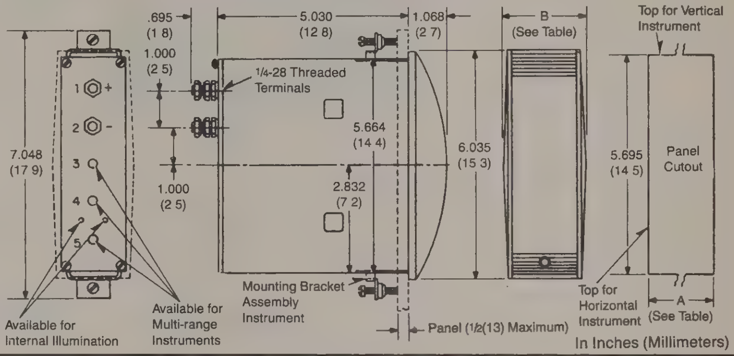
Ac: 10 milliamperes to 20 amperes
5 volts to 600 volts

Transducer-type frequency meters, varmeters, wattmeters.

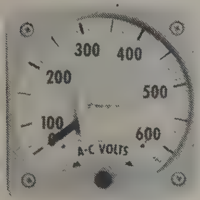
SPECIFICATIONS

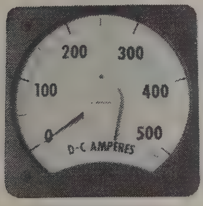
Accuracy	1½% of full scale deflection, horizontal or vertical; ±1% on special order
Waveform Compensation	To 15% of third harmonic content
Instantaneous Overload Capacity	Ac–35 Times Rating Dc–100 Times Rating
Working Voltage to Ground	1200 volts dc, 800 volts ac
Shielding	Magnetically shielded
Scale Length	4.5 inches (11.43 cm)
Net Weight	1½ pounds
Shipping Weight	2½ pounds

OUTLINE AND PANEL CUTOUT DIMENSIONS


.695
(1 8)
1.000
(2 5)
1.000
(2 5)
7.048
(17 9)
5.030
(12 8)
1.068
(2 7)
B
(See Table)
Top for Vertical Instrument
1/4-28 Threaded Terminals
5.664
(14 4)
2.832
(7 2)
6.035
(15 3)
5.695
(14 5)
Panel Cutout
1
2
3
4
5
Available for Internal Illumination
Available for Multi-range Instruments
Mounting Bracket Assembly Instrument
Panel (1/2(13) Maximum)
Top for Horizontal Instrument
A
(See Table)
In Inches (Millimeters)

TYPE K-241
4½-Inch Rectangular
For Commercial Service


KA-241 Ac Voltmeter


KX-241 Dc Ammeter

APPLICATION

The Type K-241 instruments have been designed to achieve the ultimate in reliability and performance. Instruments of this class are recommended for use on electric utility switchboards and control panels for similar industrial service.

Selection of the Type K-241 instruments is indicated whenever there is a need for frequent, accurate, quick readings and where failure in an instrument circuit could affect an associated critical circuit. This is usually the case where current and potential transformers or transducers are shared with devices having protective or control functions.

STANDARDS

The Type K-241 instruments comply with ANSI Standards C39.1 for 1% class switchboard instruments. In such areas as relate to shock, vibration, friction, repeatability and electrical losses most K-241 types will exceed these specifications, because of the improvements inherent in the unique Westinghouse taut-band design.

These instruments satisfy the requirements of IEEE Standard 344 (1975) "Qualification of Class IE Equipment for Nuclear Power Generating Stations."

FEATURES

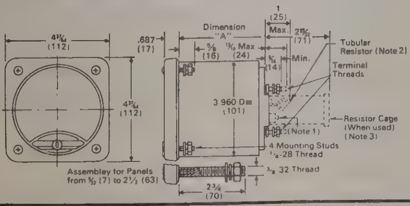
Taut-Band Suspension
All Type K-241 instruments, except those which may rotate continuously, use the Westinghouse-perfected taut-band suspension. Instruments incorporating this feature are identified by the trademark ®. This suspension is a commercial adaptation of the one developed by Westinghouse for Navy HI-Shock service. The taut-band suspension instrument has certain unique advantages over the conventional pivot and jewel types:

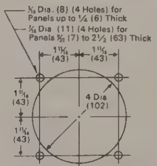
1. It eliminates friction, giving better accuracy and almost perfect repeatability.
2. It gives top performance under adverse conditions of shock and vibration.
3. It permits mounting on apparatus without fear of damage in shipment.
4. It reduces maintenance, thereby saving money throughout the lifetime of the instrument.
5. It assures longer life, reducing annual depreciation and replacement costs.
6. It has greater sensitivity, reducing power burdens on circuits being measured.

Full View Design
To facilitate quick, accurate reading, even under adverse conditions.

Type	Instrument	Dimension	A
KX-241	Dc Instruments	2.813	(71)
KC-241	Rectifier Instruments, Except Transducer Type	2.813	(71)
KA-241	Ac Voltmeters and Ammeters	3.750	(95)
KC-241	Transformer Type Rectifier Ammeter	3.750	(95)
KR3-241	Frequency Meter	3.750	(95)
KX-241	Electrical Resistance Thermometer	3.750	(95)
KI-241	Synchroscope, Single Phase	5.312	(135)
KI-241	Power Factor Meters	5.312	(135)
KP-241	Wattmeters	5.312	(135)
KV-241	Varmeters	5.312	(135)
KJ-241	Power Factor Meters	5.312	(135)

OUTLINE DIMENSIONS/ DRILLING PLAN


4¹⁷⁄₆₄
(112)
4¹⁷⁄₆₄
(112)
.687
(17)
Dimension "A"
⅝
(16)
¹⁵⁄₁₆ Max
(24)
1
(25)
Max.
2²⁵⁄₃₂
(71)
⁹⁄₁₆
(14)
Min.
Tubular Resistor (Note 2)
Terminal Threads
3 960 Dia
(101)
Resistor Cage (When used) (Note 3)
(Note 1)
4 Mounting Studs ¼-28 Thread
Assembley for Panels from ⁹⁄₃₂ (7) to 2½ (63)
⅜ 32 Thread
2¾
(70)


⁵⁄₁₆ Dia. (8) (4 Holes) for Panels up to ¼ (6) Thick
⁷⁄₁₆ Dia (11) (4 Holes) for Panels ⁹⁄₃₂ (7) to 2½ (63) Thick
1¹¹⁄₁₆
(43)
1¹¹⁄₁₆
(43)
1¹¹⁄₁₆
(43)
1¹¹⁄₁₆
(43)
4 Dia
(102)

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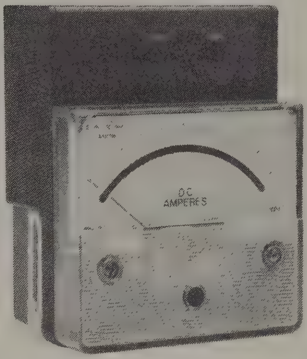
PORTABLE INSTRUMENTS (Formerly Westinghouse)

TYPE P-141 (For Rough Service) Featuring tb Mechanisms

4 Inch, 100° Arc Scale
5¾" x 2¾" x 4½" Case
½ Percent Accuracy Class

SPECIFICATIONS

Accuracy: ½% Class
Insulation Test: 2600 volts rms, terminals to case for one minute.
Scale Length: 4"
Scale Arc: 100°
Shielding: Magnetically shielded.
Dial Position: Horizontal.
Case: Molded from high impact strength ABS resin.
Cover: Molded from high impact strength polycarbonate resin.
Case Size: 5¾" x 2¾" x 4½".
Net Weight: 1½ to 2 pounds.
Shipping Weight: 3½ to 4 pounds.



FEATURES

Shock resistant case and movement make P-141 instruments the perfect choice in situations rough handling may occur.

High overload capacity is designed into the instruments. There are no high resistance spiral springs to anneal when heated with high current. The taut-band and the coil can handle momentary overloads of 35 to 150 times normal. The mechanism will not be damaged by the forces associated with these overloads.

Versatility–Ratings and ranges have been related to the common working levels so that instruments can usually be operated well up on the dial to assure maximum accuracy of reading. Composite scales are provided wherever a single scale would necessitate reading a division as an odd fraction of a measurement unit. Scales are subdivided into units of 1, 2, 5 and their decimals.

MODEL 45 RECORDING VOLTMETER/AMMETER

FEATURES

- Electronic seven-inch circular chart recorder.
- Eight programmable chart time intervals from 1 to 32 days (1, 2, 4, 7, 8, 16, 31 and 32 days).
- Disposable pen, V-pen or sealed inking system.
- Moving iron vane mechanism for true RMS current and voltage measurements.
- Precision pivot and jewel meter suspension.
- Line power or battery power for portability.
- One revolution cutoff to prevent retracing over recorded data.
- Ruggedized aluminum case that is impervious to dust, rain and the elements.
- Panel mount available.
- Electronic carryover mechanism to record measurements in the event of a power failure.

ELECTRICAL

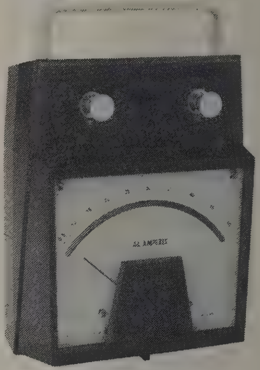
Calibrated Accuracy: 1% F.S.
Response Time: 2.5 sec. max
Clock Power Variation: ±10%
Insulation: 2600 VAC Line to ground.
Operating Temperature: 0-50°C
Humidity: 95% RH
Power Consumption:
Ammeter, 0–5A
@ 5A = 4.1VA
Voltmeter, 90–140V
@ 120V = 10.7VA
Clock Power:
120 Volts A.C. or
240 VoltsA.C.
1.5 Volts D.C.

TYPE P-151 Featuring tb Mechanism

6 Inch, 100° Arc Scale
9" x 7¼" x 3¾" Case
½ Percent Accuracy Class

SPECIFICATIONS

Insulation Test: 2600 volts rms, terminals to case for one minute.
Accuracy: ½% Class
Scale Arc: 100°
Scale Length: 6"
Shielding: Magnetically shielded.
Standard Dial Position: Horizontal.
Case Size: 9" x 7¼" x 3¾".
Net Weight: 3½ to 5 pounds.
Shipping Weight: 5½ to 7 pounds.



FEATURES

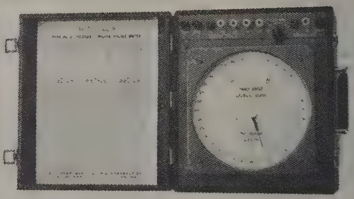
Maintenance-free operation is assured with taut-band suspension. There are no pivots and jewels to be worn in use, damaged by vibration or shock, or to become sticky with dirt.

High overload capacity is designed into the instruments. There are no high resistance spiral springs to anneal when heated with high current. The taut-band and the coil can handle momentary overloads of 35 to 150 times normal. The mechanism will not be damaged by the forces associated with these overloads.

Excellent magnetic shielding–well beyond ANSI specifications.

Versatility–Many ratings and ranges are available. These have been related to working values to permit the instruments to be used in the upper portion of the scales where maximum reading accuracy can be achieved. Scales are subdivided into units of 1, 2, 5 and their decimals to avoid awkward fractional scale readings.

TYPE PI-161 PHASE ANGLE METER



SPECIFICATIONS

- 0-360° phase angle, 4 quadrant-main scale, clockwise current lags voltage.
- Auxiliary scale-power factor beneath degrees-counter clockwise I Leads V.
- Voltage taps 15-30-60-120-240-480 (3 amp tap on voltage coil to measure phase angle between two currents).
- 120% continuous voltage.
- Ampere taps 1-3-10-30 (60 and 120 volt taps on current coil to measure phase angle between two voltages).
- 167% continuous current.
- Accuracy within ±4° at rated current, voltage and frequency.
- Length of scale – 20 inches.
- Burden – 5.6vA on voltage taps, 1.25 vA on current taps.
- Minimum pickup for positive reading is 2% of tap value.
- Dimensions: Length – 12⅝", Depth – 11", Height – 8⁵⁄₁₆".
- Weight – 18 lbs.

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WESCHLER INSTRUMENTS

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AC/DC TONG TEST AMMETERS (Formerly Columbia)

For Measuring AC or DC Current

formerly Columbia Manufacturing

- Instant Readings ■ One Hand Operation
- No Breaking of Circuit ■ No Shunts
- No Transformers ■ Accurate
- Dependable ■ Ranges Changed Quickly

Measures A.C. or D.C. Instantly and Accurately.

Simply by encircling conductor with the tongs and closing them, a clear, accurate reading is instantly registered on the scale. The tongs open by a slight pressure of one finger on the trigger and are self-closing.

Eliminates any Breaking of the Circuit.

Readings are taken without breaking the circuit or insulation. Accurate readings are made even through insulated cables. No shutdowns. No time, labor or production losses while a current measurement is being made.

SPECIAL NOTE: The 600, 800 and 1000 ampere ranges of Types C and D and the 500, 600, 800 and 1000 ampere ranges of Type CS are not universal. If ranges for AC and DC are needed separate ranges must be ordered.

TYPE AX

Accommodates conductors up to 1½″ diameter. Available ampere scale ranges: 0-50, 0-75, 0-100, 0-150, 0-200, 0-300, 0-400, 0-500, 0-600, 0-800, 0-1000. (All ranges for Type AX are for use on both AC and DC)

TYPE D

Accommodates conductors up to 3″ diameter, or bus bars up to 4½″ × ½″ or 4″ × 1″. Available ampere scale ranges: 0-75, 0-100, 0-150, 0-200, 0-300, 0-400, 0-500 for use on both AC and DC; also 0-600AC, 0-600DC, 0-800AC, 0-800DC, 0-1000AC, 0-1000DC.

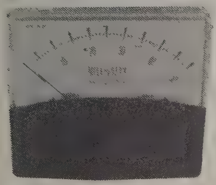
TYPE C

Accommodates conductors up to 2½″ diameter. Available ampere scale ranges: 0-75, 0-100, 0-150, 0-200, 0-300, 0-400, 0-500 for use on both AC and DC; also 0-600AC, 0-600DC, 0-800AC, 0-800DC, 0-1000AC, 0-1000DC.

TYPE CS (Not Shown) Accommodates conductor up to 2½″ diameter. Available ampere scale ranges: 0-75, 0-100, 0-150, 0-200, 0-300, 0-400 for use on both AC and DC, also 0-500AC, 0-500DC, 0-600AC, 0-600DC, 0-800AC, 0-800DC, 0-1000AC, 0-1000DC. Type CS is a modification of the standard Type C Tong Test Ammeter. It has a special reduced lamination section at the top of the tongs which permits placing the tongs around a fuse or conductor where there is a limited space (9/16″ or more) behind the fuse or conductor. The Type C is recommended for best accuracy where clearance behind fuse or conductor is 13/16″ or more.

SPECIALTY METERS (Formerly Parker/Airpax)

RECTANGULAR PANEL METERS



Sizes available: 2 1/2", 3 1/2", and 4 1/2" wide.

MEDALLION PANEL METERS

Sizes available: 2 1/2"and 3 1/2" wide.

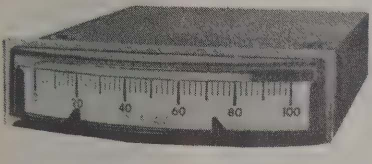
The Airpax meter deserves the phrase "simplicity-of-design." The ultra-thin movement can assemble into a compact meter unit only ½-inch "thin." This unique thin design makes the edge-reading meter ideally suited for high density applications where multiple units may be stacked to conserve space.

The Airpax meter design provides the user with unique surface mounting versatility. The meter has no protruding barrel and can be mounted directly to the panel without complicated panel cutouts.

The inherent rugged design and low mass of the patented movement enable it to withstand acceleration shocks far in excess of other meters. As much as 240G's have failed to affect indicating accuracy. The movement is typically unaffected by continuous electrical overloads.

More than 50 standard ranges in both panel-mount and wdge-reading meters are available. One of these designs may well be your answer to an indicating or control application problem. If you cannot use an existing meter, we will work with you to design a unit to meet YOUR exact specifications.

EDGE-READING METERS



Sizes available for indicating meters are: 1 1/2", 2 1/2", 3", 3 1/2", and 4 1/2" wide and 1/2", 3/4", or 7/8" thick.
Edge-reading control meters are available with 1 or 2 set-points, using contactless solid-state switching with scales and circuits to meet your requirements. Sizes available for control meters: 3 1/2" wide by 7/8" thick.

GENERAL SPECIFICATIONS

	DIRECT CURRENT		ALTERNATING CURRENT	
	CURRENT	VOLTAGE	CURRENT	VOLTAGE
Accuracy	±2%	±2%	±3%	±3%
Tracking	3%	3%	3%	3%
Scale Linearity	(1)	(1)	(1)	(1)
Symmetry (0 center meters)	±2%	±2%	±2%	±2%
Repeatability (2)	1%	1%	1%	1%
Balance	±1%	±1%	±1%	±1%
Resistance Less than 1mA	±10%	NA	NA	NA
Resistance Greater than 1mA	±30%	NA	±10%	NA
Sensitivity (ohms/volt) Less than 250V	NA	500	NA	500
Greater than 250V	NA	1000	NA	1000
Overshoot	0-10%	0-10%	0-10%	0-10%
Response Time Greater than 500µA	2 sec. max.	2 sec. max.	2 sec. max.	2 sec. max.
Response Time Less than 500µA	3 sec. max.	3 sec. max.	NA	NA
Calibration Frequency	NA	NA	60 Hz	60 Hz
Overload Capacity (1 sec.) % of rated value	1000%	NA	150%	NA
Overload Capacity (continuous) % of rated value	150%	120%	120%	120%
Temperature Influence (±10°C from 25°C)	±0.5%	±0.5%	±3%	±3%
Operating Temperature Range (°C)	0-50	0-50	0-50	0-50
Ranges (3)	DC ammeters DC voltmeters AC ammeters AC voltmeters		100µA-15A 50mV-500V 100mA-1A 10V-500V	

NOTES:
(1) All DC panel meters have non-linear scales. All DC edge-reading meters have linear scales, all AC meters have non-linear scales.
(2) Repeatability tolerances are standard. For specials, the value depends on meter size, torque, current, etc.
(3) Accessories available for higher ranges.
(4) All meters exceed or meet ANSI specification No. C39.1.
(5) For additional specifications or details, please consult factory.

WESCHLER INSTRUMENTS
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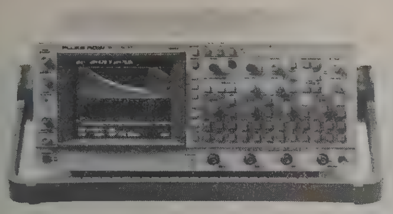
OSCILLOSCOPES

Manufacturer	Starting EEM Page No.	Model/Series	Band-width (MHz)	Rise-time (ns)	Vertical Sensi-tivity (mV/div)	Sweep Rate (µS/div)	No. of Traces	No. of Chan-nels	Lab	Field	Delayed Sweep	Auto	External Trigger	Z-Axis Input	X-Y Display Mode	Storage	IEEE-488 Interface
John Fluke Manufacturing Co.	D•1403	Fluke 90 Series	50	7	1mV/div	.01µs/div	4	2		√	√	√	√		√	√	
		PM3082 & PM3084	100	3.5	2 - 5 2 - 12. 5	5ns/div	4	4	√	√	√	√	√	√	√		√
		PM3092 & PM3094	200	1.75	2-5 2-12	2ns/div	4	4	√	√	√	√	√	√	√		√
		PM3384 & PM3382	100	3.5	2mV/div	200s/div - 2ns/div	4	4	√	√	√	√	√	√	√	√	√
		PM3394 & PM3392	200	1.75	2mV/div	200s/div - 2ns/div	4	4	√	√	√	√	√	√	√	√	√
Hameg Instruments	D•1404		20-100				3	3	√	√	√	√	√	√	√	√	√
Kenwood U.S.A.	D•1406	CS Series/ DS Series	5MHz-150MHz	2.3ns	1mV/div	20ns/div	8	4	√	√	√	√	√	√	√	√	√
Kikusui International Corp.	D•1409	COM7XX1A	200	3.5	1mV/div. - 5V/div.	.01	4	4	√	√	√	√	√	√	√	√	√
		CO50007m	100		5mV/div. - 5V/div.	.05	8	3	√	√	√	√	√	√	√		

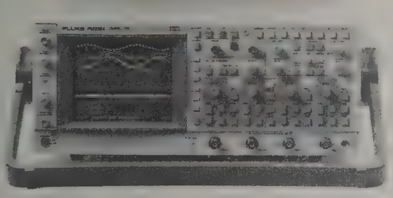
FLUKE®

Oscilloscopes


PM 3094

PM 3082/84 100 MHz & PM 3092/94 200 MHz Analog Scopes

- Choice of 4 models with 100 MHz and 200 MHz bandwidths
- True 4-channel models have 4 complete and independent signal inputs
- Exceptional 1% voltage and timing accuracy
- Autoset for instant, optimized display
- Delayed Time Base with full trigger capabilities
- Powerful cursor measurements with direct numeric readout
- Advanced trigger facilities include HDTV and on-screen trigger level display
- Automatic voltmeter measurements
- Probe recognition, automatic or manually selectable
- Standard RS-232-C interface, IEEE-488.2 optional, full remote capability
- Calibration intervals up to 2 years


PM 3394

PM 3382/84 100 MHz & PM 3392/94 200 MHz CombiScopes™

- Combined analog and digital oscilloscope performance in one instrument
- Up to 200 MS/s sample rate
- 100 or 200 MHz analog and digital bandwidth
- True 4 channel operation
- Extensive TV and logic triggering
- Up to 32K acquisition memory for storage of more than 200 traces
- Real-time Digital Signal Processing (DSP)
- Extensive mathematical functions with FFT optional
- GPIB/IEEE-488.2 (SCPI) interface capability

Vrms AC+DC
+30.95 HLD
+40.23 MAX
+32.32 AVG
+29.04 MIN
95

97

Fluke 90 Series ScopeMeters®

- Scope, meter, or simultaneous meter and scope display
- Dual channel 50 MHz Digital Storage Oscilloscope
- 25 megasamples per second
- 40 nanosecond glitch capture
- 10 front panel set-up memories plus 8 waveform memories with setups
- NEW 15 cursor measurements
- True ac or ac+dc rms measurements to 5 MHz
- Touch Hold®, Change Alert™, and Smoothing™ modes
- Simultaneous acv and dcv voltage display
- NEW Full four digit Counter to 5 MHz
- NEW Min Max Average recording mode with Time Stamp
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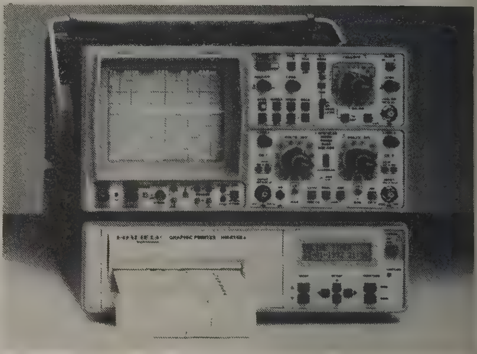
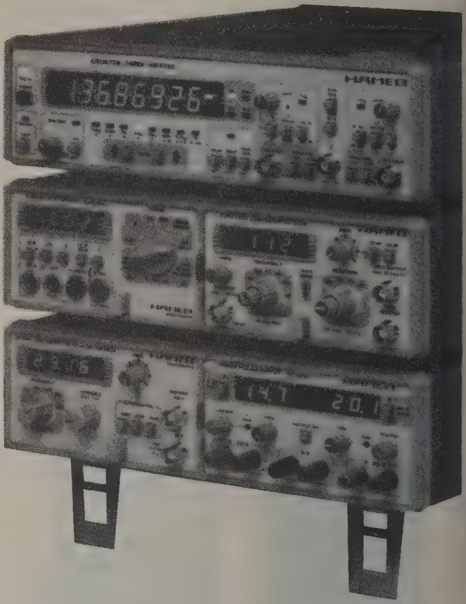
For more than 30 years, HAMEG has been engaged in the manufacture of oscilloscopes and a variety of other test instruments in Germany. HAMEG is known throughout the industry as a supplier of attractively priced instruments based on innovative technology which continues to set new standards of quality and performance.

HAMEG OSCILLOSCOPES



HM203-7	2-Channel 20MHz (analog)/component tester
HM205-3	2-Channel 20MHz (analog/digital), 20MS/s
HM408	2-Channel 40MHz (analog/digital), 40MS/s
HM604	2-Channel 60MHz (analog)
HM1005	3-Channel 100MHz (analog)
HM1007	2-Channel 100MHz (analog/digital), 40MS/s
HD148	Thermal Printer for analog/digital scopes
	Accessories, IEEE-488 + RS232 Interfaces

HAMEG MODULAR SYSTEM – Series 8000



HM8001	Mainframe (power supply) is the "heart" of the System, accommodating any two modules.
HM8011-3	Digital Multimeter 4 1/2 digit
HM8014	Milliohm Meter 200mΩ-20kΩ
HM8018	LC Meter 200µH-200H, 200pF-100µF
HM8021-3	Frequency Counter DC-1,6GHZ
HM8026	Wow and Flutter Meter
HM8027	Distortion Meter, 20Hz-20kHz
HM8028	Spectrum Analyzer 0.5-500MHz
HM8030-4	Function Generator 0.3Hz-3MHz
HM8032	Sine Wave Generator, 20Hz-20MHz
HM8035	Pulse Generator 2Hz-20MHz
HM8038	Tracking Generator for HM8028
HM8040	Power Supply 2x0-20V/0.5A, 5V/1A
HM8042	Transistor Curve Tracer
HM8070	Checkpoint Tester with 5 displays

HAMEG PROGRAMMABLE SYSTEMS – Series 8100

HM8112-2	Multimeter 6 1/2 digit
HM8122	Universal Counter/Timer DC-1GHz
HM8130	Function Generator 10mHz-10MHz
HM8133	RF-Synthesizer 1Hz-1GHz
HM8142	Power Supply 2x0-30V/1A, 5V/2A
	Programmable with opt. interfaces
	Also function as stand-alone units

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eem

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

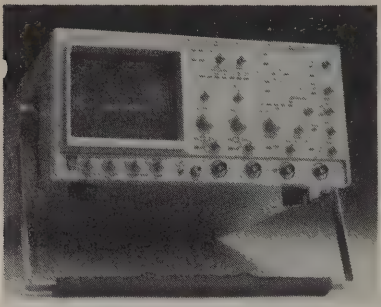
Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

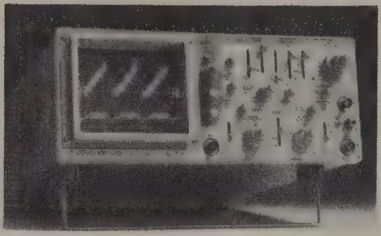
KENWOOD

100 Programmable Steps & NTSC/PAL TV Line Counter Functions



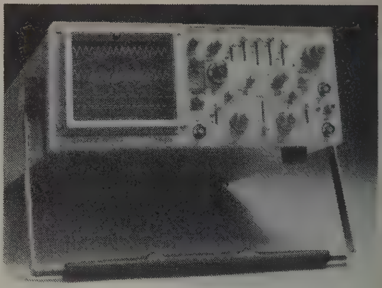
CS-6040: 150MHz, 4-Channel Oscilloscope with Readout & Cursor Measurement.
CS-6030: 100 MHz, 4-Channel Oscilloscope with Readout & Cursor Measurement. The CS-6040/6030 features a maximum of 100 programmable steps of front-panel setting values (20 steps x 5 blocks), which can be read out as required, a TV line counting function extremely valuable in video signal waveform observation, & a trigger counter function useful in digital waveform observation. These scopes display setting values using a CRT readout function, having cursor functions for digital measurements of waveform.

The 100MHz Scope that Proves Simple Can be Better



CS-5170: 100MHz, 2-Channel Oscilloscope with Readout & Cursor Measurement.
CS-5175: 100MHz, 2-Channel Oscilloscope. The CS-5170/5175 have economical pricing & superior performance in a dual channel 100MHz oscilloscope. The CS-5170 offers on-screen digital readout & measurement cursor functions for quick & easy operation. The CS-5175 offers the same performance as the CS-5170 but eliminates the CRT readout & cursors. Vertical-axis sensitivity can be set from 1mV to 5V/div & is continuously adjustable using an attenuator.

Basic Technology, High Quality and Performance



CS-5165: 60MHz, 3-Channel Oscilloscope.
CS-5155: 50MHz, 3-Channel Oscilloscope. These oscilloscopes boast the same high quality that has made even more sophisticated scopes from Kenwood true leaders in their field. The CS-5165/5155 offer a true delayed sweep, a bright CRT, and high sensitivity. These scopes clearly provide functions & performance beyond expectations for instruments in this class, making them truly powerful tools for the engineer. The vertical-axis sensitivity can be set from 1mV to 5V/div, with continuously variable adjustment in between settings.

	CS-6040	CS-6030	CS-5170	CS-5175	CS-5165	CS-5155
Bandwidth	150MHz	100MHz	100MHz	100MHz	60MHz	50MHz
Deflection Factor	1mV/div to 20MHz 5mV/div to 150MHz	1mV/div to 20MHz 5mV/div to 100MHz	1mV/div to 20MHz 5mV/div to 100MHz	1mV/div to 20 MHz 5mV/div to 100MHz	1mV/div to 20MHz 5mV/div to 60MHz	1mV/dv to 20MHz 5mV/dv to 50MHz
No. of Channels	4-Channel.10-Trace	4-Channel/10-Trace	2-Channel/4-Trace	2-Channel/4-Trace	3-Channel/6-Trace	3-Channel/6-Trace
CRT (Accelerating Voltage)	20kV	17kV	12kV	12kV	12kV	12kV
Digital Readout/ Cursor	•	•	•			
Max. Sweep	20ns/div	20ns/div	50ns/div	50ns/div	50ns/div	50ns/div
Delayed Sweep	•	•	•	•	•	•
Trigger Delay	•					
Digital Storage						
Delay Line	•	•	•	•	•	•
V-Mode Alternate Trigger			•	•	•	•
Single Sweep	•	•	•	•	•	•
Magnified Sweep	•	•	•	•	•	•
Automatic Triggering (Fix)	•	•	•	•	•	•
Intensity Modulation	•	•	•	•	•	•
Vertical-axis Signal Output	•	•	•	•	•	•
Variable Holdoff	•	•	•	•	•	•
Video Sync	•	•	•	•	•	•
Line Sync	•	•	•	•	•	•
Power Requirements	AC	AC	AC	AC	AC	AC
Dimensions (W x H x D) mm	310 x 150 x 400	310 x 150 x 400	319 x 132 x 380	319.x 132 x 380	319 x 132 x 380	319 x 132 x 380
Weight	9.0kg	9.0kg	9.2kg	9.0kg	9.2kg	9.2kg

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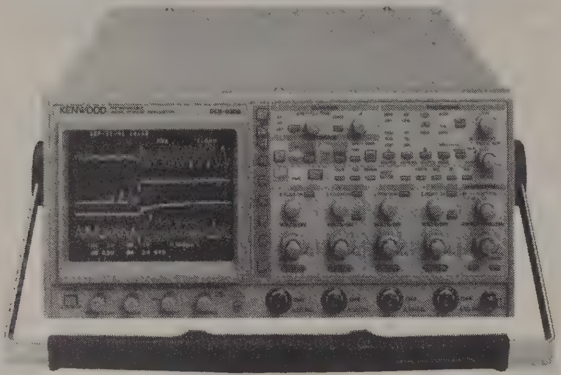
KENWOOD DIGITAL STORAGE OSCILLOSCOPES

DCS SERIES

- 100 MS/s (4Channel Simultaneously)
- GPIB/RS-232C Programmable
- 100 MHz (4 Channel Full Attenuation)
- 16K-word Segmentable Memory



Specifications

(Note: The DCS-9200 and DCS-9120 have 2-channel storage)

Real-time mode			
CRT			
Type		150mm rectangular with internal graticule	
Accelerated voltage		Approx. 17kV	
Effective area		8 x 10 div (1 div = 10mm)	
Vertical amplifier (CH1, CH2, CH3, CH4)			
Sensitivity		5mV/div to 5V/div ±2% (10°C~35°C)	
		1mV/div to 2mV/div ±4% (10°C~35°C)	
Attenuator		1mV/div to 5V/div in 1-2-5 sequence of 12 steps and	
		variable adjustment, with adjustable volume	
Input Impedance		1MΩ ±1%, 23pF ±3pF	
Frequency response			
	DC	DC to 100 MHz (-3dB) (5mV/div to 5V/div)	
		DC to 20MHz (-3dB) (1mV/div, 2mV/div)	
	AC	5Hz to 100MHz (-3dB) (5mV/div to 5V/div)	
		5Hz to 20MHz (-3dB) (1mV/div, 2mV/div)	
Sweep			
Sweep modes		A-sweep	
Sweep time	**A**	20ns/div to 0.5s/div ±2% (10°C~35°C)	
		In 1-2-5 sequence of 23 steps, and variable adjustment	
	B	20ns/div to 50ms/div ±2% (10°C~35°C)	
		In 1-2-5 sequence of 20 steps	
Magnified sweep		10 x ±5% (both A and B)	
Digital storage mode			
Vertical amplifier (CH1, CH2, CH3, CH4)			
Vertical resolution		8 bit (25 dots/div)	
Dynamic range		±5 div	
Frequency response (Single shot event)	**DC**	Effective storage frequency: DC to 40MHz [16MHz] (sine interpolation)	
	AC	Effective storage frequency: 5Hz to 40MHz [16MHz] (sine interpolation)	
Equivalent sampling	**DC**	DC to 100MHz (-3dB) (5mV/div to 5V/div)	
		DC to 20 MHz (-3dB) (1mV/div, 2mV/div)	
	AC	5Hz to 100MHz (-3dB) (5mV/div to 5V/div)	
		5Hz to 20MHz (-3dB) (1mV/div to 2mV/div)	
Rise time		Effective rise time: 16ns [40ns] max (linear interpolation)	
		Equivalent sampling periodic time: 3.5ns	
Memory use in each mode			
NORM sampling		Display memory (data)	2kword/CH (200 dots/div)
		Display memory (REF)	2Kword/CH
		Acquisition memory	16Kword/CH
		REF memory	16Kword/CH
Equivalent sampling		Display memory (data)	2kword/CH (200 dots/div)
		Display memory (REF)	2Kword/CH
		Acquisition memory	2kword/CH
		REF memory	2kword/CH
Roll mode		Display memory (data)	2kword/CH (200 dots/div)
		Display memory (REF)	2Kword/CH
		Acquisition memory	16kword/CH
		REF memory	16kword/CH
Memory backup		Battery back: Approx. 30,000hr at room temperature	
		Acquisition memory	16kword/CH
		REF memory	16kword/CH
Sweep time/display modes			
NORM sampling		20ns/div to 500s/div (20ns/div to 1μs [2μs]/div for expanded range	
		(Max sampling speed: 100MS/s [40MS/s])	
Peak detector		10μs/div 500s/div	
Equivalent sampling		20ns/div to 1μs [2μs]/div	
Roll mode		0.2s/div to 500s/div	
Storage modes			
NORM		Data updated each time an acceptable trigger is received	
SINGLE		Data maintained after storage	
AVG		Arithmetic mean of 2, 4, 8, 16, 32, 64, 128 and 256 cycles	
PEAK		Glitch detection to 50ns	
ROLL		Data continuously recorded and updated on the CRT screen	
Equivalent sampling		Random	
Memory partitioning		2kword x 8 blocks	
Expansion and compression			
Expansion		In hold state, SWEEP TIME/DIV is made faster than current	
		sweep time	
Expansion		Data expansion possible by setting sweep time	
		(expansion of up to 100:1 possible around trigger points)	
Compression		Data can be compressed by setting a sweep time/div slower	
		than the current time in the hold state	
Interpolation		Linear, sine, spline	
Trigger			
Pre-trigger		0 to 80 div (in whole divs; div display or time display)	
		(0 to 10 div with 2Kword memory)	
Post-trigger		0 to 10,000 div (in each div; div display or time display)	
B trigger		B starts after delay	
		B triggered after delay	
		Trigger count: 1 to 2,000 counts	
X-Y			
NORM		DC to 40 MHz [16MHz] (sampling speed variable using	
		sweep time/div)	
Equivalent sampling		DC to 100MHz	
Interfaces			
GP-IB (conforms to IEEE 488-1978 standards)			
Operations		Input/output of waveform data, data output and control	
		for the front panel	
Command set		64 commands	
Data format			
Waveform data		8 bit (same as digital storage mode)	
Cursor data		10 bit (same as readout)	
Analog control data		±1.0 bit (div display section) (% display not specified)	
Prices		7699./6399./9239./7699.	

Specifications subject to change without notice.

ADDITIONAL KENWOOD DSO'S

DCS-9320 100MS/s (2-ch), 100MHz (4-ch)
DCS-9120 50MS/s (2-ch), 100MHz (4-ch)
CS-8010 10MS/s, 20MHz (2-ch)
DCS-9100 50MS/s (4-ch), 100MHz (4-ch)
DCS-8200 20MS/s, 50MHz (2-ch)

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MINIGLOSSARY
CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

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- ☐ Alternate sweep mode
- ☐ Cursor measurements
- ☐ Optional plug-in GPIB or RS-232C interface cards (output only)

Model	Description
COR 5502U	100MHz, DSO, 100Ms/S, 2 channels
COR 5501U	100MHz, DSO, 20Ms/S, 2 channels
COR 5561U	60MHz, DSO, 20Ms/S, 2 channels
COR 5541U	40MHz, DSO, 20Ms/S, 2 channels

Model	Description
COR 5521U	20MHz, DSO, 20Ms/S, 2 channels
COR 5500U	100MHz, Analog only, 2 channels
COR 5560U	60MHz, Analog only, 2 channels

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Model	Description
COS 1610	6" display (no case)
COS 1611	6" display (w/ case)
COS 1711	7" display (w/ case)

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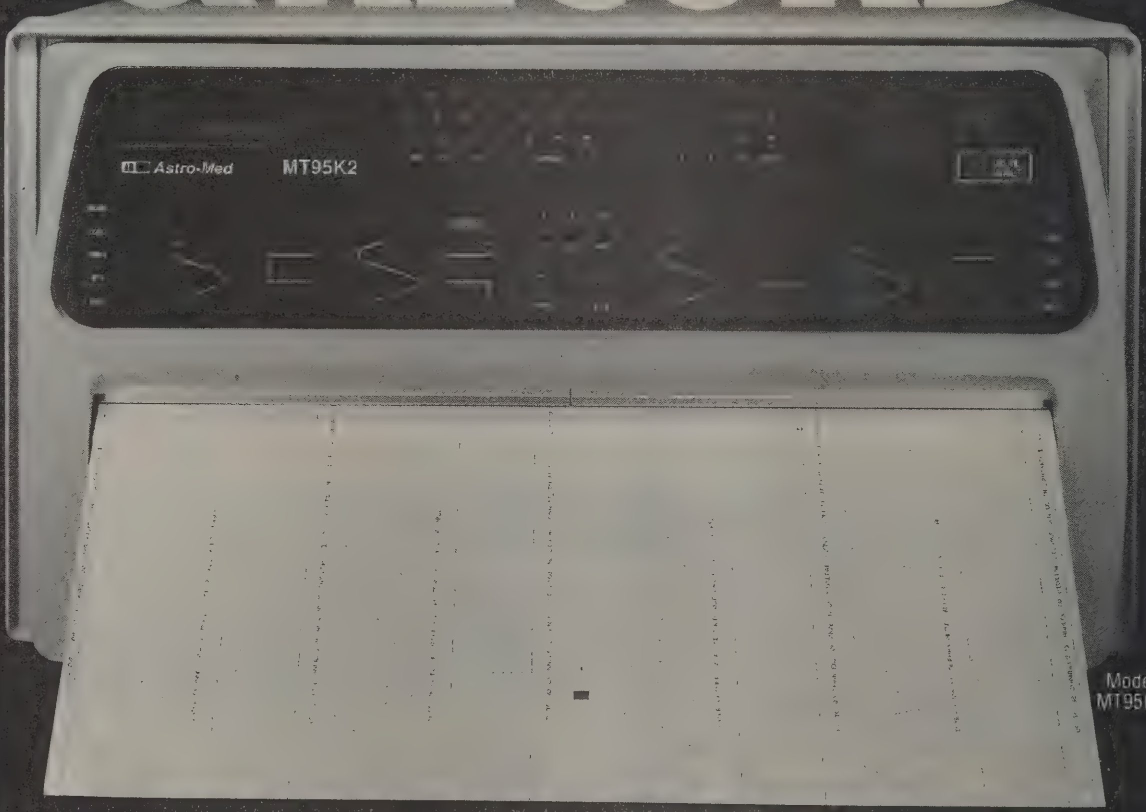

Model MT95K2

- **No Delay…see full traces on monitor while recording!**
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- **Data Capture…up to 32 megabytes in RAM; 120 megabyte internal hard drive; stream to external drive via SCSI**
- **8 to 32 Waveform Channels…plus 64 events; DC to 20 kHz; chart speeds to 500 mm/sec**
- **Laser Printer Chart Resolution…300 dpi; clear, crisp traces**

Put simply, the MT95K2 is another major Astro-Med innovation in "chart recording": you can preview your data, record it, store it, play it back, send it to disk for analysis, record it again, and more! Whether you need a basic 8 channel recorder or a sophisticated 32 channel recording system, the MT95K2 is the perfect platform for you today.

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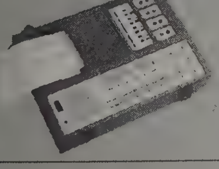
The new Dash 8 Field and Lab Recorder is the world's first and only truly portable eight channel recorder. Powered by an internal battery (or external 120/220 VAC), the Dash 8 is at home anywhere.

The Dash 8 records eight channels of data from DC to 25 kHz real time as well as eight event channels along with eight channels of alphanumeric data.

Traces are clear and sharp under all conditions. There are no pens, no liquids, and no moving parts to break and wear out thanks to Astro-Med's New Technology thermal recording technique.

Other portable field recorders from Astro-Med



Dash IV 4-channel field and lab recorder features real-time frequency response from DC to 25 kHz full scale. Family of plug-in "personality modules" permits recording of temperature, strain, current, voltage, and more

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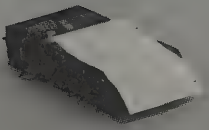

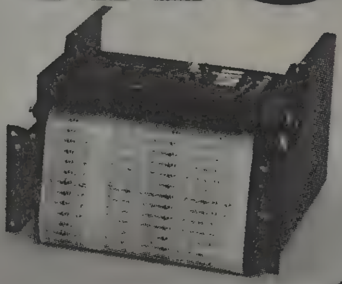

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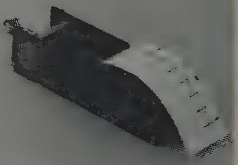

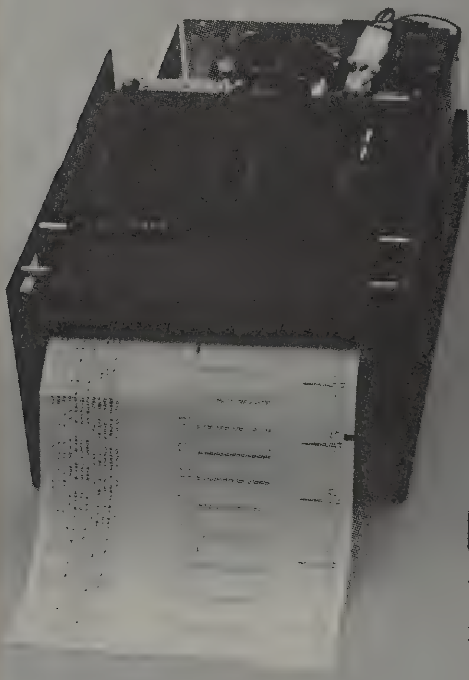

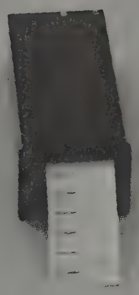

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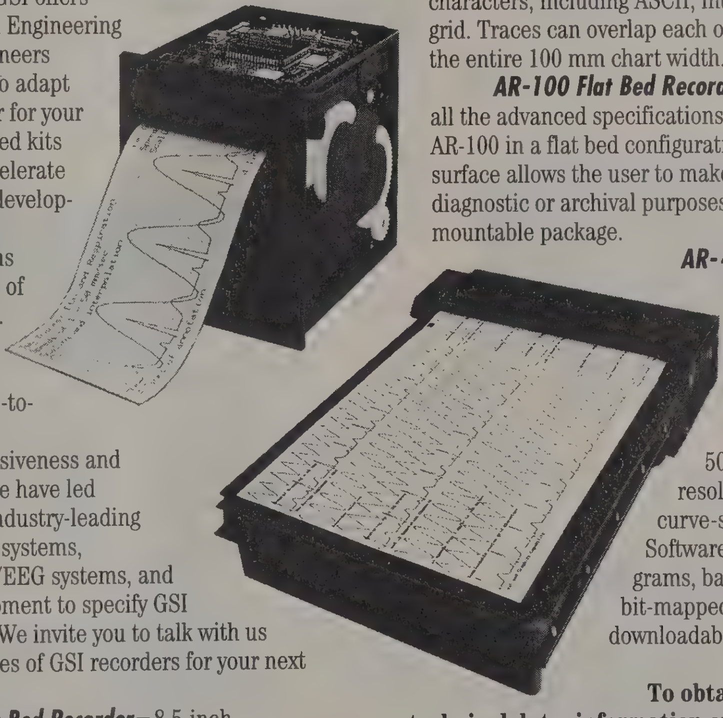

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AR-200 Flat Bed Recorder– 8.5-inch (216 mm), 32-trace recorder, with 12 lines of floating annotation. Prints background, trace, text, bit-mapped graphics at 800 x 200 dpi, and offers chart speeds up to 100 mm/sec. A breakthrough in ease of integration, small size, light weight, and cost. A programmable current limit allows maximum flexibility in host instrument power supply design

AR-42 Recorder– 2-inch (50 mm) recorder. 3 waveforms, up to 8 lines of annotation, chart speeds infinitely adjustable up to 50 mm/sec. Half the size and weight of conventional units. 800 dpi resolution. Parallel, serial, or switch interfaces give the designer more flexibility.

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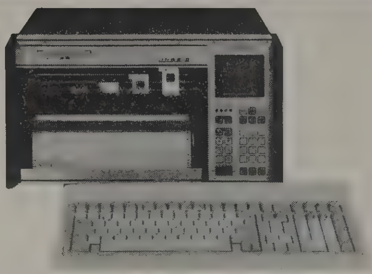

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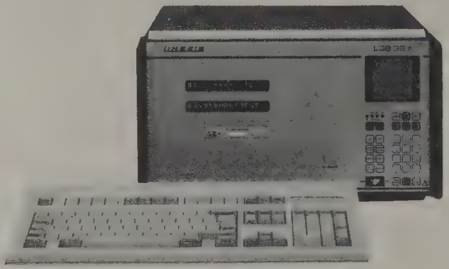

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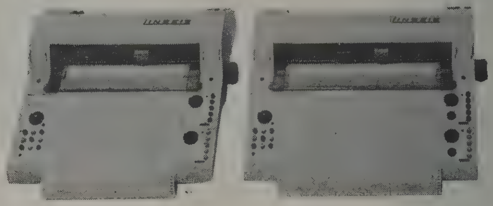
36 channel data logger with floppy and printer

Turn key solution for data logging, storage and evaluation with external color printer



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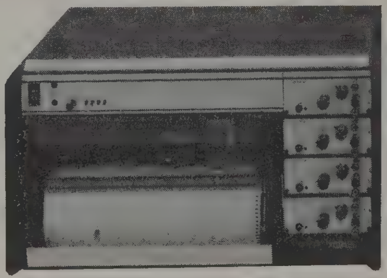

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Economy low-cost vertical rackmount recorder

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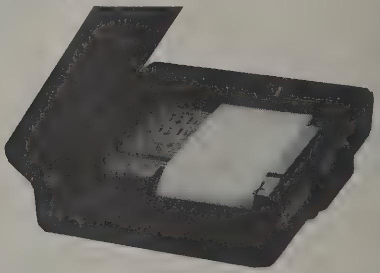

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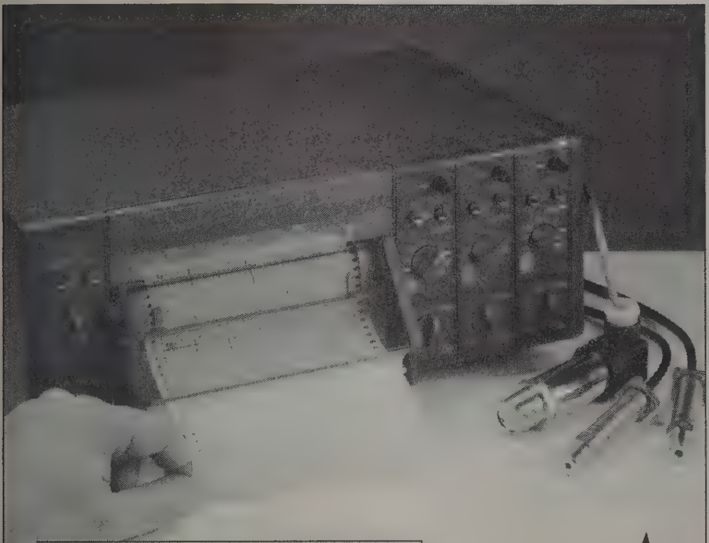

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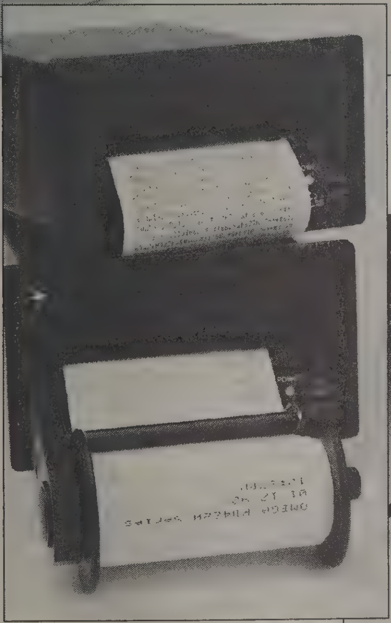

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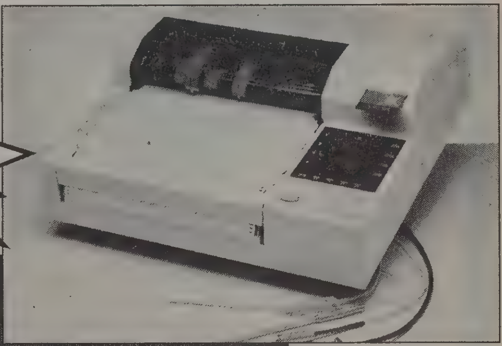

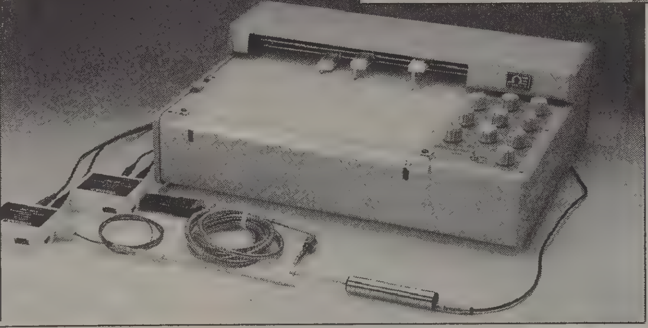

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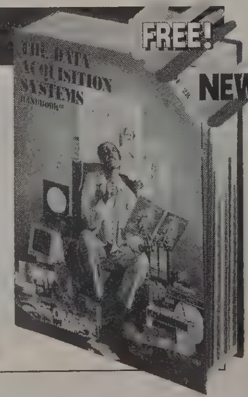

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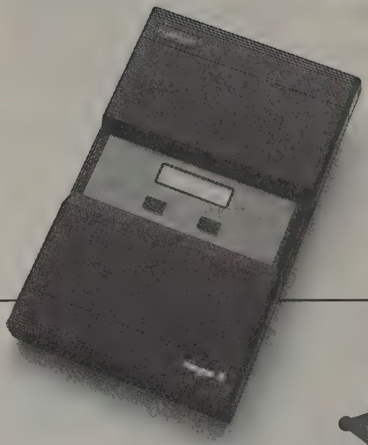

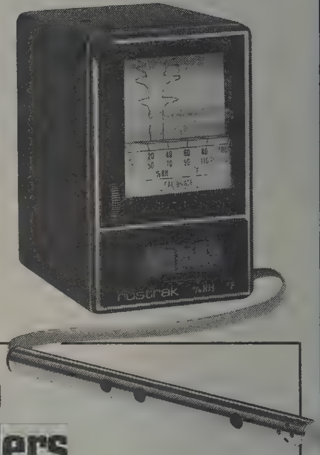

Rustrak Ranger Data Loggers

Rustrak Ranger data loggers are microprocessor-based recording, reporting and analyzing systems. Data is collected, stored in memory and then transferred to a PC. Recording can take place for a year or more. Rangers are rugged enough for use in the harshest environments; their battery operation and compact size also make them ideal for use in remote locations or where space is limited. Easily programmed through just two keys, the Ranger's LCD prompts the operator during the set-up sequence. Pronto software, included free with every data logger, is used for plotting, analyzing, hard copy reporting and storage of the data. Accessories include input modules, probes and tamper-proof and weatherproof enclosures. Available in a 4 channel or an 8 channel analog/digital model with 4 math channels.

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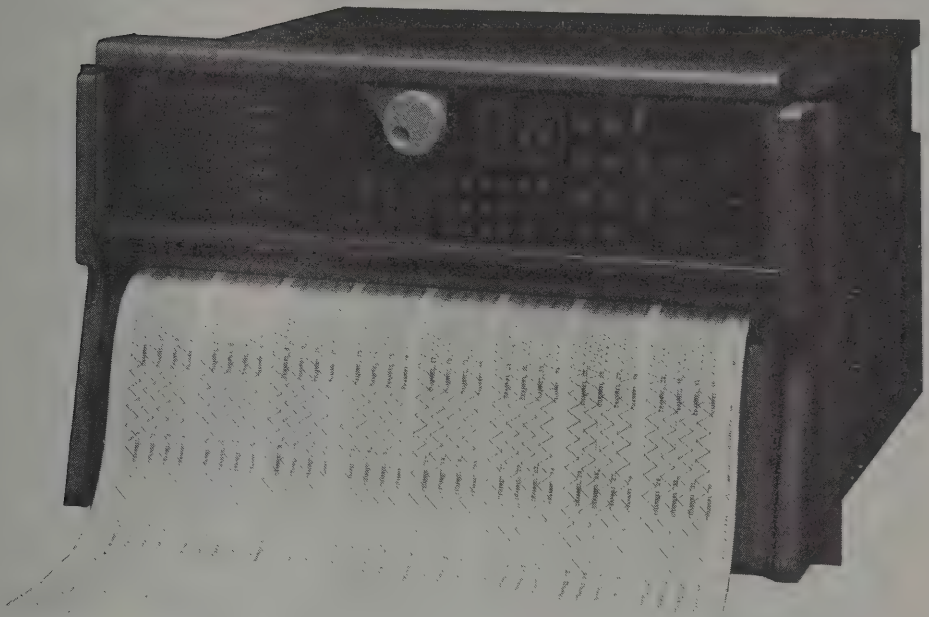

Western Graphtec has the right technology for every challenge: high performance **Arraycorders** with four to 32 channels, as well as a wide selection of field portable models. Proven **Pen Recorders** from one to twelve channels, made for lab and field use. A comprehensive line of **Servocorders**, now including some of the most modern digital models. **Multicorders** and **Hybrid Recorders** for every budget. **X—Y Recorders**, and **Data Acquisition Systems**...and so much more.

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Manufacturer	Starting EEM Page No.	Carbon Zinc	Mercury Oxide	Manganese Dioxide	Alkaline Manganese	Silver Oxide	Zinc Air	Zinc Chloride	Lithium Carbon Monofluoride	Lithium Sulphur Dioxide	Lithium Thionyl Chloride	Lithium Iodine	Lithium Manganese Dioxide	Other Types
Alexander Manufacturing	D•1423	√	√		√	√		√	√	√	√	√	√	
Avex Electronics Inc.	D•1424			√	√					√	√		√	Lithium copper oxyphosphate
Battery Engineering	D•1426										√			
Battery Specialties	D•1427	√	√	√	√	√	√	√	√	√	√	√	√	
Cell-Con	D•1431				√									
Duracell	D•1435				√				√	√	√	√	√	
Eagle-Picher	D•1440								√		√			
Electrochem	D•1447										√			Lithuim: Sulfuryl chloride, bromine complex, custom battery packs
Engineered Assemblies & Components Corp.	D•1448	√	√		√	√	√	√	√	√	√	√	√	
Eveready Battery	D•1450	√	√	√	√	√	√	√	√	√	√	√	√	Lithium/iron sulfide
Gould, Inc.	D•1454												√	
Panasonic Industrial	D•1457	√	√	√	√	√	√	√	√				√	
Plainview Batteries	D•1459				√				√	√	√		√	
Pro-Battery	D•1465	√	√	√	√	√	√	√	√	√	√	√	√	
Power Conversion Inc.	D•1462								√	√	√		√	
Sanyo Energy	D•1472				√								√	
Seiko Instruments	D•1473												√	
Shogyo International Corp.	D•1474	√	√		√	√		√						
Tadiran Electronic Industries	D•1477										√			
Tauber Electronics	D•1480	√	√	√	√	√	√	√	√	√	√	√	√	
TDI Batteries	D•1483										√			Nickel metal hydride

SECONDARY BATTERIES (RECHARGEABLE)

Manufacturer	Starting EEM Page No.	Lead Acid	Nickel Cadmium	Silver Oxide Zinc	Nickel Iron	Silver Oxide Cadmium	Carbon Lithium	Gas Recombinant	Copper Oxide Lithium	Other Types
Alexander Manufacturing	D•1423	√	√							
Avex Electronics Inc.	D•1424	√	√							
Battery Specialtists	D•1427	√	√							
Cell-Con	D•1431		√				√		√	
CSB/USA (Taiwan Kobe Battery Co., Ltd.)	D•1434	√								
Eagle-Picher	D•1440	√								
Engineered Assemblies & Components Corp.	D•1448	√	√							
Eveready Battery	D•1450		√							
Gates Industrial Battery Div.	D•1452	√	√					√		Nickel-metal hydride
Panasonic Industrial	D•1457	√	√				√			Nickel-metal hydride Vanadium lithium
Plainview Batteries	D•1458	√	√					√	√	
Pro-Battery	D•1465	√	√	√				√		
Power Sonic	D•1464	√	√							
SAFT America	D•1467		√							
Sanyo Energy	D•1472		√							Nickel metal hydride (G) Lithium ion
Seiko Instruments	D•1473									Lithium polymer
Shogyo International Corp.	D•1474		√	√						
Tauber Electronics	D•1480	√	√	√	√	√	√		√	
TDI Batteries	D•1483	√	√							
Yuasa-Exide, Inc.	D•1485	√						√		Nickel-metal hydride

G=Gas Recombinant

BATTERY ACCESSORIES & SERVICES OF VALUE ADDED DISTRIBUTORS (VARs)

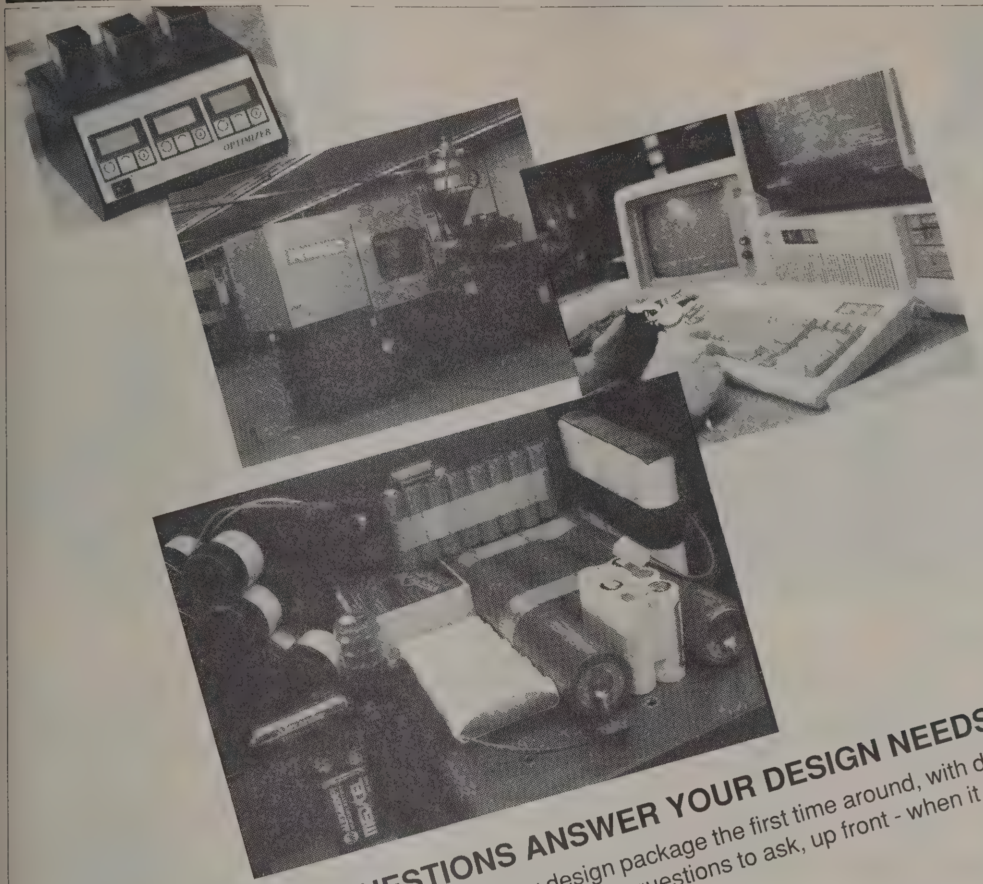
Manufacturer	Starting EEM Page No.	Value Added Reseller		Battery Accessories				Other
		Custom Design	Custom Assembly	Chargers	Analyzers	Holders	Clips	
Alexander Manufacturing	D•1423	√	√	√	√	√	√	
Avex Electronics Inc.	D•1424	√	√					
Battery Engineering	D•1426	√	√					
Battery Specialists	D•1427	√	√	√		√		
Memory Protection Devices	D•1455					√	√	
Plainview Batteries	D•1458	√	√	√		√	√	
Power Conversion Inc.	D•1462	√	√					
Power Sonic	D•1464		√	√				
Pro-Battery	D•1465	√	√	√	√	√	√	
Raychem Corp.	D•1466							Short circuit protection
Sanyo Energy	D•1472	√	√	√				
Seiko Instruments	D•1473		√					
Shogyo International Corp.	D•1474			√		√	√	
Specialty Electronics	D•1475					√		
Tadiran Electronic Industries	D•1477		√					
Tamura Corp. of America	D•1479			√				
Tauber Electronics	D•1480		√	√	√	√	√	
Yuasa-Exide, Inc.	D•1485	√	√	√				

eem

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a] Wh/kg	Capacity[a] Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
[b] Based on fuel consumption only.
[c] Weight of air not considered in computation of watt hours.
[d] Water-activated
[e] Automatically activated; high rate discharge; 2- to 10-min rate.
[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
[g] Four-minute discharge rate.
[h] β-alumina electrolyte, 300°C operation.
[i] Fused salt; 350°C operation.
[j] Solid $RbAg_4I_5$ electrolyte.
[k] Several different cathode materials used.
[l] Fuel consumption is based on source of H_2.
[m] Based on methanol battery-fuel supply in situ.



OUR KEY QUESTIONS ANSWER YOUR DESIGN NEEDS

You'll get the right battery design package the first time around, with delivery to meet your schedule. We know the right questions to ask, up front - when it counts.

23 years experience

Each year Alexander:

- Grades and sorts more than seven million nickel-cadmium cells.
- Assembles more than three million batteries.
- Produces 16 million mercury cells.
- Welcomes FDA inspections.
- Manufactures sophisticated nickel-cadmium battery chargers and analyzers/conditioners.

In-house packaging

Alexander Batteries are packaged with your choice of casing including:

- Shrink-wrapped insulation vinyl.
- Custom-design vacuum formed.
- Custom-designed injection molded. Tools and dies are produced 'in-house'.

Major suppliers

- Alexander
- Emmerich
- Eveready
- Gates (GE)
- Panasonic
- Powersonic
- Rayovac
- Saft
- Sanyo
- Varta

Electrochemical systems

- Alkaline
- Carbon Zinc
- Lithium
- Mercury
- Nickel-Cadmium
- Lead Acid
- Silver Oxide
- Zinc Chloride

Call, fax or write for additional information and design assistance.

Alexander® Batteries
New Product / OEM Division
P.O. Box 28880, San Diego, CA 92128
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PORTABLE BATTERY DIVISION

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CUSTOM PACKS™

AVEX manufactures, assembles, and tests a wide variety of battery packs, custom designed to fit your most exacting specifications. Both AVEX/SAFT, NICAD and LITHIUM Batteries are offered. Voltage ratings from 1.2 on up. Current capacities from 10 mAh to 10 Ah. Contact your AVEX salesperson for more details..

STANDARD CELLS **NICAD**®

Cell Size	Model Type	Model Series No.	.2C Rated Capacity MAH	Charge Rate Range	Temp Range	Discharge Rate Range	Dimensions Diameter inch	Dimensions Diameter mm	Dimensions Height inch	Dimensions Height mm	Weight grams
1/3 AA	VR	023	110	S, Q, R	S	Medium	0.534	13.57	0.660	16.76	4.0
AAA	VR	023	200	S, Q, R	S	Medium	0.380	9.65	1.750	44.45	9.0
1/2 AA	VRE	036	300	S, Q, R	S	Medium	0.535	13.59	1.181	30.00	10.8
1/3 A	VR	023	200	S, Q, R	S	Medium	0.652	16.56	0.655	16.89	10.8
2/3 A	VE	136	600	S, Q, R	S	Medium	0.665	16.90	1.106	28.10	19.0
4/5 A	VE	136	1000	S, Q, R	S	Medium	0.665	16.90	1.669	42.40	28.0
A	VE	026	1000	S, Q, R	S	Medium	0.665	16.90	1.933	49.10	35.0
A	VSE	146	1400	S, Q, R	S	Low	0.665	16.90	1.941	49.30	35.0
AA	VR	023	500	S, Q, R	S	Medium	0.563	14.30	1.980	50.30	24.0
AA	VT	037	500	S, Q, R	H	Low	0.563	14.30	1.980	50.30	26.0
AA	VE	026	600	S, Q, R	S	Medium	0.563	14.30	1.941	49.30	24.0
AA	VRE	036	600	S, Q, R	S	Medium	0.563	14.30	1.980	50.30	26.0
AA	VE	126	700	S, Q, R	S	Medium	0.563	14.30	1.941	49.30	24.0
AA	VSE	146	800	S, Q	S	Low	0.563	14.30	1.980	50.30	26.0
Cs	VR	033	1300	S, Q, R	S	Medium	0.875	22.23	1.661	42.20	49.0
Cs	VT	037	1300	S, Q, R	H	Low	0.882	22.40	1.665	42.30	52.0
Cs	VE	026	1400	S, Q, R	S	High	0.875	22.23	1.665	42.30	49.0
Cs	VE	126	1700	S, Q, R	S	High	0.882	22.40	1.665	42.30	49.0
Cs	VY	125	1400	S, Q, R	S	High	0.882	22.40	1.665	42.30	49.0
Cs	VY	025	1200	S, Q, R	S	High	0.882	22.40	1.665	42.30	52.0
Cs	VY	125	1400	S, Q, R	S	High	0.882	22.40	1.665	42.30	52.0
1/2 C	VR	033	700	S, Q, R	S	Medium	1.008	25.60	0.945	24.00	31.0
3/5 C	VR	033	1000	S, Q, R	S	Medium	1.008	25.60	1.161	29.50	40.0
C	VR	033	2000	S, Q, R	S	Medium	1.008	25.60	1.953	49.60	68.0
C	VT	037	2000	S, Q, R	H	Low	1.008	25.60	1.882	47.80	68.0
C	VE	026	2200	S, Q, R	S	Medium	1.008	25.60	1.882	47.80	68.0
C	VRE	036	2300	S, Q, R	S	Medium	1.008	25.60	1.882	47.80	68.0
1/2 D	VR	033	2200	S, Q, R	S	Medium	1.272	32.30	1.448	36.80	80.0
1/2 D	VT	037	2200	S, Q, R	H	Low	1.272	32.30	1.448	36.60	80.0
2/3 D	VR	023	2500	S, Q, R	S	Medium	1.284	32.60	1.709	43.40	105.0
D	VR	033	4500	S, Q, R	S	Medium	1.276	32.40	2.295	58.30	147.0
D	VRE	036	4500	S, Q, R	S	Medium	1.276	32.40	2.295	58.30	150.0
D	VR	023	4000	S, Q, R	S	High	1.284	32.60	2.378	60.40	147.0
D	VE	026	4500	S, Q, R	S	High	1.284	32.60	2.299	58.40	150.0
D	VE	126	5000	S, Q, R	S	Medium	1.284	32.60	2.299	58.40	154.0
F	VT	037	7000	S, Q, R	H	Low	1.284	32.60	3.512	89.20	231.0
F	VR	023	7000	S, Q, R	S	Medium	1.284	32.60	3.590	91.20	231.0
10SF	VR	023	10000	S, Q, R	S	High	1.630	41.40	3.508	89.10	390.0

At Avex, every day is ***Earth Day.*** *To help you promote a better* ***environment,*** *AVEX offers the* ***latest information*** *on* ***recycling*** *and disposal of NICAD® batteries at no charge. Consult your APB sales person for more details.*

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PORTABLE BATTERY DIVISION

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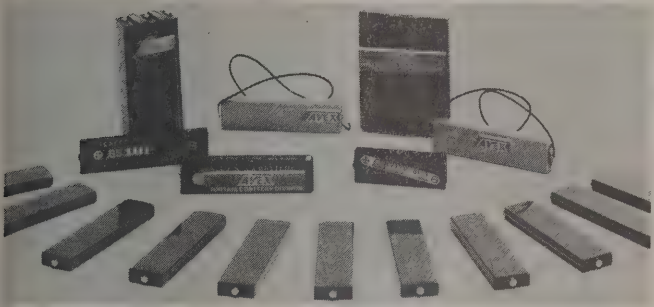
AVEX/SAFT introduces The World's First *Flat* Nicad Cell!



PRISMATIC NICAD CELL'S G.P. SERIES

THIS FLAT CELL DESIGN AFFORDS 30% HIGHER VOLUME EFFICIENCY when compared to regular cylindrical cells. G.P. SERIES cells can be made into a multitude of packs.
Consult your AVEX salesperson for more details.

Cell Size	Model Type	Model Series No.	.2C Rated Capacity MAH	Charge* Rate Range	Temp** Range	Discharge*** Rate Range	Length inch	Length mm	Dimensions Width inch	Dimensions Width mm	Thickness inch	Thickness mm	Weight grams
GP 4E	Prismatic	021	400	SQR	S	M	1.890	48.0	0.646	16.4	0.220	5.6	16
GP 6E	Prismatic	021	600	SQR	S	M	2.638	67.0	0.646	16.4	0.220	5.6	23
GP 9E	Prismatic	021	900	SQR	S	M	2.638	67.0	0.646	16.4	0.307	7.8	30
GP 20E	Prismatic	021	2000	SQR	S	M	2.638	67.0	0.646	16.4	0.646	16.4	58

Avex/Saft solid cathode lithium cells offer performance characteristics unequaled by other battery systems—over ten years shelf life, operating temperatures from -40°C to +175°C, three voltage levels, high energy densities, and low self discharge rates. Ideal for many applications such as utility meters, oil well logging equipment, memory backup, alarms, and military equipment.

SAFT offers many systems:
LC = Lithium Copper Oxide (-40°C to +85°C);
LCP = Lithium Copper Oxyphosphate (-40°C to 85°C);
LM = Lithium Manganese Dioxide (-20°C to +50°C);
LS = Lithium Thionylchloride (-40°C to +85°C)

Note: Special cells are designed for use up to 135°C and 175°C.

	Model	Standard Size	Nominal Voltage	Rated Capacity (Ah)	Maximum Dimensions Diameter Inch	Diameter mm	Length inch	Length mm	Weight oz.	Weight gr.	*Features
LC SERIES	LC3	1/2AA	1.5	1.40	0.571	14.5	1.020	26.0	0.26	7.3	B
	LC6	AA	1.5	3.30	0.571	14.5	1.990	50.5	0.61	17.4	B,
LCP SERIES	LCP3	1/2AA	2.5	0.950	0.571	14.5	1.020	26.0	0.25	7.0	B,
	LCP6	AA	2.5	2.30	0.571	14.5	1.990	50.5	0.60	17.0	B,
	LCP6 HT	AA	2.5	1.90	0.571	14.5	1.990	50.5	0.63	18.0	B,GTM,HT
	LCPH14 HT	C	2.5	4.50	1.032	26.2	1.969	50.0	1.94	55.0	S,GTM,HT
LM SERIES	LSC2650M	C	3.0	4.50	1.024	26.0	1.969	50.0	2.0	54.0	F,S,HR,GTM
	LSC3460M	D	3.0	10.0	1.339	34.0	2.362	60.0	3.5	160.0	F,S,HR,GTM
LS SERIES	LS3	1/2AA	3.6	0.850	0.571	14.50	1.02	26.0	.30	8.5	B,UL,GTM
	LS6	AA	3.6	1.800	0.571	14.50	1.99	50.5	.54	15.4	B,UL,GTM
	LSH14	C	3.6	5.00	1.032	26.20	1.97	50.0	1.96	56.0	S,F,HR,UL,GTM
	LSH20	D	3.6	12.50	1.330	33.60	2.41	61.1	3.06	98.0	S,F,HR,UL,GTM

***FEATURES**
F = Integral Fuse
S = Spiral Construction
HT = High Temperature (175°C)
HR = High Rate
GTM = Glass to Metal Seal
B = Bobbin Construction
E = Epoxy Encapsulated
GC = Gold Plated Contacts
MT = Medium Temperature (135°C)
UL = UL Recognized Component
(File #MH12609)

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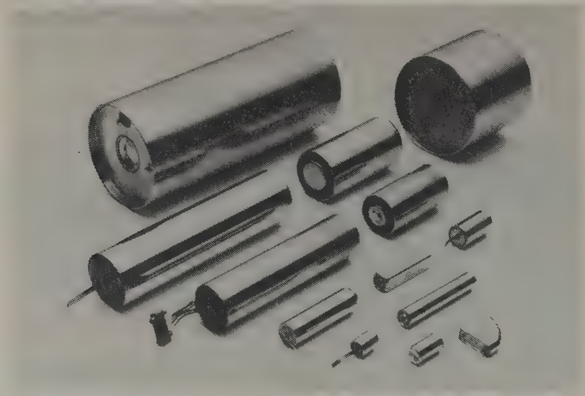


FEATURES

- High energy density
- 304 L Stainless Steel construction
- Hermetic reinforced glass-to-metal seals
- 10 year shelf life
- High reliability
- Stable operating voltage (3.67 open circuit voltage)
- Wide operating temperature (-55°C to +200°C)
- Ability to withstand vibration and high G shock
- Inspection to MIL-1-45028 available

ADDITIONAL SERVICES AVAILABLE

- Custom design and fabrication of cells
- Packaging of cells into custom battery packs
- Contract funded research

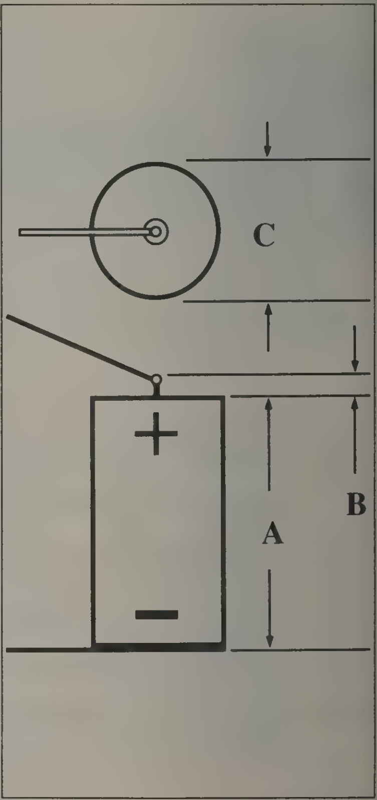
Battery Engineering, Inc., a manufacturer of standard and custom-designed lithium batteries, is committed to the development, engineering, and production of high energy density power sources for industrial, medical, and military applications.

A pioneer in Lithium Technology since 1977, Battery Engineering has been at the forefront of the design and packaging of lithium batteries. Today, Battery Engineering has state of the art facilities, and extensive engineering, quality control and R&D capabilities.

Lithium/Thionyl Chloride Batteries offer distinct advantages over other battery systems, the most significant being low self-discharge, high reliability, and the highest energy density of any electrochemical power source.

Engineering for Safety: Battery Engineering's batteries will perform safely if they are operated within the guidelines as described in the free brochure, *Safety First: A Manual for the Safe Storage and Handling of Lithium/Thionyl Chloride Batteries.*

TYPE	A (mm)	B (mm)	C (mm)	Capacity	Volume (cc)	Weight (g)
GENERAL PURPOSE TYPES (-55°C to +100°C)						
10-12	12.0	3.0	9.5	0.14	0.9	2.7
10-18	18.0	3.0	9.5	0.3	1.4	3.8
10-25	25.4	3.0	9.5	0.55	2.0	4.3
10-35	34.8	3.0	9.5	0.75	2.7	6.5
10-42 (AAA)	42.0	3.0	9.5	0.9	3.3	7.6
10-54	54.0	3.0	9.5	1.2	4.2	8.5
13-38	38.1	3.3	12.7	1.3	5.0	12.4
14-24 (1/2 AA)	24.0	3.3	13.5	0.85	3.7	10
14-48 (AA)	48.3	3.3	13.5	1.8	7.4	19
26-48 (C)	48.5	0	25.4	7	26	52
26-102 (CC)	101.6	0	25.4	16	54	100
33-60 (D)	57.9	0	31.8	12	51	105
33-127 (DD)	125.1	0	31.8	28	108	220
64-152 (#6)	152.4	0	64.3	135	489	950
HIGH TEMPERATURE TYPES (-40°C to +100°C)						
14-24HT	24.0	3.3	13.5	0.75	3.7	10
14-50HT (AA)	50.0	3.3	13.5	1.6	7.4	19
21-100HT	101.6	0	20.6	7	35	73
25-48HT (C)	48.5	0	24.6	5.5	24	50
25-102HT (CC)	101.6	0	24.6	11.5	50	95
26-48HT (C)	48.5	0	25.4	6	26	52
26-76HT (3/2C)	76.2	0	25.4	9	40	85
26-102HT (CC)	101.6	0	25.4	14	54	100
33-60HT (D)	57.9	0	31.8	11	51	105
33-76HT (5/4D)	76.2	0	31.8	16	65	136
33-127HT (DD)	125.1	0	31.8	24	108	220
MODERATE RATE TYPES (-40°C to +150°C)						
26-48MR (C)	48.5	0	25.4	6.5	26	52
26-76MR	76.2	0	25.4	11	40	85
26-102MR	101.6	0	25.4	16	54	100
33-60MR (D)	57.9	0	31.8	12	51	105
33-76MR	76.2	0	31.8	16	65	136
33-127MR	125.1	0	31.8	28	108	220



* All types also available with maximum temperature ratings of 180°C and 200°C.
* Capacity will vary depending on the current drain and temperature.

PERFORMANCE • SAFETY • POWER • RELIABILITY

BATTERY
ENGINEERING, INC.

1636 HYDE PARK AVENUE, HYDE PARK, MA 02136
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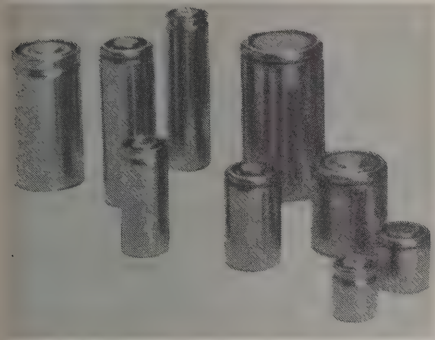
The Lithium Power Source

BATTERY SPECIALTIES

Leadership in Portable Power Solutions

SEALED RECHARGEABLE NICKEL CADMIUM BATTERIES

Gates Energy Products



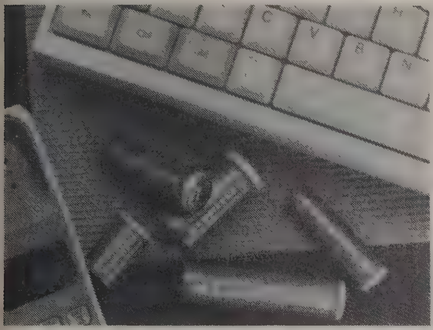
- Nominal cell voltage 1.2V.
- Standard range for use up to +50°C (cell temperature)
- Goldtop High temperature cells range up to +70°C (cell temperature)
- The sizes shown are maximum overall bare cell dimensions.
- Fast charge systems will require charge control for high rate termination.

ULTRAMAX™ Cells (GL-Series)
Premium performance for maximum runtime in high technology portable electronic products.

Model Number	Cell Type	Capacity (mAhr) 0.2C min.	1.0C min.
GL-600A	2/3A	600	550
GL-800AA	AA	800	725
GL-1000A	4/5A	1000	900
GL-1200A	A	1200	1050
GL-1700A	4/3A	1700	1500
GL-2000CS	Cs	2000	1800
GL-5700	D	5000	5700

- **Valumax cells (G-Series)-** Excellent performance at a standard price provides value.
- **Valumax Fast Charge Cell (GF-Series)-** Valumax performance with fast charge capability
- **GE Max Cells (GX-Series)-** High power delivery for demanding applications
- **GoldTop Cells (GH-Series)-** Excellent life at high temperature applications

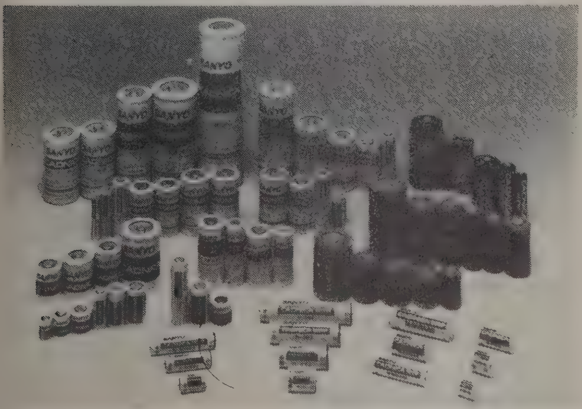
HYDRITECH



NICKEL HYDRIDE CELLS
Long run times for demanding applications.

Model Number	Cell Type	0.2C typical
GMH-950AA	AA	950
GMH-1100AA	AA	1100
GMH800A	2/3A	800
GMH-1400A	4/5A	1400
GMH-1600A	A	1600
GMH-2000A	4/3A	2000
GMH-2200A	4/3A	2200
GMH-2400CS	Cs	2400

SANYO **Cadnica Batteries meet your design requirements.**



- Over 73 Models
- Capacities from 50 MaH to 20,000 MaH
- Temperature range from -20°C to +70°C
- Extra series provides 40% higher capacities
- Slim series flat oblong shape for higher energy density for the space.
- Over 500 charge/discharge cycles
- Assembled to your custom design

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BATTERY SPECIALTIES

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RECHARGEABLE SEALED LEAD ACID BATTERIES

Gates Energy Products

Genesis™

"Application Built" — Rechargeable Sealed-Lead Battery

- Sixty percent greater power density at high rates of discharge when compared to conventional sealed-lead batteries.
- Greater power density allows the UPS designer to downsize by thirty to fifty percent.
- High reliability coupled with "office-compatible" convenience for distributed UPS systems.

APPLICATIONS

HrD Series - High Rate Discharge
CyD Series - Extended Cycle/Service life
ExD Series - High temperature & vibra- Applications

Primary applications for the Genesis G12V120W15 & G12V190W15 are uninterruptible power supplies used as distributed power backup systems, especially for medium-computer and network PC applications.

Power Output

G12V120W15

5 Minute-250 watts/cell 1500 watts/battery
10 Minute-190 watts/cell 1140 watts/battery
15 Minute-120watts/cell 720 watts/battery

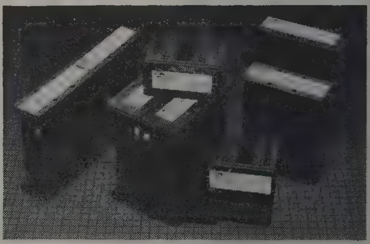
G12V190W15

5 Minute-350 watts/cell 2100 watts/battery
10 Minute-280 watts/cell 1680 watts/battery
15 Minute-190 watts/cell 1140 watts/battery

Gates Energy Products

CYCLON AND MONOBLOCS

- High Capacity- 2.5 to 25 AH
- Long Life-
  Float- Up to 10 years
  Cyclic-200-2000 dependent on depth of discharge.
- Wide Temperature Range- -65°C to +65°C
- Flexible Designs- Voltage and configuration to your specification



POWER PS SONIC

FEATURES

- Suspended Electrolyte
- Leak Proof
- Easy Handling
- Overcharge Protection
- Cycle or Float Applications
- High Discharge Rate
- Compact and Rugged
- Extended Shelf Life

EAGLE EP PICHER

Carefree®

RECHARGEABLE BATTERY

MADE IN U.S.A.

Carefree magnum
EAGLE PICHER
Carefree UPS
RECHARGEABLE BATTERY

- Performs to Rated Capacity on First Cycle.
- Largest Selection of Sealed, Rechargeable Lead Acid Batteries
- Lead Calcium Grid. Constant Charge Characteristics Throughout Life.
- Long Life and High Reliability

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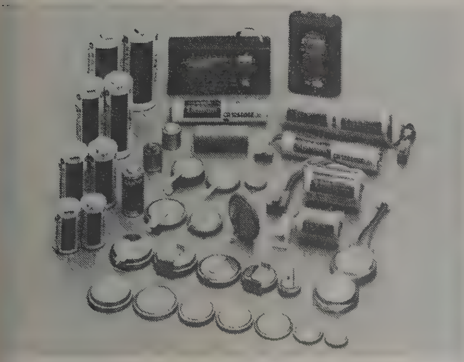
BATTERY SPECIALTIES

Leadership in Portable Power Solutions

LITHIUM BATTERIES

SANYO Lithium



- 3V operating voltage
- -40° to +85°C temperature range
- Laser seal construction
- 35-5000 MaH - primary capacities
- 12-90 MaH - rechargeable capacities
- Various termination styles

EAGLE EP PICHER

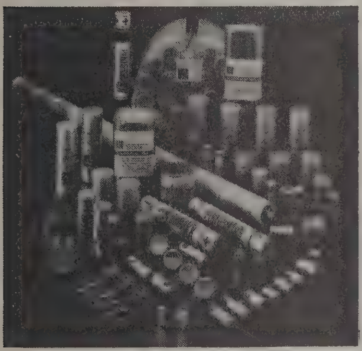
Keeper II®

- Highest utilization of valuable board space compared to cylindrical cells
- Wave solderable up to 5 seconds
- Hermetically sealed
- Capacity 350-1750 Mah
- 3.5V operating voltage

Electrochem

ELECTROCHEM INDUSTRIES

Lithium Systems



- Widest variety of lithium technologies and chemistries
- Sizes DD's-button cells
- Capacities: 200 MaH-300 AH
- Temperatures: -40°C to 150°C
- Operating voltage: 3.0-3.8VDC

TADIRAN

Lithium Inorganic Batteries

- Hermetically sealed
- 3.6 V operating voltage
- 370 to 27000 MaH
- Temperature range: -55°C to +85°C

BATTERY SPECIALTIES

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	**D**•2221
Batteries, Product Selection Guide	**D**•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C**•1003
Capacitors, Product Selection Guide	**A**•1003
Coils, Chokes, Inductors, Product Selection Guide	**A**•1179
Connectors, Terminals & Sockets, Product Selection Guide	**C**•1139
Cores, Magnets & Ferrites	**A**•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A**•1326
DC-DC Converters	**D**•2049
DC Power Supplies, Product Selection Guide	**D**•1488
Delay Lines, Product Selection Guide	**A**•1513
Discrete Semiconductors, Product Selection Guide	**A**•2130
Displays, Readouts, & CRTs, Product Selection Guide	**B**•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C**•1557
Fiber Optics, Product Selection Guide	**B**•1200
Filters, Power, Product Selection Guide	**A**•1584
Filters, Signal, Product Selection Guide	**A**•1617
Instruments, Test & Measuring, Product Selection Guide	**D**•1215
Interconnection Systems, Product Selection Guide	**C**•1670
Keyboards & Keypads, Product Selection Guide	**B**•1818
Lamps, Lights, & Indicators, Product Selection Guide	**B**•1131
Microwave Components, Product Selection Guide	**A**•1719
Military Qualified Products List	**B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide	**B**•1231
Oscilloscopes, Product Selection Guide	**D**•1402
Panel Hardware, Product Selection Guide	**C**•1522
Panel Meters, Analog & Digital, Product Selection Guide	**D**•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A**•2053
Power Supplies, AC, Product Selection Guide	**D**•2221
Power Supplies, DC, Product Selection Guide	**D**•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B**•1341
Relays, Product Selection Guide	**B**•1401
Resistors, Product Selection Guide	**A**•1859
Solenoids, Product Selection Guide	**B**•1626
Switches, Product Selection Guide	**B**•1658
Thermal Components, Product Selection Guide	**B**•1857
Transducers & Encoders, Product Selection Guide	**B**•1911
Transformers, Product Selection Guide	**A**•2229
Wire & Cable, Product Selection Guide	**C**•1701

BATTERIES

SANYO
CADNICA
CADNICA SLIM

Custom Battery Packs

- Nickel Cadmium
- Nickel Metal Hydride
- Lithium
- Alkaline

Cell-Con battery packs carry a full 1-year warranty. We provide prototypes within several days of stocked cells and offer competitive pricing with responsible service.

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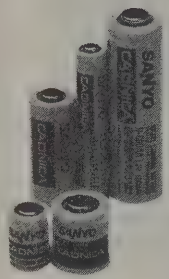
SANYO
Nickel-Cadmium

(Ratings of CADNICA Batteries)

General-use CADNICA batteries (Standard Series)

Type	Model	Nominal voltage (V)	Capacity (mAh) at 0.2C rate		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions				Weight (approx. g)
										Including tube		Bare cell		
			Min.	Typ.	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Dia. (D) (mm)	Height (H) (mm)	Dia. (D) (mm)	Height (H) (mm)	
	N-50AAA	1.2	50	55	5	14-16	15	4-6	55.0	$10.5^{0}_{-0.5}$	16.0^{0}_{-1}	10.0±0.2	15.0±0.3	3.5
	N-110AA	1.2	110	120	11		33		30.0	$14.5^{0}_{-0.5}$	17.0^{0}_{-1}	14.0±0.2	16.7±0.3	8
	N-120TA	1.2	120	130	12		36		34.0	$7.8^{0}_{-0.5}$	42.5^{0}_{-1}	7.5±0.2	41.8±0.3	7
	N-150N	1.2	160	170	15		45		27.0	$12.0^{0}_{-0.5}$	29.5^{0}_{-1}	11.5±0.2	28.5±0.3	9
	N-200AAA	1.2	200	220	20		60		21.0	$10.5^{0}_{-0.5}$	$44.5^{0}_{-0.5}$	10.0±0.2	43.7±0.3	10
	N-200A	1.2	200	225	20		60		20.0	$17.0^{0}_{-0.5}$	17.0^{0}_{-1}	16.5±0.2	16.3±0.3	11
	N-270AA	1.2	270	305	27		81		15.0	$14.5^{0}_{-0.5}$	30.0^{0}_{-1}	14.0±0.2	29.5±0.3	14
	N-500A	1.2	500	525	50		150		9.0	$17.0^{0}_{-0.5}$	28.0^{0}_{-1}	16.5±0.2	27.8±0.2	20
	N-600AA	1.2	600	650	60		180		12.0	$14.2^{0}_{-0.5}$	50.0^{0}_{-1}	13.8±0.2	49.5±0.3	24
	N-600AAL	1.2	600	650	60		180		12.0	$14.2^{0}_{-0.5}$	48.7^{0}_{-1}	13.8±0.2	48.2±0.3	24
	N-650SC	1.2	650	700	65		–	–	6.0	23.0^{-0}_{-1}	26.0^{0}_{-1}	22.0±0.3	25.8±0.2	29
	N-1000SC	1.2	1000	1100	100		–		4.8	23.0^{0}_{-1}	34.0^{0}_{-1}	22.0±0.3	33.0±0.3	42
	N-1100C	1.2	1100	1200	110		–		4.6	26.0^{0}_{-1}	30.0^{0}_{-1}	25.2±0.3	29.8±0.2	44
	N-1300SC	1.2	1300	1450	130		–		4.2	23.0^{0}_{-1}	43.0^{0}_{-2}	22.0±0.3	42.0±0.3	50
	N-1800C	1.2	1800	2100	180		–		4.1	26.0^{0}_{-1}	50.0^{0}_{-2}	25.2±0.3	49.0±0.3	80
	N-4000D	1.2	4000	4600	400		–		3.3	34.0^{0}_{-1}	61.0^{0}_{-2}	32.3±0.3	60.0±0.4	160
	N-6PT	7.2	120	130	12		24	7-8	210.0	17.0(W) X 26.0(L) X 48.5(H)		–	–	42

Operating temperature range: Charge: 0° ˜45°C (standard), 10° ˜45°C (quick), discharge: –20° ˜60°C, storage: –30° ˜50°C (–30 - 35°C for long periods) Note: Consult Sanyo concerning operating conditions for quick charging of N-650SC or

Standard CADNICA batteries (KR Series)

Type	Model	Nominal voltage (V)	Capacity (mAh) at 0.2C rate		Standard charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
								Including tube		Bare cell		
			Min.	Typ.	Current (mA)	Time (hr.)		Dia. (D) (mm)	Height (H) (mm)	Dia. (D) (mm)	Height (H) (mm)	
	KR-1300SC	1.2	1300	1450	130	14-16	6.0	23.0^{0}_{-1}	43.0^{0}_{-2}	22.0±0.3	42.0±0.3	46
	KR-1500SC	1.2	1500	1600	150		6.0	23.0^{0}_{-1}	43.0^{0}_{-2}	22.0±0.3	42.0±0.3	47
	KR-2000C	1.2	2000	2200	200		5.2	26.0^{0}_{-1}	50.0^{0}_{-2}	25.2±0.3	49.0±0.3	75
	KR-2800D	1.2	2800	3200	280		4.5	34.0^{0}_{-2}	44.0^{0}_{-2}	32.3±0.3	43.5±0.4	110
	KR-4400D	1.2	4400	4800	440		3.8	34.0^{0}_{-2}	61.0^{0}_{-2}	32.3±0.3	60.0±0.4	150
	KR-7000F	1.2	7000	7500	700		3.4	34.0^{0}_{-2}	91.0^{0}_{-2}	32.3±0.3	90.0±0.4	230
	KR-10000M	1.2	10000	12000	1000		2.6	43.0^{0}_{-2}	91.0^{0}_{-2}	42.0±0.4	90.0±0.4	400
	KR-20000M	1.2	20000	24000	2000		2.5	43.0^{0}_{-2}	146.0^{0}_{-2}	42.0±0.4	145.0±0.4	660

Operating temperature range: Charge: 0° - 45°C (quick) discharge: –20° - 60°C, storage: –30° - 50°C (–30 - 35°C for long periods)
Note: When using assembled batteries consisting of KR-4400D or higher model batteries, consideration must be given to the problem of cell temperature increase. Sanyo can provide assembled batteries that meet your specific conditions of use.

High-capacity CADNICA batteries (E Series)

Type	Model	Nominal voltage (V)	Capacity (mAh) at 0.2C rate		Standard charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
								Including tube		Bare cell		
			Min.	Typ.	Current (mA)	Time (hr.)		Dia. (D) (mm)	Height (H) (mm)	Dia. (D) (mm)	Height (H) (mm)	
	N-225AE	1.2	225	245	23	14-16	20.0	17.0^{0}_{-1}	17.0^{0}_{-1}	16.5±0.2	16.3±0.3	12
	KR-600AE	1.2	600	650	60		10.0	17.0^{0}_{-1}	28.0^{0}_{-1}	16.5±0.2	27.8±0.2	21
	N-700AAE	1.2	700	770	70		11.0	$14.2^{0}_{-0.5}$	50.0^{0}_{-1}	13.8±0.2	49.5±0.3	27
	N-1000AAE	1.2	950	1050	100		10.5	$14.2^{0}_{-0.5}$	65.0^{0}_{-2}	13.8±0.2	64.5±0.3	33
	KR-1000AE(L)	1.2	950	1050	100		8.0	17.0^{0}_{-1}	43.0^{0}_{2}	16.5±0.2	42.0±0.3	31
	KR-1200AE	1.2	1200	1300	120		7.6	17.0^{0}_{-1}	50.0^{0}_{-2}	16.5±0.2	48.5±0.3	34
	KR-1700AE	1.2	1700	1850	170		7.0	17.0^{0}_{-1}	67.0^{0}_{-2}	16.5±0.2	66.0±0.3	45
	KR-1700SCE	1.2	1700	1850	170		5.5	23.0^{0}_{-1}	43.0^{0}_{-2}	22.0±0.3	42.0±0.3	53
	KR-2000SCE	1.2	2000	2200	200		5.5	23.0^{0}_{-1}	50.0^{0}_{-2}	22.0±0.3	49.0±0.3	60
	KR-2400CE	1.2	2400	2650	240		5.0	26.0^{0}_{-1}	50.0^{0}_{-2}	25.2±0.3	49.0±0.3	76
	KR-2800CE	1.2	2800	3000	280		5.5	26.0^{0}_{-1}	50.0^{0}_{-2}	25.2±0.3	49.0±0.3	78
	KR-5000DEL	1.2	5000	5400	500		3.5	34.0^{0}_{-2}	59.0^{0}_{-1}	32.3±0.3	58.4±0.4	155

Operating temperature range: Charge:)° ˜45°C (standard: discharge: –20° - 60°C: storage: –30° - 35°C for long periods)
Note: Consult Sanyo concerning 1-hour charge.

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(Before Jan. 8, 1994, use 215 area code)

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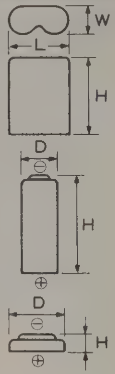
SANYO
Lithium

Specifications of Sanyo Lithium Batteries

Classifications		Model	Nominal voltage (V)	Nominal capacity current (mA)	Standard discharge current (mA)	Max. discharge current (mA) *2		Max dimensions(mm)		Weight
						Continuous	Pulse	Diameter(D)	Height(H)	(G)
Flat Type Lithium Batteries Crimp-sealed cells		CR1220	3	35	0.1	1	5	12.5	2.0	0.8
		CR1620	3	60	0.2	2	6	16.0	2.0	1.2
		CR2016	3	80	0.3	4	15	20.0	1.6	1.7
		CR2025	3	140	0.3	3	15	20.0	2.5	2.5
		CR2032	3	190	0.3	3	15	20.0	3.2	3.0
		CR2430	3	270	0.3	3	20	24.5	3.0	4.0
		CR2450	3	500	0.2	2	10	24.5	5.0	6.2
Cylindrical Type Lithium Batteries	Crimp-sealed cells	CR-1/3N	3	160	2.0	20	80	11.6	10.8	3.3
		2CR-1/3N	6	160	2.0	20	80	13.0	25.2	9.1
		2CR5	6	1300	10	250	3000	34(L)X17(W)X45(H)		40
	Laser-sealed cells	CR14250SE	3	800	0.5	3	7	14.5	25.0	9.0
		CR12600SE	3	1400	1	5	30	12.0	60.0	15
		CR17335SE	3	1700	1	4	15	17.0	33.5	17
		CR17450SE	3	2500	1	5	20	17.0	45.0	22
		CR23500SE	3	5000	1	6	30	23.0	50.0	42



*1 Capacity is calculated to an end voltage of 2.0V when the battery is allowed to discharge with a standard current level at 23°C.
*2 If batteries are to be used at current discharge levels exceeding those given above, please contact Sanyo.
*3 Sanyo batteries are Ul-approved (File No. MH 12383).

Lithium Batteries for Memory Backup

Flat Lithium Batteries (Crimp -Sealed Cells)

Model	Capacity (mAh)	Dimensions				Terminal material	Reference figure
		A	B	C	D		
CR1220-T1	35	Ø	15.5	7	4	0.1t nickel	Fig.1
CR2032-T1	190	ø20.0	3.2	10	—	0.1t nickel	
CR2420	270	ø24.5	3.0	10	—	0.15t nickel	Fig. 2
CR2450-T1	500	ø24.5	5.0	10	—	0.15t nickel	
CR2032-T4-2	190	ø20.5	3.2	7	10	0.15t nickel	Fig. 3
CR2032-T12	190	21.5	3.2	7.5	20.0	0.15t nickel	
CR2430-T11	270	25.0	3.0	7.5	20.5	0.15t nickel	Fig. 4
CR1220-P1	35	14.0	2.0	6.5	10.0	0.2t stainless steel	Fig. 5
CR2032-T14-1	190	21.5	3.2	6.5	20.5	0.2t stainless steel	
CR2032-P5-1	190	21.0	3.2	9.0	15.2	0.2t stainless steel	Fig. 6
CR2430-P1-2	270	25.5	3.0	6.5	20.3	0.2t stainless steel	
CR2450-P2	500	25.5	5.0	6.5	20.3	0.2t stainless steel	
CR2032-T9-2	190	ø20.5	3.2	4.5	10.5	0.2t stainless steel	Fig. 7
CR2430-P2-2	270	ø25.0	3.0	4.5	10.5	0.2t stainless steel	
CR2032-FT1	190	21.0	3.2	6.0	15.2	0.15t nickel	
CR2032-FT6	190	21.0	3.2	5.0	17.8	0.2t stainless steel	
CR22430-FT1	270	25.0	3.0	6.0	17.8	0.15t nickel	Fig. 8
CR2430-FT6	270	25.5	3.0	5.0	17.8	0.2t stainless steel	
CR2450	500	25.5	3.0	5.0	17.8	0.2t stainless steel	
CR2032-FT4-2	190	ø20.5	3.2	5.0	3.4	0.2t stainless steel	
CR2430-FT4-2	270	ø25.5	3.0	5.0	3.2	0.2t stainless steel	Fig. 9
CR2450-FT5-4	500	ø24.5	5.0	5.0	5.1	0.2t stainless steel	
CR2032-T16	190	ø20.5	3.2	10.2	7.5	0.2t stainless steel	Fig. 10
CR1220-T2	35	ø13.5	3.0	3.5	3.8	0.2t stainless steel	Fig. 11

Cylindrical Lithium Batteries (Crimp-Sealed Cells)

CR-1/3N-T1	160	ø11.6	10.8	9.0	—	0.5t nickel	Fig. 12

Fig. 1

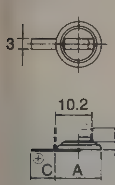


Fig. 2

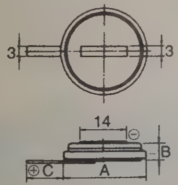


Fig. 3

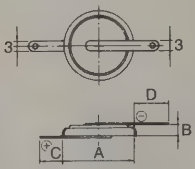


Fig. 4

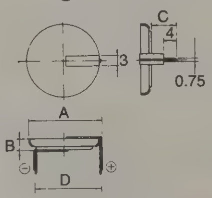


Fig. 5

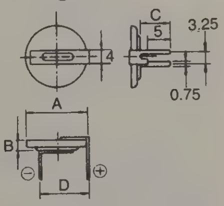


Fig. 6

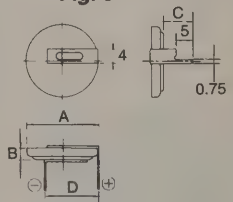


Fig. 7

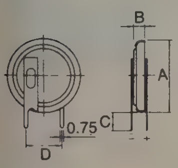


Fig. 8

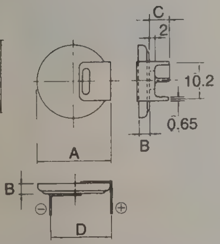


Fig. 9

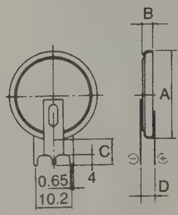


Fig. 10

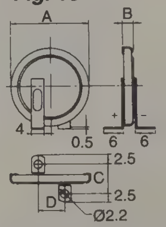


Fig. 11

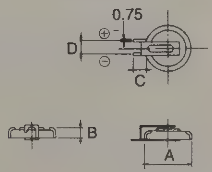
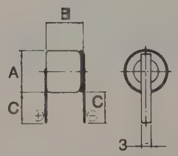


Fig. 12



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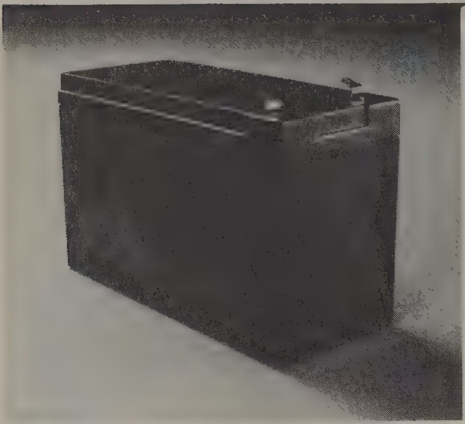
CELL-CON
INCORPORATED

BATTERY

SEALED RECHARGEABLE LEAD ACID BATTERIES



"The CSB Advantage"

- No Gelled Electrolyte
- 100% Capacity 1st Cycle
- Lead Calcium Grid Design
- Usable in any Position
- Starved Electrolyte Design
- Cyclical or standby application
- No Memory Effect
- Gas Recombination Technology

® MH14533

CSB BATTERY MODEL	STAND. TERMINAL (Optional)	NOMINAL VOLTAGE (V)	NOMINAL CAPACITY (AH)	DIMENSIONS								Weight (Approx.)	
				L		W		H		H (Over Terminal)			
				mm	in.	mm	in.	mm	in.	mm	in.	Kgs	Lbs.
GP613	F1	6	1.3	97	3.82	25	0.98	51	2.01	57	2.24	0.28	0.62
GP633	F1	6	3.3	134	5.28	34	1.34	60	2.36	66	2.60	0.62	1.40
GP645	F1(F2)	6	4.5	70	2.76	48	1.89	102	4.02	108	4.25	0.80	1.80
GP670	F1(F2)	6	7.0	151	5.94	34	1.34	94	3.70	100	3.94	1.20	2.60
GP690	F1(F2)	6	9.0	151	5.94	50	1.97	94	3.70	100	3.94	1.70	3.80
GP6110	F1(F2)	6	11.0	151	5.94	50	1.97	94	3.70	100	3.94	1.90	4.20
GP1213	F1	12	1.3	97	3.82	43	1.69	51	1.99	57	2.22	0.56	1.20
GP1222	F1	12	2.2	178	7.01	34	1.34	60	2.36	66	2.60	0.93	2.10
GP1245	F1(F2)	12	4.5	93	3.66	70	2.75	101	4.01	108	4.25	1.80	3.96
GP1270	F1(F2)	12	7.0	151	5.94	65	2.56	94	3.70	100	3.94	2.50	5.50
GP12110	F1(F2)	12	11.0	151	5.94	98	3.86	94	3.70	100	3.94	4.10	9.02
GP12170	B3	12	17.0	181	7.13	78	3.07	167	6.57	167	6.57	6.10	13.50
GP12260	B3	12	26.0	166	6.54	175	6.89	125	4.92	125	4.92	9.00	19.90
GP12400	B2	12	40.0	197	7.76	165	6.50	170	6.69	170	6.691	14.00	30.90

TERMINALS - F1) FASTON TYPE .187 F2) FASTON TYPE .250 B2) LEAD POST/M5 BOLT & NUT B3) GROOVED LEAD POST/M5 BOLT & NUT
CASE MATERIAL - (UL1778) 94V-2 AVAILABLE JANUARY 1, 1992 BATTERIES DESIGNATED AS "FR" SERIES
AIR TRANSPORTATION - CSB BATTERIES ARE CLASSIFIED AS "DRY CHARGED" AND MAY BE SHIPPED BY AIR
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTIFICATION

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Ft. Worth, TX 76116
Tel: (817) 732-2258
FAX: (817) 732-2019
1-8003CSB/USA

CSB BATTERY CO., LTD.
4 Fl., No. 24, Sec. 2, Chung Cherng Rd., Shin-Lin
Taipei, Taiwan R.O.C.
Tel: 886 2-835-5100 TLX 19617 CHINABAT –
FAX 886-2-835-1055

DURACELL®

SPECIFICATION SUMMARY

Premium Batteries for OEM Applications:
Alkaline • Lithium • Zinc Air • Nickel–Metal Hydride

DURACELL
DA146

DURACELL BATTERIES

DURACELL *BATTERIES*

ALKALINE

PRIMARY CELLS & BATTERIES

DURACELL® alkaline-manganese dioxide batteries are the popular choice for most consumer, industrial and military applications where an economical, general purpose battery is required. Advantages include high energy output, reliability, long shelf life, and superior low temperature performance.(1) In standard sizes, the DURACELL® alkaline battery system is generally available in cylindrical and multicell configurations.

Duracell is committed to working with manufacturers in the design and production of tomorrow's electronic products. Our Account Managers can provide expert applications and product specifications assistance to help you match the optimum premium battery system to your requirements. We are also ready to assist you in developing your concepts into successful products by offering global supply and distribution information and production launch support. If you have additional questions, or would like to discuss your applications with one of our Account Managers, please contact Duracell. We would appreciate hearing from you.

DURACELL PRODUCT NUMBER	SIZE	NOMINAL VOLTAGE (V)	RATED CAPACITY(2) (mAh)	RATED VOLTAGE CUTOFF (V)	RATED LOAD (OHMS)	APPROX. DRAIN (mA)	DIMENSIONS(4) MAXIMUM		MAXIMUM		MAXIMUM		AVERAGE WEIGHT		AVERAGE VOLUME		TERMINALS(3)	CROSS REFERENCE NEDA/ANSI	IEC
							in.	mm	in.	mm	in.	mm	oz.	g	in.^{3}	cm^3			
CYLINDRICAL CELLS–STANDARD PRODUCTS							DIAMETER		HEIGHT										
MN1300	D	1.5	14,250	0.8	4.7	235	1.346	34.20	2.421	61.50	–	–	4.71	133.5	3.44	56.4	F	13A	LR20
MN1400	C	1.5	7,100	0.8	10.0	110	1.031	26.20	1.969	50.00	–	–	2.32	65.8	1.64	26.9	F	14A	LR14
MN1500	AA	1.5	2,450	0.8	24.0	50	0.571	14.50	1.988	50.50	–	–	0.80	22.7	0.51	8.4	F	15A	LR6
MN2400	AAA	1.5	1,120	0.8	160.0	8	0.413	10.50	1.752	44.50	–	–	0.38	10.8	0.23	3.8	F	24A	LR03
MN9100	N	1.5	800	0.8	100.0	12	0.472	12.00	1.189	30.20	–	–	0.34	9.6	0.21	3.4	F	910A	LR1
OTHER SELECTED MULTICELL BATTERIES–STANDARD PRODUCTS							LENGTH		HEIGHT		WIDTH								
MN1203	–	4.5	4,400	2.4	20	175	2.441	62.00	2.638	67.00	0.866	22.00	5.43	154.0	5.58	91.4	TL	706A	3LR12
7K67	J	6.0	565	3.2	340	14	1.400	35.56	1.900	48.26	0.360	9.14	1.20	34.0	0.96	15.7	RF	1412AP	4LR61
* MN908	LANTERN	6.0	13,000	3.2	15	290	2.665	67.69	4.312	109.52	2.665	67.69	21.60	612.0	30.62	501.8	CS	908A	–
* MN918	LANTERN	6.0	27,000	3.2	9	490	5.365	136.27	4.937	125.40	2.865	72.77	44.80	1,270.0	75.88	1,243.5	IS	918A	–
MN1604	9-VOLT	9.0	565	4.8	510	14	1.043	26.50	1.938	49.20	0.688	17.50	1.62	45.9	1.39	22.8	MS	1604A	6LR61
MN21	CYLINDRICAL	12.0	33	6.0	20K	50	0.406	10.32	1.122	28.50	–	–	0.26	7.4	0.14	2.3	F	1811A	–
OTHER SELECTED MULTICELL BATTERIES–INDUSTRIAL PRODUCTS							LENGTH		HEIGHT		WIDTH								
* PC908	LANTERN	6.0	13,000	3.2	15	290	2.665	67.69	4.312	109.52	2.665	67.69	21.60	612.3	30.62	501.8	CS	908AC	–
* PC915	LANTERN	6.0	13,000	3.2	15	290	2.665	67.69	4.350	110.49	2.665	67.69	21.60	612.3	30.89	506.2	IS	915AC	–
* PC918	LANTERN	6.0	27,000	3.2	9	490	5.365	136.27	4.937	125.40	2.865	72.77	44.80	1,270.0	75.88	1,243.5	IS	918AC	–
* PC903	LANTERN	7.5	40,000	4.0	10	650	7.250	184.15	3.749	95.22	4.062	103.17	78.40	2,222.6	110.41	1,809.3	IS	903AC	–

(1) Operating temperature range is -4°F (-20°C) to 130°F (54°C)
(2) Rated at 70°F (21°C). Typical capacities can be higher based on user's particular application.
(3) Terminal code: F-flat; S-snap; RF-recessed flat; CS-coiled springs; IS-insulated screw; MS-miniature snap; TL-tab leads.
(4) Dimensions are IEC/ANSI standards.
* Dimensions are Duracell standards

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For a technical discussion, call
1-800-544-5454 Ext. 3281.
To obtain literature, call
1-800-422-9001 Ext. 439.

LITHIUM/MnO$_2$
PRIMARY CELLS & BATTERIES

DURACELL® lithium-manganese dioxide (Li/MnO$_2$) batteries possess high energy density, high rate capability over a broad temperature range,[1] and excellent capacity retention determined at over 95% after five years at room temperature. DURACELL® Li/MnO$_2$ batteries are ideally suited for a wide range of uses, from supplying high current output for pulse-type applications to providing long-term standby power for memory retention.

Duracell is committed to working with manufacturers in the design and production of tomorrow's electronic products. Our Account Managers can provide expert applications and product specifications assistance to help you match the optimum premium battery system to your requirements. We are also ready to assist you in developing your concepts into successful products by offering global supply and distribution information and production launch support. If you have additional questions, or would like to discuss your applications with one of our Account Managers, please contact Duracell. We would appreciate hearing from you.

DURACELL PRODUCT NUMBER	SIZE	NOMINAL VOLTAGE (V)	TYPICAL VOLTAGE (V)	RATED CAPACITY[2] (mAh)	LOAD (OHMS)	APPROX. DRAIN (mA)	VOLTAGE CUTOFF (V)	MAX. DISCHARGE CURRENT (mA)		MAX. REVERSE CHARGING CURRENT[3] (mA)	DIMENSIONS				AVERAGE WEIGHT		AVERAGE VOLUME		TERMINALS (4)	CROSS REFERENCE
											MAXIMUM DIAMETER		MAXIMUM HEIGHT							NEDA/ ANSI
								(cont.)	(pulse)		in.	mm	in.	mm	oz.	g	in.^{3}	cm^3		
HIGH POWER CYLINDRICAL CELLS (SPIRAL-WOUND)																				
DL123A	1 x 2/3A	3.0	3.2-3.3	1,400	100	14.0	2.0	1,200	5,000	20	0.665	16.89	1.358	34.50	0.600	17.0	0.438	7.18	F	5018LC
DL2/3A	2/3A	3.0	3.2-3.3	1,400	100	14.0	2.0	1,200	5,000	20	0.669	16.99	1.333	33.86	0.600	17.0	0.438	7.18	F, PC,	5017LC
DL1/3N	1/3N	3.0	3.2-3.3	160	2,700	1.0	2.0	20	80	2	0.457	11.61	0.425	10.80	0.116	3.3	0.069	1.13	F	5008LC
MICROLITHIUM™ CYLINDRICAL CELLS (BOBBIN)																				
DL1/2AAL	1/2AA	3.0	3.2-3.3	650	30,000	0.5	2.0	3	10	5	0.571	14.50	0.906	23.01	0.247	7.0	0.210	3.50	F, PC, T	5028LC
DLAAL	AA	3.0	3.2-3.3	1,900	15,000	1.0	2.0	4	20	15	0.571	14.50	1.988	50.50	0.600	17.0	0.490	8.10	F, PC, T	5042LC
MICROLITHIUM™ COIN CELLS																				
DL2016	–	3.0	3.1-3.4	76	15,000	0.2	2.0	4	15	8	0.787	20.00	0.063	1.60	0.063	1.8	0.031	0.50	F	5000LC
DL2025	–	3.0	3.1-3.4	140	15,000	0.2	2.0	3	15	8	0.787	20.00	0.098	2.50	0.078	2.2	0.048	0.79	F	5003LC
DL2032	–	3.0	3.1-3.4	190	15,000	0.2	2.0	3	15	8	0.787	20.00	0.126	3.20	0.099	2.8	0.062	1.00	F, PC,T	5004LC
DL2325	–	3.0	3.1-3.4	190	15,000	0.2	2.0	3	15	8	0.905	23.00	0.098	2.50	0.106	3.0	0.063	1.04	F, PC,T	5002LB
DL2430	–	3.0	3.1-3.4	270	15,000	0.2	2.0	3	20	10	0.965	24.50	0.118	3.00	0.141	4.0	0.086	1.41	F, PC, T	5011LC
DL2450	–	3.0	3.1-3.4	500	15,000	0.2	2.0	2	15	10	0.965	24.50	0.197	5.00	0.217	6.2	0.144	2.36	F, PC, T	5029LC
STANDARD BATTERIES																				
DL245	2 x 2/3A	6.0	6.4-6.6	1,400	200	14.0	4.0	1,200	5,000	20	(6)		(6)		1.400	39.7	1.320	21.70	F	5032LC
DL 223A[5]	2 x 2/3A	6.0	6.4-6.6	1,400	200	14.0	4.0	1,200	5,000	20	(6)		(6)		1.340	38.0	1.340	20.10	F, C	5024LC
PX28L	2 x 1/3N	6.0	6.4-6.6	160	5,400	1.0	4.0	20	80	2	0.512	13.00	0.992	25.20	0.329	9.4	0.204	3.35	F, PC, T	1406LC

(1) Operating temperature range is -40°F (-40°C) to 140°F (60°C). Information on performance beyond this range available upon request.
(2) Rated at 68°F (20°C). Typical capacities can be higher based on user's particular application.
(3) Li/MnO$_2$ cells should not be charged. UL has established these values as the maximum current the cell will tolerate in the event of diode failure.
(4) Terminal code: F-flat; PC-printed circuit board pins; C-connector; T-tabs.
(5) DL223A is also available as DL223AR with wire leads, connector and Velcro patch for computer clock/calendar, and memory back-up applications.
(6)

	HEIGHT		WIDTH		THICKNESS	
	in.	mm	in.	mm	in.	mm
DL245	1.772	45.00	1.339	34.00	0.669	17.00
DL223A	1.417	36.00	1.378	35.00	0.768	19.50

Note: Contact Duracell for information regarding transportation and disposal.

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DURACELL *BATTERIES*

DURACELL *BATTERIES*

NICKEL-METAL HYDRIDE

RECHARGEABLE CELLS & BATTERIES

DURACELL® nickel-metal hydride batteries deliver the highest energy density and excellent rate capability in a rechargeable chemical system. In high power consumer devices, nickel-metal hydride batteries are the preferred rechargeable battery due to one hour charge capability, broad temperature range[1] and long cycle life.

Duracell is committed to working with manufacturers in the design and production of tomorrow's electronic products. Our Account Managers can provide expert applications and product specifications assistance to help you match the optimum premium battery system to your requirements. We are also ready to assist you in developing your concepts into successful products by offering global supply and distribution information and production launch support. If you have additional questions, or would like to discuss your applications with one of our Account Managers, please contact Duracell. We would appreciate hearing from you.

DURACELL PRODUCT NUMBER	SIZE	NOMINAL VOLTAGE (V)	RATED CAPACITY[2] (mAh)	RATED VOLTAGE CUTOFF (V)	RATED LOAD (mA)	MAXIMUM DIAMETER		MAXIMUM HEIGHT				AVERAGE WEIGHT		AVERAGE VOLUME		TERMINALS[3]
						mm	in.	mm	in.			g	oz.	cm^3	$in.^3$	
CYLINDRICAL CELLS																
DHAA	AA	1.2	1100	1.0	220	14.4	0.57	49.0	1.93			26	0.917	8.0	0.49	F
DH4/5A	4/5A	1.2	1500	1.0	300	17.0	0.67	42.8	1.69			32	1.129	9.7	0.60	F
DH4/3A	4/3A	1.2	2400	1.0	480	17.0	0.67	67.0	2.64			52	1.835	15.2	0.93	F
						MAXIMUM LENGTH		MAXIMUM HEIGHT		MAXIMUM WIDTH						
DHF-5	F-5	1.2	600	1.0	120	48.3	1.90	7.4	0.29	14.4	0.57	17	0.600	5.2	0.31	F
STANDARD BATTERIES						MAXIMUM LENGTH		MAXIMUM HEIGHT		MAXIMUM WIDTH						
DR10	55	6	1500	5.0	300	89.3	3.52	19.1	0.75	46.0	1.81	182	6.421	78.5	4.78	F
DR11	77	6	3000	5.0	300	89.3	3.52	36.5	1.44	46.0	1.81	348	12.275	149.9	9.17	F

(1) Operating temperature range is -4°F (-20°C) to 122°F (50°C)
(2) Rated at 68°F (20°C). Typical capacities can be higher based on user's particular application.
(3) Terminal code: F-flat; C-connector.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

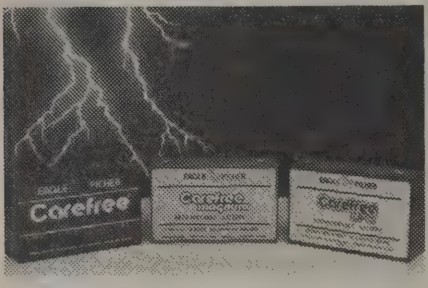
YIG yttrium iron garnet

Z

ZIF zero insertion force

Carefree®

Valve Regulated, Lead-Acid Rechargeable Batteries



Eagle-Picher features the world's largest selection of sealed, lead-acid, rechargeable batteries

Powerful Features

Performs at rated capacity on first cycle.

No memory limitations.

Delivers rated capacity upon demand, whether use is cyclic or stand-by.

Lead-Calcium grid. Maintains constant charge characteristics throughout life.

Long life and High reliability.

Requires only proper recharging for years of service.

Rechargeable. Provides hundreds of charge-discharge cycles.

Charging

The life of all maintenance-free, lead-acid batteries can be greatly affected by the charging method used. To achieve optimum performance and life from batteries, the charging method must be adjusted to the conditions of service.

Float Service

A battery in float service is being subjected to continuous charging and is called upon to deliver power at infrequent intervals or in case of a power outage. Under this condition, the battery charging should be:

Constant potential	2.28-2.32 Volts/Cell
Limiting Current	20%-Rated Capacity in Amps
Charging Time	Continuous

Cyclic Service

A battery in cyclic service is normally being discharged at a more frequent interval than when it is in float service. In cyclic service it has less time to recharge. Under this condition, the battery charging should be:

Constant Potential	2.50-2.55 Volts/Cell
Limiting Current	50%-Rated Capacity in Amps
Charging Time	10-24 Hours

EAGLE PICHER

Electronics Division

Box 130 • Bethel Road • Seneca, MO 64865

Phone: 417-776-2256 • FAX: 417-776-2257

Carefree Sealed Lead-Acid Batteries

Battery Number	Nom Cap 20 Hr. Rate	Length In(mm)	Width In(mm)	Ht. Inch (mm)	Ht. Incl. Terms.	Wt. Lbs
CF2V2.5	2	2.30(58.42)	1.04(26.42)	2.60(66.04)	2.94(74.88)	.5
CF2V5	5.2	2.33(59.18)	1.06(26.92)	3.95(100.03)	4.33(109.98)	.8
CF2V30	28.0	3.34(84.84)	2.15(54.61)	6.50(165.10)	6.85(173.99)	4.1
CF2V140	125.0	7.42(188.47)	4.51(114.55)	7.42(188.47)	8,34(211.84)	21.5
CF4V8	8.0	4.03(102.36)	2.00(50.80)	3.75(95.25)	3.93(99.82)	2.4
CF4V15	15.0	5.27(133.86)	1.78(45.21)	6.80(172.72)	7.12(180.85)	4.7
CF6V1/2	0.45	1.92(48.77)	1.00(25.40)	2.00(50.80)	2.25(57.15)	0.3
CF6V1	0.90	2.00(50.80)	1.65(41.91)	1.97(50.04)	2.20(55.88)	0.5
CF6V2.6	2.60	5.30(134.62)	1.35(34.29)	2.37(60.20)	2.56(65.02)	1.4
CF6V4	4.00	2.76(70.10)	1.89(48.01)	4.02(102.11)	4.22(107.19)	1.7
CF6V4.5	4.50	6.00(152.40)	1.34(34.04)	3.75(95.25)	3.95(100.33)	2.8
CF6V5.3	5.60	5.22(132.59)	1.85(46.99)	3.08(78.23)	3.08(78.23)	2.6
CF6V5.5	5.50	6.00(152.40)	1.34(34.04)	3.75(95.25)	3.95(100.33)	2.8
CF6V8	8.00	6.00(152.40)	2.00(50.80)	3.75(95.25)	3.93(99.82)	3.9
CF6V9	9.00	4.25(107.95)	2.75(69.85)	5.50(139.70)	5.50(139.70)	4.5
CF6V9.5	11.00	4.25(107.95)	2.75(69.85)	5.50(139.70)	5.50(139.70)	5.1
CF6V15	15.00	3.60(91.44)	3.34(84.84)	6.49(164.85)	6.70(170.18)	6.4
CF6V30	28.00	6.25(158.75)	3.35(85.09)	6.50(165.10)	6.75(171.45)	12.1
CF6V40	40.00	6.51(165.35)	4.91(124.71)	6.53(165.86)	6.75(171.45)	16.5
CF6V50	50.00	7.43(188.72)	4.52(114.81)	7.46(189.48)	8.37(212.60)	21.5
CF8V6	6.00	3.34(84.84)	2.15(54.61)	6.50(165.10)	6.66(169.16)	3.9
CF12V1/2	0.45	1.92(48.77)	2.05(52.07)	2.00(50.80)	2.25(57.15)	0.6
CF12V1/2L	0.45	3.85(97.79)	1.00(25.40)	2.00(50.80)	2.25(57.15)	0.6
CF12V1	0.90	3.30(83.82)	2.00(50.80)	1.97(50.04)	2.20(55.88)	1.1
CF12V1L	0.90	4.02(102.11)	1.65(41.91)	1.97(50.04	2.20(55.88)	1.1
CF12V1.5	1.50	7.02(178.31)	1.33(33.78)	2.40(60.96)	2.60(66.04)	1.19
CF12V1.5PP	1.50	3.00(76.20)	2.26(57.40)	8.75(222.25)	NA	2.3
CF12V2.6S1	2.60	5.28(134.11)	2.52(64.01)	2.30(58.42)	2.48(62.99)	2.7
CF12V4	4.00	3.81(96.77)	2.76(70.10)	4.02(102.11)	4.22(107.19)	3.4
CF12V5L	5.20	6.12(155.45)	2.42(61.47)	3.94(100.08)	4.16(105.66)	4.8
CF12V5PP	5.20	6.12(155.45)	2.42(61.47)	6.60(167.64)	NA	5.0
CF12V5.3	5.60	5.22(132.59)	3.72(94.49)	3.08(78.23)	3.08(78.23)	5.2
CF12V8	8.00	6.00(152.40)	4.03(102.36)	3.75(95.25)	3.93(99.82)	7.9
CF12V9	9.00	5.53(140.46)	4.25(107.95)	5.50(139.70)	5.50(139.70)	9.0
CF12V9L	9.00	8.52(216.41)	2.75(69.85)	5.50(139.70)	5.50(139.70)	9.0
CF12V9LPP	9.00	8.52(216.41)	2.75(69.85)	5.50(139.70)	NA	9.0
CF12V15	15.00	7.22(189.39)	3.34(84.84)	6.49(164.85)	6.70(170.18)	12.8
CF12V20	22.00	6.51(165.35)	4.91(124.71)	6.53(165.86)	6.75(171.45)	16.2
CF12V30	28.00	6.72(170.69(	6.25(158.75)	6.50(165.10)	6.75(171.45)	24.2
CF12V30L	28.00	10.04(25.5)	4.31(10.95)	6.50(165.10)	6.75(171.45)	24.6
CF18V1	0.90	4.90(124.46)	2.00(50.80)	1.97(50.04)	2.20(55.88)	1.7
CF24V20	22.0	9.83(249.68)	6.51(165.35)	6.53(165.86)	6.765(171.45)	33.0
CF24V30	28.0	12.50(317.50)	6.72(170.69)	6.50(165.10)	6.75(171.45)	48.4

Carefree Magnum, Extra Capacity Batteries

CFM4V4.6	4.60	1.87(47.50)	1.89(48.01)	4.02(102.11)	4.22(107.19)	1.3
CFM4V10	9.50	4.03(102.36)	2.00(50.80)	3.75(95.25)	3.93(99.82)	2.6
CFM6V3	3.0	5.30(134.62)	1.35(34.29)	2.37(60.20)	2.56(65.02)	1.5
CFM6V4.6	4.60	2.76(70.10)	1.89(48.01)	4.02(102.11)	4.22(107.19)	1.8
CFM6V6.4	6.4	5.22(132.59)	1.85(46.99)	3.08(78.23)	3.08(78.23)	2.9
CFM6V6.5	6.50	6.00(152.40)	1.34(34.04)	3.75(95.25)	3.95(100.33)	2.8
CFM6V10	9.50	6.00(152.40)	2.00(50.80)	3.75(95.25)	3.93(99.82)	3.85
CFM6V12	12.0	4.25(107.95)	2.75(69.85)	5.50(139.70)	5.50(139.70)	5.1
CFM6V12.5	12.5	4.25(107.95	2.75(69.85)	5.50(139.70)	5.50(139.70)	5.1
CFM6V18	18.0	3.60(91.44)	3.34(84.84)	6.49(164.85)	6.70(170.18)	6.8
CFM6V33	33.0	6.25(158.75)	3.35(85.09)	6.50(165.10)	6.75(171.45)	12.2
CFM12V3	3.0	5.28(134.11)	2.52(64.01)	2.30(58.42)	2.48(62.99)	3.1
CFM12V4.6	4.6	3.80(96.52)	2.76(70.10)	4.02(102.11)	4.22(107.19)	3.6
CFM12V4.6M	4.6	3.55(90.17)	2.76(70.10)	4.01(101.85)	4.25(107.95)	3.9
CFM12V6.2L	6.2	6.12(155.45)	2.42(61.47)	3.94(100.08)	4.16(105.66)	5.4
CFM12V6.5	6.5	5.95(151.13)	2.58(65.53)	3.75(95.25)	3.95(100.33)	5.6
CFM12V10	10.0	6.00(152.40)	4.00(101.60)	3.75(95.25)	3.93(99.82)	7.7
CFM12V12	12.0	5.53(140.46)	4.25(107.95)	5.50(139.70)	5.50(139.70)	10.2
CFM12V12L	12.0	8.52(216.41)	2.75(69.85)	5.50(139.70)	5.50(139.70)	10.2
CFM12V12LPP	12.0	8.52(216.41)	2.75(69.85)	5.50(139.70)	5.50(139.70)	10.2
CFM12V18	18.0	7.21(188.13)	3.34(84.84)	6.49(164.85)	6.70(170.18)	13.6
CFM12V25	25.0	6.51(165.35)	4.91(124.71)	6.53(165.86)	6.75(171.45)	17.3
CFM12V33	33.0	6.72(170.69)	6.25(158.75)	6.50(165.10)	6.75(171.45)	24.5

Carefree UPS, High Output Batteries

CF6V10UPS	10.0	6.00(152.40)	2.00(50.80)	3.75(95.25)	3.93(99.82)	4.1
CFP6V18UPS	18.0	3.60(91.44)	3.34(84.84)	6.49(164.84)	7.33(186.18)	7.2
CFP6V33UPS	33.0	6.25(158.75)	3.35(85.09)	6.40(162.56)	7.34(186.44)	12.5
CFP6V60UPS	60.0	7.42(188.47)	4.51(114.55)	7.42(188.47)	8.32(211.33)	22.0
CFP12V25UPS	25.0	6.51(165.35)	4.91(124.71)	6.50(165.10)	7.37(187.20)	19.7

TIME KEEPER™

Computer Clock Batteries

Saves You And Your Customers Time & Money Every Day.

Over 9 million 286 and 386-based PC's are currently in use. An estimated 14 million more will be shipped in the next two years. Each one requires a replaceable battery which maintains the internal real time clock and important configuration files.

Your customers can rely on Time Keeper to provide that power. Every Day! And, because these batteries are produced in the USA, you can rely on Eagle-Picher for lower prices, reliable service and instant delivery. Every Time!

TIME KEEPER™ Computer Batteries

Battery No.	Working Voltage	Capacity 350 hr. rate 25°C	Length		Width		Thickness		Weight (Grams)	MOLEX Connector (Or Equal)	Pin Polarization				Diode	Resistor
			IN.	MM.	IN.	MM.	IN.	MM.			1	2	3	4		
LTC-16P-CO-F-S3***	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	22-41-4043	O*	KEY	POS	NEG	1N914	1K
LTC-16P-CO-F-S5***	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	50-57-9004	NEG	POS	KEY	O*	N/A	N/A
LTC-16P-CO-F-S6*** (EP5242)	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	22-41-4033	NEG	O*	POS	X**	N/A	N/A
LTC-16P-CO-F-S7***	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	22-01-3037	POS	NEG	O*	X**	N/A	N/A
LTC-16P-CO-F-S8*** (EP5242/W)	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	50-57-9004	POS	KEY	O*	NEG	N/A	N/A
LTC-16P-CO-F-S9***	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	22-01-3037	NEG	O*	POS	X**	N/A	N/A
LTC-16P-CO-F-S12	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	22-01-3037	POS	NEG	O*	X**	N/A	N/A
LTC-16P-CO-F-S14	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	NONE	--	--	--	--	N/A	N/A
LTC-16P-CO-F-S15	3.5	1600mAH	1.90	48.26	.70	17.78	.72	18.29	30.0	641191-4****	POS	KEY	O*	NEG	N/A	N/A
LTC-16P-MS-F-S9*** (EP5253)	6.8	1600mAH	1.90	48.26	1.30	33.02	.70	17.78	53.0	50-57-9004	POS	KEY	O*	NEG	1N914	39K
LTC-16P-MS-F-S10*** (EP5257)	6.8	1600mAH	1.90	48.26	1.30	33.02	.70	17.78	53.0	22-01-3047	POS	KEY	O*	NEG	1N914	30K
LTC-16P-MS-F-S11*** (EP5280)	6.8	1600mAH	1.90	48.26	1.30	33.02	.70	17.78	53.0	22-41-4043	POS	KEY	O*	NEG	(2)1N914	11K
LTC-16P-MS-F-S12***	7.0	1600mAH	1.90	48.26	1.30	33.02	.70	17.78	53.0	22-01-3037	POS	NEG	O*	X	N/A	N/A
LTC-16P-MP-F-S1***	3.5	3200mAH	1.90	48.26	1.30	33.02	.70	17.78	53.0	22-01-3037	POS	NEG	O*	X	N/A	N/A

*O is blank. **is 3-pin connector. ***Optional case size, as well as internal resistors, diodes or connectors may be ordered to exact customer specifications. All replaceable battery modules have 9"(±.25) wire leads..
****Amp only. Time Keeper™ batteries containing diode and resistor protection (working voltage rate dependent). See table above for diode and resistor values.

Compatibility Chart

Time Keeper	Replaces	Computer
EP-5242	TL-5242*	AT&T 3B
EP-5242/W	TL-5242/W*	Kaypro
EP-5253	TL-5253*	IBM PC/AT, PC Limited, AST-286, Hewlett Packard, Vectra, NCR-PC8, Samsung 3001, Pro Executive 286
EP-5257	TL-5257*	Tandy 3000, Epson Equity
EP-5280	TL-5280*	Compaq Desk Pro 286, Portable 286

*Or original equipment battery installed in computer.

3 Year Limited Warranty

Eagle-Picher will replace the Time Keeper products, if found to be defective because of workmanship and/or materials, within 3 years from purchase. No other warranty is expressed or implied. Under no circumstances will Eagle-Picher be liable for consequential damages.

Electrical Specifications

Operating Temperature..-55°C to 75°C
Shelf Life At 25°C (80% of rated capacity)..........................10 years

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Keeper II®

Memory Backup & Consumer Replaceable Batteries

The electrochemistry of Eagle-Picher's Keeper II Lithium batteries ensures years of dependable service in stand-by applications where long-life memory back-up is required.

Its prismatic design allows the Keeper II to be customized to meet unique commercial applications.

Keeper II® Batteries

Years of low rate, continuous use.

Standby power for 10 years and more.

Microcalorimetry tests show an 80% retention of capacity in 15 years.

Highest utilization of valuable board space when compared to round and cylindrical cells.

Energy density is significantly higher than other chemistries.

Wave solderability.

Underwriters Laboratories recognized component.

Hermetically sealed to ensure long life and non leakage at high temperatures.

All Eagle-Picher batteries are made in the United States of America

Keeper II® Lithium Batteries

Battery No.	Working Voltage	Capacity 350 hr. rate	Length		Width		Thickness		Weight (Grams)
			IN.	MM	IN.	MM	IN.	MM	
LTC-3PN	3.5	350mAH	.60	15.24	.65	16.51	.25	6.35	4.0
LTC-3PN-S2	3.5	350mAH	.65	16.51	.25	6.35	.60	15.24	4.0
LTC-3PN-S4	3.5	350mAH	.60	15.24	.25	6.35	.65	16.51	4.0
LTC-7P	3.5	750mAH	1.20	30.48	.70	17.78	.35	8.89	9.0
LTC-7PN	3.5	750mAH	1.00	25.40	.65	16.51	.25	6.35	6.8
LTC-7PN-S4	3.5	750mAH	.65	16.51	.25	6.35	1.00	25.40	6.8
LTC-7PN-S6	3.5	750mAH	1.00	25.40	.25	6.35	.65	16.51	6.8
LTC-7PMP	3.5	1500mAH	1.50	38.10	1.20	30.48	.35	8.89	19.0
LTC-7PMS	7.0	750MAH	1.50	38.10	1.20	30.48	.35	8.89	19.0
LTC-16P*	3.5	1600mAH	1.44	36.58	.55	13.97	.55	13.97	16.0
LTC-7P-MP-F-S2***	3.5	1500mAH	1.50	38.10	1.20	30.48	.45	11.43	25.0
LTC-16P-CO-F-S11**	3.5	1600mAH	1.86	47.24	.66	16.76	.66	16.76	25.0

*Standard termination button negative case positive also available with tabs. ***Standard termination is .20 square pins, 1.700 center to center.
***Battery contains diode and resistor protection (IN5817 diode 1.6K resistor). Working voltage rate dependent.

Keeper II® Magnum™ Batteries

Battery No.	Working Voltage	Capacity 350 hr. rate	Length		Width		Thickness		Weight (Grams)
			IN.	MM	IN.	MM	IN.	MM	
LTC-16M	3.5	1600mAH	1.71	43.43	.99	25.15	.37	9.40	20
LTC-16M-S2	3.5	1600mAH	1.50	38.10	.90	22.86	.28	7.11	18
LTC-16M-MS-S1*	7.0	1600mAH	1.92	48.79	1.03	26.16	.68	17.27	45

*Battery is standard transistor-type configuration

Keeper II Cylindrical Batteries

Battery No.	Universal Size	Nominal Working Voltage	Nominal Capacity 350 hr. rate	Length		Diameter		Weight (Grams)
				IN.	MM	IN.	MM	
LTC-9C	1/2 AA	3.5	950 maH	.985	25.02	.540	13.72	8.6
LTC-17C	AA	3.5	1700 maH	1.950	49.53	.540	13.72	15.5
LTC-24C	AA	3.5	2400 maH	1.950	49.53	.540	13.72	17.5

Also available with: •.030 diameter radial pins •pin tabs •.005 x .125 tabs

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Electronics Division
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Phone: 417-776-2256 • FAX: 417-776-2257

Lithium Batteries

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Eagle-Picher has been producing cells and batteries for the Aerospace market for over 30 years. This long-term commitment has made us one of the world's most diversified battery manufacturers.

Today, our Electronics Division produces more than 20 different cell systems, including:

- Lithium/Carbon Monofluoride
- Lithium/Thionyl Chloride
- Reserve Lithium/Thionyl Chloride
- Calcium/Thionyl Chloride
- Silver-Zinc
- Reserve Silver-Zinc
- Nickel-Hydrogen
- Calcium/Calcium Chromate Thermal
- Lithium-Alloy/Iron Disulfide Thermal
- Lead Acid
- Sealed Nickel-Cadmium
- Vented Nickel-Cadmium
- Nickel-Zinc

Lithium Battery Systems

Eagle-Picher produces the two most energetic lithium systems available on the market today: Lithium/Carbon monofluoride (Li/CF$_x$) and Lithium/Thionyl chloride (Li/SOCl$_2$).

Development And Production Capabilities

Eagle-Picher's in-house capabilities are unmatched in the industry. A group of over 100 engineers, for design and project management, enables Eagle-Picher to staff a battery program of any magnitude. 200 people in our machine tool facility fabricate tooling and fixturing for hardware development and production.

Eagle-Picher has built qualified batteries for nearly every major weapons system currently used by the U.S. Government. We've earned a reputation for high quality, low cost development and production.

Eagle-Picher produces Lithium anode cells in LI/CF$_x$, Li/SOCL$_2$, and Reserve Li/SOCL$_2$. Batteries and cells are produced both as special purpose designs and "off the shelf" existing designs. Some of the existing cells and batteries are listed below.

Batt/Cell Part #	Type & Configuration	OCV	Cap. (Ahr.)	Vol (In^3)	Wt. (g.)	Remarks
GAP-9051	Li/SOCL$_2$Reserve	3.65	0.28	0.17	7.0	Low Rate
GAP-9059	Li/SOCL$_2$Reserve	32.90	3.5	45.9	1880	
GAP-9133	LI/SOCL$_2$Reserve	81.50	28.75	421.3	10450	Multisection
GAP-9133	Li/SOCL$_2$Reserve	33.3	7.5	MS	MS	Multisection
GAP-9146	Li/SOCL$_2$Reserve	14.80	1.1	5.09	350	Artillery Dynamics
GAP-9175	Li/SOCL$_2$Reserve	85.00	5.8	421.3	10450	Multisection
GAP-9175	Li/SOCL$_2$Reserve	37.00	8.0	MS	MS	Multisection
GAP-9218	Li/SOCL$_2$Reserve	3.65	0.001	0.007	0.40	Artillery Dynamics
GAP-9246	Li/SOCL$_2$Reserve	18.3	0.006	0.118	5.75	Artillery Dynamics
GAP-9254	Li/SOCL$_2$Reserve	22.00	.073	5.59	150	Artillery Dynamics
GAP-9254	Li/SOCL$_2$Reserve	11.00	.294	MS	MS	Multisection
LCF-111	Li/CF$_x$	3.00	240	34.7	880	>300 Whr./Lb.
LCF-112	Li/CF$_x$	3.00	39.4	6.06	170	>250 Whr./Lb.
LCF-113	Li/CF$_x$	3.00	12.0	3.00	93	High Rate
LCF-114	Li/CF$_x$	3.00	25.0	6.22	178	
LCF-115	Li/CF$_x$	3.00	25.0	6.22	180	Space Qualified
LCF-311	Li/CF$_x$	3.00	3.75	2.80	96	ALCM Cell
LCF-312	Li/CF$_x$	3.00	1.60	1.60	45	ALCM Cell
LCF-313	Li/CF$_x$	3.00	40.0	8.30	250	
LCF-314	Li/CF$_x$	3.00	6.0	2.11	64	High Rate
LCF-315	Li/CF$_x$	3.00	9.8	2.11	65	Low Rate
LCF-511	Li/CF$_x$	3.00	0.34	0.13	7.6	High Rate
LCF-512	Li/CF$_x$	3.00	0.60	0.20	8.7	High Rate
LCF-5P	Li/CF$_x$	3.00	0.50	0.28	8.5	OEM/Commercial
LCF-5PN	Li/CF$_x$	3.00	0.50	0.16	6.0	OEM/Commercial
LTC-311	Li/SOCL$_2$	3.65	1.00	0.27	13.3	High Rate
LTC-312	Li/SOCL$_2$	3.65	0.22	0.08	5.3	High Rate
LTC-313	Li/SOCL$_2$	3.65	0.60	0.16	7.08	High Rate
LTC-314	Li/SOCL$_2$	3.65	.310	0.10	6.5	High Rate
LTC-511	Li/SOCL$_2$	3.65	0.37	0.35	26.0	Artillery Dynamics

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Lithium Batteries Group

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Lithium Batteries

For Military And Aerospace Applications

Batt/Cell Part #	Type & Configuration	OCV	Cap. (Ahr.)	Vol (In^3)	Wt. (g.)	Remarks
MAP-9032	Li/CF$_x$	39.00	23.5	181.9	3402	Space Qualified
MAP-9036	Li//CF$_x$	39.00	23.5	279.5	4082	Space Qualified
MAP-9037	LI/CF$_x$	39.00	23.5	296.4	6124	Space Qualified
MAP-9045	Li/CF$_x$	3.00	0.35	0.24	9	
MAP-9046	Li/CF$_x$	30.00	3.75	120.3	3405	ACLM Batt Multisection
MAP-9046	Li/CF$_x$	30.00	3.75	MS	MS	ACLM Batt Multisection
MAP-9052	Li/CF$_x$	3.00	0.5	0.26	9	
MAP-9056	Li/CF$_x$	3.00	0.5	0.16	6.8	
MAP-9057	Li/SOCL$_2$	3.65	0.75	0.26	9	Military LTC-7P
MAP-9058	Li/CF$_x$	36.00	25.0	147.7	4086	Space Qualified
MAP-9062	Li/XOCL$_2$	10.95	0.25	0.13	16.5	High Rate
MAP-9063	Li/SOCL$_2$	3.65	3.2	1.18	48	
MAP-9066	Li/SOCL$_2$	3.65	3	0.54	24	
MAP-9068	Li/CF$_x$	3.00	1	5.08	68.5	
MAP-9068-1	LI/SOCL$_2$	3.65	1.5	5.08	68.5	
MAP-9070	Li/CF$_x$	3.00	0.5	0.26	9	
MAP-9072-1	Li/SOCL$_2$	3.65	1.5	1.39	20.6	
MAP-9072-2	Li/SOCL$_2$	3.65	22.5	1.39	20.6	
MAP-9074	Li/SOCL$_2$	3.65	1.6	0.56	22	
MAP-9076	Li/SOCL$_2$	6.00	1.5	4	95	Multisection
MAP-9076	Li/SOCL$_2$	-3.00	0.75	MS	MS	Multisection
MAP-9077-1	LI/SOCL$_2$	3.65	2.8	0.54	24	
MAP-9077	LI/SOCL$_2$	3.65	2.8	0.54	24	
MAP-9078-1	Li/SOCL$_2$	3.65	1.2	0.28	12	
MAP-9078	Li/SOCL$_2$	3.65	1.2	0.28	12	
MAP-9081	Li/SOCL$_2$	3.65	0.35	0.09	4	
MAP-9083	Li/CF$_x$	24.00	25.0	147.7	4086	Space Qualified
MAP-9084	Li/CF$_x$	3.00	0.5	0.16	6.8	
MAP-9084-1	Li/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9086	LI/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9088	Li/SOCL$_2$	3.65	3	1.52	21.2	
MAP-9090	Li/CF$_x$	3.00	0.5	0.16	6.8	
MAP-9091	Li/CF$_x$	3.00	1	0.57	19	
MAP-9092	Li/CF$_x$	6.00	0.5	0.57	19	
MAP-9094	Li/SOCL$_2$	3.65	0.75	0.16	6.8	Military LTC-7PN
MAP-9095	Li/SOCL$_2$	3.65	1.5	0.57	19	Military LTC-7PMP
MAP-9096	Li/SOCL$_2$	7.30	0.75	0.57	19	Military LTC-7PMS
MAP-9097	Li/SOCL$_2$	3.65	1.2	0.28	12	
MAP-9098	Li/SOCL$_2$	3.65	1.6	0.4	16	Military LTC-16P
MAP-9099	Li/SOCL$_2$	3.65	1.6	0.4	16	
MAP-9102-1	Li/SOCL$_2$	3.65	0.75	0.26	9	
MAP-9102-2	Li/SOCL$_2$	3.65	0.75	0.26	9	
MAP-9106	LI/SOCL$_2$	3.65	0.75	0.26	9	
MAP-9108	Li/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9113	Li/SOCL$_2$	7.20	12	17.9	1135	
MAP-9117	Li/SOCL$_2$	3.65	3	2.88	60	
MAP-9120	Li/SOCL$_2$	7.30	4.5	5.02	113.5	
MAP-9122	Li/SOCL$_2$	3.65	2.6	0.54	25	
MAP-9123	Li/SOCL$_2$	3.65	0.75	0.16	9	
MAP-9124	Li/SOCL$_2$	3.65	12	21.5	343.3	
MAP-9127	Li/SOCL$_2$	7.3	0.75	0.9	19	
MAP-9132	Li/SOCL$_2$	3.65	0.75	0.16	9	
MAP-9141	Li/SOCL$_2$	30.00	2.7	29.8	681	
MAP-9143	Li/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9150	Li/CF$_x$	15.00	200.0	230.0	13.3	Multisection
MAP-9150	Li/CF$_x$	3.00	48.0	MS	MS	Multisection
MAP-9151	Li/CF$_x$	18.00	12.0	62.7	1400	Multisection
MAP-9151	Li/CF$_x$	3.00	48.0	MS	MS	Multisection

Lithium Batteries

For Military And Aerospace Applications

Batt/Cell Part #	Type & Configuration	OCV	Cap. (Ahr.)	Vol (In^3)	Wt. (g.)	Remarks
MAP-9152	Li/SOCL$_2$	7.3	1.6	1.36	40	
MAP-9153	Li//SOCL$_2$	3.65	0.75	.16	6.8	
MAP-9161	LI/SOCL$_2$	3.65	0.35	0.097	4.5	
MAP-9164-1	Li/SOCL$_2$	3.65	1.6	0.9	28	
MAP-9164	Li/SOCL$_2$	3.65	1.5	0.9	28	
MAP-9166	Li/SOCL$_2$	3.65	1.6	1.36	28	
MAP-9168	Li/SOCL$_2$	3.65	1.5	0.57	19	
MAP-9170	Li/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9172	Li/SOCL$_2$	3.65	3	1.63	113.5	
MAP-9172-1	Li/SOCL$_2$	3.65	3	1.63	113.5	
MAP-9176	Li/XOCL$_2$	3.65	3	0.84	19	
MAP-9179	Li/SOCL$_2$	3.65	1.5	0.76	25	
MAP-9180	Li/SOCL$_2$	14.60	0.75	0.73	28	
MAP-9181	Li/SOCL$_2$	21.90	1.5	15.68	120	
MAP-9182-1	LI/SOCL$_2$	3.65	0.75	0.16	7.1	
MAP-9182	Li/SOCL$_2$	3.65	0.75	0.16	7.1	
MAP-9183	Li/SOCL$_2$	7.30	6	15.5	246	
MAP-9187	Li/SOCL$_2$	3.65	12	21.85	343.3	
MAP-9188	Li/SOCL$_2$	3.65	1.6	1.05	30	
MAP-9190	Li/SOCL$_2$	21.90	0.75	1.089	41	
MAP-9192	Li/SOCL$_2$	7.20	0.75	0.81	29	
MAP-9194	LI/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9195	LI/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9196	Li/SOCL$_2$	3.65	1.6	1.19	22	
MAP-9197	Li/SOCL$_2$	3.65	0.75	0.51	14.3	
MAP-9199	Li/SOCL$_2$	3.65	0.75	0.27	9.5	
MAP-9200	Li/SOCL$_2$	3.65	0.75	0.81	29	
MAP-9201	Li/SOCL$_2$	7.20	0.75	1.57	24	
MAP-9202	Li/SOCL$_2$	7.20	0.75	2.18	28	
MAP-9203	LI/SOCL$_2$	18.2	0.75	1.23	35	
MAP-9206	Li/SOCL$_2$	3.65	1.5	0.57	19	
MAP-9207	Li/SOCL$_2$	7.30	0.75	0.29	14	
MAP-9208	Li/SOCL$_2$	3.65	1.6	0.9	30	
MAP-9215	Li/SOCL$_2$	3.65	0.35	0.097	4.5	
MAP-9217	Li/SOCL$_2$	3.65	0.001	0.001	0.40	Artillery Dynamics
MAP-9219	Li/SOCL$_2$	10.95	1.00	0.90	126.8	High Rate
MAP-9220	Li/SOCL$_2$	7.20	4.8	10.64	204	
MAP-9220	Li/SOCL$_2$	3.65	1.6	MS	MS	
MAP-9221	Li/SOCL$_2$	3.65	12.8	19.67	431	
MAP-9223	Li/CF$_X$	24.0	35.0	88.3	1860	
MAP-9224	Li/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9225	Li/CF$_X$	15.0	240.0	301.3	6000	
MAP-9226	LI/SOCL$_2$	3.65	0.75	0.16	6.8	
MAP-9232	Li/SOCL$_2$	7.30	0.60	0.37	14.2	High Rate
MAP-9233	Li/SOCL$_2$	36.50	0.37	6.25	465	Artillery Dynamics
MAP-9235	Li/SOCL$_2$	3.65	15	21.85	499.4	
MAP-9241	Li/SOCL$_2$	3.65	0.75	0.16	6.8	

Customer Service

Eagle-Picher's battery facilities benefit from a unique combination of multiple system capability and a large support organization. Those benefits, coupled with strong customer orientation, Midwest economics and our long-term commitment to the product, have made us a leader in the industry of special purpose military batteries. The large existing production base, plus continued development into new battery technologies, is assurance that Eagle-Picher will meet your battery needs now, and still be here to produce them in the future.

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Alexander		•					•				•		
Ault											•		
Duracell	•	•	•	•	•	•	•					•	
Eveready	•	•	•	•	•	•	•				•	•	
Gates							•	•	•			•	
Gold Peak	•	•	•	•	•	•	•	•				•	
Kodak		•	•	•		•							
Motorola							•						
MPD													•
Panasonic	•	•	•	•		•	•	•	•	•		•	
Power Conversion						•						•	
Power Sonic							•		•		•	•	
Rayovac	•	•	•	•	•	•						•	
Renata				•		•							
Saft						•	•					•	
Sanyo						•	•	•				•	
Specialty Electronics													•
Tadiran		•				•	•					•	
Union Battery									•				
Varta		•	•	•		•	•	•		•		•	
Xenotronix											•		
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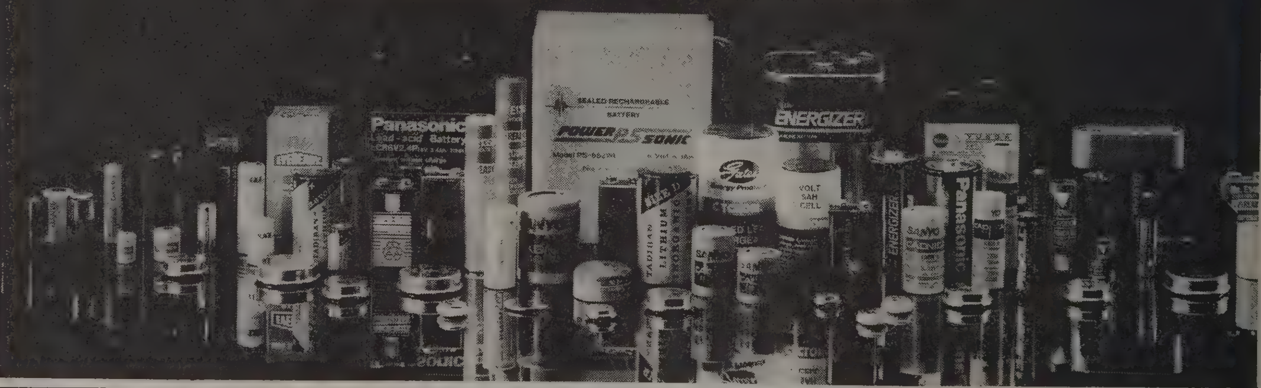

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Series	Size	Part #	Rated Capacity Ah	Rated Current mA	Maximum Continuous Current	Open Circuit Voltage	Operating Temp Range °C
BCX 72	PC	3B50	1.0	1.0	10 mA	3.9	−40 to +72
	.5gAA	3B27	1.6	10	50 mA	3.9	−40 to +72
	AA	3B64	2.0	20	100 mA	3.9	−40 to +72
	C	3B70	7.0	50	500 mA	3.9	−40 to +72
	C-N*	3B1600	7.0	50	500 mA	3.9	−40 to +72
	D	3B75	14	175	1 Amp	3.9	−40 to +72
	D-N*	3B1320	14	175	1 Amp	3.9	−40 to +72
	DD	3B76	30	350	3 Amps	3.9	−40 to +72
CSC 93	AA	3B24	2.0	50	150 mA	3.9	−32 to +93
	2/5C	3B665	2.5	50	250 mA	3.9	−32 to +93
	C	3B30	7.0	175	1 Amp	3.9	−32 to +93
	D	3B35	14	500	2 Amps	3.9	−32 to +93
	DD	3B36	30	1000	4 Amps	3.9	−32 to +93
PMX 150	AA	3B1065	1.6	20	150 mA	3.9	0 to +150
	C	3B90	6.5	50	500 mA	3.9	0 to +150
	CC	3B3000	13	180	500 mA	3.9	0 to +150
QTC	PC	3B880	1.0	1.0	1 mA	3.6	−40 to +85
	1/2 AA	3B960	.75	.04	4 mA	3.6	−40 to +85
	2/3 AA	3B950	1.5	.08	8 mA	3.6	−40 to +85
	AA	3B940	1.9	0.1	10 mA	3.6	−40 to +85

*Non-Magnetic Cells

BCX 72-Lithium Bromine Complex/Spirally Wound

Unique BCX technology for superior performance in moderate drain rate and low temperature applications requiring long life and high capacity.

CSC 93 and PMX 150 Lithium Sulfuryl Chloride/Spirally Wound

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QTC-Lithium Thionyl Chloride/Bobbin

QTC cells are ideal for CMOS RAM backup and many other low drain rate applications. Low self discharge rate. Low cost. Single/multiple cell packaging available with customer specified connectors.

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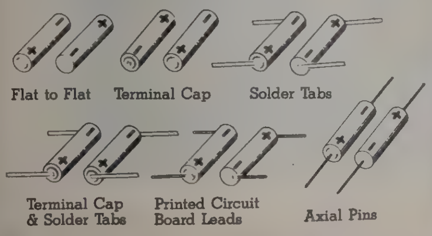
Electrochem can design custom battery packs specifically for your application. Safety and reliability are designed and manufactured into every pack taking into account application requirements, cell matching, protective circuitry, and vibration and shock specifications.

Terminations - Standard terminations available from Electrochem:



Electrochem
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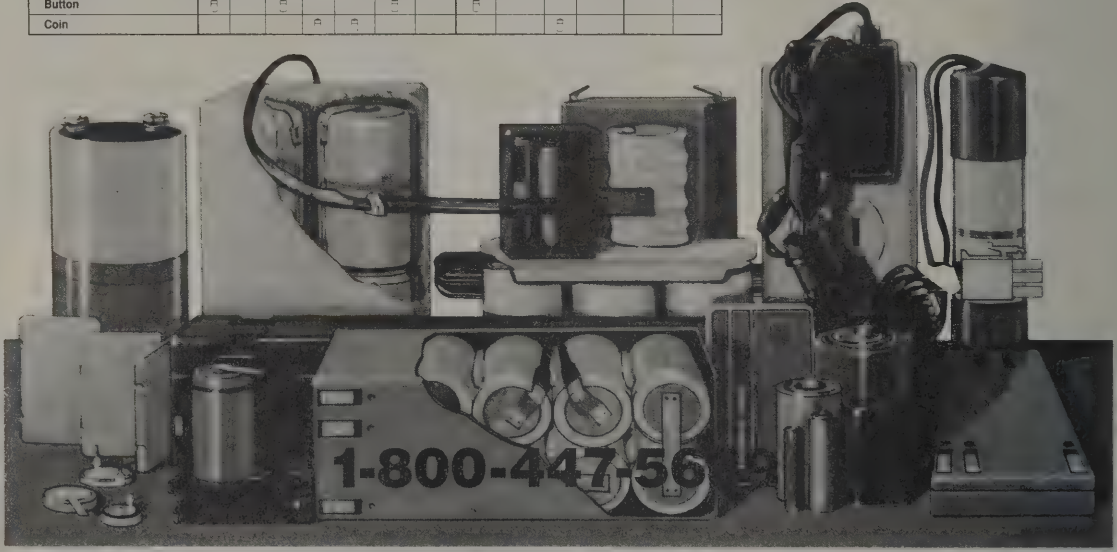
THE EAC CELL SELECTOR GUIDE

CHEMISTRY / MANUFACTURER	Primary							Rechargeable				Other	
	Alk.	Carb Zinc	Merc.	Li	Silver Oxide	Zinc Air	Zinc Chlor.	NiCd	Sealed Lead	Li	Nickel Metal Hydride	Solar Cell	Memory Card
Duracell	●			●	●	●							
Eagle-Picher				●					●				
Electrochem				●									
Eveready	●	●	●	●	●	●		●					
Gates Energy Products								●	●		●		
Maxell				●									●
Panasonic	●	●	●	●	●	●	●	●	●	●	●	●	●
Portable Energy Products									●				
Renata				●									
Saft				●				●					
Sanyo	●			●				●		●	●	●	
Sonnenschein									●				
Varta	●			●	●			●	●				
Yuasa/Exide								●	●				
AVAILABLE STYLE													
Cylindrical	●	●	●	●	●		●	●	●	●	●		
Rectangular	●					●		●	●				
Button	●		●			●		●					
Coin				●	●					●			

PACKAGING OPTIONS

- Shrink Wrap – Standard & Custom
- Plastic Casing – Injection Molded & Vacuum Formed
- Metal Housing & Brackets
- Printed Circuit Board Mountable
- Pressure Contacts
- Encapsulating – Potted & Foamed
- Shock & Vibration Resistant
- High Temperature Resistant
- Protective Componentry – Fuses, Short Circuit Devices, Temperature Sensors, Thermal Fusing



EAC

Engineered Assemblies
& Components Corporation

Battery Products Division

TQM
COMMITTED TO TOTAL QUALITY

ENGINEERED ASSEMBLIES ! ! !

EAC LOCATIONS:

NEW JERSEY
Corporate Headquarters
Assembly & Distribution
380 North Street
Teterboro, NJ 07608

MASSACHUSETTS
Assembly & Distribution
Burnap Industrial Park
12-B John Road
Sutton, MA 01590

NORTH CAROLINA
Assembly & Distribution
One North Commerce Center
5204 Greens Dairy Rd.
Raleigh, NC 27604

GEORGIA
Assembly & Distribution
The Plaza 85 Business Park
5900-E Unity Drive
Norcross, GA 30071

FLORIDA
Sales Office
4133 Seton Circle
Palm Harbor
Florida 34683

CANADA
1-800-833-4449

MISSION STATEMENT

"Our mission is to strive for Excellence in service, products, and performance. We will be Accountable to our customers, our suppliers, our community, and each other. Our Credibility will be assured and reinforced through this commitment.

Gates Energy Products
Industrial Battery Division

Gates Energy Products sealed-lead CYCLON cells and batteries feature a patented "starved electrolyte" system which affords longer life, superior performance, reliability, and durability. They are available in single cells as well as standard and custom assemblies. GENESIS batteries are 30% smaller and lighter than conventional batteries; have low internal resistance, high rate discharge and fast charge capability.

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

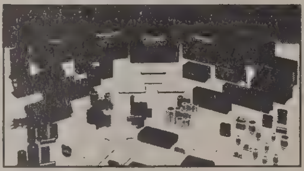
Gates Energy Products
Portable Battery Division

From the reliable, high performance, high capacity Nickel Cadmium family designed for specific application requirements, to Nickel-Metal Hydride, the "rechargeable technology of the future", Gates Energy Products offers a variety of cell performance types to meet your needs of today—and tomorrow.

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

Panasonic.
Batteries

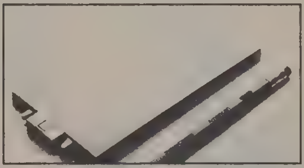


Panasonic has one of the broadest battery lines in the entire world; rechargeable lithiums, Ni-Cds, and sealed leads, plus lithium, micro alkaline and manganese primary batteries. We have the battery you need to power or backup the products or systems you make.

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

PORTABLE ENERGY PRODUCTS, INC.

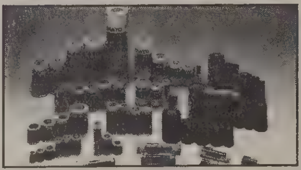


Portable Energy Products THINLINE energy cells are rechargeable sealed-lead cells in a flat thin package. Available in two sizes, (2.62" x 3.91", and 3.12" x 5.32") they are .332" thick making them ideal for applications where size and weight are at a premium, including laptop and notebook computers, portable and cellular telephones, remote equipment battery packs and the like.

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

SANYO
ENERGY CORPORATION



Our technology and innovation makes us a leader in sealed, chargeable Nickel Cadmium batteries. Cell designs and configuration from 45 to 20,000 MAHs (at 1.2 volts).

Sanyo is a leader in Primary Lithium Manganese Dioxide Cells. Designs and configurations available from (3.0 volts).

A Full line of primary alkaline cells for industrial and retail requirements AAA, AA, C, D, (at 1.5 volts).

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

YUASA EXIDE
YUASA BATTERY (AMERICA), INC.

Yuasa began development of the NP Series of maintenance free sealed lead batteries in 1958. Today's NP battery is the culmination of over 65 years of battery manufacturing experience.

The high energy density, advanced plate technology, fully sealed construction, efficient performance in float or cyclic service, and long service life combine to make Yuassa NP batteries the most reliable and versatile maintenance free rechargeable sealed lead batteries available.

EAC Engineered Assemblies & Components Corporation
Battery Products Division

- Custom Assembly & Distribution
- In House Engineering Support
- Computerized Sales & Customer Service Department
- Computer Aided Design
- Extensive Production Capabilities

EAC Engineered Assemblies
& Components Corporation
Battery Products Division

TQM
COMMITTED TO TOTAL QUALITY

EVEREADY®

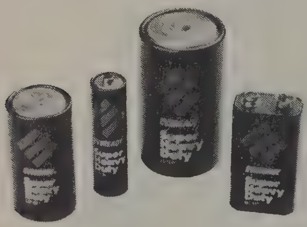
ENGINEERING FOR INNOVATION

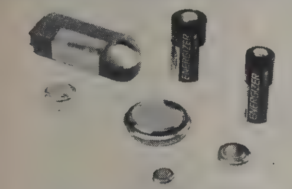
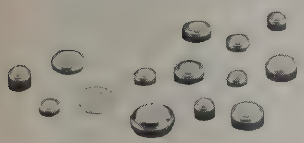
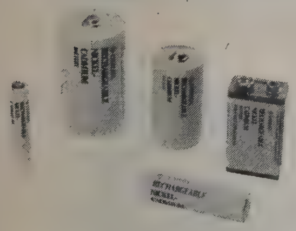
The name consumers trust
For over 100 years, Eveready has had a rich tradition of innovation and ingenuity. EVEREADY developed the world's first dry cell in the late 1800's. Since then, through a total commitment to quality, EVEREADY remains one of the most recognized and most trusted brand names of consumer products the world over.

Comprehensive technical support
EVEREADY provides a consulting service of experienced battery engineers as an aid to manufacturers in need of special battery designs. In a recent survey of OEM customers, EVEREADY sales managers were rated significantly better than the competition on their knowledge and expertise in battery technology and in the service they provide.

For help with your specific battery problems, call (314)982-2000 or write Eveready Battery Company, Inc., Battery Engineering, 1EBC, Checkerboard Square, St. Louis, MO 63164.

CHOOSE THE RIGHT BATTERY FOR THE RIGHT JOB

	Characteristics	Configurations	Battery Voltage	Applications
CLASSIC (Zn/MnO_2) Standard C/Zn 	Economical, dependable Variety of shapes and sizes Good shelf life Voltage drops gradually with use Reduced performance at low temperatures	AA C D 6V 9V Other Cylindrical and Rectangular	1.5 to 510	*Low to moderate periodic power needs* Radios, flashlights, lanterns, small lighted toys and novelties, barricade flashers, lighting and alarm systems, electric fence controllers, laboratory instruments, smoke detectors, remote control transmitters
SUPER HEAVY DUTY (Zn/MnO_2) Premium C/Zn 	Premium power at popular prices Variety of shapes and sizes Good shelf life Excellent leakage resistance Lasts longer than standard C/Zn batteries	AA AAA C D 6V 9V Other Rectangular	1.5 to 9	*Moderate to heavy current or regular use* Flashlights and lanterns, moderate power portable audio devices, calculators, motor driven devices, communication equipment, electronic games, remote control transmitters, clocks
ENERGIZER (Zn/MnO_2) Alkaline 	Premium price Variety of shapes and sizes Best, longest lasting power source Excellent shelf life Best low temperature characteristics Best voltage maintenance under load	AA AAA AAAA C D 9V Other Cylindrical and Rectangular	1.5 to 9	*Heavy current or continuous use* High power flashlights and lanterns, cameras and photo accessories, high drain toys and games, high power portable audio devices - Boom Boxes, CD players, personal stereo - "Walkman," portable TV's, smoke detectors, shavers, portable communication systems, medical instruments, clocks

	Characteristics	Configurations	Battery Voltage	Applications
MANGANESE DIOXIDE (Zn/MnO_2) 	Lower cost and energy density than silver oxide, mercuric oxide, and zinc air Variety of shapes and sizes Excellent shelf life Gradual sloping discharge curve Good low temperature characteristics Good resistance to shock, vibration, and acceleration	Miniature	1.5 to 12	*Miniature battery powered electronic equipment* Calculators, photo, novelties, watches, remote controls
MERCURIC OXIDE (Zn/HgO) 	Variety of shapes and sizes Outstanding shelf life High capacity Good resistance to shock, vibration, and acceleration Relatively flat discharge curve	AA 9V Miniature Other Cylindrical	1.35 to 8.4	*Miniature battery powered electronic equipment* Cameras, exposure meters, instruments, hearing aids, watches, calculators, microphones
SILVER OXIDE (Zn/Ag_2O) 	Variety of shapes and sizes Outstanding shelf life High capacity Flat discharge curve Good low temperature characteristics Good voltage maintenance under load Exceptional salting resistance Good resistance to shock, vibration, and acceleration	Miniature Photo	1.5 to 6	*Miniature battery powered electronic equipment* Hearing aids, cameras, instruments, watches, calculators
ZINC AIR (Zn/O_2) 	Variety of shapes and sizes Excellent shelf life until activated Highest capacity-to-volume ratio for miniature batteries Flat discharge curve Good low temperature characteristics Good resistance to shock, vibration, and acceleration Activated by removing tab covering from air access hole Must have access to air (oxygen) to operate	Miniature Hearing Aid 9V	1.4 to 8.4	*Miniature battery powered electronic equipment* Hearing aids, pagers
NICKEL CADMIUM (Ni/Cd) Rechargeable 	Variety of shapes and sizes Can be assembled into multicell packs Relatively flat discharge curve Good high and low temperature performance High resistance to shock, vibration, and acceleration Long cycle life, up to 1000 charges Higher self discharge than ENERGIZER alkaline Fast charge types available Consumer cells and chargers available Capacities from 80 mAh to 4 Ah available	AA AAA C D 9V	1.2 to 7.2	*Rechargeable devices, standby power and replacement cells for high usage devices* Portable tools and appliances, photoflash, remote control models, standby power, alarm systems, personal pagers, cordless phones, cellular phones, high use consumer devices, portable computers
LITHIUM (Li) 	Variety of shapes and sizes High energy density Outstanding shelf life Leak resistant UL Recognition on most sizes Good low and high temperature use and storage performance	AA Miniature Cylindrical	1.5 to 6	*Long life, low to moderate drain electronic equipment* Watches, calculators, cameras, memory back-up, hearing aids, pagers 1.5V AA for High Drain, High Tech Applications

Eveready Battery Company, Inc.
St. Louis, MO 63164

Gates Energy Products

Industrial Battery Division

CYCLON® SEALED-LEAD BATTERIES

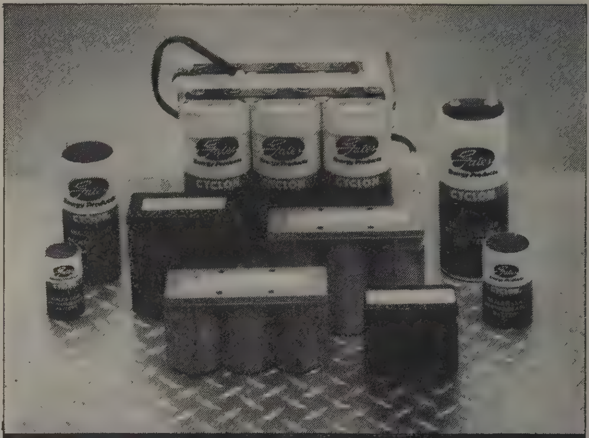
Gates invented and patented the starved-electrolyte, oxygen recombining sealed-lead battery. The unique construction of Gates' sealed-lead cells offers advantages not found in conventional lead-acid batteries. The starved electrolyte system allows recombination of gas to prevent dry-out and the venting of acid vapor, effectively eliminating terminal corrosion and allowing mounting in any position.

Gates offers a wide range of sealed-lead single-cell and monobloc batteries.

- **Cyclon®** – single cells for design versatility
- **Monoblocs** – standard batteries for volume applications

Cyclon single cells can be custom assembled to meet your precise needs. Available in three basic design sizes – 2.5, 5.0 and 25 Ah – Gates single cells can be connected in series or parallel to meet voltage, capacity and space requirements.

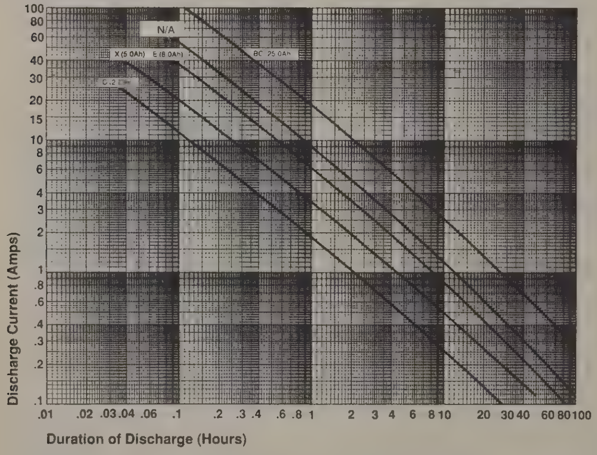
Monobloc batteries offer you the convenience of a pre-assembled component for a diversity of applications. Monoblocs are available in 4-, 6- and 12-volt modules of 2.5, 5.0 and 8.0 Ah sizes. These can also be connected in series or in parallel for additional voltage and amp-hour capacity.



A full range of Cyclon batteries offers superior performance, including longer life, designed to meet your application-specific needs.

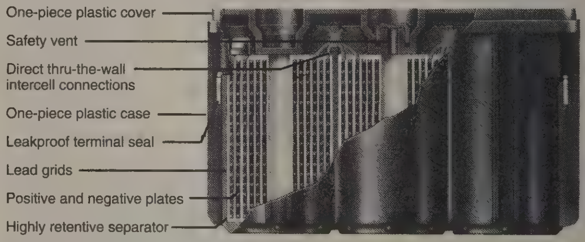
Standard batteries are available in a wide range of voltage and amp-hour choices, using either shrink-sleeve or plastic case packaging. If your needs are more specialized, Gates can custom assemble batteries to your precise amp-hour and voltage requirements with the packaging type, geometry and terminations best suited to your design.

SEALED-LEAD PERFORMANCE CHARACTERISTICS

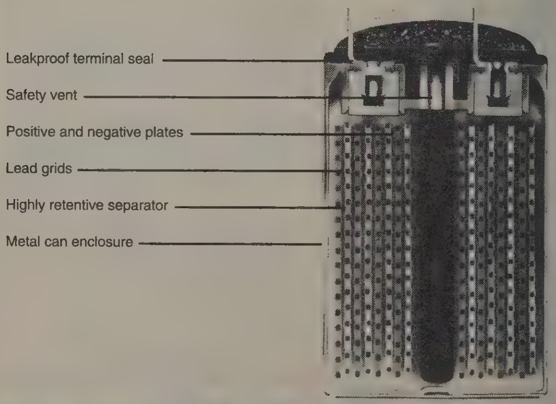


New cells must be cycled appropriately before full rated capacity, as shown on this curve, is reached.

GATES MONOBLOC BATTERY CONSTRUCTION


One-piece plastic cover
Safety vent
Direct thru-the-wall intercell connections
One-piece plastic case
Leakproof terminal seal
Lead grids
Positive and negative plates
Highly retentive separator

GATES SINGLE-CELL CONSTRUCTION


Leakproof terminal seal
Safety vent
Positive and negative plates
Lead grids
Highly retentive separator
Metal can enclosure

617 N. RIDGEVIEW DR. / WARRENSBURG, MO 64093-9301 **CALL 1-800-67-POWER**

Gates Energy Products

Industrial Battery Division

GENESIS® SEALED-LEAD BATTERIES

The new Genesis line of sealed-lead batteries has been specifically designed to meet a variety of customer needs and is available in different ratings, to provide unsurpassed reliability and performance. Genesis sets new industry standards in weight, size, terminal design, longevity and high-rate discharge power.

The expanded Genesis line includes an "application built" series; the HrD for high-rate discharge with 100% rated capacity on the first cycle, the CyD for cycle duty over short and long run times and the ExD for extreme duty performance under high temperatures and in severe environments.

Smaller and Lighter

Because of its high volumetric power density, Genesis provides equivalent power at high rates of discharge in 30% less space and weight.

Low Internal Resistance

Utilizing Gates' patented pure lead-tin technology, thin plate design provides the lowest internal resistance in the industry.

Industry Standard Sizes

Genesis is designed to fit into existing UPS cabinets, thereby reducing the amount of engineering needed for retrofit.

Maintenance-Free Design

Recombinant sealed technology combined with hardened copper terminals eliminates periodic terminal tightening, while assuring no acid leakage.

The Genesis sealed-lead acid battery is now available in three versions for use in high-rate discharge, cycle-duty, and extreme-duty applications.

Office Compatible

The Genesis battery features a flame-retardant, UL 94-VO case, flame arrestor vent (except 50 w/cell) and sealed design for use in the office environment.

Long Life

Gates' technology has been proven in demanding telecommunications field conditions for more than 17 years.

GENESIS PRODUCT FAMILIES

HrD Series (high-rate discharge)	**CyD Series** (cycle duty)	**ExD Series** (extreme duty)
50 watt per cell @ 15 min. rate	12 Amp. Hour @ 10 hr. rate	26 Amp. Hour @ 8 hr. rate
120 watt per cell @ 15 min. rate	26 Amp. Hour @ 10 hr. rate	37 Amp. Hour @ 8 hr. rate
190 watt per cell @ 15 min. rate	38 Amp. Hour @ 10 hr. rate	26 Amp. Hour Telecom model

AUTHORIZED GATES ENERGY PRODUCTS DISTRIBUTORS

UNITED STATES

Battery Specialties
Costa Mesa, California
(714) 755-0888

Engineered Assemblies
Teterboro, New Jersey
(201) 288-4477

Raleigh, North Carolina
(919) 790-9700

Sutton, Massachusetts
(508) 865-0722

Norcross, Georgia
(404) 446-3135

JaBro Batteries
Lisle, Illinois
(708) 964-9358

Kent Electronics
Houston, Texas
(713) 780-7770

Englewood, Colorado
(303) 792-9100

St. Paul, Minnesota
(612) 642-2828

Micro Power Electronics
Beaverton, Oregon
(503) 626-7086

Promark Electronics
Columbus, Ohio
(614) 351-2191

Rose Electronics
San Jose, California
(408) 943-0440

Southwest Electronics
Stafford, Texas
(713) 240-4000

TDI Batteries
Downers Grove, Illinois
(708) 971-3460

Tauber Electronics, Inc.
San Diego, California
(619) 274-7242

CANADA

Cantec Systems Ltd.
Ottowa, Ontario
(613) 725-3704

Enercell Technologies Inc.
Vancouver, British Columbia
(604) 298-1181

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PORTABLE POWER
HIGH ENERGY LITHIUM BATTERIES

POWERDEX®

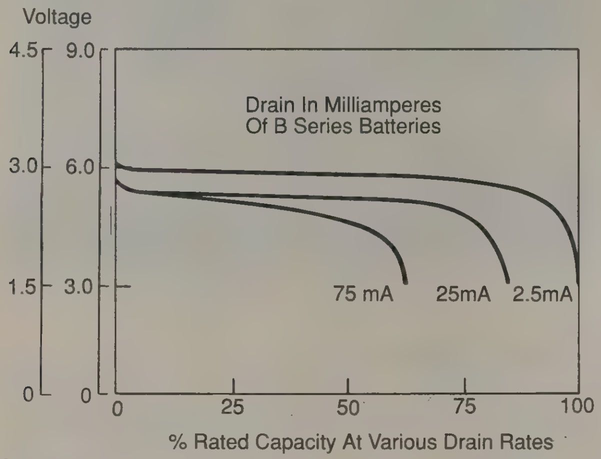
An Ultra-Thin, Ultra-Light, High-Energy Lithium Battery

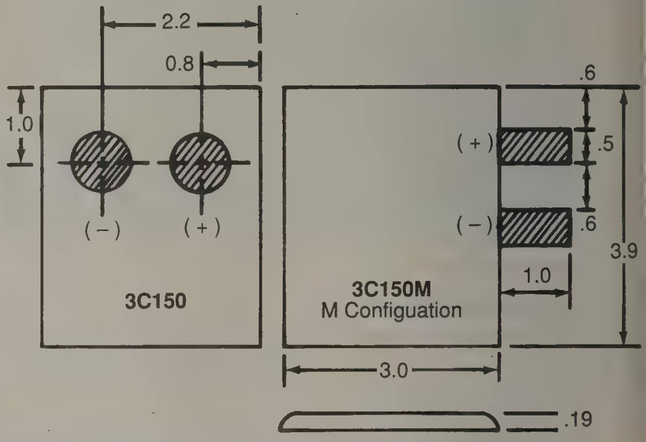
POWERDEX
POWERDEX

Portable Power

The Gould POWERDEX® primary battery is portable power technology advanced to a new plane. Outstanding power-to-weight and power-to-volume ratios offer the broadest possible freedom for product designs. The wafer-thin construction of POWERDEX® batteries provides reliable high-energy density in a light weight, compact package. POWERDEX® is the battery of choice where high energy density is acquired in a planar geometry configuration.

Typical Technical Data





C Series Batteries Dimensions (cm)

For Smartcard applications, customized 0.07 cm thin battery is available.

Advantages

- High energy density
- Flat Discharge curve
- Planar Construction
- Customized capacity
- Long shelf life
- Unique terminal arrangement

A New Dimension in Portable Power...

The POWERDEX® battery brings planar geometry to the contemporary design of electronic equipment. With high energy density, high capacity, and a flat discharge profile, the advanced technology of POWERDEX® planar batteries expands the potential of product design and performance.

The exceptionally efficient bipolar cell design and construction of the POWERDEX® battery provides low-resistance connection between cells. Together with this advanced construction, lithium manganese dioxide chemistry produces a reliable portable power source for today's electronic devices.

...For a New Generation of Products

The POWERDEX® battery is an excellent choice of portable power for low- to medium-drain applications. Its planar geometry can be accommodated in a wide range of electronic devices.

Characteristics of Gould Powerdex® Lithium Power Source Batteries

Battery Designation		Standard Dimensions (cm)	Nominal Voltage	Rated Capacity mAh	Recommended Max. Discharge Rate mA
A	3A1400	9.4 x 7.6 x 0.23	3	1400	125
	6A1400	9.4 x 7.6 x 0.41	6	1400	125
B	3B500	7.4 x 4.6 x 0.24	3	500	50
	6B500	7.4 x 4.6 x 0.40	6	500	50
C	3C150	3.9 x 3.0 x 0.19	3	150	20
	3C150M	3.9 x 3.0 x 0.19	3	150	20

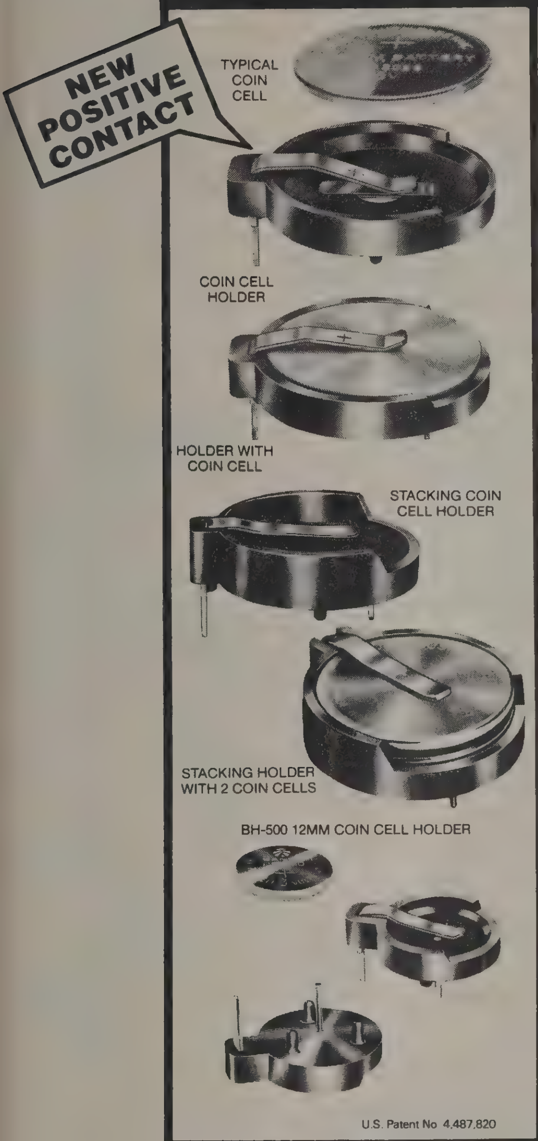
For more information on technical data, design assistance, prices and delivery, write or call:

Gould Inc., Electronic Power Sources
35129 Curtis Boulevard, Eastlake, Ohio 44095-4001
Phone: (216) 953-5151 Fax: (216) 953-5152
Toll Free: (800) 722-7890 (U.S. and Canada)

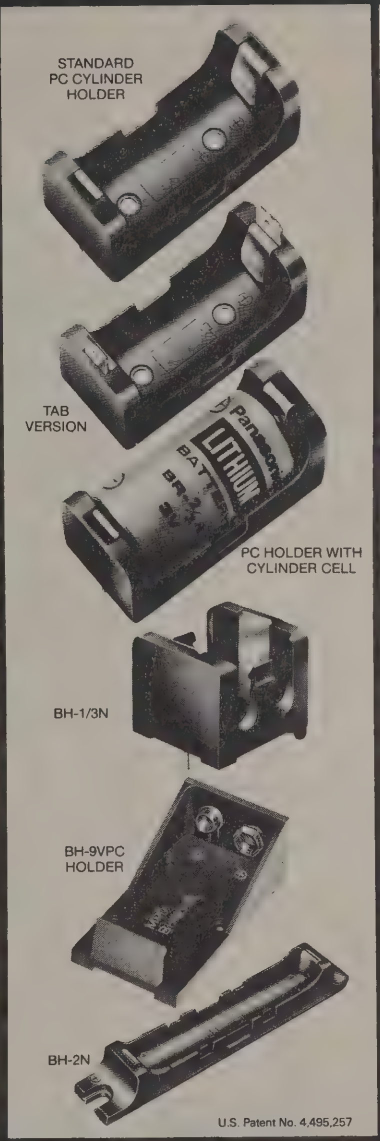
GOULD
Electronics

BATTERY HOLDERS

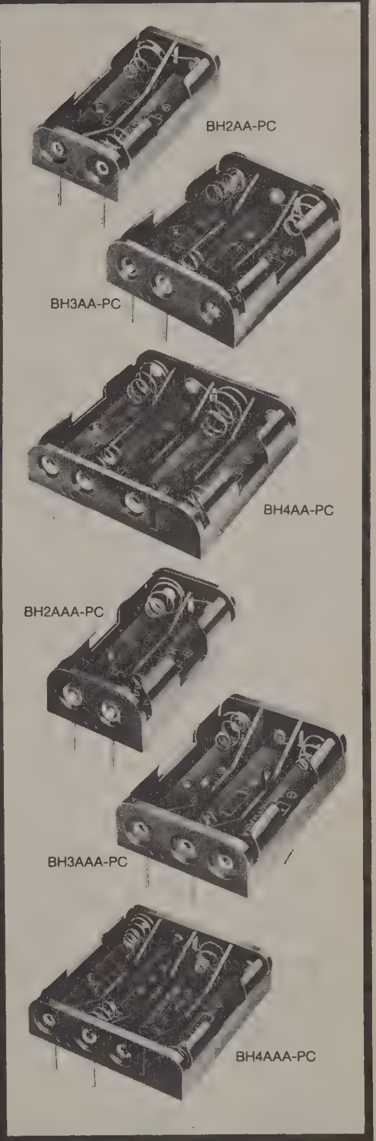
For Lithium, NiCd, Carbon, Carbon-Zinc & Alkaline Cells.


NEW POSITIVE CONTACT
TYPICAL COIN CELL
COIN CELL HOLDER
HOLDER WITH COIN CELL
STACKING COIN CELL HOLDER
STACKING HOLDER WITH 2 COIN CELLS
BH-500 12MM COIN CELL HOLDER

U.S. Patent No 4,487,820


STANDARD PC CYLINDER HOLDER
TAB VERSION
Panasonic
LITHIUM BATTERY
PC HOLDER WITH CYLINDER CELL
BH-1/3N
BH-9VPC HOLDER
BH-2N

U.S. Patent No. 4,495,257


BH2AA-PC
BH3AA-PC
BH4AA-PC
BH2AAA-PC
BH3AAA-PC
BH4AAA-PC

FOR MEMORY BACK-UP SYSTEMS

COIN CELL SERIES

Printed circuit board-mounted lithium coin cell battery holders eliminate the need for permanent solder tab mounting of cells. Unique molded design permits easy insertion and removal of battery without soldering or special tools. Fits 3-volt coin cells: Sizes 10mm, 12mm, 16mm, 20mm, 23mm, 24/25mm and 30mm. UL flammability rating-UL94V-0.

HORIZONTAL SERIES

Fits 3-volt lithium and other horizontal cells: sizes 2/3A, 1/2AA, AA, C, 2N and 1/3N, 9 volt batteries, too. Simple PC board mounting with fast-on tab terminals for hardware soldering and eyelet mounting.
UL flammability rating — UL94V-0.

BATTERY PACK SERIES

Four styles: PC (Printed Circuit), W (Wire), SF (Snap Fastener, male/female terminals), quick-connect solder lug. Fits all AA and AAA type cells, 2, 3 and 4 cell capacity. Corrosion-free nickel plated contacts, impact-resistant nylon #6. UL flammability rating — UL94V-2.

ALSO AVAILABLE: BATTERY HARDWARE, 9V SNAPS, PLASTIC BATTERY CASES.

CUSTOM BATTERY HOLDERS AVAILABLE ON REQUEST

MPD *Memory Protection Devices Inc.*

320 BROAD HOLLOW ROAD, FARMINGDALE, NY 11735 • 516-293-5891 • FAX 516-752-1971

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a] Wh/kg	Capacity[a] Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

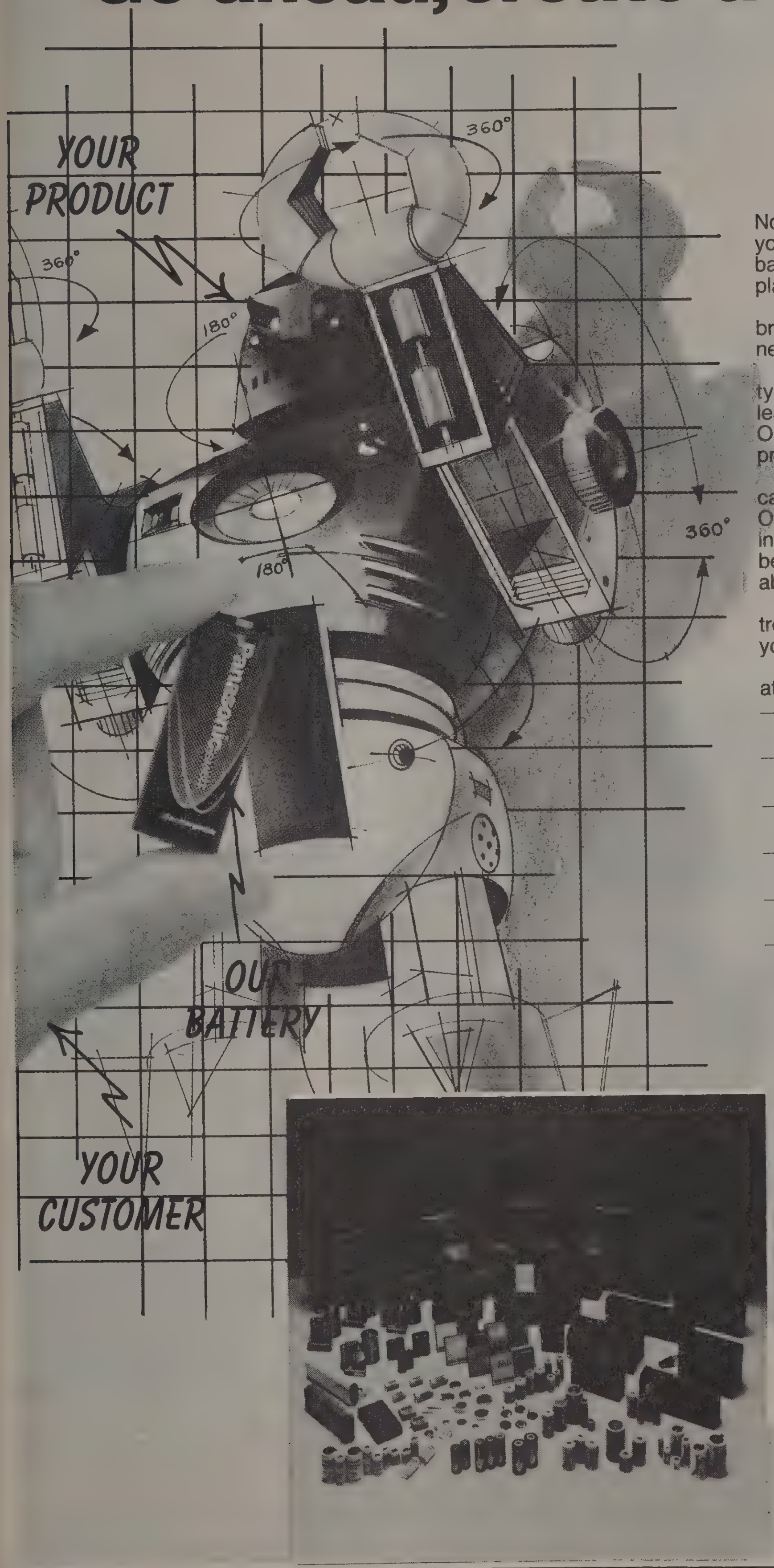
[j] Solid $RbAg_4I_5$ electrolyte.

[k] Several different cathode materials used.

[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

Go ahead, create a monster.



No matter how monstrous...or how small... your product may be, Panasonic has a battery to make it walk, run, hop, bop, work, play...or anything else you have in mind.

Surprised? Panasonic sells one of the broadest battery lines in the world, with new ones on the way.

So, it stands to reason that we have plenty to choose from. Including Ni-Cd, sealed lead and lithium rechargeable batteries. Or lithium, micro, alkaline or manganese primary batteries.

That's not all! You can choose super high capacity batteries. Rapid rechargeables. Or compact power sources for the ultimate in small size and portability. And they'll all be 100% tested to ensure top quality, reliability and durability.

With an eye toward the future, we're introducing new power sources that'll take your products well into the 21st century.

Panasonic batteries. They're your creative power source.

Northeast:
SECAUCUS, NJ 07094 • (201) 348-5272

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North Central:
ELGIN, IL 60123 • (708) 468-5692

South Central:
FT. WORTH, TX 76155 • (817) 685-1177

West Coast:
CYPRESS, CA 90630 • (714) 373-7567

Panasonic batteries.

From the industry giant.

Panasonic
Industrial Company
BATTERY SALES GROUP
OEM DIVISION

Are you getting all you want from eem?

EEM/Electronic Engineers Master is **user**-named, **user**-driven, and **user**-sensitive.

You, the electronic engineer, are the individual the thousands of manufacturers represented in EEM are trying to reach. **You** are the reason hundreds of manufacturers place their data pages in EEM—so that **you can specify their product in your project.**

EEM wants to know:

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- what products you are looking for
- what you call them
- what are their basic parameters
- where do they belong in the EEM Product Sections

What kind of reference material/engineering aids will help you make your electronic component choices:

- glossaries
- nomographs
- charts
- product selection guides

Write to the editor: The Editor
EEM/Electronic Engineers Master
645 Stewart Ave.
Garden City, NY 11530

Plainview Batteries offers a wide selection of rechargeable miniatures-Nickle-Cadmium in the range 1.2 to 4.8V, 15to600 mAh; and Nickel Metal Hydride Hydricell™ batteries in a rapidly expanding number of ratings. All feature maximum capacity for their size, low internal resistance, long life and easy re-charging...all at attractive low prices.

Nickel-Cadmium models retain over 50% of their original capacity after one year at room temperature. Design life is 5 to 7 years at a constant trickle charge rate.

Hydricells have up to 50% greater capacity than Nickel-Cadmium equivalents. Environmentally-friendly, they're well-suited for applications requiring no cadmium, lead or mercury. May be continuously trickle-charged, or quick charged under controlled conditions.

Check the standard-unit tables for the model that's perfect for your application. Should you require a 'special', we'll be happy to assemble it for you, using our extensive line of button cells as 'building blocks'.

Termination & Mounting Options

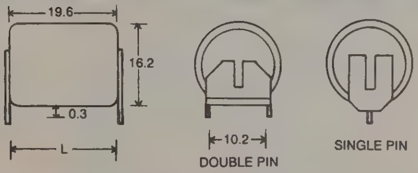
- Pins
- Solder Tabs
- PCB Mounting
- Axial Leads
- Flat Paks
- Eco-Paks™

HYDRICELL™ NICKEL METAL HYDRIDE

Standard Assemblies

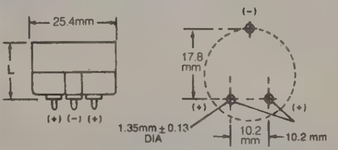
		Volts V	Cap mAh	Vert Horiz.	No. of Pins	Dia mm	L mm
PBNH-	2.4/100	2.4	100	H	2, 3	16.2	13.0
	3.6/100	3.6					19.5
	4.8/100	4.8					26.4
	2.4/250	2.4	250	V	3	25.4	12.6
	3.6/250	3.6					19.0

HORIZONTAL MOUNT



VERTICAL MOUNT

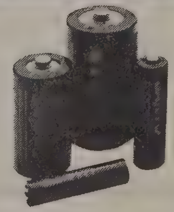
PBNH 3.6/250
PLAINVIEW BATTERIES



LEAD ACID

Sealed Lead Acid Batteries
Leakproof, Maintenance-Free 6V, 12V. Capacities to 200 Amp-Hrs.

ALKALINE

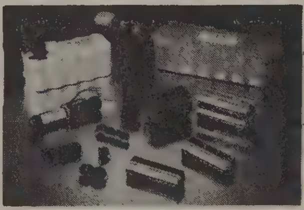


Alkaline Batteries
Triple-A, Double-A, C, D, 9V

NICKEL-CADMIUM CYLINDRICAL & FLAT CELLS, AND ASSEMBLIES

1.2V, up to 20,000 mAh

SANYO
CADNICA
Panasonic



Plainview's construction methods normally include: gluing of cells together to form a rigid block, double welding of all interconnect tabs, insulation over the tabs and heat shrink covering of the pack. Interconnections are provided for via output tabs, wire leads and leads plus connectors., Packs may also include fuses, thermal switches or sensors if required.

CLOCKMATE® COMPUTER CLOCK BATTERIES

Plainview has the correct battery for every computer model.

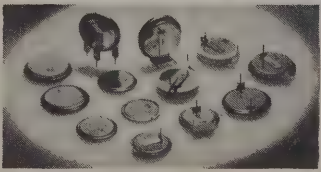
ClockMate
COMPUTER CLOCK BATTERY

ClockMate® 913 Alkaline
4.5 Volts • 2100 mAh • Temp: -30° to +60°C

ClockMate
COMPUTER CLOCK BATTERY

ClockMate® 914 Lithium
6 Volts • 1700 mAh • Temp: -40° to +85°C

LITHIUM



Lithium Coins
2 & 3-Volts.
Capacity 5 to 1000 mAh
UL-Recognized

Lithium Power-Plus Cylindricals
2.8 to 3.6 Volts.
Capacities to 35 Amp-Hrs.
Operating Temps:
-55° to +125°C

Lithium 9-Volt "Transistor" Battery
1200 mAh
UL-Recognized

ULTRALIFE
LITHIUM POWER CELL
ULTRALIFE
LITHIUM POWER CELL

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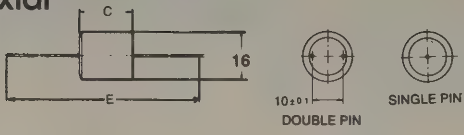
Nickel-Cadmium Standard Assemblies

AXIAL/RADIAL LEADS

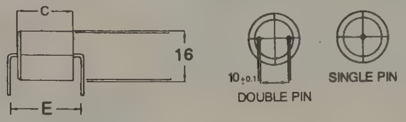
Users have total flexibility in pin spacing and component placement. Axial are available in tape-and-reel for large-quantity production, with two or three-leads.

Axial


C
16
E
10±0.1
DOUBLE PIN
SINGLE PIN

Radial

Best Buy! Check our Prices!

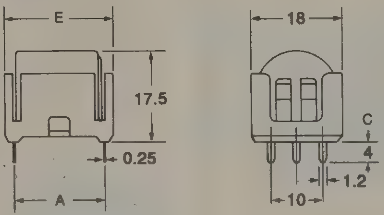

C
16
E
10±0.1
DOUBLE PIN
SINGLE PIN

		Volts V	Cap mAh	C mm	E mm
PMB-A- (Axial)	1.2/35	1.2	35	4.0	65
	2.4/35	2.4		6.3	65
	3.6/35	3.6		10.3	70
	1.2/65	1.2	65	6.3	65
	2.4/65	2.4		11.5	80
	3.6/65	3.6		16.7	85
PMB-R- (Radial)	2.4/65	2.4	65	11.5	12.5
	3.6/65	3.6		16.7	18.0

ECO-PAK™ BATTERY HOLDERS

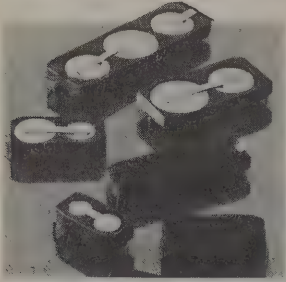
The Ecological Solution

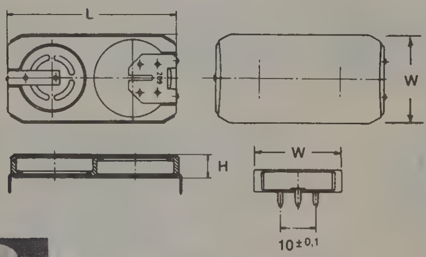
Manufacturers can meet "easily removable" requirements, using conventional through-hole assembly techniques. The battery is easily field-replaceable.


E
17.5
0.25
A
18
C
4
1.2
10

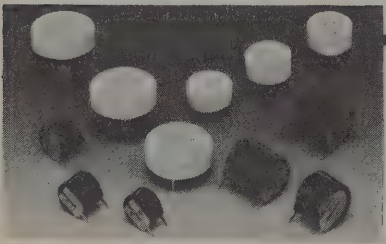
		Volts V	Cap mAh	A mm	E mm
PMB-AM-	2.4/65	2.4	65	12	16
	3.6/65	3.6		17.8	21

FLAT-PAKS

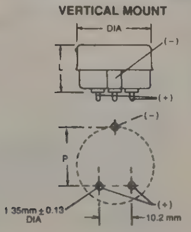


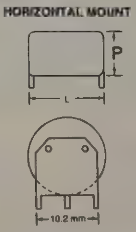


		Volts V	Cap mAh	L mm	W mm	H mm
PMB-F-	2.4/33	2.4	33	27.9	14	6.8
	3.6/33	3.6		38.1		
	2.4/35	2.4	35	35.5	18	5.2
	3.6/35	3.6		50.8		
	2.4/65	2.4	65	35.5	18	7.3
	3.6/65	3.6		50.8		
	2.4/110	2.4	110	48.2	25	6.0
	3.6/110	3.6		71.1		



WITH MOUNTING PINS


VERTICAL MOUNT
DIA
(-)
L
(+)
(-)
P
1.35mm ± 0.13 DIA
(+)
10.2 mm


HORIZONTAL MOUNT
P
L
10.2 mm

		Volts V	Cap mAh	Max. I_D mA	Vert. Hor.	No. of Pins	Dia mm	L mm	P mm
PMB-	2.4/15		15	15	H	2, 3	12.0	7.5	7.25
	3.6/15	3.6						10.5	10.25
	4.8/15	4.8						14.5	14.25
	2.4C	2.4	35	40	V	3	16.5	7.1	12.7
	3.4C	3.6						11.3	
	4.8C							13.6	
	2.4/65	2.4	65	75	H	2,3	16.5	12.5	12.25
	3.6/65	3.6						17.9	17.4
	4.8/65	4.8						24.4	24.25
	2.4/B	2.4	110	165	V	3	23.5	9.6	17.8
	3.6/B	3.6						14.3	
	4.8/B	4.8						17.5	

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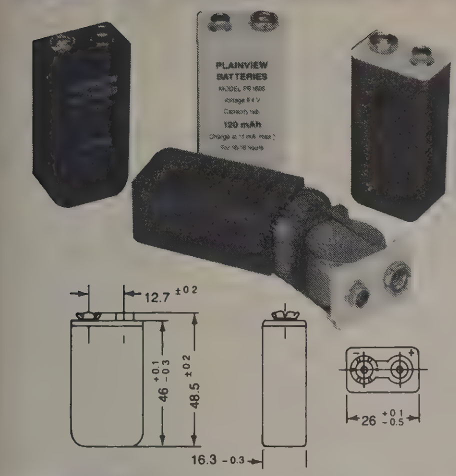
7.2, 8.4 & 9.6-Volt "Transistor" *Highest Voltages! Highest Capacities!*



STANDARD OFF-THE-SHELF NICKEL CADMIUM BUTTON CELL ASSEMBLIES

The economical solution—in a standard package—for new designs as well as replacement applications. They feature very low self discharge; high energy storage; stable discharge voltage; and low internal impedance. Can be recharged more than 500 times.

		Nom. Volts	No. of Cells	Nom. Cap. mAh	Typ. Cap. mAh	Max Cont. I_D mA	Max Surge A
PB-	1604	7.2	6	110	120	165	1.0
	1605	8.4	7				
	1606	9.6	8				

TEMPERATURE RANGE
CHARGE: 0 to +50°C
DISCHARGE: -30 to +50°C
STORAGE: -40 to +50°C
+55°C allowed for short periods

Button Cells *For Your Custom Packs*

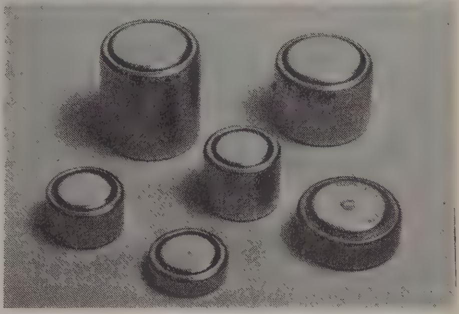
Plainview Batteries can supply battery assemblies up to 12 volts to meet your specific requirements, using our extensive line of button cells as 'building blocks' in a variety of form factors.

NICKEL CADMIUM

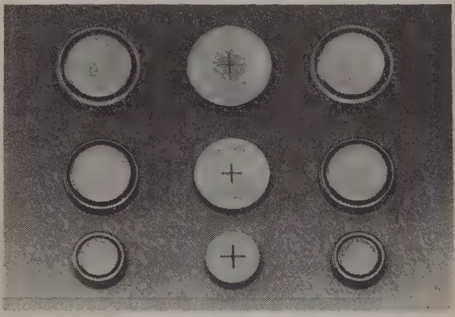
		Nom. Cap mAh	Max I_D Cont. mA	Dia. mm	Ht. mm
SINGLE **ZA-** 1.2V	15	15	15	11.5	3.8
	33*	33	33	11.5	5.4
	35	35	40	15.5	4.0
	60	60	100	15.5	6.0
	65	65	110	15.5	6.0
	110	110	165	22	4.6
	180	180	250	25	6.0
	280	280	280	25	9.0
	600	600	300	35	10
DOUBLE **Z2A-** 2.4V	15	15	15	11.5	7.0
	35	35	40	15.5	6.5
	65	65	75	15.5	12.0
	110	110	165	22	7.5
	180	180	250	25	10.0
	250	250	250	25	13.5
	300	300	600	35	10.0
TRIPLE **Z3A-** 3.6V	15	15	15	11.5	10
	65	65	75	15.5	17.4
DA-/VA- Multi-Element Hi-Discharge 1.2V	280	280	560	25	9.0
	600	600	1800	35	10

* Ideal for Hearing Aids

TEMPERATURE
STORAGE & OPERATING: -40° to +55°C
Also available to +65°C



Nickel-Cadmium

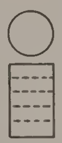


Hydricell™ Nickel Metal Hydride

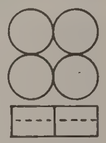
NICKEL METAL HYDRIDE

		Nom. Cap mAh	Typ. Cap mAh	Max. I_D Cont. mA	Max. Pulse 2-Sec A	internal imped mOhms	Dia mm	Ht. mm	Wt. Gr
NH- **Single** **1.2V**	80	80	85	80	0.7	180	15.5	6.3	4.3
	100	100	110	100	0.7	180	15.5	6.3	4.6
	120	120	130	120	1.5	150	22.1	4.8	6.6
	150	150	165	150	1.5	150	22.1	4.8	7.0
	200	200	220	200	2.0	80	25.2	6.1	10.2
	250	250	270	250	2.0	80	25.2	6.1	10.5
	300	300	320	300	2.0	80	25.2	7.7	12.2
	380	380	400	380	2.0	80	25.2	7.7	12.7

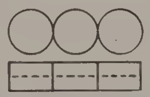
ASSEMBLY OPTIONS



Cylindrical Stack for Hor. or Vert. Mt.



Double Row Flat Pack



Single Line Flat Pack (any No. of Cells per Stack)

TEMPERATURE STORAGE & OPERATING: -20° to +50°C
STD. CHARGE: 0 to +50°C
RAPID CHARGE: +10 to +50°C

Plainview Batteries, Inc.

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ETERNACELL®

LITHIUM-TCL

Ideally Suited for Clock Battery Replacement or as Original Equipment

The TCL system allows operation of many electronic functions in addition to volatile memory support—with just a single cell. Today's Lithium batteries exceed all the previously accepted operating parameters for primary batteries and allow design freedom from virtually all shelf life and operating temperature constraints. While not intended for high rate applications, **Eternacell TCL batteries offer a combination of features unmatched by any other lithium battery system.**

Committed to Continuing Development

Formed in 1970 specifically to develop and apply high energy battery systems, Power Conversion introduced the first commercial lithium systems and today is the leading manufacturer of lithium batteries in the world, supplying both high and low rate requirements for commercial, industrial and government applications. Today Power Conversion markets three lithium battery systems to cover all types of applications from low rate miniaturization to larger size, high rate cells capable of meeting extreme environmental requirements

These systems are:
TCL — Lithium Thionyl Chloride ($Li/SOCl_2$)
MDX— Lithium Manganese Dioxide (Li/MNO_2)
SDX — Lithium Sulfur Dioxide (Li/SO_2)

General Specifications of TCL Eternacell® Lithium Thionyl Chloride Batteries

The Eternacell® TCL is offered in a complete line ranging in capacity from 0.8 ampere hours to 11 ampere hours. The following features are standard:

- Every cell is a power limited cell designed for safe operation.
- Every cell incorporates a safety vent in the cell case.
- Every cell is hermetically sealed.
- Every cell is 100% voltage checked, and 100% high temperature stored prior to shipment.

Model No.	Equivalent Size	Weight		Height		Diameter		Nominal Capacity (AHR)	Capacity @ 10,000 Hrs (AHR)	Protected C-MOS Support Capacity (AHR) (100,000 Hrs)	Terminals
		OZ.	GM	IN.	MM.	IN.	MM				
T04/51 T04/52 T04/53 T04/56	1/2 AA	.32	9	.975	25.0	.56	14.2	.850	.95	.85	Button Solder Tab Radial PC Axial*
T06/51 T06/52 T06/53 T06/56	AA	.56	16	1.96	49.3	.56	14.2	1.80	1.80	1.75	Button Solder Tab Radial PC Axial*
T32/51 T32/52 T32/53 T32/56	2/3 A	.60	17	1.32	33.1	.64	16.6	1.50	1.50	1.50	Button Solder Tab Radial PC Axial*
T52/51 T52/52 T52/56	C	1.8	52	1.95	49.5	1.01	25.7	6.00	6.50	6.00	Button Solder Tab Axial*
T20/51 T20/52 T20/56	D	3.5	99	2.38	60.2	1.31	33.3	14.00	14.50	14.00	Button Solder Tab Axial*

*20ga Insulated 1.75 Inch Axial Lead Wire Each Terminal

Over the last twenty years Eternacell lithium batteries have been meeting the power needs of hundreds of products around the world -- in personel computers, utility meters, security products, industrial controls, and high performance military and aerospace products. Custom pack 3V and 6V batteries are available in addition to the sizes listed above. Every cell is approved by Underwriters Laboratory, Inc. Eternacell also offers the largest number of sizes, terminations, and mounting options available.

Made in
★★★★★
U.S.A.

HAWKER PCI ETERNACELL BATTERIES **Power Conversion, Inc.**

495 Boulevard, Elmwood Park, N.J. 07407
Phone: 201-796-4800 • Fax: 201-796-6243

LITHIUM BATTERY
ETERNACELL
ETERNACELL
COMPUTER BATTERY
ETERNACELL

INDUSTRIAL
COMMERCIAL
AEROSPACE
MILITARY APPROVED
ARMY
NAVY
AIR FORCE

Delivered to spec
LITHIUM BATTERIES
Packaged to fit

If your design needs a lithium battery, we can provide the right battery system that will fit your requirements exactly, even for the most hostile environments. Power Conversion is the largest U.S. producer of lithium cells and batteries, from miniature cells to large complex multicell battery designs.

• Lithium Sulfur Dioxide	2.9V/cell
• Lithium Thionyl Chloride	3.7V/cell
• Lithium Manganese Dioxide	3.4V/cell

We have designed, qualified, and produced a broad range of hi-rel lithium batteries to satisfy virtually any application over the past twenty years.

Count on our experience to develop the high-rate, low rate, or special battery system for your project. Call us today.

HAWKER BATTERIES
PCI ETERNACELL BATTERIES

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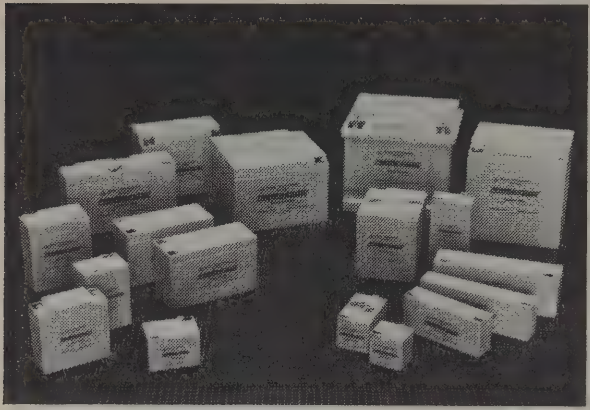
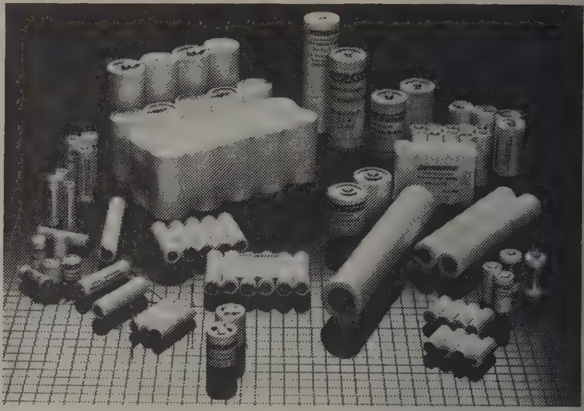
RECHARGEABLE POWER PS SONIC BATTERIES





SEALED LEAD-ACID BATTERIES

Model	Nominal Voltage V	Nominal Capacity @ 20 hr. rate (A.H.)	Current @ 20 hr. rate mA	DIMENSIONS								Weight	
				Length		Width		Height		Ht. Over Terminal			
				in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kg.
PS-445	4	4.5	225	1.93	49	2.09	53	3.70	94	3.86	98	1.5	0.7
PS-490	4	9.0	450	4.02	102	1.73	44	3.70	94	3.86	98	2.4	1.1
PS-605	6	0.5	25	2.24	57	0.55	14	1.97	50	1.97	50	.20	.09
PS-610	6	1.0	50	2.00	51	1.65	42	2.00	51	2.20	56	0.6	0.3
PS-612	6	1.2	60	3.82	97	0.94	24	2.00	51	2.13	54	0.6	0.3
PS-620	6	2.0	100	2.95	75	2.00	51	2.09	53	2.28	58	1.1	0.5
PS-630	6	3.0	150	5.28	134	1.34	34	2.35	60	2.56	65	1.5	0.7
PS-632	6	3.2	160	2.60	66	1.30	33	4.84	123	5.00	127	1.5	0.7
PS-640	6	4.0	200	2.76	70	1.89	48	4.02	102	4.02	102	1.8	0.8
PS-650L	6	5.0	250	2.63	67	2.63	67	3.78	96	4.28	109	2.0	0.9
PS-665	6	6.5	325	3.86	98	2.20	56	4.05	103	4.05	103	3.0	1.4
PS-670	6	7.0	350	5.95	151	1.34	34	3.70	94	3.86	98	3.0	1.4
PS-682	6	8.0	400	3.86	98	2.20	56	4.65	118	4.65	118	3.3	1.5
PS-695	6	9.5	475	4.26	108	2.75	70	5.54	141	5.54	141	4.9	2.2
PS-6100	6	10.0	500	5.95	151	2.00	51	3.70	94	3.86	98	4.6	2.1
PS-6120	6	12.0	600	4.26	108	2.75	70	5.54	141	5.54	141	5.5	2.5
PS-6200	6	20.0	1000	6.18	157	3.27	83	4.92	125	4.92	125	8.2	3.7
PS-1207	12	0.7	35	3.78	96	0.98	25	2.42	62	2.42	62	0.8	0.35
PS-1212	12	1.2	60	3.82	97	1.65	42	2.00	51	2.13	54	1.3	0.6
PS-1220	12	2.0	100	7.01	178	1.34	34	2.36	60	2.56	65	1.9	0.9
PS-1226	12	2.6	130	7.01	178	1.34	34	2.36	60	2.56	65	2.2	1.0
PS-1230	12	3.0	150	5.23	134	2.64	67	2.36	60	2.60	66	2.6	1.2
PS-1232	12	3.2	160	7.68	195	1.85	47	2.76	70	2.95	75	3.1	1.4
PS-1242	12	4.0	200	3.54	90	2.76	70	3.98	101	4.13	105	3.8	1.7
PS-1252	12	5.0	250	3.54	90	2.76	70	4.02	102	4.25	108	4.2	1.9
PS-1270	12	7.0	350	5.95	151	2.56	65	3.70	94	3.86	98	5.7	2.6
PS-1282	12	8.0	400	3.86	98	4.40	112	4.65	118	4.65	118	6.7	3.0
PS-1295	12	9.5	475	8.38	213	2.75	70	5.50	140	5.50	140	10.0	4.6
PS-12100	12	10.0	500	5.95	151	4.00	102	3.70	94	3.86	98	9.2	4.2
PS-12120	12	12.0	600	5.94	151	3.86	98	3.70	94	3.94	100	9.0	4.1
PS-12120L	12	12.0	600	8.38	213	2.75	70	5.50	140	5.50	140	11.0	5.0
PS-12170	12	17.0	850	7.13	181	2.99	76	6.57	167	6.57	167	12.8	5.8
PS-12260	12	26.0	1300	6.89	175	6.54	166	4.92	125	4.92	125	18.7	8.5
PS-12280	12	28.0	1400	6.54	166	4.92	125	6.89	175	6.89	175	19.4	8.8
PS-12330	12	33.0	1650	7.68	197	5.19	132	6.38	162	7.15	182	26.5	12.0
PS-12400	12	40.0	2000	7.75	197	6.50	165	6.69	170	6.69	170	30.9	14.0
PS-12500	12	50.0	2500	9.40	239	5.50	140	8.20	208	9.05	230	36.0	16.4
PS-12600	12	60.0	3000	10.25	260	6.60	168	8.20	208	9.45	240	46.0	20.9
PS-12800	12	80.0	4000	12.00	305	6.60	168	8.20	208	9.45	240	55.0	25.0

TOLERANCES: Length and Width: ±0.04 in. (1mm) - Height: ±0.08 in. (2mm)

SEALED NICKEL-CADMIUM BATTERIES

Model	Nominal Voltage (V)	Capacity 5 hr. rate (mAh)	Standard Charge		Quick Charge		Diameter (Max.)		Height (Max.)		Weight	
			(mA)	(hrs.)	(mA)	(hrs.)	inches	mm.	inches	mm.	oz.	g
PS-1/3AA	1.2	110	11	15	28	6.0	0.571	14.5	0.669	17.0	0.25	7
PS-N	1.2	150	15	15	38	6.0	0.473	12.0	1.142	29.0	0.30	9
PS-AAA	1.2	180	18	15	45	6.0	0.413	10.5	1.752	44.5	0.35	10
PS-2/3AA	1.2	270	25	15	75	4.5	0.571	14.5	1.181	30.0	0.42	12
PS-AA	1.2	600	50	15	150	4.5	0.571	14.5	1.988	50.5	0.74	22
PS-SC	1.2	1300	120	15	300	6.0	0.906	23.0	1.693	43.0	1.69	48
PS-C	1.2	2000	200	15	–	–	1.024	26.0	1.969	50.0	2.65	75
PS-1/2D	1.2	2200	220	15	–	–	1.271	32.3	1.448	36.8	2.82	80
PS-D	1.2	4000	400	15	–	–	1.339	34.0	2.421	61.5	5.47	155
PS-F	1.2	7000	700	15	–	–	1.339	34.0	3.583	91.5	8.82	250

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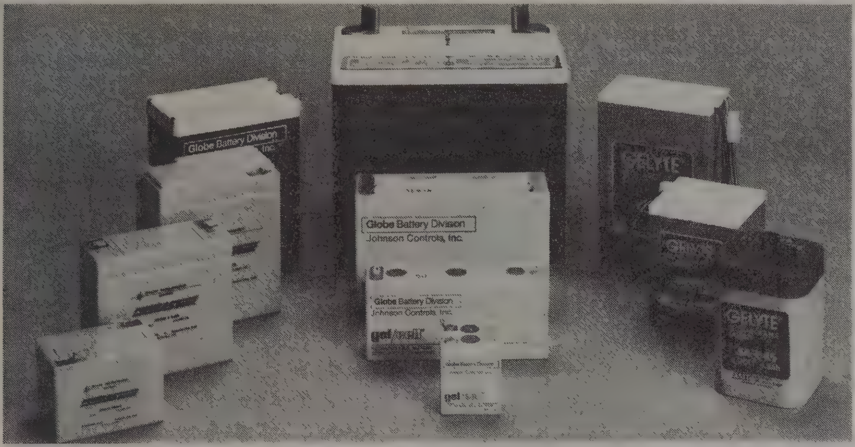
STANDARD & CUSTOM BATTERY ASSEMBLIES



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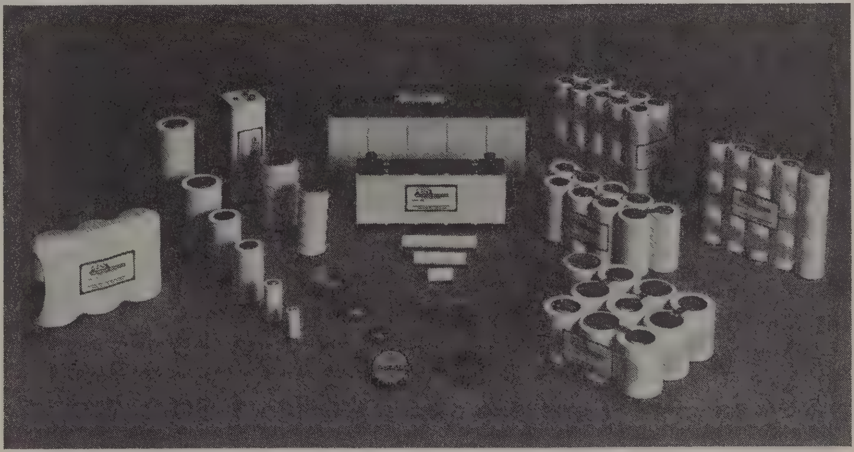
U.P.S. • Hobby
Oceanography



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PolySwitch® **Resettable** Devices for the Battery Market

Noncycling, low-profile polymer devices provide reliable, resettable protection for rechargeable batteries

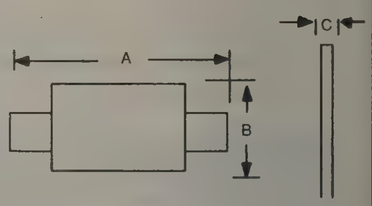
Weldable nickel leads and narrow, low-profile design make PolySwitch strap products extremely easy to install on the edges of battery packs.

Solid-state PolySwitch strap SRP and PRP products provide reliable, noncycling protection for rechargeable batteries and their surroundings. Sensitive to both current and temperature, the devices protect against external short circuits and internal overheating.

PolySwitch devices are positive temperature coefficient resistors that increase in resistance when heated by temperature or excess current.

A PolySwitch device "trips" and remains "latched" in a high resistance state until a fault is removed. Latching prevents continuous cycling, which occurs in bimetallic products, and can cause a short-circuiting metal object to overheat and create a potential fire hazard.

- The devices are rugged-they have no contacts to weld closed and their solid-state design is insensitive to shock and vibration.
- PolySwitch devices are remotely resettable-they can trip and automatically reset thousands of times.
- Low resistance remains stable over time and has minimal impact on battery life.
- All products are TUV and UL recognized.

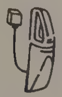
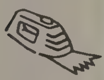
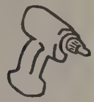
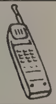
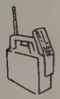
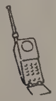
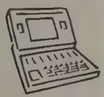
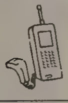
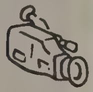
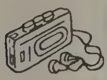
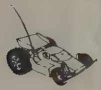
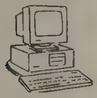
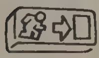
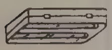
Part Number	Maximum Voltage	Rated Current (20°) (amps)			Nominal R (ohms)	Recognized By	Dimensions (inches)			Diagram
		Hold	Trip	Max			A	B	C	
PRP120	15	1.20	2.30	50	0.12	UL, TUV	.95	.22	.03	
PRP175	15	1.75	3.40	50	0.06	UL, TUV	1.14	.22	.03	
SRP200	30	2.00	4.40	100	0.04	UL, TUV	.92	.43	.03	
SRP350	30	3.50	6.30	100	0.02	UL, TUV	1.25	.53	.03	
SRP420	30	4.20	7.60	100	0.02	UL, TUV	1.25	.53	.03	

See Our Additional Data Pages In Sections A • 4800 - B • 4300 - B • 5300

Raychem Corporation • PolySwitch® Division • 300 Constitution Drive • Menlo Park, CA 94025

For technical support and complete catalog call **800-2-RAYCHEM x6900 • FAX: 800-227-4866**

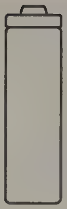
APPLICATION GUIDE

	VR	VBE	VE/VSE VS	VRE	VP	VY	VT	VBM/GB	GP
	△		△	△	▲	△			
	△		△		▲	▲			
	△		△		▲	▲			
	△	▲	▲	▲				△	▲
	△		▲						△
	△	▲	▲						▲
	△		▲					▲	▲
	△	▲	▲	△					▲
	△		▲						△
	△		▲						▲
	△		▲	△		▲			
	△	▲	△	△			△	▲	
	△						▲		
	△						▲		

▲ recommended △ possible

SELECTOR GUIDE

STANDARD (VR and VBE)



Engineered for cycling applications Saft's two standard series are proven classics manufactured in hundreds of millions of units They are available in cylindrical (VR) and button (VBE) format, and feature ''sintered'' type electrode technology providing reduced charge times as well as permanent charge acceptance.

The VBE is unique among button batteries in delivering high-intensity power peaks. Both series offer an excellent cost/performance ratio.

Saft type	Format	Capacity C_5Ah	Voltage (V)	Dimensions (mm)		Weight (g)
				Ø*	H*	
VR023 series						
VR 0.11 1/3AA	1/3 AA	0.11	1.2	13.8	16.8	8
VR 0.25 1/2AA	1/2AA	0.27	1.2	13.8	30.5	12
VR 0.5 AA	AA	0.50	1.2	14.3	50.3	22
VR 1.2 Cs	Cs	1.20	1.2	22.4	42.3	48
VR 2 C	C	2.00	1.2	25.6	49.6	73
VR 2.5 2/3D	2/3D	2.50	1.2	32.6	43.4	105
VR 4 D	D	4.00	1.2	32.6	60.4	147
VR 7 F	F	7.00	1.2	32.6	91.2	231
VR 10 SF	SF	10.00	1.2	41.4	89.1	393
VBE 022 series						
VB 4E		0.04	1.2	15.7	6.0	3.5
VB 10E		0.10	1.2	23.0	5.3	7
VB 22E		0.22	1.2	25.1	7.8	12
VB 30E		0.30	1.2	34.7	5.5	18
VB 60E		0.60	1.2	34.7	9.8	31

* Maximum dimensions of sleeved cells (CFG).

HIGH ENERGY (VE, VRE and VSE)

To create significant capacity gains for the same volume, Saft has upgraded its sintered electrode technology. And to meet the needs of increasingly light and compact applications, the company has developed and implemented nickel foam electrode technology for the VSE series.
The result is an 'ultra-high energy' battery, fully recommended for the whole range of portable electronics applications.

Saft type	Format	Capacity C_5Ah	Voltage (V)	Dimensions (mm)		Weight (g)
				Ø*	H*	
VE 026, 126, 136 series						
VE 2/3 A 600	2/3A	0.60	1.2	16.9	28.1	19
VE AA	AA	0.60	1.2	14.3	49.3	24
VE AA 700	AA	0.70	1.2	14.3	49.3	24
VE 4/5 A 1000	4/5A	1.00	1.2	16.9	42.4	28
VE A	A	1.00	1.2	16.9	49.1	35
VE Cs	Cs	1.40	1.2	22.4	42.3	49
VE Cs 1700	Cs	1.70	1.2	22.4	42.3	54
VE D	D	4.50	1.2	32.6	58.4	152
VE D 5000	D	5.00	1.2	32.6	58.4	154
VR 033, VRE 036 series						
VRE AAA 180	AAA	0.18	1.2	10.7	44.5	10
VRE 1/2 AA 300	1/2 AA	0.30	1.2	13.8	30.0	12
VRE AA H 600	AA	0.60	1.2	14.3	50.3	20
VR 1/2 C	1/2C	0.70	1.2	25.6	24.0	31
VR 3/5 C	3/5C	1.00	1.2	25.6	29.5	40
VR Cs	Cs	1.30	1.2	22.3	42.2	52
VR 1/2 D	1/2D	2.20	1.2	32.3	36.8	80
VRE C 2300	C	2.30	1.2	25.6	47.8	68
VRE D 4500	D	4.50	1.2	32.4	58.3	150
VSE 146, VS 066 series						
VSE AA 800	AA	0.80	1.2	14.3	49.3	23
VS 4/5 A 1200	4/5A	1.20	1.2	16.9	42.4	29
VS A 1400	A	1.40	1.2	16.9	49.3	33

* Maximum dimensions of sleeved cells (CFG).

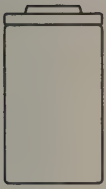
HIGH POWER: ULTRA-FAST CHARGE AND FAST DISCHARGE (VY)

With a highly reduced charge time (15 minutes) for a high-performance discharge rate, these cells are specially designed for cordless tools. Their high capacity (1.4 Ah) significantly increases the run time of the tools, and they benefit from recent upgrades in internal connections which enhance both discharge performance and reliability. The use of "sintered" electlode technology ensures a long cycling life.

Saft type	Format	Capacity C_5Ah	Voltage (V)	Dimensions (mm)		Weight (g)
				Ø*	H*	
VY 025, 125 series						
VY Cs	Cs	1.20	1.2	22.4	42.3	51
VY Cs 1400	Cs	1.40	1.2	22.4	42.3	54

* Maximum dimensions of sleeved cells (CFG).

HIGH POWER, PERMANENT CHARGE AND FAST DISCHARGE (VP)

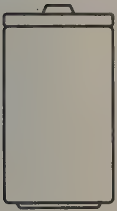


Specially engineered to meet the constraints of applications such as cordless vacuum cleaners and emergency medical equipment, which require permanent charge and frequent high intensity discharge, this series is designed to provide the longest possible lifetime.

Saft type	Format	Capacity C_5Ah	Voltage (V)	Dimensions (mm) Ø*	Dimensions (mm) H*	Weight (g)
VP 134 series						
VP Cs 1300	Cs	1.30	1.2	22.4	42.3	48

* Maximum dimensions of sleeved cells (CFG).

HIGH TEMPERATURE (VT)

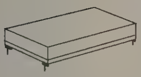


These cells are available in varied formats and accept a permanent charge in high-temperature environments such as security lighting installations. Specially adapted electrodes and electrolyte ensure a considerable lifetime, further enhanced in the VTD 70 by virtue of an improved electrode and separator.

Saft type	Format	Capacity C_5Ah	Voltage (V)	Dimensions (mm) Ø*	Dimensions (mm) H*	Weight (g)
VT 027, 037, 137 series						
VT 1/3 AA	1/3AA	0.11	1.2	13.8	16.8	8
VT AA	AA	0.50	1.2	14.3	50.3	21
VT Cs	Cs	1.20	1.2	22.4	42.3	46
VT Cs 1500	Cs	1.50	1.2	22.4	42.3	49
VT C 2000	C	2.00	1.2	25.6	47.8	67
VT 1/2 D	1/2D	2.20	1.2	32.3	36.6	80
VT D	D	4.00	1.2	32.5	60.4	134
VT D 70	D	4.00	1.2	32.5	60.4	136
VT F	F	7.00	1.2	32.6	89.2	213

* Maximum dimensions of sleeved cells (CFG)

BACK-UP MEMORY (GBH and VBM)



GBH and VBM button cells have been designed to operate in permanent charge to supply back-up memory for both mass market and industrial applications. Assembly has been engineered to facilitate insertion on integrated circuits. The Memoguard tolerates extremely high discharge peaks, and its integrated assembly makes it a genuine electronic component, as reliable as a chip.

Saft type	Capacity C_5Ah	Voltage (V)	Dimensions (mm) Ø*	Dimensions (mm) H*	Weight (g)
GBH 019 series					
GB 60 H	0.06	1.2	15.8	6.3	3.3
GB 170 H	0.17	1.2	23.4	6.9	9.0
GB 280 H	0.28	1.2	23.4	9.7	12.5

Saft type	Capacity C_5Ah	Voltage (V)	Dimensions L x l x H (mm)	Weight (g)
VBM 029 Memoguard**				
40 RF 204	0.04	2.4	40.6 x 20.3 x 8.9	10.5
40 RH 204	0.04	2.4	22.9 x 19.0 x 19.5	12.5
40 RM 210	0.10	2.4	30.5 x 27.9 x 19.5	22.9

* Maximum dimensions of sleeved cells (CFG).
** For other available products, see the MEMOGUARD R Catalogue.

PRISMATIC (GP)

GP cells are specially shaped to contain high energy in a small volume - a unique Saft design.
With sintered electrodes providing a prolonged life-time and a fast charge potential, they are tailored to such high technology applications as portable telecoms handsets.

Saft type	Capacity C_5Ah	Voltage (V)	Dimensions L x l x H (mm)	Weight (g)
GP 021 series				
GP 4	0.36	1.2	47.8 x 16.7 x 5.9	16
GP 6	0.54	1.2	66.5 x 16.7 x 5.9	23
GP 6 CM	0.54	1.2	47.8 x 16.7 x 8.1	23
GP 9	0.81	1.2	66.8 x 16.7 x 8.1	30
GP 22	2.00	1.2	66.8 x 16.7 x 16.7	60

LITHIUM

SAFT

	Model	Standard Size	Nominal Voltage	Rated Capacity (Ah)	Maximum Dimensions				Weight	
					Diameter inch	Diameter mm	Length inch	Length mm	oz.	gr.
LC SERIES	LC3	½AA	1.5	1.40	0.571	14.5	1.020	26.0	0.26	7.3
	LC6	AA	1.5	3.30	0.571	14.5	1.990	50.5	0.61	17.4
LCP SERIES	LCP3	½AA	2.5	0.95	0.571	14.5	1.020	26.0	0.25	7.0
	LCP6	AA	2.5	2.30	0.571	14.5	1.990	50.5	0.60	17.0
	LCP6 HT	AA	2.5	1.90	0.571	14.5	1.990	50.5	0.63	18.0
	LCPH14 HT	C	2.5	4.50	1.032	26.2	1.969	50.0	1.94	55.0
LO SERIES	LO34SX	⅖C	3.0	0.86	1.010	25.5	0.750	19.1	0.56	16
	LO35SX	--	3.0	2.0	1.010	25.6	1.400	35.6	1.05	30
	LO29SHX	C	3.0	3.5	1.010	25.6	1.980	50.3	1.40	40
	LO30SH	--	3.0	4.3	1.145	29.1	2.359	59.9	2.24	63
	LO26SH	D	3.0	6.4	1.330	33.8	2.324	59.0	2.98	85
	LO26SX	D	3.0	7.5	1.330	33.8	2.324	59.0	2.98	85
	LO25SX	--	3.0	8.0	1.525	38.7	1.969	50.0	3.40	96
	LO39SH	F	3.0	13.0	1.236	31.4	3.920	99.5	4.40	125
LS SERIES	LS3	½AA	3.6	0.85	0.571	14.5	.985	25	0.28	8.0
	LS6	AA	3.6	1.80	0.571	14.5	1.990	50.5	0.53	15.0
	LSH14	C	3.6	5.00	1.032	26.2	1.969	50.0	1.94	56.0
	LSH20	D	3.6	12.5	1.33	33.6	2.41	61.1	3.06	98
	LS14250	½AA	3.6	0.90	0.571	14.5	.985	25	0.28	8.0
	LS14500	AA	3.6	2.10	0.571	14.5	1.990	50.5	0.53	15.0
	LS26500	C	3.6	6.50	1.032	26.2	1.969	50.0	1.94	56.0
	LS33600	D	3.6	14.50	1.33	33.6	2.41	61.1	3.06	98

	Model	Nominal Voltage	Rated Capacity (Ah)	Dimension						Weight	
				Length inch	Length mm	Width inch	Width mm	Height inch	Height mm	lbs.	gr.
BA 5000 SERIES	BA5567/U	2.8	.800	1.00	25.4	1.00	25.4	0.718	18.2	0.04	20.0
	BA5847/U	5.6	7.200	2.55	65.0	1.50	38.0	3.750	95.3	0.53	240.0
	BA5588/U	14.0	3.900	3.55	19.0	1.22	31.0	3.480	88.4	0.65	295.0
	BA5590/U	28.0	7.200	4.40	112.0	2.45	62.0	5.000	127.0	2.25	1021.0
	BA5598/U	14.0	8.000	3.57	52.4	4.69	119.1	2.06	52.4	1.50	681.0
	BA5112/U	11.2	1.800	2.25	57.2	1.54	39.1	3.06	77.7	0.40	180.0

LITHIUM METER BATTERIES

Model	Standard Appl.	Nominal Voltage	Rated Capacity (Ah)	Maximum Dimensions				Weight		*Features
				Diameter inch	Diameter mm	Length inch	Length mm	oz.	gr.	
LS3	GE TM90	3.5	.850	.675	17.2	1.125	12.0	.42	12	GTM,GC
LX2649	SW EMT	2.8	3.500	1.03	26.2	1.97	50.0	1.52	43	GTM

SAFT

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	GA	Marietta	SAFT America Inc.	404-992-6950
	IL	Palatine	SAFT America Inc.	708-934-0780
	IN	Indianapolis	SAFT America Inc.	317-594-0443
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	CO	Littleton	AVT	303-798-1958
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SANYO RECHARGEABLE NICKEL-CADMIUM BATTERIES

Standard Charge Batteries

Model No.	Nominal voltage (v)	Minimum Capacity (mAH)	Outside Dimensions	
			Dia. (D) (mm)	Height (H) (mm)
N-50AAA	1.2	50	10.5 $^{+0}_{-0.5}$	16.0 $^{+0}_{-1}$
N-110AA	1.2	110	14.5 $^{+0}_{-0.5}$	17.0 $^{+0}_{-1}$
N-120TA	1.2	120	7.8 $^{+0}_{-0.5}$	42.5 $^{+0}_{-1}$
N-150N	1.2	160	12.0 $^{+0}_{-0.5}$	29.5 $^{+0}_{-1}$
N-200AAA	1.2	200	10.5 $^{+0}_{-0.5}$	44.5 $^{+0}_{-1}$
N-200A	1.2	200	17.0 $^{+0}_{-1}$	17.0 $^{+0}_{-1}$
N-270AA	1.2	270	14.5 $^{+0}_{-0.5}$	30.0 $^{+0}_{-1}$
N-600AA	1.2	600	14.2 $^{+0}_{-0.5}$	50.0 $^{+0}_{-1}$
N-650SC	1.2	650	23.0 $^{+0}_{-1}$	26.0 $^{+0}_{-1}$

Temperature Range: Charge: 0 ~45°C (Standard Charge), 10 ~45°C (Quick Charge), Discharge: −20~60°C, Storage: −30~50°C (Long Period: −30~35°C)

Fast Charge Batteries

N-1000SCR	1.2	1000	23.0 $^{+0}_{-1}$	34.0 $^{+0}_{-1}$
N-1100CR	1.2	1100	26.0 $^{+0}_{-1}$	30.0 $^{+0}_{-1}$
N-1400SCR	1.2	1400	23.0 $^{+0}_{-1}$	43.0 $^{+0}_{-2}$
N-4000DRL	1.2	4000	34.0 $^{+0}_{-1}$	61.0 $^{+0}_{-2}$

Temperature range: Charge: 0°~45°C (standard); 10°~45°C (quick); 5°~40°C (1 hour). Discharge:-20°~60°C; Storage: -30°~50°C (-30°~35°C for long periods)

Cadnica Slim Batteries

Model No.	Nominal Voltage (v)	Minimum Capacity (mAh) At 0.2C Rate	Outside Dimension (With Tube)		
			L (mm)	W (mm)	T (mm)
KF-B400	1.2V	360mAh	48.0 $^{0}_{-0.8}$	17.0 $^{0}_{-0.8}$	6.1 $^{0}_{-0.6}$
KF-A600	1.2V	540mAh	67.0 $^{0}_{-1}$	17.0 $^{0}_{-0.8}$	6.1 $^{0}_{-0.6}$
KF-A900	1.2V	810mAh	67.0 $^{0}_{-1}$	17.0 $^{0}_{-0.8}$	8.0 $^{0}_{-0.5}$
KF-A1200	1.2V	1080mAh	67.0 $^{0}_{-1}$	17.0 $^{0}_{-0.8}$	10.3 $^{0}_{-0.6}$

High-Capacity Batteries—Extra Series

Model No.	Nominal Voltage (v)	Minimum Capacity (mAh)	Outside Dimension (Including Tube)	
			Diameter (D) (mm)	Height (H) (mm)
N-225AE	1.2	225	17.0 $^{0}_{-1}$	17.0 $^{0}_{-1}$
KR-600AE	1.2	600	17.0 $^{0}_{-1}$	28.0 $^{0}_{-1}$
N-700AAE	1.2	700	14.2 $^{0}_{-0.5}$	50.0 $^{0}_{-1}$
KR-1100AEL	1.2	1100	17.0 $^{0}_{-1}$	43.0 $^{0}_{-2}$
KR-1400AE	1.2	1400	17.0 $^{0}_{-1}$	50.0 $^{0}_{-2}$
KR-1700AE	1.2	1700	17.0 $^{0}_{-1}$	67.0 $^{0}_{-2}$
KR-1800SCE	1.2	1800	23.0 $^{0}_{-1}$	43.0 $^{0}_{-2}$
KR-2000SCE	1.2	2000	23.0 $^{0}_{-1}$	50.0 $^{0}_{-2}$
KR2400CE	1.2	2400	26.0 $^{0}_{-1}$	50.0 $^{0}_{-2}$
KR5000DE (L)	1.2	5000	34.0 $^{0}_{-2}$	59.0 $^{0}_{-1}$
KR-1100AAE	1.2	1100	13.8 $_{+0.2}$	64.5 $_{+0.3}$

Standard Charge Batteries (KR-Series)

Model No.	Nominal Voltage (v)	Minimum Capacity (mAH)	Outside Dimensions	
			Dia. (mΩ)	Height (mm)
KR-1500SC	1.2	1500	23.0 $^{+0}_{-1}$	43.0 $^{+0}_{-2}$
KR-2000C	1.2	2000	26.0 $^{+0}_{-1}$	50.0 $^{+0}_{-2}$
KR-2800D	1.2	2800	34.0 $^{+0}_{-1}$	44.0 $^{+0}_{-2}$
KR-4400D	1.2	4400	34.0 $^{+0}_{-2}$	61.0 $^{+0}_{-2}$
KR-7000F	1.2	7000	34.0 $^{+0}_{-2}$	91.0 $^{+0}_{-2}$
KR-10000M	1.2	10000	43.0 $^{+0}_{-2}$	91.0 $^{+0}_{-2}$
KR-20000M	1.2	20000	43.0 $^{+0}_{-2}$	146.0 $^{+0}_{-2}$

Temperature Range: Charge: 0 ~45°C (Standard Charge), Discharge: 20 ~60°C, Storage: −30~50°C (Long Period: −30~35°C)

LITHIUM BATTERIES 3V Manganese Dioxide Lithium Batteries

Primary Batteries

Model	Nominal voltage (V)	Nominal capacity †1 (mAh)	Standard discharge current (mA)	Max discharge current (mA)		Max dimensions (mm)		Weight (g)
				continuous †2	pulse †3	diameter (D)	height (H)	
CR1220	3	35	0.1	2	10	12.5	2.0	0.8
CR1620	3	60	0.2	3	20	16.0	2.0	1.2
CR2016	3	80	0.3	5	50	20.0	1.6	1.7
CR2025	3	155	0.3	6	50	20.0	2.5	2.7
CR2032	3	220	0.3	4	40	20.0	3.2	3.2
CR2430	3	280	0.3	6	50	24.5	3.0	4.0
CR2450	3	560	0.2	3	50	24.5	5.0	6.2

Recharageable Batteries

Model	Nominal voltage (V)	Nominal capacity†1 (mAh)	Standard charge/discharge current (mA)	Max. discharge current (mA)		Charge/discharge Cycle characteristics	Charging method (constant voltage charge)	Dimensions (mm)		Weight (g)
				continuous†2	pulse†3			diameter (D)	height (H)	
ML1220*	3	12	0.1	2	5	3,000 cycles with 0.6mAh (discharge depth of 5%) 500 cycles with 2.4mAH (discharge depth of 20%)	3.1±0.15V trickle charge (2.8 ~ 3.1V)	12.5	2.0	0.7
ML2016*	3	25	0.3	8	20	3,000 cycles with 1.25mAh (discharge depth of 5%) 500 cycles with 5mAH (discharge depth of 20%)	3.1±0.15V trickle charge (2.8 ~ 3.1V)	20.0	1.6	1.8
ML2430*	3	90	0.5	10	20	3,000 cycles with 4.5mAh (discharge depth of 5%) 500 cycles with 18mAH (discharge depth of 20%)	3.1±0.15V trickle charge (2.8 ~ 3.1V)	24.5	3.0	4.0

* denotes model supplied with PC-mount terminal.
†1 Nominal capacity is determined to an end voltage of 2.0V when the battery is allowed to discharge at a standard current level at 23°C.
†2 Current value is determined so that 50% of the nominal capacity is obtained with an end voltage of 2.0V at 23°C.
†3 Current value for obtaining 2.0V cell voltage when 15sec. pulse applied at 50% discharge depth (23°C).
Sanyo batteries are UL recognized components (File No. MH12383). ●Consult us for details of items not described in this catalog.

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MICRO BATTERIES

Lithium Coin Batteries

Model No.	Electrical Characteristics (at room temperature)[1]				Dimensions		Weight (g)	C.C.V.[2]		Storage Loss (%)
	Nominal Voltage (V)	Nominal Capacity (mAh)	Maximum Drain		Diameter (mm)	Height (mm)		+24° C (V)	-10° C (V)	
			Pulse Load (mA)	Continuous Load (mA)						
•CR614*	3.0	4	1	0.1	6.90	1.4	0.1	2.60	2.00	3
•CR1025		30	4	0.8	10.0	2.5	0.9	2.65	2.20	
•CR1220		38	5	1	12.5	2.0	0.8	2.70	2.40	
•CR2016		70 (**80)	15	3	20.5	1.6	1.9			
•CR2025		140 (**150)				2.5	2.5			
•CR2032		180 (**200)				3.2	3.1			
•CR2325		190	20	4	23.0	2.5	3.3			
•CR2430		250			24.5	3.0	4.6			
•CR2450		550				5.0	6.8			
•CR2477		1,000	10			7.7	10.5			

1-Operating Temperature Range: -10 ~ +60°C
2-C.C.V.: Closed Circuit Voltage 500Ω 5 secs.
*C.C.V.: Closed Circuit Voltage 2KΩ 5 secs.
**High Capacity
•U.L. Component Recognition (MH 15628)
Any shapes of the terminal are available upon your request.

Rechargeable Polymer Lithium Batteries

Model No.	Electrical Characteristics (at Room Temperature)*						Dimensions		Weight (g)
	Nominal Voltage (V)	Nominal Capacity (mAh)	Standard Charging Current (mA)	Standard Charging Method	Cycle Characteristics	Operating Voltage (V)	Diameter (mm)	Thickness (mm)	
SL414	3.3	0.01 (3.3V->2.0V)	0.001-0.25	Constant Voltage Charging	More than 1000 cycles at depth of 0.01mAh	3.3V<->0V	4.8 (MAX)	1.3 +0.1/-0.2	0.06
SL621	3.3	0.15 (3.3V->2.0V)	0.001-1.0	Constant Voltage Charging	More than 1000 cycles at depth of 0.15mAh	3.3V<->0V	6.8 (MAX)	2.1 +0.1/-0.2	0.2
SL920	3.3	0.3 (3.3V->2.0V)	0.001-3.0	Constant Voltage Charging	More than 1000 cycles at depth of 0.3mAh	3.3V<->0V	9.5 (MAX)	2.1 +0.1/-0.2	0.4

*Operating Temperature Range: -10 ~ +60°C

Polyacene Capacitors

Model No.	Electrical Characteristics (at Room Temperature)*						Dimensions		Weight (g)
	Nominal Voltage (V)	Electrostatic Capacity (F)	Internal Resistance (ohms)	Standard Charging Method	Cycle Life (Cycles)	Operating Voltage (V)	Diameter (mm)	Thickness (mm)	
SC414	2.5	0.036	120	Constant Voltage Charging	10,000	2.5V<->0V	4.8	1.4	0.06
SC609		0.07	30				6.8	0.9	0.14
SC621		0.33						2.1	0.20
SC920		0.6	15				9.6		0.36
SC2016		2.7	4				20.0	1.6	1.60
SC2025		5						2.5	2.10
2SC414	5.0	0.018	240	Constant Voltage Charging	10,000	5.0V<->0V	5.7	3.0	0.16
2SC609		0.035	60				7.8	2.4	0.32
2SC621		0.17						4.4	0.43
2SC920		0.3	30				10.5		0.80
2SC2016		1.3	8				21.0	3.7	3.80
2SC2025		2.5						5.3	4.60

*Operating Temperature Range: -10 ~ +60°C

SII
Seiko Instruments

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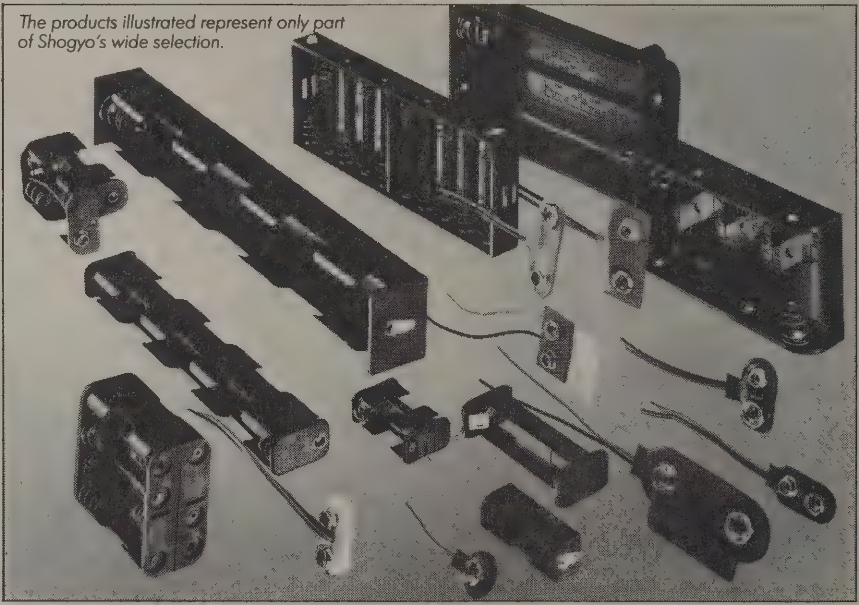
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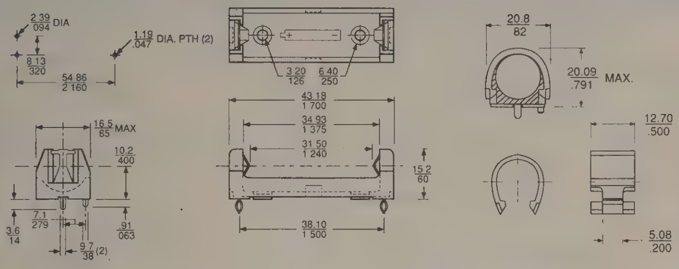
Battery Holders

2/3 A Battery Holder


2.39 .094 DIA
1.19 .047 DIA. PTH (2)
8.13 .320
54.86 2.160
3.20 .126
6.40 .250
43.18 1.700
34.93 1.375
31.50 1.240
15.2 .60
38.10 1.500
16.5 .65 MAX
10.2 .400
7.1 .279
3.6 .14
.91 .063
9.7 .38 (2)
20.8 .82
20.09 .791 MAX.
12.70 .500
5.08 .200

Description

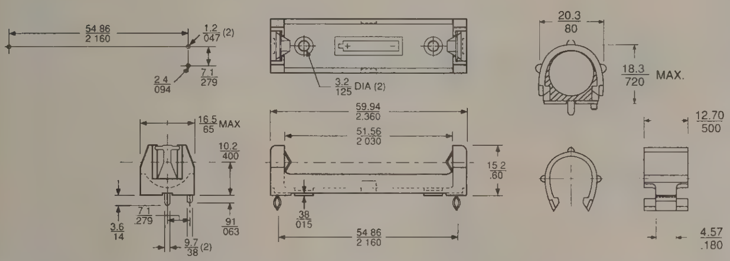
BATTERY HOLDER

PART NUMBER: 6S-2/3A
SPECIFICATIONS: * Housing Material: 30% glass filled PBT, UL flammability rating 94 V-O. Color, black.
- Contact Materal: Spring hard stainless steel.
- Contact Finish: 1.27μm(50μ") min. nickel all-over, 3.81μm (150μ") min. tin/lead selective tails.

BATTERY HOLDER COVER

PART NUMBER: C-2018
SPECIFICATIONS: * Cover Material: Polystyrene, black UL 94 V-1.
* Application: Recommended for use with battery holder P/N 6S-2/3A.

AA Battery Holder


54.86 2.160
1.2 .047 (2)
2.4 .094
7.1 .279
3.2 .125 DIA (2)
59.94 2.360
51.56 2.030
15.2 .60
16.5 .65 MAX
10.2 .400
7.1 .279
3.6 .14
.91 .063
9.7 .38 (2)
.38 .015
54.86 2.160
20.3 .80
18.3 .720 MAX.
12.70 .500
4.57 .180

Description

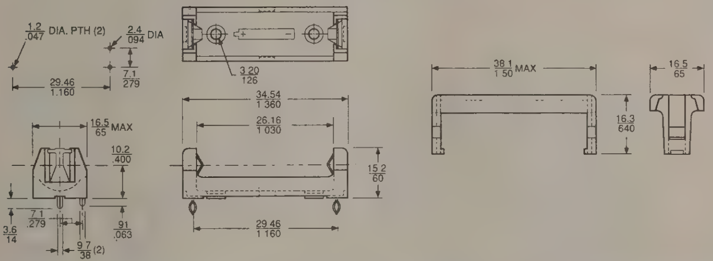
BATTERY HOLDER

PART NUMBER: 6S-AA
SPECIFICATIONS: * Housing Material: 30% glass filled PBT, UL flammability rating 94 V-O. Color, black.
- Contact Materal: Spring hard stainless steel.
- Contact Finish: 1.27μm(50μ") min. nickel all-over, 3.81μm (150μ") min. tin/lead selective tails.

BATTERY HOLDER COVER

PART NUMBER: C 6S-AA
SPECIFICATIONS: * Cover Material: Polystyrene, black UL 94 V-1.
* Application: Recommended for use with battery holder P/N 6S-AA.

1/2AA Battery Holder


1.2 .047 DIA. PTH (2)
2.4 .094 DIA
7.1 .279
29.46 1.160
3.20 .126
34.54 1.360
26.16 1.030
15.2 .60
29.46 1.160
16.5 .65 MAX
10.2 .400
7.1 .279
3.6 .14
.91 .063
9.7 .38 (2)
38.1 1.50 MAX
16.3 .640
16.5 .65

Description

BATTERY HOLDER

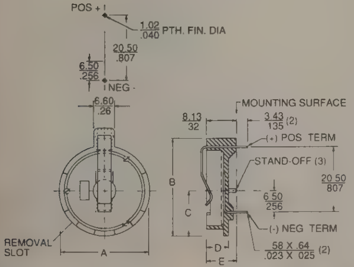
PART NUMBER: 6S1/2AA
SPECIFICATIONS: * Housing Material: 30% glass filled PBT, UL flammability rating 94 V-O. Color, black.
- Contact Materal: Spring hard stainless steel.
- Contact Finish: 1.27μm(50μ") min. nickel all-over, 3.81μm (150μ") min. tin/lead selective tails.

BATTERY HOLDER COVER

PART NUMBER: C-6S1/2AA
SPECIFICATIONS: * Cover Material: Thermoplastic, UL flammability rating 94 V-O. Color, black.
* Application: Recommended for use with battery holder P/N 6S1/2AA.

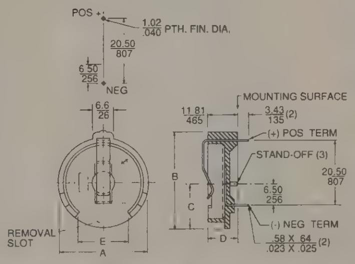
Lithium Coin Cell Battery Holder

Single Cell, 3 Volt


POS +
1.02 .040 PTH. FIN. DIA
20.50 .807
6.50 .256
NEG -
6.60 .26
8.13 .32
MOUNTING SURFACE
3.43 .135 (2)
(+) POS TERM
STAND-OFF (3)
B
C
20.50 .807
6.50 .256
(-) NEG TERM
.58 X .64 .023 X .025 (2)
REMOVAL SLOT
A
D
E

Lithium Coin Cell Battery Holder

Dual Cell, 6 Volt


POS +
1.02 .040 PTH. FIN. DIA.
20.50 .807
6.50 .256
NEG
6.6 .26
11.81 .465
MOUNTING SURFACE
3.43 .135 (2)
(+) POS TERM
STAND-OFF (3)
B
C
20.50 .807
6.50 .256
(-) NEG TERM
.58 X .64 .023 X .025 (2)
REMOVAL SLOT
E
A
D

Description

DESCRIPTION: Single Cell, 3 Volt

Part No.	Dimensions (mm/inches)				
	A	B	C	D	E
2S2032-0, -1, -2	22.86/.900	27.43/1.08	11.43/4.50	4.95/.195	6.86/2 70
2S2325-0, -1	25.40/1.00	28.78/1 13	12.70/.500	4.32/ 170	6.99/.275
2S2425-0, -1	26.67/1.050	29.46/1.16	13 34/.525	4.32/.170	6.99/.275

DESCRIPTION: Dual Cell, 6 Volt

Part No.	Battery	Dimensions (mm/inches)				
		A	B	C	D	E
4S2032-0	CR BR 2032	22.53/.900	27.4/1.08	11.43/4.50	9.27/.365	12.7/.50
4S2325-0	BR 2325	25.65/1.010	28.83/1.135	12.83/ 505	10.16/ 400	15.2/ 60
4S2425-0	LM 2425 CR/DL 2430	27.69/1.090	29.85/1.175	13.84/ 545	10.16/.400	17.8/.70

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CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity^a	
						Wh/kg	Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	^{b}	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air^c	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air^c	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65^d
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95^d
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75^e
Thermal	Ca	^{b}	2.8	240	2.6	10	20^f
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60^g
High-	NA	S	2.1	685	1.8	200	^{h}
temperature	Li	S	2.2	1,150	1.8	200	^{i}
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75^j
Fuel cell:							
Hydrogen^c	H_2	Air	1.23	26,000	0.7		^{k}
Hydrazine^c	N_2H_4	Air	1.5	2,100	0.7	800^b	^{l}
Methanol^c	CH_2OH	Air	1.3	1,400	0.9	175^b	185^m

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

[j] Solid $RbAg_4I_5$ electrolyte.

[k] Several different cathode materials used.

[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

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ELECTRONIC INDUSTRIES, INC.
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CONTINUOUS CURRENT (mA)
OPERATING TIME months/years
XTRA SERIES
MEMORY BACKUP SERIES
HIGH-CAPACITY SERIES
CAPACITY REQUIRED
RECOMMENDED BATTERY
TL-5186
TL-5101
TL-5134
TL-5135
TL-5104
TL-2150
TL-2100
TL-5902
TL-5903
INSTRUCTIONS

Tadiran Lithium Battery Slide Rule Selector Helps You Speed Through The Design Process!

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FOR QUALIFIED USERS

CYLINDRICAL	Model	Max. Cont. Current (mA)	Capac mAh	Dia. × Length
Xtra				
½AA	TL-2150	50	850 @ 1.8mA to 2V	0.58'' 1.0 ''
AA	TL-2100	100	1900 @ 1.5mA to 2V	0.58'' 2.0 ''
C	TL-2200	230	5200 @ 3mA to 2V	1.0 '' 2.0 ''
D	TL-2300	230	13,500 @ 2mA to 2V	1.3 '' 2.4 ''
DD	TL-5137	450	27,000 @ 4mA to 2V	1.3 '' 4.9 ''
High-Capacity Xtra				
½AA	TL-5902	50	1200 @ 500uA to 2V	0.58'' 1.0 ''
AA	TL-5903	100	2400 @ 1.0mA to 2V	0.58'' 2.0 ''
C	TL-5920	230	8000 @ 100uA to 2V	1.0 '' 2.0 ''
D	TL-5930	230	19,000 @ 200uA to 2V	1.3 '' 2.4 ''
Medium Power				
D	TP-5830	1000	11,500 @ 100mA to 2V	1.3 '' 2.4 ''
Memory Back-Up				
½AA	TL-5101	0.1	850 @ 100uA to 3V	0.58'' 1.0 ''
AA	TL-5104	0.2	1900 @ 200uA to 3V	0.58'' 2.0 ''
WAFER				
Memory Back-Up				**Dia. × Thk**
1/10-D	TL-5134	0.1	1000 @ 100uA to 3V	1.3 '' 0.28''
1/6-D	TL-5135	0.1	1500 @ 100uA to 3V	1.3 '' 0.28''
BEL	TL-5186	0.1	370 @ 100uA to 3V	0.9 '' 0.28''
ASSEMBLIES—PC Real-Time Clock & CMOS Memory Back-Up				
AA	TL-5242/W	3.6V	1900 @ 200uA to 3V	0.7''×0.6''×2.4''
2XAA	TL-5293/W	6.0V	1900 @ 100uA to 4V	0.8''×1.5''×2.3''
UTILITY METER BATTERIES				
	TL-5276/W	50	850 @ 1.8mA to 2V	0.66'' 1.126''
Hi-Capacity	TL-5276/SL	50	1200 @ 500uA to 2V	0.66'' 1.126''

ISO 9000 CERTIFIED

Standard Terminals for Cylindrical Cells: Pressure Contact (S); Flat Solder Tab (T); and Axial Pin (P). Others available upon request.

Recognized under the Component Program of Underwriters Laboratories, Inc. File #MH 12193.

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WEST:
2975 Bowers Avenue, Santa Clara, CA 95051
(408) 727-0300 Fax (408) 727-0560

eem

MAXIMUM CURRENT CAPACITY—CONDUCTORS

	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
Size, AWG	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	. . .	. . .	. . .	. . .	. . .	0.2	0.4	. . .	0.20
28	. . .	. . .	. . .	. . .	. . .	0.4	0.6	. . .	0.32
26	. . .	. . .	. . .	. . .	. . .	0.6	1.0	. . .	0.51
24	. . .	. . .	. . .	. . .	. . .	1.0	1.6	. . .	0.81
22	9	5	. . .	. . .	. . .	1.6	2.5	. . .	1.28
20	11	7.5	. . .	. . .	. . .	2.5	4.0	3	2.04
18	16	10	. . .	. . .	6	4.0	6.0	5	3.24
16	22	13	. . .	. . .	10	6.0	10.0	7	5.16
14	32	17	. . .	. . .	20	10.0	16.0	15	8.22
12	41	23	. . .	. . .	30	16.0	26.0	20	13.05
10	55	33	. . .	. . .	35	. . .	. . .	25	20.8
8	73	46	58	36	50	. . .	. . .	35	33.0
6	101	60	86	51	70	. . .	. . .	50	52.6
4	135	80	108	64	90	. . .	. . .	70	83.4
2	181	100	149	82	125	. . .	. . .	90	132.8
1	211	125	177	105	150	. . .	. . .	100	167.5
0	245	150	204	125	200	. . .	. . .	125	212.0
00	283	175	237	146	225	. . .	. . .	150	266.0
000	328	200	. . .	. . .	275	. . .	. . .	175	336.0
0000	380	225	. . .	. . .	325	. . .	. . .	225	424.0

TAMURA BATTERY CHARGERS

Wall Plug-In, 120VAC, 60Hz.

file no. E82180

file no. LR38236

Tamura battery chargers are particularly suited for charging NiCd, lead acid and Gel-Cell batteries. They are UL 1310 listed for battery charger circuits. Contact the battery manufacturer for recommended voltage and current. For additional UL/CSA/VDE models see DC Power Supplies section for DC regulated and unregulated models and Transformers section for AC to AC models.

FEATURES

- UL Listed For Battery Charger Ckts.
- UL 544 Medical Capability.
- Thermal Overload Protection.
- 100% Testing.
- Transformer: 3 flange bobbin.
- US 3-Blade Ground Plug Available.
- Temp Range: 0 to +40°C.
- Case Temp Rise: ≤35°C.
- Oper Humidity: 10-90% RH.
- Material: Black ABS resin/UL 94-V0.
- No Audible Noise.

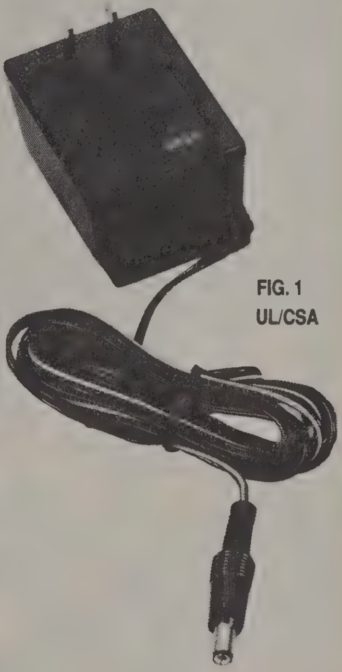


FIG. 1 UL/CSA

BATTERY CHARGER - 120VAC, 60Hz.

UL/CSA MODEL No.	RATED OUTPUT		OUTPUT VAC[1]			UL[2]	CSA[3]	PLUG[4]	PRICE (qty)			
	VOLTS DC	ma DC	100% FL 108VAC	100% FL 132VAC	10% FL 132VAC				1-9	10-24	25-99	100up
212A2220	4.5	150	3.80	5.20	7.35	UL*	L	Y	$7.00	$5.90	$5.60	$4.90
216A4222	4.5	350	3.50	5.20	8.70	UL*	C	F	7.30	6.20	5.80	5.10
416A2219	4.5	600	4.10	5.60	7.40	UL*	L	I	9.10	7.70	7.30	6.40
420AR4207	6.0	400	---------------REGULATED---------------			UL*	C	I	14.90	12.70	11.90	10.40
825A2617	6.0	2000	5.10	6.80	9.70	UL	C	I	24.10	20.50	19.30	16.90
212A2136	9.0	100	7.40	10.60	16.20	UL*	L	I	7.00	5.90	5.60	4.90
825A4620G	9.0	1200	7.80	10.40	13.70	UL	L	I	16.90	14.40	13.50	11.80
318A4146	12.0	200	10.30	13.50	17.60	UL*	L	L	8.90	7.60	7.10	6.20
416A2141	12.0	300	10.30	13.60	19.10	UL*	L	F	8.90	7.60	7.10	6.20
825A4425G	12.0	900	10.40	13.80	17.00	UL*	L	I	17.40	14.80	13.90	12.20
820A4276G	14.0	700	12.20	16.10	21.60	UL	L	I	15.60	13.30	12.50	10.90
820A4279G	16.0	400	13.90	18.10	21.70	UL	L	I	15.60	13.30	12.50	10.90
416A2045	18.0	100	16.10	20.30	24.10	UL*	C	I	8.90	7.60	7.10	6.20
811A4214	3-9[5]	300	4.60	6.25	8.10	UL*	L	U	15.40	13.10	12.30	10.80

Note 1: Typical output voltage for % load (FL) and line (VAC) indicated.
Note 2: UL notations: UL, UL 1310 listed; UL*, UL 1310 listing includes a UL 1411 recognized transformer.
Note 3: Complies (C) with or is listed (L) to CSA 22.2, No. 223/66.
Note 4: See output plug table for dimensions, gender and polarity.
Note 5: Five switched output voltages of 3.0, 4.5, 6.0, 7.5 & 9.0VDC with universal, polarity reversing, output plugs. Ratings are for 6.0VDC setting.

TAMURA
AC-DC POWER SUPPLY
416A4136
INPUT AC 120V 60Hz 9W
OUTPUT DC 9V 500mA
USE WITH AUDIO, VIDEO,
COMPUTER & TELEPHONE
WITHOUT ANTENNA CONNECTIONS
LISTED
E82180 784-4140 LR38236
KR MADE IN TAIWAN

MECHANICAL DIMENSION TABLE

SERIES PREFIX	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
212A	53 (2.09)	36 (1.42)	35 (1.38)	120 (4.23)	1
216A	53 (2.09)	36 (1.42)	38 (1.50)	140 (4.94)	1
318A	60 (2.36)	45 (1.77)	42 (1.65)	190 (6.70)	1
416A	61 (2.40)	55 (2.17)	41 (1.59)	230 (8.11)	1
420AR	61 (2.40)	55 (2.17)	41 (1.59)	270 (9.52)	1
811A	84 (3.31)	56 (2.20)	35 (1.38)	260 (9.20)	1
820A-G	82 (3.23)	60 (2.36)	55 (2.17)	420 (14.81)	1
825A-G	82 (3.23)	60 (2.36)	55 (2.17)	490 (17.28)	1

OUTPUT PLUG DIMENSIONS

PLUG TYPE	D1 (mm)	D2 (mm)	L (mm)	MALE/ FEMALE	CTR PIN (+/-)	FIG No.
I	5.5	2.10	9.5	FEMALE	-	2
F	5.0	2.50	11.5	FEMALE	-	2
L	5.5	2.10	16.0	FEMALE	+	2
U	------Universal/Reversible Connector------				rev	4
Y	3.5	3.00	14.0	MALE	+	3

FIG. 2 FEMALE

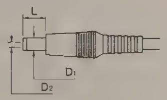


FIG. 3 MALE

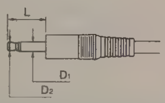
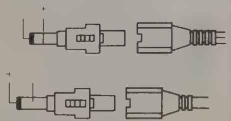


FIG. 4 UNIVERSAL/REVERSIBLE



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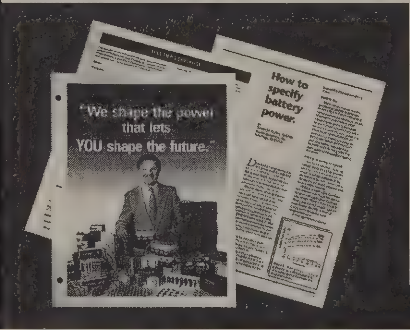
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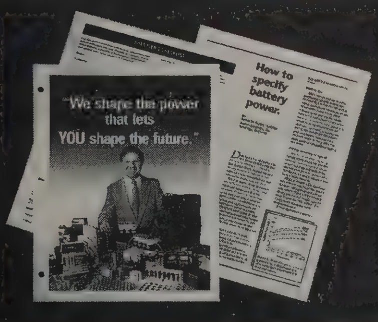
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Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

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YUASA

YUASA
NP7-6 6V 7.0Ah
NP4 6 6V 4.0Ah
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NP7-12 12V 7.0Ah
NP12-12 12V 12Ah
NP38-12 12V 38Ah
NP24-12B 12V 24Ah

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NP SERIES

Type	Nominal Capacity (20 hr rate) (Ah)	Length Inches	Width Inches	Overall Height (Including Terminals)
4 Volt				
NP3-4	3.0	3.56	1.33	2.51
NP4.2-4H	4.4	1.89	1.40	4.68
NP10-4	10.0	4.02	1.97	3.85
6 Volt				
NP1-6	1.0	2.00	1.67	2.15
NP1.2-6	1.2	3.82	0.98	2.15
NP2.6-6	2.6	5.27	1.33	2.52
NP3-6	3.0	5.27	1.33	2.52
NP4-6	4.0	2.76	1.85	4.15
NP4-6W	4.0	2.76	1.85	4.04
NP4.2-6H	4.4	1.89	2.03	4.68
NP7-6	7.0	5.95	1.33	3.84
NP10-6	10.0	5.95	1.97	3.84
12 Volt				
NP0.8-12	0.8	3.78	0.98	2.42
NP1.2-12	1.2	3.82	1.89	2.15
NP2.3-12	2.3	7.01	1.34	2.52
NP2-12	2.0	5.91	0.79	3.35
NP2.6-12	2.6	5.27	2.64	2.52
NP4-12	4.0	3.54	2.75	4.17
NP7-12	7.0	5.95	2.56	3.84
NP12-12	12.0	5.95	3.86	3.84
NPG18-12	17.2	7.13	2.99	6.57
NP24-12	24.0	6.54	6.89	4.92
NP24-12B	24.0	6.54	6.89	4.92
NP26-12	26.0	6.54	4.92	6.89
NP38-12	38.0	7.75	6.50	6.69
NP38-12P	38.0	7.75	6.50	6.89
NP65-12	65.0	13.78	6.53	6.85
NPX SERIES				
NPX-100	95w/cell	6.54	4.92	6.89
NPX-150	150w/cell	7.75	6.50	6.89

NPH SERIES

Type	Nominal Capacity (10 hr rate) (Ah)	Length Inches	Width Inches	Overall Height (Including Terminals)
6 Volt				
NPH1.3-6	1.3	3.82	0.98	2.15
NPH3.2-6	3.2	5.28	1.34	2.52
12 Volt				
NPH1.3-12	1.3	3.82	1.89	2.15
NPH3.2-12	3.2	5.28	2.64	2.52
NPH5-12	5.0	3.54	2.75	4.17

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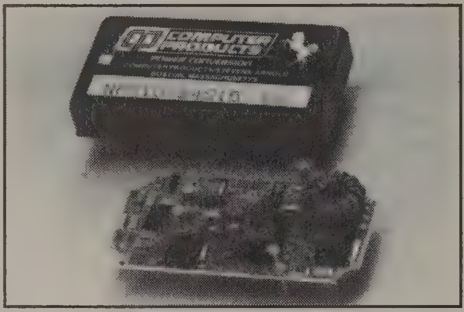

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- High Performance, 15W to 30W WR15/WR30 Series
- General Purpose, 0.5W to 100W
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POWER SUPPLIES, DC

Manufacturer	Starting EEM Page No.	Output						Dual	Three or More	Programmable	DC-DC Converter	Linear	Switching	Open Frame	Encapsulated	Enclosed/ Modular	Lab or System
		Volts (V)			Current (A)												
		<28	28.01-1000	>1000	<1	1-1000	>1000										
Abbott Electronics	D•1491	√*			√*	√*		√*	√*		√*	√*	√*		√*		
Abbott Technologies	D•1512	√*				√*			√*		√*	√	√*	√		√*	
Acopian Corp.	D•1517	√*	√*	√	√*	√*		√*	√	√	√	√*	√		√	√*	√
Adtech Power	D•1549	√	√			√		√	√		√	√	√	√		√	
Advanced High Voltage	D•1553		√	√	√					√*	√*	√*	√*		√*	√*	
Advanced Power Solutions	D•1554	√	√		√	√		√	√		√	√	√	√		√	
AJ's Power Source, Inc.	D•1557	√	√			√				√	√	√				√	√
Albar Inc.	D•1560	√	√		√	√		√	√		√	√	√	√		√	
American Skynet Electronics Co.	D•1561	√						√	√			√	√	√	√	√	
Analog Modules	D•1573		√*	√*	√*	√*	√*			√	√		√			√	√
Applied Power Conversions Div.	D•1574	√*	√*		√*	√*		√*	√*	√	√*		√*	√		√	√
APX Technologies, Inc.	D•1580	√	√		√	√				√		√	√		√	√	
Arnold Magnetics	D•1585	√*	√*		√*	√*		√*	√*		√*		√*		√*	√*	
Ascent Power Technology	D•1592	√*	√*	√*	√*	√*		√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
Astec Standard Power	D•1598	√				√	√	√	√		√	√	√	√	√	√	
AT&T Microelectronics	D•1604	√			√	√		√	√		√		√		√		
Astec High Voltage	D•1596	√	√	√	√	√		√	√	√	√		√		√	√	√
Ault Inc.	D•1608	√				√		√	√			√	√				
Autec Power Systems	D•1610	√			√	√		√	√			√	√	√			
Avel Transformers	D•1616	√	√			√					√		√		√		
Basler Electric Electronic Products Group	D•1617	√				√			√				√	√		√	
Bertan High Voltage	D•1618		√	√	√			√	√	√	√	√	√	√	√	√	√
Calex Manufacturing Co. Inc.	D•1624	√			√			√	√			√			√	√	
Cherokee International	D•1625	√	√		√	√			√		√		√	√		√	
Collmer Semiconductor	D•1630			√	√								√	√	√	√	
Computer Products	D•1631	√	√		√	√		√	√		√	√	√	√	√	√	
Condor Inc.	D•1636	√	√		√			√	√			√	√	√		√	
Converter Concepts Inc.	D•1646	√	√			√					√		√	√			
Cosel USA	D•1648	√	√		√	√		√	√		√		√	√	√		
Criterion Instruments	D•1651	√	√	√	√	√	√					√					√
CUI/Stack, Inc.	D•1653	√	√		√	√						√	√			√	
D&B Power Inc.	D•1654	√*	√*		√*	√*		√*	√*			√*			√*	√*	√
Del Electronics Corp.	D•1656		√*	√*	√*	√*		√*	√*	√*	√*		√*		√*	√*	√*
Dynage Power and Magnetics	D•1660	√*	√*	√*	√*	√*		√*	√*	√*	√*	√*	√*	√*	√*	√*	
Dynapower Corp.	D•1665	√	√			√	√	√	√	√	√	√	√	√		√	√
EG&G Power Systems	D•1670	√*	√*		√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
Electromech Inc.	D•1672	√	√		√	√		√	√			√		√		√	
Electro-Mech Co.	D•1673	√			√												

* MIL Spec.

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Manufacturer	Starting EEM Page No.	Output						Dual	Three or More	Programmable	DC-DC Converter	Linear	Switching	Open Frame	Encapsulated	Enclosed/ Modular	Lab or System
		Volts (V)			Current (A)												
		<28	28.01-1000	>1000	<1	1-1000	>1000										
Electronic Measurements	D•1674	√	√	√	√	√	√			√	√	√	√	√	√	v	√
Elgar	D•1684	√	√		√	√			√	√*						√	√
EMCO High Voltage Co.	D•1686		√*	√*	√*	√*				√*	√*	√*	√*		√*	√*	
Endicott Research	D•1687	√	√	√	√	√		√	√		√	√	√	√	√		
EPD Electronics	D•1688	√									√					√	
Epsco Inc.	D•1689	√	√		√	√						√				√	√
Ericsson Components	D•1691	√	√			√		√	√		√		√				
Farnell Advanced Power	D•1699	√			√	√		√			√	√	√	√			
Gamma High Voltage Research	D•1706		√	√	√	√	√	√		√	√	√	√	√	√	√	
Geopower Inc.	D•1858	√			√	√								√		√	
Glassman High Voltage	D•1712			√	√	√				√			√			√	√
Globtek	D•1730	√	√		√	√		√	√	√	√	√	√	√	√	√	
Golden Pacific Electronics	D•1734	√			√	√		√	√			√	√				
Hauman Inc.	D•1737	√	√		√	√						√					√
HC Power Inc.	D•1738	√	√			√		√	√		√		√			√	
Hitran Corp.	D•1744	√	√			√						√					
Instek America Corp.	D•1745	√	√					√				√	√	√			
Integrated Power Designs	D•1747	√	√		√	√		√	√		√		√	√		√	
Interelectronics Corp.	D•1750	√*	√*	√*	√*	√*	√*		√		√*						
International Power Devices	D•1751	√	√		√	√		√	√		√		√		√	√	
Jerome Industries Corp.	D•1756	√	√		√	√					√	√	√			√	
Jeta Power Systems	D•1762	√				√			√				√			√	
Joule Power	D•1765	√	√		√	√		√	√		√		√	√		√	
Kaiser Systems	D•1766		√	√	√	√		√		√		√	√			√	√
Keltron Corp.	D•1770			√	√	√		√	√		√				√		
Kenwood U.S.A.	D•1772	√	√		√	√		√	√	√		√					√
Kepco Inc.	D•1777	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√
KGS Electronics	D•1807	√				√		√			√						
Kikusui International	D•1808							√	√	√	√	√	√			√	√
Lambda Qualidyne Inc.	D•1810	√	√		√	√		√	√	√	√		√	√		√	√
Logitek Inc.	D•1816	√*	√*		√*	√*		√*	√*		√*		√*			√*	
LZR Electronics	D•1818	√	√		√	√		√	√		√	√	√	√	√	√	
Magna Power Electronics	D•1828	√	√			√	√			√			√	√		√	√
Mid-Eastern Industries	D•1832	√	√*	√		√		√	√*	√		√*	√*				√
Modular Devices	D•1837	√*	√*	√*	√*	√*		√*	√*	√*	√*	√*	√*		√*		
MPC Consulting Systems	D•1846	√			√	√		√			√	√			√	√	
Multi-National Resources	D•1850	√			√	√		√			√		√	√		√	
Multipower Inc.	D•1847	√	√		√	√		√	√				√	√	√		√
Multiproducts International Inc.	D•1848	√	√		√	√		√	√			√	√		√	√	

* MIL Spec.

POWER SUPPLIES, DC (cont'd)

Manufacturer	Starting EEM Page No.	Output						Dual	Three or More	Programmable	DC-DC Converter	Linear	Switching	Open Frame	Encapsulated	Enclosed/ Modular	Lab or System
		Volts (V)			Current (A)												
		<28	28.01-1000	>1000	<1	1-1000	>1000										
NH Research	D•1849	√*	√*		√*	√*		√*	√*	√*			√*			√*	√*
NWL Transformers	D•1851	√*	√*	√*	√*	√*	√*	√*	√*			√*		√*		√*	
Oram High Voltage Systems	D•1852	√	√	√	√	√	√			√		√	√	√	√	√	√
PCA Electronics	D•1854	√			√						√						
Penn-Tran Corp.	D•1857			√*	√*			√*	√*		√*		√*		√*	√*	
Pico Electronics	D•1859	√*	√*		√*	√*		√*	√*		√*	√*	√*	√*	√*		
Pillar Industries	D•1874	√			√			√								√	
Pioneer Magnetics	D•1879	√	√			√		√	√		√		√			√	
Polytron Devices	D•1882	√	√		√	√		√	√		√	√	√		√	√	√
Power One Inc.	D•1886	√	√		√	√		√	√			√	√	√		√	
Power Supply Concepts	D•1896	√*	√*	√*	V•	√*		√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
Power Switch Corp.	D•1899	√				√		√	√			√	√	√	√	√	
Power Ten Inc.	D•1907	√*	√*			√*		√*		√*			√*				√*
Rantec Microwave and Electronics Inc.	D•1908			√*	√*			√*	√*		√*	√*		√*	√*	√*	
RELCO/Ritz	D•1913	√			√	√						√		√		√	
Resonant Power Technology	D•1914	√	√		√	√		√	√	√			√	√		√	
RO Associates	D•1916	√*				√*		√*	√*		√*	√*	√*		√*	√*	
Semtech	D•1845	√			√	√								√		√	
Shindengan America	D•1918	√				√	√	√	√		√		√	√		√	
Shogyo International Corp.	D•1921	√			√	√	√	√	√		√	√	√	√	√	√	
Spellman High Voltage	D•1922			√	√	√		√	√	√	√		√		√	√	√
Staco Energy Products	D•1936																
Stancor, White Rodgers	D•1937	√			√	√						√					
Switching Systems International	D•1938	√	√			√		√	√		√		√	√		√	
Taltronics	D•1942	√*	√*		√*	√*	√*	√*	√*		√*	√*	√*	√*		√*	
Tamura Corp. of America	D•1945	√	√		√	√		√	√		√	√	√	√	√	√	
Technical Devices	D•1956	√			√	√		√	√		√	√	√	√		√	
Technipower	D•1958	√*	√*		√*	√*										√*	
Tectrol Inc.	D•1960	√	√		√	√		√	√		√	√	√	√		√	
Texmate	D•1965	√	√		√	√	√						√	√		√	
Todd Products Corp.	D•1967	√	√			√		√	√		√		√	√		√	√
Top Link Computer	D•1998	√	√		√	√							√	√		√	
Total Power International	D•2002	√	√		√	√		√	√		√	√	√	√	√	√	
Transistor Devices	D•2003	√*	√*	√*		√*	√*	√	√	√	√*	√*	√*			√*	√
Tri-Mag Inc.	D•2004	√*	√*		√*	√*		√*	√*		√*		√*	V*	√*	√*	
Tri-Source Inc.	D•2008		√	√		√		√	√		√	√	√	√	√	√	
Ultravolt	D•2013		√*	√	√			√	√	√	√		√		√	√	√
Unipower Corp.	D•2016	√	√		√	√		√	√				√	√		√	√
Universal Voltronics	D•2037		√	√		√	√			√	√	√	√	√	√	√	√
Wilmore Electronics	D•2041	√	√	√	√	√		√	√		√	√	√	√	√	√	√
Xentek Inc.	D•2042	√	√		√	√		√	√		√	√*	√*	√	√	√	√

* MIL Spec.

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Power Supply Modules

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WHEN RELIABILITY IS IMPERATIVE.®

For MIL SPEC and critical industrial applications where reliability is the prime consideration, Abbott Power Supplies have been the predominant choice for the past 32 years. This enduring acceptance has been earned through sound design, dependable components, meticulous workmanship, exhaustive quality control and proven performance in the field under severe operating conditions. Whatever your demanding requirements, you will find the correct Abbott Power Supply module in the pages listed below.

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Military Power Supplies

Index/Table of Contents

INPUT	DESCRIPTION	POWER	MODEL	PAGE
AC-DC CONVERTERS				
115 Vac, 47-440 Hz, Single phase	High density AC/DC converters; single and dual outputs	20-200 watts	AW Series	D-1492 D-1493
115/220 Vac; 47-400 Hz, Single or Three Phase (Delta or WYE)	Multi-inputs, customer selectable	50 watts 100 watts	AM Series	D-1494 D-1495
115/220 Vac; 47-440 Hz, Single or Three Phase (Delta or WYE)	High power switcher, low EMI	500 watts	MH Series	D-1496
115 Vac; 47-440 Hz	High power switching power supply; single and triple outputs	300 watts	M Series	D-1497
115 Vac; 47-440 Hz	Low EMI, 200 kHz switcher; single and triple outputs	60 watts 100 watts	MB Series	D-1499 D-1498
115/220 Vac; 60/400 Hz	High power linear power supply; single or dual outputs	12-210 watts	LV & LLV Series	D-1500
115 Vac; 400 Hz	Low EMI, 200 kHz switcher; single and triple outputs	60 watts & 100 watts	WM Series	D-1499 D-1501
115 Vac; 400 Hz	Linear power supplies; single and dual outputs	12-280 watts	W & WW Series	D-1502
115 Vac 400 Hz 3Ø	High density, single and dual outputs	100-420 watts 48-60 watts	WL & WWL Series	D-1503
DC-DC CONVERTERS				
28 Vdc and 270 Vdc	Very High Density, board mountable	100-280 watts	SM Series	D-1504
14-32 Vdc	Full Mil, high density; single and dual outputs	20-50 watts 100-200 watts	AB Series	D-1506 D-1505
28 Vdc	High efficiency, 100 kHz switcher; single and triple output	60 watts 100 watts 200 watts	BC Series	D-1509 D-1508 D-1507
28 Vdc	Linear, low noise power supplies; single and dual outputs Output voltage: 5-50 Vdc	12-100 watts 3-210 watts	C Series CC Series	D-1510
28 Vdc	Linear, low noise power supplies; single and dual output. Output voltage: 5-500 vdc	2-170 watts	B & BB Series	D-1511
90-160 Vdc	High density, single and dual converters	20-200 watts	AW Series	D-1492 D-1493
100-300 Vdc	Multi-input, customer selectable; single and triple outputs	50 watts	AM Series	D-1494
200-300 Vdc	Multi-input, customer selectable; single outputs	100 watts	AM Series	D-1495
DC-AC INVERTERS				
24-30 Vdc	Sine Wave Inverter	180 watts; 27, 115 Vac, 400-1600 Hz	SN Series	D-2227
24-30 Vdc	Sine Wave Inverter	5-120 watts; 27, 115 Vac 400-1600 Hz	S Series	D-2226

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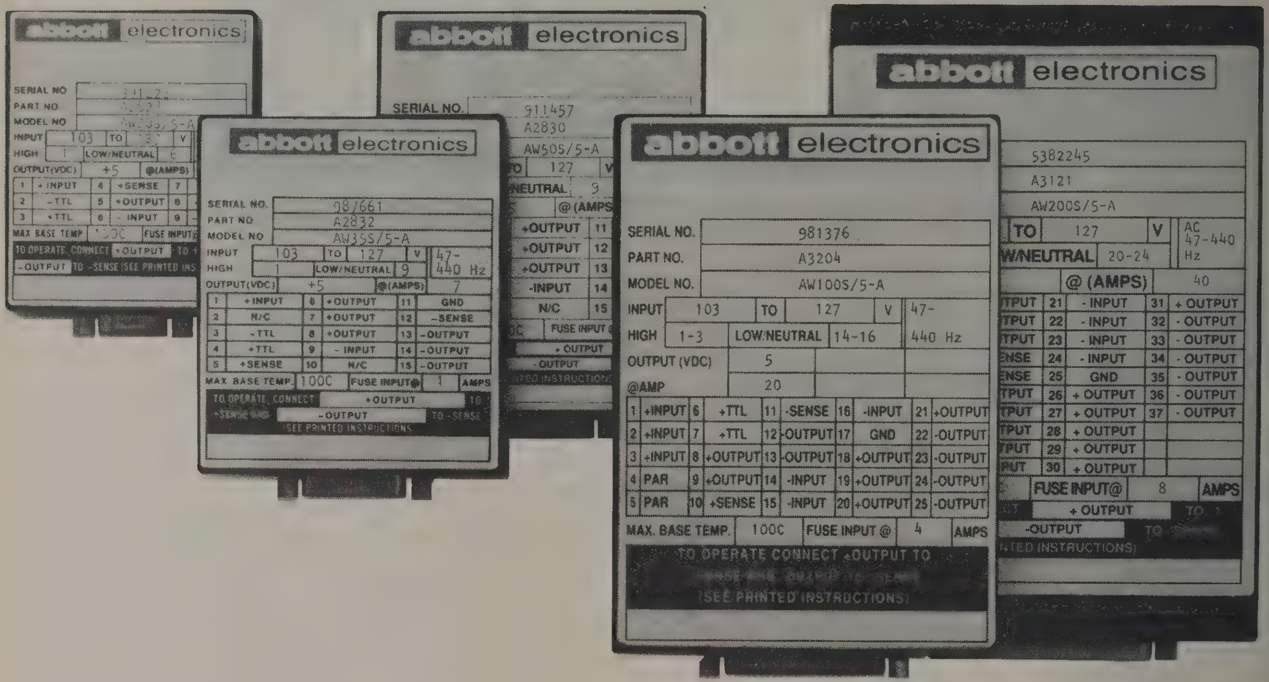
MILITARY POWER SUPPLIES

New High Density AC/DC Converters – 20-200 Watts

MODEL AW 20-200



SPECIFICATIONS

Input:
103 to127 V rms; 47-440 Hz
Single Phase and 90 to 160 V dc.

Efficiency:
65% minimum. Typically 70-80% (nominal input, full load, room ambient).

Line Regulation:
0.1% or 10 mV, whichever is greater, for each output with input change from low line to high line at constant load.

Load Regulation:
10 mV or 0.1%, whichever is greater. (Each output from no load to full load at constant line).

Pard (Noise and Ripple):
25 mV rms, 100 mV P-P for 5 V output, 50 mV rms, 200 mV P-P for other voltages; measured at 25 MHz bandwidth over temperature range.

Isolation Voltage:
700 Vdc, input to output;
500 Vdc, input to case;
200 Vdc, output to case.

Insulation Resistance:
50 megohms between input and output, input and case, output and case, when measured at 50 Vdc.

Temperature Range:
Operating: -55°C to +100°C maximum, at center of the baseplate. Storage: -55°C to +125°C, ambient.

Temperature Coefficient:
0.01%/°C maximum over entire temperature range.

Input Transient Protection:
Unit will provide normal regulated output and withstand 180 V ac for 0.1 second, in accordance with MIL-STD-704A (under AC input operating mode).

Load Transient Recovery:
Output voltage returns to regulation limits within 0.5 milliseconds after 50% change in load current.

Load Transient Overshoot:
0.5 V maximum from nominal voltage set point.

Short Circuit Protection:
Each output is independently protected against a short circuit of any duration and automatically restores to normal when overload is removed.

Remote Sensing:
Compensates up to 0.5 volt drop in output leads.

Remote Inhibit:
Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 1) will inhibit the output.

Parallelability:
The 100 watt and 200 watt units allow for multiple unit current sharing without the need for external components, via a single pin connection on each unit.

Electromagnetic Interference:
Units, when tested in accordance with MIL-STD-462, meet the majority of the requirements of MIL-STD-461C for conducted and radiated, emission and susceptibility, for Class A1, A2 and A3 equipment for input power leads. For further details regarding levels and extent of compliance in each class or requirement, consult your nearest sales office.

Reliability:
The Mean Time Between Failure (MTBF) is calculated per MIL-HDBK-217E at 50°C baseplate temperature with maximum operating input voltage and maximum rated output power.

The MTBF for AW20S at ground benign environment is 199,209 hours. With the MIL-STD-2000 option, MTBF was calculated to be 288,278 hours of ground benign. The standard AW200S at ground benign and naval sheltered is 100,000 and 15,000 hours, respectively. Please consult the local sales office for additional environments and models.

Environment:
Units meet MIL-STD-810C, altitude, shock, acceleration, vibration and MIL-S-901C high-impact shock requirements. For information, please consult factory.

Hook Up:
Via D-Subminiature Connectors.

Options

The following standard options are available on the AW Series power supplies.

Enhanced Reliability:
-ER Option provides increased reliability by using higher levels of military grade components. (To order, add "-ER" after model number, i.e., AW200S/15-A-ER).

MIL-STD-2000:
Workmanship standard, MIL-STD-2000 version of each unit is available. This option includes "-ER" option as a standard feature. Case size will increase, consult sales office for dimensions on AW100 and AW200. (To order, add "-M" after "A" in model number, i.e., AW200S/12-A-M).

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MILITARY POWER SUPPLIES

New High Density AC/DC Converters – 20-200 Watts

MODEL AW 20-200

SINGLE OUTPUT

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5	4.00	7	198	AW20S/5-A
	7.00	9	255	AW35S/5-A
	10.00	12	326	AW50S/5-A
	20.00	21	600	AW100S/5-A
	40.00	32	900	AW200S/5-A
5.2	3.85	7	198	AW20S/5.2-A
	6.73	9	255	AW35S/5.2-A
	9.62	12	326	AW50S/5.2-A
	19.23	21	600	AW100S/5.2-A
	38.46	32	900	AW200S/5.2-A
12	1.66	7	198	AW20S/12-A
	2.91	9	255	AW35S/12-A
	4.16	12	326	AW50S/12-A
	8.33	21	600	AW100S/12-A
	16.67	32	900	AW200S/12-A

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
15	1.33	7	198	AW20S/15-A
	2.33	9	255	AW35S/15-A
	3.33	12	326	AW50S/15-A
	6.66	21	600	AW100S/15-A
	13.33	32	900	AW200S/15-A
24	.83	7	198	AW20S/24-A
	1.45	9	255	AW35S/24-A
	2.08	12	326	AW50S/24-A
	4.16	21	600	AW100S/24-A
	8.33	32	900	AW200S/24-A
28	.71	7	198	AW20S/28-A
	1.25	9	255	AW35S/28-A
	1.78	12	326	AW50S/28-A
	3.57	21	600	AW100S/28-A
	7.14	32	900	AW200S/28-A

DUAL OUTPUT*

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
±5	1.50	9.25	259	AW35D/5-A
	2.10	11.75	329	AW50D/5-A
±12	1.46	9.25	259	AW35D/12-A
	2.08	11.75	329	AW50D/12-A
±15	1.17	9.25	259	AW35D/15-A
	1.67	11.75	329	AW50D/15-A

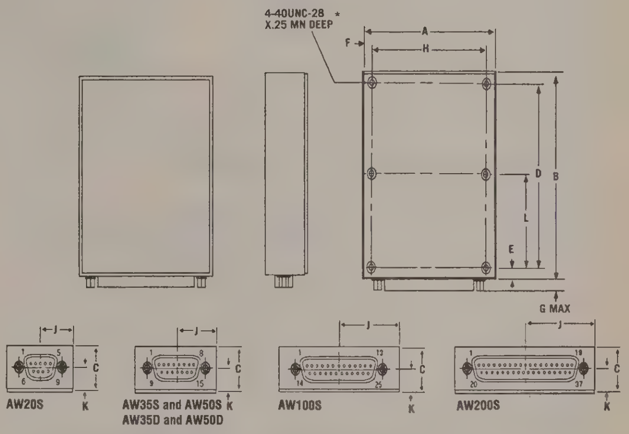
* Each output is independent and isolated, which may be connected in a ± configuration.

[1] Maximum estimated weight, not including options.

	Dimensions										
Model	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**
AW20S	Inches 2.50 mm 63.5	3.00 76.2	.85 21.6	2.600 66.04	.20 5.1	.20 5.1	.25 6.4	2.100 53.34	1.25 31.8	.46 11.7	N/A
AW35S AW35D	3.00 76.2	3.50 88.9	.85 21.6	3.100 78.74	.20 5.1	.20 5.1	.25 6.4	2.600 66.04	1.50 38.1	.46 11.7	N/A
AW50S AW50D	3.25 82.6	4.00 101.6	.85 21.6	3.600 91.44	.20 5.1	.20 5.1	.25 6.4	2.850 72.39	1.63 41.4	.46 11.7	N/A
AW100S	3.75 95.3	5.25 133.4	.85 21.6	4.850 123.19	.20 5.1	.20 5.1	.25 6.4	3.350 85.09	1.87 47.5	.46 11.7	2.425 61.60
AW200S	4.50 114.30	6.50 165.10	.85 21.57	6.100 154.94	.20 5.1	.20 5.1	.25 6.4	4.100 104.14	2.25 57.15	.46 11.7	3.050 77.47

Tolerances: Inches - .xxx = ±0.015 or .xx = ±0.03; MM - .xx = ±0.4 OR .X = ±0.8.
Material: Base - For AW100 and AW200, 6061-T6. For the others, 5052-H32. Case for all models - Steel.
Finish: black flat lacquer per FED-STD-595, Color 37038.
Mounting: 4-40 THD inserts 1/4" minimum depth are provided in baseplate. Steel 4-40 bolts American Standard, unified national coarse series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.
Metric: M3 inserts and hardware.

MECHANICAL DRAWINGS



* Number of mounting holes: 4 places for all other models.

PIN DESIGNATIONS

Model: AW20S AW20S-M
Connector: DEMME9PF M24308/24 Type
Mate: DEMM9S M24308/1-1 Type

1. +Input
2. -TTL
3. +TTL
4. +Sense
5. +Output
6. -Input
7. Ground
8. -Sense
9. -Output

Model: AW35S and AW50S AW35S-M and AW50S-M
Connector: DAMME15PF M24308/24 Type
Mate: DAMM15S M24308/1-2 Type

1. +Input
2. N/C
3. -TTL
4. +TTL
5. +Sense
6. +Output
7. +Output
8. +Output
9. -Input
10. N/C
11. Ground
12. -Sense
13. -Output
14. -Output
15. -Output

Model: AW35D and AW50D AW35D-M and AW50D-M
Connector: DAMME15PF M24308/24 Type
Mate: DAMM15S M24308/1-2 Type

1. +Input
2. N/C
3. -TTL
4. +TTL
5. +Sense 1
6. +Output 1
7. +Sense 2
8. +Output 2
9. -Input
10. N/C
11. Ground
12. -Sense 1
13. -Output 1
14. -Sense 2
15. -Qutput 2

Model: AW100S
Connector: DBMME25PF
Mate: DBMME25S

1. +Input
2. +Input
3. +Input
4. Parallel[1]
5. Parallel[1]
6. +TTL
7. -TTL
8. +Output
9 +Output
10. +Sense
11. -Sense
12. -Output
13. -Output
14. -Input
15. -Input
16. -Input
17. Ground
18. +Output
19. +Output
20. +Output
21. +Output
22. -Output
23. -Output
24. -Output
25. -Output

Model: AW200S
Connector: DCMME37PF
Mate: DCMM37S

1. +Input
2. +Input
3. +Input
4. +Input
5. +Input
6. Parallel[1]
7. Parallel[1]
8. +TTL
9. -TTL
10. +Output
11. +Output
12. +Output
13. +Output
14. +Sense
15. -Sense
16. -Output
17. -Output
18. -Output
19. -Output
20. -Input
21. -Input
22. -Input
23. -Input
24. -Input
25. Ground
26. +Output
27. +Output
28. +Output
29. +Output
30. +Output
31. +Output
32. -Output
33. -Output
34. -Output
35. -Output
36. -Output
37. -Output

[1] Parallel pins are internally connected and redundant. Either pin can be used for single pin parallelability or either pin can be left open and unused.

MODEL NUMBERING SYSTEM

Model Series	Total Output Power	Number of Outputs	Slash	Output Voltage	Dash	Header Type	Dash	Options
AW	35	D	/	12	–	A	–	M
AW	100	S	/	12	–	A	–	ER

INPUT CURRENT (Typical Amps)

Model	Output Load	Low Line	High Line
AW20S	50% 100%	0.21 0.39	0.17 0.32
AW35S	50% 100%	0.34 0.69	0.28 0.56
AW35D	50% 100%	0.4 0.74	0.32 0.60
AW50S	50% 100%	0.65 1.1	0.5 0.88
AW50D	50% 100%	0.69 1.20	0.54 .95
AW100S	50% 100%	1 2.1	0.8 1.7
AW200S	50% 100%	2.0 4.2	1.6 3.4

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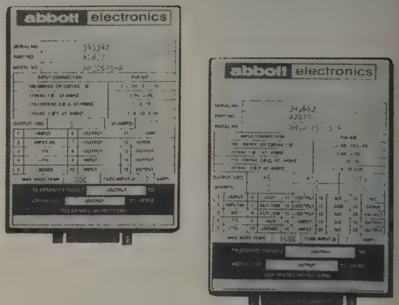
High Density DC/AC to DC Converters

MODEL AM

SPECIFICATIONS

Input: Inputs for 50 watt model:
"U" input ranges: 90-130 Vac; 47-440 Hz, Single Phase or Three Phase (Delta, WYE). 180-260 Vac, 47-440 Hz, Single Phase or Three Phase (Delta). 200-300 Vdc. For these input ranges, add (U) to model number AM50S/5-A(U). "S" input ranges: 100-200 Vdc. For this input range, add (S) to model number AM50S/5-A(S).
Efficiency: 65% minimum. Typically 75% (Full load, room ambient).
Line Regulation: Single and Main: .1% or 10 mV, whichever is greater. Triple ±15 V: 100 mV maximum; 12 V: 60 mV maximum.
Load Regulation: Single and Triple: 10 mV or 0.1%, whichever is greater. Auxiliary Outputs: 150 mV max. over the temperature range.
Pard (Noise and Ripple): 25 mV rms, 100 mV P-P at 25 MHz bandwidth for 5 V outputs and 200 mV for other voltages; measured over temperature range.
Isolation Voltage: 1000 V dc, input to output; 1000 V dc, input to case; 200 V dc, output to case.
Insulation Resistance: 50 megohms minimum between input and outputs, input and case, outputs and case, when measured at 50 V dc.
Temperature range: Operating: –55°C to +100°C maximum, at center of the baseplate. Storage: –55°C to +125°C, ambient.
Temperature Coefficient: 0.01%°C maximum over entire temperature range.
Input Transient Protection: Unit will not be damaged or exhibit degradation of performance when subjected to input transients in accordance with MIL-STD-704A, MIL-STD-704D and MIL-STD-1399, as applicable to corresponding input configurations. Consult your nearest sales office if further details are needed.
Load Transient Recovery: Main output voltage returns to regulation limits within 0.5 milliseconds after 50% change in load current.
Load Transient Overshoot: 0.5 V from nominal voltage set point, single and triple outputs.
Short Circuit Protection: All outputs are completely protected against a short circuit of any duration. Outputs automatically restore to normal when overload is removed.
Remote Sensing: Compensates for up to 0.5 volt drop in output leads. (Single and main output only.)
Remote Inhibit: Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 1) will inhibit the outputs.
Preload Requirements: For triple output only. A one amp minimum load is required on the main for full load capabilities on the auxiliaries.
Electromagnetic Interference: Units, when tested in accordance with MIL-STD-462, meet the majority of the requirements of MIL-STD-461C for conducted and rediated, emission and susceptibility, for Part 2, Class A1B equipment, for input power leads. For further details regarding levels and extent of compliance in each class, input configuration, or requirement, consult your nearest sales office.
Reliability: The Mean Time Between Failure (MTBF) per MIL-HBDK-217E calculated for standard model AM50S under operating conditions of 50°C baseplate, maximum operating input voltage and maximum rated output power, is 160,300 hours for a ground benign environment and 20,200 hours for a naval sheltered environment. With "-ER" option MTBF was calculated to be 240,000 hours for a ground benign environment and 25,000 for naval sheltered environment. Please consult factory for additional environments and models.
Environment: Units meet MIL-STD-810D, altitude, shock, acceleration, vibration and MIL-S-901C, high-impact shock conformance.



- Customer Selectable Multi-inputs
- Wireless Submodular Construction for High Reliabilty
- Current Mode Control
- Standard Current Limiting

PRODUCT SELECTION GUIDE

Single Output Standard Models

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5.0	10.0	12	340	AM50S/5-A
5.2	9.62	12	340	AM50S/5.2-A
15.0	3.33	12	340	AM50S/15-A
24.0	2.08	12	340	AM50S/24-A
28.0	1.79	12	340	AM50S/28-A

1. Maximum weight, not including options.

Triple Output Standard Models

Output Voltage (Main)	Output Current Main	Output Voltage (Aux)	Output Current (Aux)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5	7.0	±12	0.63	15	410	AM50T/5/12-A
	7.0	±15	0.5	15	410	AM50T/5/15-A

1. Maximum weight, not including options.

PIN DESIGNATIONS

(Standard model, not including options. Consult factory for details.)

Single Output

1.	+ Input	**6.**	+ Output	**11.**	Ground
2.	± Input	**7.**	+ Output	**12.**	– Sense
3.	– TTL	**8.**	+ Output	**13.**	– Output
4.	+ TTL	**9.**	– Input	**14.**	– Output
5.	+ Sense	**10.**	– Input	**15.**	– Output

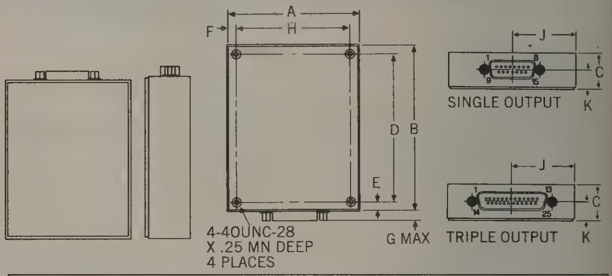
Connectors and Mates
Connectors: DAMME15PF
Mate: DAMM15S
Note: ± input connection is only for DC input

Triple Output

1.	+ Input	**6.**	+ AUX	**11.**	+ Output	**16.**	N/C	**21.**	N/C
2.	± Input	**7.**	+ AUX CM	**12.**	+ Output	**17.**	GND	**22.**	– Sense
3.	N/C	**8.**	– AUX CM	**13.**	+ Output	**18.**	N/C	**23.**	– Output
4.	– TTL	**9.**	– AUX	**14.**	– Input	**19.**	N/C	**24.**	– Output
5.	+ TTL	**10.**	+ Sense	**15.**	– Input	**20.**	N/C	**25.**	– Output

Connectors and Mates
Connectors: DBMME25PF
Mate: DBMM25S
Note: ± input connection is only for DC input

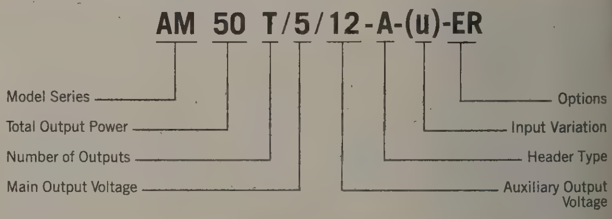
MECHANICAL DRAWINGS (AM50S + T)



Dimensions											
Model		**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**
AM50S	IN.	3.25	4.25	.85	3.850	.20	.20	.25	2.850	1.63	.46
	MM	82.6	108.0	21.6	97.79	5.1	5.1	6.4	72.39	41.4	11.7
AM50T	IN.	3.50	4.50	.85	4.100	.20	.20	.25	3.100	1.75	.46
	MM	88.9	114.3	21.6	104.14	5.1	5.1	6.4	78.74	44.5	11.7

Tolerances: Inches - .XXX = ±0.015 or .XX = ±0.03; MM - .XX = ±0.4 or .X = ±0.8.
Material: Base - Aluminum 5052-H32, Case - Steel.
Finish: Black flat per FED-STD-595, Color 37038.
Mounting: 4-40 THD inserts .25″ minimum depth are provided in baseplate. Steel4-40 bolts American standard. unified national coarse series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

HOW TO ORDER



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MILITARY POWER SUPPLIES

New High Density AC/DC Converters – Multiple Inputs

MODEL
AM
100

SPECIFICATIONS

Input:
Inputs for 100 watt model
103 to 127 Vac; 47-440 Hz, Single Phase
206 to 254 Vac, 47 to 440 Hz, Single Phase;
200 to 300 Vdc.

Efficiency:
65% minimum. Typically 75% (Full load, room ambient).

Line Regulation:
0.1% or 10 mV, whichever is greater.

Load Regulation:
10 mV or 0.1%, whichever is greater.

Pard (Noise and Ripple):
25 mV rms, 100 mV P-P for 5 V dc output and 50 mV rms, 200 mV P-P for other voltages; measured at 25 MHz bandwidth over temperature range.

Isolation Voltage:
1,000 V dc, input to output;
1,000 V dc, input to case;
500 V dc, output to case.

Parallelability:
Multiple unit current sharing without the need for external components, via a single pin connection on each unit.

Insulation Resistance:
50 megohms minimum between input and outputs, input and case, outputs and case, when measured at 50 V dc.

Temperature Range:
Operating: -55°C to +100°C maximum, at center of the baseplate. Storage: -55°C to +125°C, ambient.

Temperature Coefficient:
0.01%/°C maximum over entire temperature range.

Input Transient Protection:
Unit will not be damaged or exhibit degradation of performance when subjected to input transients in accordance with MIL-STD-704A, MIL-STD-704D and MIL-STD-1399, as applicable to corresponding input configurations. Consult your nearest sales office if further details are needed.

Load Transient Recovery:
Output voltage returns to regulation limits within 0.5 milliseconds after 50% change in load current.

Load Transient Overshoot:
0.5 V from nominal voltage set point.

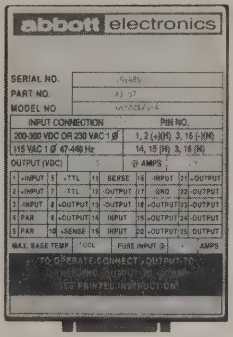
Short Circuit Protection:
Output completely protected against a short circuit of any duration. Output automatically restores to normal when overload is removed.

Remote Sensing:
Compensates up to 0.5 volt drop in output leads.

Remote Inhibit:
Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 1) will inhibit the output.

Electromagnetic Interference:
Units, when tested in accordance with MIL-STD-462, meets or minimizes the majority of the requirements of MIL-STD-461C for conducted and radiated, emission and susceptibility, for Part 2, Class A1b, equipment for input power leads; with different levels of compliance under each input configuration. For further details regarding levels and extent of compliance in each class, input configuration, or requirement, consult your nearest sales office.

Reliability:
The Mean Time Between Failure (MTBF) PER MIL-HDBK-217e for an AM100S was calculated to be 75,000 hours. Please consult the local sales office for specific environments and models.



Environment:
Units meet MIL-STD-810D, altitude, shock, acceleration, vibration and MIL-S-901C high-impact shock requirements. For information, please consult factory.

Hook Up:
Via D-Subminiature Connectors.

OPTIONS

The following standard options are available on the AM Series power supplies.

Enhanced Reliability:
-ER Option provides increased reliability by using higher levels of military grade components.

SINGLE OUTPUT

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5	20.00	28	775	AM100S/5-A
5.2	19.23	28	775	AM100S/5.2-A
12	8.33	28	775	AM100S/12-A
15	6.67	28	775	AM100S/15-A
24	4.17	28	775	AM100S/24-A
28	3.57	28	775	AM100S/28-A

[1] Maximum weight, not including -ER options

INPUT CURRENT (Typical Amps)

Model	Output Load	Low Line	High Line
AM100S-115 V ac	50%	1.0	0.78
	100%	2.1	1.73

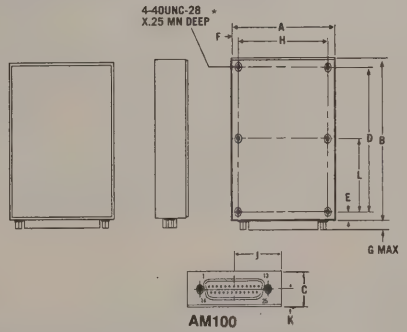
PIN DESIGNATIONS

Model: AM100S
Connector: DBMME25PF
Mate: DBMM25S

1. +Input
2. +Input
3. -Input
4. Parallel[1]
5. Parallel[1]
6. +TTL
7. -TTL
8. +Output
9. +Output
10. +Sense
11. -Sense
12. -Output
13. -Output
14. Input
15. Input
16. -Input
17. Ground
18. +Output
19. +Output
20. +Output
21. +Output
22. -Output
23. -Output
24. -Output
25. -Output

[1] Parallel pins are internally connected and redundant. Either pin can be used for single pin parallelability or either pin can be left open and unused.

MECHANICAL DRAWINGS



AM100

* Number of mounting holes: 4 places for all other models.

DIMENSIONS

Model		A	B	C	D	E	F	G	H	J	K	L
AM100S	Inches mm	4.25 108.0	6.00 152.4	.85 21.6	5.600 142.24	.20 5.1	.20 5.1	.25 6.4	3.850 97.79	2.13 54.0	.46 11.7	2.800 71.12

Tolerances: Inches - .xxx = ±0.010 or .xx = ±0.020; MM - .xx = ±0.4 or .x = ±0.8. Angles ±30°.
Material: Base - Aluminum 5052-H32, Case - Steel.
Finish: black flat lacquer per FED-STD-595, Color 37038.
Mounting: 4-40 THD inserts 1/4" minimum depth are provided in baseplate. Steel 4-40 bolts American Standard, unified national coarse series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.
Metric: M3 inserts and hardware.

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MILITARY POWER SUPPLIES

60 Hz to DC

MODEL MH

SPECIFICATIONS

Input: 103.5 to 126.5 V rms standard, 47 to 440 Hz, single phase. For 207 to 253 V rms input, add "(230)" to model number, i.e., MH500S/15-DE(230). Other inputs available (Option H and Option -3).

Efficiency: 65% minimum.

Line Regulation: Within 0.2% or 25 mV (whichever is greater) for input change of 103.5 to 126.5 V ac with load constant.

Load Regulation: Within 0.2% or 25 mV (whichever is greater) for change from no load to full load with line constant.

Pard (Noise and Ripple): 50 mV rms, 100 mV peak-to-peak maximum at 25 MHz bandwidth.

Isolation Voltage: 500 V dc input to output and input to case, 100 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Polarity: Inputs and outputs are isolated. Either positive or negative side of output may be grounded.

Temperature Range: Operating: 0°C to +71°C maximum at center of mounting base. Storage: −55°C to +85°C.

Temperature Coefficient: 0.03%/°C maximum over entire temperature range.

Input Transient Protection: Unit will withstand 180 V ac for 0.1 second in accordance with MIL-STD-704.

Load Transient Recovery Time: Output voltage returns to regulation limits within 300 microseconds after a 50% change in load current.

Holdup Time: 20 ms after nominal input is lost at full load.

Short Circuit Protection: Completely protected against an overload or short circuit of any duration. Output automatically restores to normal when the overload is removed. (Foldback to 60%.)

Output Overvoltage Protection: A non-crowbar type OVP. Input must be recycled to restore output.

Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.3 volt in the load leads.

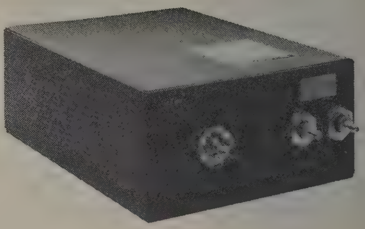
Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to radiated and conducted interference.

Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output power was calculated to be 54,530 hrs. for a ground benign environment.

Environment: Encapsulated and hermetically sealed to meet the environmental requirements of MIL-STD-810C, MIL-S-901C and MIL-E-5400P, Class 2, including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Maintainability: Units are repairable at depot level.

Connectors: Standard unit is provided with an input solder pin header and an output "hermetic seal" stud-type connector.



FEATURES

- 500-Watt Switching 100 kHz Power Supply
- High Efficiency, 65% Minimum
- Meets MIL-STD-461B, MIL-STD-810C and MIL-S-901C
- Standard Soft-start and Short Circuit Protection

Output Voltage Range[1]	Output Current (amps)	Weight[2] (Lbs.)	Model Number
4.75—5.25	100	15	MH500S/5-DE
11.40—12.60	41.67*	15	MH500S/12-DE
14.25—15.75	33.33*	15	MH500S/15-DE
22.80—25.20	20.83*	15	MH500S/24-DE
26.60—29.40	17.86*	15	MH500S/28-DE

* Rounded figures. Total watts equal 500.

1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 50 mV for nominal output voltages 5 to 15 V dc and 60 mV for outputs 24 to 28 V dc.
2. Weights are ±5%.

OPTIONAL FEATURES

Special Connectors: A military-type hermetically sealed connector is provided as **Option A** in place of our standard input header. (To order, replace the "D" in the model number with "A", i.e., MH500S/5-AE.)

Wide Input Voltage: With **Option H**, the units operate either from 115 V ac ±15% or 230 V ac ±15%. (To order, add an "H" after the "E" in the model number, i.e., MH500S/5-DEH or MH500S/5-DEH (230).)

Remote Turn On/Off: Option L provides isolated terminals to turn output(s) on/off with TTL logic signal. (To order, add "L" after "E" in model number, i.e., MH500S/5-DEL.)

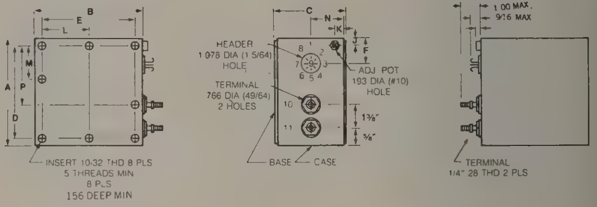
Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "E" in model number, i.e., MH500S/5-DER.)

Wider Operating Temperature: −20°C to +71°C is available with **Option T**. (To order, add "T" after "E" in model number, i.e., MH500S/5-DET.)

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military-grade components. (To order, add "-ER" after model number, i.e., MH500S/5-DE-ER.)

WYE Input: Option -3 changes input to 3-phase, 4-wire "WYE". (To order, add "-3" to the end of the model number, i.e., MH500S/5-DE-3.)

MECHANICAL DIMENSIONS



A	B	C	D	E	F	J	K	L	M	N	P
7	10	3½	6.46	9.45	2 3/32	¼	⅜	4.73	2.14	1 11/16	4.32

Tolerances: If a fraction, ±1/32 in, a decimal, ±.015 in.

Material: Base—Aluminum 6061-T6, Case—Steel.

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts 5/32" minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. AC Input
2. AC Input
3. Not Used
4. −Sense
5. +Sense
6. Not Used
7. Not Used
8. Not Used
9. Ground
10. +Output DC
11. −Output DC

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MILITARY POWER SUPPLIES

60 Hz to DC

MODEL
M300

SPECIFICATIONS

Input: 103.5 to 126.5 V rms standard, 47 to 440 Hz. single phase. Other inputs available (Options H and -3).

Efficiency: 60% minimum at full load.

Line Regulation: Within 0.2% or 25 mV (whichever is greater) for change from low line to high line with load constant.

Load Regulation: Within 0.2% or 25 mV (whichever is greater) for change from no load to full load with line constant.

Auxiliary Output Tracking Accuracy: The negative output will track the positive output within 200 mV for all rated conditions. (M300T).

Pard (Noise and Ripple) for Main and Auxiliary Outputs: 30 mV rms, 100 mV peak to peak (maximum) at 25 MHz bandwidth, over the entire temperature range.

Isolation Voltage: 500 V dc input to output. 500 V dc input to case. 100 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Temperature Range: Operating: 0°C to +71°C maximum at center of baseplate. Storage: −55°C to +85°C ambient.

Temperature Coefficient: 0.1%/°C maximum for main and auxiliary outputs over the entire temperature range.

Input Transient Protection: Unit will withstand 143.8 V ac to 0.3 second in accordance with MIL-STD-1399.

Load Transient Recovery Time: Output voltage returns to regulation limits within 1.5 millisecond for main and 100 microseconds for auxiliary outputs after a 50% change in load current.

Holdup Time: 10 ms after nominal input is lost at full load.

Short Circuit Protection: Completely protected against a short circuit of any duration. Outputs automatically restore to normal when the overload is removed. All outputs will foldback for overload.

Current Limiting: Output current is limited to 120% on main and auxiliary outputs (±10%) under overload conditions.

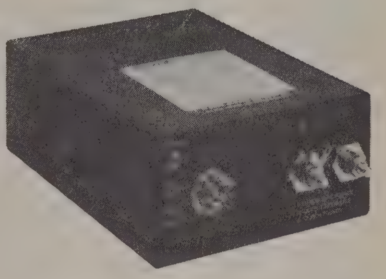
Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.5 volt in the load leads.

Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to conducted interference (meets CE03, CS01, CS02 and CS06).

Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output power was calculated to be 77,455 hours for a ground benign environment and 11,642 hours for a naval sheltered environment. With Enhanced Reliability Option -ER ground benign is 119,771 hours; naval sheltered is 16,233 hours. (M300T).

Environment: Encapsulated and hermetically sealed to meet the environmental requirements of MIL-STD-810C and MIL-S-901 including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Connectors: Standard unit is provided with solder-pin input header and a hermetic seal, stud-type, output connector.



FEATURES

- 300-Watt Single and Triple Output, Switching Power Supply
- High Efficiency, 60% Minimum
- Short Circuit Protection Standard
- Meets MIL-STD-461B, MIL-STD-810C and MIL-S-901C

Output Voltage Range[1] (Main)	Output Voltage Range[1] (Aux)	Output Current[2] (Main)	Output Current[2] (Aux)	Wt.[3] (Lbs.)	Model Number
4.75- 5.25		60		8.0	M300S/ 5-D
11.40-12.60		25		8.0	M300S/12-D
14.25-15.75		20		8.0	M300S/15-D
22.80-25.20		12.5		8.0	M300S/24-D
26.60-29.40		10.7		8.0	M300S/28-D
4.8 - 5.3	±11.4-±12.6	48	2.5	8.2	M300T/5/12-D
4.8 - 5.3	±14.3-±15.8	48	2.0	8.2	M300T/5/15-D

1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 35 mV.
2. Maximum output power equals 300 Watts.
3. Weights are ±5%.

OPTIONAL FEATURES

Special Connectors: A military-type hermetically sealed connector is provided as **Option A** in place of our standard header. (To order, replace the "D" in the model number with "A," i.e., M300T/5/15-A or M300S/5-A.)

Severe Shock, Acceleration and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., M300T/5/15-DE or M300S/5-DE.)

Wide Input Voltage: With **Option H** the units will operate from 90 to 126.5 V ac, with 20% derating in output power. (To order, add an "H" after the "D" in the model number, i.e., M300T/5/15-DH or M300S/5-DH.)

Remote Turn On/Off: Option L provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" after "D" in model number, i.e., M300T/5/15-DL or M300S/5-DL.)

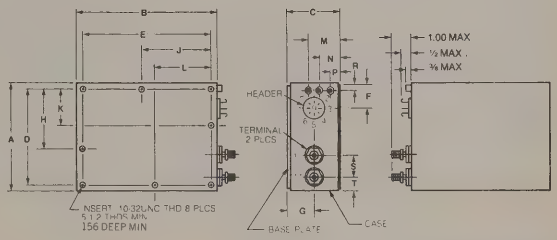
Remote Output Adjustment: With **Option R** an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number, i.e., M300T/5/15-DR or M300S/5-DR.)

Wider Operating Temperature: −20°C to +71°C is available with **Option T.** Pard (noise and ripple) specification increases to 200 mV peak-to-peak. (To order, add a "T" after "D" in model number, i.e., M300T/5/15-DT or M300S/5-DT.)

WYE Input: Option -3 changes input to 3-phase, 4 wire "WYE". (To order, add "-3" to the end of the model number, i.e., M300T/5/15-3 or M300S/5-D-3).

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military grade components. (To order, add "-ER" after model number, i.e., M300T/5/15-ER or M300S/5-ER.)

MECHANICAL DIMENSIONS (M300T)



A	B	C	D	E	F	G	H	J
6	8	3	5.50	7.50	1 13⁄32	1½	3.411	4.113

K	L	M	N	P	R	S	T
2.089	3.387	1 11⁄16	1 3⁄32	½	⅜	1¼	¾

Tolerances: If a fraction, ±1⁄32 inch, a decimal, ±.015 inch.

Material: Base—Aluminum 6061-T6, Case—Steel.

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts 5⁄32″ minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. AC Input
2. AC Input
3. Not Used
4. −Sense (Main)
5. +Sense (Main)
6. +Aux. Output
7. Aux. Com.
8. −Aux. Output
9. Case Ground
10. +Main Output
11. −Main Output

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MILITARY POWER SUPPLIES

60 Hz to DC

MODEL
MB100

SPECIFICATIONS

Input: 103.5 to 126.5 V rms standard, 47 to 65 Hz, single phase. Other inputs available (Option H).

Efficiency: 65% minimum at full load.

Line Regulation: 10 mV input change of 103.5 to 126.5 V ac with load constant.

Load Regulation: 10 mV for main output, 0.5% for auxiliary outputs for change from no load to full load with line constant.

Auxiliary Output Tracking Accuracy: The negative output will track the positive output within 100 mV for all rated conditions.

Pard (Noise and Ripple) for Triple Output: 100 mV p-p (Max.); Single Output 5 V: 100 mV p-p; 28 V: 200 mV p-p (Max.).

Isolation Voltage: 700 V dc input to output. 500 V dc input to case, 200 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Temperature Range: Operating: −20°C to +71°C maximum at center of baseplate. Storage: −55°C to +85°C ambient.

Temperature Coefficient: 0.01%/°C maximum for main and auxiliary outputs over the entire temperature range.

Input Transient Protection: Unit will withstand 143.8 V ac for 0.3 second in accordance with MIL-STD-1399, Sec. 103.

Load Transient Recovery Time: Output voltage returns to regulation limits within 0.5 millisecond for main and auxiliary outputs after a 50% change in load current.

Load Transient Over/Undershoot: 0.8 V or 3% (whichever is greater) from nominal voltage set point.

Short Circuit Protection: Completely protected against a short circuit of any duration. Outputs automatically restore to normal when the overload is removed. Auxiliary outputs will fold back for overload.

Current Limiting: Output current is limited to 120% on main, 150% on auxiliary outputs (±10%) under overload conditions.

Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.5 volt in the load leads (on 5 V main output).

Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to radiated and conducted interference.

Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output power was calculated to be 97,930 hours for a ground benign environment and 17,632 hours for naval sheltered (MB100T).

Environment: Encapsulated and hermetically sealed to meet the environmental requirements of MIL-STD-810C and MIL-S-901 including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Connectors: Standard unit is provided with solder-type, single-pin input terminals and a solder-type, multiple-pin output header.

OPTIONAL FEATURES

Special Connectors: A military-type hermetically sealed connector is provided as **Option A** in place of our standard header. (To order, replace the "D" in the model number with "A," i.e., MB100T/5-12-A or MB100S/5-A.)

Severe Shock, Acceleation and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., MB100T/5/12-DE or MB100S/5-DE.)

Wide Input Voltage: With **Option H**, the units will operate from 90 to 130 V ac, with 20% derating in output power. (To order, add an "H" after the "D" in the model number, i.e., MB100T/5/12-DH or MB100S/5-DH.)

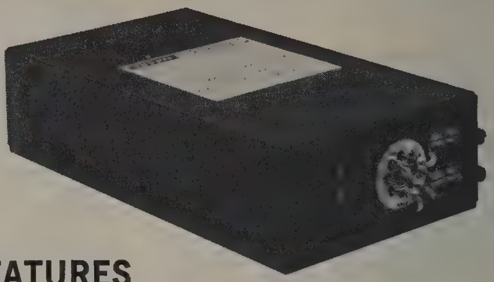
Remote Turn On/Off: Option L provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" after "D" in model number, i.e., MB-100T/5/12-DL or MB100S/5-DL.)

Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number, i.e., MB100T/5/12-DR or MB100S/5-DR.)

Internal Overvoltage Protection: Option -1 provides a non-crowbar internal OVP on the main output (Output 1). Input must be recycled to restore output. (To order, add "-1" afer "D" in model number, i.e., MB100T/5/12-D-1 or MB100S/5-D-1.)

50/50 Distributed Power: Option -7 distributes 50 watts to the main and 50 watts to the auxiliaries. (To order, add "-7" to the end of the model number, i.e., MB100T/5/12-D-7.)

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military-grade components. (To order, add "-ER" after model number, i.e., MB100T/5/12-D-ER or MB100S/5-D-ER.)



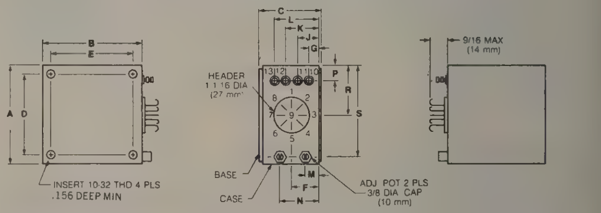
FEATURES

- 100-Watt Single and Triple Output, 200 kHz Switching Power Supply
- High Efficiency, 65% Minimum
- −20°C to +71°C Temperature Range
- Meets MIL-STD-461B, MIL-STD-810C and MIL-S-901C
- Low Profile

Output Voltage Range[1] (Main)	Output Current[2] (Main)	Output Voltage Range[1] (Aux)	Output Current[2] (Aux)	Wgt.[3] (Lbs.)	Wgt.[3] (Kgs.)	Model Number
4.75- 5.25	20.0			3.0	1.5	MB100S/ 5-D
11.40-12.60	8.3			3.0	1.5	MB100S/12-D
14.25-15.75	6.6			3.0	1.5	MB100S/15-D
22.80-25.20	4.2			3.0	1.5	MB100S/24-D
26.60-29.40	3.6			3.0	1.5	MB100S/28-D
4.8 - 5.8	15	±14.5-±15.5	0.8	3.5	1.6	MB100T/5/15-D
4.8 - 5.8	15	±11.5-±12.5	1	3.5	1.6	MB100T/5/12-D

1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 35 mV.
2. Maximum output power equals 100 Watts.
3. Weights are ±5%.

MECHANICAL DIMENSIONS (MB100T)



A	B	C	D	E	F	G	J
4	7½	1⅞	3.44	6.94	⅞	⅜	11/16

K	L	M	N	P	R	S
1	1 5/16	9/16	1 5/32	13/16	2 9/32	3¾

Tolerances: If a fraction, ±1/32 inch, if a decimal, ±.015 inch.

Material: Base—Aluminum 6061-T6, Case—Steel.

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts 5/32" minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. Ground
2. 5V Common
3. +5V Output
4. +Sense
5. Internal Connection
6. −Sense
7. +V (Aux)
8. −V (Aux)
9. V Common (Aux)
10. AC Input (Hot)
11. AC Input (Neutral)
12. Not Used
13. Not Used

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MILITARY POWER SUPPLIES

60 Hz/400 Hz to DC

MODEL
MB60
WM60

SPECIFICATIONS:

Input: 103.5 to 126.5 V rms standard, MB: 47-440 Hz, single phase; WM: 320 to 480 Hz, single phase.

Input Transient Protection: Unit will withstand 180 Vac for 0.1 second in accordance with MIL-STD-704A, Category B.

Efficiency: Minimum at full load: 65%.

Line Regulation: Input change of 103.5 to 126.5 V rms, with load held constant.
Single: 0.1% or 10mV, whichever is greater.
Triple: 0.1%, all outputs.

Load Regulation: No load to full load, with line held constant.
Single: 10 mV or 0.1%, whichever is greater.
Triple: Main output, 0.2%; Auxiliaries, 0.5%.

Load Transient Recovery: Output voltage returns to regulation limits within 0.5 mS after a 50% change in load current.

Load Transient Overshoot: 0.8V or 3% (whichever is greater) from nominal voltage set point.

Pard (Noise and Ripple): Measured at 25 MHz bandwidth. Single Output Unit: 30mV rms; P-P: 5V – 2.0%, 12 or 15V – 1.0%, 24 or 28V – 0.7%. Triple Output Unit: 30mV rms; 100mV P-P for main and auxiliary outputs. Note: Turn on at low temperature extreme can result in increased PARD measurements prior to unit warm up (1-3) minutes. Consult nearest sales office for applications details.

Temperature Range: MB (single and triple): Operating, −20°C to +85°C maximum, at center of baseplate. Storage, −55°C to +105°C ambient.
WM (single and triple): Operating, −55°C to −100°C maximum, at center of baseplate. Storage, −65°C to +125°C ambient.

Temperature Coefficient: 0.03%/°C maximum over entire temperature range.

Auxiliary Output Tracking: Negative output tracks positive within 100 mV for all rated conditions of line and load at ambient conditions, with positive set at nominal, ±50 mV (250 mV for all rated conditions of line, load, temperature or set point).

Isolation Voltage: 700 VDC, input to output; 500 VDC, input to case; 200 VDC, output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, output and case, when measured at 50 VDC.

Overvoltage Protection: Electronic overvoltage protection standard for singles and main output of triples.

Short Circuit Protection: Completely protected against a short circuit of any duration. Output automatically restores to normal when overload is removed.

Current Limiting: Foldback current limiting standard for all outputs, 120%, ±10% limit for singles and main, 160% for auxiliary outputs, ±30% under overload conditions.

Remote Sensing: On single output units, main output on triple. Compensates for up to 0.5 V drop in load leads.

EMI: Units meet MIL-STD-461C for select curves, please consult factory for detailed information.

Environment: Encapsulated and hermetically sealed units meet MIL-STD-810C altitude, shock and acceleration.

Hook Up: Standard unit is provided with a solder-type multiple-pin output header, and solder turrets.

OPTIONS

"A" – Hermetic Connectors: Replaces solder header/turret with military connectors:
Input: MS3113H10-6P
Output: MS3113H14-12P
Other hermetic, MIL connectors available on special order.

"E" – Severe Shock, Vibration, Acceleration: Extra encapsulent to meet 60g shock, 30g vibration, 50g acceleration and MIL-S-901C, High Impact Shock.

"L" – Remote Enable/Inhibit: Provides for remote turn on/off with TTL logic signal. (Logic 1 will enable).

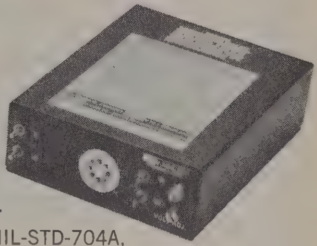
"ER" – Enhanced Reliability: Provides increased reliability via higher level MIL grade components.

PRODUCT SELECTION GUIDE

Model MB	Main Output/ Current[1]	Output #2[1]	Output #3[1]	Weight[2] (lbs)	(kgs)	Model WM
MB60S/5-D	5V@12A			2.10	0.95	WM60S/5-D
MB60S/12-D	12V@5A			2.10	0.95	WM60S/12-D
MB60S/15-D	15V@4A			2.10	0.95	WM60S15-D
MB60S/24-D	24V@2.5A			2.10	0.95	WM60S/24-D
MB60S/28-D	28V@2.14A			2.10	0.95	WM60S/28-D
MB60T/5/12-D	5V@6A	+12V@1.25A	−12V@1.25A	2.16	0.98	WM60T/5/12-D
MB60T/5/15-D	5V@6A	+15V@1A	−15V@1A	2.16	0.98	WM60T/5/15-D

1. Single/Main Output adjust range ±5%, 35 mV resolution. Auxiliary Output adjust ±0.5V.
2. Typical, not including options, weight ±5%.

FEATURES



- Sub-modular internal construction, wireless board to board connections.
- Field proven, 200 kHz, MOSFET, forward converter topology.
- Input transient protection per MIL-STD-704A, Category B.
- Short circuit protection, foldback current limiting and OVP.
- Meets comprehensive MIL-STD-810C environmental conditions.
- Built in EMI filter to MIL-STD-461C.

RELIABILITY DATA – MTBF

MB Series

Environment:	Ground Benign	Naval Sheltered	Air Inhabited (Attack)	Ground Mobile
MB60S-STD	177,533 hrs	27,289 hrs	23,357 hrs	16,240 hrs
MB60S-ER	290,620 hrs	38,654 hrs	38,802 hrs	23,233 hrs
MB60T-STD	125,901 hrs	21,655 hrs	17,420 hrs	12,960 hrs
MB60T-ER	259,829 hrs	37,236 hrs	37,242 hrs	22,547 hrs

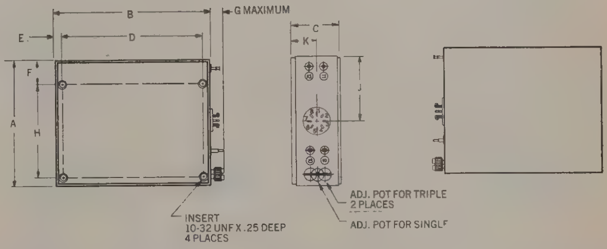
RELIABILITY DATA – MTBF

WM Series

Environment:	Ground Benign	Naval Sheltered	Air Inhabited (Attack)	Ground Mobile
WM60S-STD	91,636 hrs	20,863 hrs	19,500 hrs	13,221 hrs
WM60S-ER	149,839 hrs	28,477 hrs	31,049 hrs	18,142 hrs
WM60T-STD	60,613 hrs	17,283 hrs	15,021 hrs	11,120 hrs
WM60T-ER	117,137 hrs	26,737 hrs	28,839 hrs	17,350 hrs

All MTBF's per MIL-HDK-217E, 50°C baseplate, high line and full load.

MECHANICAL DIMENSIONS



SYM	A	B	C	D	E	F	G	H	J	K
INCHES	4.00	5.00	1.50	4.450	.28	.78	.45	2.950	2.00	.78
MM	101.6	127.0	38.1	113.03	7.1	19.8	11.4	74.93	50.8	19.8

PIN DESIGNATIONS (Single)
1. Not Used
2. Not Used
3. Not Used
4. +Sense
5. Ground
6. −Sense
7. Not Used
8. Not Used
9. +5V
10. 5V COM
11. +Input
12. −Input

Tolerances
(Inches) .XXX = ±0.015 .XX = ±0.03
(MM) .XX = ±0.4 .X = ±0.8

PIN DESIGNATIONS (Triple)
1. COM (Aux)
2. +V (Aux)
3. Not Used
4. +Sense
5. Ground
6. −Sense
7. Not Used
8. −V (Aux)
9. +5V
10. 5V COM
11. +Input
12. −Input

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MILITARY POWER SUPPLIES

60 Hz to DC

MODEL
LV

SPECIFICATIONS

INPUT: 105 to 125 VRMS, 55 to 65 Hz or 380 to 420 Hz single phase. May be operated down to 47 Hz with 20% derating.

EFFICIENCY: 35% typical for 5V; 65% for 28V.

LINE REGULATION: 0.05% (±1 VC for LLV model).

LOAD REGULATION: 0.10%.

PARD (NOISE & RIPPLE): 1 mVRMS or 5 mV p-p.

OUTPUT ADJUSTMENT RANGE: ±5% of nominal at output terminals.

ISOLATION VOLTAGE: 500 VDC input to output, input to case and output to case.

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case when measured at 50 VDC.

POLARITY: Inputs and outputs are isolated, either positive or negative output may be grounded.

TEMPERATURE RANGE: Operating −20°C to +71°C baseplate temperature; −40°C to +85°C (Option T); storage: −55°C to +85°C.

TEMPERATURE EFFECT COEFFICIENT: 0.015% per degree Celsius maximum.

ENVIRONMENT: Hermetically sealed to meet environmental requirements of MIL-STD-810C. Meet MIL-S-901C 5-ft. hammer drop.

ADJUSTMENT RANGE: Equipped with internal potentiometer. External adjustment potentiometer available.

SHORT CIRCUIT PROTECTION: Completely protected against short circuit of any duration. Output automatically restores to normal after removal of short.

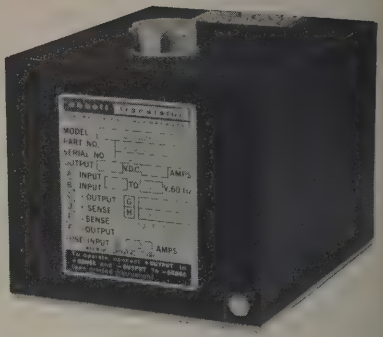
INPUT TRANSIENT PROTECTION: 143.8 VRMS, for 0.3 seconds.

REMOTE ERROR SENSING: (LV series only). Regulator monitors output voltage directly at the load using extra "sensing" leads and compensates for dc voltage drop up to 0.4 volt in load leads.

LOAD TRANSIENT: Output voltage returns to regulation limit within 100 microseconds after 50% step change in load current.

ELECTROMAGNETIC INTERFERENCE: Meets MIL-STD-461A, methods CE01 and CEQ3 for conducted emissions.

RELIABILITY: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of +50°C baseplate temperature, maximum rated output power for LV5DE20-1 was calculated to be 68,987 hrs. for ground benign environment and 10,384 hrs. for naval sheltered environment. MTBF for LLV12-DE0.5-1 was calculated to be 186,947 hrs. for a ground benign environment and 30,081 for naval sheltered environment. With Enhanced Reliability Option (ER) MTBF for LV5DE20-1 (ER) was calculated to be 236,033 hrs. for ground benign environment and 35,585 hrs. for naval sheltered environment. For LLV12DE0.5-1 (ER) MTBF was calculated to be 330,349 hrs. for ground benign environment and 50,682 hrs. for a naval sheltered environment.



FEATURES

- Up to 65% efficiency
- Low Output Ripple, 5 mV peak-to-peak
- 0.1% Regulation
- Single and Dual Outputs

SINGLE OUTPUT: LV SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Weight (Lbs.)	Model Number
4.75 to 5.25	2.4	9A	3.7	LV5DE2.4
	6.0	11C	6.9	LV5DE6
	10.0	12A	9.2	LV5DE10
	20.0	13B	13.0	LV5DE20
11.4 to 12.6	1.7	9A	3.7	LV12DE1.7
	4.0	11C	6.9	LV12DE4
	7.5	12A	9.2	LV12DE7.5
14.2 to 15.7	1.5	9A	3.7	LV15DE1.5
	3.0	11C	7.8	LV15DE3
14.5 to 15.5	4.0	12A	9.2	LV15DE4
22.8 to 25.2	0.9	9A	3.7	LV24DE0.9
	2.5	11C	6.9	LV24DE2.5
	3.9	12A	9.2	LV24DE3.9
	7.5	13B	13.0	LV24DE7.5
26.6 to 29.4	0.75	9A	3.7	LV28DE0.75
	2.0	11C	6.7	LV28DE2
	3.15	12A	9.0	LV28DE3.15
	7.5	13B	15.6	LV28DE7.5

DUAL OUTPUT: LLV SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Weight (Lbs.)	Model Number
±11 to ±13	0.5	11N	4.9	LLV12DE0.5
	0.9	12K	6.6	LLV12DE0.9
	1.5	13D	9.1	LLV12DE1.5
±14 to ±16	0.5	11N	4.9	LLV15DE0.5
	0.9	12K	6.6	LLV15DE0.9
	1.5	13D	9.1	LLV15DE1.5

OPTIONAL FEATURES

TTL: (L Option) Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "1", and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character after the character "E" in the model number. (EXAMPLE: LV5DE6 to LV5DEL5)

SPECIAL CONNECTORS: A hermetically sealed military-type connector is available for the LV series (as shown in picture). Please consult your nearest Abbott Sales Office for details.

WIDER OPERATING TEMPERATURE RANGE: (T Option) −40°C to +85°C operating temperature range available. Please consult your nearest Abbott Sales Office for details.

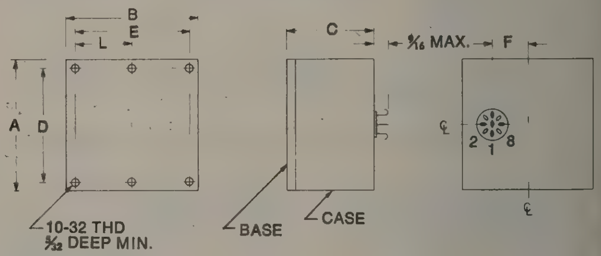
OVER TEMPERATURE PROTECTION: (OT Option) Removes input power when conduction surfaces exceed safe limits. Please consult your nearest Abbott Sales Office for details.

OVERVOLTAGE PROTECTION: (-1 Option) An internal crowbar type OVP is available. Unit will crowbar output when output voltage exceeds adjustable set point. Unit input power must be recycled to restore unit. To specify this feature, please add a "-1" after the last number in the model number. (EXAMPLE: LV5DE6 to LV5DE6-1)

WIDER INPUT VOLTAGE RANGE: (H Option) Available at a voltage range 210 to 250 VAC. Please consult your nearest Abbott Sales Office for details.

ENHANCED RELIABILITY: (ER Option) This option provides increased reliability by using enhanced military grade components. This feature allows the power supply to meet customer specific requirements as to "Hi-Rel" components.

MECHANICAL DIMENSIONS



SIZE	A	B	C	D	E	F	L
9A	2¾	4¾	3¾	2.25	4.25	⅞	—
11C	4¼	5¼	4	3.75	4.75	1⅞	2.375
12A	4½	6	4	4.00	5.5	2¼	2.75
13B	5½	6½	5	5.00	6	2	3
11N	3	6	3⅜	2.50	5.5	2	—
12K	4	6¼	3⅜	3.50	5.75	⅞	2.875
13D	5½	6	3⅜	5.00	5.5	1½	2.75

PIN DESIGNATIONS

Standard Header	Mil-Spec Connector	Standard Models		Models with Internal OVP		Models with TTL (Option L)	
		LV	LLV	LV	LLV	LV	LLV
1	A	AC Input	AC Input	AC Input	AC Input	AC Input	AC Input
2	B	AC Input	AC Input	AC Input	AC Input	AC Input	AC Input
3	K	Ground	Ground	Ground	Ground	+5 Logic	+5 Logic
4	J	Not Used	Not Used	OVP Trim	+OVP Trim	5V Return	5V Return
5	C	+Output	+Output	+Output	+Output	+Output	+Output
6	D	+Sense	Common Output	+Sense	Common Output	+Sense	Common Output
7	E	−Output	−Output	−Output	−Output	−Output	−Output
8	F	−Sense	Not Used	−Sense	−OVP Trim	−Sense	Not Used
9	H	Output Trim	Output Trim	Output Trim	Output Trim	Output Trim	Output Trim
—	G	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

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MILITARY POWER SUPPLIES

400 Hz to DC

MODEL
WM100

SPECIFICATIONS

Input: 103.5 to 126.5 V rms standard, 320 to 480 Hz, single phase. **Other inputs** available (See Options H and -3).

Efficiency: 65% minimum at full load.

Line Regulation: 10 mV for input change of 103.5 to 126.5 V ac with load constant.

Load Regulation: 10 mV on main output. 0.5% on auxiliary outputs for change of no load to full load with line constant.

Auxiliary Output Tracking Accuracy: The negative output will track the positive output within 100 mV for all rated conditions. (WM100T).

Pard (Noise and Ripple) for Triple Output: 100 mV p-p (Max.); Single Output 5 V: 100 mV p-p; 28 V: 200 mV p-p (Max.).

Isolation Voltage: 700 V dc input to output. 500 V dc input to case, 200 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Temperature Range: Operating: −55°C to +100°C maximum at center of baseplate. Storage: −65°C to +125°C ambient.

Temperature Coefficient: 0.01%/°C maximum for main and auxiliary outputs over entire temperature range.

Input Transient Protection: Unit will withstand 180 V ac for 0.1 second in accordance with MIL-STD-704A category B.

Load Transient Recovery Time: Output voltage returns to regulation limits within 0.5 millisecond for main and auxiliary outputs after a 50% change in load current.

Load Transient Over/Undershoot: 0.8 V or 3% (whichever is greater) from nominal voltage set point.

Holdup Time: 2.0 ms after nominal input is lost at full load.

Short Circuit Protection: Completely protected against a short circuit of any duration. Outputs automatically restore to normal when the overload is removed. Auxiliary outputs will fold back for overload.

Current Limiting: Output current is limited to 120% on main, 150% on auxiliary outputs (± 5%) under overload conditions.

Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.5 volt in the load leads (on 5 V main output).

Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to radiated and conducted interference.

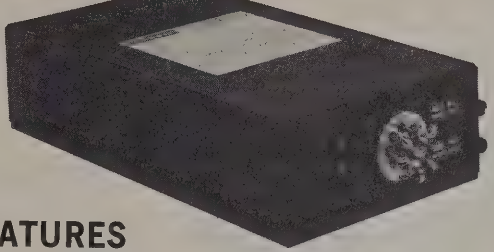
Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output power was calculated to be 99,468 hours for a ground benign environment and 14,985 hours for Air Inhabited (WM100T).

Environment: Encapsulated and hermetically sealed to meet the environmental requirements of MIL-STD-810C and MIL-S-901C including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Connectors: Standard unit is provided with solder-type, single-pin input terminals and a solder-type multiple-pin, output header.

Output Voltage Range[1] (Main)	Output Current[2] (Main)	Output-Voltage Range[1] (Aux)	Output Current[2] (Aux)	Wgt.[3] (Lbs.)	Wgt.[3] (Kgs.)	Model Number
4.75-5.25	20.0			3.0	1.5	WM100S/5-D
11.40-12.60	8.3			3.0	1.5	WM100S/12-D
14.25-15.75	6.6			3.0	1.5	WM100S/15-D
22.80-25.20	4.2			3.0	1.5	WM100S/24-D
26.60-29.40	3.6			3.0	1.5	WM100S/28-D
4.8-5.8	15.0	±11.5-±12.5	1	3.5	1.6	WM100T/5/12-D
4.8-5.8	15.0	±14.5-±15.5	0.8	3.5	1.6	WM100T/5/15-D

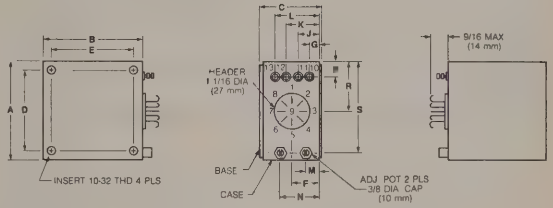
1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 35 mV.
2. Maximum output power equals 100 Watts.
3. Weights are ±5%.



FEATURES

- 100-Watt Single and Triple Output, 200 kHz Switching Power Supply
- High Efficiency, 65% Minimum
- −55°C to +100°C Temperature Range
- Meets MIL-STD-461B, MIL-STD-810C and MIL-STD-704A
- Low Profile

MECHANICAL DIMENSIONS (WM100T)



A	B	C	D	E	F	G	J
4	7½	1⅞	3.44	6.94	⅞	⅜	11/16

K	L	M	N	P	R	S
1	1 15/16	9/16	1 5/32	13/16	2 9/32	3¾

Tolerances: If a fraction, ±1/32 inch, if a decimal, ±.015 inch.

Material: Base—Aluminum 6061-T6. Case—Steel.

Finish: Black flat lacquer per FED-STD-595, Color 37038.

Mounting: 10-32 THD inserts 5/32" minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. Ground
2. 5V Common
3. +5V Output
4. +Sense
5. Internal Connection
6. −Sense
7. +V (Aux)
8. −V (Aux)
9. V Common (Aux)
10. AC Input (Hot)
11. AC Input (Neutral)
12. Not Used
13. Not Used

OPTIONAL FEATURES

Special Connectors: Military-type hermetically sealed connectors are provided as **Option A** in place of our standard header and the input terminals. (To order, replace the "D" in the Model number with "A," i.e., WM100T/5/12-A or WM100S/5-A.)

Severe Shock, Acceleration and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., WM100T/5/12-DE orWM100S/5-DE.)

Wide Input Voltage: With **Option H**, the units will operate from 90 to 130 V ac, with 20% derating in output power. (To order, add an "H" after the "D" in the model number i.e., WM100T/5/12-DH or WM100S/5-DH.)

Remote Turn On/Off: **Option L** provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" after "D" in model number i.e., WM-100T/5/12-DL or WM100S/5-DL.)

Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number i.e., WM100T/5/12-DR or WM100S/5-DR.)

Internal Overvoltage Protection: **Option -1** provides a non-crowbar internal OVP on the main output (Output 1). Input must be recycled to restore output. (To order, add "-1" after "D" in model number, i.e., WM100T/5/12-D-1 or WM100S/5-D-1.)

WYE Input: **Option -3** changes input to 3-phase, 4 wire "WYE." (To order, add "-3" to the end of the model number, i.e., WM100T/5/12-3 or WM100S/5-D-3.)

50/50 Distributed Power: **Option -7** distributes 50 watts to the main and 50 watts to the auxiliaries. (To order, add "-7" to the end of the model number, i.e., WM100T/5/12-D-7.)

Enhanced Reliability: **-ER Option** provides increased reliability by using enhanced military-grade components. (To order, add "-ER" after model number, i.e., WM100T/5/12-D-ER or WM100S/5-D-ER.)

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MILITARY POWER SUPPLIES

400 Hz to DC

MODEL
W
and WW

SPECIFICATIONS

INPUT VOLTAGE RANGE: 105 to 125 VRMS

INPUT FREQUENCY RANGE: 380 to 420 Hertz, 1 phase

INPUT POWER: Per MIL-STD-704A for category B equipment

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 105 to 125 VRMS with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full load with line constant

RIPPLE: 0.02% or 5 mv RMS (whichever is greater) 25 mv peak-to-peak maximum, each output, measured with scope having 25 MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 750 vdc input to output and input to case • 200 vdc output to case

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 vdc.

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded

TEMPERATURE RANGE: Operating: −55°C to +100°C maximum at center of mounting base Storage: −65°C to +125°C

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

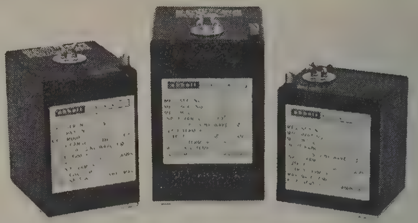
ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810C and MIL-E-5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION: MIL-STD-704A Figure 3, Limit 1 (180 VAC for 0.1 seconds)

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

ELECTROMAGNETIC INTERFERENCE: Built to meet the requirements of MIL-STD-461 for generation of and susceptibility to radiated and conducted interference



High Performance

- Encapsulated and hermetically sealed to meet MIL-STD-810C and MIL-E-5400P, Class 2.
- Operating temperature range: −55°C to +100°C.
- Low Peak-to-Peak Ripple.
- Tight line and load regulation.
- High reliability. Up to 214,600 hrs. MTBF per MIL-HDBK-217C.
- Compact. Power density up to 2 watts per cu. in.
- Low EMI.

RELIABILITY: MTBF per MIL-HDBK-217C up to 214.600 Hrs.

OVER-VOLTAGE PROTECTION*: An internal, non-crowbar type OVP is available. Power supply turns off when output voltage exceeds set-point.

TTL*: Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off.

* Inclusion of these optional features on these models will most likely require that the case size increases slightly. Please consult nearest Abbott sales office for further details.

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number
4.5-5.5	2.5	2E	1.9	W5D2.5
	5.0	4D	2.7	W5D5.0
	10.0	10B	5.1	W5D10
	15.0	14C	8.9	W5D15
	20.0	14C	8.9	W5D20
5.5-6.5	2.5	2E	1.9	W6D2.5
	5.0	4D	2.7	W6D5.0
	10.0	10B	5.1	W6D10
	15.0	14C	8.9	W6D15
	20.0	14C	8.9	W6D20
6.5-7.5	2.5	2E	1.9	W7D2.5
	5.0	4D	2.7	W7D5.0
	10.0	10B	5.1	W7D10
	15.0	14C	8.9	W7D15
	20.0	14C	8.9	W7D20
7.5-8.5	2.5	2E	1.9	W8D2.5
	5.0	4D	2.7	W8D5.0
	10.0	10B	5.1	W8D10
	15.0	14C	8.9	W8D15
	20.0	14C	8.9	W8D20
8.5-9.5	2.5	2E	1.9	W9D2.5
	5.0	4D	2.7	W9D5.0
	10.0	10B	5.1	W9D10
	15.0	14C	8.9	W9D15
	20.0	14C	8.9	W9D20
9.5-10.5	2.5	2E	1.9	W10D2.5
	5.0	4D	2.7	W10D5.0
	10.0	10B	5.1	W10D10
	15.0	14C	8.9	W10D15
	20.0	14C	8.9	W10D20
10.5-11.5	2.5	2E	1.9	W11D2.5
	5.0	4D	2.7	W11D5.0
	10.0	10B	5.1	W11D10
	15.0	14C	8.9	W11D15
	20.0	14C	8.9	W11D20
11-13	2.5	2E	1.9	W12D2.5
	5.0	4D	2.7	W12D5.0
	10.0	10B	5.1	W12D10
	15.0	14C	8.9	W12D15
	20.0	14C	8.9	W12D20
13-15	1.2	2E	1.9	W14D1.2
	2.5	4D	2.7	W14D2.5
	5.0	10B	5.1	W14D5.0
	10.0	14C	8.9	W14D10
	15.0	14C	8.9	W14D15
14-16	1.2	2E	1.9	W15D1.2
	2.5	4D	2.7	W15D2.5
	5.0	10B	5.1	W15D5.0
	10.0	14C	8.9	W15D10
	15.0	14C	8.9	W15D15
15-17	1.2	2E	1.9	W16D1.2
	2.5	4D	2.7	W16D2.5
	5.0	10B	5.1	W16D5.0
	10.0	14C	8.9	W16D10
	15.0	14C	8.9	W16D15
17-19	1.2	2E	1.9	W18D1.2
	2.5	4D	2.7	W18D2.5
	5.0	10B	5.1	W18D5.0
	10.0	14C	8.9	W18D10
19-21	1.2	2E	1.9	W20D1.2
	2.5	4D	2.7	W20D2.5
	5.0	10B	5.1	W20D5.0
	10.0	14C	8.9	W20D10
21-23	1.2	2E	1.9	W22D1.2
	2.5	4D	2.7	W22D2.5
	5.0	10B	5.1	W22D5.0
	10.0	14C	8.9	W22D10
23-25	1.2	2E	1.9	W24D1.2
	2.5	4D	2.7	W24D2.5
	5.0	10B	5.1	W24D5.0
	10.0	14C	8.9	W24D10
25-27	1.2	2E	1.9	W26D1.2
	2.5	4D	2.7	W26D2.5
	5.0	10B	5.1	W26D5.0
	10.0	14C	8.9	W26D10
27-29	1.2	2E	1.9	W28D1.2
	2.5	4D	2.7	W28D2.5
	5.0	10B	5.1	W28D5.0
	10.0	14C	8.9	W28D10
DUAL OUTPUT				
±3.75- ±4.25	0.3	8B	1.9	WW4D0.3
	0.5	9C	2.2	WW4D0.5
	1.0	9C	2.2	WW4D1.0
	2.0	9D	3.1	WW4D2.0
	4.0	11D	5.5	WW4D4.0
±4.5- ±5.5	0.3	8B	1.9	WW5D0.3
	0.5	9C	2.2	WW5D0.5
	1.0	9C	2.2	WW5D1.0
	2.0	9D	3.1	WW5D2.0
	4.0	11D	5.5	WW5D4.0
±11- ±13	0.3	8B	1.9	WW12D0.3
	0.5	9C	2.2	WW12D0.5
	1.0	9C	2.2	WW12D1.0
	2.0	9D	3.1	WW12D2.0
	4.0	11D	5.5	WW12D4.0
±14- ±16	0.3	8B	1.9	WW15D0.3
	0.5	9C	2.2	WW15D0.5
	1.0	9C	2.2	WW15D1.0
	2.0	9D	3.1	WW15D2.0
	4.0	11D	5.5	WW15D4.0
±29- ±31	0.3	9C	2.2	WW30D0.3
	0.5	9C	2.2	WW30D0.5
	1.0	9D	3.1	WW30D1.0
	2.0	11D	5.5	WW30D2.0
	4.0	14C	8.0	WW30D4.0

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office. * See page **D•1542** for size charts.
Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

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MILITARY POWER SUPPLIES

400 Hz to DC

MODEL WL AND WWL

SPECIFICATIONS

INPUT VOLTAGE RANGE: 105-125 VRMS 3ϕ delta.

INPUT FREQUENCY RANGE: 380-420 Hz.

INPUT TRANSIENT PROTECTION: 180 VRMS for 0.1 seconds per MIL-STD-704, Figure 3, Limit 1.

LINE REGULATION: 0.1% or 20 mV, whichever is greater.

ELECTROMAGNETIC INTERFERENCES: Meets MIL-STD-461A, methods CE and CS for conducted emissions.

TURN-ON/TURN-OFF OVERSHOOT: 0.2% or 20 mV, whichever is greater.

LOAD REGULATION: 0.1% or 20 mV, whichever is greater. For load change of no load to full load.

RIPPLE: 0.02% or 5 mVRMS (whichever is greater) 25 mV peak-to-peak.

TRACKING ACCURACY: (WWL models only) The negative output will track the positive output to within 100 mV for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment.

POLARITY: Outputs are isolated. Either positive or negative may be grounded.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The regulator circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limit within 100 microseconds after 50% step change in load current for units outputting 10A or less.

ISOLATION VOLTAGE: 750 VDC between input and output, input and case, and 200 VDC between output and case.

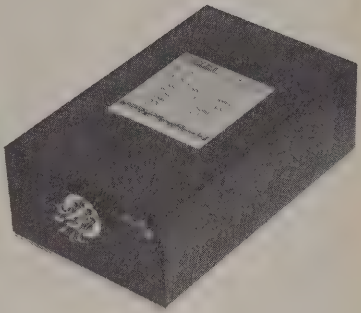
INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case when measured at 50 VDC.

TEMPERATURE RANGE: −55°C to +80°C baseplate temperature. 80% rated power at −55°C to +100°C. Storage: −65°C to +125°C.

RELIABILITY: MTBF per MIL-HBK-217D under operating conditions of 50°C baseplate temperature, maximum rated output power for standard model was calculated to be 164,406 hrs. for ground benign environment and 25,633 hrs. for air inhabited transport. With Enhanced Reliability Option (ER) MTBF was calculated to be 883,580 hrs. for ground benign environment and 94,956 hrs. for air inhabited transport.

ENVIRONMENT: Hermetically sealed and encapsulated to meet MIL-STD-810C, including altitude (to 1.3 inches of Hg), acceleration, vibration, shock and temperature altitude cycling.

EFFICIENCY: Typical 55%.



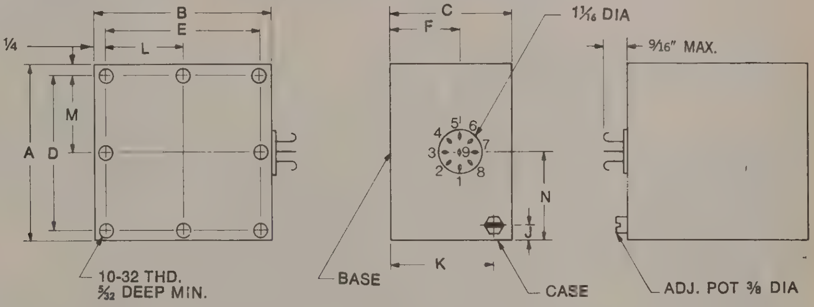
SINGLE OUTPUT: WL SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Model Number
4.8 to 5.8	20	12R	WL5.3D-20
5.8 to 6.8	20	12R	WL6.3D-20
11 to 13	10	12R	WL12D-10
11 to 13	20	12N	WL12D-20
14 to 16	12	12R	WL15D-12
23 to 25	7.5	12R	WL24D-7.5
23 to 25	15	12N	WL24D-15
27 to 29	10	12N	WL28D-10
27 to 29	15	12N	WL28D-15

DUAL OUTPUT: WWL SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Model Number
±11 to 13	2	11S	WWL12D-2
±14 to 16	2	11S	WWL15D-2

MECHANICAL DIMENSIONS



SIZE	A	B	C	D	E	F	J	K	L	M	N
11S	3¼	6	2½	2.75	5.50	1½	¼	2⅛	2.75	—	1⅜
12N	4¾	8¾	2¾	4.25	8.25	1½	¼	2¼	4.13	—	2⅜
12R	4¾	8	2¾	4.25	7.5	1½	¼	2¼	3.75	—	1⅞

TOLERANCE: Fractions = ±1⁄32, Decimals = .015, ±.050
MATERIAL: Base — Aluminum 6061-T6, Case — Steel

PIN DESIGNATIONS:

	Single Output	Dual Output		Single Output	Dual Output		Single Output	Dual Output
1	AC Input	AC Input	4	+ Output	+ Output	7	− Sense	− Output
2	AC Input	AC Input	5	+ Sense	+ Sense	8	Case Gnd	− Sense
3	AC Input	AC Input	6	− Output	Com Output	9	Not Used	Case Gnd

OPTIONAL FEATURES

OVERVOLTAGE PROTECTION: (−1 Option) An internal crowbar-type OVP is available. Unit will crowbar output when output voltage exceeds adjustable set point, to 10% or 2V above maximum rated output. To specify option, add "−1" to model number.

ENHANCED RELIABILITY: (ER Option) This option provides increased reliability by using a higher level of military grade components. This feature allows the power supply to meet customer specific requirements as to "Hi-Rel" components. Please consult your nearest Abbott Sales Office for details.

TTL: (L Option) Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "1" and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character preceding the first dash of the model number.

3ϕ WYE: (−3 Option) This input voltage is also available as an option. To specify, add "−3" to the end of the model number.

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MILITARY POWER SUPPLIES

New Very High Density DC to DC Converters, PCB Mountable

MODEL SM 200

SPECIFICATIONS

Input:
18 to 36 V dc.

Efficiency:
Typical (normal input, full load, room ambient) 75 - 85%.

Line Regulation:
0.1% over entire input range with load held constant.

Load Regulation:
No load to full load with constant line 0.2%.

Pard (Noise and Ripple):
1% typical at 25MHz bandwidth, measured over temperature range.

Isolation Voltage:
1,000 V dc, input to output;
500 V dc, input to case;
500 V dc, output to case.

Insulation Resistance:
50 megohms minimum between input and output, input and case, output and case, when measured at 50 V dc.

Temperature Range:
Operating: -55°C to +100°C maximum, at center of the baseplate. Storage: -55°C to +125°C, ambient.

Temperature Coefficient:
0.02%/°C typical over entire temperature range.

Input Transient Protection:
Unit will not be damaged and will withstand 50 V dc for 0.1 second, in accordance with MIL-STD-704D.

Load Transient Recovery:
Output voltage returns to regulation limits within 200 microseconds after change of load from 20 to 80%, 50 to 100% and line change from low line to high line.

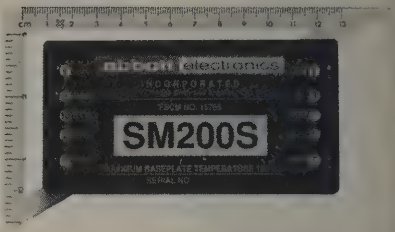
Load Transient Overshoot:
0.2 V from nominal voltage set point.

Environment:
Units meet MIL-STD-810C, altitude, shock, acceleration, vibration and MIL-S-901C high-impact shock conformance.

Remote Sensing:
Compensates up to 0.5 volt drop in output leads.

Short Circuit Protection:
Completely protected against a short circuit of any duration. Output automatically restores to normal when overload is removed.

Remote Inhibit:
Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 0) will inhibit the output.



Internal Input/Output Overvoltage Protection:
Output: Provides an internal crowbar type OVP. Input must be recycled to restore output.
Input: Provides automatic recycling type OVP.

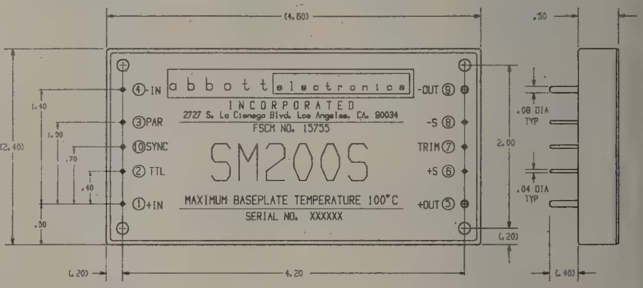
Hook Up:
Via pins - Board mounted. Pins can be located on either the top or baseplate side. Consult sales office for details.

SINGLE OUTPUT STANDARD MODELS

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5.0	40.0	8.5	240	SM200S/5
5.2	38.0	8.5	240	SM200S/5.2
12.0	20.0	8.5	240	SM200S/12
15.0	16.0	8.5	240	SM200S/15
24.0	11.0	8.5	240	SM200S/24
28.0	10.0	8.5	240	SM200S/28

[1] Weight ±5%

MECHANICAL DRAWINGS



SPECIFICATION TABLE

	Minimum	Typical	Maximum	Units
Input				
Input Voltage *	18	28	36	VDC
Brown Out (75% FL)	17			VDC
No Load Power Dissipation		2	3	W
Inrush Charge			20×10^{-4}	C
Refl. Ripple Current (Vin Nom)			15	%
Logic Disable Current (Sink)		1.0	1.5	mA
Logic Disable Power In		0.35	0.75	W
Input Ripple Rej. (120 Hz)		60		dB
Turn On Time		100		mS
Logic Turn On Time		100		mS
Input Overvoltage (No Damage)	37		50	VDC
Efficiency		75-85		%
Output				
Set Point Accuracy			1	%
Load Regulation		0.02	0.2	%
Line Regulation		0.02	0.1	%
Ripple (@25 MHz Bandwidth)				%
Trim Range (5V + 5.2V min = 85%)	60		115	%
Remote Sense Compensation		0.5		V
Over Voltage Protection		115	125	%
Current Sharing		±10		%
(Output continues at top of next column)				
(Output Continued)				
Transient Response (Vout 1%) Time/Overshoot				
20-80% Load		200/200		µS/mV
Low Line - High Line		200/200		µS/mV
50 - 100% Load		200/200		µS/mV
Temperature Drift		.01	.02	%/°C
Long Term Drift		.01	.02	%1KHRS
Current Limit	105		150	%
Short Circuit Current	105		160	%
Isolation In - Out		1000		V
Isolation Out - Base		500		V
Isolation In - Base		500		V
In - Out Capacitance		.01		µF
Temperature				
Baseplate (Operating)	-55		100	°C
Ambient (Storage)	-55		125	°C
Over Temperature Shutdown		105		°C
Thermal Resistance Case - Ambient			5	°C/W
Mechanical Specifications				
Weight		8.5		OZ
Size		2.4W 4.6L 0.5H		IN
Volume		5.5		CU . IN

*Also available in 270 VDC input, consult your nearest sales office.

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MILITARY POWER SUPPLIES

New High Density 100/200 Watt DC/DC Converters

MODEL AB

SPECIFICATIONS & FEATURES

Input:
18 to 32 Vdc.

Efficiency:
65% minimum. Typically (nominal input, full load, room ambient) 70-80%.

Line Regulation:
10 mV or 0.1%, whichever is greater, over entire input range with load held constant.

Load Regulation:
10 mV or 0.1%, whichever is greater from no load to full load with line held constant.

Pard (Noise and Ripple):
25 mV rms, 100 mV P-P at 25 MHz bandwidth, measured over temperature range.

Isolation Voltage:
500 V dc, input to output; 400 V dc, input to case; 100 V dc, output to case.

Insulation Resistance:
50 megohms between input and output, input and case, output and case, when measured at 50 V dc.

Temperature Range:
Operating: -55°C to +100°C maximum, at center of the baseplate. Storage: -55°C to +125°C, ambient.

Parallelability:
Multiple unit current sharing without the need for external components, via a single pin connection on each unit.

Temperature Coefficient:
0.01%/°C maximum over entire temperature range.

Input Transient Protection:
Unit will provide normal regulated output and withstand 50 V dc for 0.1 second, in accordance with MIL-STD-704D.

Load Transient Recovery:
Output voltage returns to regulation limits within 0.5 milliseconds after 50% change in load current.

Load Transient Overshoot:
0.5 V from nominal voltage set point.

Short Circuit Protection:
Completely protected against a short circuit of any duration. Output automatically restores to normal when overload is removed.

Remote Sensing:
Compensates for up to 0.5 volt drop in leads.

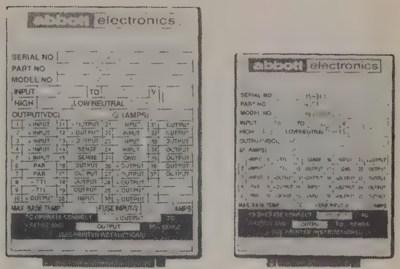
Remote Inhibit:
Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 1) will inhibit the outputs.

Electromagnetic Interference:
Meets MIL-STD-461C (test reports available upon request).

Reliability:
The Mean Time Between Failure (MTBF) is calculated per MIL-HDBK-217E at 50°C baseplate temperature with maximum operating input voltage and maximum rated output power. The MTBF for AB200S at ground benign and naval sheltered is 294,500 and 58,000 respectively. Please consult the local sales office.

Environment:
Units meet MIL-STD-810C, altitude, shock, acceleration, vibration and MIL-S-901C high-impact shock requirements.

Hook Up:
Via D-Subminiature Connectors.



OPTIONS

The following standard options are available on the AB Series power supplies.

Enhanced Reliability:
-ER Option provides increased reliability by using higher levels of military grade components. (To order, add "-ER" after model number, i.e., AB200S/15-A-ER).

MIL-STD-2000:
Workmanship standard, MIL-STD-2000 version of each unit is available. This option includes "-ER" option as a standard feature. Case size will increase. Consult sales office for dimensions. (To order, add "-M" after "A" in model number, i.e., AB200S/12-A-M

SINGLE OUTPUT

Nominal Output Voltage	Output Current (Amps)	Weight[1] (Oz.)	Weight[1] (Grams)	Model Number
5	20.00	18	510	AB100S/5-A
	40.00	26	717	AB200S/5-A
5.2	19.23	18	510	AB100S/5.2-A
	38.46	26	717	AB200S/5.2-A
12	8.33	18	510	AB100S/12-A
	16.67	26	717	AB200S/12-A
15	6.66	18	510	AB100S/15-A
	13.33	26	717	AB200S/15-A
24	4.16	18	510	AB100S/24-A
	8.33	26	717	AB200S/24-A
28	3.57	18	510	AB100S/28-A
	7.14	26	717	AB200S/28-A

[1] Maximum weight, not including options

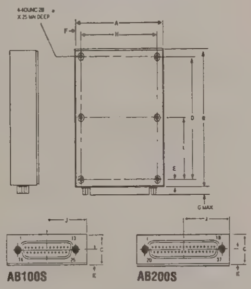
INPUT CURRENT (Typical Amps)

Model	Output Load	Low Line	High Line
AB100S	50%	5.5	2.5
	100%	10.5	4.8
AB200S	50%	11	4.9
	100%	22	9.8

MODEL NUMBERING SYSTEM

Model Series	Total Output Power	Number of Outputs	Slash	Main Output Voltage	Dash	Header Type	Dash	Options
AB	100	S	/	12	–	A	–	M

MECHANICAL DRAWINGS



Dimensions											
Model	A	B	C	D	E	F	G	H	J	K	L
AB100S	Inches 3.50 mm 88.9	4.50 114.3	.85 21.6	4.100 104.14	.20 5.1	.20 5.1	.25 6.4	3.100 78.74	1.75 44.5	.46 11.7	N/A
AB200S	4.25 108.0	5.50 139.7	.85 21.6	5.100 129.54	.20 5.1	.20 5.1	.25 6.4	3.850 97.79	2.13 54.1	.46 11.7	2.550 64.77

Tolerances: Inches - .xxx = ±0.015 or .xx = ±0.03; MM - .xx = ±0.4 or .x = ±0.8.
Material: Base - Aluminum 5052-H32, Case - Steel.
Finish: black flat lacquer per FED-STD-595, Color 37038.
Mounting: 4-40 THD inserts 1/4" minimum depth are provided in baseplate. Steel 4-40 bolts American Standard, unified national coarse series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.
Metric: M3 inserts and hardware.

PIN DESIGNATIONS

Model: AB100S
Connector: DBMME25PF
Mate: DBMM25S

1. +Input
2. +Input
3. +Input
4. Parallel[1]
5. Parallel[1]
6. +TTL
7. -TTL
8. +Output
9. +Output
10. +Sense
11. -Sense
12. -Output
13. -Output
14. -Input
15. -Input
16. -Input
17. Ground
18. +Output
19. +Output
20. +Output
21. +Output
22. -Output
23. -Output
24. -Output
25. -Output

Model: AB200
Connector: DCMME37PF
Mate: DCMM37S

1. +Input
2. +Input
3. +Input
4. +Input
5. +Input
6. Parallel[1]
7. Parallel[1]
8. +TTL
9. -TTL
10. +Output
11. +Output
12. +Output
13. +Output
14. +Sense
15. -Sense
16. -Output
17. -Output
18. -Output
19. -Output
20. -Input
21. -Input
22. -Input
23. -Input
24. -Input
25. Ground
26. +Output
27. +Output
28. +Output
29. +Output
30. +Output
31. +Output
32. -Output
33. -Output
34. -Output
35. -Output
36. -Output
37. -Output

[1] Parallel pins are internally connected and redundant. Either pin can be used for single pin parallelability or either pin can be left open and unused.

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MILITARY POWER SUPPLIES

High Density 20/35/50 Watt DC-DC Converters

MODEL
AB
20/35/50

SPECIFICATIONS & FEATURES

Input: 14-32 Vdc.

Input Transient Protection: Unit will withstand 50 Vdc for 0.1 second in accordance with MIL-STD-704D.

Efficiency: 65% minimum typically (nominal input, full load, room ambient) 70-80%.

Line Regulation: Input change of 14 to 32 Vdc with constant load. 0.1% or 10mV, whichever is greater.

Load Regulation: No load to full load with constant line: 10mV or 0.1%, whichever is greater.

Load Transient Recovery: Output voltage returns to regulation limits within 0.5 milliseconds after a 50% change in load current.

Load Transient Overshoot: 0.5V from nominal voltage set point.

Pard (Noise and Ripple): 25mV rms, 100mV P-P at 25 MHz bandwidth, measured at room ambient.

Temperature Range: Operating: −55° C to 100° C maximum, at center of baseplate. Storage, −65° C to 125° C, ambient.

Temperature Coefficient: 0.01%° C maximum over entire temperature range.

Isolation Voltage: 500 Vdc, input to output; 400 Vdc, input to case; 100 Vdc, output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, output and case, when measured at 50 Vdc.

Remote Sensing: Compensates for up to 0.5 volt drop in leads.

Short Circuit Protection: Competely protected against a short circuit of any duration. Output automatically restores to normal when overload is removed.

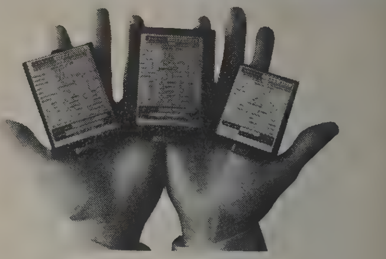
EMI: Meets MIL-STD-461C (Test report available upon request.)

Reliability: All MTBF's per MIL-HDBK-217E, 50° C baseplate, high line and full load.

Environment: Units meet MIL-STD-810C, altitude, shock, acceleration, vibration and MIL-S-901C, high-impact shock conformance. Hermetically sealed units available. Please consult factory.

Hook Up: Via D-Subminiature connectors.

Remote Inhibit: Provides for remote turn on/off with TTL logic signal. Application of TTL Signal (logic 1) will inhibit the output.



- All New Wireless Submodular Construction
- Extra Wide Input Range
- Current Mode Control
- MIL-STD-2000 Version Available
- Standard Current Limiting
- Inherent Over Voltage Control
- Qualified by rigorous Environmental Stress Screening

RELIABILITY DATA – MTBF (Hours)

	Product	Ground Benign	Naval Sheltered	Cargo Air Inhabited	Ground Mobile
STD	AB20S	428,000	80,000	118,000	45,000
	AB35S	353,000	67,000	96,000	37,000
	AB50S	258,000	50,000	75,000	28,000
MIL-STD-2000	AB20S-M	1,444,000	276,000	404,000	145,000
	AB35S-M	1,387,000	265,000	385,000	140,000
	AB50S-M	1,338,000	256,000	377,000	136,000

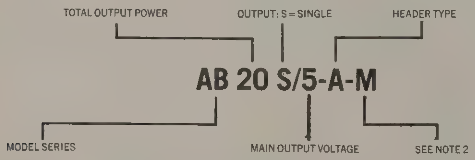
Note: MTBF per MIL-HDBK–217E @ 50°C baseplate, high line, full load.

PRODUCT SELECTION GUIDE

	CURRENT (AMPS)		
Output Voltage	AB20S	AB35S	AB50S
5V	4.00	7.00	10.00
12V	1.66	2.91	4.16
15V	1.33	2.33	3.33
24V	.83	1.45	2.08
28V	.71	1.25	1.78
Weight			
Ounces	7.00	9.00	11.50
Grams	198.45	255.15	326.03

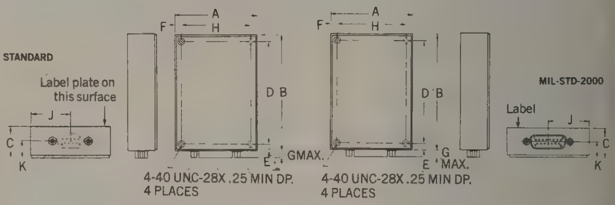
(+5% weight differential between standard and MIL-STD-2000 models.)

HOW TO ORDER



Auxiliary Output Voltages
1. Single = 20W, 35W or 50W
2. MIL-STD-2000: Add "M" after "A" in P/N, i.e. AB20S/5-D–M

MECHANICAL DRAWINGS (AB20/35/50)


STANDARD
Label plate on this surface
J
C
K
F
A
H
D
B
E
GMAX.
4-40 UNC-28X .25 MIN DP. 4 PLACES
F
A
H
D
B
G
E
MAX.
4-40 UNC-28X .25 MIN DP. 4 PLACES
MIL-STD-2000
Label
J
C
K

Standard Dimensions											
Model #	SYM	A	B	C	D	E	F	G	H	J	K
AB20S	IN	2.20	2.80	.85	2.450	.18	.18	.25	1.850	1.10	.46
	MM	55.9	71.1	21.6	62.13	4.5	4.5	6.4	46.99	27.9	11.7
AB35S	IN	2.50	3.50	.85	3.100	.20	.20	.25	2.100	1.25	.46
	MM	63.5	88.9	21.6	78.74	5.1	5.1	6.4	53.34	31.8	11.7
AB50S	IN	3.00	3.85	.85	3.450	.20	.20	.25	2.600	1.50	.46
	MM	76.2	97.8	21.6	87.63	5.1	5.1	6.4	66.04	38.1	11.7

PIN DESIGNATIONS (Model AB20)

1. −input
2. −TTL
3. +TTL
4. +Sense
5. +Output
6. +Input
7. Ground
8. −Sense
9. −Output

Tolerances: (Inches) (MM)
.XXX = ±0.015
.XX = ±0.03
.XX = ±0.04
.X = ±0.8

AB20S
Connector: DEM9PR
Mate: DEM9S

AB20S-M
Connector: M24308/24-49
Mate: M24308/1-1

MIL-STD-2000 Dimensions											
Model #	SYM	A	B	C	D	E	F	G	H	J	K
AB20S-M	IN	2.50	3.50	.85	3.100	.20	.20	.25	2.100	1.25	.46
	MM	63.5	88.9	21.6	78.74	5.1	5.1	6.4	53.34	31.8	11.7
AB35S-M	IN	3.00	3.85	.85	3.450	.20	.20	.25	2.600	1.50	.46
	MM	76.2	97.8	21.6	87.63	5.1	5.1	6.4	66.04	38.1	11.7
AB50S-M	IN	3.25	4.25	.85	3.850	.20	.20	.25	2.850	1.63	.46
	MM	82.6	108.0	21.6	97.79	5.1	5.1	6.4	72.39	41.3	11.7

PIN DESIGNATIONS (Model AB35 and AB50)

1. −input
2. N/C
3. −TTL
4. +TTL
5. N/C
6. +Sense
7. +Output
8. +Output
9. +Input
10. N/C
11. Ground
12. N/C
13. −Sense
14. −Output
15. −Output

Tolerances: (Inches) (MM)
.XXX = ±0.015
.XX = ±0.03
.XX = ±0.04
.X = ±0.8

AB35S and AB50S
Connector: DAM15PA
Mate: DAM15S

AB35S-M and AB50S-M
Connector: M24308/24-38
Mate: M24308/1-2

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28 VDC to DC

MODEL
BC200

SPECIFICATIONS

Input: 22 to 32 V dc standard, 18 to 32 V dc optional (see Option H).

Efficiency: 60% minimum at full load.

Line Regulation: 10 mV for input change of 22 to 32 V dc with load constant.

Load Regulation: 10 mV main output. 0.5% on auxiliary outputs for change of no load to full load with line constant.

Auxiliary Output Tracking Accuracy: The negative output will track the positive output within 100 mV for all rated conditions (BC200T).

Pard (Noise and Ripple) for Main and Auxiliary Outputs: 20 mV rms; 100 mV peak to peak (maximum), at 25 MHz scope bandwidth, over the entire temperature range.

Isolation Voltage: 400 V dc input to output, 200 V dc input to case, 200 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Temperature Range: Operating: −55°C to +100°C maximum at center of baseplate. Storage: −65°C to +125°C ambient.

Temperature Coefficient: 0.01%/°C maximum for main and auxiliary outputs over entire temperature range.

Input Transient Protection: Unit will withstand 50 V dc for 0.1 second in accordance with MIL-STD-704D.

Load Transient Recovery Time: Output voltage returns to regulation limits within 0.5 millisecond for main and auxiliary outputs after a 50% charge in load current.

Load Transient Overshoot: 0.8 V or 3% (whichever is greater) from nominal voltage set point.

Short Circuit Protection: Completely protected against a short circuit of any duration. Outputs automatically restore to normal when overload is removed. Auxiliary outputs will fold back for overload.

Current Limiting: Output current is limited to 120% on main, 150% on auxiliary outputs (±10%) under overload conditions.

Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.5 volts in the load leads (on 5 V main output).

Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to radiated and conducted interference.

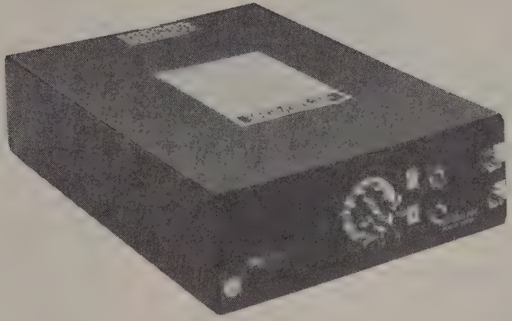
Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output was calculated to be 75,274 hours for a ground benign environment and 27,522 hours for an air inhabited environment. With -ER option MTBF was calculated to be 560,669 hours for a ground benign environment and 175,234 hours for an air inhabited environment.

Environment: Encapsulated and hermetically sealed to meet environmental requirements of MIL-STD-810C including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Connectors: Standard unit is provided with an input and main output "hermetic seal" stud connector, for the auxiliary outputs a solder-type multiple-pin, output header.

Output Voltage Range[1] (Main)	Output Current[1] (Main)	Output Voltage Range[1] (Aux)	Output Current[2] (Aux)	Weight[3] (Lbs.)	Model Number
4.75-5.25	40.0			5.5	BC200S/5-D
11.40-12.60	17.0			5.5	BC200S/12-D
14.25-15.75	13.5			5.5	BC200S/15-D
22.80-25.20	8.5			5.5	BC200S/24-D
26.60-29.40	7.5			5.5	BC200S/28-D
4.8-5.8	30	±11.5-±12.5	2.1	5.5	BC200T/5/12
4.8-5.8	30	±14.5-±15.5	1.7	5.5	BC200T/5/15

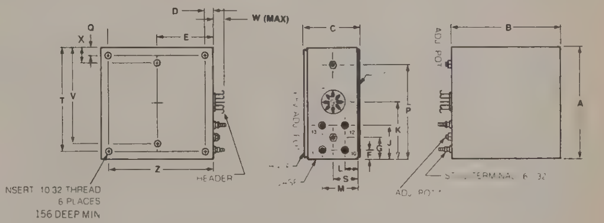
1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 35 mV.
2. Maximum output power equals 200 Watts.
3. Weights are ±5%.



FEATURES

- 200-Watt Single and Triple Output, 100 kHz Switching DC/DC Converter
- High Efficiency, 60% Minimum
- −55°C to +100°C Temperature Range
- Meets MIL-STD-461B, MIL-STD-810C and MIL-STD-704D for Input Transient Protection

MECHANICAL DIMENSIONS



* This adjustment pot used only on triple output model.

All pins appear on both models. Pins 1, 2, 8 and 9 are used for triple output.

A	B	C	D	E	F	G	J	K	L
5¾	8	1⅞	.280	3.749	½	1¹⁄₁₆	1²¹⁄₃₂	2⅞	⁹⁄₁₆

M	P	Q	S	T	V	W	X	Z
1⁵⁄₃₂	4¹¹⁄₁₆	.280	²⁷⁄₃₂	5.470	5.120	⁹⁄₁₆ MAX	.630	7.219

Tolerances: If a fraction, ±¹⁄₃₂ inch, a decimal, ±.015 inch.

Material: Base—Aluminum 6061-T6. Case—Steel.

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts ⁵⁄₃₂″ minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. Common (Aux)
2. +V (Aux)
3. N/C
4. +Sense
5. Ground
6. −Sense
7. N/C
8. −V (Aux)
9. Internal Connection
10. +Input (DC)
11. −Input (DC)
12. +5V Output
13. 5V Return

OPTIONAL FEATURES

All options apply to both single and triple output units unless otherwise specified.

Special Connectors: Military-type hermetically sealed connectors are provided as **Option A** in place of our standard header and studs. (To order, replace the "D" in the model number with "A," i.e., BC200S/5/12-A.)

Severe Shock, Acceleration and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., BC200T/5/12-DE.)

Wide Input Voltage: With **Option H**, the units will operate from 18 to 32 V dc, with 20% derating in output power. (To order, add an "H" after the "D" in the model number, i.e., BC200S/5-DH.)

Remote Turn On/Off: Option L provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" after "D" in model number, i.e., BC200T/5/12-DL.)

Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number, i.e., BC200S/5-DR.)

Flexible Current Feature: Option -5 assigns 10 watts from the 2nd and 3rd auxiliary outputs to main output. (To order, add "-5" after model number, i.e., BC200T/5/12-D-5.)

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military-grade components. (To order, add "-ER" after model number, i.e. BC200T/5/12-D-ER.)

Internal Over Voltage Protection: Option -1 provides a non-crowbar internal OVP on single output and 5 V main on triple outputs. (To order, add "-1" after the D in model number, i.e., BC200S/5-D-1.)

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MILITARY POWER SUPPLIES

28 VDC to DC

MODEL BC100

SPECIFICATIONS

Input: 22 to 32 V dc standard, 18 to 32 V dc optional (see option H).

Efficiency: 65% minimum at full load.

Line Regulation: 10 mV for input change of 22 to 32 V dc with load constant.

Load Regulation: 10 mV main output, 0.5% on auxiliary outputs for change of no load to full load with line constant.

Auxiliary Output Tracking Accuracy: The negative output will track the positive output within 100 mV for all rated conditions. (BC100T)

Pard (Noise and Ripple) For Main and Auxiliary Outputs: 20 mV rms; 100 mV peak to peak (maximum), at 25 MHz bandwdith, over the entire temperature range.

Isolation Voltage: 400 V dc input to output. 200 V dc input to case. 200 V dc output to case.

Insulation Resistance: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 V dc.

Temperature Range: Operating: −55°C to +100°C maximum at center of baseplate. Storage: −65°C to +125°C ambient.

Temperature Coefficient: 0.01%/°C maximum for main and auxiliary outputs over entire temperature range.

Input Transient Protection: Unit will withstand 50 V dc for 0.1 second in accordance with MIL-STD-704D.

Load Transient Recovery Time: Output voltage returns to regulation limits within 0.5 milliseconds for main and auxiliary outputs after a 50% change in load current.

Load Transient Overshoot: 0.8 V or 3% (whichever is greater) from nominal voltage set point.

Short Circuit Protection: Completely protected against a short circuit of any duration. Outputs automatically restore to normal when overload is removed. Auxiliary outputs will fold back for overload.

Current Limiting: Output current is limited to 120% on main, 150% on auxiliary outputs (±10%) under overload conditions.

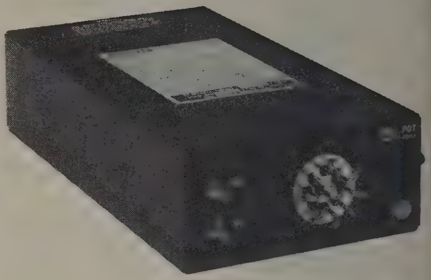
Remote Error Sensing: Regulator monitors voltage directly at the load using extra "sensing" leads and compensates for a dc voltage drop up to 0.5 volts in the load leads (on 5 V main output).

Electromagnetic Interference: Meets the requirements of MIL-STD-461B for generation of and susceptibility to radiated and conducted interference.

Reliability: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of 50°C baseplate temperature, maximum operating input voltage and maximum rated output power was calculated to be 81,690 hours for a ground benign environment and 29,771 for an air inhabited environment. With -ER option MTBF was calculated to 608,380 hours for a ground benign environment and 185,471 hours for an air inhabited environment. (BC100T)

Environment: Encapsulated and hermetically sealed to meet the environmental requirements of MIL-STD-810C including altitude (to 70,000 ft.), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Connectors: Standard unit is provided with an input "hermetic seal" stud connector, for auxiliary and main outputs a solder-type, multiple-pin, output header.



FEATURES

- 100-Watt Single and Triple Output, 200 kHz Switching DC to DC Converter
- High Efficiency, 65% Minimum
- −55°C to +100°C Temperature Range
- Meets MIL-STD-461B, MIL-STD-810C and MIL-STD-704D for Input Transient Protection

Output.. Voltage Range[1] (Main)	Output Current[2] (Main)	Output Voltage Range[1] (Aux)	Output Current[2] (Aux)	Wgt.[3] (Lbs.)	Wgt.[3] (Kgs.)	Model Number
4.75-5.25	20.0			3.0	1.5	BC100S/5-D
11.40-12.60	8.3			3.0	1.5	BC100S/12-D
14.25-15.75	6.6			3.0	1.5	BC100S/15-D
22.80-25.20	4.2			3.0	1.5	BC100S/24-D
26.60-29.40	3.6			3.0	1.5	BC100S/28-D
4.8-5.8	15	±11.5-±12.5	1.0	3.2	1.5	BC100T/5/12-D
4.8-5.8	15	±14.5-±15.5	0.8	3.2	1.5	BC100T/5/15-D

1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Adjustment resolution is 35 mV.
2. Maximum output power equals 100 watts.
3. Weights are ±5%.

OPTIONAL FEATURES

Special Connectors: A military-type hermetically sealed connector is provided as **Option A** in place of our standard header. (To order, replace the "D" in the model number with "A" i.e., BC100T/5/12-A or BC100S/5-A.)

Severe Shock, Acceleration and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., BC100T/5/12-DE or BC100S/5-DE.)

Wide Input Voltage: With **Option H**, the units will operate from 18 to 32 V dc with 20% derating in output power. (To order, add an "H" after the "D" in the model number, i.e., BC100T/5/12-DH or BC100S/5-DH.)

Remote Turn On/Off: Option L provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" after "D" in model number, i.e., BC100T/5/12-DL or BC100S/5-DL.)

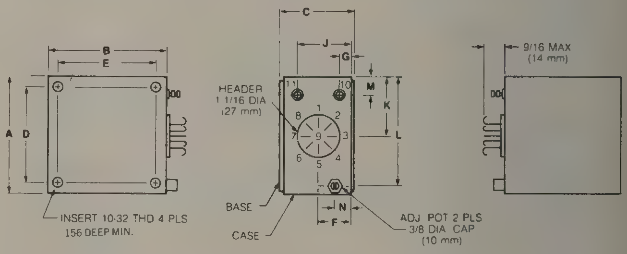
Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number, i.e., BC100T/5/12-DR or BC100S/5-DR.)

Internal Overvoltage Protection: Option -1 provides a non-crowbar internal OVP on the main output (Output 1). Input must be recycled to restore output. (To order, add "-1" after the"D" in model number, i.e., BC100T/5/12-D-1 or BC100S/5-D-1.)

50-50 Distributed Power: Option -7 distributes 50 watts to the main and 50 watts to the auxiliaries. (To order add "-7" to the end of the model number, i.e., BC100T/5/12-D-7.)

Flexible Current Feature: Option -5 assigns 10 watts from 2nd and 3rd auxiliary outputs to main output. (To order, add "-5" after model number, i.e., BC100T/5/12-D-5.)

MECHANICAL DIMENSIONS (BC100T)



A	B	C	D	E	F	G
4	7½	1⅞	3.44	6.94	27/32	9/16

J	K	L	M	N
1 5/32	2 9/32	3¾	7/16	½

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military-grade components. (To order, add "-ER" after model number, i.e., BC100T/5/12-D-ER or BC100S/5-D-ER.)

Tolerances: If English unit is a fraction, ±1/32 inch, (0.8 mm); if English unit is a decimal, ±0.15 inch, (0.4 mm).

Material: Base — Aluminum 6061-T6. Case — Steel.

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts 5/32" minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

PIN DESIGNATIONS

1. Auxiliary common	4. +Sense	7. 5V Return	10. +Input
2. +Auxiliary	5. Ground	8. −Auxiliary	11. −Input
3. +5V	6. −Sense	9. Int conn.	

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MILITARY POWER SUPPLIES

BC-60 Series
60 Watt DC-DC Converters

MODEL
BC 60

SPECIFICATIONS:

Input: 18-36 Vdc (28 Vdc nominal)

Input Transient Protection: 50 Vdc for 0.1 second per MIL-STD-704D

Efficiency: Typical (nominal input, full load, room ambient). Single output: 72 to 79%. Triple output: 70%.

Line Regulation: Input change of 18-36Vdc, constant load. Single: 0.1% or 10mV, whichever is greater. Triple: 0.1%, all outputs.

Load Regulation: No load to full load, constant line. For singles and main output (triples): 0.1% or 10mV, whichever is greater; auxiliaries, 0.5%.

Load Transient Recovery: Output voltage returns to regulation envelope within 0.5 mS for 50% load charge.

Load Transient Overshoot: 0.5V or 3%, whichever is greater, from nominal set point at full load, for 50% load charge.

Pard (Noise and Ripple): Measured at 25 MHz bandwidth. Single Output Unit: 30mV rms; P-P: 5V-2.0%, 12 or 15V - 1.0%, 24 or 28V - 0.7%. Triple Output Unit: 30mV rms; 100mV P-P for main and auxiliary outputs.

Temperature Range: Operating, −55° C to 100° C maximum at center of baseplate. Storage, −65° C to 125° C ambient. Note: Turn on at low temperature extreme can result in increased PARD measurements prior to unit warm up (1-3 minutes). Consult nearest sales office for application details.

Temperature Coefficient: 0.03%/°C maximum over entire temperature range.

Auxiliary Output Tracking: Negative output tracks positive within 100mV for all rated conditions, with auxiliaries set at nominal output voltage (±200mV).

Isolation Voltage: 400Vdc, input to output; 200Vdc, input to case; 200Vdc, output to case.

Insulation Resistance: 50 megohoms minimum between input and output, input and case, output and case when measured at 50Vdc.

Overvoltage Protection: Electronic overvoltage protection standard; 120% limit ± 10%, non-crowbar. Requires recycling of input for recovery.

Short Circuit Protection: Protected against short circuit of any duration. Automatic recovery when overload is removed.

Current Limiting: Foldback current limiting standard for all outputs, 120% (± 10%) limit for single output and main output on triples; 150% (± 10%) for auxiliary output on triples.

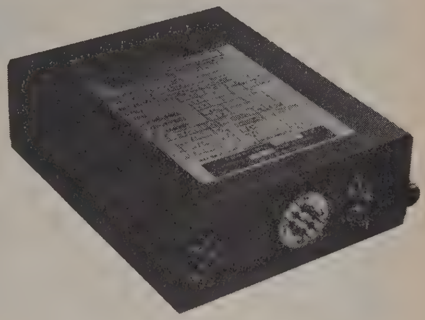
Remote Sensing: Standard on all single output units and main output of triple output units. Compensates for up to 0.5V drop in load leads.

EMI: Units qualified to MIL-STD-461C part 2; CE01, CE03*, CS01, CS02, RE02*, CE07, RS02, RS03 and CS06, for input leads. *Consult nearest sales office for additional data.

Reliability: All MTBF's per MIL-HDBK-217E, 50° C baseplate, highline and full load. See MTBF chart for your requirement.

Environment: Encapsulated and hermetically sealed units meet MIL-STD-810C, altitude, shock, acceleration, and MIL-S-901C, high impact shock conformance.

Hook Up: Via hermetic, solder-type multiple pin header and solder turrets for I/O.



FEATURES

- 60-Watt Single and Triple Output
- High Efficiency, 65% Minimum
- −55° C to +100° C Temperature Range
- Meets MIL-STD-461C, MIL-STD-810C and MIL-STD-704D for Input Transient Protection

Model	Main Output/ Current[1]	Output #2[1]	Output #3[1]	Weight (lbs)	Weight (kgs)
BC60S/5-D	5V@12A			2.10	0.95
BC60S/12-D	12V@5A			2.10	0.95
BC60S/15-D	15V@4A			2.10	0.95
BC60S/24-D	24V@2.5A			2.10	0.95
BC60S/28-D	28V@2.14A			2.10	0.95
BC60T/5/12D	5V@6A	+12V@1.25A	−12V@1.25A	2.16	0.98
BC60T/5/12D	5V@6A	+15V@1A	−15V@1A	2.16	0.98

1. Single/Main Outputs adjust ±5%, 35 mV resolution
   Auxiliary Output adjust ±0.5V
2. Weight ±5%

OPTIONAL FEATURES

"A" Hermetic Connectors
Replaces solder header/turrets with military connectors:
Input: MS3113H10-6P (Mate Inc.)
Output: MS3113H14-12P (Mate Inc.)
Other hermetic, MIL connectors available on special order.

"E" Severe Shock, Vibration, Acceleration
Extra encapsulent to meet 60g shock, 30g vibration and 50g acceleration.

"L" Remote Enable/Inhibit
Provides for remote turn on/off with TTL logic signal.

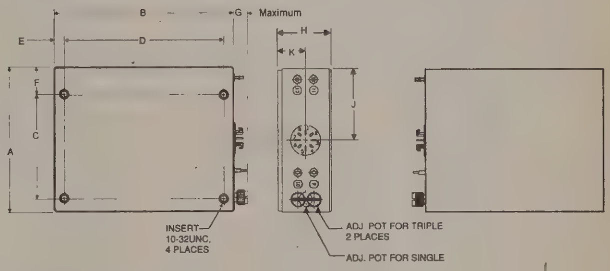
"ER" Enhanced Reliability
Provides increased reliability via higher level MIL grade components.

RELIABILITY DATA — MTBF

Environment	Ground Benign	Naval Sheltered	Air Inhabited (Attack)	Ground Mobile
BC60S-STD	250,222 hrs	48,153 hrs	42,939 hrs	28,571 hrs
BC60S-ER	748,982 hrs	149,203 hrs	137,721 hrs	81,514 hrs
BC60T-STD	168,050 hrs	32,921 hrs	27,639 hrs	19,714 hrs
BC60T-ER	596,480 hrs	126,060 hrs	125,137 hrs	71,994 hrs

Note: Calculations for other 217E environments available upon request.

MECHANICAL DIMENSIONS (BC60)



PIN DESIGNATIONS (BC60 Triple)

1. COM (Aux)
2. +V (Aux)
3. Not Used
4. +Sense
5. Ground
6. −Sense
7. Not Used
8. −V (Aux)
9. +5V
10. 5V Com.
11. +Input DC
12. −Input DC

PIN DESIGNATIONS (BC60 Single)

1. Not Used
2. Not Used
3. Not Used
4. +Sense
5. Ground
6. −Sense
7. Not Used
8. Not Used
9. +5V
10. 5V Com.
11. +Input DC
12. −Input DC

DIMENSIONS

SYM	A	B	C	D	E	F	G	H	J	K
INCHES	4	5	2.950	4.450	.275	.775	½	1½	2.00	.78
MM	101.6	127.0	74.93	113.03	6.99	19.69	12.7	38.1	50.8	19.8

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MILITARY POWER SUPPLIES

28 VDC to DC

MODEL C and CC

SPECIFICATIONS

INPUT VOLTAGE RANGE: 24 to 30 VDC. Other input ranges available

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 24 to 30 VDC with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full load with line constant

RIPPLE: 0.02% or 5 mv RMS (whichever is greater) 50 mv peak-to-peak maximum, each output, measured with scope having 25 MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 200 volts DC between input and output, input and case, and output and case

INSULATION RESISTANCE: 50 megohms minimum at 50 volts DC between input and output, input and case, and output and case

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating: −55°C to +100°C maximum at center of mounting base
Storage: −65°C to +125°C

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810C and MIL-E-5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION: MIL-STD-704A, Fig. 9, Limt 1 (80 VDC for 0.1 sec.).

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

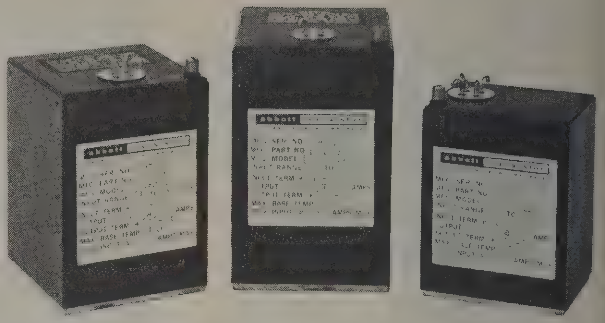
RELIABILITY: MTBF per MIL-HDBK-217D up to 277,200 hrs.

ELECTROMAGNETIC INTERFERENCE: Units meet EMI requirements of MIL-STD 461 conducted and radiated.

OVER-VOLTAGE PROTECTION*: An internal, crowbar type OVP is available. Power supply turns off when output voltage exceeds set-point.

TTL*: Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off.

* Inclusion of these optional features on these models will most likely require that the case size increases slightly. Please consult nearest Abbott sales office for further details.



High Performance

- Operating temperature range: −55°C to +100°C.
- Low Peak-to-Peak Ripple.
- Compact. Power density up to 2 watts per cu. in.
- High reliability. Up to 277,200 hrs. MTBF per MIL-HDBK-217D
- Low EMI. To MIL-STD-461.
- Encapsulated and hermetically sealed to meet MIL-STD-810C and MIL-E-5400P, Class 2.
- 0.1% Line and Load regulation.
- TTL compatibility available.
- Internal OVP optional.

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number
4.5-5.5	2.5	2D	1.2	C5D2.5
	5.0	6B	1.7	C5D5.0
	10.0	7A	2.6	C5D10
5.5-6.5	2.5	2D	1.2	C6D2.5
	5.0	6B	1.7	C6D5.0
	10.0	7A	2.6	C6D10
6.5-7.5	2.5	2D	1.2	C7D2.5
	5.0	6B	1.7	C7D5.0
	10.0	7A	2.6	C7D10
7.5-8.5	1.8	2D	1.2	C8D1.8
	3.5	6B	1.7	C8D3.5
	7.5	7A	2.6	C8D7.5
8.5-9.5	1.8	2D	1.2	C9D1.8
	3.5	6B	1.7	C9D3.5
	7.5	7A	2.6	C9D7.5
9.5-10.5	1.8	2D	1.2	C10D1.8
	3.5	6B	1.7	C10D3.5
	7.5	7A	2.6	C10D7.5
10.5-11.5	1.8	2D	1.2	C11D1.8
	3.5	6B	1.7	C11D3.5
	7.5	7A	2.6	C11D7.5
11-13	1.2	2D	1.2	C12D1.2
	2.5	6B	1.7	C12D2.5
	5.0	7A	2.6	C12D5.0
13-15	1.2	2D	1.2	C14D1.2
	2.5	6B	1.7	C14D2.5
	5.0	7A	2.6	C14D5.0
14-16	1.2	2D	1.2	C15D1.2
	2.5	6B	1.7	C15D2.5
	5.0	7A	2.6	C15D5.0
15-17	1.2	2D	1.2	C16D1.2
	2.5	6B	1.7	C16D2.5
	5.0	7A	2.6	C16D5.0
17-19	1.2	2D	1.2	C18D1.2
	2.5	6B	1.7	C18D2.5
	5.0	7A	2.6	C18D5.0
19-21	0.8	2D	1.2	C20D0.8
	1.8	6B	1.7	C20D1.8
	3.5	7A	2.6	C20D3.5
21-23	0.8	2D	1.2	C22D0.8
	1.8	6B	1.7	C22D1.8
	3.5	7A	2.6	C22D3.5
23-25	0.8	2D	1.2	C24D0.8
	1.8	6B	1.7	C24D1.8
	3.5	7A	2.6	C24D3.5
25-27	0.8	2D	1.2	C26D0.8
	1.8	6B	1.7	C26D1.8
	3.5	7A	2.6	C26D3.5
27-29	0.8	2D	1.2	C28D0.8
	1.8	6B	1.7	C28D1.8
	3.5	7A	2.6	C28D3.5
29-31	0.6	2D	1.2	C30D0.6
	1.2	6B	1.7	C30D1.2
	2.5	7A	2.6	C30D2.5
31-33	0.6	2D	1.2	C32D0.6
	1.2	6B	1.7	C32D1.2
	2.5	7A	2.6	C32D2.5
33-35	0.6	2D	1.2	C34D0.6
	1.2	6B	1.7	C34D1.2
	2.5	7A	2.6	C34D2.5
35-37	0.6	2D	1.2	.C36D0.6
	1.2	6B	1.7	.C36D1.2
	2.5	7A	2.6	C36D2.5

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number
±2.75- ±3.25	0.5	10C	2.3	CC3D0.5
	1.0	10C	2.3	CC3D1.0
	2.0	10D	2.5	CC3D2.0
	3.5	11E	3.9	CC3D3.5
±4.5- ±5.5	0.5	10C	2.3	CC5D0.5
	1.0	10C	2.3	CC5D1.0
	2.0	10D	2.5	CC5D2.0
	3.5	11E	3.9	CC5D3.5
±11- ±13	0.5	10C	2.3	CC12D0.5
	1.0	10C	2.3	CC12D1.0
	2.0	10D	2.5	CC12D2.0
	3.5	11E	3.9	CC12D3.5
±14- ±16	0.5	10C	2.3	CC15D0.5
	1.0	10C	2.3	CC15D1.0
	2.0	10D	2.5	CC15D2.0
	3.5	11E	3.9	CC15D3.5
±19- ±21	0.5	10C	2.3	CC20D0.5
	1.0	10D	2.5	CC20D1.0
	2.0	11E	3.9	CC20D2.0
	3.5	14D	7.9	CC20D3.5
±23- ±25	0.5	10C	2.3	CC24D0.5
	1.0	10D	2.5	CC24D1.0
	2.0	11E	3.9	CC24D2.0
	3.5	14D	7.9	CC24D3.5

*See page **D•1542** for size charts.

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.
Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

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Reliability is
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Western Office
2727 S. La Cienega Blvd.
Los Angeles, CA 90034
Tel: (310) 202-8820
Fax: (310) 836-1027

Southwest Office
275 W. Campbell Road
Suite 227
Richardson, TX 75080
(214) 437-0697
Fax: (214) 437-0698

Eastern Office
520 Main St.
Suite 301
Fort Lee, NJ 07024
(201) 461-4411
Fax: (201) 461-2936

European Office
Ashford, Kent, England
Tel: 0233 623404
Fax: 0233 641777

abbott
MILITARY POWER SUPPLIES

28 VDC to DC

MODEL B

SPECIFICATIONS

Input Voltage Range
24 to 30 volts DC Other ranges available

Line Regulation
Within 0.4% for input 24 to 30 VDC

Combined Line and Load Regulation
Within 3.0% for input 24 to 30 VDC and from ½ load to full load on Model B's
Within 5.0% for input 24 to 30 VDC and from ½ load to full load on Model BL's

Ripple
0.5 RMS — Model B's
1.0% RMS — Model BL's

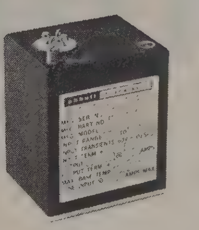
Voltage Adjustment Range
12% by screwdriver adjustment

Input Transient Protection
In accordance with MIL-STD-704A, Fig. 9, Limit 1, (80 VDC for 0.1 sec.)

Environment
+212°F max. at mounting base using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal).
Vibration, shock, sand, dust, humidity, salt-spray, fungus, sunshine, rain, and explosion to MIL-STD-810C and MIL-E-5400P, Class 2

Output Voltage and Current
See specific models listed
(Outputs and inputs are isolated)

Reliability: MTBF per MIL-HDBK-217C up to 626,400 hrs.



High Reliability

- Operating temperature range −55°C to +100°C.
- Small size.
- High reliability. Up to 626,400 hrs. MTBF per MIL-HDBK-217C.
- Encapsulated and hermetically sealed. Meets MIL-STD-810C and MIL-E-5400P, Class 2.

Output Voltage Range	Output Current (Amps)	Size*	Wt. lbs.	Model Number
4.7-5.3	0.400	1B	0.5	BL02D-5A
	1.0	1A	0.9	BL05D-5A
	2.0	1	1.0	BL1D-5A
	4.0	2	1.1	BL2D-5A
	6.0	4	1.3	BL3D-5A
	10.0	6A	2.5	BL5D-5A
5.3-5.9	0.357	1B	0.5	BL02D-5.6A
	0.9	1A	0.9	BL05D-5.6A
	1.8	1	1.0	BL1D-5.6A
	3.6	2	1.1	BL2D-5.6A
	5.4	4	1.3	BL3D-5.6A
	8.91	6A	2.5	BL5D-5.6A
5.9-6.6	0.318	1B	0.5	BL02D-6.3A
	0.8	1A	0.9	BL05D-6.3A
	1.6	1	1.0	BL1D-6.3A
	3.2	2	1.1	BL2D-6.3A
	4.8	4	1.3	BL3D-6.3A
	7.92	6	1.9	BL5D-6.3A
6.6-7.4	0.286	1B	0.5	BL02D-7A
	0.7	1A	0.9	BL05D-7A
	1.4	1	1.0	BL1D-7A
	2.8	2	1.1	BL2D-7A
	4.2	4	1.3	BL3D-7A
	7.15	6	1.9	BL5D-7A
7.4-8.3	0.253	1B	0.5	BL02D-7.9A
	0.63	1A	0.9	B05D-7.9A
	1.26	1	1.0	BL1D-7.9A
	2.52	2	1.1	BL2D-7.9A
	3.78	4	1.3	BL3D-7.9A
	6.32	6	1.9	BL5D-7.9A
8.3-9.3	0.227	1B	0.5	BL02D-8.8A
	0.57	1A	0.9	B05D-8.8A
	1.14	1	1.0	BL1D-8.8A
	2.28	2	1.1	BL2D-8.8A
	3.42	4	1.3	BL3D-8.8A
	5.68	6	1.9	BL5D-8.8A
9.3-10.4	0.202	1B	0.5	B02D-9.9A
	0.50	1A	0.9	B05D-9.9A
	1.00	1	1.0	BL1D-9.9A
	2.00	2	1.1	BL2D-9.9A
	3.00	4	1.3	BL3D-9.9A
	5.05	6	1.9	BL5D-9.9A
	10.10	11	3.7	BL10D-9.9A
10.4-11.6	0.182	1B	0.5	B02D-11A
	0.45	1A	0.9	B05D-11A
	0.91	1	1.0	BL1D-11A
	1.82	2	1.1	BL2D-11A
	2.73	4	1.3	BL3D-11A
	4.55	6	1.9	BL5D-11A
	9.10	11	3.7	BL10D-11A
11.6-13.0	0.163	1B	0.5	B02D-12.3A
	0.40	1A	0.9	B05D-12.3A
	0.81	1	1.0	BL1D-12.3A
	1.62	2	1.1	BL2D-12.3A
	2.43	4	1.3	BL3D-12.3A
	4.06	6	1.9	BL5D-12.3A
	8.12	11	3.7	BL10D-12.3A
	13.83	14	10.3	BL17D-12.3A
13.0-14.8	0.145	1B	0.5	B02D-13.8A
	0.36	1A	0.9	B05D-13.8A
	0.72	1	1.0	BL1D-13.8A
	1.44	2	1.1	BL2D-13.8A
	2.15	4	1.3	BL3D-13.8A
	3.62	6	1.9	BL5D-13.8A
	7.24	11	3.7	BL10D-13.8A
	12.31	14	10.3	BL17D-13.8A
14.8-16.6	0.127	1B	0.5	B02D-15.7A
	0.32	1A	0.9	B05D-15.7A
	0.64	1	1.0	BL1D-15.7A
	1.28	2	1.1	BL2D-15.7A
	1.92	4	1.3	BL3D-15.7A
	3.18	6	1.9	BL5D-15.7A
	6.36	11	3.7	BL10D-15.7A
	10.81	14	10.3	BL17D-15.7A
16.6-18.6	0.114	1B	0.5	B02D-17.6A
	0.28	1A	0.9	B05D-17.6A
	0.57	1	1.0	BL1D-17.6A
	1.14	2	1.1	BL2D-17.6A
	1.71	4	1.3	BL3D-17.6A
	2.84	6	1.9	BL5D-17.6A
	5.68	11	3.7	BL10D-17.6A
	9.65	14	10.3	BL17D-17.6A
18.6-20.8	0.101	1B	0.5	B02D-19.7A
	0.255	1A	0.9	B05D-19.7A
	0.510	1	1.0	BL1D-19.7A
	1.02	2	1.1	BL2D-19.7A
	1.63	4	1.3	BL3D-19.7A
	2.54	6	1.9	BL5D-19.7A
	5.08	11	3.7	BL10D-19.7A
	8.62	14	10.3	BL17D-19.7A
20.8-23.3	0.091	1B	0.5	B02D-22A
	0.230	1A	0.9	B05D-22A
	0.460	1	1.0	BL1D-22A
	0.920	2	1.1	BL2D-22A
	1.38	4	1.3	BL3D-22A
	2.27	6	1.9	BL5D-22A
	4.54	11	3.7	BL10D-22A
	7.72	14	10.3	BL17D-22A
23.3-26.1	0.081	1B	0.5	B02D-24.7A
	0.205	1A	0.9	B05D-24.7A
	0.410	1	1.0	BL1D-24.7A
	0.820	2	1.1	BL2D-24.7A
	1.23	4	1.3	BL3D-24.7A
	2.02	6	1.9	BL5D-24.7A
	4.04	11	3.7	BL10D-24.7A
	6.88	14	10.3	BL17D-24.7A
26.1-29.2	0.073	1B	0.5	B02D-27.6A
	0.180	1A	0.9	B05D-27.6A
	0.360	1	1.0	BL1D-27.6A
	0.720	2	1.1	BL2D-27.6A
	1.08	4	1.3	BL3D-27.6A
	1.81	6	1.9	BL5D-27.6A
	3.62	11	3.7	BL10D-27.6A
	6.16	14	10.3	BL17D-27.6A
29.2-32.6	0.065	1B	0.5	B02D-31A
	0.160	1A	0.9	B05D-31A
	0.320	1	1.0	B1D-31A
	0.640	2	1.1	B2D-31A
	0.960	4	1.3	BL3D-31A
	1.61	6	1.9	BL5D-31A
	3.22	11	3.7	BL10D-31A
	5.48	14	10.3	BL17D-31A
32.6-36.5	0.058	1B	0.5	B02D-34.6A
	0.145	1A	0.9	B05D-34.6A
	0.290	1	1.0	B1D-34.6A
	0.580	2	1.1	B2D-34.6A
	0.870	4	1.3	BL3D-34.6A
	1.44	6	1.9	BL5D-34.6A
	2.88	11	3.7	BL10D-34.6A
	4.91	14	10.3	BL17D-34.6A
36.5-40.9	0.052	1B	0.5	B02D-38.7A
	0.130	1A	0.9	B05D-38.7A
	0.260	1	1.0	B1D-38.7A
	0.520	2	1.1	B2D-38.7A
	0.780	4	1.3	BL3D-38.7A
	1.29	6	1.9	BL5D-38.7A
	2.58	11	3.7	BL10D-38.7A
	4.39	14	10.3	BL17D-38.7A
40.9-45.8	0.046	1B	0.5	B02D-43.3A
	0.155	1A	0.9	B05D-43.3A
	0.230	1	1.0	B1D-43.3A
	0.460	2	1.1	B2D-43.3A
	0.690	4	1.3	BL3D-43.3A
	1.15	6	1.9	BL5D-43.3A
	2.30	11	3.7	BL10D-43.3A
	3.92	14	10.3	BL17D-43.3A
45.8-51.4	0.041	1B	0.5	B02D-48.6A
	0.103	1A	0.9	B05D-48.6A
	0.206	1	1.0	B1D-48.6A
	0.412	2	1.1	B2D-48.6A
	0.618	4	1.3	B3D-48.6A
	1.03	6	1.9	BL5D-48.6A
	2.06	11	3.7	BL10D-48.6A
	3.49	14	10.3	BL17D-48.6A
51.4-59.0	0.036	1B	0.5	B02D-55.2A
	0.091	1A	0.9	B05D-55.2A
	0.182	1	1.0	B1D-55.2A
	0.364	2	1.1	B2D-55.2A
	0.546	4	1.3	B3D-55.2A
	0.905	6	1.9	BL5D-55.2A
	1.81	11	3.7	BL10D-55.2A
	3.07	14	10.3	BL17D-55.2A
59.0-66.0	0.032	1B	0.5	B02D-63A
	0.080	1A	0.9	B05D-63A
	0.160	1	1.0	B1D-63A
	0.320	2	1.1	B2D-63A
	0.480	4	1.3	B3D-63A
	0.795	6	1.9	BL5D-63A
	1.59	11	3.7	BL10D-63A
	2.69	14	10.3	BL17D-63A
66.0-74.0	0.029	1B	0.5	B02D-70A
	0.071	1A	0.9	B05D-70A
	0.143	1	1.0	B1D-70A
	0.286	2	1.1	B2D-70A
	0.429	4	1.3	B3D-70A
	0.715	6	1.9	BL5D-70A
	1.43	11	3.7	BL10D-70A
	2.42	14	10.3	BL17D-70A
74.0-83.0	0.025	1B	0.5	B02D-79A
	0.063	1A	0.9	B05D-79A
	0.127	1	1.0	B1D-79A
	0.254	2	1.1	B2D-79A
	0.381	4	1.3	B3D-79A
	0.634	6	1.9	BL5D-79A
	1.27	11	3.7	BL10D-79A
	2.15	14	10.3	BL17D-79A
83.0-514	Other standard models are available with output voltages between 83.0 and 514 Vdc at output power ratings of 2, 5, 10, 20, 30, 50, 100 or 170 watts. For complete information, please consult one of the offices listed below.			

*See page D•1542 for size charts.

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Southwest Office
275 W. Campbell Road
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Eastern Office
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(201) 461-4411
Fax: (201) 461-2936

European Office
Ashford, Kent, England
Tel: 0233 623404
Fax: 0233 641777

Abbott
TECHNOLOGIES, INC.

The Powerhouse of Quality™

At Abbott Technologies, we believe that the key to our success is our dependability in providing reliable, cost-effective solutions to our customers power requirements. Our dependability extends to all of our interactions with our customers as well. This commitment has qualified Abbott Technologies as the vendor of choice in a wide range of industrial applications since 1961.

Most of our standard products are **UL** recognized, and we can modify our units to provide features and capabilities normally available only on custom power supplies, usually at a fraction of the cost. This allows us to offer very competitive pricing even in small quantity orders of our modified as well as our standard product. And our quick, responsive service is hard to beat.

Our continual efforts to enhance the quality of our products is augmented by our search for new ways to save our customers time and money in the long-run. The key elements of our approach to providing you with the best possible service include:

-Conservative design philosophy which ensure that product performance will always exceed product specifications

-Commitment to Total Quality Management (**TQM**) to ensure that we continually improve our skills to help you gain the competitive edge

-Computerized production control to ensure our on-time delivery

-Continual cost reduction programs to ensure our price competitiveness

-DIRECT Sales/Service Support

-On-line applications engineering support

-American owned/operated facilities located in the United States

Our many years of experience with power design/ management contribute to us maintaining a very high degree of customer satisfaction.

The following pages list some of our standard products. We would be happy to provide you with more detailed specifications on these and other power products including **ruggedized DC supplies**, **DC to AC inverters**, **transformers**, and other **power magnetics modules**.

Please contact us for a free catalog or a quote on your requirements.

Also see our listing for Transformers in Volume **A**, Pages **A**•2234-**A**•2253, and Inverters in the next section, Pages **D**•2228, 29.

ABBOTT TECHNOLOGIES, INC.
Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395
Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott
TECHNOLOGIES, INC.

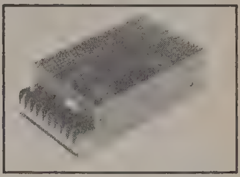
AC-DC Switchers

ZB (4" x 6.75" x 2.25")

Voltage	Maximum Load		Model Number
	Current	Power	
5	20A	100W	Z5B20
6	18A	108W	Z6B18
10	12A	120W	Z10B12
12	10A	120W	Z12B10
15	8A	120W	Z15B8
18	6.7A	120W	Z18B7
20	6A	120W	Z20B6
22	5.5A	120W	Z22B6
24	5A	120W	Z24B5
28	4.3A	120W	Z28B4
30	4A	120W	Z30B4

AC Input - 90 -132/180 - 265 VRMS, 47 - 400 Hz
Operating Temperature - O to +85 degrees C
Efficiency - 75% or greater
Regulation - within 0.2%
Ripple - 50 mV peak to peak (typical)
Low Temperature Option: (-20 to +85 degree C operation)

Power Supplies-Also see our listing for Transformers in Volume A, Pages A.2204-A.2219, and Inverters in the next section, Pages D.2188,89.



ND * (5" X 11" X 2.5")

5	36A	180W	ND120S5
12	15A	180W	ND180S12
15	12A	180W	ND180S15
24	7.5A	180W	ND180S24
28	6.4A	180W	ND180S28

AC Input - 90 -132/180 - 264 VRMS, 47 - 400 Hz
Operating Temperature - 0 to +70 degrees C
Efficiency - 75% or greater
Regulation - within 0.15%
Ripple - 50 mV peak to peak (typical)

LG * (5" x 8" x 11")

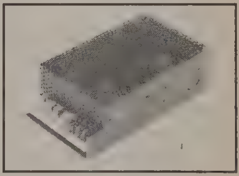
2	150A	300W	LG750S2
5	150A	750W	LG750S5
12	62A	750W	LG750S12
15	50A	750W	LG750S15
18	42A	750W	LG750S18
24	31A	750W	LG750S24
28	27A	750W	LG750S28
2	200A	400W	LG1000S2
5	200A	1000W	LG1000S5
12	83A	1000W	LG1000S12
15	67A	1000W	LG1000S15
18	56A	1000W	LG1000S18
24	42A	1000W	LG1000S24
28	36A	1000W	LG1000S28

AC Input - 92 - 132/184 - 264 VAC, 47 - 64 Hz
Operating Temperature - 0 to +70 degrees C
Efficiency - 75% or greater
Regulation - within 0.2%
Ripple - 0.5% peak to peak maximum

Standard features include: Undervoltage, overvoltage, overcurrent protection circuits, parallel operation, logic inhibit, remote sense, power failure warning

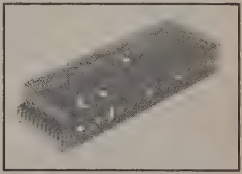
ZBT/ZBQ (4" x 6.75" x 2.25")

OUTPUT NO. 1		OUTPUT NO. 2		OUTPUT NO. 3			
Voltage	Maximum Current	Voltage	Maximum Current	Voltage	Maximum Current	Model No.	Maximum Continuous Power
5	13A	+12	1.0	-12	1.0	ZB95T5/12	90W
5	13A	+15	1.0	-15	1.0	ZB95T5/15	95W
5	11A	+12	1.3	-12	1.3	ZB90T5/12	85W
5	10A	+15	1.3	-15	1.3	ZB90T5/15	90W



OUTPUT NO 1		OUTPUT NO 2		OUTPUT NO 3		OUTPUT NO 4			
Voltage	Maximum Current	Voltage	Maximum Current	Voltage	Maximum Current	Voltage	Maximum Current	Model No.	Maximum Continuous Power All Outputs
5	10A	+12	1.0A	-12	1.0A	24	2.0A	ZB100Q5/12/24	100W
5	10A	+15	1.0A	-15	1.0A	24	2.0A	ZB100Q5/15/24	100W
5	10A	+12	1.0A	-12	1.0A	-5	1.0A	ZB100Q5/12/5	79W
5	10A	+15	1.0A	-15	1.0A	-5	1.0A	ZB100Q5/15/5	85W
5	10A	+12	1.0A	-12	1.0A	12	2.0A	ZB100Q5/12/12	98W
5	10A	+15	1.0A	-15	1.0A	12	2.0A	ZB100Q5/15/12	100W

AC Input - 90 - 132/180 - 265 VRMS, 47 - 400 Hz
Operating Temperature - 0 to +85 degrees C
Efficiency - 65%
Regulation - within 0.2% main, 1% aux.
Ripple - Main = 100mV p-p, AUX = 200 mV p-p
Low Temperature Option: (-20 to +85 degree C oper.)



ESA * (4.8" x 13.5" x 2.5")

OUTPUT NO 1		OUTPUT NO 2		OUTPUT NO 3		OUTPUT NO 4			
Voltage	Maximum Current	Voltage	Maximum Current	Voltage	Maximum Current	Voltage	Maximum Current	Model No.	Maximum Continuous Power All Outputs
5	25A	+12	4A	-12	4A	-	-	ESA150T5/12	150W
5	25A	+15	4A	-15	4A	-	-	ESA150T5/15	150W
5	25A	+12	4A	-12	4A	-5	4A	ESA150Q5/12/5	150W
5	25A	+15	4A	-15	4A	-5	4A	ESA150Q5/15/5	150W
5	25A	+12	4A	-12	4A	+24	2A	ESA150Q5/12/24	150W
5	25A	+15	4A	-15	4A	+24	2A	ESA150Q5/15/24	150W

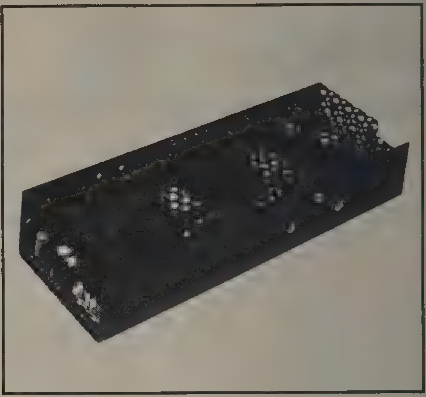
AC Input - 90 - 132/180 - 265 VRMS, 47-440 Hz
Operating Temperature - 0 to +70 degrees C
Efficiency - 75%
Regulation - 0.2% all outputs
Ripple - 25 mV peak to peak (typical)

* ALL MODELS HAVE BEEN TESTED TO MEET UL478, U.L. FILE #E107304S
WE ALSO OFFER SEVERAL LINEAR MODELS (FROM 15 TO 170 WATTS).

For more information call us :
1 800 367 8200

CFT/CFQ (5" x 13.5" x 2.5") (UL1950 testing underway)

OUTPUT NO 1		OUTPUT NO 2		OUTPUT NO 3		OUTPUT NO 4		Model No.	Maximum Power Continuous 250 (Watts)
Voltage (Volt)	Maximum Current (Amps)	Voltage (Volt)	Maximum Current (Amps)	Voltage (Volt)	Maximum Current (Amps)	Voltage (Volt)	Maximum Current (Amps)		
5	35	+12	5/7PK	-12	5/7PK	-	-	CF250T5/12	250
5	35	+15	5/7PK	-15	5/7PK	-	-	CF250T5/12	250
5	35	+12	5/7PK	-12	5/7PK	5	3	CF250Q5/12/5	250
5	35	+15	5/7PK	-15	5/7PK	5	3	CF250Q5/15/5	250
5	35	+12	5/7PK	-12	5/7PK	24	5/7PK	CF250Q5/12/24	250
5	35	+15	5/7PK	-15	5/7PK	24	5/7PK	CF250Q5/12/24	250



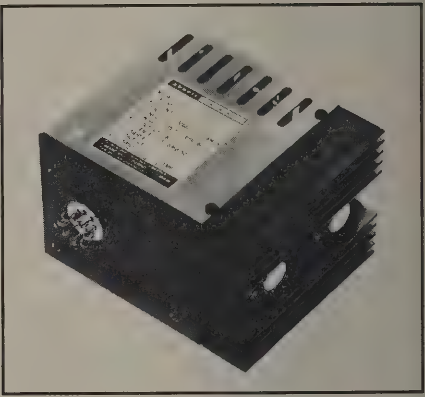
AC Input : 90 -132/180 - 260 Vac, 47-440 Hz
Operating Temperature : 0 to +70 degrees C
Efficiency : 70%
Regulation : Main Output 0.2%,
Aux Output 0.5%
Ripple : 50 mV (typical)

AC-DC LINEARS

ENCLOSED HIGH QUALITY LINEARS

SINGLE OUTPUT MODELS

Nominal Voltage	Maximum Current (Amps)	Power	Model Number	Case Dimensions (inches)
5	0.3	1.5	RN5S0.3	6 1/2 x 4 x 1 7/8
5	1.2	6	RN5S1.2	5 x 4 x 4 1/2
5	2.5	12.5	RN5S2.5	5 x 4 x 5 3/4
5	5.0	25	RN5S5	6 1/2 x 4 x 7 1/2
5	10	50	RN5S10	5 x 8 x 8 3/4
5	15	75	RN5S15	5 x 12 x 8
5	20	100	RN5S20	6 1/2 x 4 x 1 7/8
12	0.3	3.6	RN12S0.3	5 x 4 x 1 7/8
12	1.2	14.4	RN12S1.2	5 x 4 x 4 1/2
12	2.5	30	RN12S2.5	5 x 4 x 5 3/4
12	5.0	60	RN12S5	6 1/2 x 4 x 7 1/2
12	10	120	RN12S10	5 x 8 x 8 3/4
12	15	174	RN12S15	6 1/2 x 12 x 8
12	20	240	RN12S20	6 1/2 x 12 x 9 3/4
15	0.3	4.5	RN15S0.3	6 1/2 x 4 x 1 7/8
15	1.2	18	RN15S1.2	5 x 4 x 4 1/2
15	2.5	37.5	RN15S2.5	5 x 4 x 5 3/4
15	5.0	75.0	RN15S5	6 1/2 x 4 x 7 1/2
15	10	150	RN15S10	5 x 12 x 8
15	15	225	RN15S15	6 1/2 x 12 x 8
24	0.3	7.2	RN24S0.3	6 1/2 x 4 x 1 7/8
24	1.2	28.8	RN24S1.2	5 x 4 x 4 1/2
24	2.5	60	RN24S2.5	5 x 4 x 5 3/4
24	5.0	120	RN24S5.0	5 x 8 x 8 3/8
24	10	240	RN24S10	5 x 12 x 8
28	0.15	4.2	RN28S0.15	6 1/2 x 4 x 1 7/8
28	0.6	16.8	RN28S0.6	5 x 4 x 4 1/2
28	1.2	33.6	RN28S1.2	5 x 4 x 5 3/4
28	2.5	70	RN28S2.5	6 1/2 x 4 x 7 1/2
28	5.0	140	RN28S5.0	5 x 8 x 8 3/4



AC Input : 105 - 125 Vrms,
50 - 420 Hz, single phase
Operation Temperature : -20 to + 71 degrees C
Efficiency : 40% - 60%
Regulation : Within 0.1%
Ripple : 5 m Vrms (typical)

DUAL OUTPUT MODELS

Nominal Voltage	Maximum Current (Amps)	Model Number	Case Dimensions (Inches)
±12	1.2	RRN12S1.2	7 5/8 x 4 x 5 3/4
±12	2.5	RRN12S2.5	7 5/16 x 4 x 7 1/2
±12	5.0	RRN12S5	5 x 8 x 8 3/4
±15	1.2	RRN12S1.2	7 5/8 x 4 x 5 3/4
±15	2.5	RRN12S2.5	7 5/16 x 4 x 7 1/2
±15	5.0	RRN12S5	5 x 8 x 8 3/4

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Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395
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The Powerhouse of Quality
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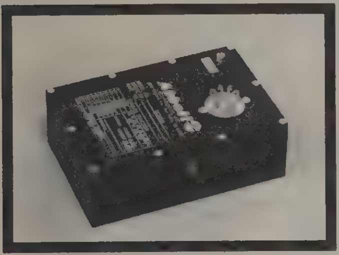
Abbott Ruggedized Switchers

High-Performance 100-120 Watt Switching Power Supply Ruggedized for Extreme Environment Applications



list price: **$499**

size: 6" x 4" x 2.5"

Standard Single Output Models

Voltage	Current (max)	Power	Model
5	20 A	100 W	Z5xR20
6	18 A	108 W	Z6xR18
12	10 A	120 W	Z12xR10
15	8 A	120 W	Z15xR8
18	6.7 A	120 W	Z18xR7
24	5 A	120 W	Z24xR5
28	4.3 A	120 W	Z28xR4
30	4 A	120 W	Z30xR4

GENERAL SPECIFICATIONS:

Input Range: (A): 90-132VAC, 47-440HZ, 124-186 VDC
(B): 180-265VAC,47-400HZ, 248-372 VDC
(C): 20-32 VDC

To indicate preference please place letter designator after nominal voltage in model number: EXAMPLE: Z5AR-20.

Line Regulation: 0.15%
Load Regulation: 0.2%
Ripple: 100 mV peak-to-peak or 0.5% which ever is greater
Construction: Aluminum extruded case, with removable gasket-sealed cover.
Repairability: Non-hermetically sealed construction allows units to be repaired in field (with optional modular field repair kits).
Temperature Range: -40 to +85 degrees C baseplate temperature.

Storage Temperature: -40 to +85 degrees C.
Efficiency: 80% typical, 75% minimum.
Short Circuit Protection
Over Voltage Protection
Remote Error Sensing
EMI: MIL-STD-461A , CEO1, CEO3 (above 2Mhz bandwidth)
Input Transient Protection: MIL-STD-1399, 143.8 VAC for 0.3 seconds.
MIL-STD-704A(CAT. B), 180 VAC for 0.1 seconds.
Reliability: Over 123,000 hrs MTBF per MIL-HDBK 217
Environment: MIL-STD-810D,(environmental portions, including shock, vibration, moisture, altitude, etc.)
Typical Applications: oil exploration, aircraft, shipboard and mobile equipment, field instruments, ground support, etc.
Options: Side-mounted header, mil-type connectors, field repair kits, output configurations, extreme shock encapsulation, component upgrades

ABBOTT WILL MODIFY ANY OF OUR POWER SUPPLIES FOR YOUR PARTICULAR APPLICATION QUICKLY AND FOR A REASONABLE PRICE.

Sample modifications include: input filtering, input/output connector style and location, ruggedization, output voltages and power levels, special functions, custom enclosures, labeling, special testing, sub-assembly integration, remote on/off, and parallel operation.

We regularly modify our power supplies for customers who require optimum power supply performance for their application. We can normally accomodate small runs of modified products at a very nominal NRE fee, and for larger requirements we can do modifications free of charge. All modified units are thoroughly tested and meet the same high quality standards of our standard products.

A modified Abbott power supply can be an attractive low-cost alternative to more costly custom or special purpose units.

Our CAE/CAD , SPC, and CAM systems assure on-time delivery of our modified as well as standard products. We also have a fully qualified environmental test laboratory on-site to quickly test and verify our units complience to various extreme environmental conditions.

Please contact us for more information.

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Abbott
The Powerhouse of Quality
1 800 367 8200

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

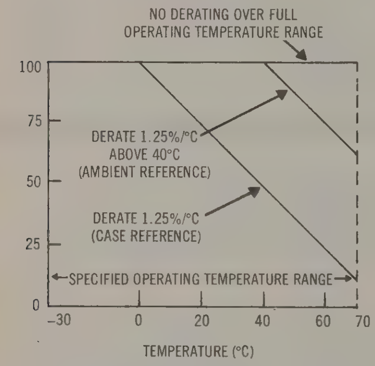

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

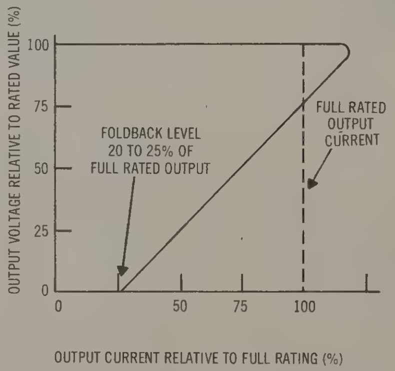

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

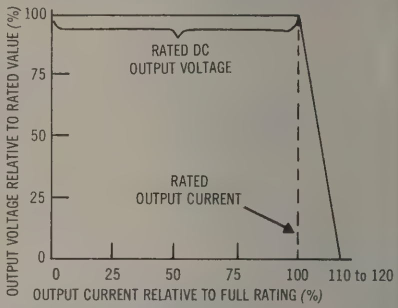

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

WE SHIP POWER SUPPLIES IN 3 DAYS

Any time you order Acopian power modules selected from the thousands of models described on the following pages, shipment will be made within 3 days after your purchase order is received. To save more time, telephone your order. We'll ship within 3 days after you've put down the phone.

Miniaturized Single Output 2
Miniaturized Dual Output 4
Miniaturized with Screw Terminals 6
Series A, 0.005% Regulation
Series B, 0.05 to 0.5% Regulation 8
Narrow Profile 12
Wide Output Adjustment 14, 24
Dual Outputs (User Selectable) 16
Dual Tracking Outputs 18
Triple Output 19
Series U Unregulated 20
Rack Mounting 22
Redundant Power Systems 25
Rack-Mountable Assemblies 28
High Voltage (to 30,000 volts) 30

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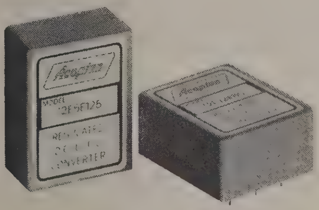
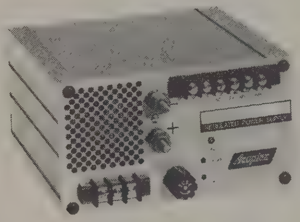


DC-DC Converters
For printed circuit boards
or with screw terminals.
Single and dual output.



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Outputs to 48 Vdc,
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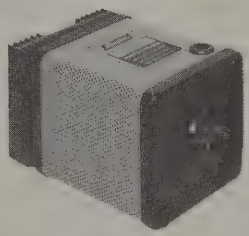
low noise.



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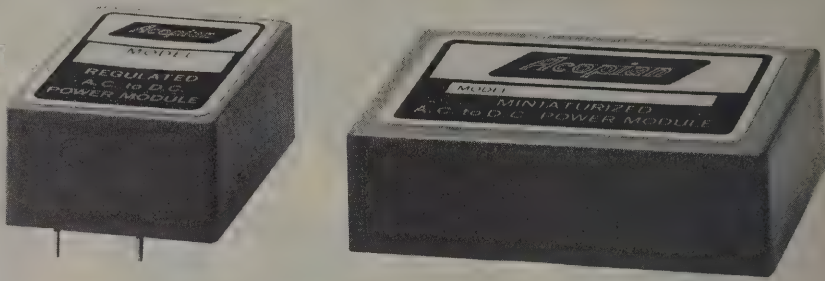
Acopian

MINIATURIZED SINGLE OUTPUT

PC BOARD MOUNTING LINEAR REGULATED AC-DC


Acopian
MODEL
REGULATED
A.C. to D.C.
POWER MODULE
Acopian
MODEL
MINIATURIZED
A.C. to D.C. POWER MODULE

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED

Conserve space with mini-modules as small as 2.3″ x 1.8″ x 1.0″. Models with outputs ranging from 1 to 75 volts, and from 30 mA to 2.5 amps are available. All feature excellent regulation and ripple parameters, and are short circuit protected.

Rugged encapsulated construction and generously derated components insure years of reliable operation. Mini-modules are also available with multiple outputs—see pages 4 and 5.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

SPECIFICATIONS:

Input Voltage: 105-125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See table.

Output Voltage Trim Adjustment: Output is factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Output may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Output is floating. Either positive or negative terminal may be grounded.

Ambient Operating Temperature: −20 to +71°C. (Model 5E150, 0 to +71°C.) No derating required.

Storage Temperature: −55 to +85°C.

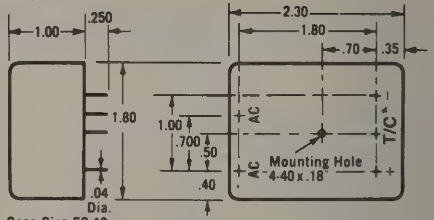
Temperature Coefficient: From 9 to 75 volts, typical TC is 0.015%/°C; 1 to 8 volts, 0.03%/°C.

Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

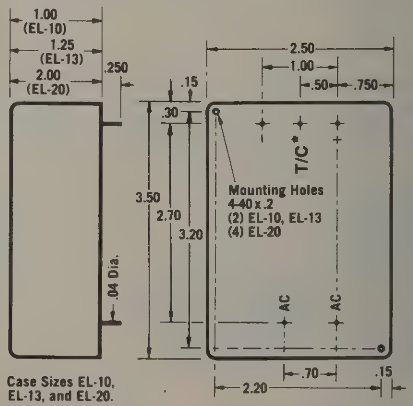
Weight: 7 oz. (Case size ES-10.)
13 oz. (Case size EL-10.)
1 lb. 3 oz. (Case size EL-13.)
1 lb. 15 oz. (Case size EL-20.)

Mounting: May be mounted on printed circuit board or in socket. See page 5.

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "−230" to model number and $10.00 to price.


1.00
.250
2.30
1.80
.70
.35
1.80
1.00
.700
.50
.40
AC
AC
T/C*
Mounting Hole
4-40 x .18
.04
Dia.

Case Size ES-10


1.00
(EL-10)
1.25
(EL-13)
2.00
(EL-20)
.250
.15
2.50
1.00
.50
.750
.30
3.50
2.70
3.20
T/C*
Mounting Holes
4-40 x .2
(2) EL-10, EL-13
(4) EL-20
.04 Dia.
AC
AC
.70
.15
2.20

Case Sizes EL-10, EL-13, and EL-20.

*TRIM on single output modules.

SINGLE OUTPUT, FOR PC BOARD MOUNTING

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
1	.250	.1	.05	0.5	$ 59	1E25	ES-10
1	.500	.2	.05	1	75	1E50A	EL-10
1.5	.250	.1	.05	0.5	59	1.5E25	ES-10
1.5	.500	.2	.05	1	75	1.5E50A	EL-10
1.5	1.0	.3	.05	1	98	1.5E100	EL-13
1.5	2.5	.3	.05	1	130	1.5E250	EL-20
2	.200	.1	.05	0.5	59	2E20	ES-10
2	.400	.2	.05	1	75	2E40A	EL-10
3	.250	.1	.05	0.5	59	3E25	ES-10
3	.500	.2	.05	1	75	3E50A	EL-10
3.6	.250	.05	.05	0.5	59	3.6E25	ES-10
3.6	.500	.1	.05	1	75	3.6E50A	EL-10
3.6	1.0	.3	.05	1	98	3.6E100	EL-13
3.6	2.5	.3	.05	1	130	3.6E250	EL-20
4	.200	.05	.05	0.5	59	4E20	ES-10
4	.400	.1	.05	1	75	4E40A	EL-10
5	.250	.05	.05	0.5	59	5E25	ES-10
5	.500	.1	.05	1	69	5E50A	EL-10
5	1.0	.2	.05	1	85	5E100	EL-13
5	1.5	.3	.1	1	98	5E150	EL-13
5	2.0	.15	.05	1	115	5E200	EL-20
5	2.5	.15	.05	1	130	5E250	EL-20
6	.200	.05	.05	0.5	59	6E20	ES-10
6	.400	.1	.05	1	75	6E40A	EL-10
6	.550	.2	.05	1	89	6E55	EL-10
6	1.0	.2	.05	1	105	6E100	EL-13
6	1.75	.15	.05	1	125	6E175	EL-20
7	.170	.05	.05	0.5	59	7E17	ES-10
7	.340	.1	.05	1	75	7E34A	EL-10
7	.450	.2	.05	1	89	7E45	EL-10
7	.900	.2	.05	1	105	7E90	EL-13
7	1.15	.15	.05	1	125	7E115	EL-20
8	.150	.05	.05	0.5	59	8E15	ES-10
8	.300	.1	.05	1	75	8E30A	EL-10
8	.700	.2	.05	1	105	8E70	EL-13
8	1.1	.15	.05	1	125	8E110	EL-20
9	.130	.05	.05	0.5	59	9E13	ES-10
9	.260	.1	.05	1	75	9E26A	EL-10
9	.450	.15	.05	1	89	9E45	EL-10
9	.850	.15	.05	1	105	9E85	EL-13
9	1.5	.15	.05	1	130	9E150	EL-20
10	.120	.02	.02	0.5	49	10E12	ES-10
10	.240	.05	.05	1	75	10E24A	EL-10
10	.400	.15	.05	1	89	10E40	EL-10
10	.750	.15	.05	1	105	10E75	EL-13
10	1.2	.1	.05	1	130	10E120	EL-20
11	.110	.02	.02	0.5	59	11E11	ES-10
11	.220	.05	.05	1	75	11E22A	EL-10
11	.350	.15	.05	1	89	11E35	EL-10
11	.600	.15	.05	1	105	11E60	EL-13
11	1.0	.1	.05	1	130	11E100	EL-20
12	.100	.02	.02	0.5	49	12E10	ES-10
12	.150	.05	.05	0.5	65	12E15	ES-10
12	.200	.05	.05	1	75	12E20A	EL-10
12	.400	.1	.05	1	89	12E40	EL-10
12	.700	.1	.05	1	110	12E70	EL-13
12	1.2	.15	.05	1	130	12E120	EL-20
13	.100	.02	.02	0.5	59	13E10	ES-10
13	.200	.05	.05	1	75	13E20A	EL-10
13	.350	.1	.05	1	89	13E35	EL-10
13	1.0	.1	.05	1	130	13E100	EL-20
14	.100	.02	.02	0.5	59	14E10	ES-10
14	.200	.05	.05	1	75	14E20A	EL-10
14	.300	.1	.05	1	89	14E30	EL-10
14	.500	.1	.05	1	105	14E50	EL-13
14	1.0	.1	.05	1	130	14E100	EL-20
15	.100	.02	.02	0.5	49	15E10	ES-10
15	.150	.05	.05	0.5	65	15E15	ES-10
15	.200	.05	.05	1	75	15E20A	EL-10
15	.400	.1	.05	1	89	15E40	EL-10
15	.600	.1	.05	1	105	15E60	EL-13
15	1.0	.1	.05	1	130	15E100	EL-20
16	.080	.02	.02	0.5	59	16E08	ES-10
16	.160	.05	.05	1	75	16E16A	EL-10
16	.350	.1	.05	1	95	16E35	EL-10
16	.500	.1	.05	1	110	16E50	EL-13
16	.900	.1	.05	1	130	16E90	EL-20
17	.070	.02	.02	0.5	59	17E07	ES-10
17	.140	.05	.05	1	75	17E14A	EL-10
17	.450	.1	.05	1	$110	17E45	EL-13
17	.750	.1	.05	1	130	17E75	EL-20
18	.060	.02	.02	0.5	49	18E06	ES-10
18	.120	.05	.05	1	75	18E12A	EL-10
18	.270	.1	.05	1	89	18E27	EL-10
18	.400	.1	.05	1	105	18E40	EL-13
18	.550	.1	.05	1	125	18E55	EL-20
19	.060	.02	.02	0.5	59	19E06	ES-10
19	.120	.05	.05	1	75	19E12A	EL-10
19	.250	.1	.05	1	89	19E25	EL-10
19	.400	.1	.05	1	105	19E40	EL-13
19	.700	.1	.05	1	130	19E70	EL-20
20	.060	.02	.02	0.5	59	20E06	ES-10
20	.120	.05	.05	1	75	20E12A	EL-10
20	.200	.1	.05	1	89	20E20	EL-10
20	.400	.1	.05	1	105	20E40	EL-13
20	.700	.1	.05	1	130	20E70	EL-20
21	.060	.02	.02	0.5	59	21E06	ES-10
21	.120	.05	.05	1	75	21E12A	EL-10
21	.175	.1	.05	1	89	21E18	EL-10
21	.375	.1	.05	1	105	21E38	EL-13
21	.600	.1	.05	1	125	21E60	EL-20
22	.050	.02	.02	0.5	59	22E05	ES-10
22	.100	.05	.05	1	75	22E10A	EL-10
22	.150	.1	.05	1	89	22E15	EL-10
22	.300	.1	.05	1	105	22E30	EL-13
22	.500	.1	.05	1	125	22E50	EL-20
23	.050	.02	.02	0.5	59	23E05	ES-10
23	.100	.05	.05	1	75	23E10A	EL-10
23	.200	.1	.05	1	89	23E20	EL-10
23	.300	.1	.05	1	105	23E30	EL-13
23	.600	.1	.05	1	130	23E60	EL-20
24	.050	.02	.02	0.5	49	24E05	ES-10
24	.100	.05	.05	1	75	24E10A	EL-10
24	.200	.1	.05	1	89	24E20	EL-10
24	.350	.1	.05	1	110	24E35	EL-13
24	.600	.1	.05	1	130	24E60	EL-20
25	.050	.02	.02	0.5	59	25E05	ES-10
25	.100	.05	.05	1	75	25E10A	EL-10
25	.190	.1	.05	1	89	25E19	EL-10
25	.325	.1	.05	1	110	25E33	EL-13
25	.550	.1	.05	1	130	25E55	EL-20
26	.040	.02	.02	0.5	59	26E04	ES-10
26	.080	.05	.05	1	75	26E08A	EL-10
26	.170	.1	.05	1	89	26E17	EL-10
26	.300	.1	.05	1	105	26E30	EL-13
26	.450	.1	.05	1	125	26E45	EL-20
27	.040	.02	.02	0.5	59	27E04	ES-10
27	.080	.05	.05	1	75	27E08A	EL-10
27	.160	.1	.05	1	89	27E16	EL-10
27	.300	.1	.05	1	105	27E30	EL-13
27	.500	.1	.05	1	130	27E50	EL-20
28	.040	.02	.02	0.5	49	28E04	ES-10
28	.080	.05	.05	1	75	28E08A	EL-10
28	.150	.1	.05	1	89	28E15	EL-10
28	.300	.1	.05	1	110	28E30	EL-13
28	.500	.1	.05	1	130	28E50	EL-20
30	.080	.02	.02	1	79	30E08A	EL-13
32	.070	.02	.02	1	79	32E07A	EL-13
34	.060	.02	.02	1	79	34E06A	EL-13
35	.050	.02	.02	1	79	35E05A	EL-13
36	.050	.02	.02	1	79	36E05A	EL-13
38	.040	.02	.02	1	79	38E04A	EL-13
40	.030	.02	.02	1	79	40E03A	EL-13
40	.060	.02	.02	1	98	40E06A	EL-13
42	.030	.02	.02	1	79	42E03A	EL-13
44	.030	.02	.02	1	79	44E03A	EL-13
45	.030	.02	.02	1	79	45E03A	EL-13
48	.030	.02	.02	1	79	48E03A	EL-13
48	.050	.02	.02	1	98	48E05A	EL-13
50	.030	.02	.02	1	79	50E03A	EL-13
50	.050	.02	.02	1	98	50E05A	EL-13
55	.040	.02	.02	1	98	55E04A	EL-13
60	.050	.02	.02	1	98	60E05A	EL-13
65	.050	.02	.02	1	98	65E05A	EL-13
70	.040	.02	.02	1	98	70E04A	EL-13
75	.030	.02	.02	1	98	75E03A	EL-13
185	.025	Unregulated		2V	49	NX-25A	EL-10
185	.050	Unregulated		3.5V	69	NX-50	EL-13

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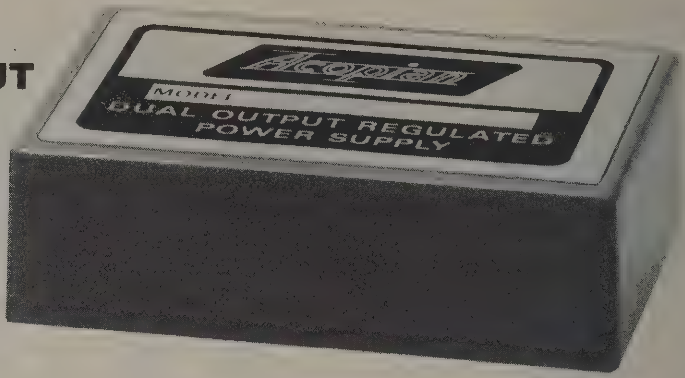
Acopian

MINIATURIZED DUAL & TRIPLE OUTPUT

PC BOARD MOUNTING
LINEAR REGULATED
AC-DC


Acopian
MODEL
DUAL OUTPUT REGULATED POWER SUPPLY

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED

These dual and triple output mini-modules are compact and convenient sources of the voltages required to power operational amplifiers and related circuits. They may be mounted directly on printed circuit board assemblies, simplifying system layout and minimizing the connectors and wiring required.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Compact, lightweight

SPECIFICATIONS:

Input Voltage: 105-125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See table.

Output Voltage Setting: Each output is factory preset to ±2% (1 to 9 volt outputs) or ±1% (10 to 28 volt outputs) of the nominal output voltage. Outputs of Case Size END modules, except those marked (*), may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Single output sections may be used in either polarity. Dual output sections, marked (*), are provided with a plus/common/minus output connection configuration.

Ambient Operating Temperature: −20 to +71°C. No derating required.

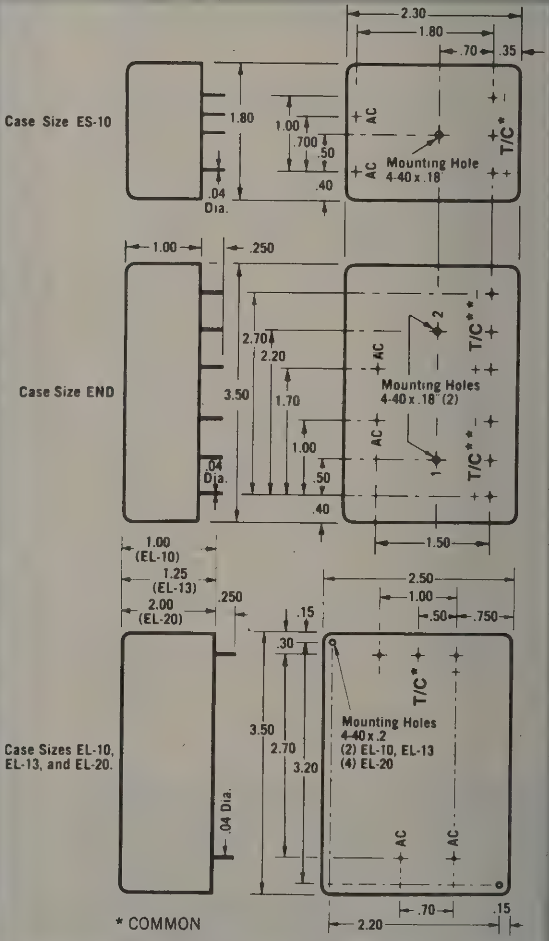
Storage Temperature: −55 to +85°C.

Temperature Coefficient: From 9 to 28 volts, typical TC is 0.015%/°C; 1 to 8 volts, 0.03%/°C.

Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

Weight: 7 oz. (Case size ES-10.)
13 oz. (Case size END.)
13 oz. (Case size EL-10.)
1 lb. 3 oz. (Case size EL-13.)
1 lb. 15 oz. (Case size EL-20.)

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "−230" to model number and $10.00 to price.

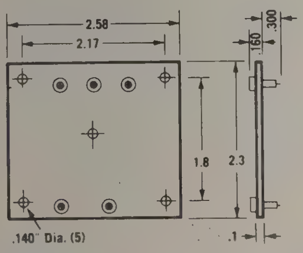

Case Size ES-10
2.30
1.80
.70
.35
1.80
1.00
.700
.50
.40
.04 Dia.
AC
AC
T/C*
Mounting Hole 4-40 x .18
Case Size END
1.00
.250
2.70
2.20
3.50
1.70
1.00
.50
.40
.04 Dia.
AC
AC
T/C**
T/C**
2
1
Mounting Holes 4-40 x .18 (2)
1.50
Case Sizes EL-10, EL-13, and EL-20.
1.00 (EL-10)
1.25 (EL-13)
2.00 (EL-20)
.250
.15
.30
3.50
2.70
3.20
.04 Dia.
2.50
1.00
.50
.750
T/C*
Mounting Holes 4-40 x .2 (2) EL-10, EL-13 (4) EL-20
AC
AC
.70
.15
2.20

* COMMON

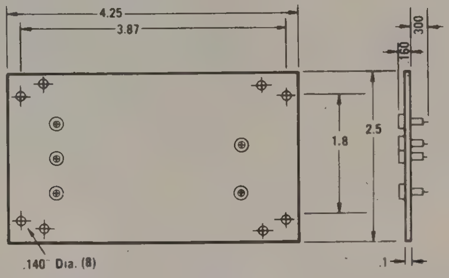
** TRIM (COMMON on ±12V and ±15V sections)

ACCESSORY SOCKETS

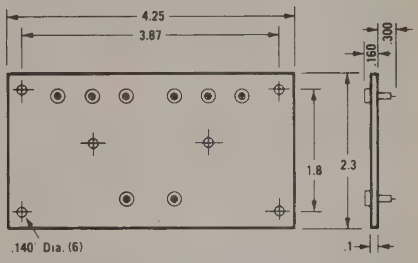
Each of these sockets has a sturdy phenolic base with gold plated teflon-insulated contacts.



Model ES-1 (for case sizes ES-10 and ESC-10) . . . .$15.00 ea.



Model EL-1 (for case sizes EL-10, EL-13, EL-20 and ELC-10) . . . .$15.00 ea.



Model END-1 (for case size END) . . . .$15.00 ea.

DUAL (ISOLATED) & TRIPLE OUTPUT, USER-SELECTED

Any two of the sections listed below, or two of the same section, can be combined into a multiple-output module. The complete model number is the combination of the two section numbers selected. Note that some sections provide two outputs; combination with a single output section results in a triple-output module.

Example: The combination of sections 6E20D and 15E10D is the Model 6E20D-15E10D. Always assign the lower voltage section first. For pricing purposes, add the costs of the sections selected. Example: The price of the Model 6E20D-15E10D is $52.00 plus $45.00, or $97.00 total.

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to order")	Case Size
		Load ±%	Line ±%				
1	.250	.1	.05	0.5	$52	1E25D	END
1.5	.250	.1	.05	0.5	52	1.5E25D	END
2	.200	.1	.05	0.5	52	2E20D	END
3	.250	.1	.05	0.5	52	3E25D	END
3.6	.250	.05	.05	0.5	52	3.6E25D	END
4	.200	.05	.05	0.5	52	4E20D	END
5	.250	.05	.05	0.5	52	5E25D	END
6	.200	.05	.05	0.5	52	6E20D	END
7	.170	.05	.05	0.5	52	7E17D	END
8	.150	.05	.05	0.5	52	8E15D	END
9	.130	.05	.05	0.5	45	9E13D	END
10	.120	.02	.02	0.5	45	10E12D	END
±12*	.050	.10	.05	1	52	D12E05	END
12	.100	.02	.02	0.5	45	12E10D	END
12	.150	.05	.05	0.5	55	12E15D	END
13	.100	.02	.02	0.5	45	13E10D	END

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to order")	Case Size
		Load ±%	Line ±%				
14	.100	.02	.02	0.5	$45	14E10D	END
±15*	.050	.10	.05	1	52	D15E05	END
15	.100	.02	.02	0.5	45	15E10D	END
15	.150	.05	.05	0.5	55	15E15D	END
16	.080	.02	.02	0.5	45	16E08D	END
17	.070	.02	.02	0.5	45	17E07D	END
18	.060	.02	.02	0.5	45	18E06D	END
20	.060	.02	.02	0.5	45	20E06D	END
21	.060	.02	.02	0.5	45	21E06D	END
22	.050	.02	.02	0.5	45	22E05D	END
23	.050	.02	.02	0.5	45	23E05D	END
24	.050	.02	.02	0.5	45	24E05D	END
25	.050	.02	.02	0.5	45	25E05D	END
26	.040	.02	.02	0.5	45	26E04D	END
27	.040	.02	.02	0.5	45	27E04D	END
28	.040	.02	.02	0.5	45	28E04D	END

*Dual output section. Combination with a single output section results in a triple output module.

DUAL TRACKING OUTPUTS

(These model numbers are complete as shown.)

Nominal Output Voltages	Current per Output Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ± %	Line ± %				
±5	.150	.1	.05	1.5	$ 79	D5-15	EL-10
±5	.250	.1	.05	1.5	98	D5-25	EL-10
±5	.500	.1	.05	1.5	135	D5-50	EL-20
±10	.200	.05	.05	1	89	D10-20	EL-10
±10	.300	.05	.05	1	115	D10-30	EL-13
±10	.400	.1	.05	1	135	D10-40	EL-20
±12	.025	.1	.05	1	49	D12-03	ES-10
±12	.050	.1	.05	1	59	D12-05	ES-10
±12	.100	.05	.05	1	69	D12-10A	EL-10
±12	.150	.05	.05	1	79	D12-15A	EL-10
±12	.200	.05	.05	1	89	D12-20	EL-10
±12	.300	.05	.05	1	105	D12-30	EL-13
±12	.350	.05	.05	1	115	D12-35	EL-13
±12	.500	.1	.05	1	135	D12-50	EL-20

Nominal Output Voltages	Current per Output Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
±15	.025	.1	.05	1	$ 49	D15-03	ES-10
±15	.050	.1	.05	1	59	D15-05	ES-10
±15	.100	.05	.05	1	69	D15-10A	EL-10
±15	.150	.05	.05	1	79	D15-15A	EL-10
±15	.200	.05	.05	1	89	D15-20	EL-10
±15	.300	.05	.05	1	105	D15-30	EL-13
±15	.350	.05	.05	1	115	D15-35	EL-13
±15	.500	.1	.05	1	135	D15-50	EL-20

Acopian

MINIATURIZED
SINGLE & DUAL OUTPUT

WITH SCREW TERMINALS
LINEAR REGULATED
AC-DC

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED

Although small in size, these mini-modules offer high performance at modest prices. All models, with series regulated outputs ranging from 1 to 75 volts and as high as 2.5 amps, may be mounted in an area only 3.5″ x 2.5″. Dual output models are available with the ratings commonly required for driving op amps and other balanced loads. Terminal strip input/output connections eliminate all need for sockets or soldering. Short circuit protection, encapsulated construction, and conservative design assure long term reliability.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

SPECIFICATIONS:

Input Voltage: 105-125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See tables.

Output Voltage Trim Adjustment: Outputs factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Single output models may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Either positive or negative terminal of a single output module may be grounded. Dual output modules have a positive/common/negative output terminal configuration.

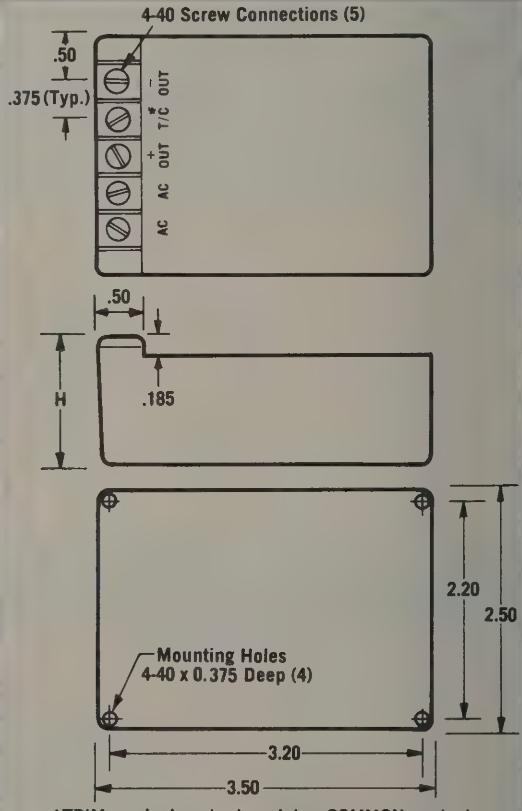
Ambient Operating Temperature: −20 to +71°C. (Model 5EB150, 0 to +71°C.) No derating required.

Storage Temperature: −55 to +85°C.

Temperature Coefficient: From 9 to 75 volts, typical TC is 0.015%/°C; 1 to 8 volts, 0.03%/°C.

Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "−230" to model number and $10.00 to price.



*TRIM on single output modules; COMMON on duals

Case	H	Approx. Weight
EB-10	1.375	15oz
EB-13	1.625	1lb 4 oz
EB-20	2.375	2lb 1oz

SINGLE OUTPUT, WITH SCREW TERMINALS

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
1	.500	.4	.05	1	$ 79	1EB50	EB-10
1.5	.500	.3	.05	1	79	1.5EB50	EB-10
1.5	1.0	.5	.05	1	105	1.5EB100	EB-13
1.5	2.5	.6	.05	1	140	1.5EB250	EB-20
2	.400	.25	.05	1	79	2EB40	EB-10
3	.500	.25	.05	1	79	3EB50	EB-10
3.6	.500	.15	.05	1	79	3.6EB50	EB-10
3.6	1.0	.4	.05	1	105	3.6EB100	EB-13
3.6	2.5	.4	.05	1	140	3.6EB250	EB-20
4	.400	.15	.05	1	79	4EB40	EB-10
5	.500	.15	.05	1	79	5EB50	EB-10
5	1.0	.25	.05	1	95	5EB100	EB-13
5	1.5	.35	.1	1	110	5EB150	EB-13
5	2.0	.25	.05	1	125	5EB200	EB-20
5	2.5	.25	.05	1	140	5EB250	EB-20
6	.400	.1	.05	1	79	6EB40	EB-10
6	.550	.25	.05	1	95	6EB55	EB-10
6	1.0	.25	.05	1	110	6EB100	EB-13
6	1.75	.2	.05	1	130	6EB175	EB-20
7	.340	.1	.05	1	79	7EB34	EB-10
7	.450	.2	.05	1	95	7EB45	EB-10
7	.900	.25	.05	1	110	7EB90	EB-13
7	1.15	.2	.05	1	130	7EB115	EB-20
8	.300	.1	.05	1	79	8EB30	EB-10
8	.700	.2	.05	1	110	8EB70	EB-13
8	1.1	.2	.05	1	130	8EB110	EB-20
9	.260	.1	.05	1	79	9EB26	EB-10
9	.450	.15	.05	1	95	9EB45	EB-10
9	.850	.2	.05	1	110	9EB85	EB-13
9	1.5	.2	.05	1	135	9EB150	EB-20
10	.240	.05	.05	1	79	10EB24	EB-10
10	.400	.15	.05	1	95	10EB40	EB-10
10	.750	.2	.05	1	110	10EB75	EB-13
10	1.2	.15	.05	1	135	10EB120	EB-20
11	.220	.05	.05	1	79	11EB22	EB-10
11	.350	.15	.05	1	95	11EB35	EB-10
11	.600	.15	.05	1	110	11EB60	EB-13
11	1.0	.15	.05	1	135	11EB100	EB-20
12	.200	.05	.05	1	79	12EB20	EB-10
12	.400	.1	.05	1	95	12EB40	EB-10
12	.700	.15	.05	1	115	12EB70	EB-13
12	1.2	.2	.05	1	135	12EB120	EB-20
13	.200	.05	.05	1	79	13EB20	EB-10
13	.350	.1	.05	1	95	13EB35	EB-10
13	.600	.1	.05	1	115	13EB60	EB-13
13	1.0	.15	.05	1	135	13EB100	EB-20
14	.200	.05	.05	1	79	14EB20	EB-10
14	.300	.1	.05	1	95	14EB30	EB-10
14	.500	.1	.05	1	110	14EB50	EB-13
14	1.0	.15	.05	1	135	14EB100	EB-20
15	.200	.05	.05	1	79	15EB20	EB-10
15	.400	.1	.05	1	95	15EB40	EB-10
15	.600	.1	.05	1	110	15EB60	EB-13
15	1.0	.15	.05	1	135	15EB100	EB-20
16	.160	.05	.05	1	79	16EB16	EB-10
16	.350	.1	.05	1	100	16EB35	EB-10
16	.500	.1	.05	1	115	16EB50	EB-13
16	.900	.15	.05	1	135	16EB90	EB-20
17	.140	.05	.05	1	79	17EB14	EB-10
17	.325	.1	.05	1	100	17EB33	EB-10
17	.450	.1	.05	1	115	17EB45	EB-13
17	.750	.15	.05	1	135	17EB75	EB-20
18	.120	.05	.05	1	79	18EB12	EB-10
18	.270	.1	.05	1	95	18EB27	EB-10

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
18	.400	.1	.05	1	$110	18EB40	EB-13
18	.550	.1	.05	1	130	18EB55	EB-20
19	.120	.05	.05	1	79	19EB12	EB-10
19	.250	.1	.05	1	95	19EB25	EB-10
19	.400	.1	.05	1	110	19EB40	EB-13
19	.700	.1	.05	1	135	19EB70	EB-20
20	.120	.05	.05	1	79	20EB12	EB-10
20	.200	.1	.05	1	95	20EB20	EB-10
20	.400	.1	.05	1	110	20EB40	EB-13
20	.700	.1	.05	1	135	20EB70	EB-20
21	.120	.05	.05	1	79	21EB12	EB-10
21	.175	.1	.05	1	95	21EB18	EB-10
21	.375	.1	.05	1	110	21EB38	EB-13
21	.600	.1	.05	1	130	21EB60	EB-20
22	.100	.05	.05	1	79	22EB10	EB-10
22	.150	.1	.05	1	95	22EB15	EB-10
22	.300	.1	.05	1	110	22EB30	EB-13
22	.500	.1	.05	1	130	22EB50	EB-20
23	.100	.05	.05	1	79	23EB10	EB-10
23	.200	.1	.05	1	95	23EB20	EB-10
23	.300	.1	.05	1	110	23EB30	EB-13
23	.600	.1	.05	1	135	23EB60	EB-20
24	.100	.05	.05	1	79	24EB10	EB-10
24	.200	.1	.05	1	95	24EB20	EB-10
24	.350	.1	.05	1	115	24EB35	EB-13
24	.600	.1	.05	1	135	24EB60	EB-20
25	.100	.05	.05	1	79	25EB10	EB-10
25	.190	.1	.05	1	95	25EB19	EB-10
25	.325	.1	.05	1	115	25EB33	EB-13
25	.550	.1	.05	1	135	25EB55	EB-20
26	.080	.05	.05	1	79	26EB08	EB-10
26	.170	.1	.05	1	95	26EB17	EB-10
26	.300	.1	.05	1	110	26EB30	EB-13
26	.450	.1	.05	1	130	26EB45	EB-20
27	.080	.05	.05	1	79	27EB08	EB-10
27	.160	.1	.05	1	95	27EB16	EB-10
27	.300	.1	.05	1	110	27EB30	EB-13
27	.500	.1	.05	1	135	27EB50	EB-20
28	.080	.05	.05	1	79	28EB08	EB-10
28	.150	.1	.05	1	95	28EB15	EB-10
28	.300	.1	.05	1	115	28EB30	EB-13
28	.500	.1	.05	1	135	28EB50	EB-20
30	.080	.02	.02	1	85	30EB08	EB-13
32	.070	.02	.02	1	85	32EB07	EB-13
34	.060	.02	.02	1	85	34EB06	EB-13
35	.050	.02	.02	1	85	35EB05	EB-13
36	.050	.02	.02	1	85	36EB05	EB-13
38	.040	.02	.02	1	85	38EB04	EB-13
40	.030	.02	.02	1	85	40EB03	EB-13
40	.060	.02	.02	1	105	40EB06	EB-13
42	.030	.02	.02	1	85	42EB03	EB-13
44	.030	.02	.02	1	85	44EB03	EB-13
45	.030	.02	.02	1	85	45EB03	EB-13
48	.030	.02	.02	1	85	48EB03	EB-13
48	.050	.02	.02	1	105	48EB05	EB-13
50	.030	.02	.02	1	85	50EB03	EB-13
50	.050	.02	.02	1	105	50EB05	EB-13
55	.040	.02	.02	1	105	55EB04	EB-13
60	.050	.02	.02	1	105	60EB05	EB-13
65	.050	.02	.02	1	105	65EB05	EB-13
70	.040	.02	.02	1	105	70EB04	EB-13
75	.030	.02	.02	1	105	75EB03	EB-13
185	.025	Unregulated		2V	55	NX-25B	EB-10
185	.050	Unregulated		3.5V	75	NX-50B	EB-13

DUAL TRACKING OUTPUTS

Output Voltage Voltages	Current per Output Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ± %	Line ± %				
±5	.150	.1	.05	1.5	$ 85	DB5-15	EB-10
±5	.250	.1	.05	1.5	105	DB5-25	EB-10
±5	.500	.1	.05	1.5	145	DB5-50	EB-20
±10	.200	.05	.05	1	95	DB10-20	EB-10
±10	.300	.05	.05	1	125	DB10-30	EB-13
±10	.400	.1	.05	1	145	DB10-40	EB-20
±12	.100	.05	.05	1	75	DB12-10	EB-10
±12	.150	.05	.05	1	85	DB12-15	EB-10
±12	.200	.05	.05	1	95	DB12-20	EB-10

Output Voltage Voltages	Current per Output Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
±15	.100	.05	.05	1	$ 75	DB15-10	EB-10
±15	.150	.05	.05	1	85	DB15-15	EB-10
±15	.200	.05	.05	1	95	DB15-20	EB-10
±15	.300	.05	.05	1	115	DB15-30	EB-13
±15	.350	.05	.05	1	125	DB15-35	EB-13
±15	.500	.1	.05	1	145	DB15-50	EB-20

Acopian

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Acopian

SINGLE OUTPUT

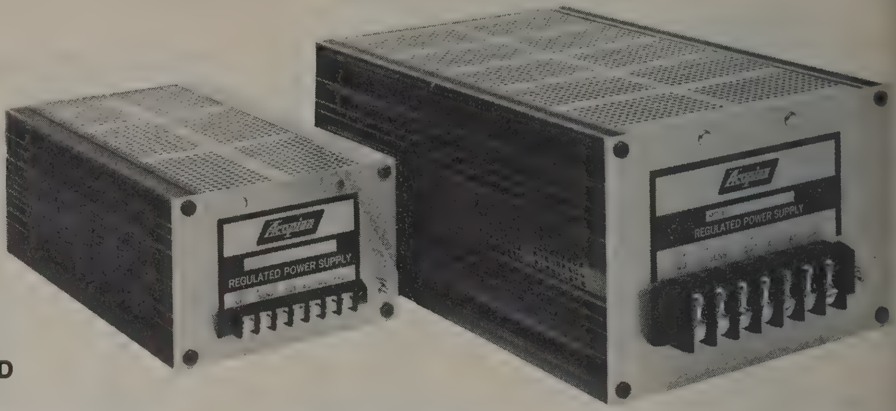
SERIES A

.005% REGULATION

SERIES B

.05 to .5% REGULATION

LINEAR REGULATED
AC-DC
GOLD BOX
SHIPPED IN 3 DAYS
ALL MODELS U.L. RECOGNIZED


Acopian
REGULATED POWER SUPPLY
Acopian
REGULATED POWER SUPPLY

A broad selection of power supplies offering unusually high performance—many models have regulation of ±0.005%. Electronic current limiting and provision for remote voltage sensing are standard features; overvoltage protection is available as a built-in option. Rugged extruded aluminum cases include threaded mounting holes on bottom, back, and side, permitting mounting in any position.

SERIES A HIGH PERFORMANCE POWER SUPPLIES

STANDARD FEATURES

- Provision for remote sensing and/or external output adjustment
- Short circuit proof with automatic recovery (electronic current limiting)
- Can be mounted on any of three surfaces (case sizes H8, H11 and H16, two surfaces)

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See pages 10 and 11. Series A supplies have model numbers beginning with the letter A.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, so that drops in the load line are compensated, is a standard feature.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Temperature Coefficient: 0.015%/°C (Typical).

Ambient Operating Temperature: −20 to +71°C.

Storage Temperature: −55 to +85°C.

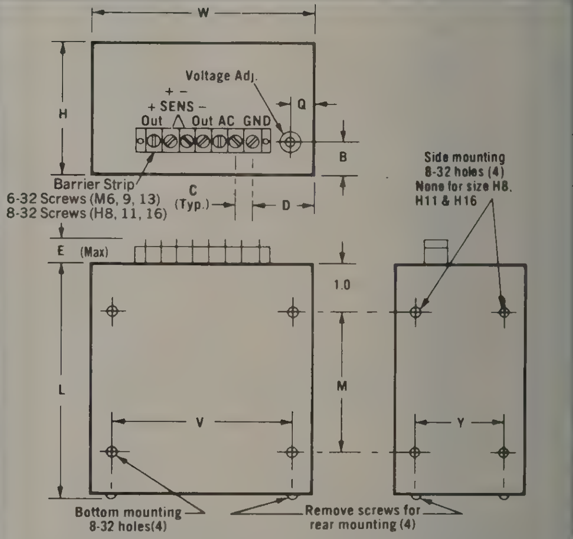
Response Time: Less than 20 microseconds.

OPTIONS

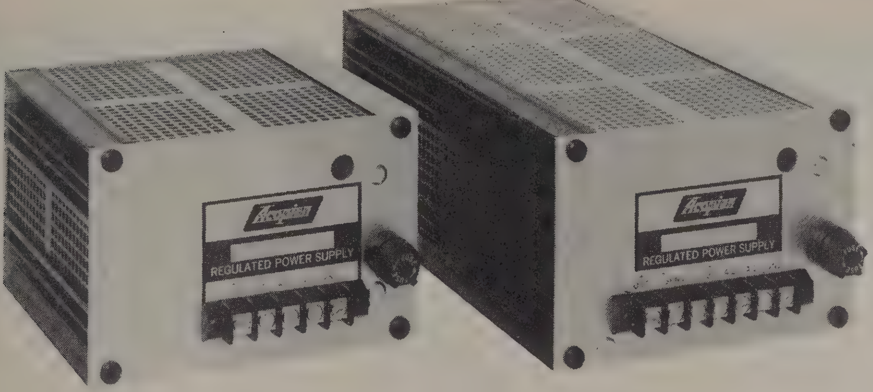
Overvoltage Protection: An internal preset overvoltage protector is available in models with outputs of 3 volts and higher. To order, add prefix "V" to the model number, and increase standard price as follows:

Outputs of	3-70V	75-150V
All case sizes except H16	$25.00	$35.00
Case size H16	75.00	85.00

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "−230" to model number and $25.00 to price. (For models in case sizes H8, H11 and H16, add $40.00.)


W
H
Voltage Adj.
+ −
+ SENS −
Out
Out AC GND
Q
B
Barrier Strip
6-32 Screws (M6, 9, 13)
8-32 Screws (H8, 11, 16)
C
(Typ.)
D
Side mounting
8-32 holes (4)
None for size H8.
H11 & H16
E (Max)
1.0
L
M
V
Y
Bottom mounting
8-32 holes(4)
Remove screws for
rear mounting (4)

Size	L	W	H	M	V	Y	E	Q	B	C	D	Approx. Weight
M6	6.59	5.12	3.44	4.0	4.5	3.0	.58	.5	.75	.375	1.44	4lb 4oz
M9	9.25	5.12	3.44	6.0	4.5	3.0	.58	.5	.75	.375	1.44	7lb 4oz
M13	13.25	5.12	3.44	10.0	4.5	3.0	.58	.5	.75	.375	1.44	11lb
H8	8.75	7.37	5.12	6.0	6.75	4.56	.78	1.12	1.25	.562	2.25	15lb 8oz
H11	11.25	7.37	5.12	8.0	6.75	4.56	.78	1.12	1.25	.562	2.25	18lb 4oz
H16	16.00	7.37	5.12	11.0	6.75	4.56	.78	1.12	1.25	.562	2.25	26 lb


Acopian
REGULATED POWER SUPPLY
Acopian
REGULATED POWER SUPPLY

These versatile supplies are ideal for powering digital circuitry, test sets, instrument bridges, and process control transmitters. Many models have regulation of ±0.1% or better. All components are generously derated to insure a long and trouble-free life, and they use the same rugged construction as the Series A line. Overvoltage protection and other options are available.

SERIES B GENERAL PURPOSE POWER SUPPLIES

STANDARD FEATURES

- Short circuit proof (electronic current limiting)
- May be mounted on any of three surfaces
- Completely serviceable

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See pages 10 and 11. Series B supplies have model numbers beginning with the letter B.

Remote Voltage Adjustment/Sensing: Available as an option. See below.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: 0 to +71°C.

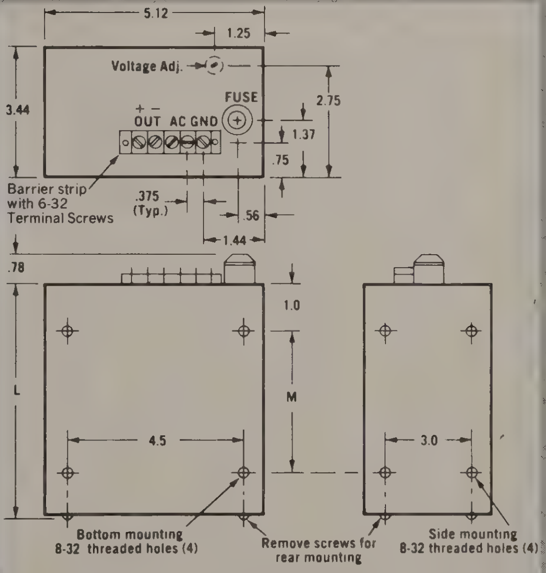
Storage Temperature: −55 to +85°C.

OPTIONS

Overvoltage Protection: An internal preset overvoltage protector is available in all models with outputs of 3 volts and higher. To order, add prefix "V" to the model number, and add $25.00 to the standard price of models with outputs of 3 to 70 volts; $35.00, for 75 to 200 volt outputs.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, so that drops in the load lines are compensated, is available on all models. (This option also permits the use of an externally located potentiometer to adjust output voltage.) To order, add prefix "R" to the model number. No increase in price.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "−230" to model number and $25.00 to price.


5.12
1.25
Voltage Adj.
3.44
FUSE
2.75
+ −
OUT AC GND
1.37
.75
Barrier strip with 6-32 Terminal Screws
.375 (Typ.)
.56
1.44
.78
1.0
L
M
4.5
3.0
Bottom mounting 8-32 threaded holes (4)
Remove screws for rear mounting
Side mounting 8-32 threaded holes (4)

Size	L	M	Approx. Weight
G3	3.71	1.62	3lb 2oz
G5	5.09	3.00	4lb 14oz
G6	6.59	4.00	5lb 8oz
G9	9.25	6.00	7lb 4oz
G13	13.25	10.00	11lb

Acopian SERIES A & B

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
1.5	5	6.0	4.3	3.5	.005	.005	.250	$205	A1.5MT600	M6
1.5	5	9.0	7.2	5.5	.005	.005	.250	235	A1.5MT900	M9
1.5	5	12.0	10.0	8.0	.005	.005	.250	280	A1.5MT1200	M13
1.5	5	22.0	18.5	15.5	.005	.005	250	360	A1.5H2200	H11
1.5	5	32.0	27.0	22.5	.005	005	.250	440	A1.5H3200	H16
2	5	6.0	4.3	3.5	005	005	250	205	A2MT600	M6
2	5	12.0	10.0	8.0	005	.005	.250	280	A2MT1200	M13
3	5	500	500	500	2	1	1	95	B3G50	G3
3	5	1.2	1.1	1.0	2	1	1	115	B3G120	G3
3	5	2.1	2.1	2.0	5	1	1	135	B3G210	G5
3	5	4.0	3.5	3.0	5	1	1.5	170	B3G400	G6
3	5	6.0	4.3	3.5	005	005	250	205	A3MT600	M6
3	5	9.0	7.2	5.5	005	005	250	235	A3MT900	M9
3	5	12.0	10.0	8.0	005	005	250	280	A3MT1200	M13
3	5	17.0	14.5	12.0	005	005	250	315	A3H1700	H8
3	5	20.0	16.5	13.5	005	005	250	360	A3H2000	H11
3	5	30.0	25.0	20.0	005	005	250	440	A3H3000	H16
3.6	5	500	500	500	2	1	1	95	B3.6G50	G3
3.6	5	1.2	1.1	1.0	2	1	1	115	B3.6G120	G3
3.6	5	2.1	2.1	2.0	5	1	1	135	B3.6G210	G5
3.6	5	4.0	3.5	3.0	5	1	1.5	170	B3.6G400	G6
3.6	5	6.0	4.3	3.5	005	005	250	205	A3.6MT600	M6
3.6	5	7.0	5.9	4.9	5	1	1.5	210	B3.6G700	G9
3.6	5	9.0	7.2	5.5	005	005	250	240	A3.6MT900	M9
3.6	5	12.0	10.0	8.0	005	005	250	280	A3.6MT1200	M13
3.6	5	17.0	14.5	12.0	005	005	250	315	A3.6H1700	H8
3.6	5	22.0	18.5	15.5	005	005	250	360	A3.6H2200	H11
3.6	5	32.0	27.0	22.5	005	005	250	440	A3.6H3200	H16
5	5	500	500	500	1	1	1	95	B5G50	G3
5	5	1.2	1.1	1.0	1	1	1	115	B5G120	G3
5	5	1.7	1.5	1.3	2	1	1.5	125	B5G170	G3
5	5	2.1	2.1	2.0	2	1	1.5	135	B5G210	G5
5	5	4.0	3.5	3.0	3	1	1.5	160	B5G400	G6
5	5	5.0	4.4	3.0	4	1	1.5	175	B5G500	G6
5	5	5.1	3.6	2.6	005	005	250	190	A5MT510	M6
5	5	6.0	4.3	3.5	005	005	250	210	A5MT600	M6
5	5	8.0	7.0	5.0	4	1	1.5	215	B5G800	G9
5	5	9.0	7.2	5.5	005	005	250	240	A5MT900	M9
5	5	10.0	9.0	7.0	4	1	1.5	245	B5G1000	G13
5	5	12.0	10.0	8.0	005	005	250	280	A5MT1200	M13
5	5	17.0	14.5	12.0	005	005	250	315	A5H1700	H8
5	5	22.0	18.5	15.0	005	005	250	360	A5H2200	H11
5	5	32.0	27.0	22.0	005	005	250	440	A5H3200	H16
6	1	500	500	500	1	1	1	95	B6G50	G3
6	5	1.2	1.1	1.0	1	1	1	115	B6G120	G3
6	5	1.7	1.5	1.3	2	1	1.5	125	B6G170	G3
6	5	3.2	3.1	3.0	3	1	1.5	155	B6G320	G6
6	5	4.9	3.5	2.5	005	005	250	175	A6MT490	M6
6	5	6.0	4.5	3.5	005	005	250	200	A6MT600	M6
6	5	8.5	7.5	5.2	005	005	250	240	A6MT850	M9
6	5	11.0	9.3	7.5	005	005	250	280	A6MT1100	M13
6	5	16.0	13.6	11.2	005	005	250	320	A6H1600	H8
6	5	21.0	17.0	14.0	005	005	250	365	A6H2100	H11
6	5	28.0	23.0	19.0	005	005	250	440	A6H2800	H16
7	1	500	500	500	1	05	1	100	B7G50	G3
7	1	1.0	1.0	1.0	1	1	1	125	B7G100	G3
7	5	2.0	2.0	2.0	2	1	1.5	145	B7G200	G5
7	5	3.0	2.7	2.5	3	1	1.5	165	B7G300	G6
7	5	5.0	4.0	3.0	005	005	250	200	A7MT500	M6
7	5	6.5	5.2	4.0	4	1	1.0	210	B7G650	G9
7	5	8.0	6.5	5.0	005	005	250	245	A7MT800	M9
7	5	10.0	8.0	7.0	4	1	1.5	255	B7G1000	G13
7	5	10.0	8.8	7.0	005	005	250	280	A7MT1000	M13
8	1	500	500	500	1	05	1	100	B8G50	G3
8	1	1.0	1.0	1.0	1	1	1	125	B8G100	G3
8	5	2.0	2.0	2.0	2	1	1.5	145	B8G200	G5
8	5	3.0	2.7	2.5	2	1	1.5	165	B8G300	G6
8	5	5.0	4.0	3.5	005	005	250	200	A8MT500	M6
8	5	6.5	5.2	4.0	3	1	1.5	220	B8G650	G9
8	5	8.0	6.5	5.0	005	005	250	245	A8MT800	M9
8	5	10.0	8.0	7.0	4	1	1.5	255	B8G1000	G13
8	5	10.5	8.8	7.0	005	005	250	280	A8MT1050	M13
8	5	20.0	16.8	13.5	005	005	250	385	A8H2000	H11
8	5	28.0	23.0	19.0	005	005	250	440	A8H2800	H16
9	1	500	500	500	1	05	1	100	B9G50	G3
9	1	1.0	1.0	1.0	1	1	1	125	B9G100	G3
9	5	2.0	2.0	2.0	2	1	1.5	145	B9G200	G5
9	5	3.0	2.7	2.5	2	1	1.5	165	B9G300	G6
9	5	6.5	5.2	4.0	3	1	1.5	220	B9G650	G9
9	5	10.0	8.3	7.0	005	005	250	280	A9MT1000	M13

*or 2 mv, whichever is greater

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
10	1	500	500	500	1	05	1	$95	B10G50	G3
10	1	1.0	1.0	1.0	.1	.1	1	115	B10G100	G3
10	.5	2.0	2.0	2.0	.2	.1	1.5	145	B10G200	G5
10	.5	3.0	2.7	2.5	.2	.1	1.5	165	B10G300	G6
10	.5	4.5	3.6	2.7	005	005	250	200	A10MT450	M6
10	5	6.0	5.0	4.0	3	1	1.5	220	B10G600	G9
10	5	7.5	6.0	4.5	005	005	250	250	A10MT750	M9
10	5	10.0	8.3	7.0	4	1	1.5	255	B10G1000	G13
10	5	10.0	8.3	7.0	005	005	250	280	A10MT1000	M13
10	5	14.0	11.9	9.8	005	005	250	335	A10H1400	H8
10	5	18.0	15.0	12.0	005	005	250	385	A10H1800	H11
10	5	25.0	20.0	16.5	005	005	250	440	A10H2500	H16
12	1	.500	.500	500	1	.05	1	95	B12G50	G3
12	1	1.0	1.0	1.0	.1	1	1	115	B12G100	G3
12	.5	2.0	1.7	1.5	2	1	1.5	140	B12G200	G5
12	.5	3.0	2.7	2.5	.2	1	1.5	160	B12G300	G6
12	.5	3.8	3.3	2.6	.2	1	1.5	170	B12G380	G6
12	.5	4.0	3.3	2.6	.005	005	250	195	A12MT400	M6
12	5	6.5	5.3	4.0	3	1	1.5	220	B12G650	G9
12	5	6.5	5.3	4.0	005	005	250	245	A12MT650	M9
12	.5	9.0	7.5	6.0	4	.1	1.5	255	B12G900	G13
12	.5	9.0	7.5	6.0	005	005	250	280	A12MT900	M13
12	.5	13.0	11.0	9.1	005	005	250	335	A12H1300	H8
12	5	17.0	14.3	11.5	005	005	250	385	A12H1700	H11
12	.5	21.0	17.5	14.5	005	005	250	440	A12H2100	H16
13	1	.500	500	.500	1	05	1	105	B13G50	G3
13	1	1.5	1.4	1.3	1	1	1.5	140	B13G150	G3
13	5	2.0	2.0	2.0	2	1	1.5	155	B13G200	G5
13	5	3.0	2.7	2.5	2	1	1.5	175	B13G300	G6
13	5	3.5	3.0	2.5	005	005	250	200	A13MT350	M6
13	5	5.0	4.5	4.0	2	1	1.5	215	B13G500	G9
13	5	8.0	7.5	7.0	3	1	1.5	255	B13G800	G13
13	5	8.0	7.5	7.0	005	005	250	280	A13MT800	M13
14	1	500	500	500	1	05	1	105	B14G50	G3
14	1	1.5	1.4	1.3	1	1	1.5	140	B14G150	G3
14	5	2.0	2.0	2.0	2	1	1.5	155	B14G200	G5
14	5	3.0	2.7	2.5	2	1	1.5	175	B14G300	G6
14	5	3.0	2.7	2.5	005	005	250	195	A14MT300	M6
14	5	5.0	4.5	4.0	2	1	1.5	210	B14G500	G9
14	5	7.0	6.5	6.0	3	1	1.5	255	B14G700	G13
14	5	8.0	7.5	7.0	005	005	250	280	A14MT800	M13
15	1	750	750	750	1	1	1	110	B15G75	G3
15	1	1.0	1.0	1.0	1	1	1	115	B15G100	G3
15	1	1.5	1.4	1.3	1	1	1.5	130	B15G150	G3
15	5	2.0	1.7	1.5	1	1	1.5	145	B15G200	G5
15	5	3.0	2.8	2.5	1	1	1.5	165	B15G300	G6
15	5	3.0	2.8	2.5	005	005	250	180	A15MT300	M6
15	5	4.2	3.8	3.0	15	1	1.5	195	B15G420	G9
15	5	5.5	4.7	4.0	005	005	250	245	A15MT550	M9
15	5	6.0	5.0	4.0	2	1	1.5	235	B15G600	G9
15	5	7.0	6.0	5.0	2	1	1.5	255	B15G700	G13
15	5	8.0	6.5	5.5	005	005	250	280	A15MT800	M13
15	5	11.5	9.7	8.0	005	005	250	335	A15H1150	H8
15	5	15.0	12.8	10.5	005	005	250	380	A15H1500	H11
15	5	19.0	16.3	13.5	005	005	250	440	A15H1900	H16
16	1	300	300	300	05	05	1	80	B16G30	G3
16	5	1.0	1.0	1.0	1	1	1	125	B16G100	G3
16	5	3.0	2.5	2.0	15	1	1	190	B16G300	G9
16	5	5.0	5.0	5.0	2	1	1.5	245	B16G500	G9
16	5	6.5	6.0	5.5	005	005	250	280	A16MT650	M13
18	1	300	300	300	05	05	1	80	B18G30	G3
18	1	750	750	750	1	1	1	110	B18G75	G3
18	5	1.1	1.1	1.0	1	1	1	125	B18G110	G5
18	5	2.1	2.0	1.8	1	1	1	155	B18G210	G5
18	5	2.1	2.1	2.0	005	005	250	175	A18MT210	M6
18	5	3.0	2.8	2.5	15	1	1	190	B18G300	G9
18	5	4.5	4.0	3.5	005	005	250	235	A18MT450	M9
18	5	6.5	6.0	5.5	005	005	250	280	A18MT650	M13
18	5	14.0	12.0	10.0	005	005	250	385	A18H1400	H11
18	5	18.0	15.5	13.0	005	005	250	440	A18H1800	H16
20	1	300	300	300	05	05	1	80	B20G30	G3
20	1	750	750	750	1	05	1	110	B20G75	G3
20	1	1.1	1.1	1.0	1	1	1	125	B20G110	G5
20	5	1.7	1.7	1.5	1	1	1.5	140	B20G170	G5
20	5	2.0	2.0	2.0	005	005	250	180	A20MT200	M6
20	5	2.7	2.0	1.2	15	1	1.5	190	B20G270	G6
20	5	4.0	3.5	3.0	005	005	250	235	A20MT400	M9
20	5	5.0	5.0	5.0	15	1	1.5	250	B20G500	G13
20	5	6.0	5.5	5.0	005	005	250	280	A20MT600	M13
20	5	9.5	8.0	6.6	005	005	250	335	A20H950	H8

*or 2 mv, whichever is greater

Acopian

(610) area code after 1993

P.O. Box 638, Easton, PA 18044 • Phone: (215) 258-5441 • FAX: (215) 258-2842

Nominal Output Voltage	Ad-just ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
20	5	13 0	11 3	9 5	005	005	250	$385	A20H1300	H11
20	5	16 0	14 0	12 0	005	005	250	440	A20H1600	H16
24	1	300	300	300	05	05	1	80	B24G30	G3
24	1	750	750	750	1	05	1	115	B24G75	G3
24	1	1 1	1 1	1 0	1	1	1 5	130	B24G110	G5
24	5	1 7	1 7	1 5	1	1	1 5	145	B24G170	G5
24	5	2 1	2 0	2 0	1	1	1 5	160	B24G210	G5
24	5	2 1	2 0	2 0	005	005	250	185	A24MT210	M6
24	5	3 5	3 0	2 5	15	1	1 5	205	B24G350	G9
24	5	3 5	3 0	2 5	005	005	250	245	A24MT350	M9
24	5	5 0	5 0	5 0	15	1	1 5	255	B24G500	G13
24	5	5 5	5 0	4 5	005	005	250	280	A24MT550	M13
24	5	8 5	7 2	5 9	005	005	250	335	A24H850	H8
24	5	12 0	10 5	9 0	005	005	250	385	A24H1200	H11
24	5	15 0	13 0	11 0	005	005	250	440	A24H1500	H16
25	1	300	300	300	05	05	1	100	B25G30	G3
25	1	750	750	750	1	05	1	120	B25G75	G3
25	1	1 1	1 1	1 1	1	1	1 5	140	B25G110	G5
25	5	1 7	1 7	1 5	1	1	1 5	165	B25G170	G5
25	5	2 1	2 1	2 0	1	1	1 5	170	B25G210	G5
25	5	3 5	3 0	2 5	15	1	1 5	210	B25G350	G9
25	5	5 0	5 0	5 0	15	1	1 5	265	B25G500	G13
28	1	300	300	300	05	05	1	100	B28G30	G3
28	1	500	500	500	05	05	1	110	B28G50	G3
28	1	800	800	800	1	05	1	120	B28G80	G5
28	1	1 1	1 1	1 0	1	05	1	135	B28G110	G5
28	5	1 8	1 6	1 5	1	1	1 5	160	B28G180	G5
28	5	2 1	2 1	2 0	1	1	1 5	170	B28G210	G5
28	5	2 1	2 1	2 0	005	005	250	190	A28MT210	M6
28	5	3 0	2 7	2 5	15	1	1 5	200	B28G300	G9
28	5	3 0	2 7	2 5	005	005	250	225	A28MT300	M9
28	5	5 0	5 0	5 0	15	1	1 5	255	B28G500	G13
28	5	5 0	5 0	5 0	005	005	250	280	A28MT500	M13
28	5	8 0	6 8	5 6	005	005	250	335	A28H800	H8
28	5	11 0	9 5	8 0	005	005	250	385	A28H1100	H11
28	5	14 0	12 0	10 0	005	005	250	440	A28H1400	H16
30	1	300	300	300	05	05	1	100	B30GT30	G3
30	1	500	500	500	05	05	1	115	B30GT50	G3
30	1	1 1	1 1	1 0	1	1	1	145	B30GT110	G5
30	5	1 7	1 6	1 5	1	1	1 5	160	B30GT170	G5
30	5	2 1	2 1	2 0	1	1	1 5	175	B30G210	G6
30	5	2 1	2 1	2 0	005	005	250	195	A30MT210	M6
30	5	3 0	2 7	2 5	005	005	250	230	A30MT300	M9
30	5	5 0	5 0	5 0	15	1	1 5	260	B30GT500	G13
30	5	5 0	5 0	5 0	005	005	250	280	A30MT500	M13
30	5	7 5	6 3	5 2	005	005	250	340	A30H750	H8
30	5	10 0	9 0	8 0	005	005	250	395	A30H1000	H11
30	5	14 0	12 0	10 0	005	005	250	455	A30H1400	H16
32	1	300	300	300	05	05	1	100	B32GT30	G3
32	1	500	500	500	05	05	1	115	B32GT50	G3
32	1	1 0	1 0	1 0	1	1	1	145	B32GT100	G5
32	1	1 5	1 5	1 5	1	1	1 5	170	B32GT150	G5
32	5	1 8	1 6	1 3	005	005	250	205	A32MT180	M6
32	5	2 5	2 1	1 7	005	005	250	245	A32MT250	M9
32	5	9 0	7 5	6 0	005	005	250	410	A32HT900	H11
34	1	300	300	300	05	05	1	100	B34GT30	G3
34	1	800	800	800	1	1	1	145	B34GT80	G5
34	1	1 5	1 5	1 5	1	1	1 5	175	B34GT150	G5
35	1	100	100	100	05	05	1	90	B35GT10	G3
35	1	300	300	300	05	05	1	100	B35GT30	G3
35	1	500	500	500	05	05	1	120	B35GT50	G3
35	1	600	600	600	1	05	1	135	B35GT60	G3
35	1	800	800	800	1	1	1 5	145	B35GT80	G5
36	1	100	100	100	05	05	1	90	B36GT10	G3
36	1	500	500	500	05	05	1	120	B36GT50	G3
36	1	800	750	700	1	05	1	145	B36GT80	G5
36	5	1 3	1 3	1 3	1	1	1 5	160	B36GT130	G6
36	5	1 3	1 3	1 3	005	005	250	200	A36MT130	M6
36	5	2 3	2 0	1 8	1	1	1 5	225	B36GT230	G9
36	5	2 3	2 0	1 8	005	005	250	245	A36MT230	M9
36	5	4 0	3 2	2 5	005	005	250	290	A36MT400	M13
36	5	8 0	6 6	5 3	005	005	250	410	A36HT800	H11
36	5	11 0	9 1	7 2	005	005	250	510	A36HT1100	H16
40	1	200	200	200	05	05	1	105	B40GT20	G3
40	1	400	400	400	05	05	1	130	B40GT40	G3
40	1	500	500	500	1	05	1	145	B40GT50	G5
40	1	1 0	1 0	1 0	1	1	1 5	165	B40GT100	G6
45	1	200	200	200	05	05	1	105	B45GT20	G3
45	1	400	400	400	05	05	1	140	B45GT40	G3
48	1	200	200	200	05	05	1	$105	B48GT20	G3
48	1	400	400	400	05	05	1	145	B48GT40	G3
48	1	600	600	600	1	1	1	175	B48GT60	G5
48	1	1 1	1 0	600	1	1	1 5	190	B48GT110	G6
48	1	1 2	1 0	800	005	005	250	215	A48MT120	M6
48	1	1 8	1 6	1 2	005	005	250	250	A48MT180	M9
48	1	3 0	2 6	2 1	005	005	250	290	A48MT300	M13
48	1	6 0	5 0	4 0	005	005	250	410	A48HT600	H11
48	1	8 5	7 2	5 5	005	005	250	510	A48HT850	H16
50	1	400	400	400	05	05	1	155	B50GT40	G3
50	1	500	500	500	05	05	1	180	B50GT50	G5
50	1	1 0	800	700	005	005	250	225	A50MT100	M6
50	1	1 5	1 3	1 0	005	005	250	265	A50MT150	M9
50	1	2 7	2 3	1 8	005	005	250	305	A50MT270	M13
50	1	6 0	5 0	4 0	005	005	250	420	A50HT600	H11
50	1	8 0	6 6	5 2	005	005	250	510	A50HT800	H16
55	1	300	300	300	05	05	1	155	B55GT30	G3
55	1	500	500	500	05	05	1	185	B55GT50	G5
60	1	200	200	200	05	05	1	130	B60GT20	G3
60	1	300	300	300	05	05	1	160	B60GT30	G3
60	1	400	400	400	05	05	1	185	B60GT40	G5
60	1	850	720	600	005	005	250	230	A60MT85	M6
60	1	1 2	1 0	800	005	005	250	265	A60MT120	M9
60	1	2 5	2 1	1 7	005	005	250	305	A60MT250	M13
60	1	5 0	4 1	3 3	005	005	250	425	A60HT500	H11
60	1	7 0	5 8	4 6	005	005	250	515	A60HT700	H16
65	1	300	300	300	05	05	1	160	B65GT30	G3
70	1	100	100	100	05	05	1	120	B70GT10	G3
70	1	300	300	300	05	05	1	160	B70GT30	G3
75	1	050	050	050	05	05	1	105	B75GT05	G3
75	1	200	200	200	05	05	1	155	B75GT20	G3
75	1	600	500	400	005	005	250	230	A75MT60	M6
75	1	1 0	830	660	005	005	250	270	A75MT100	M9
75	1	2 0	1 8	1 5	005	005	250	305	A75MT200	M13
75	1	4 0	3 3	2 6	01	01	1	425	A75HT400	H11
75	1	5 6	4 6	3 6	01	01	1	520	A75HT560	H16
80	1	100	100	100	05	05	1	135	B80GT10	G3
80	1	200	200	200	05	05	1	160	B80GT20	G3
85	1	200	200	200	05	05	1	160	B85GT20	G3
90	1	200	200	200	05	05	1	160	B90GT20	G3
90	1	500	400	300	005	005	250	230	A90MT50	M6
90	1	800	700	600	005	005	250	270	A90MT80	M9
90	1	1 5	1 3	1 0	005	005	250	305	A90MT150	M13
90	1	3 3	2 7	2 1	01	01	1	435	A90HT330	H11
90	1	4 4	3 6	2 9	01	01	1	525	A90HT440	H16
95	1	200	200	200	05	05	1	165	B95GT20	G3
100	1	100	100	100	05	05	1	150	B100GT10	G3
100	1	200	200	200	05	05	1	165	B100GT20	G3
100	1	460	460	340	1	1	1 5	200	B100GT46	G6
100	1	650	650	650	1	1	1 5	225	B100G65	G6
100	1	700	600	500	005	005	250	265	A100M70	M6
100	1	1 3	1 2	1 0	005	005	250	305	A100MT130	M13
100	1	3 0	2 5	2 0	01	01	1	435	A100HT300	H11
100	1	4 0	3 3	2 6	01	01	1	525	A100HT400	H16
110	1	200	200	200	05	05	1	170	B110GT20	G3
120	1	100	100	100	05	05	1	155	B120GT10	G3
120	1	200	200	200	05	05	1	170	B120GT20	G3
120	1	400	400	300	1	1	1 5	195	B120GT40	G6
120	1	550	550	550	1	1	1 5	235	B120G55	G6
120	1	600	500	400	005	005	250	275	A120M60	M6
120	1	1 2	1 1	1 0	005	005	250	305	A120MT120	M13
120	1	2 5	2 0	1 6	01	01	1	445	A120HT250	H11
120	1	3 5	2 9	2 3	01	01	1	535	A120HT350	H16
125	1	200	200	200	05	05	1	190	B125GT20	G3
130	1	200	200	200	05	05	1	195	B130GT20	G3
135	1	200	200	200	05	05	1	195	B135GT20	G3
140	1	200	200	200	05	05	1	195	B140GT20	G3
150	1	100	100	100	05	05	1	160	B150GT10	G3
150	1	200	200	200	05	05	1	190	B150GT20	G3
150	1	320	320	250	1	1	1 5	210	B150GT32	G6
150	1	420	420	420	1	1	1 5	225	B150GT42	G9
150	1	1 0	900	800	005	005	250	335	A150MT100	M13
150	1	3 0	2 5	2 0	01	01	1	555	A150HT300	H16
200	1	100	100	100	1	05	1 5	190	B200GT10	G3

*or 2 mv, whichever is greater

*or 2 mv, whichever is greater

Acopian

(610) area code after 1993

P.O. Box 638, Easton, PA 18044 • Phone: (215) 258-5441 • FAX: (215) 258-2842

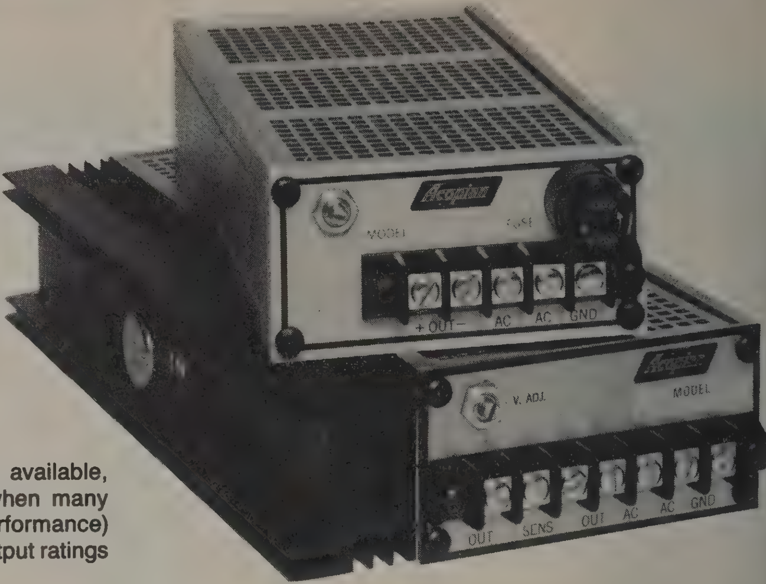
Acopian

NARROW PROFILE SINGLE OUTPUT

LINEAR REGULATED AC-DC

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED


Acopian
MODEL
FUSE
+ OUT −
AC
AC
GND
Acopian
V. ADJ.
MODEL
OUT
SENS
OUT
AC
AC
GND

Where only a narrow mounting space is available, Acopian narrow profile power supplies fit when many others cannot. Choose from Series A (high performance) and Series B (general purpose) models with output ratings up to 150 volts, up to 3.5 amps.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See table.
- **Series A:** Model numbers begin with the letter A.
- **Series B:** Model numbers begin with the letter B.

Remote Voltage Adjustment/Sensing: Standard in Series A, not available in Series B.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Temperature Coefficient:
- **Series A:** 0.015%/°C (Typical).
- **Series B:** 0.02%/°C (Typical).

Ambient Operating Temperature:
- **Series A:** −20 to +71°C.
- **Series B:** 0 to +71°C.

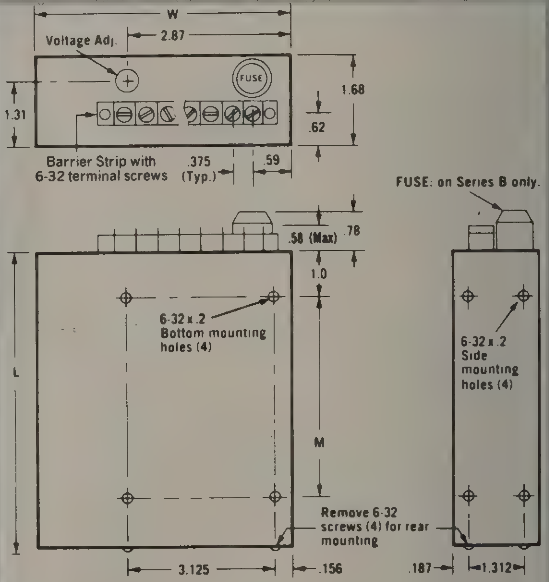
Storage Temperature: −55 to +85°C.

Overload/Short Circuit Protection:
- **Series A:** Foldback current limiting with automatic recovery.
- **Series B:** Input fuse and output current limiting.

OPTIONS

Overvoltage Protection: An internal preset overvoltage protector is available on all models with outputs of 3 volts and higher. To order, add prefix "V" to the model number and add $25.00 to the standard price of models with outputs of 3 to 70 volts; $35.00, for 75 to 150 volt outputs.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "−230" to model number and $25.00 to price.


W
Voltage Adj.
2.87
FUSE
1.68
1.31
.62
Barrier Strip with 6-32 terminal screws
.375 (Typ.)
.59
FUSE: on Series B only.
.58 (Max)
.78
1.0
6-32 x .2 Bottom mounting holes (4)
L
M
6-32 x .2 Side mounting holes (4)
Remove 6-32 screws (4) for rear mounting
3.125
.156
.187
1.312

Size	L	W	M	Approx. Weight
F6T	6.59	3.84	4.0	2 lb 4 oz
F8T	8.47	3.84	5.0	3 lb 2 oz
N8T	8.47	3.84	5.0	3 lb 2 oz
N8H	8.47	4.68	5.0	3 lb 14 oz

NARROW PROFILE SINGLE OUTPUT

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
1	.5	2.2	2.1	2.0	.005	.005	.250	$150	A1NT220	N8T
1	.5	3.5	3.5	3.0	.005	.005	.250	180	A1NT350	N8H
1.5	.5	2.2	2.1	2.0	.005	.005	.250	150	A1.5NT220	N8T
1.5	.5	3.5	3.5	3.0	.005	.005	.250	180	A1.5NT350	N8H
2	.5	2.2	2.1	2.0	.005	.005	.250	150	A2NT220	N8T
2	.5	3.0	3.0	3.0	.005	.005	.250	180	A2NT300	N8H
3	.5	1.0	1.0	1.0	.5	.1	1	125	B3TN100	F6T
3	.5	2.2	2.1	2.0	.005	.005	.250	150	A3NT220	N8T
3	.5	3.5	3.5	3.0	.005	.005	.250	180	A3NT350	N8H
3.6	.5	1.0	1.0	1.0	.5	.1	1	125	B3.6TN100	F6T
3.6	.5	2.2	2.1	2.0	.005	.005	.250	150	A3.6NT220	N8T
3.6	.5	3.5	3.5	3.0	.005	.005	.250	180	A3.6NT350	N8H
5	.5	1.0	1.0	1.0	.1	.1	1	120	B5TN100	F6T
5	.5	1.1	1.0	1.0	.005	.005	.250	130	A5TN110	N8T
5	.5	2.2	2.1	2.0	.005	.005	.250	150	A5NT220	N8T
5	.5	3.5	3.5	3.0	.005	.005	.250	180	A5NT350	N8H
6	.5	1.0	1.0	1.0	.1	.1	1	125	B6TN100	F6T
6	.5	2.2	2.1	2.0	.005	.005	.250	150	A6NT220	N8T
6	5	2.7	2.7	2.7	.005	.005	.250	180	A6NT270	N8H
7	1	1.0	1.0	1.0	.1	.1	1	125	B7TN100	F6T
7	.5	1.1	1.0	1.0	.005	.005	.250	145	A7TN110	N8T
7	.5	2.0	2.0	2.0	.005	.005	.250	170	A7NT200	N8H
8	1	1.0	1.0	1.0	.1	.1	1	125	B8TN100	F6T
8	.5	1.1	1.0	1.0	.005	.005	.250	145	A8TN110	N8T
8	.5	2.0	2.0	2.0	.005	.005	.250	170	A8NT200	N8H
9	1	1.0	1.0	1.0	.1	.1	1	125	B9TN100	F6T
9	.5	1.1	1.0	1.0	.005	.005	.250	145	A9TN110	N8T
9	.5	2.0	2.0	2.0	.005	.005	.250	170	A9NT200	N8H
10	1	1.0	1.0	1.0	.1	.1	1	130	B10TN100	F6T
10	.5	1.1	1.0	1.0	.005	.005	.250	145	A10TN110	N8T
10	.5	2.0	2.0	2.0	.005	.005	.250	170	A10NT200	N8H
11	1	1.0	1.0	.750	.1	.1	1	130	B11TN100	F6T
11	.5	1.1	1.0	1.0	.005	.005	250	145	A11TN110	N8T
11	.5	2.0	2.0	2.0	.005	.005	.250	170	A11NT200	N8H
12	1	1.0	1.0	.750	.1	.1	1	130	B12TN100	F6T
12	.5	1.1	1.0	1.0	.005	.005	.250	145	A12TN110	N8T
12	.5	2.0	2.0	2.0	.005	.005	.250	170	A12NT200	N8H
13	1	1.0	1.0	.750	.1	.1	1	130	B13TN100	F6T
13	.5	1.1	1.0	1.0	.005	.005	.250	145	A13TN110	N8T
13	.5	2.0	2.0	2.0	.005	.005	.250	170	A13NT200	N8H
14	1	1.0	1.0	.750	.1	.1	1	130	B14TN100	F6T
14	.5	1.1	1.0	1.0	.005	.005	.250	145	A14TN110	N8T
14	.5	2.0	2.0	2.0	.005	.005	.250	170	A14NT200	N8H
15	1	1.0	1.0	.750	.1	.1	1	130	B15TN100	F6T
15	.5	1.1	1.0	1.0	.005	.005	.250	145	A15TN110	N8T
15	.5	2.0	2.0	2.0	.005	.005	.250	170	A15NT200	N8H
16	1	1.0	1.0	.750	.1	.1	1	130	B16TN100	F6T
16	.5	1.0	1.0	1.0	.005	.005	.250	145	A16TN100	N8T
16	.5	1.75	1.75	1.75	.005	.005	.250	170	A16NT175	N8H
18	1	.750	.750	.750	.1	.1	1	130	B18TN75	F6T
18	.5	1.0	1.0	1.0	.005	.005	.250	145	A18TN100	N8T
18	.5	1.5	1.5	1.5	.005	.005	.250	170	A18NT150	N8H
20	1	.500	.500	.500	.1	.1	1	115	B20TN50	F6T
20	.5	.900	.900	.900	.005	.005	.250	145	A20TN90	N8T
20	.5	1.25	1.25	1.25	.005	.005	.250	170	A20NT125	N8H
24	1	.750	.750	.750	.1	.1	1	130	B24TN75	F6T
24	.5	1.0	1.0	1.0	.005	.005	.250	150	A24TN100	N8T
24	.5	1.25	1.25	1.25	.005	.005	.250	175	A24NT125	N8H
25	1	.750	.750	.750	.1	.05	1	130	B25TN75	F6T
25	.5	.750	.750	.750	.005	.005	.250	150	A25TN75	N8T
25	.5	1.25	1.25	1.25	.005	.005	.250	175	A25NT125	N8H

*or 2 mv, whichever is greater

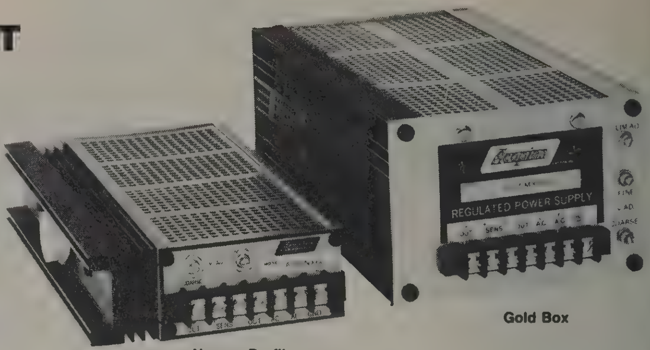
Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
26	1	.750	.750	.750	.1	.05	1	$130	B26TN75	F6T
26	.5	1.2	1.25	1.25	.005	.005	.250	175	A26NT125	N8H
28	1	.700	.700	.700	.1	.05	1	130	B28TN70	F6T
28	.5	.800	.800	.800	.005	.005	.250	150	A28NT80	N8T
28	.5	1.25	1.25	1.25	.005	.005	.250	175	A28NT125	N8H
30	1	.500	.500	.500	.05	.05	1	130	B30TN50	F6T
30	.5	.750	.750	.750	.005	.005	.250	155	A30NT75	N8T
30	.5	1.1	1.1	1.1	.005	.005	.250	180	A30NT110	N8H
32	1	.400	.400	.400	.05	.05	1	125	B32TN40	F6T
32	.5	.600	.600	.600	.005	.005	.250	150	A32TN60	N8T
34	1	.400	.400	.400	.05	.05	1	125	B34TN40	F6T
34	.5	1.1	1.1	1.1	.005	.005	.250	180	A34NT110	N8H
35	1	.400	.400	.400	.05	.05	1	125	B35TN40	F6T
35	.5	.600	.600	.600	.005	.005	.250	150	A35TN60	N8T
35	.5	1.1	1.1	1.1	.005	.005	.250	180	A35NT110	N8H
36	1	400	.400	.400	.05	.05	1	125	B36TN40	F6T
36	.5	.600	.600	.600	.005	.005	.250	150	A36TN60	N8T
36	.5	1.0	1.0	1.0	.005	.005	.250	180	A36NT100	N8H
38	1	.200	.200	.200	.05	.05	1	115	B38TN20	F6T
40	1	.400	.400	.400	.05	.05	1	135	B40TN40	F6T
40	.5	.750	.750	.750	.005	.005	.250	170	A40NT75	N8T
45	1	.400	.400	.400	.05	.05	1	145	B45TN40	F6T
45	.5	.600	.600	.600	.005	.005	.250	175	A45NT60	N8T
48	1	.400	.400	.400	.05	.05	1	150	B48TN40	F6T
48	.5	.500	.500	.500	.005	.005	.250	180	A48NT50	N8T
50	1	.400	.400	.400	.05	.05	1	160	B50FT40	F6T
50	1	.450	.450	.450	.005	.005	.250	185	A50NT45	N8T
55	1	.200	.200	.200	.05	.05	1	135	B55FT20	F6T
55	1	.400	.400	.400	.005	.005	.250	185	A55NT40	N8T
60	1	.150	.150	.150	.05	.05	1	135	B60FT15	F6T
60	1	.350	.350	.350	.005	.005	.250	185	A60NT35	N8T
65	1	.100	.100	.100	.05	.05	1	130	B65FT10	F6T
65	1	.250	.250	.250	.05	.05	1	165	B65FT25	F8T
65	1	.270	.270	.270	.005	.005	.250	185	A65NT27	N8T
67	1	.100	.100	.100	.05	.05	1	130	B67FT10	F6T
70	1	.100	.100	.100	.05	.05	1	130	B70FT10	F6T
70	1	.250	.250	.250	.005	.005	.250	185	A70NT25	N8T
75	1	.200	.200	.200	.05	.05	1	160	B75FT20	F8T
75	1	.250	.250	.250	.005	.005	.250	185	A75NT25	N8T
80	1	.100	.100	.100	.05	.05	1	140	B80FT10	F6T
80	1	.200	.200	.200	.05	.05	1	160	B80FT20	F8T
80	1	.250	.250	.250	005	.005	.250	185	A80NT25	N8T
85	1	.250	.250	.250	.005	.005	.250	185	A85NT25	N8T
90	1	.100	.100	.100	.05	.05	1	145	B90FT10	F6T
90	1	.200	.200	.200	.05	.05	1	165	B90FT20	F8T
90	1	.250	.250	.250	.005	.005	.250	190	A90NT25	N8T
95	1	.200	.200	.200	.05	.05	1	170	B95FT20	F8T
95	1	.200	.200	.200	.005	.005	.250	185	A95NT20	N8T
100	1	.100	.100	.100	.05	.05	1	160	B100FT10	F6T
100	1	.200	.200	.200	.05	.05	1	175	B100FT20	F8T
100	1	.200	.200	.200	.005	.005	.250	195	A100NT20	N8T
110	1	.100	.100	.100	.05	.05	1	160	B110FT10	F6T
115	1	.100	.100	.100	.05	.05	1	160	B115FT10	F6T
120	1	.050	.050	.050	.05	.05	1	155	B120FT05	F6T
120	1	.200	.200	.200	.05	.05	1	180	B120FT20	F8T
120	1	.200	.200	.200	.005	.005	.250	195	A120NT20	N8T
125	1	.050	.050	.050	.05	.05	1	155	B125FT05	F6T
125	1	.200	.200	.200	.05	.05	1	180	B125FT20	F8T
125	1	.200	.200	.200	.005	.005	.250	195	A125NT20	N8T
150	1	.100	.100	.100	.05	.05	1	175	B150FT10	F8T
150	1	.100	.100	.100	.005	.005	.250	195	A150NT10	N8T

*or 2 mv, whichever is greater

Acopian

WIDE OUTPUT ADJUSTMENT

FIXED & ADJUSTABLE CURRENT LIMITING LINEAR REGULATED AC-DC



Narrow Profile

Gold Box

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED

Power supplies with the broad adjustment capability required for analog instrumentation and circuitry, electronic system development; basic research, and similar applications.

For applications requiring a constant current or adjustable current limiting, a power supply with a true constant current characteristic, such as those with model numbers beginning with the letter P, should be used.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Regulation, Ripple (constant voltage operation):
Line Regulation: ±0.005% or 2 mV, whichever is greater.
Load Regulation: ±0.005% or 2 mV, whichever is greater.
Ripple: 0.25 mV rms.

Regulation, Ripple (constant current operation):
Line Regulation: ±0.1% or 2 mA.
Load Regulation: ±0.2% or 5 mA.
Ripple: 0.1% rms.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, to compensate voltage drops in output wiring, is a standard feature.

Remote Voltage Programming: The output voltage of all models may be controlled by means of external resistance connected in series with the −S lead.

Voltage Programming Coefficient: See table. Calibration tolerance, ±2%.

Current Limiting: Models with fixed current limiting have a roll off characteristic with automatic recovery. All others have current limiting with a constant-voltage/constant-current crossover characteristic.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Temperature Coefficient: 0.015%/°C (Typical).

Ambient Operating Temperature: −20 to +71°C.

Storage Temperature: −55 to +85°C.

OPTIONS

Remote Current Limiting Adjustment: All models having numbers beginning with the letter P have a built in (front panel) current limit control. Provision for control of the current limit setting by adjustment of an external resistance is available as an option. To order, add the prefix letter "E" to the model number, and add $10.00 to the standard price.

The current limit setting is inversely related to resistance. Use a 200 ohm ½ W potentiometer.

Overvoltage Protection: An internally mounted overvoltage protection circuit, fixed set approximately 20% above the maximum output voltage rating of the supply, is available on all models. To order, add prefix "V" to the model number, and increase standard price as follows:

Maximum output of	**6-60V**	**100-150V**
All case sizes except H16 . .	$25.00	$35.00
Case size H16	75.00	

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "- 230" to model number and $25.00 to price. (For models in case sizes H11 and H16, add $40.00.)

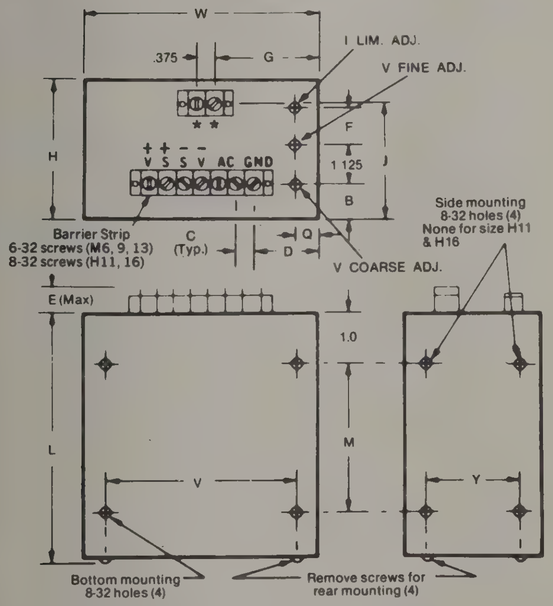
GOLD BOX MODELS

Output Voltage Range	Output Current Amps. at 40°C	55°C	71°C	Voltage Prgmg. Coeff. (Ω/V)	Case Size	Voltage Programmable Fixed Current Limiting Model	Price	Voltage Programmable Adjustable Current Limiting Model	Price
0-6	1.2	1.2	1.2	820	M6	A06MX120	$165	P06MX120	$185
0-6	2.0	2.0	2.0	820	M6	A06MX200	185	P06MX200	205
0-6	3.0	2.5	2.0	820	M6	A06MX300	215	P06MX300	235
0-6	5.0	4.0	3.0	820	M9	A06MX500	260	P06MX500	280
0-6	8.0	7.0	6.0	820	M13	A06MX800	300	P06MX800	320
0-6	12.0	10.0	7.0	820	H11	A06HX1200	385	P06HX1200	405
0-6	16.0	13.0	10.0	820	H16	A06HX1600	460	P06HX1600	480
0-15	1.0	1.0	1.0	330	M6	A015MX100	155	P015MX100	175
0-15	2.0	1.6	1.2	330	M6	A015MX200	205	P015MX200	225
0-15	3.0	2.4	1.8	330	M9	A015MX300	260	P015MX300	280
0-15	5.0	4.0	2.5	330	M13	A015MX500	300	P015MX500	320
0-15	8.0	6.0	4.0	330	H11	A015HX800	400	P015HX800	420
0-15	10.0	8.0	6.0	330	H16	A015HX1000	460	P015HX1000	480
0-30	.50	.50	.50	160	M6	A030MX50	175	P030MX50	195
0-30	1.0	1.0	1.0	160	M6	A030MX100	205	P030MX100	225
0-30	1.6	1.4	1.2	160	M9	A030MX160	245	P030MX160	265
0-30	2.5	2.0	1.5	160	M13	A030MX250	295	P030MX250	315
0-30	4.0	3.0	2.0	160	H11	A030HX400	410	P030HX400	430
0-30	5.0	4.0	3.0	160	H16	A030HX500	475	P030HX500	495
0-50	.35	.34	.33	1000	M6	A050MX35	195	P050MX35	215
0-50	.60	.50	.40	1000	M6	A050MX60	245	P050MX60	265
0-50	.85	.75	.65	1000	M9	A050MX85	285	P050MX85	305
0-100	.10	.09	.08	500	M6	A0100MX10	245	P0100MX10	265
0-100	.25	.20	.15	500	M6	A0100MX25	285	P0100MX25	305

NARROW PROFILE MODELS FOR LIMITED SPACE APPLICATIONS

Output Voltage Range	Output Current Amps. (To +71°C)	Voltage Prgmg. Coeff. (Ω/V)	Case Size	Model	Price
0-7	1.0	700	N8T	A07XN100	$155
0-7	2.1	700	N8H	A07NX210	190
0-18	.400	270	N8T	A018XN40	150
0-18	1.0	270	N8H	A018NX100	180
0-32	.250	150	N8T	A032XN25	135
0-32	.600	150	N8H	A032NX60	180
0-60	.125	820	N8T	A060NX12	160
0-60	.250	820	N8H	A060NX25	200
0-150	.050	330	N8T	A0150NX05	190
0-150	.100	330	N8H ,	A0150NX10	230

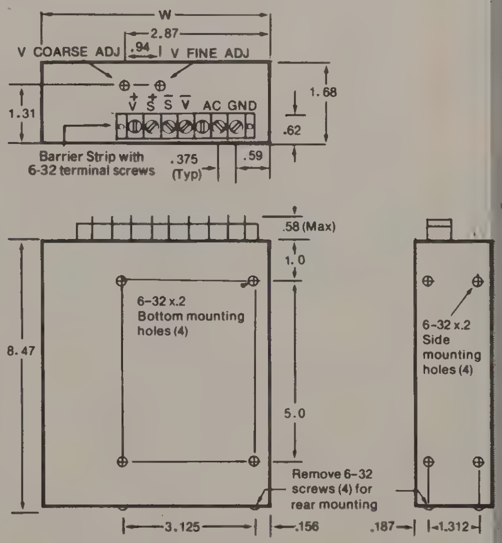
GOLD BOX


W
.375
G
I LIM. ADJ.
V FINE ADJ.
H
* *
+ + - -
V S S V AC GND
F
1.125
J
B
Barrier Strip
6-32 screws (M6, 9, 13)
8-32 screws (H11, 16)
C (Typ.)
Q
D
V COARSE ADJ.
Side mounting 8-32 holes (4) None for size H11 & H16
E (Max)
1.0
M
L
V
Y
Bottom mounting 8-32 holes (4)
Remove screws for rear mounting (4)

*To external current limit control (optional)

Case Size	L	W	H	M	V	Y	E	Q	B	C	D	F	G	J	Approx. Weight
M6	6.59	5.12	3.44	4.0	4.5	3.0	.58	.5	.75	.375	1.44	.75	2.37	3.09	4lb 4oz
M9	9.25	5.12	3.44	6.0	4.5	3.0	.58	.5	.75	.375	1.44	.75	2.37	3.09	7lb 4oz
M13	13.25	5.12	3.44	10.0	4.5	3.0	.58	.5	.75	.375	1.44	.75	2.37	3.09	11lb
H11	11.25	7.37	5.12	8.0	6.75	4.56	.78	1.12	1.25	.562	2.25	1.12	3.75	4.72	18lb 4oz
H16	16.00	7.37	5.12	11.0	6.75	4.56	.78	1.12	1.25	.562	2.25	1.12	3.75	4.72	23lb

NARROW PROFILE


W
2.87
V COARSE ADJ
.94
V FINE ADJ
+ + - -
V S S V AC GND
1.31
1.68
.62
Barrier Strip with 6-32 terminal screws
.375 (Typ)
.59
.58 (Max)
1.0
6-32 x.2 Bottom mounting holes (4)
8.47
5.0
6-32 x.2 Side mounting holes (4)
Remove 6-32 screws (4) for rear mounting
3.125
.156
.187
1.312

Case Size	W	Approx. Weight
N8T	3.84	3lb 2oz
N8H	4.68	3lb 14oz

Acopian

DUAL OUTPUTS (USER-SELECTABLE) OUTPUTS ISOLATED

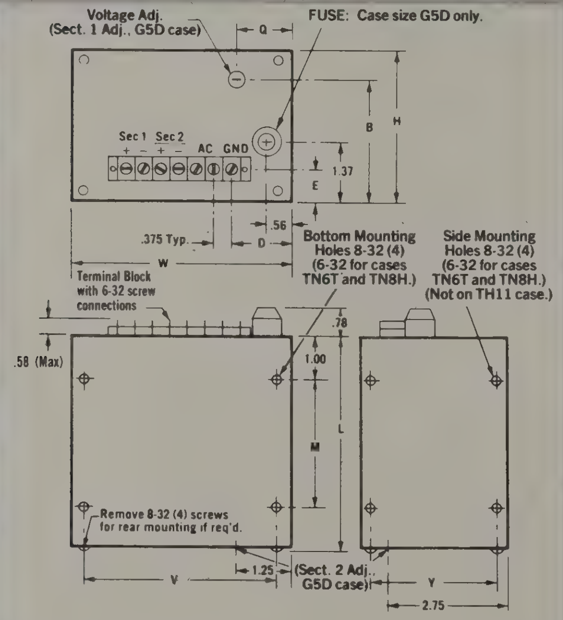
Acopian
DUAL OUTPUT POWER SUPPLY
DUAL OUTPUT POWER SUPPLY

LINEAR REGULATED
AC-DC
GOLD BOX

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED

Acopian general purpose duals furnish two completely independent outputs, either identical or different, in less space and at less cost than two equivalent single output supplies. Thousands of output voltage/current rating combinations are available. Mounting and system wiring are simplified. Quality components, generously derated, insure long-term reliability.


Voltage Adj. (Sect. 1 Adj., G5D case)
FUSE: Case size G5D only.
Q
B
H
Sec 1
Sec 2
+ – + –
AC
GND
1.37
E
.56
.375 Typ.
D
W
Terminal Block with 6-32 screw connections
Bottom Mounting Holes 8-32 (4) (6-32 for cases TN6T and TN8H.)
Side Mounting Holes 8-32 (4) (6-32 for cases TN6T and TN8H.) (Not on TH11 case.)
.58 (Max)
.78
1.00
L
M
Remove 8-32 (4) screws for rear mounting if req'd.
1.25
(Sect. 2 Adj., G5D case)
V
Y
2.75

Size	L	W	H	M	V	Y	E	Q	B	D	Approx. Weight
G5D	5.09	5.12	3.44	3.00	4.50	3.00	.75	1.25	2.73	1.44	4 lb
TG5	5.09	5.12	3.44	3.00	4.50	3.00	.75	1.25	2.73	1.44	3 lb 4 oz
TG6	6.59	5.12	3.44	4.00	4.50	3.00	.75	1.25	2.73	1.44	4 lb 4 oz
TG9	9.25	5.12	3.44	6.00	4.50	3.00	.75	1.25	2.73	1.44	6 lb 8 oz
TG13	13.25	5.12	3.44	10.00	4.50	3.00	.75	1.25	2.73	1.44	12 lb
TH11	11.25	7.37	5.12	8.00	6.75	4.56	.75	2.73	4.36	2.38	18 lb 4 oz
TN6T	6.59	3.84	1.68	4.00	3.12	1.31	.62	2.87	1.31	.59	2 lb 4 oz
TN8H	8.47	4.68	1.68	5.00	3.12	1.31	.62	2.87	1.31	.59	3 lb 14 oz

HOW TO ORDER: Select two sections (from the same table) on page 17. The complete model number is the combination of the two sections selected. Example: The combination of section 5GT20D and section 8GT50D is Model 5GT20D-8GT50D. Always assign the lower voltage section first. For pricing purposes, add the cost of the individual sections selected.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See page 17.

Short Circuit Protection: Delivers current surges without damage—built-in fuse protects supply against prolonged overloads and shorts.

Polarity: Outputs are floating. Each output may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 volts above ground.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: –10 to +71°C. No derating required.

Storage Temperature: –55 to +85°C.

Dimensions and Weight: Case size G5D.

OPTIONS

Overvoltage Protection: Two separate, preset overvoltage protection circuits, one for each output. To order, add prefix "V" to model number and add $30.00 to the standard price for 3 to 70 volt outputs; add $50.00 if either or both outputs are greater than 70 volts. Not available for outputs less than 3 volts.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "–230" to the model number and $25.00 to the standard price.

(500 MA MAXIMUM)

Nominal Output Voltage	Adjust ± V.	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to Order")
			Load ± %	Line ± %			
1.5	.5	.200	.4	.05	1	$70	1.5GT20D
1.5	.5	.400	.5	.1	1	85	1.5GT40D
2.5	.5	.200	.4	.05	1	70	2.5GT20D
2.5	.5	.400	.5	.1	1	85	2.5GT40D
3	.5	.200	.3	.05	1	70	3GT20D
3	.5	.400	.5	.1	1	85	3GT40D
3.6	.5	.200	.2	.05	1	70	3.6GT20D
3.6	.5	.400	.3	.1	1	85	3.6GT40D
5	.5	.200	.2	.05	1	70	5GT20D
5	.5	.500	.3	.05	1	85	5GT50D
6	1	.200	.05	.05	1	70	6GT20D
6	1	.500	.15	.05	1	85	6GT50D
7	1	.200	.05	.05	1	70	7GT20D
7	1	.500	.15	.05	1	85	7GT50D
8	1	.200	.05	.05	1	70	8GT20D
8	1	.500	.1	.05	1	85	8GT50D
9	1	.200	.05	.05	1	70	9GT20D
9	1	.500	.1	.05	1	85	9GT50D
10	1	.250	.05	.05	1	70	10GT25D
10	1	.500	.1	.05	1	85	10GT50D
12	1	.250	.05	.05	1	70	12GT25D
12	1	.500	.1	.05	1	85	12GT50D
13	1	.250	.05	.05	1	70	13GT25D
13	1	.500	.1	.05	1	85	13GT50D
15	1	.150	.05	.05	1	65	15GT15D
15	1	.250	.05	.05	1	70	15GT25D
15	1	.500	.1	.05	1	85	15GT50D
18	1	.250	.05	.05	1	70	18GT25D
18	1	.500	.1	.05	1	85	18GT50D
20	1	.250	.05	.05	1	70	20GT25D
20	1	.500	.1	.05	1	85	20GT50D
24	1	.250	.05	.05	1	70	24GT25D
24	1	.500	.05	.05	1	85	24GT50D
25	1	.250	.05	.05	1	70	25GT25D
25	1	.500	.05	.05	1	85	25GT50D
28	1	.250	.05	.05	1	70	28GT25D
28	1	.400	.05	.05	1	85	28GT40D
30	1	.250	.05	.05	1	70	30GT25D
30	1	.400	.05	.05	1	85	30GT40D
35	1	.100	.05	.05	1	70	35GT10D
35	1	.200	.05	.05	1	80	35GT20D
40	1	.100	.05	.05	1	70	40GT10D
40	1	.200	.05	.05	1	80	40GT20D
45	1	.100	.05	.05	1	75	45GT10D
45	1	.200	.05	.05	1	85	45GT20D
48	1	.100	.05	.05	1	80	48GT10D
48	1	.200	.05	.05	1	90	48GT20D
50	1	.100	.05	.05	1	80	50GT10D
50	1	.200	.05	.05	1	90	50GT20D
55	1	.100	.05	.05	1	85	55GT10D
55	1	.200	.05	.05	1	100	55GT20D
60	1	.050	.05	.05	1	85	60GT05D
60	1	.100	.05	.05	1	95	60GT10D
65	1	.050	.05	.05	1	85	65GT05D
65	1	.100	.05	.05	1	95	65GT10D
70	1	.050	.05	.05	1	85	70GT05D
70	1	.100	.05	.05	1	95	70GT10D
75	1	.050	.05	.05	1	90	75GT05D
75	1	.100	.05	.05	1	100	75GT10D
80	1	.020	.05	.05	1	85	80GT02D
80	1	.050	.05	.05	1	95	80GT05D
90	1	.020	.05	.05	1	95	90GT02D
90	1	.050	.05	.05	1	105	90GT05D
100	1	.020	.05	.05	1	105	100GT02D
100	1	.050	.05	.05	1	115	100GT05D

(2 AMP MAXIMUM)

Nominal Output Voltage	Adjust ± V.	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to Order")
			Load ± %	Line ± %			
1.5	.5	.400	.5	.1	1	$85	1.5GT40D
2.5	.5	.400	.5	.1	1	85	2.5GT40D
3	.5	.400	.5	.1	1	85	3GT40D
3	.5	.700	.5	.1	1	95	3GT70D
3	.5	1.0	.5	.1	1	100	3GT100D
3.6	.5	.400	.3	.1	1	85	3.6GT40D
3.6	.5	.700	.4	.1	1	95	3.6GT70D
3.6	.5	1.0	.5	.1	1	100	3.6GT100D
5	.5	.500	.3	.05	1	85	5GT50D
5	.5	.700	.4	.05	1	95	5GT70D
5	.5	1.0	.5	.05	1	100	5GT100D
5*	.25	2.0	.5	.05	1	115	5GT200D
6	1	.500	.15	.05	1	85	6GT50D
6	.5	.700	.2	.05	1	95	6GT70D
6	.5	1.0	.3	.05	1	100	6GT100D
7	1	.500	.15	.05	1	85	7GT50D
7	.5	.700	.2	.05	1	95	7GT70D
7	.5	1.0	.3	.05	1	100	7GT100D
8	1	.500	.1	.05	1	85	8GT50D
8	.5	.700	.15	.05	1	95	8GT70D
8	.5	1.0	.2	.05	1	100	8GT100D
9	1	.500	.1	.05	1	85	9GT50D
9	.5	.700	.15	.05	1	95	9GT70D
9	.5	1.0	.2	.05	1	100	9GT100D
10	1	.500	.1	.05	1	85	10GT50D
10	.5	.700	.15	.05	1	95	10GT70D
10	.5	1.0	.2	.05	1	100	10GT100D
12	1	.500	.1	.05	1	85	12GT50D
12	.5	.700	.1	.05	1	95	12GT70D
12	.5	1.0	.1	.05	1	100	12GT100D
14	1	.500	.1	.05	1	85	14GT50D
14	.5	.700	.1	.05	1	95	14GT70D
14	.5	1.0	.1	.05	1	100	14GT100D
15	1	.500	.1	.05	1	85	15GT50D
15	.5	.700	.1	.05	1	95	15GT70D
15	.5	1.0	.1	.05	1	100	15GT100D
18	1	.500	.1	.05	1	85	18GT50D
18	.5	.700	.1	.05	1	95	18GT70D
18	.5	1.0	.1	.05	1	105	18GT100D
20	1	.500	.1	.05	1	85	20GT50D
20	.5	.750	.1	.05	1	95	20GT75D

*Other section chosen may not have output current rating exceeding 500 ma.

(90 TO 150 VOLTS)

Nominal Output Voltage	Adjust ± V.	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to Order")
			Load ± %	Line ± %			
90	1	.050	.05	.05	1	$105	90GT05D
90	1	.100	.05	.05	1	120	90GT10D
95	1	.050	.05	.05	1	110	95GT05D
95	1	.100	.05	.05	1	125	95GT10D
100	1	.050	.05	.05	1	115	100GT05D
100	1	.100	.05	.05	1	130	100GT10D
110	1	.050	.05	.05	1	120	110GT05D
110	1	.100	.05	.05	1	135	110GT10D
120	1	.050	.05	.05	1	125	120GT05D
120	1	.100	.05	.05	1	140	120GT10D
125	1	.050	.05	.05	1	130	125GT05D
125	1	.100	.05	.05	1	145	125GT10D
130	1	.050	.05	.05	1	130	130GT05D
130	1	.100	.05	.05	1	145	130GT10D
140	1	.050	.05	.05	1	130	140GT05D
140	1	.100	.05	.05	1	145	140GT10D
150	1	.050	.05	.05	1	130	150GT05D
150	1	.100	.05	.05	1	145	150GT10D

Other output ratings also available. Contact factory for information.

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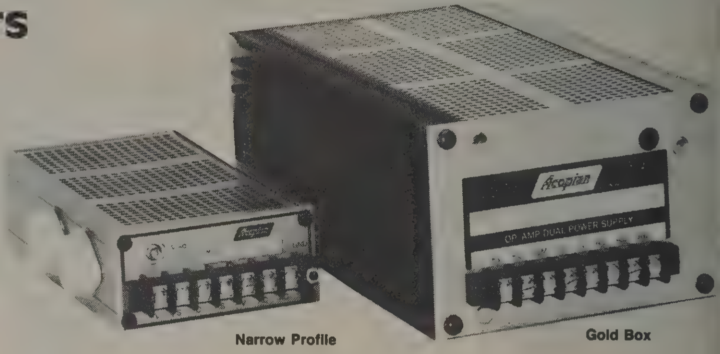
Acopian

DUAL TRACKING OUTPUTS

LINEAR REGULATED
AC-DC

SHIPPED IN 3 DAYS

ALL MODELS U.L. RECOGNIZED



Series D dual output power supplies are a convenient source of the tracking voltages required for powering operational amplifiers and related circuits. Their positive/common/negative output terminal configuration minimizes system wiring. Provision for remote sensing permits compensation of load line effects. Although moderately priced, they are sturdily constructed and conservatively rated.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Voltages: Tracking within 1%.
Output Currents:
Output Voltage Adjustment Ranges:
} See tables. Outputs are short circuit protected.

Load Regulation: ±0.1%.

Line Regulation: ±0.1%.

Ripple: 1.5 mV RMS.

Polarity: Positive output, common, and negative output.

Remote Voltage Sensing: Standard.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: −10 to +71°C.

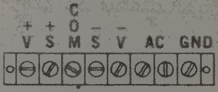
Storage Temperature: −55 to +85°C.

OPTIONS

Overvoltage Protection: A built-in preset overvoltage protection circuit is available on all models. If either output fails, both outputs are "crowbarred." To order, add prefix "V" to the model number, and increase standard price by $30.00.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "−230" to model number and $25.00 to price.

***Connections:**
(Supplies for Op Amps)



GOLD BOX MODELS

Nominal Output Voltages	Adjust ±V.	Current/Output Amps. at 40°C	55°C	71°C	Price	Model	Size*
±5	.5	.750	.650	.550	$190	TD5-75	TG5
±5	.5	1.5	1.25	1.0	225	TD5-150	TG6
±5	.5	2.5	2.0	1.5	270	TD5-250	TG9
±12	1	1.0	.900	.800	195	TD12-100	TG5
±12	1	1.6	1.4	1.0	230	TD12-160	TG6
±12	1	2.5	2.0	1.5	270	TD12-250	TG9
±12	.5	4.5	3.7	3.0	335	TD12-450	TG13
±12	.5	8.5	7.0	5.5	440	TD12-850	TH11
±15	1	.400	.400	.400	150	TD15-40	TG5
±15	1	1.0	.900	.800	195	TD15-100	TG5
±15	1	1.6	1.4	1.0	230	TD15-160	TG6
±15	1	2.5	2.0	1.5	270	TD15-250	TG9
±15	.5	4.5	3.7	3.0	335	TD15-450	TG13
±15	.5	8.5	7.0	5.5	440	TD15-850	TH11

NARROW PROFILE MODELS — for limited space applications

Nominal Output Voltage	Adjust ±V.	Current/Output Amps. at 40°C	55°C	71°C	Price	Model	Size*
±12	1	.500	.500	.400	$165	FD12-50A	TN6T
±12	.5	1.0	.900	.800	220	LD12-100	TN8H
±15	1	.500	.500	.400	165	FD15-50A	TN6T
±15	.5	1.0	.900	.800	220	LD15-100	TN8H

TRIPLE OUTPUT

OUTPUTS ISOLATED
LINEAR REGULATED
AC-DC
GOLD BOX

SHIPPED IN 3 DAYS

Acopian
EASTON, PA
TRIPLE OUTPUT POWER SUPPLY
FUSE

Triple isolated output power supplies provide the features and characteristics of three supplies in one compact, easy-to-use package. They are available in the voltage combinations most frequently required for driving microprocessors and associated circuitry.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See table.

Polarity: Outputs are floating. Each output may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 volts above ground.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: –10 to +60°C. No derating required.

Storage Temperature: –55 to +85°C.

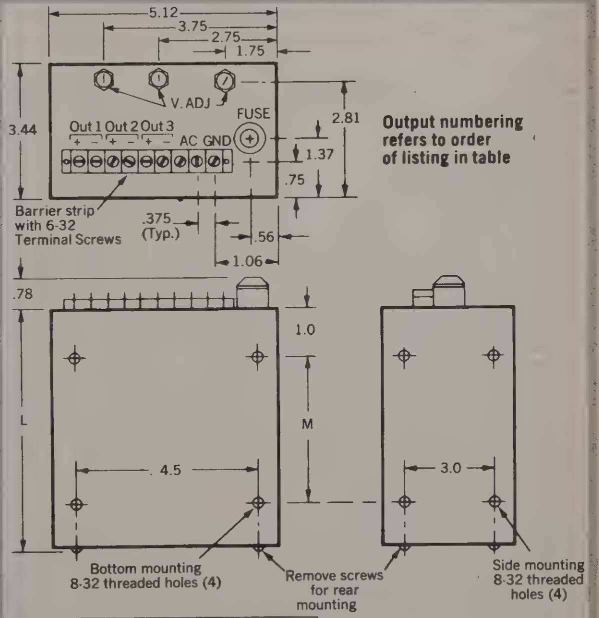
Nominal Output Voltage	Adjustment ± Volts	Output Current Amps.	Regulation Load ± %	Regulation Line ± %	Ripple mv RMS	Price	Model	Size
5 5 12	.25 .25 1	3.0 1.0 .600	.15 .15 .15	.15 .15 .15	1 1 1	$240	5512T6A	GT6
5 5 12	.25 .25 1	6.0 2.0 1.2	.15 .15 .15	.15 .15 .15	1 1 1	295	5512T9A	GT9
5 9 12	.25 1 1	6.0 1.4 1.2	.15 .15 .15	.15 .15 .15	1 1 1	295	5912T9A	GT9
5 12 12	.25 1 1	2.0 300 .300	.15 15 .15	15 .15 .15	1 1 1	215	51212T5A	GT5
5 12 12	.25 1 1	3.0 .600 .600	.15 .15 .15	15 .15 .15	1 1 1	240	51212T6A	GT6
5 12 12	.25 1 1	6.0 1.2 1.2	.15 .15 .15	.15 .15 .15	1 1 1	295	51212T9A	GT9
5 15 15	.25 1 1	2.0 .250 .250	.15 .15 .15	.15 .15 .15	1 1 1	215	51515T5A	GT5
5 15 15	.25 1 1	3.0 .500 500	.15 .15 .15	.15 .15 .15	1 1 1	240	51515T6A	GT6
5 15 15	.25 1 1	6.0 1.0 1 0	.15 .15 .15	.15 .15 15	1 1 1	295	51515T9A	GT9

OPTIONS

Overvoltage Protection:

Separate overvoltage protection circuit on each output. Add prefix "3V" to model number and add $30.00 to the standard price.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "–230" to the model number and $25.00 to the standard price.


5.12
3.75
2.75
1.75
3.44
V. ADJ
Out 1 Out 2 Out 3
FUSE
AC GND
2.81
1.37
.75
Barrier strip with 6-32 Terminal Screws
.375 (Typ.)
.56
1.06
.78
1.0
L
M
4.5
3.0
Bottom mounting 8-32 threaded holes (4)
Remove screws for rear mounting
Side mounting 8-32 threaded holes (4)

Output numbering refers to order of listing in table

Size	L	M	Approx. Weight
GT5	5.09	3.00	4lb 14oz
GT6	6.59	4.00	5lb 8oz
GT9	9.25	6.00	7lb 4oz

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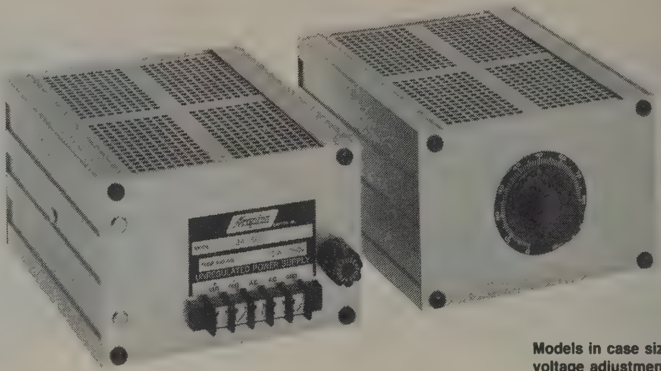
Acopian

UNREGULATED

FIXED OUTPUT & WIDE OUTPUT ADJUSTMENT
AC-DC
GOLD BOX

SHIPPED IN 3 DAYS

U.L. RECOGNIZED


Models in case size YA have output voltage adjustment on rear panel.

Low-cost DC power suitable for driving loads such as lamps, relays, and small motors is provided by Series U unregulated power supplies. All components are generously derated, insuring a long and trouble-free life; built-in fusing prevents damage due to prolonged overloading or short circuits. Mechanically similar to the regulated supplies shown on pages 8 and 9, they are housed in extruded aluminum cases which can be mounted in any position. Many models are U.L. Recognized.

STANDARD FEATURES

- Capacitive filtering
- Fused input
- May be used in series or parallel
- No derating or heat sinking required
- Completely serviceable

SPECIFICATIONS

Input Voltage: 0-125 VAC, 50-400 Hz, single phase.

Output Voltage:
Output Current: } See table
Ripple:

Output Voltage Adjustment: Adjustable voltage models are provided with a built-in continuously adjustable autotransformer.

Load Regulation: The nominal output voltages of fixed output models, and the maximum rated output voltages for models with adjustable outputs, are based on 115 VAC input with approximately one-half load. At no load, they will increase by approximately 10%. At full load, they will be reduced by approximately 10%.

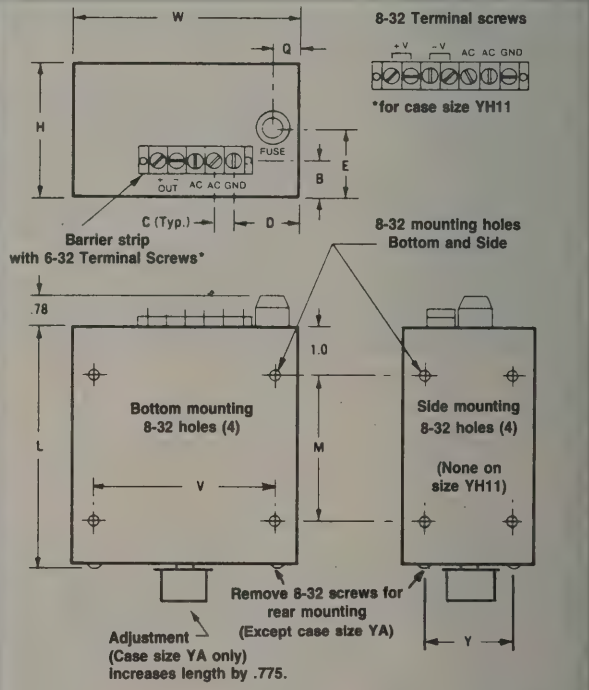
Line Regulation: Output voltage change due to line change directly proportional to input change.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Ambient Operating Temperature: −10 to +65°C. No derating required.

Storage Temperature: −55 to +85°C.

Optional 230 Volt Input
Provision for inputs of 0-250 VAC, 50-400 Hz, replacing the standard of 0-125 VAC input voltage range, is available on most models. Contact factory for information.


W
Q
8-32 Terminal screws
+V
-V
AC AC GND
*for case size YH11
H
FUSE
E
B
+ - OUT AC AC GND
C (Typ.)
D
Barrier strip with 6-32 Terminal Screws*
8-32 mounting holes Bottom and Side
.78
1.0
L
Bottom mounting 8-32 holes (4)
M
V
Side mounting 8-32 holes (4)
(None on size YH11)
Remove 8-32 screws for rear mounting (Except case size YA)
Adjustment (Case size YA only) increases length by .775.
Y

Size	L	W	H	M	V	Y	Q	E	B	D	C	Approx. Weight
Y3	3.71	5.12	3.44	1.62	4.5	3.0	.56	1.37	.75	1.44	.375	2 lb. 8 oz.
Y5	5.09	5.12	3.44	3.00	4.5	3.0	.56	1.37	.75	1.44	.375	4 lb. 8 oz.
Y6	6.59	5.12	3.44	4.00	4.5	3.0	.56	1.37	.75	1.44	.375	7 lb. 8 oz.
YH11	11.25	7.37	5.12	8.0	6.75	4.56	1.10	2.64	1.25	2.25	.562	18 to 23 lb.
YA	6.59	5.12	3.44	4.00	4.5	3.0	.56	1.37	.75	1.44	.375	4 to 5 lb.

FIXED OUTPUT

Nominal Output Voltage	Output Amps.	Output Voltage N/L-F/L	Ripple Volts RMS	Price	Model	Case Size
4	.200	4.4 to 3.6	2	$ 60	U4Y20	Y3
5	10.0 (@ 5.0)	6.7 to 3.6 (5.0)	1.8 (1.3)	95	U5Y1000	Y6
6 6	2.0 5.0	7.7 to 4.8 7.5 to 5.0	2.0 1.8	60 95	U6Y200 U6Y500	Y3 Y5
7	8.0	8.0 to 5.4	1.5	95	U7Y800	Y6
9	10.0 (@ 5.0)	11.5 to 7.5 (9.0)	2.3 (1.3)	95	U9Y1000	Y6
10	10.0 (@ 5.0)	12.4 to 8.0 (9.8)	2.3 (1.3)	95	U10Y1000	Y6
12 12 12	1.5 5.0 10.0 (@ 5.0)	14.9 to 10.9 14.8 to 10.5 14.1 to 9.8 (11.5)	2.5 1.8 2.3 (1.3)	60 90 100	U12Y150 U12Y500 U12Y1000	Y3 Y5 Y6
14 14	1.0 10.0 (@ 5.0)	15.4 to 12.6 16.4 to 12.1 (14.0)	.7 2.3 (1.3)	60 100	U14Y100 U14Y1000	Y3 Y6
15	10.0 (@ 5.0)	17.2 to 12.8 (14.5)	2.3 (1.3)	100	U15Y1000	Y6
16 16	1.0 10.0 (@ 5.0)	17.6 to 14.4 18.8 to 14.2 (16.0)	.7 2.3 (1.3)	60 100	U16Y100 U16Y1000	Y3 Y6
18 18	1.0 10.0 (@ 5.0)	19.8 to 16.2 21.0 to 15.8 (18.0)	.7 2.4 (1.4)	60 100	U18Y100 U18Y1000	Y3 Y6
20 20	4.0 10.0 (@ 5.0)	22.0 to 17.5 23.7 to 18.3 (20.4)	2.0 2.4 (1.4)	90 100	U20Y400 U20Y1000	Y5 Y6
24 24 24 24 24 24	1.0 3.5 5.0 10.0 17.0 23.0	26.4 to 21.6 26.0 to 21.0 26.5 to 21.0 26.8 to 21.4 26.4 to 21.6 27.0 to 21.0	1.7 2.0 2.5 2.4 1.5 1.5	60 90 100 135 210 240	U24Y100 U24Y350 U24Y500 U24Y1000 U24Y1700 U24Y2300	Y3 Y5 Y6 Y6 YH11 YH11
25	5.0	28.1 to 22.3	2.5	100	U25Y500	Y6
27	5.0	30.0 to 24.0	2.6	100	U27Y500	Y6
28 28 28 28 28 28	1.0 3.0 5.0 8.0 15.0 20.0	30.8 to 25.2 30.8 to 26.0 31.2 to 24.8 30.2 to 25.0 30.8 to 25.2 30.4 to 24.5	1.7 2.0 2.6 2.4 1.5 1.5	60 90 100 135 210 240	U28Y100 U28Y300 U28Y500 U28Y800 U28Y1500 U28Y2000	Y3 Y5 Y6 Y6 YH11 YH11
30 30	1.0 2.0	33.0 to 27.0 33.0 to 27.0	1.6 1.5	70 80	30UY100 U30Y200	Y3 Y5
32 32	.400 5.0	35.2 to 28.8 35.5 to 28.0	.6 3.3	60 100	U32Y40 U32Y500	Y3 Y6
35	5.0	38.0 to 30.0	3.3	100	U35Y500	Y6
37	5.0	40.5 to 32.2	3.3	100	U37Y500	Y6
38	5.0	43.0 to 34.0	3.3	100	U38Y500	Y6
40 40 40	1.0 2.0 5.0	44.0 to 36.0 44.0 to 36.0 45.0 to 37.0	1.6 1.5 3.3	70 90 100	40UY100 U40Y200 U40Y500	Y3 Y5 Y6
41	.400	45.1 to 36.9	.6	60	U41Y40	Y3
42	5.0	48.0 to 36.0	6.5	100	U42Y500	Y6

Nominal Output Voltage	Output Amps.	Output Voltage N/L-F/L	Ripple Volts RMS	Price	Model	Case Size
44	2.0	48.4 to 39.6	1.5	$ 90	U44Y200	Y5
45 45	1.0 5.0	49.5 to 40.5 51.0 to 38.5	1.6 6.5	70 100	45UY100 U45Y500	Y3 Y6
48	.400	52.8 to 43.2	.6	65	U48Y40	Y3
50	1.0	55 to 45	1.5	75	50UY100	Y3
52	.400	57.2 to 46.8	.6	70	U52Y40	Y3
55	.250	60.5 to 49.5	.4	65	U55Y25	Y3
60	1.0	65.3 to 53.0	2.8	85	U60Y100	Y5
62	.400	69.0 to 58.0	1.5	70	U62Y40	Y3
65	.250	71.5 to 58.5	.4	70	U65Y25	Y3
80	.300	88.0 to 72.0	1.0	75	U80Y30	Y3
90	.400	99.0 to 81.0	2.2	75	U90Y40	Y3
95	.150	105 to 85	1.1	75	U95Y15	Y3
100	.200	110 to 93	1.0	80	U100Y20	Y3
110	.200	121 to 100	1.0	80	U110Y20	Y3
120	.200	132 to 110	1.0	80	U120Y20	Y3
140	.200	154 to 126	1.7	80	U140Y20	Y3
150	.200	165 to 135	1.7	85	U150Y20	Y3
165	.200	176 to 144	1.7	85	U165Y20	Y3
170	.200	187 to 153	2.0	85	U170Y20	Y3
180	.200	190 to 162	2.0	85	U180Y20	Y3
200	.200	220 to 180	2.0	90	U200Y20	Y3
230	.100	252 to 207	3.0	80	U230Y10	Y3
250	.200	275 to 225	4.0	90	250UY20	Y3
275 275	.100 .200	303 to 247 303 to 247	3.0 4.0	80 90	U275Y10 U275Y20	Y3 Y5
300	.200	330 to 270	5.0	90	U300Y20	Y5
325	.200	360 to 295	6.0	90	U325Y20	Y5
340	.100	374 to 306	3.0	80	U340Y10	Y3
360	.100	396 to 324	3.0	80	U360Y10	Y3
370	.100	407 to 333	3.0	80	U370Y10	Y3
400	.200	440 to 360	6.0	95	U400Y20	Y5
420	.100	462 to 378	6.7	80	U420Y10	Y3
475	.020	523 to 426	3.1	75	U475Y02	Y3
500	.200	550 to 450	9.1	100	U500Y20	Y5
550†	.100	605 to 495	4.8	100	U550Y10	Y5
580†	.020	638 to 522	3.1	75	U580Y02	Y3
600†	.100	660 to 540	10.0	100	U600Y10	Y5
750†	.020	825 to 675	3.1	80	U750Y02	Y3
800†	.100	880 to 720	13.0	100	U800Y10	Y5
900† 900†	.020 .100	990 to 810 990 to 810	5.0 13.0	80 105	U900Y02 U900Y10	Y3 Y5
1000†	.100	1100 to 900	13.0	105	U1000Y10	Y5

WIDE OUTPUT ADJUSTMENT

Output Voltage Range	Output Current Amps.	Ripple Volts RMS	Price	Model	Case Size
0-8†	2.0	2	$160	U8YA200	YA
0-15†	1.5	2.5	160	U15YA150	YA
0-54†	1.0	1.6	160	U54YA100	YA
0-95†	.300	2.2	160	U95YA30	YA
0-125†	.200	1.5	160	U125YA20	YA
0-220†	.200	2	160	U220YA20	YA

Output Voltage Range	Output Current Amps.	Ripple Volts RMS	Price	Model	Case Size
0-260†	.200	4	$160	U260YA20	YA
0-370†	.100	3	160	U370YA10	YA
0-450†	.100	6.7	160	U450YA10	YA
0-800†	.020	3.1	160	U800YA02	YA
0-950†	.020	5	160	U950YA02	YA

†Not U.L. recognized when this catalog was published.

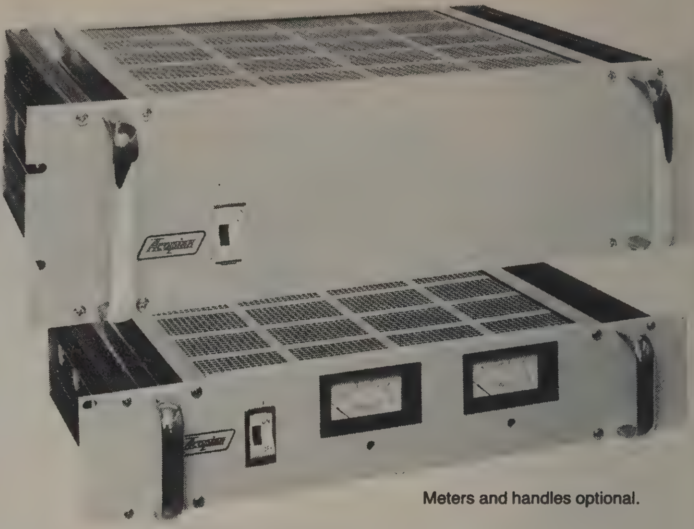
Acopian

RACK MOUNTING

SINGLE & DUAL OUTPUT LINEAR REGULATED AC-DC

SHIPPED IN 9 DAYS

ALL MODELS U.L. RECOGNIZED


Meters and handles optional.

Acopian rack-mounting power supplies feature excellent regulation and ripple specifications in 101 models with outputs up to 150 volts and 60 amps. Metering and overvoltage protection are available as options. These power supplies are constructed in sturdy extruded aluminum assemblies designed expressly for mounting in standard 19″ wide RETMA cabinet racks. The front panels are finished in light gray enamel.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Specifications: See tables.

Remote Voltage Sensing: Provision for sensing the output voltage across the load is a standard feature.

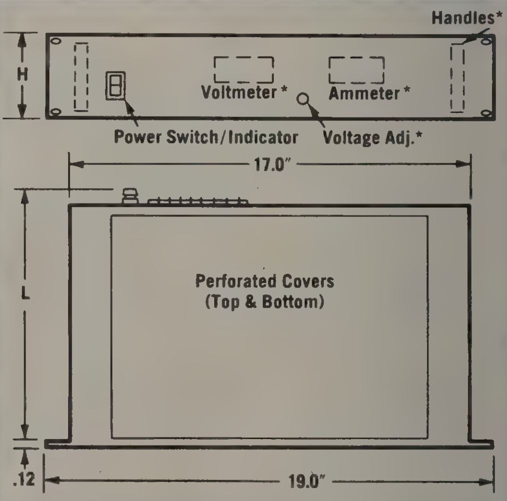
Polarity:
Single Output Models: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.
Dual Output Models: Positive output, common, negative output.

Temperature Coefficient:
Single Output Models: 0.015%/°C (Typical).
Dual Output Models: 0.02%/°C (Typical).

Ambient Operating Temperature:
Single Output Models: −20 to +55°C.
Dual Output Models: −10 to +55°C.

Storage Temperature: −55 to +85°C.

Overload/Short Circuit Protection: Foldback current limiting with automatic recovery.

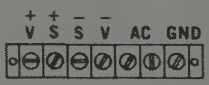


*Optional (Option positions shown are for single output models.)

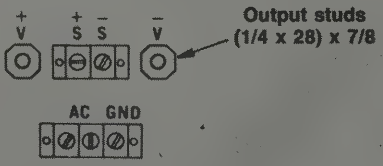
Size	H	L	Approx. Weight
3P11	3½	11.0	22 lb.
3P17	3½	17.0	38 lb
5P12	5¼	12.0	28 lb
5P17	5¼	17.0	53 lb

CONNECTIONS: Single Output Models

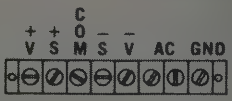
Case Sizes 3P11 and 5P12



Case Sizes 3P17 and 5P17



CONNECTIONS: Dual Output Models



SINGLE OUTPUT

Nominal Output Voltage	Adjust Range ± V	Output Current Amps@ 40°C	Output Current Amps@ 55°C	Regulation Load* ± %	Regulation Line* ± %	Ripple mv RMS	Price	Model	Size
1 5	.5	20	20	.005	.005	.25	$495	1.5PT20	3P11
1.5	.5	32	27	.005	.005	.25	610	1.5PH32	5P12
1.5	.25	60	47	.05	.05	1	890	1.5PH60	5P17
2	.5	20	20	.005	.005	.25	495	2PT20	3P11
2	.5	30	25	.005	.005	.25	610	2PH30	5P12
3	.5	20	20	.005	.005	.25	495	3PT20	3P11
3	.5	30	25	.005	.005	.25	610	3PH30	5P12
3	.25	60	47	.05	.05	1	890	3PH60	5P17
3.6	.5	20	20	.005	.005	.25	495	3.6PT20	3P11
3 6	.5	32	27	.005	.005	.25	610	3.6PH32	5P12
3.6	.25	60	47	.05	.05	1	890	3.6PH60	5P17
5	.5	20	20	.005	.005	.25	495	5PT20	3P11
5	.5	32	27	.005	.005	.25	610	5PH32	5P12
5	.25	48	37	.05	05	1	760	5PT48	3P17
5	.25	60	47	.05	.05	1	890	5PH60	5P17
6	.5	20	20	.005	.005	.25	495	6PT20	3P11
6	.5	28	23	.005	.005	.25	610	6PH28	5P12
6	.25	47	36	.05	.05	1	760	6PT47	3P17
6	.25	58	45	.05	.05	1	890	6PH58	5P17
7	.5	20	20	.005	.005	.25	495	7PT20	3P11
8	.5	20	20	.005	.005	.25	495	8PT20	3P11
8	.5	28	23	.005	.005	.25	610	8PH28	5P12
8	.5	44	34	.05	.05	1	760	8PT44	3P17
8	.25	54	42	.05	.05	1	890	8PH54	5P17
9	.5	20	20	.005	.005	.25	495	9PT20	3P11
9	.5	41	32	.05	.05	1	760	9PT41	3P17
9	.5	52	41	.05	.05	1	890	9PH52	5P17
10	.5	20	20	.005	.005	.25	495	10PT20	3P11
10	.5	25	20	.005	.005	.25	610	10PH25	5P12
10	.5	38	30	.05	.05	1	760	10PT38	3P17
10	.5	50	39	.05	.05	1	890	10PH50	5P17
12	.5	17	17	.005	.005	25	495	12PT17	3P11
12	.5	22	22	.005	.005	.25	610	12PH22	5P12
12	.5	33	26	.05	05	1	760	12PT33	3P17
12	.5	45	35	.05	.05	1	890	12PH45	5P17
13	.5	16	16	.005	.005	.25	495	13PT16	3P11
13	.5	43	34	.05	.05	1	890	13PH43	5P17
14	.5	12	12	.005	.005	25	495	14PT12	3P11
15	.5	10	10	.005	.005	.25	495	15PT10	3P11
15	.5	19	16	.005	.005	.25	610	15PH19	5P12
15	.5	25	20	.05	.05	1	760	15PT25	3P17
15	.5	40	31	.05	.05	1	890	15PH40	5P17
16	.5	10	10	.005	.005	.25	495	16PT10	3P11
18	.5	10	10	005	.005	25	495	18PT10	3P11
18	.5	18	15	.005	.005	.25	610	18PH18	5P12
18	.5	24	19	.05	.05	1	760	18PT24	3P17
18	.5	36	28	.05	.05	1	890	18PH36	5P17
20	.5	10	10	.005	.005	25	495	20PT10	3P11
20	.5	16	14	005	005	.25	610	20PH16	5P12
20	.5	23	18	.05	.05	1	$760	20PT23	3P17
20	.5	32	25	.05	.05	1	890	20PH32	5P17
22	.5	10	10	.005	.005	.25	495	22PT10	3P11
24	.5	10	10	.005	.005	25	495	24PT10	3P11
24	.5	15	13	.005	.005	.25	610	24PH15	5P12
24	.5	20	16	.05	.05	1	760	24PT20	3P17
24	.5	30	23	.05	.05	1	890	24PH30	5P17
25	.5	10	10	.005	.005	.25	495	25PT10	3P11
26	.5	10	10	.005	.005	.25	495	26PT10	3P11
28	.5	10	10	.005	.005	.25	495	28PT10	3P11
28	.5	14	12	.005	.005	.25	610	28PH14	5P12
28	.5	19	15	.05	.05	1	760	28PT19	3P17
28	.5	28	22	.05	.05	1	890	28PH28	5P17
30	.5	10	10	.005	.005	.25	495	30PT10	3P11
30	.5	14	12	.005	.005	.25	610	30PH14	5P12
32	.5	5	5	.005	.005	.25	425	32PT5	3P11
32	.5	10	10	.005	.005	.25	555	32PT10	5P12
34	.5	5	5	.005	.005	.25	435	34PT5	3P11
34	.5	10	10	.005	.005	.25	570	34PT10	5P12
35	.5	5	5	.005	.005	.25	445	35PT5	3P11
35	.5	10	10	.005	.005	.25	585	35PT10	5P12
36	.5	5	5	.005	.005	.25	455	36PT5	3P11
36	.5	10	10	.005	.005	.25	600	36PT10	5P12
38	.5	5	5	.005	.005	.25	465	38PT5	3P11
38	.5	10	10	.005	.005	.25	615	38PT10	5P12
40	.5	5	5	.005	.005	.25	475	40PT5	3P11
40	.5	10	10	.005	.005	.25	630	40PT10	5P12
45	.5	5	5	.005	.005	.25	485	45PT5	3P11
45	.5	10	10	.005	.005	.25	645	45PT10	5P12
48	.5	5	5	.005	.005	.25	495	48PT5	3P11
48	.5	10	10	.005	.005	.25	660	48PT10	5P12
48	.5	15	12	.005	.005	.25	790	48PT15	5P17
50	.5	5	5	.005	.005	.25	495	50PT5	3P11
50	.5	10	10	.005	.005	.25	660	50PT10	5P12
55	.5	5	3.8	.005	.005	.25	505	55PT5	3P11
55	.5	8	6	.005	.005	.25	675	55PT8	5P12
60	.5	5	3.8	.005	005	.25	510	60PT5	3P11
60	.5	8	6	.005	.005	.25	680	60PT8	5P12
75	1	4	3	.01	.01	1	520	75PT4	3P11
75	1	5.6	4.2	.01	.01	1	690	75PT5	5P12
90	1	3.3	2.5	.01	.01	1	530	90PT3	3P11
90	1	4.4	3.3	.01	.01	1	700	90PT4	5P12
100	1	3	2.2	.01	.01	1	540	100PT3	3P11
100	1	4	3	.01	.01	1	710	100PT4	5P12
120	1	2.5	1.8	.01	.01	1	550	120PT2	3P11
120	1	3.5	2.6	.01	.01	1	720	120PT3	5P12
150	1	2.3	1.7	.01	.01	1	560	150PT2	3P11
150	1	3	2.2	.01	.01	1	730	150PT3	5P12

*or 2 mv, whichever is greater.

DUAL TRACKING OUTPUTS

Nominal Output Voltages	Adjust. Range ± V	Output Current Amps. 40°C	Output Current Amps. 55°C	Regulation Load ± %	Regulation Line ± %	Ripple mv RMS	Price	Model	Size
± 12	.5	7	5.6	.1	.1	1.5	$530	PD12-700	3P11
± 12	.5	9	7.2	.1	.1	1.5	645	PD12-900	5P12
± 15	.5	7	5.6	.1	.1	1.5	530	PD15-700	3P11
± 15	.5	9	7.2	.1	.1	1.5	645	PD15-900	5P12

OPTIONS

EXAMPLE: The Model 5PT20 equipped with all options is designated as the Model V5PT20AFHP-230. (List suffix letters in alphabetical sequence.)

Overvoltage Protection: An internally installed and preset overvoltage protector is available for models with outputs of 3 volts and higher. On dual output models, if either output falls, both outputs are "crowbarred." To order, add prefix "V" to the model number and increase price as follows:

Outputs of	3-70V	Over 70V
Case size 3P11	$25.00	$35.00
Other case sizes	75.00	85.00

Metering (Single Output Models):

Ammeter: Add suffix "A" to model number and $35.00 to price.

Voltmeter: Add suffix "F" to model number and $35.00 to price.

Metering (Dual Output Models):

Ammeters: One for each output. Add suffix "A" to model number and $70.00 to price. "A" and "F" options cannot be combined in one power supply.

Voltmeters: One for each output. Add suffix "F" to model number and $70.00 to price. "A" and "F" options cannot be combined in one power supply.

Voltmeter and Ammeter: Each with switch for selecting output to be monitored. Add suffix "G" to model number and $120.00 to price.

Handles: Add suffix "H" to model number and $25.00 to price.

Front Panel Voltage Adjustment: Standard models have a voltage adjustment located at the rear. A voltage control mounted on the front panel is available as an option. To order, add suffix "P" to the model number and $10.00 to price.

230 Volt Input: For operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "–230" to model number and $40.00 to price.

Acopian

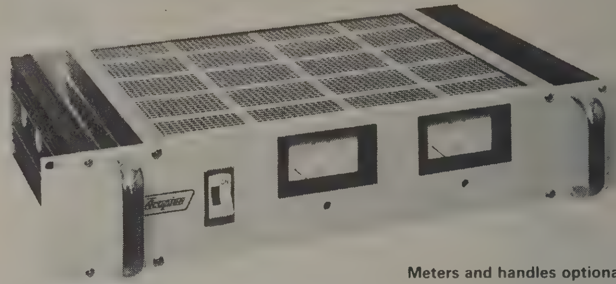
RACK MOUNTING

WIDE OUTPUT ADJUSTMENT
FIXED & ADJUSTABLE CURRENT LIMITING
LINEAR REGULATED
AC-DC

SHIPPED IN 9 DAYS

ALL MODELS U.L. RECOGNIZED

Similar to the rack mounting power supplies listed on pages 22 and 23, but with broadened output voltage ranges. All models may be programmed through their voltage ranges by means of external resistance. Models with adjustable current limiting have a constant-voltage/constant-current crossover characteristic, and so may be used as constant current sources.



Meters and handles optional.

Output Voltage Range	Output Current Amps. at			Voltage Prgmg. Coeff. (Ω/V)	Size	Voltage Programmable Fixed Current Limiting		Voltage Programmable Adjustable Current Limiting	
	40°C	55°C	71°C			Model	Price	Model	Price
0-6	10.0	8.0	6.0	820	3P11	A06PX10	$520	P06PX10	$560
0-6	16.0	12.8	9.6	820	5P12	A06PX16	640	P06PX16	680
0-15	7.0	5.6	4.2	330	3P11	A015PX7	520	P015PX7	560
0-15	10.0	8.0	6.0	330	5P12	A015PX10	640	P015PX10	680
0-30	4.0	3.2	2.4	160	3P11	A030PX4	520	P030PX4	560
0-30	5.0	4.0	3.0	160	5P12	A030PX5	640	P030PX5	680
0-50	2.4	1.9	1.5	1000	3P11	A050PX2	520	P050PX2	560
0-50	3.0	2.4	1.8	1000	5P12	A050PX3	640	P050PX3	680

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Regulation, Ripple (constant voltage operation):
Line Regulation: ±0.005% or 2 mV, whichever is greater.
Load Regulation: ±0.005% or 2 mV, whichever is greater.
Ripple: 0.25 mV rms.

Regulation, Ripple (constant current operation):
Line Regulation: ±0.1% or 2 mA.
Load Regulation: ±0.2% or 5 mA.
Ripple: 0.1% rms.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, to compensate voltage drops in output wiring, is a standard feature.

Remote Voltage Programming: The output voltage of all models may be controlled by means of external resistance connected in series with the −S lead.

Voltage Programming Coefficient: See table. Calibration tolerance, ±2%.

Current Limiting/Programming: Models with fixed current limiting have a rolloff characteristic with automatic recovery. All others have current limiting with a constant-voltage/constant-current crossover characteristic.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 volts above ground.

Controls: Coarse and fine voltage adjustments, and the current limit adjustment, are located at the rear of the assembly.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: −20 to +71°C.

Storage Temperature: −55 to +85°C.

Input/Output Connections: Barrier strip terminals at the rear (#6 screws for case size 3P11, #8 screws for case size 5P12).

OPTIONS

Overvoltage Protection: An internally installed and preset over-voltage protector is available for all models. To order, add the prefix "V" to the model number and $25.00 to the price.

Remote Current Limit Adjustment: All models having numbers beginning with the letter P have a built in current limit control. Provision for control of the current limit setting by adjustment of an external resistance is available as an option. To order, add the prefix letter "E" to the model number, and add $20.00 to the standard price.

The current limit setting is inversely related to resistance. Use a 200 ohm ½W potentiometer.

Ammeter: Add suffix "A" to model number and $35.00 to price.

Voltmeter: Add suffix "F" to model number and $35.00 to price.

Handles: Add suffix "H" to model number and $25.00 to price.

Front Panel Controls: For voltage controls (coarse and fine) mounted on the front panel, instead of the standard screwdriver-slot adjustments at the rear, add suffix "P" to the model number and $20.00 to price. For a current limit control mounted on the front panel, add suffix "Y" to the model number and $10.00 to price.

230 Volt Input: For operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "−230" to model number and $40.00 to price.

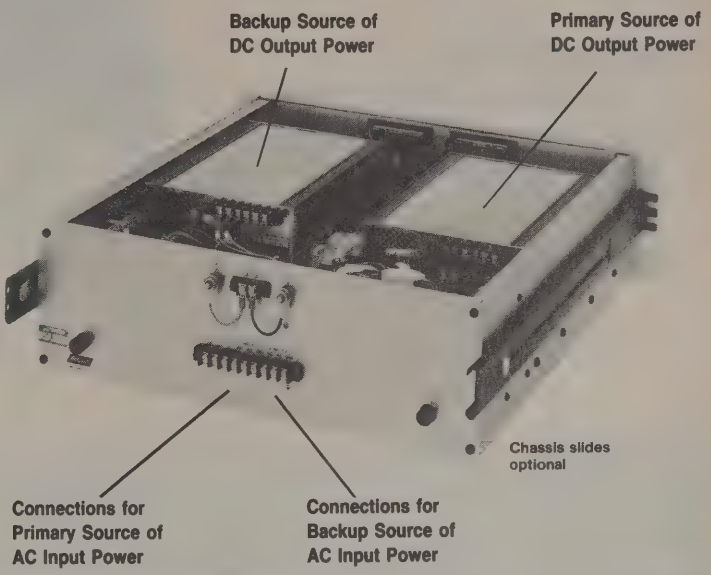
Acopian

REDUNDANT POWER SYSTEMS

LINEAR & SWITCHING

SHIPPED IN 9 DAYS

Use an Acopian Redundant Power System to assure that your load will receive continuous power even if one source of ac input power is interrupted, or if one power module of the redundant pair is either not delivering the correct output voltage or has been removed for calibration, preventative maintenance or repair.


Backup Source of DC Output Power
Primary Source of DC Output Power
Chassis slides optional
Connections for Primary Source of AC Input Power
Connections for Backup Source of AC Input Power

STANDARD FEATURES

- Separate ac input power circuit for each power module, permitting the use of two independent sources of input power for input redundancy.
- Specifically designed to safely permit the rapid changing of a power module while the system continues to furnish uninterrupted power to the load.
- Provision for control of external failure alarms or indicators (standard), or built-in audible alarms (optional).
- Foldback current limiting with automatic recovery.
- Overvoltage protection.

Redundant power systems should be considered for any equipment where the highest attainable reliability is essential, and an unexpected loss of power would be disastrous. Such applications include communications systems (both voice and data types), computer systems (volatile memory systems in particular), process controls, utility and municipal systems, and security/safety alarm systems.

Output Redundancy:
The system contains two identical power modules with their outputs interconnected through a diode switching arrangement that senses an abnormal output, isolates it from the load being driven, and passes only the output of the other module with no interruption of output power during the transition.

Input Redundancy:
All Acopian redundant power systems may be operated with only one ac power source. However, two isolated sets of ac input connections are provided, so that two independant sources of input power may be used, to obtain the additional protection of input redundancy. A battery-backup power source (UPS) and/or a second power line from the power utility can be used to maintain output power without interruption when your primary source of ac power fails.

Operation:
Each system consists of the two power modules installed in a rack-mountable assembly. The assembly contains two voltage monitoring circuits with relays, the contacts of which are available to control external failure alarms or other circuitry. The contact wiring of the two relays is connected in cascade, to simulate a single set of Form C contacts which switches if the output voltage of either power module decreases by more than 2.0 volts (3.0 volts for outputs over 48 volts) from the nominal rating.

The output voltage of the primary module is set approximately 0.2 volt higher than that of the backup module. Under this condition, the backup module's diode is not forward biased; only the primary module delivers current to the load. If the output voltage of the primary module decreases by more than 0.2 volt, the situation is reversed and only the backup module delivers load current. There is no interruption of output power during the transition.

Each power module contains an overvoltage protection circuit, to assure that the output will not significantly exceed the nominal output voltage rating under any condition, including incorrect application and misadjustment.

Serviceability:
Thumbscrew mounting, and insulated connectors in the wiring to each power module, facilitate the rapid and safe installation or removal of a module from the system without the need for tools. All input, output and alarm-contact connections are at the rear of the assembly. The chassis slide and handle options are recommended for applications where it is desired to service the system without removing it from the rack.

Acopian

REDUNDANT POWER SYSTEMS

CONTAINING TWO LINEAR REGULATED POWER SUPPLIES AC-DC

SHIPPED IN 9 DAYS

Ammeters, handles and audible alarms optional.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase. A separate set of ac input terminals is provided for each power supply, so that if two sources of ac input power are available, one may be used for each supply and so reduce the possibility of output dropout due to loss of input power.

Output Voltage:
Normal mode—Nominal voltage shown in table.
Backup mode—0.2 volt less than nominal voltage shown in table.

Output Regulation:
Line—±0.05%.
Load—±0.05% (Dynamic regulation—does not include 0.2 volt shift which occurs during switching to lower-set backup supply.)

Output Ripple: 1 mV rms.

Load Protection: Overvoltage protection.

Overload/Short Circuit Protection: Foldback current limiting with automatic recovery.

Polarity: Output is floating; either positive or negative output terminal may be grounded or floated up to 300 volts above ground.

Voltage Monitor Circuits: One for each power supply. Relay contacts switch when output voltage decreases approximately 2 volts from the nominal rating (approximately 3 volts for outputs over 48 volts), and may be used to control an external failure alarm.

Output Metering: Two voltmeters (standard). Ammeters available; see Options.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: −20 to +71°C.

Storage Temperature: −55 to +85°C.

Assembly Size:

3R14	3½" x 19" panel, 14⅛" deep. (15 lbs.)
5R14	5¼" x 19" panel, 14⅛" deep. (23 lbs.)
5R17	5¼" x 19" panel, 17" deep. (53 lbs.)
5R18	5¼" x 19" panel, 17¾" deep. (29 lbs.)
7R18	7" x 19" panel, 18½" deep. (50 lbs.)
7R20	7" x 19" panel, 20½" deep. (64 lbs.)

Front Panel Finish: Light gray baked enamel.

OPTIONS

Add option suffixes in alphabetical order. Example: R5H16AH-230.

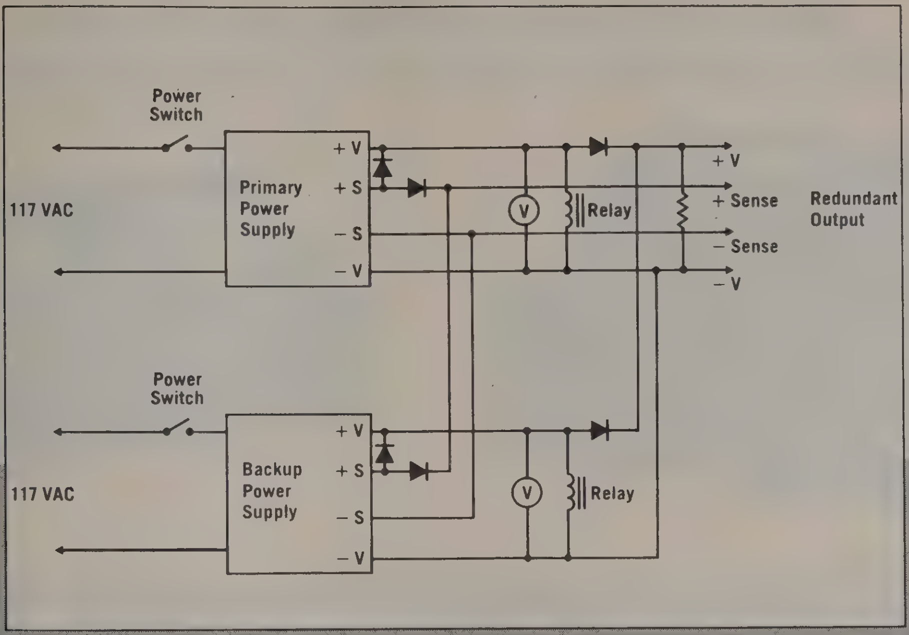
Ammeters: One for each output. For models in case size 3R14, two volt/ammeters, each with switch, are substituted for the standard voltmeters. Add suffix letter "A" to model number and $70.00 to system prices, $35.00 to unit prices of parallelable supplies.

Audible Alarms: Piercing whistle alerts personnel to a voltage lower than normal. Front panel mounted, one for each power supply. Systems and supplies with this option do not have provision for control of an external alarm. To order, add suffix "K" to model number and $70.00 to system prices, $35.00 to unit prices of parallelable supplies.

Handles: Add suffix "H" to model number and $25.00 to price.

Slides: For racks having rear mounting rails spaced 20" to 22" behind the front panel. Not available on parallelable supplies. To order, add suffix "S" to model number and $75.00 to price.

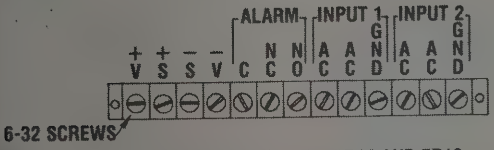
230 Volt Input: For operation on inputs of 210-250 Vac, 50-400 Hz. To order, add suffix "−230" to model number and $75.00 to system prices, $40.00 to unit prices of parallelable supplies.


Power Switch
117 VAC
Primary Power Supply
+V
+S
−S
−V
V
Relay
+V
+Sense
−Sense
−V
Redundant Output
Power Switch
117 VAC
Backup Power Supply
+V
+S
−S
−V
V
Relay

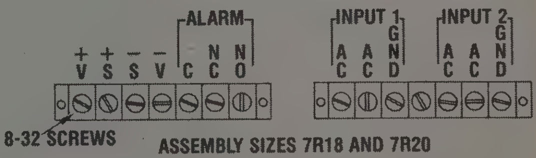
Nominal Output Voltages	Adjust Range ±V	Output Current Amps at			Price	Model	Assembly Size
		40°C	55°C	71°C			
5	.5	2.6	2.5	2.4	$1095	R5N8X	3R14
5	.5	5.3	4.4	3.5	1195	R5M6	5R14
5	.5	11.0	9.3	7.5	1295	R5M13	5R18
5	.5	21.0	17.0	14.0	1495	R5H11	7R18
5	.5	28.0	23.0	19.0	1695	R5H16	7R20
12	.5	1.5	1.5	1.5	1095	R12N8X	3R14
12	.5	3.5	3.0	2.5	1195	R12M6	5R14
12	.5	8.0	7.5	7.0	1295	R12M13	5R18
12	.5	16.0	13.8	11.2	1495	R12H11	7R18
12	.5	20.0	17.0	14.2	1695	R12H16	7R20
15	.5	1.5	1.5	1.5	1095	R15N8X	3R14
15	.5	4.0	3.8	3.6	1195	R15M9	5R14
15	.5	6.5	6.0	5.5	1295	R15M13	5R18
15	.5	14.7	12.5	10.3	1495	R15H11	7R18
15	.5	18.7	16.0	13.3	1695	R15H16	7R20
24	.5	.9	.9	.9	1095	R24N8X	3R14
24	.5	3.0	2.7	2.4	1195	R24M9	5R14
24	.5	5.0	5.0	5.0	1295	R24M13	5R18
24	.5	11.7	10.2	8.7	1495	R24H11	7R18
24	.5	14.7	12.7	10.7	1695	R24H16	7R20
28	.5	1.0	1.0	1.0	1095	R28N8X	3R14
28	.5	2.7	2.6	2.5	1195	R28M9	5R14
28	.5	5.0	5.0	5.0	$1295	R28M13	5R18
28	.5	10.5	9.2	8.0	1495	R28H11	7R18
28	.5	14.0	12.0	10.0	1695	R28H16	7R20
48	.5	.4	.4	.4	1130	R48N8T	3R14
48	.5	1.6	1.4	1.2	1240	R48M9	5R14
48	.5	3.0	3.0	3.0	1340	R48M13	5R18
48	.5	6.0	5.0	4.0	1545	R48H11	7R18
48	.5	8.5	7.2	5.5	1835	R48H16	7R20
60	1	.25	.25	.25	1160	R60N8T	3R14
60	1	1.0	.9	.8	1270	R60M9	5R14
60	1	2.5	2.1	1.7	1370	R60M13	5R18
60	1	5.0	4.1	3.3	1575	R60H11	7R18
60	1	7.0	5.8	4.6	1845	R60H16	7R20
75	1	.17	.17	.17	1160	R75N8T	3R14
75	1	.9	.8	.7	1270	R75M9	5R14
75	1	2.0	1.8	1.5	1370	R75M13	5R18
75	1	4.0	3.3	2.6	1575	R75H11	7R18
75	1	5.6	4.6	3.6	1855	R75H16	7R20
120	1	.12	.12	.12	1180	R120N8T	3R14
120	1	.5	.5	.4	1295	R120M6	5R14
120	1	1.2	1.1	1.0	1400	R120M13	5R18
120	1	2.5	2.0	1.6	1615	R120H11	7R18
120	1	3.5	2.9	2.3	1890	R120H16	7R20

Other models with higher output current ratings are also available. Contact factory for information.

CONNECTIONS:


ALARM
INPUT 1
INPUT 2
+V
+S
−S
−V
C
NC
NO
AC
AC
GND
AC
AC
GND
6-32 SCREWS

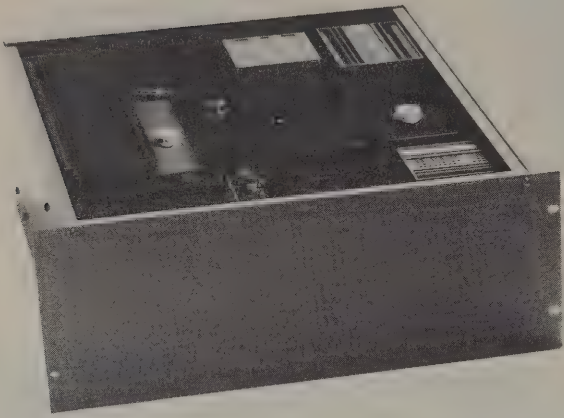
ASSEMBLY SIZES 3R14, 5R14 AND 5R18

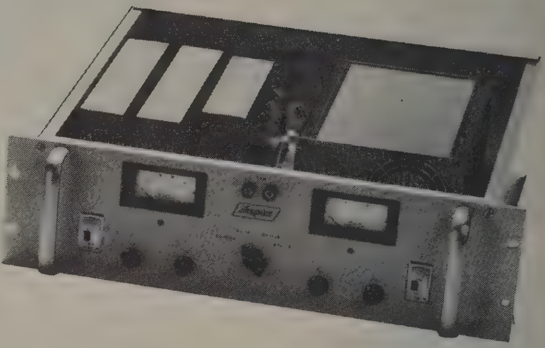

ALARM
INPUT 1
INPUT 2
+V
+S
−S
−V
C
NC
NO
AC
AC
GND
AC
AC
GND
8-32 SCREWS

ASSEMBLY SIZES 7R18 AND 7R20

Acopian

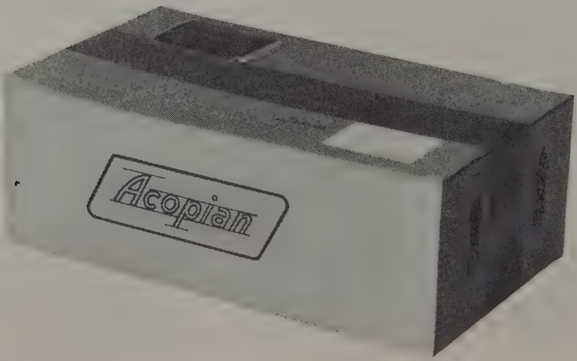
WIRED RACK-MOUNTABLE ASSEMBLIES





CONTAINING ANY POWER MODULES YOU NEED

SHIPPED TO YOU IN JUST 9 DAYS.



How TO ORDER an Acopian Rack Mountable Assembly

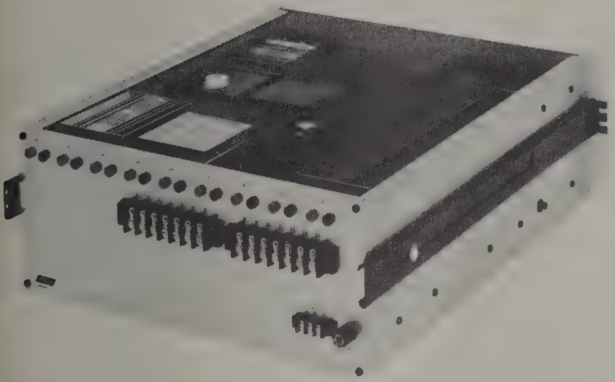
List the DC output ratings you require. Or, select the power modules that you wish to be included. Any module in this catalog can be used.

Also list any assembly features you would like to be included — output controls, meters, test points, switches, handles, chassis slides, etc.

Determine if any size restrictions (assembly height or depth) would be necessary.

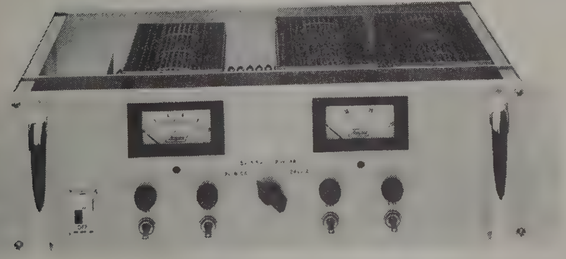
Call Acopian and ask for Department RM5. We will quote a firm price, assign a special model number and ship in only 9 DAYS after your order is received.

Shown are just a few examples of the unlimited variety of assemblies that Acopian can build and ship in 9 DAYS.

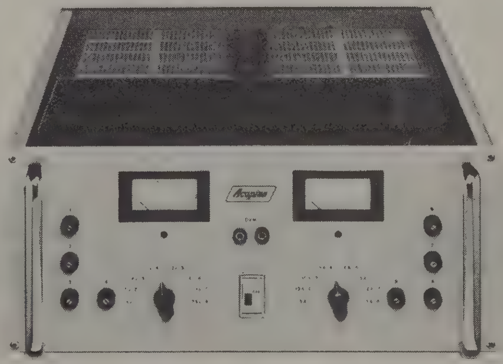


Test points for all outputs, in addition to screw terminals for all input and output connections, are on the rear panel of this 7″ high assembly. Chassis slides permit easy access.

This Acopian power supply assembly, only 3½″ high, furnishes seven regulated DC outputs. Selector switches permit monitoring of the current and voltage of each output.



Four outputs, each separately switched, are provided by this 5¼″ high assembly. The voltmeter and ammeter may be switched to monitor any output.



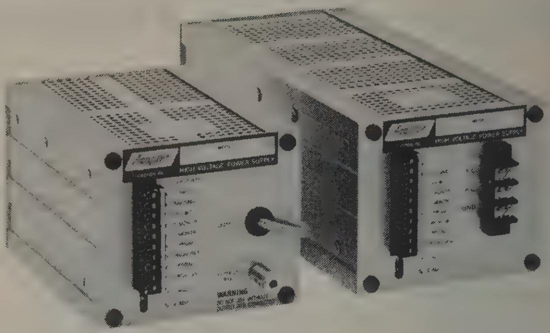
Front panel adjustments, each with a shaft lock to prevent accidental changes, permit easy calibration of the eight outputs provided by this 7″ high assembly.

Acopian

HIGH VOLTAGE

0 TO 30,000 VOLTS
AC-DC & DC-DC

SHIPPED IN 9 DAYS



These modular high voltage supplies may be used as constant voltage or constant current sources. They may be remotely programmed by means of either voltage or resistance, and have provisions for remote monitoring and output inhibiting. All control and monitoring connections are on a pluggable terminal block that functions as a connector, providing wiring convenience and permitting easy and rapid connect/disconnect. Outputs are arc/short circuit protected.

GENERAL SPECIFICATIONS

Output Polarity: Positive output is standard. For negative output, change first letter of model number from P to N.

Regulation (constant voltage operation):
Line: ±0.05%
Load: ±0.05%

Regulation (constant current operation):
Line: ±0.1%
Load: ±0.1% plus 50 μA.

Ripple: 0.05%, peak-to-peak.

Output Controls: Voltage and current may be controlled by means of two 20-turn front panel adjustments, or by using remotely located 1000 ohm potentiometers.

Output Programming: Output voltage and current may be programmed from 0 to full rating by means of control voltage inputs of 0 to +5.1 Vdc.

Voltage Monitor Terminal: Permits monitoring output voltage, stepped down by ratio shown. Accuracy is 2% of maximum rated output voltage.

Current Monitor Terminal: Permits monitoring output current at mV/mA ratio shown. Accuracy is 2% of maximum rated output current.

AC INPUT MODELS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Connections: 24″ flying lead for high side of output and 5-way binding post for return (ground) are at the rear. AC input connections on separate terminal strip. All other connections on pluggable terminal block.

Optional 230 Volt Input: For operation on inputs of 210-250 VAC, 50-400 Hz, single phase. To order, add suffix "–230" to model number and $40.00 to price.

Inhibit Terminal: Grounding inhibits output.

Input Protection: "Soft start" circuit minimizes startup power stresses.

Output Protection: Current regulation circuit protects power supply from short circuits, overload, and arcing.

Efficiency: Greater than 70% at full load.

Response Time: Less than 5 mS for 100 μA load step change.

Stability: 0.05% over eight hours, after 30 minute warmup.

Temperature Coefficient: 200 PPM/°C = 0.02%/°C (Typical).

Ambient Operating Temperature: –10 to +60°C. No derating required.

Storage Temperature: –20 to +85°C.

Humidity: Maximum of 90% relative, non-condensing.

Optional Output Connector: Models with an output of 5000 volts or less can be provided with an MHV connector (and 8′ long detachable output cable with mating MHV connector installed) instead of the flying lead. To order, add suffix letter T to the model number and $50.00 to price.

DC INPUT MODELS

Input Voltage: +21.6 to 32.0 Vdc.

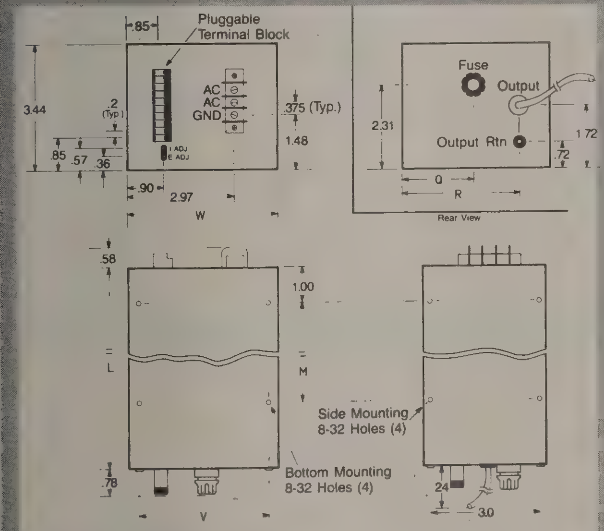
Connections: 24″ flying lead for high side of output and 5-way binding post for return (ground). All other connections on pluggable terminal block.

TO 30,000 VOLTS

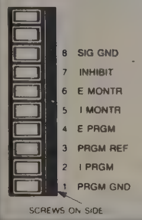
AC INPUT

Output Range k Vdc	Output Current mA	Output Monitor Ratio Voltage	Output Monitor Ratio Current mV/mA	Price	Model (Positive Output)*	Case Size
0-1	30	1,000:1	100:1	$590	P01HA30	HA349
0-1	60	1,000:1	10:1	690	P01HA60	HA359
0-1.5	20	1,000:1	100:1	590	P01.5HA20	HA349
0-1.5	40	1,000:1	100:1	690	P01.5HA40	HA359
0-2	15	1,000:1	100:1	590	P02HA15	HA349
0-2	30	1,000:1	100:1	690	P02HA30	HA359
0-2.5	12	1,000:1	100:1	590	P02.5HA12	HA349
0-2.5	24	1,000:1	100:1	690	P02.5HA24	HA359
0-3.5	8.5	1,000:1	100:1	590	P03.5HA8.5	HA349
0-3.5	17	1,000:1	100:1	690	P03.5HA17	HA359
0-5	6	10,000:1	100:1	650	P05HA6	HA349
0-5	12	10,000:1	100:1	750	P05HA12	HA359
0-7.5	4	10,000:1	100:1	650	P07.5HA4	HA349
0-7.5	8	10,000:1	100:1	750	P07.5HA8	HA359
0-10	3	10,000:1	1,000:1	650	P010HA3	HA349
0-10	6	10,000:1	100:1	750	P010HA6	HA359
0-12	2.5	10,000:1	1,000:1	650	P012HA2.5	HA349
0-12	5	10,000:1	100:1	750	P012HA5	HA359
0-15	2	10,000:1	1,000:1	690	P015HA2	HA349
0-15	4	10,000:1	100:1	790	P015HA4	HA359
0-18	1.6	10,000:1	1,000:1	690	P018HA1.6	HA349
0-18	3.2	10,000:1	1,000:1	790	P018HA3.2	HA359
0-20	1.5	10,000:1	1,000:1	790	P020HA1.5	HA349
0-20	3	10,000:1	1,000:1	890	P020HA3	HA359
0-22	1.3	10,000:1	1,000:1	790	P022HA1.3	HA349
0-22	2.6	10,000:1	1,000:1	890	P022HA2.6	HA359
0-25	1.2	10,000:1	1,000:1	890	P025HA1.2	HA349
0-25	2.4	10,000:1	1,000:1	990	P025HA2.4	HA359
0-30	1	10,000:1	1,000:1	890	P030HA1	HA349
0-30	2	10,000:1	1,000:1	990	P030HA2	HA359

*Positive output is standard. For negative output, change first letter of model number from P to N.


.85
Pluggable Terminal Block
3.44
.2 (Typ.)
AC
AC
GND
.375 (Typ.)
1.48
.85
.57
.36
I ADJ
E ADJ
.90
2.97
W
Fuse
Output
2.31
Output Rtn
1.72
.72
Q
R
Rear View
.58
1.00
L
M
Side Mounting 8-32 Holes (4)
Bottom Mounting 8-32 Holes (4)
.78
V
24
3.0

PLUGGABLE TERMINAL BLOCK CONNECTIONS

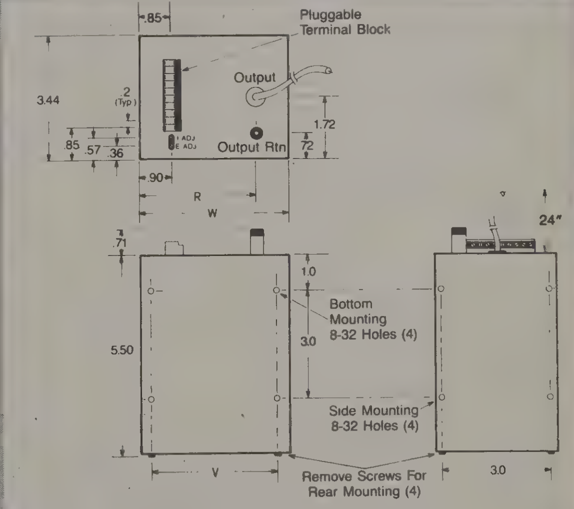

8 SIG GND
7 INHIBIT
6 E MONTR
5 I MONTR
4 E PRGM
3 PRGM REF
2 I PRGM
1 PRGM GND
SCREWS ON SIDE

Size	L	W	M	V	Q	R	Approx. Weight
HA349	8.82	4.13	6.00	3.50	2.00	3.25	6 lbs. 8 oz.
HA359	9.33	5.13	7.00	4.50	2.78	4.25	10 lbs.

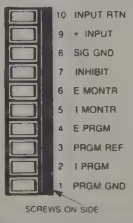
DC INPUT

Output Range k Vdc	Output Current mA	Output Monitor Ratio Voltage	Output Monitor Ratio Current mV/mA	Price	Model (Positive Output)*	Case Size
0-1	30	1,000:1	100:1	$490	P01HD30	HD345
0-1	60	1,000:1	10:1	590	P01HD60	HD355
0-1.5	20	1,000:1	100:1	490	P01.5HD20	HD345
0-1.5	40	1,000:1	100:1	590	P01.5HD40	HD355
0-2	15	1,000:1	100:1	490	P02HD15	HD345
0-2	30	1,000:1	100:1	590	P02HD30	HD355
0-2.5	12	1,000:1	100:1	490	P02.5HD12	HD345
0-2.5	24	1,000:1	100:1	590	P02.5HD24	HD355
0-3.5	8.5	1,000:1	100:1	490	P03.5HD8.5	HD345
0-3.5	17	1,000:1	100:1	590	P03.5HD17	HD355
0-5	6	10,000:1	100:1	550	P05HD6	HD345
0-5	12	10,000:1	100:1	650	P05HD12	HD355
0-7.5	4	10,000:1	100:1	550	P07.5HD4	HD345
0-7.5	8	10,000:1	100:1	650	P07.5HD8	HD355
0-10	3	10,000:1	1,000:1	550	P010HD3	HD345
0-10	6	10,000:1	100:1	650	P010HD6	HD355
0-12	2.5	10,000:1	1,000:1	550	P012HD2.5	HD345
0-12	5	10,000:1	100:1	650	P012HD5	HD355
0-15	2	10,000:1	1,000:1	590	P015HD2	HD345
0-15	4	10,000:1	100:1	690	P015HD4	HD355
0-18	1.6	10,000:1	1,000:1	590	P018HD1.6	HD345
0-18	3.2	10,000:1	1,000:1	690	P018HD3.2	HD355
0-20	1.5	10,000:1	1,000:1	690	P020HD1.5	HD345
0-20	3	10,000:1	1,000:1	790	P020HD3	HD355
0-22	1.3	10,000:1	1,000:1	690	P022HD1.3	HD345
0-22	2.6	10,000:1	1,000:1	790	P022HD2.6	HD355
0-25	1.2	10,000:1	1,000:1	790	P025HD1.2	HD345
0-25	2.4	10,000:1	1,000:1	890	P025HD2.4	HD355
0-30	1	10,000:1	1,000:1	790	P030HD1	HD345
0-30	2	10,000:1	1,000:1	890	P030HD2	HD355

*Positive output is standard. For negative output, change first letter of model number from P to N.


.85
Pluggable Terminal Block
3.44
.2 (Typ.)
Output
Output Rtn
1.72
.72
.85
.57
.36
I ADJ
E ADJ
.90
R
W
24"
.71
1.0
Bottom Mounting 8-32 Holes (4)
3.0
5.50
Side Mounting 8-32 Holes (4)
V
Remove Screws For Rear Mounting (4)
3.0

PLUGGABLE TERMINAL BLOCK CONNECTIONS


10 INPUT RTN
9 + INPUT
8 SIG GND
7 INHIBIT
6 E MONTR
5 I MONTR
4 E PRGM
3 PRGM REF
2 I PRGM
1 PRGM GND
SCREWS ON SIDE

Size	W	V	R	Approx. Weight
HD345	4.13	3.50	3.25	2 lbs.
HD355	5.13	4.50	4.25	2 lbs. 12 oz.

Acopian

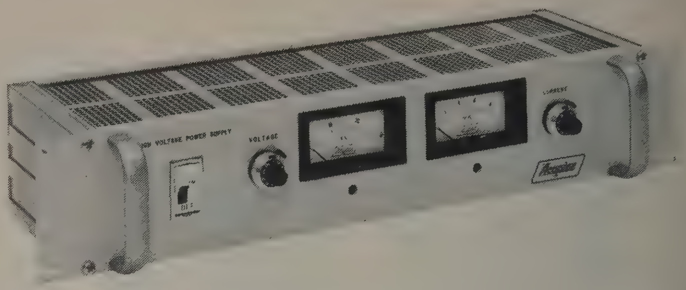
(610) area code after 1993
P.O. Box 638, Easton, PA 18044 • Phone: (215) 258-5441 • FAX: (215) 258-2842

Acopian

HIGH VOLTAGE

0 TO 30,000 VOLTS
AC-DC & DC-DC

SHIPPED IN 9 DAYS



Ideal for laboratory and instrumentation applications, these rack mounting supplies have the same output ratings and specifications as the modular supplies shown on pages 30 and 31, but additionally feature calibrated ten-turn controls (with locking vernier dials) for precisely setting voltage and current. Voltmeter and ammeter are standard. An 8′ long shielded output cable is included.

GENERAL SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Input Current:
- 30 watt output ratings: 0.6A
- 60 watt output ratings: 1.2A

Output Polarity: Positive output is standard. For negative output, change first letter of model number from P to N.

Regulation (constant voltage operation):
- **Line:** ±0.05%
- **Load:** ±0.05%

Regulation (constant current operation):
- **Line:** ±0.1%
- **Load:** ±0.1% plus 50 µA.

Ripple: 0.05%, peak-to-peak.

Output Controls: Voltage and current may be controlled by means of two 10-turn front panel adjustments with locking vernier dials. Control linearity is 1% of full rated output. Calibration accuracy is 1% of rated output plus 1% of setting. (Remotely located 1000 ohm potentiometers may alternately be used for output control.)

Output Programming: Output voltage and current may be programmed from 0 to full rating by means of control voltage inputs of 0 to +5.1 Vdc, ±2%.

Metering: Voltmeter and ammeter are standard. Accuracy is 2% of full scale.

Voltage Monitor Terminal: Permits remote monitoring of output voltage, stepped down by ratio shown. Accuracy is 2% of maximum rated output voltage.

Current Monitor Terminal: Permits remote monitoring of output current, at mV/mA ratio shown. Accuracy is 2% of maximum rated output current.

Inhibit Terminal: Grounding inhibits output.

Output Protection: Current regulation circuit protects power supply from short circuits, overload, and arcing.

Response Time: Less than 5 mS for 100 µA load step change.

Stability: 0.05% over eight hours, after 30 minute warmup.

Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: −10 to +60°C. No derating required.

Storage Temperature: −20 to +85°C.

Humidity: Maximum of 90% relative, non-condensing.

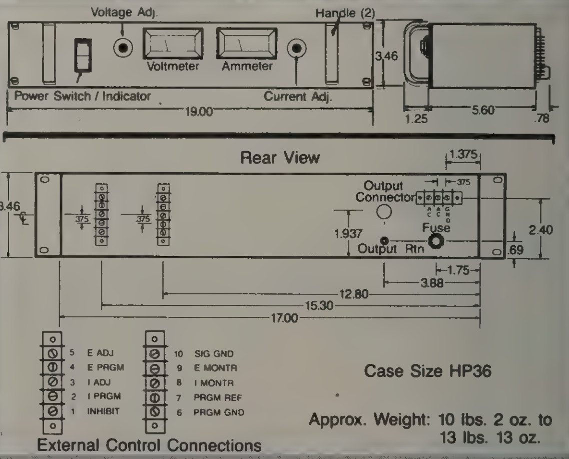
Connections:

Input, Control and Monitoring: Screw terminals.

Output: High voltage connector (Type varies with model number). An 8′ shielded output cable, with mating connector installed, is provided.

Optional 230 Volt Input: For operation on inputs of 210-250 VAC, 50-400 Hz, single phase. To order, add suffix "-230" to model number and $40.00 to price.

Output Range kVdc	Output Current mA	Output Monitor Ratio		Price	Model (Positive Output)
		Voltage	Current mV/mA		
0-1	30	1,000:1	100:1	$ 995	P01HP30
0-1	60	1,000:1	10:1	1095	P01HP60
0-1.5	20	1,000:1	100:1	1095	P01.5HP20
0-1.5	40	1,000:1	100:1	1195	P01.5HP40
0-2	15	1,000:1	100:1	995	P02HP15
0-2	30	1,000:1	100:1	1095	P02HP30
0-2.5	12	1,000:1	100:1	995	P02.5HP12
0-2.5	24	1,000:1	100:1	1095	P02.5HP24
0-3.5	8.5	1,000:1	100:1	995	P03.5HP8.5
0-3.5	17	1,000:1	100:1	1095	P03.5HP17
0-5	6	10,000:1	100:1	1050	P05HP6
0-5	12	10,000:1	100:1	1150	P05HP12
0-7.5	4	10,000:1	100:1	1050	P07.5HP4
0-7.5	8	10,000:1	100:1	1150	P07.5HP8
0-10	3	10,000:1	1,000:1	1050	P010HP3
0-10	6	10,000:1	100:1	1150	P010HP6
0-12	2.5	10,000:1	1,000:1	1050	P012HP2.5
0-12	5	10,000:1	100:1	1150	P012HP5
0-15	2	10,000:1	1,000:1	1095	P015HP2
0-15	4	10,000:1	100:1	1195	P015HP4
0-18	1.6	10,000:1	1,000:1	1095	P018HP1.6
0-18	3.2	10,000:1	1,000:1	1195	P018HP3.2
0-20	1.5	10,000:1	1,000:1	1095	P020HP1.5
0-20	3	10,000:1	1,000:1	1195	P020HP3
0-22	1.3	10,000:1	1,000:1	1150	P022HP1.3
0-22	2.6	10,000:1	1,000:1	1250	P022HP2.6
0-25	1.2	10,000:1	1,000:1	1195	P025HP1.2
0-25	2.4	10,000:1	1,000:1	1295	P025HP2.4
0-30	1	10,000:1	1,000:1	1195	P030HP1
0-30	2	10,000:1	1,000:1	1295	P030HP2



Case Size HP36

Approx. Weight: 10 lbs. 2 oz. to 13 lbs. 13 oz.

Adtech Power Incorporated

Single and Multiple Output 250 to 400 Watt Switch Mode Power Supplies

- ☐ Customized Standards 5-24VDC/5-48VDC Outputs Customer Selects Adtech Builds
- ☐ Soft-Start Circuitry
- ☐ High Efficiency/High Reliability Mag Amp Outputs
- ☐ Protection against overvoltage, overloads, reverse voltage, short circuits, over temperature and high or low line conditions.

- ☐ High Power Density
- ☐ International Safety Standards. UL1950, CSA 22.2 No. 154-1983, Bulletin 1402, VDE 0806/IEC 380-Class 1 SELV
- ☐ Hybrid Control Circuit
- ☐ Built-In FCC/VDE E.M.I. filter
- ☐ International Power Inputs (External Field Selectable): 90VAC-132VAC or 180VAC-264VAC

Output Voltage/Current Ratings

MODEL PREFIX[1]	OUTPUTS	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	TOTAL POWER[2]
CS2401	1	5 TO 48V UP TO 50A					250 W
CS2404	4	5 TO 48V UP TO 50A	5 TO 48V UP TO 15A	+5 TO 24V UP TO 5A	−5 to 24V UP TO 5A		250 W
CS2405	5	5 TO 48V UP TO 50A	5 TO 48V UP TO 15A	+5 TO 48V UP TO 15A	+5 TO 24V UP TO 5A	−5 TO 24V UP TO 5A	400 W

NOTES:

1. Consult factory for specific model number according to output voltages selected.
2. Total Power with 300 LF/M Air. Derate 20% for convection cooling.

Specifications:

AC Input Range:
90-132 or 180-264VAC 47-440Hz Single Phase.

Inrush Current:
Less than 50A peak thermistor limited for units that have been off for at least 30 minutes.

Undervoltage Protection:
Protected against malfunction due to AC undervoltage operation.

Efficiency:
Typically 75% at nominal line, full load.

Turn-On Time:
400 mS Max.

Hold-Up Time:
20 mS. Typical at nominal line, full load.

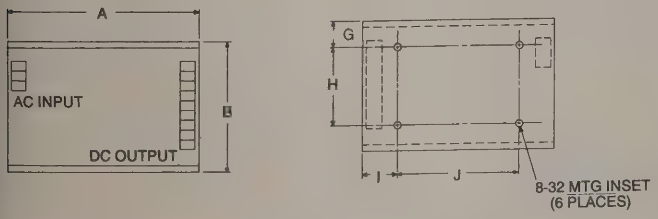
DC Outputs:
All outputs are adjustable, ±5% min. Output 2 is floating.

Output Regulation:
Line ±0.2% over input range, 90-132 or 180-264VAC. at 100% rated load.
Load ±0.5% all outputs

Cross regulation:
Each output independently regulated and effects do not apply.

Dynamic Response:
All outputs will settle to 1% of output within 400µs after a 25% load step change and will deviate no more than ±2%.

Outline Mounting/Interface



Thermal Regulation: ±0.2%/°C

Ripple and Noise:
True differential measurement with a 20MHz scope and a ×1 probe 1% or 100mV peak to peak, whichever is greater.

Overvoltage protection:
Standard. Preset at 6.0—6.5V on 5V main output.
Consult factory for other voltages.

Overload Short Circuit Protection:
CS2401 Output 1, CS2404 Outputs 1 & 2, CS2505 Outputs 1,2, & 3 will shut down power supply in short circuit condition. CS2404 Outputs 3 & 4, CS2405 outputs 4 & 5 will go into current fold back under short circuit condition.

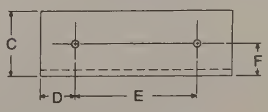
Remote Sense:
On Output 1 - compensates for up to 0.5V lead drop.

Operating Temperature Range:
0—50°C ambient with min. of 300LFM of air directed through power supply lengthwise. Derate linearly to 50% at 70°C
Derate 20% for convection cooling.

Power Fail:
A TTL compatible signal flag raises a minimum of 5mS prior to outputs dropping out of regulation; adjustable to 10mS. minimum at full load, nom. line. TTL low or high is selectable on P.C. board, consult factory.

Standard Chassis Dimensions (Inches)

Model	A	B	C	D	E	F	G	H	I	J
CS2401	8.00	5.00	2.50	.25	7.50	1.25	1.00	3.00	1.00	6.00
CS2404	10.00	5.00	2.50	.25	0.50	1.25	1.00	3.00	1.00	8.00
CS2405	13.50	5.00	2.50	.25	13.00	1.40	1.00	3.00	1.00	11.50



ADTECH POWER

Adtech Power Incorporated
2220 S. Dupont Drive, Anaheim, CA 92806 Tele: (714) 634-9211 FAX (714) 634-0802

LL-SERIES SPECIFICATIONS

AC INPUTS: 90-132/180-264 VAC, user selectable, 47-63 Hz single phase (LL40 has continuous range of 90-264 VAC, 47-63 Hz.)

DC OUTPUTS: See output rating table.

HOLDUP TIME: 20 mS minimum at full load and nominal line input voltage.

OUTPUT REGULATION:
Fully regulated output: ±0.5%
Dual sensed regulated output: ±1.5%
Semi-regulated output: ±4%
Cross regulation factor of ±3% must be added to semi-regulated output where the main output +5V varies ±25%.

MINIMUM LOAD: A minimum load of 10% is required on the main +5V output to maintain proper operation of the other outputs.

OUTPUT NOISE AND RIPPLE: 1% or 100 mV peak to peak maximum (whichever is greater) on all outputs.

TRANSIENT RESPONSE: Main +5V output only. Output return to within 1% in less than 1 millisecond for a 50% load change. Maximum voltage deviation is ±5%.

TEMPERATURE COEFFICIENT: 0.03%/°C for all outputs.

TEMPERATURE RATING: 0 to 50°C at full rated output power, with natural convection cooling in a non-restricted environment. For operation in a restrained space, moving air is recommended. For operation above 50°C, it is important to maintain the heatsinks below 100°C.

SAFETY SPECIFICATIONS: All models are designed to meet the specifications of IEC 601, VDE 0750, UL 544, CSA 22.2 No. 234.

SAFETY LEAKAGE CURRENT: 30 µA maximum.

OVERVOLTAGE PROTECTION: Built-in on +5V output, with crowbar set at 6.2V ± 0.6 VDC.

VOLTAGE ADJUSTMENT: Built-in potentiometer adjusts voltage from 4.5V to overvoltage crowbar point (6.2V nominal.)

EFFICIENCY: 70%±5% depending on model and load distribution. Measured at full load and nominal line.

PEAK POWER LIMIT: Factory set to begin peak power limit under nominal line conditions as following:

LL040: fixed at 45 watts
LL080: 90 watts
LL120: 130 watts

OVERLOAD PROTECTION: Fully protected against output overload and short circuit. Automatic recovery after removal of fault.

REVERSE VOLTAGE PROTECTION: All outputs are protected against inappropriate application of reverse voltage.

OVERSHOOT: No output overshoot during turn on and turn off.

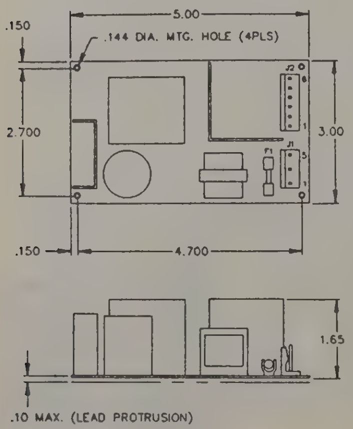
INPUT PROTECTION: Internal AC fuse is provided on all units.

INRUSH CURRENT: Inrush current is limited by an internal thermistor for maximum protection of input Caps and Rectifiers.

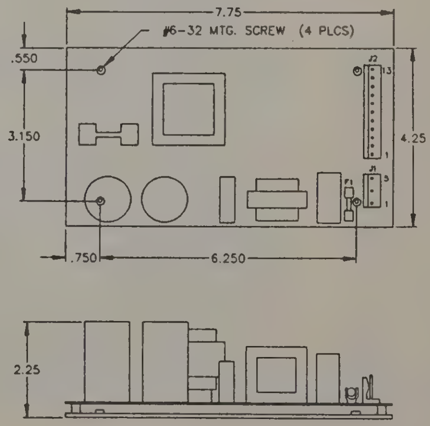
EMI SPECIFICATIONS: All models are designed to meet the conducted emission requirements of FCC and VDE 0871 Class B.

RELIABILITY: 200,000 hours minimum calculated per MIL-HDBK-217E.

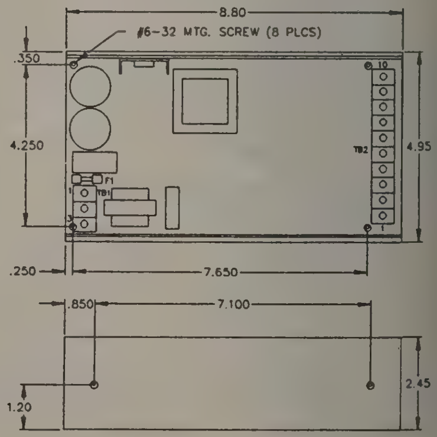
LL040 (WT. 0.665 LB.)



LL080 (WT. 1.5 LB.)



LL120 (WT. 2.1 LB.)



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FOR MEDICAL APPLICATIONS

New Low Leakage Current Switching Power Supplies

LL-Series Features:

- 3 sizes, 3 power levels, 40 to 120 watts
- Multi-output configurations (up to 5 outputs)
- Designed to meet IEC 601, VDE 0750, UL 544 and CSA 22.2 No. 234 Level 3 medical specifications
- Less than 30 µA leakage current
- Meets stringent FCC and VDE 0871 Class B EMI
- Power Fail/Power Good available on 120 watts units
- Worldwide AC input ranges 90-132/180-264 VAC, 47-440 Hz
- Enclosures available on all models
- Easily modifiable for all custom applications
- Adtech SPC program standard on all units
- 24 hour full load burn-in and 2-year warranty
- Industrial standard packages

LL040 40 WATTS (45W PK.)

MODEL	OUTPUT	VOLTAGE	CURRENT	INITIAL SETTINGS (±)	OUTPUT REGULATION (±)	NOTE
LL0403-2E3C3A	1	+5V	5.0A	ADJ.	0.5%	1
	2	+12V	2A	4.0%	1.0%	3
	3	-12V	0.5A	4.0%	1.0%	3
LL0403-2E4C4A	1	+5V	5.0A	ADJ.	0.5%	1
	2	+15V	2A	4.0%	1.0%	3
	3	-15V	0.5A	4.0%	1.0%	3

LL080 80 WATTS (90W PK.)

MODEL	OUTPUT	VOLTAGE	CURRENT	INITIAL SETTINGS (±)	OUTPUT REGULATION (±)	NOTE
LL0804-2F3B5B	1	+5V	7.0A	ADJ.	1.5%	2
	2	+12V	2A (3.5A PK)	3.0%	1.5%	2
	3	-12V	1.0A	4.0%	1.0%	3
	4	+24V	1A (2.0A PK)	4.0%	4.0%	4
LL0804-2F3C3B2B	1	+5V	7.0A	ADJ.	1.5%	2
	2	+12V	2A (3.5A PK)	3.0%	1.5%	2
	3	-12V	1.0A	4.0%	1.0%	3
	4	-5V	1.0A	4.0%	1.0%	3
LL0804-2F4C4B5B	1	+5V	7.0A	ADJ.	1.5%	2
	2	+15V	2A (3.5A PK)	3.0%	1.5%	2
	3	-15V	1.0A	4.0%	1.0%	3
	4	+24V	1A (2.0A PK)	4.0%	1.0%	4
LL0804-2F4C4B2B	1	+5V	5.0A	ADJ.	0.5%	1
	2	+15V	2A	4.0%	1.0%	3
	3	-15V	0.5A	4.0%	1.0%	3
	4	-5V	1.0A	4.0%	1.0%	3

LL120 120 WATTS (130W PK.)

MODEL	OUTPUT	VOLTAGE	CURRENT	INITIAL SETTINGS (±)	OUTPUT REGULATION (±)	NOTE
LL1205-2H3D5C3D2B	1	+5V	12.0A	ADJ.	0.5%	1
	2	+12V	3.0A (5.0A PK)	3.0%	3.0%	4
	3	+24V	2.0A (3.0A PK)	3.0%	3.0%	4
	4	-12V	3.0A	3.0%	3.0%	4
	5	-5V	1.0A	4.0%	1.0%	3
LL1205-2H3D4C3D2B	1	+5V	12.0A	ADJ.	0.5%	1
	2	+12V	3.0A (5.0A PK)	3.0%	3.0%	4
	3	+15V	2.0A (3.0A PK)	3.0%	3.0%	4
	4	-12V	3.0A	3.0%	3.0%	4
	5	-5V	1.0A	4.0%	1.0%	3
LL1205-2H4D5C4B2A	1	+5V	12.0A	ADJ.	0.5%	1
	2	+15V	3.0A (5.0A PK)	3.0%	3.0%	4
	3	+24V	2.0A (3.0A PK)	3.0%	3.0%	4
	4	-15V	1.0A	3.0%	3.0%	4
	5	-5V	0.5A	4.0%	1.0%	3

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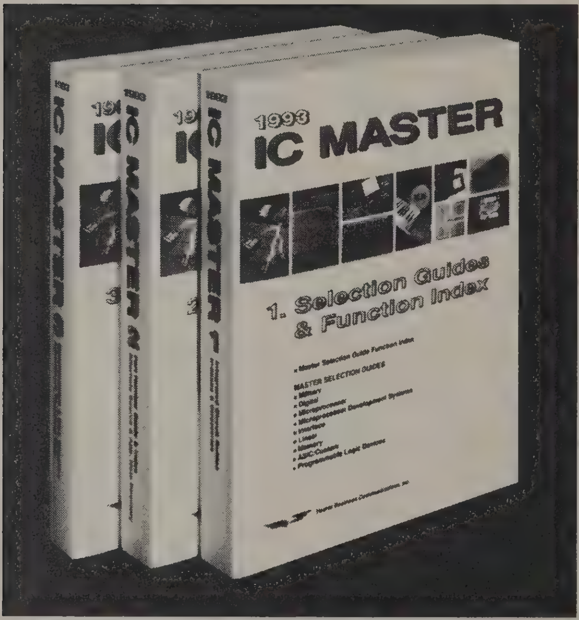
SUPER
TIME
SAVER!



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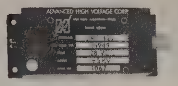
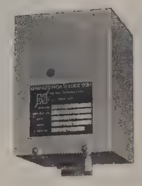
Eout Nom. kV	Iout Max. mA	Model No.	Features, Specifications and Options
200V	15.0	DRF 325	Miniature, fully regulated DC to DC converter with 0.05% line and regulation. Has remote programming capability. 3 watts output. Shielded, RFI decoupled. **Input:** 12, 15, 24, 28 VDC. **Output Adjustment Range:** –30% to +10%, standard (wider: option –04). **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** –10°C to +65°C. **Dimensions:** 3.0" x 1.5" x 0.6" (Flange length is 3.625".) **Weight:** 4 oz.
400V	7.5	DRF 335	
600V	5.0	DRF 345	
800V	3.7	DRF 355	
1.1	3.0	DRF 365	
1.5	2.0	DRF 375	
2.0	1.5	DRF 385	
3.0	1.0	DRF 405	
200V	30.0	ARM 016	Line operated, 6 watt supply for photomultiplier and similar applications. Units are shielded, serviceable, short circuit proof and light weight. Input and output are RFI decoupled. Standard adjustment range is –30% to +10%. Remote program is standard. **Input:** 117 VAC, 50 to 400 Hz, 28 VDC. **Regulation (L/L):** 0.02%, (better with less than 0 to full load changes). **Ripple and Noise:** 0.02%. **Operating Temperature:** –10°C to +65°C. **Size:** 3.04" x 2.60" x 4.23". **Weight:** 32 oz. **Options:** Negative output (–01), wide adjustment range (–04).
400V	15.0	ARM 026	
600V	10.0	ARM 036	
800V	7.5	ARM 046	
1.0	6.0	ARM 056	
1.2	5.0	ARM 066	
1.5	4.0	ARM 076	
1.8	3.3	ARM 086	
500V	30.0	ARA 1362	Line operated, 15 watt High Voltage Module. Adjustable and/or programmable to zero. Fully serviceable, short circuit proof and shielded. Standard adjustment range is –30% to +10%. **Input:** 117 VAC, 50 to 400 Hz. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** –10°C to +65°C. **Dimensions:** 4.66" x 3.98" x 3.0". **Weight:** 3.5 lbs. **Options:** 0 to 110% voltage adjustment (–03), remote program (–05), negative output (–01), lower ripple figure (–09). Other output voltages.
3.0	5.0	ARA 106	
4.0	4.0	ARA 116	
5.0	3.0	ARA 126	
8.0	2.0	ARA 146	
10	1.5	ARA 156	
12	1.3	ARA 166.	
15	1.0	ARA 176	
18	0.8	ARA 186	
22	0.7	ARA 196	
±15V	500.0	DUM 1263	Fully regulated High Voltage Module, 15 or 30 watts output. Output adjustment +10%, –30%. Short-circuit proof. HV return may be floated to 500 volts from chassis. Magnetically shielded. Serviceable. **Input:** 12, 15, 24, 28 VDC. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** –20°C to +65°C. **Size:** 3.0 x 2.6 x 4.3 (to 5 KV), 3.04 x 3.54 x 4.84 (over 5KV). **Options:** Negative output (–01), wider adjustment range (–04), remote program (–05), 30 watts output power (–19). Units also available with other voltages from 2.2 volts (filament supplies) to 24 KV. Other options. Also available with floating output: DUM series.
300V	50.0	DRM 1291	
1.0	15.0	DRM 115	
1.5	10.0	DRM 125	
2.5	6.0	DRM 135	
3.5	4.0	DRM 145	
5.0	3.0	DRM 155	
7.5	2.0	DRM 165	
10	1.5	DRM 175	
12.5	1.2	DRM 185	
15	1.0	DRM 195	
18	0.8	DRM 205	
22	0.6	DRM 215	
1.0	80.0	NRL 602	Medium power DC to DC High Voltage Converter, 80 or 160 watts. **Input:** 24 to 32 VDC. **Outputs:** to 30 KV. Adjustable constant voltage/constant current operation. Units can be paralleled for higher power. Remote program of voltage and current. **Standard Adjustment Range:** +10%, –30% of rated output voltage. Efficiency better than 70%. Buffered metering outputs, voltage and current. **Operating Temperature:** –20°C to +65°C. **Ripple:** 0.1% P-P. **Regultion (L/L):** 0.1%. **Size:** 4.75 x 4.75 x 5.0 inches. **Weight:** approx. 6 lbs. 160 watts output, option (–19). Other options, see next block.
1.5	53.0	NRL 612	
2	40.0	NRL 622	
2.5	32.0	NRL 632	
3.5	22.0	NRL 642	
5	16.0	NRL 652	
8	10.0	NRL 662	
10	8.0	NRL 672	
15	5.3	NRL 682	
22	3.7	NRL 712	
1.0	250	NRL 1350	250 watt DC to DC converter. **Input:** 24 to 32 VDC. **Output:** 500 volts to 30 KV for this series. Adjustable constant voltage/constant current operation. Units can be paralleled for higher power. **Standard Adjustment Range:** +10, –30% for voltage, 0 to 100% for current. **Operating Temperature:** –20°C to +65°C. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P (0-5% for 20 KV and higher). Efficiency better than 70%. **Size:** 4.75 x 4.75 x 5.00 inches. **Weight:** Approx. 6 lbs. **Options:** Negative output (–01). Remote programming and metering (–05).
2.5	100	NRL 1177	
3.5	68	NRL 1320	
5	50	NRL 1322	
10	25	NRL 1314	
15	16	NRL 1337	
20	12	NRL 1338	
30	8	NRL 1336	

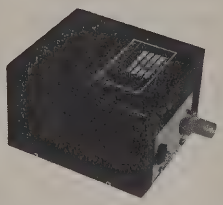
DRF



ARM

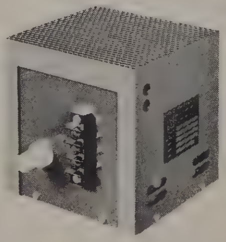


ARA



DRM/DUM

NRL



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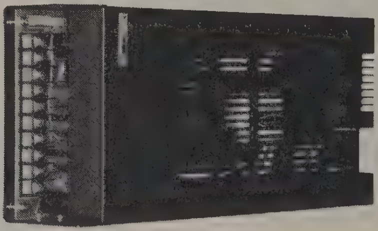
10 To 200 Watt Universal Auto input Range VI Series Switching D.C. Power Supplies



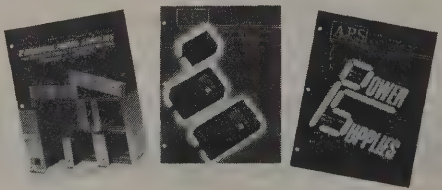
Features:

- Automatically Accommodates Universal AC Sources.
- Designed and Tested to Worldwide EMI/RFI Regulations. Meets VDE and FCC Level "B" Emissions.
- Compact Size. • Overload Protection.
- Overvoltage Protection. • Many Options Available.
- Calculated MTBF Greater Than 100K Hours.
- UL Recognized, CSA Certified, TUV Licensed.

Advanced Power Solutions (APS), a division of M&L Enterprises Inc. both American owned and operated companies. was founded with the goal of providing quality power products at the best possible price. With U.S. and Canadian design teams, mature products are transferred to APS selected sites in Taiwan or Hong Kong for high volume production. The far east facilities are ***BABT APPROVE*** facilities and specialize in the manufacture of distant product families.Total manufacturing area in these 4 facilities is 700,000 square feet. ***Products Offered***-APS offers a wide variety of products. The standard products include Desk top & Wall mount power supplys, Universal AC input Desk Top and Open frame switchers in the Power range of 15 watts to 300 watts. AC input Open frame switchers in power ranges of 10 watts to 1,000 watts. Eurocard & Vme power supplies with Universal AC input and Dc input available. 19" rack supplies are available in "Hot plug in" redundant style or non-redundant style. New for 1993 is the APS "KAM" series, which is a potted Universal AC input module that is PCB mountable. The power range offered is 5W to 60W per module.

Parameter	*Conditions*	*Limits*
AC Input	No load to full load Auto input range without any external changes	90-264 VAC (115 or 230 VAC nominal)
AC Input Frequency	No load to full load	47-63 Hz (Consult factory for 440 Hz operation)
Input Surge Current	Peak (cold start)	20A(115VAC 40A(230VAC)
DC Output		See Voltage/Current Rating Charts
DC Output Adjustment	Main output	+5V(4.5 to ovp trip point)
Centering (initial setting on auxiliary outputs.)	All outputs 50% max rated load. +5V adjusted to 5.0V	+/-5% typical +/-2% (optional)
Hold-up Time	Nominal input voltage and max output power	20msec.
Line Regulation	Within specified AC limits	+/-5% typical
Load Regulation	20% to 100% load change	+/-1.0% main output +/-3.0% for auxiliary output w/o post regulator +/-1.0% for auxiliary output w/post regulator
Cross Regulation	Main output: Change any other output from 50% to 100% max rated load. Aux output: Change +5V output from 50% to 100% max rated load. Change another aux output from 20% to 100% max rated load.	+/-1% max +/-3.5% max +/-1% with post regulator +/-1%
Ripple and Noise	Max load.	50mV Pk-Pk max 5V output(1% max any other output)
Transient Response	50% load change	2% max deviation, returns to initial condition in 1 msec max
Temperature Coefficients of outputs	Main output Auxiliaries	0.02%/°C typical 0.02%/°C typical
Long Term Stability	For 8 hours, after 20 min warm-up.	0.1%
Overshoot	On turn-on, turn-off, or power failure.	No voltage spikes
Ambient Operating Temperature	Continuous duty, full rating Derate linearly to 50% of full rating at + 71°C With 12cfm fan cooling	0° to 50°C 50° to 71°C 0° to 70°C
Storage Temperature	Non operating	-20°C to +80°C
Overvoltage	+5V output only	+6.2V +/-0.4V
Short Circuit Protection	Will withstand a continous short without damage. Will automatically return to regulation upon removal of the short	
Overload Protection	Maximum rated current cannot be drawn from all output at the same time. The overload feature will reduce all output voltages to a safe dissipation level when the total output power exceed 125% of the maximum rated power.	
No Load Operation	No damage to power supply will occur when operating at no load.	

For more power supplies see:
POWERTRONICS
Pages A•2509 thru A•2511



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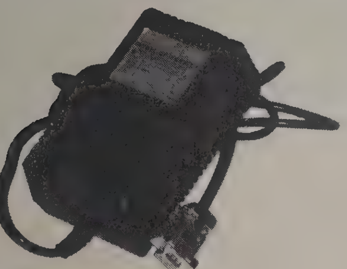
AC DC External Regulated Switching Power Supply



20,40 & 60 Watts Desktop Universal Input APS20-ES, APS40-ES & APS60-ES Series Adapter

Features:

- **Automatically Accommodates Universal ASource**
- **Desktop With IEC 320 Input Connector**
- **Universal Safety Standards**
- **EMI/RFI Meets VDE and FCC Part 15 Level B.**
- **Overvoltage and Overload Protection**

IEC950

FCC IEC380

Specifications

Inputs:

Input Voltage: Typical : 90-260 VAC. Also available:85-265VAC.
Input Frequency: 47-440Hz
Inrush Current: 20A for APS20 & AP40; 25A for APS60
Dielectric Withstand: Meet VDE 0806 for 1 minute 3,750VAC-Output/Input; 1,500VAC-Input/Safety GND; 500VAC-Output SAfety GND
EMI/RFI: Meet VDE 0871-B & FCC Part 15 class B.
Operating Temperature: 0-40°C
Storage Temperature:-20 to+85°C
Cooling: Convention
Efficiency: 65-75%
Hold-Up Time: 20ms at 120VAC. Full load.
Switching Frequency: Approximate 25KHZ. at full load and 90VAC input, higher at increasing input voltage or light load.
Transient Response: Output voltage returns in less than 3ms following a 50% load change.
Case: Impact resistant mold thermoplastic, flame rating 94V-1 for UL, 94V-0 for CSA.
MTBF: Great than 50K hours at typical load at 25°C ambient temperature calculated according to MIL-HDBK-217E..
Temperature Coefficient: 0.04% per degree C on main output.

Outputs:

Output Voltages: See rating charts.
Output Currents: See rating charts.
Load & Cross Regulations:

	Load Regulation	Cross Regulation
At PSU PCB Outputs:		
Main VO1	2.0%	0.2%
AUX. VO2	5.0%	5.0%
AUX. VO3	1.5%	1.5%
At PSU cord connector end:		
Main VO1	5.0%	2.0%
AUX. VO2	5.0%	5.0%
AUX. VO3	1.5%	1.0%

Remark: The exact voltage regulation obtainable depends upon the output cord & connector selected and load current. Upper are for 6 ft.(or 2 meters) cord AWG#18/20 wires with PD-5 connector.

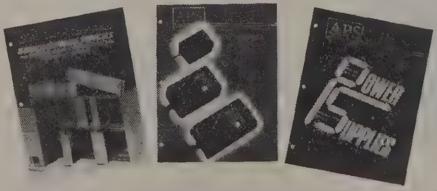
Noise & Ripple: Typical 1% peak to peak.
Over Voltage Protection (OVP): 124% ±8% on main output.
Adjustability: Main output internal adjustable from 4.5V till OVP trip point.
Overload Protection: Max. Current cannot be draw from all out puts simultaneously. The over current protection feature will reduce all output voltage to safe dissipation level when the average power rating exceeds 125%-150% of max. power. The overload feature will also protect against short circuit.

Voltage/Current Rating Chart

Model No.	D.C. Output Current (AMP) at 40°C									Construction	Max. Output	Output Plug
	Main Output			Selectable Auxiliary Outputs								
	Type.		Max.	Type.		Max.	Type.		Max.			
	+VO1 *@			+VO2 • OR			-VO3 •			Plastic Box	20W	Option
APS20-ES-10	4A	+5V	4A							EI 57/3,4	20W	Opt. B
APS20-ES-11	1.5A	+12V	1.7A							EI 57/3,4	20W	Opt.
APS20-ES-20	3A	+5A	3A				0.5A	5V	1A	EI 57/3,4	20W	PD,PMD,PMX,PMY
APS20-ES-21	3A	+5V	3A				0.5A	12V	1A	EI 57/3,4	20W	PD,PMD,PMX,PMY
APS20-ES-30	2A	+5A	3A	0.5A	+12A	1A	0.5A	-12A	1A	EI 57/3,4	20W	PD,PMD,PSD,PMZ,PMY
APS20-ES-31	2A	+5A	3A	0.5A	+12V	1A	0.5A	-5V	1A	EI 57/3,4	20W	PD,PMD,PSD,PMX,PMY
APS40-ES-10	7A	+5A	8A							EI 57/5	40W	Opt.B
APS40-ES-11	3A	+12V	3.5A							EI57/5	40W	Opt.B
APS40-ES-20	6A	+5A	7A				0.75A	5V	1A	EI 57/5	40W	PD,PMD,PMX,PMY
APS40-ES-21	5A	+5V	6A				0.75A	12V	1A	EI 57/5	40W	PD,PMD,PMX,PMY
APS40-ES-30	3A	+5V	4A	1.5A	+12V	1.5A	0.5A	-12V	1A	EI57/5	40W	PD,PMD,PSD,PMX,PMY
APS40-ES-31	3A	+5A	4A	1.5A	+12V	1.5A	0.5A	-5A	1A	EI57/5	40W	PD,PMD,PSD,PMX,PMY
APS60-ES-10	10A	+5V	12A							EI66/3	50-60W	PMX,PMY,PD
APS60-ES-11	4.5A	+12V	5A							EI66/3	55-60W	PMX,PMY,PD
APS60-ES-20	9A	+5V	11A				0.75A	-5V	1A	EI66/3	50-60W	PMX,PMY,PD
APS60-ES-21	6A	+5A	7A	2A	+12V	2A				EI 66/3	55-60W	PMX,PMY,PD
APS60-ES-30	5A	+5V	6A	2A	+12V	2A	0.5A	-12V	1A	EI66/3	55-60W	PD,PSD
APS60-ES-31	5A	+5A	6A	2A	+12V	1A	0.75A	-5V	1A	EI66/3	55-60W	PD,PSD

Note: Alternate case sizes are available, please consult the factory.
Note: Alternate output selection is available, please consult the factory.

**For more power supplies see:
POWERTRONICS
Pages A•2509 thru A•2511**



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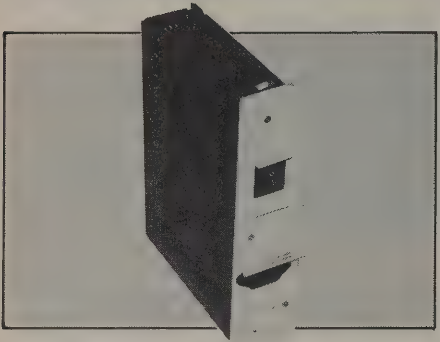
360 WATTS Double Eurocard Power Supply for VMEbus System Model APS360SU AC-DC Switching Power Supply



Features:

- **Incorporates the Latest 100KHZ. Mosfet Switching Power Supply Technology.**
- **Triple Output with Individual Regulation Circuit and Adjustable DC Output.**
- **User-selectable Dual Input (115/230VAC).**
- **OVP and UVP Protections Installed.**
- **Status LED on Front Panel.**
- **Full Hold-up for Missing Half Cycle.**
- **IEC950/EN60 950 Requirement.**
- **EMI Compliance with VDE 0871-B and FCC-B Curve.**
- **VME-bus Double Eurocard Architecture 12TEX6UX160mm.**

Specifications

Inputs:

Input Voltage: 90-120VAC (115VAC nominal)or180-260VAC (230VAC nominal)Dual Input user selectable.

Input Current: 115Vac/6.5A ; 230Vac/3.2A

Input Frequency: 47-63 Hz.

Inrush Current: Less than 80A at cold start.

Input Connector: AC input receptacle IEC 320 located in front panel.

Input Connector: AC input receptacle IEC320 on front panel and controlled by ON/OFF switch.

Earth Leakage Current: 3.5mA Max.

Isolation Voltage (Dielectric Withstand):2,5000VAC Output/ Input;1,500VAC Input/Safety GND;500VAC Output/Safety GND.

EMI: In compliance with FCC 20780 class B & VDE 0871 class B.

Ambient Temperature Range: 0°C to 50°C full rating; 50°C to 70°C derate linearly to 50% full rating;-20°c to 85°C Storage.

Cooling: 360W continuos with at least 60 cubic feet per minute forced air cooling.; 220W continuos at convection cooling.

Efficiency: 70% typical.

Hold-Up Time: 20msec. min. after loss of AC line at full load and nominal Input.

Transient Response: Output voltage returns in less than 3 msec. following a 50% load change.

Power Indicator: Green LED

Power ON/OFF Switch: Located on front panel.

Voltage/Current Rating Chart

Model No.	DC Output Current at 40°C									Max. Watts
	+VO1 Output			+VO2 Output			-VO3 Output			
	Typ.	★@#U	Max.	Typ.	★@#U	Max.	Typ.	★@	Max.	
APS360SU-30	42A	+5A	45A	6A	+12V	6A	6A	-5V	6A	360W
APS360SU-31	42A	=5V	45A	5A	+15V	5A	5A	-15V	5A	360W
APS360SU-32	42A	+5V	45A	6A	+12V	6A	6A	-12V	6A	360W
APS360SU-33	42A	+5V	45A	3A	+24V	3A	6A	-12V	6A	360W
APS360SU-34	42A	+5V	45A	31	+24V	3A	5A	-15V	5A	360W
APS360SU-35	42A	+5V	45A	6A	+12V	6A	5A	-15V	5A	360W

Symbols: ★ OVP Built-in
@ Adjustable
U Under›Voltage Protection
# Remote Senese

Outputs:

Output Voltage: See rating chart

Output Current: See rating chart.

Output Connector: Single DIN 41612 male connector.

Line Regulation: 0.5% typical.

Load Regulation: For 50% to full load change

VO1....................................+/- 2.0%
VO2....................................+/- 2.0%
VO3....................................+/- 2.0%

Output Voltage Adjustment: VO1 from UVP to OVP trip points; VO2 from UVP to OVP trip points: VO3 10% up to OVP trip points.

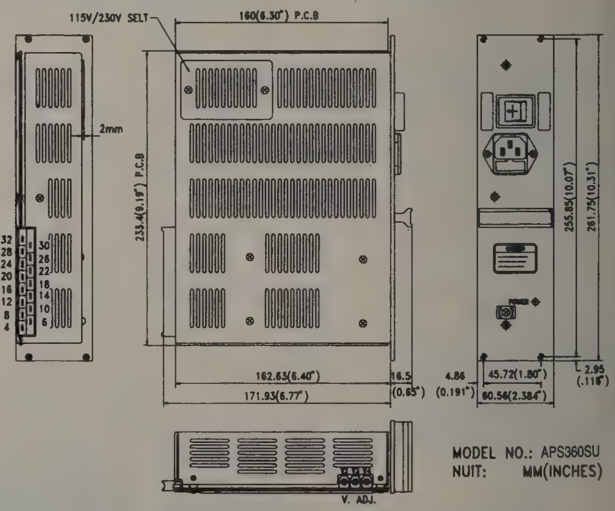
Ripple: 1% peak-peak typical per output 2% max.

Remote sensing: Installed in V\O1 OUTPUT RAIL ONLY.

Over Voltage and Under Voltage Protections: OVP available at each output typically set at 124 +/-8% output voltage. UVP available at VO1 and VO2.

Overload Protection: The overload feature will protect against short circuit on output.

Mechanical Dimensions:mm(inches)



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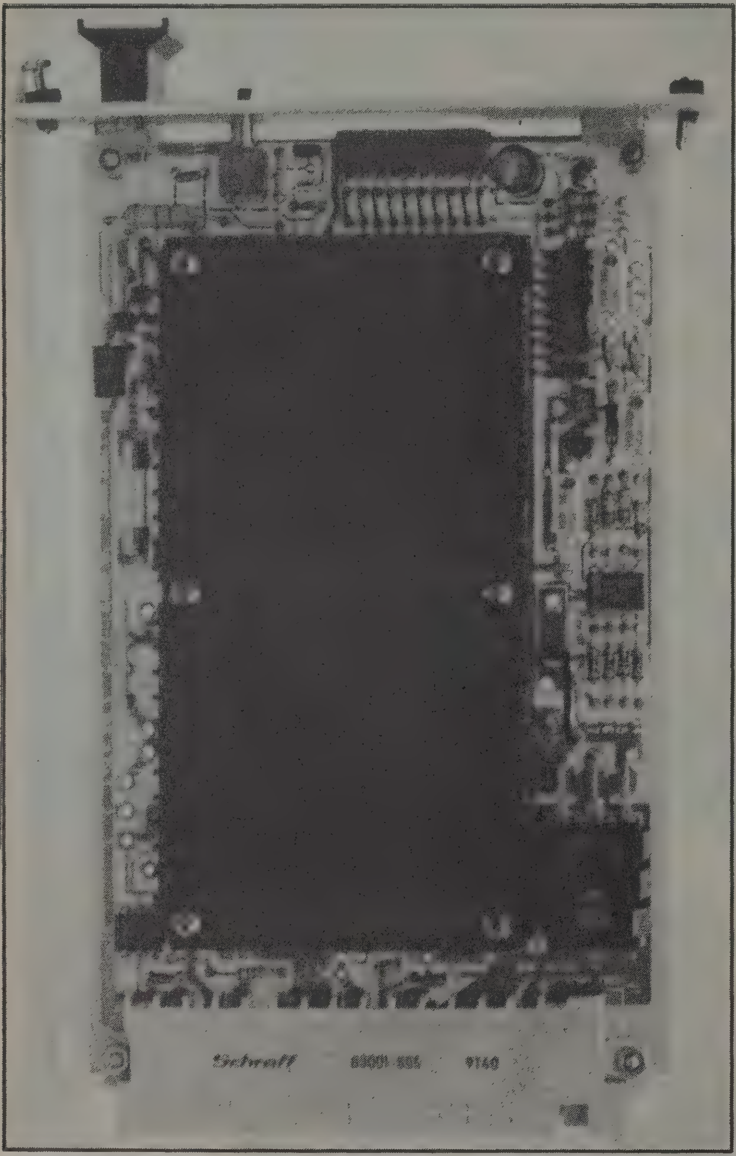

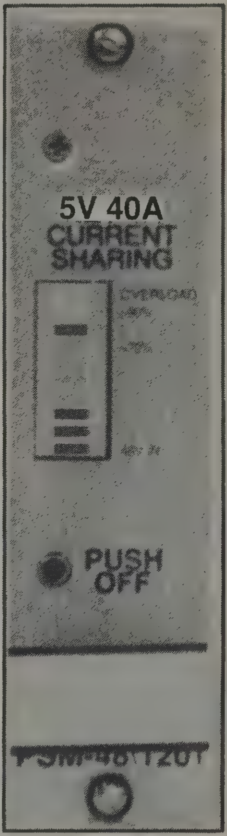
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P = Plug-in
R = Rack Mount
T = Table Top

Type of Input:

AC = AC Voltage
DC = DC Voltage
HP = High Power
UI = Universal

P-HP-100-A000-K-S-361-ACGHMS

Output Power (Watts):

Insert Required Wattage

Input Voltage:

Use "Output Voltage"

Output Voltage:

0 = Not Used
2 = 2
3 = 3
5 = 5
6 = 6
7 = 7.5
9 = 9

A = 12
B = 15
C = 18
D = 20
E = 24
F = 28
G = 32
H = 36

J = 42
K = 48
L = 60
M = 90
N = 100
P = 115
R = 208 /240
U = 90 -264

Module Manufacturer:

A = AT&T
E = Ericson
M = Mesa Power
N = Acon
R = RO Associates
S = Shindengen
T = Astec
V = Vicor
Z = Other

Dimensions (H x W x D):

0 = 10 HP
1 = 12 HP / 160mm
2 = 14 HP / 220mm
3 = U / HP / 280mm
4 = U / Other

5 = U / HP
6 = U / HP
7 = HP
8 = HP
9 = U

Features / Options:

A = Customers Faceplate Design / Finish
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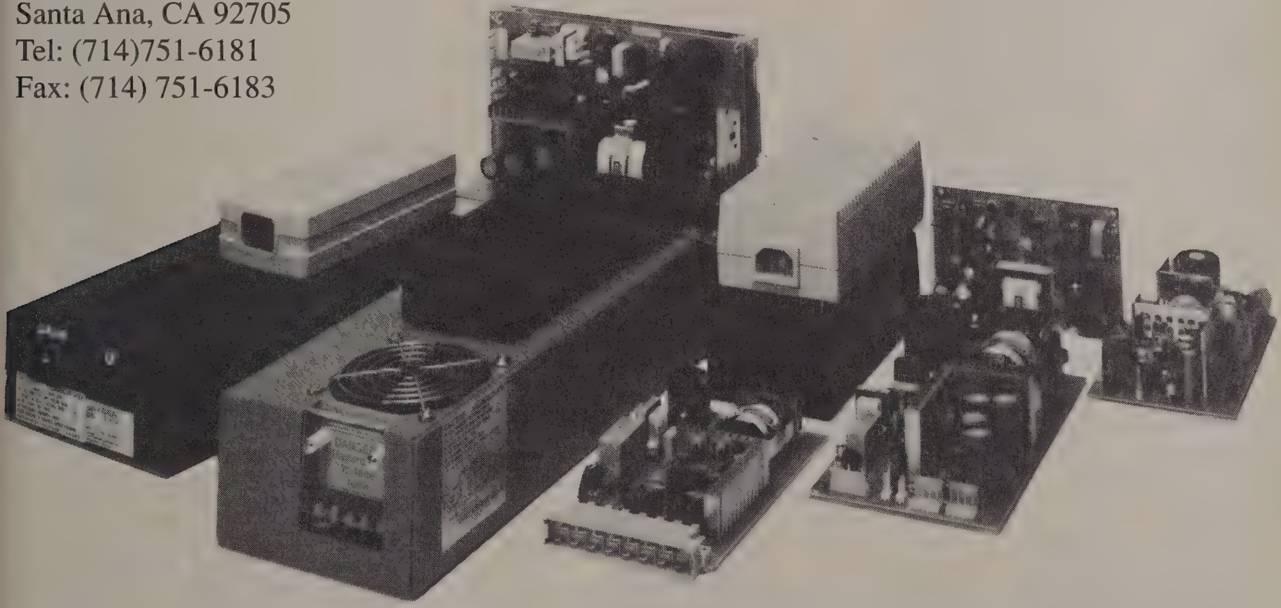

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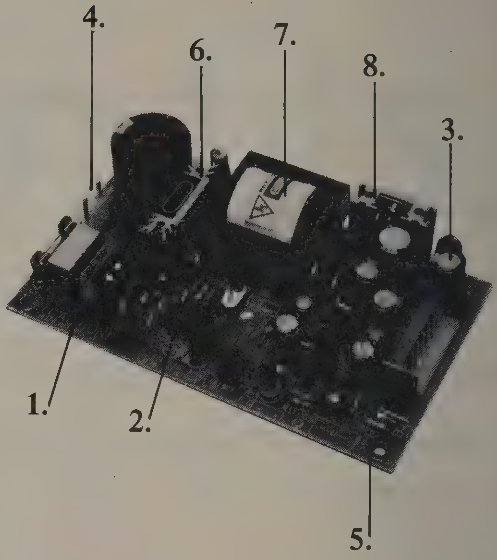
- Build-in line filter for FCC B or VDE B
- Custom PWM IC
- LXF low ESR extra long life 105°C capacitor
- High efficiency
- No minimum load required
- Compact and low cost

Visible Difference

1. Build-in EMI line filter for FCC B or VDE B
2. Custom PWM IC make no minimum load and best protection
3. LXF low ESR extra long life 105°C capacitor
4. Wide range universal input
5. Ground Tab
6. Low RDS on high speed MOSFET
7. Custom core and bobbin make low profile
8. Golden heatsink



QUICK REFERENCE LIST

MODEL		V1	V2	V3	V4	UL	CSA	VDE	TUV	EMI	SIZE (W × L × H)	MOUNTING HOLE
20W												
SDA-3021*		5V/2A	12V0.5A	-12V/0.5A		V	V		V	FCC B	2.75 × 5.12 × 1.02	2.36 × 4.72
SNP-5023	X	5V/1.5A	12V/1.2A							FCC B	2.0 × 5.5 × 1.0	1.6 × 5.1
SNP-5023-1	X	5V/1.5A	12V/1.2A			V	V		V	VDE B	2.0 × 5.5 × 1.0	1.6 × 5.1
SNP-6023	X	5V/1.5A	12V/1.2A							FCC B	2.0 × 6.0 × 1.0	1.6 × 5.6
SNP-6023-1	X	5V/1.5A	12V/1.2A			V	V		V	VDE B	2.0 × 6.0 × 1.0	1.6 × 5.6
SNP-7023	X	5V/1.5A	12V/1.5A			V	V		V	FCC B	2.0 × 7.0 × 1.0	1.59 × 6.59
SNP-7023-1	X	5V/1.5A	12V/1.5A			V	V		V	VDE B	2.0 × 7.0 × 1.0	1.59 × 6.59
SNP-9021		5V/1A	12V/1A	-12V/0.3A						FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9021-1		5V/1A	12V/1A	-12V/0.3A						VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9023		5V/1A	12V/1A	MOLEX BASE						FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9023-1	X	5V/1A	12V/1A	MOLEX BASE		V	V		V	VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-902M		5V/1A	12V/1.5A	AMP CONNECTOR		V	V		V	FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-902L		5V/1.5A	12V/1A	MOLEX CONNECTOR		V	V		V	FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9026		5V/4A								FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9026-1		5V/4A								VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9027		12V2A								FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9027-1		12V2A								VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9029		24V/1A								FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33
SNP-9029-1		24V/1A								VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33
30W												
SNP-6033	X	5V/2A	12V/1.5A			V	V	V		FCC B	2.0 × 6.0 × 1.20	1.60 × 5.60
SNP-7033	X	5V/2A	12V/1.5A			V	V		V	FCC B	2 × 7 × 1.13	1.59 × 6.59
SNP-7033-1	X	5V/2A	12V/1.5A			V	V		V	VDE B	2 × 7 × 1.13	1.59 × 6.59
SNP-9031		5V/2A	12V/1.5A	-12V/0.3A		V	V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9033		5V/2A	12V/1.5A				V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9033-1	X	5V/2A	12V/1.5A							VDE B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9034		5V/1.5A	15V/1.2A	-15V/0.3A						FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9035		5V/2A	24V/0.75A				V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9036		5V/6A					V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9037		12V/2.5A					V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9038		15V/2A								FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9039		24V/1.3A				V	V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9433	X	5V/2A	12V/1.8A			V	V		V	FCC B	3.0 × 4.0 × 1.38	2.60 × 3.58
SNP-9433-1	X	5V/2A	12V/1.8A			V	V		V	VDE B	3.0 × 4.0 × 1.38	2.60 × 3.58
SNP-9433-2		5V/2A	12V/1.8A							FCC B	3.0 × 4.0 × 1.38	2.60 × 3.58

13 Years Experience in Design Production Support and Service

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QUICK REFERENCE LIST

MODEL		V1	V2	V3	V4	UL	CSA	VDE	TUV	EMI		CASE/SIZE (mm)
40W												
SNP-3541		5V/2.5A	12V/2A	-12V/0.2A		V	V		V	FCC B	3.54 × 5.41 × 1.26	3.15 × 4.82
SNP-7043	X	5V/3A	12V/2A			V	V	V		FCC B	2.0 × 7.0 × 1.18	1.59 × 6.59
SNP-7043-1	X	5V/3A	12V/2A			V	V		V	VDE B	2.0 × 7.0 × 1.18	1.59 × 6.59
SNP-9040		5V/3A	12V/2A	-12V/0.2A	-5V/0.2A	V	V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9041		5V/3A	12V/2A	-12V/0.3A		V	V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9041-1		5V/3A	12V/2A	-12V/0.3A						VDE B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9042		5V/3A	12V/2A	-5V/0.3A		V	V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9043		5V/3A	12V/2A			V	V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9043-1	X	5V/3A	12V/2A							VDE B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9043-2	X	5V/3A	12V/2A			V	V		V	FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9046		5V/8A					V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9047		12V/3.5A					V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9049		24V/1.7A					V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
60W FORCED AIR COOLING												
SNP-9F40		5V/4A	12V/3A	-12V/0.3A	-5V/0.3A	V	V	V		FCC B	3.0 × 5.0 × 1.40	2.55 × 4.55
SNP-9F43		5V/4A	12V/3A				V			FCC B	3.0 × 5.0 × 1.40	2.55 × 4.55
SNP-9F43-1		5V/4A	12V/3A			V	V	V	V	VDE B	3.0 × 5.0 × 1.40	2.55 × 4.55
65W												
SNP-3160		5V/5.5A	12V/2.5A	-12V/0.5A	-5V/0.5A	V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3161		5V/6A	12V/2.5A	-12V/0.5A		V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3162		5V/5.5A	12V/3A	-5V/0.5A		V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3163		5V/6A	12V/3A			V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3166		5V/13A				V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3167		12V/5.5A				V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3168		15V/4.5A				V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
SNP-3169		24V/2.75A				V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
85W												
SNP-3180		5V/8A	12V/3A	-12V/0.5A	-5V/0.5A	V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3181		5V/8.5A	12V/3A	-12V/0.5A		V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3183		5V/8.5A	12V/3.5A			V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3185		5V/4A	15V/0.5A	-15V/0.5A	24V/2A	V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3187		12V/7A								FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3188		15V/6A								FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-3189		24V/3.5A								FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
100W												
SNP-9100		5V/10A	12V/3.5A	-5V/0.5A	-12V/0.5A					FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9100-1		5V/10A	12V/3.5A	-5V/0.5A	-12V/0.5A					VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9103	X	5V/4A	12V/7A			V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9103-1	X	5V/4A	12V/7A							VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9105		5V/4A	24V/3A	12V/0.3A	-12V/0.3A					FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9105-1		5V/4A	24V/3A	12V/0.3A	-12V/0.3A					VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9106		5V/20A								FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9106-1		5V/20A								VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9107		12V/9A	5V/0.5A							FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9107-1		12V/9A	5V/0.5A							VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9109		24V/4.5A	5V/0.5A							FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9109-1		24V/4.5A	5V/0.5A							VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25

1 * SDA-3021 EQUIPED WITH POWER GOOD & POWER FAIL SIGNAL. 2 "X" MEANS WITH FAN & LED CONNECTORS. 3 ALL SIZES ARE IN INCHES.

FAX MACHINES SERIES

MODEL	P	V1	V2	V3	V4	V5	UL	EMI	SIZE (W × L × H)	MOUNTING HOLE
SNP-2960	N	5V/0.7A	12V/0.7A	-12V/0.1A	24VA/0.7A	24VB/1A, A/H	V	VDE B	2.36 × 7.28 × 1.39	1.97 × 6.89
SNP-2960-2	Y	5V/0.7A	12V/0.7A	-12V/0.1A	24VA/0.7A	24VB/1A, A/H	V	VDE B	2.36 × 7.28 × 1.39	1.97 × 6.89
SNP-2962	N	5V/0.8A	12V/0.2A	-12V/0.1A	24VA/0.6A	24VB/1A, A/L		FCC B	2.28 × 7.48 × 1.39	1.81 × 7.01

1 P - OVER VOLTAGE PROTECTION 2 A/H: ACTIVE HIGH 3 A/L: ACTIVE LOW 4 ALL SIZES ARE IN INCHES

ENCLOSED TYPE WITH METAL CASE

30W										
SNP-5531		5V/2A	12V/1.5A	-12V/0.3A				FCC B	2.95 x 6.30 x 1.57	1.77 x 5.31
SNP-5533		5V/2A	12V/1.5A					FCC B	2.95 x 6.30 x 1.57	1.77 x 5.31

THE MODELS WITHOUT SAFETY APPROVAL WILL DEPEND ON MARKET DEMAND TO APPLY FOR SAFETY LICENSE.

13 Years Experience in Design Production Support and Service

UL • CSA • TUV • VDE • FCC B • VDE B • BABT • ISO 9000

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The Switcher Experts

20 Watts for Computer Subsystem

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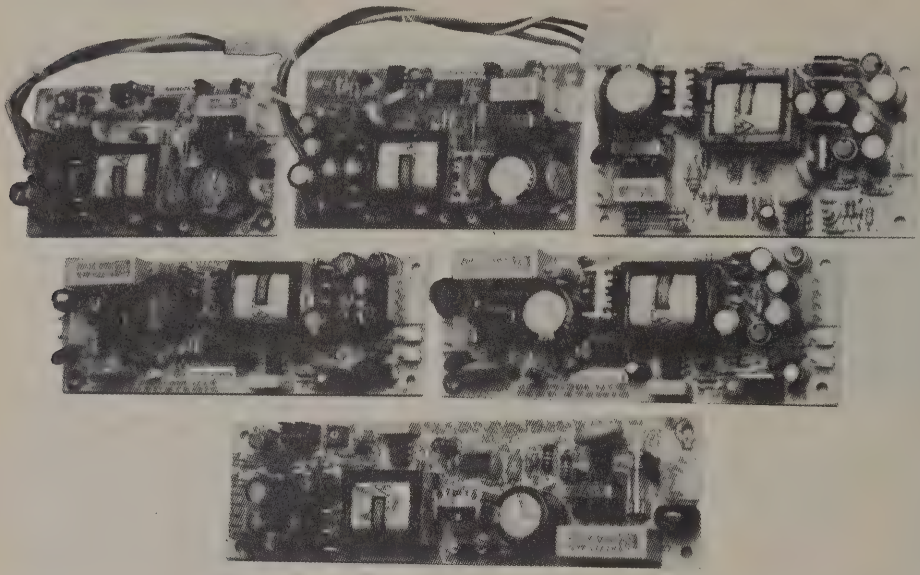

Applications

- CD ROM
- Optical drive
- Hard Disk

Features

- LED & fan output
- Tape drive
- Compack
- Variety size choice

MODEL		V1	V2	UL	CSA	VDE	TUV	EMI	SIZE (W × L × H)	MOUNTING HOLE	REMARK
SNP-5023	X	5V/1.5A	12V/1.2A					FCC B	2.0 × 5.5 × 1.0	1.6 × 5.1	
SNP-5023-1	X	5V/1.5A	12V/1.2A	V	V		V	VDE B	2.0 × 5.5 × 1.0	1.6 × 5.1	
SNP-6023	X	5V/1.5A	12V/1.2A					FCC B	2.0 × 6.0 × 1.0	1.6 × 5.6	
SNP-6023-1	X	5V/1.5A	12V/1.2A	V	V		V	VDE B	2.0 × 6.0 × 1.0	1.6 × 5.6	
SNP-7023	X	5V/1.5A	12V/1.5A	V	V		V	FCC B	2.0 × 7.0 × 1.0	1.59 × 6.59	
SNP-7023-1	X	5V/1.5A	12V/1.5A	V	V		V	VDE B	2.0 × 7.0 × 1.0	1.59 × 6.59	
SNP-9023		5V/1A	12V/1A					FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33	MOLEX BASE
SNP-9023-1	X	5V/1A	12V/1A	V	V		V	VDE B	2.36 × 4.72 × 1.0	1.97 × 4.33	MOLEX BASE
SNP-902M		5V/1A	12V/1.5A	V	V		V	FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33	AMP CONNECTOR
SNP-902L		5V/1.5A	12V/1A	V	V		V	FCC B	2.36 × 4.72 × 1.0	1.97 × 4.33	MOLEX CONNECTOR

"X" MEANS WITH FAN AND LED CONNECTORS. ALL SIZES ARE IN INCHES.

13 Years Experience in Design Production Support and Service

UL • CSA • TUV • VDE • FCC B • VDE B • BABT • ISO 9000

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The Switcher Experts

30 Watts for Computer Subsystem

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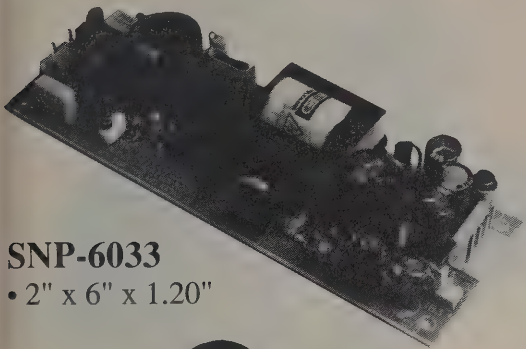
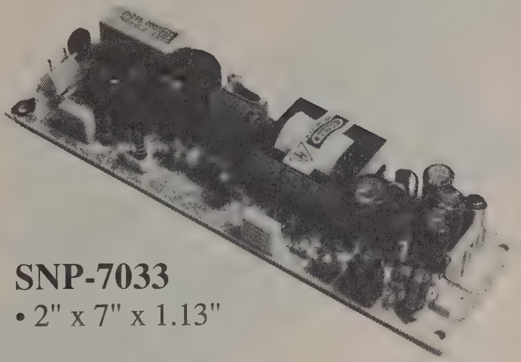
Applications

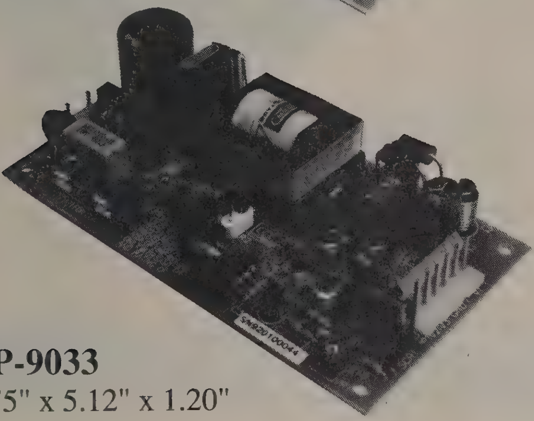
- Hard disk drive
- Tape backup



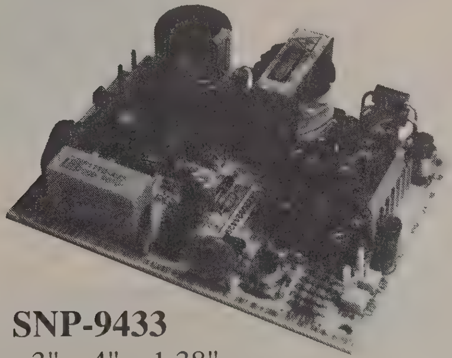
SNP-6033
- 2" x 6" x 1.20"



SNP-7033
- 2" x 7" x 1.13"



SNP-9033
- 2.75" x 5.12" x 1.20"



SNP-9433
- 3" x 4" x 1.38"

MODEL		V1	V2	UL	CSA	VDE	TUV	EMI	SIZE (W × L × H)	MOUNTING HOLE
SNP-5533		5V/2A	12V/1.5A					FCC B	2.95 x 6.30 x 1.57	1.77 x 5.31
SNP-6033	X	5V/2A	12V/1.5A	V	V	V		FCC B	2.0 × 6.0 × 1.20	1.60 × 5.60
SNP-7033	X	5V/2A	12V/1.5A	V	V		V	FCC B	2 × 7 × 1.13	1.59 × 6.59
SNP-7033-1	X	5V/2A	12V/1.5A	V	V		V	VDE B	2 × 7 × 1.13	1.59 × 6.59
SNP-9033		5V/2A	12V/1.5A		V	V		FCC B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9033-1	X	5V/2A	12V/1.5A					VDE B	2.75 × 5.12 × 1.20	2.36 × 4.72
SNP-9433	X	5V/2A	12V/1.8A	V	V		V	FCC B	3.0 × 4.0 × 1.38	2.60 × 3.58
SNP-9433-1	X	5V/2A	12V/1.8A	V	V		V	VDE B	3.0 × 4.0 × 1.38	2.60 × 3.58
SNP-9433-2		5V/2A	12V/1.8A					FCC B	3.0 × 4.0 × 1.38	2.60 × 3.58

"X" MEANS WITH FAN & LED CONNECTORS.
ALL SIZES ARE IN INCHES.

13 Years Experience in Design Production Support and Service

UL • CSA • TUV • VDE • FCC B • VDE B • BABT • ISO 9000

Skynet

The Switcher Experts

40/60 Watts for Computer Subsystem

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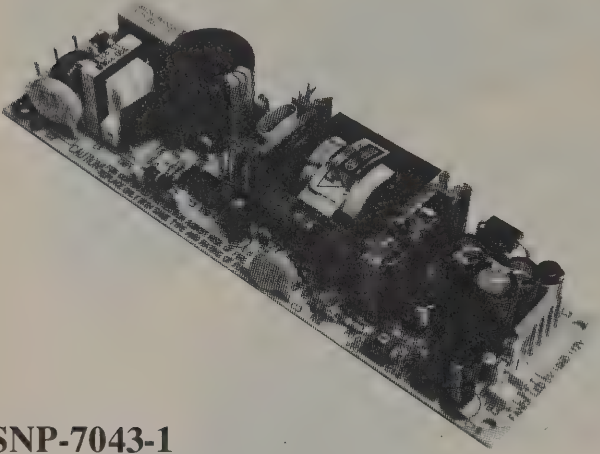
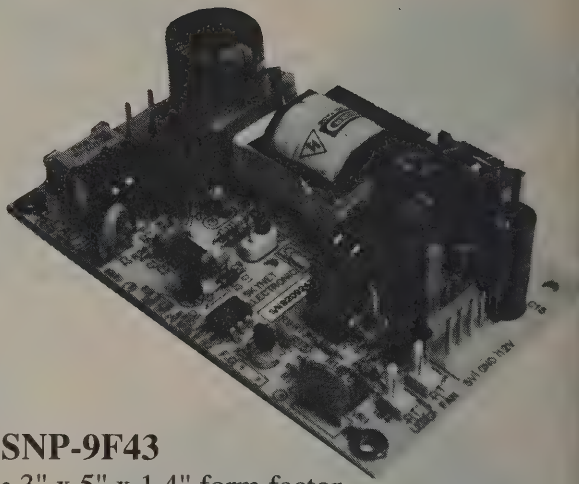
Applications

- Hard disk systems
- Tape backup systems



SNP-7043-1

- 2" x 7" x 1.18"
- VDE B/ FCCB
- LED & Fan Output



SNP-9F43

- 3" x 5" x 1.4" form factor
- Force air 60W output
- Best for high power surge equipment

MODEL		V1	V2	UL	CSA	VDE	TUV	EMI	SIZE (W × L × H)	MOUNTING HOLE
40W										
SNP-7043	X	5V/3A	12V/2A	V	V	V		FCC B	2.0 × 7.0 × 1.18	1.59 × 6.59
SNP-7043-1	X	5V/3A	12V/2A	V	V		V	VDE B	2.0 × 7.0 × 1.18	1.59 × 6.59
SNP-9043		5V/3A	12V/2A	V	V	V		FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9043-1	X	5V/3A	12V/2A					VDE B	3.0 × 5.0 × 1.26	2.55 × 4.55
SNP-9043-2		5V/3A	12V/2A	V	V		V	FCC B	3.0 × 5.0 × 1.26	2.55 × 4.55
60W FORCED AIR COOLING										
SNP-9F43	X	5V/4A	12V/3A		V			FCC B	3.0 × 5.0 × 1.40	2.55 × 4.55
SNP-9F43-1	X	5V/4A	12V/3A	V	V	V	V	VDE B	3.0 × 5.0 × 1.40	2.55 × 4.55

"X" MEANS WITH FAN & LED CONNECTORS.
ALL SIZES ARE IN INCHES.

13 Years Experience in Design Production Support and Service

UL • CSA • TUV • VDE • FCC B • VDE B • BABT • ISO 9000

Skynet

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OEM Products

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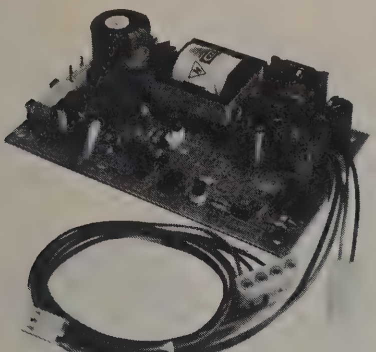
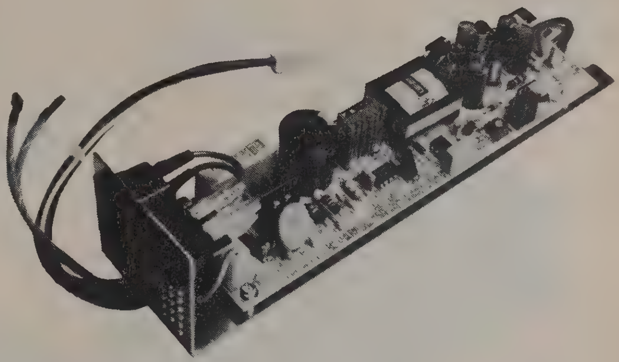
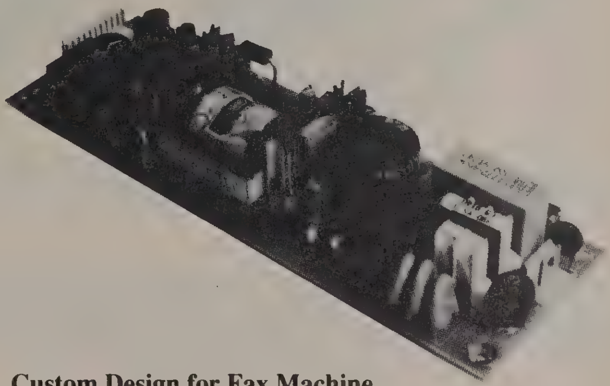


Custom Wiring



Custom Bracket with Wiring

Custom Chassis with Power Supply



Custom Design for Fax Machine

SKYNET—with 13 year experience dedicated in handing OEM projects, has been proved as one of the best Switcher expert in the world. Intelligent engineering forces supported by standard circuit block library ensure the shorter throughput time of OEM project.

Normal throughput time is 6 weeks only. In case of urgent need, we can complete a new project within 3 weeks if its potential justified in advance.

Total Capacity 100K sets/month supported by flexible U-shape production line which allow small scale production flexibility and product diversification. SPC management has been fully applied in production process.

Numberless OEM project covering following applications:

DAT, MIDI, FAX machine, Adapter Satellite receiver, Memory subsystem and redundant power supply; have been successfully developed and run into mass production.

13 Years Experience in Design Production Support and Service

UL • CSA • TUV • VDE • FCC B • VDE B • BABT • ISO 9000

Skynet

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65/85/100/170 Watts for Computer Subsystem

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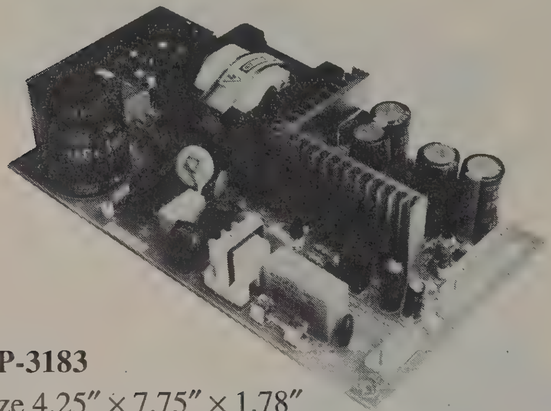
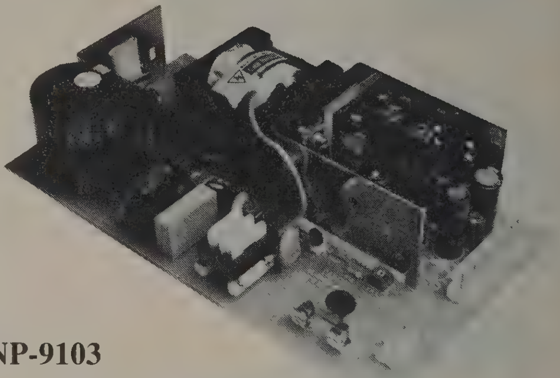
Applications

- Hard disk array
- CD ROM library



SNP-3183
- Size 4.25″ × 7.75″ × 1.78″
- Economic



SNP-9103
- 12V main regulator
- 5V Auxilliary MOSFET
- Size 4.25″ × 7.75″ × 1.78″

MODEL		V1	V2	UL	CSA	VDE	TUV	EMI	SIZE (W × L × H)	MOUNTING HOLE
65W										
SNP-3163		5V/6A	12V/3A	V	V	V		FCC B	3.5 × 6.0 × 1.73	3.15 × 4.80
85W										
SNP-3183		5V/8.5A	12V/3.5A	V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
100W										
SNP-9103	X	5V/4A	12V/7A	V	V		V	FCC B	4.25 × 7.75 × 1.78	3.75 × 7.25
SNP-9103-1	X	5V/4A	12V/7A					VDE B	4.25 × 7.75 × 1.78	3.75 × 7.25
170W ENCLOSED TYPE (WITH METAL CASE & FAN SPEED CONTROL)										
SNP-917C-2		5V/10A	12V/10A		V			FCC B	5.71 x 6.12 x 3.52	PC SLIM CASE
SNP-917C-3		5V/10A	12V/10A					VDE B	5.71 x 6.12 x 3.52	PC SLIM CASE

"X" MEANS WITH FAN & LED CONNECTORS.
ALL SIZES ARE IN INCHES.

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Adapter & Battery Charger

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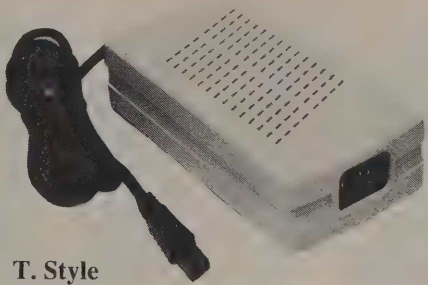
T. Style
- IEC sockets
- Single or multi output

S. Style
- IEC connector
- On/Off switch
- Single or multi output

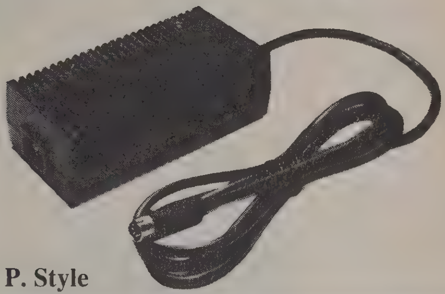
L. Style
- IEC sockets
- LED indicator

P. Style
- 30W to 50W
- IEC sockets
- LED indicator
- Single or multi output


T. Style

S. Style

L. Style


P. Style

MODEL	V1	V2	V3	V4	UL	CSA	VDE	TUV	EMI	CASE/SIZE (mm)	AVAILABILITY
ADAPTER											
20W											
SNP-T021	5V/1A	12V/1A	-12V/0.3A		V	V		V	FCC/VDE B	T/75 × 150 × 40	YES
SNP-T021-2	5V/1A	12V/1A	-12V/0.3A		V	V		V	FCC/VDE B	T/75 x 150 x 40	YES
SNP-S021	5V/1A	12V/1A	-12V/0.3A		V	V		V	FCC/VDE B	S/75 × 150 × 40	YES
30W											
SNP-T035	18V/1.7A				V	V		V	FCC/VDE B	T/75 × 150 × 40	
SNP-T037	12V/2.5A				V	V		V	FCC/VDE B	T/75 × 150 × 40	
SNP-T039	24V/1.5A				V	V		V	FCC/VDE B	T/75 × 150 × 40	
50W											
SNP-PA51	5V/3A	12V/2.5A	-12V/0.3A		V				FCC/VDE B	P/80 × 165 × 57	
SNP-P051	5V/2A	12V/1.5A	-12V/0.3A		V	V		V	FCC/VDE B	P/80 × 165 × 57	YES
SNP-P053	5V/3.5A	12V/2A				V		V	FCC/VDE B	P/80 × 165 × 57	YES
SNP-P054	5V/4A	15V/1.5A	-15V/0.3A						FCC/VDE B	P/80 × 165 × 57	
SNP-PA55	18V/3A				V	V		V	FCC/VDE B	P/80 × 165 × 57	YES
SNP-P057	12V/4.2A								FCC/VDE B	P/80 × 165 × 57	SNP-P059
SNP-P059	24V/2.1A								FCC/VDE B	P/80 × 165 × 57	
CHARGER											
SNP-PC5M*	13.8V/4A								FCC/VDE B	P/80 × 165 × 57	YES

SNP-PC5M: LEAD ACID BATTERY

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Adapter & Battery Charger

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Order Information:

SNP X- XXX -X-XX -X

Case Style L, P, S, T

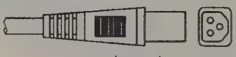
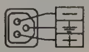
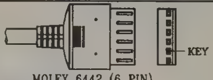
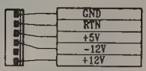
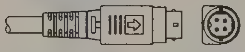
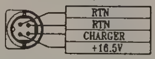
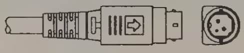
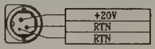
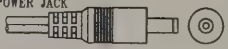
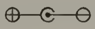
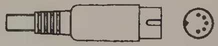
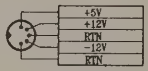
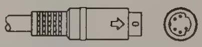
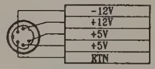
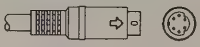
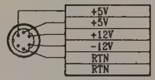
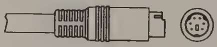
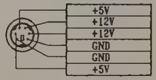
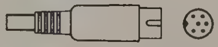
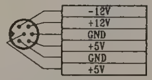
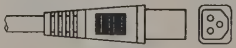
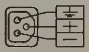
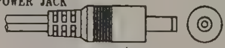
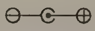
Electrical Output

Case Color
0 : Black
1 : Beige

Connector No. (Please see drawing below)

Output Cable Length (Feet)

Exceptional model
SNP-P051-0 : Black
SNP-P051-8 : Beige

ITEM	POWER CORD PLUG TYPE	PIN ASSIGNMENT	WIRE RANGE	SKYNET P/N
1	 ø1.98mm(3 PINS)		20AWG×3C	866-87CH
2	 MOLEX 6442 (6 PIN)	 GND RTN +5V -12V +12V	20AWG×5C	866-03AS
3	 SINGATRON 4 PINS	 RTN RTN CHARGER +16.5V	20AWG×4C	866-C3CH
4	 HOSIDEN 3 PINS		18AWG×2C & 24AWG × 1C	866-H4DN
5	DC POWER JACK  (ID)2.1mm x (OD)5.5mm		18AWG × 2C	866-76DJ
6	 DIN PLUG 5 PINS AT 180°	 +5V +12V RTN -12V RTN	20AWG×5C	866-77GO
7	 MINI DIN PLUG 5 PINS	 -12V +12V +5V +5V RTN	20AWG×5C	866-AO51
8	 MINI DIN PLUG 6 PINS	 +5V +5V +12V -12V RTN RTN	20AWG×6C	866-C5TP
9	 MINI DIN PLUG 6 PINS	 +5V +12V +12V GND GND +5V	22AWG×6C	866-63AO
10	 DIN PLUG 6 PINS,5 PINS AT 240°	 -12V +12V GND +5V GND +5V	20AWG×6C	866-82MS
11	 ø1.98mm(3 PINS)		18AWG×3C	866-B7AM
12	DC POWER JACK  (ID)2.54mm x (OD)5.56mm		18AWG × 2C	866-B2DJ

Note: No. 1–6 are preferred types.
No. 7–12 are not recommended, only for special request.

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P.C. Series

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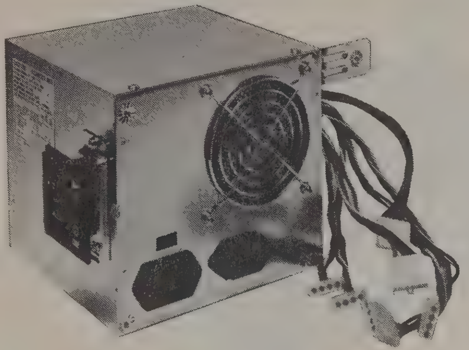
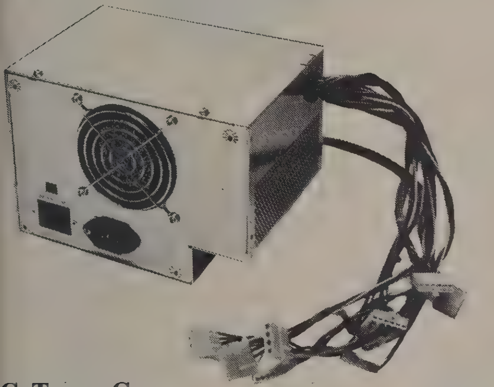
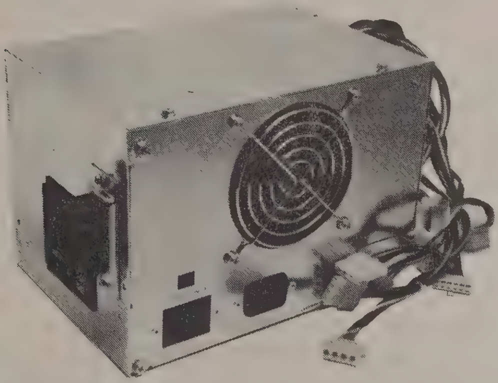
A. Slim Case



B. Baby AT Case



C. Tower Case



D. AT Desktop Case

MODEL	O/P	V1	V2	V3	V4	UL	CSA	VDE	TUV	EMI	CASE TYPE
SNP-915C	145W	5V/17A	12V/4.5A	-12V/0.3A	-5V/0.3A	V	V		V	FCC B	A
SNP-915C-1	145W	5V/17A	12V/4.5A	-12V/0.3A	-5V/0.3A	V	V		V	FCC B	A
SNP-917C	165W	5V/21.3A	12V/4.4A	-12V/0.3A	-5V/0.3A	V	V		V	FCC B	A
SNP-917C-1	165W	5V/21.3A	12V/4.4A	-12V/0.3A	-5V/0.3A	V	V		V	VDE B	A
SNP-920C	200W	5V/20A	12V/7.5A	-5V/0.3A	-12V/0.3A	V	V		V	FCC B	A
SNP-920C-1	200W	5V/20A	12V/7.5A	-5V/0.3A	-12V/0.3A	V	V		V	VDE B	A
SNP-200E-01	200W	5V/20A	12V/7.5A	-5V/0.3A	-12V/0.3A	V	V		V	FCC B	B
SNP-200E-02	200W	5V/20A	12V/7.5A	-5V/0.3A	-12V/0.3A	V	V	V	V	VDE B	B
SNP-200E-03	200W	5V/20A	12V/7.5A	-5V/0.3A	-12V/0.3A	V	V		V	FCC B	B
SNP-925T	250W	5V/25A	12V/10A	-12V/0.3A	-5V/0.3A	V	V		V	FCC B	C
SNP-925T-1	250W	5V/25A	12V/10A	-12V/0.3A	-5V/0.3A	V	V		V	VDE B	C
SNP-925T-2	250W	5V/25A	12V/10A	-12V/0.3A	-5V/0.3A					FCC B	D
SNP-925T-3	250W	5V/25A	12V/10A	-12V/0.3A	-5V/0.3A					VDE B	D
SNP-930T	300W	5V/30A	12V/12A	-5V/0.5A	-12V/0.5A	V	V		V	FCC B	C

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Eurocard Series

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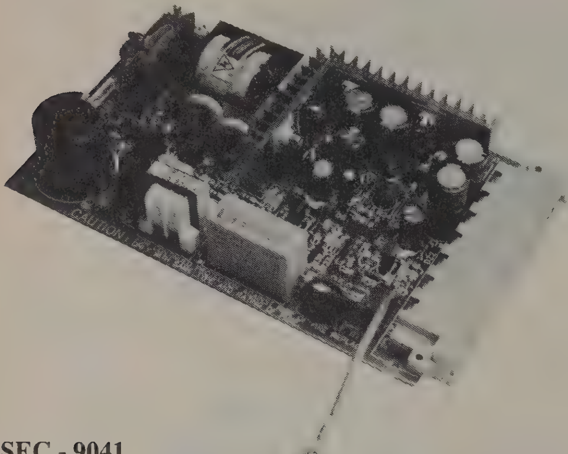

SEC - 9041

SEC - 9101

Eurocard series are designed to be fitted into 19″—card-frames, with remote sense input, inhibit input and power good/power fail output

- **Single/Dual/Triple outputs are available from all series.**
- **All series can meet VDE B conducted limit.**
- **All series meet IEC 950 or its equivalent.**
- **The additional added +5V/0.5A in normal single output models (+12V and +24V) can offer special advantage for those systems which may need +5V for CPU and logic control circuit.**

MODEL	V1	V2	V3	VDE	EMI	DIMENSION (mm)
SEC-9041	5V/3A	12V/2A	-12V/0.5A		VDE B	3U/7TE
SEC-9046	5V/8A				VDE B	3U/7TE
SEC-9047	12V/3.5A	5V/0.5A			VDE B	3U/7TE
SEC-9049	24V/2A	5V/0.5A			VDE B	3U/7TE
SEC-9061	5V/5A	12V/3A	-12V/0.5A		VDE B	3U/8TE
SEC-9066	5V/13A				VDE B	3U/8TE
SEC-9067	12V/5.5A	5V/0.5A			VDE B	3U/8TE
SEC-9069	24V/2.7A	5V/0.5A			VDE B	3U/8TE
SEC-9101	5V/8A	12V/5A	-12V/0.5A		VDE B	3U/10TE
SEC-9106	5V/20A				VDE B	3U/10TE
SEC-9107	12V/9A	5V/0.5A			VDE B	3U/10TE
SEC-9109	24V/4.5A	5V/0.5A			VDE B	3U/10TE
SEC-9121	5V/9A	12V/6A	-12V/0.5A		VDE B	3U/12TE
SEC-9126	5V/24A				VDE B	3U/12TE
SEC-9127	12V/10A	5V/0.5A			VDE B	3U/12TE
SEC-9129	24V/5A	5V/0.5A			VDE B	3U/12TE

13 Years Experience in Design Production Support and Service

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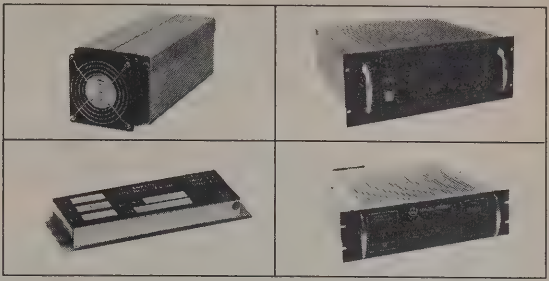
ANALOG MODULES, INC.

Specialists in Analog Electronics and Electro-Optics



Analog Modules, Inc. is a leader in flashlamp/arc lamp power supplies and laser electronics. From capacitor chargers to complete laser power systems, from laser energy monitors to pockels' cell drivers, AMI can provide the high quality, reliability and customer support your investment requires. Call our applications staff today to discuss your power supply/laser electronic requirements.

- **CAPACITOR CHARGING POWER SUPPLIES**
- **CUSTOM PULSE FORMING NETWORKS**
- **CW ARC LAMP POWER SUPPLIES**
- **FLASHLAMP SIMMER SUPPLIES**
- **LASER ELECTRONICS**
- **LAB AND OEM MODELS (MIL Specs Available)**

H.V. POWER SUPPLIES AND CONTROLLERS

Model	Type	Standard Input Voltage (VDC)	Standard Output Voltage (VDC)	Average Output Power (W)	Pkg. Dim. (Inches)	Special Features
521	DC to DC Converters	+12 to +28	0-300/600	210mW	2.05 x 1.0 x 0.61	Photodiode bias applications w/0-5V control, to 1KV available
522		+5	20-250/200-500	350mW	3.15 x 1.58 x 0.39	Photodiode bias applications w/0-2.5V/°C adj. temp. compensation
531		+12 to +28	0-3000	180mW	3.12 x 1.5 x 1.09	H.V., Low noise applications w/0-5V control, MHV output
532		+12 to +16	100-3000	1	2.08 x 1.25 x 0.56	H.V., Low noise applications, miniature, programmable
562/564	Capacitor Charging Power Supplies	+10 to +32	0-1000	6 25	2.0 x 2.0 x 0.74 5.25 x 2.4 x 1.3	Low/medium power, compact, DC-DC converter, suitable for capacitor charging for OEM, medical, industrial applications.
566/568		+18 to +32	0-1500	75/150	3.63 x 3.27 x 2.94	DC-DC capacitor charger suitable for military portable lasers.
576/7/8		+240 to +340[1]	0-2500	250-1.5KW	6.0 x 4.0 x 4.75	Programmable, isolated modules for laser power designed to meet UL544 and CSE/TUV specifications. Field proven high reliability.
882/885		115 or 220VAC or 208VAC 3Ø	0-2500	1KW-5KW	7 x 19 x 17	Complete charging system incorporating 577 modules. Programmable with safety features and 10 years of proven performance.
861A/862A	Flashlamp Simmer Supplies	+24 to +32	1300 striking 300 operation	28 45	5.25 x 2.4 x 1.3 5.78 x 3.68 x 2.03	Includes high energy trigger O/P for Trigger X-former and post flash boost. Can simmer series or difficult lamps.
883-X-1/4	Complete PFN Discharge Power Supplies	115 or 220VAC	0-2500	250-1KW	7 x 19 x 17	Complete laser controller and custom PFN w/internal charger. Ideal for solid state lasers requiring a compact single-chassis. Can be customized to OEM specifications.
883/882 or 885		115 or 220VAC or 208VAC 3Ø	0-2500	1KW-5KW	2ea. 7 x 19 x 17	For higher power applications, can be interfaced with a complete range of AMI electronics. Expandable to >20KW.
883-X-V-2		115 or 220VAC	0-425/1000	500	7 x 19 x 17	Complete controller and variable PFN w/internal charger, adjustable pulsewidth 0.1 to 1.5mS, instantaneous display to 200J, available for high and low K_0 lamps. Modular OEM versions available.
883-X-V/882-V or 885-V		115 or 220VAC or 208VAC 3Ø	0-425/1000	1KW-5KW	2 ea. 7 x 19 x 17	For higher power applications, can be interfaced with a complete range of AMI electronics. Expandable to >20KW.
893-1C/PFC	CW Arc Lamp Modules and Complete Power Supplies	115VAC	100-250	1.4KW (std. outlet)	5.25 x 19 x 17	Complete CW system incl. power module, igniter, and controls. This low-cost turn-key system provides modular flexibility to meet OEM requirements. Various local and remote options are available together with active power factor correction (PFC option). Optional remote control module available in lieu of front panel adjustment.
893-1D/PFC		220VAC	100-250	2KW	5.25 x 19 x 17	
893-2D/PFC		220VAC	100-250	4KW	5.25 x 19 x 17	
893-3D		208-230V 3Ø	100-250	6KW	5.25 x 19 x 17	

1. AMI offers **Model 581** for 115V/230V AC to 300V DC Conversion.

OTHER LASER ELECTRONICS

- Model 811 Laser Energy Monitor, long and short pulse versions, various detectors.
- Model 821 High Voltage switch modules for E-O crystals/Pockels' cells, to 3.3KV, 70nS risetime
- Model 824 Hybrid Q-Switch driver, 50nS risetime, <25µS recovery, output to 3KV
- Model 827 Pockels' Cell Driver, miniature, solid state, built-in power supply, output to 3.2KV
- Model 828 Same as 827 with fast rise and fall time to 2KV, adjustable pulsewidth
- Model 851 Series trigger module adjustable to 20KV, 115VAC input
- Laser diode drivers and laser rangefinder products also available.

For other products, please see our ad in Amplifier Assemblies/Instrumentation and Fiber-Optic Equipment and Accessories.

ANALOG MODULES, INC.
126 Baywood Avenue
Longwood, FL 32750
PHONE: (407) 339-4355
FAX: (407) 834-3806

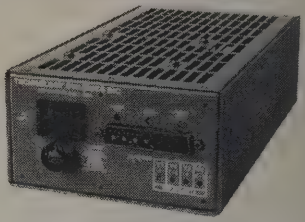
FULL LINE SWITCHING POWER SUPPLIES AND DC-DC CONVERTERS

COMMERCIAL MILITARY MILITARIZED

All Standard Products Can Be Modified and Customized

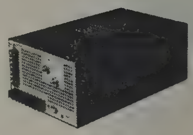
TBC SERIES 150-600W
A family of rugged switches providing up to 4 outputs and capable of battery backup and -30 to +70°C operation range. Remote site applications.

TDL SERIES 500-1000W
The same as the TBC Series except for a higher output power capability.

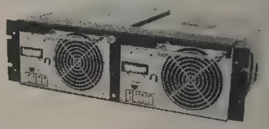


TBC Series 5.5 x 3 x 10"
TDL Series 5.5 x 5 x 11.5

NTDM SERIES 500W-3000W
Industry standard 8 x 5 x 12.5 inch available in single and 3 outputs, and can be optimally ruggedized for -30 to +70°C operation and shock/vibration to MIL-STD-810.

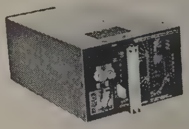


REDUNDANT AND HOT SWAP
(N+1) POWER SUPPLY SYSTEMS, RACK MOUNT.
5.25" Height up to 3000W 8.75" Height up to 4500W



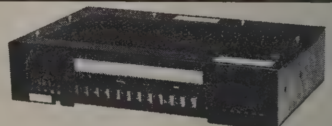
UNINTERRUPTIBLE SWITCHING POWER SUPPLIES WITH BATTERY BACKUP—DC OUTPUTS

NTDM-UPS SERIES **Available with Battery**
Backup Feature, Dual input of 115/230V & 48VDC (or 28VDC) battery. Provide Glitch Free Transfer Up to 1500W. Up to 3 Outputs. Eliminates the Need for UPS Inverters. Capable of Battery charging as well.

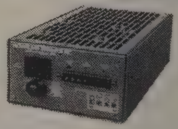


DC-DC CONVERTERS

TDC-150
DC-DC with 24V, 36V, 48V or 120 VDC Inputs, up to 4 Outputs. Slim Line 5.5″ × 9.5″ × 2.2″. Up to 150 Watt. Standard Outputs: 5V, +12V, −12V & 24V. Powerful yet very compact unit.

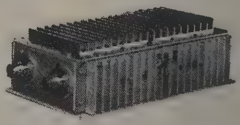


TBDC SERIES 150-500W
A family of rugged DC-DC Converters up to 4 outputs, all tightly regulated. Available optionally with -30 to +70°C temp. range and shock/vibration per MIL-STD-810.



MIL APPROVED AND MILITARIZED POWER SUPPLIES

Custom Full MIL and Militarized power supplies to MIL-STD-2000. Airborne, shipboard and ground support applications meets MIL-STD-461, 810, 901.



17 Years of Design Excellence!

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HIGH RELIABILITY STANDARD & CUSTOM POWER SYSTEMS

COMPACT 150-600 WATT SINGLE/MULTIPLE OUTPUT SWITCHERS

TBC and TBCM SERIES

TECHNOLOGY DYNAMICS INC

Features/Options

- Rugged design in 5 x 3 x 10 package
- Available with several options
- Can be made for military environment

Table (1) TBC Series: Single Output

OUTPUT	MAX LOAD	MODEL NO.
5	50	TBC-5-50
12	40	TBC-12-40
24	24	TBC-24-24
28	20	TBC-28-20
48	12	TBC-48-12

TBCM Series: Multiple Output

Use Model TBCM for Multiple Output.
Select first, second, third or fourth output from the tables below.
Second and third output must be equal in voltage and share common ground.
Output four is floating.
Example: P/N TBCM 5-50 A2B2C1-Suffix
+5V 50A, -12V3A, +12V 4A, +5V 2A

LBVD Module (Low battery auto-disconnect)

The LBVD module adds a new dimension to battery charger power supplies. The power supply simultaneously charges the battery and powers the load. If the AC power fails, the battery continues to support the load. However, when the battery voltage drops below a predetermined level, the LBVD module disconnects the battery from the load, thereby protecting the battery from the damaging effects of complete discharge.

Table (2)

OUTPUT #1 (V1)		
VDC	MAX AMP	MODEL
5	50	TBCM-5-50
12	40	TBCM-12-40
24	24	TBCM-24-24
28	20	TBCM-28-20
48	12	TBCM-48-12

Table (3)

OUTPUT #2 (V2)	CODE
VDC @ MAX AMP	
-5V @ 3A	A1
-12V @ 3A	A2
-15V @ 3A	A3
-24V @ 3A	A4

Table (4)

OUTPUT #3 (V3)	CODE
VDC @ MAX AMP	
+5V @ 4A	B1
+12V @ 4A	B2
+15V @ 4A	B3
+24V @ 2A	B4

Table (5)

OUTPUT #4 (V4)	CODE
VDC @ MAX AMP	
5V @ 2A	C1
12V @ 2A	C2
15V @ 2A	C3
24V @ 2A	C4
48 @ 1A	C5

NOTE: Other voltages and currents available, contact the factory. Maximum total output power cannot exceed 600 watts, maximum current per output cannot be exceeded.

Input

Input: 115/230 strappable
Hold up time: 16-20ms typical
Leakage current: 3.5ma maximum
Efficiency: 75% typical
Line Regulation: ±.3%
Load Regulation: ±2%
Ripple: 1% max. peak to peak, not to exceed 100mV
Output Termination: "D" Subminiature connector

Agency Certifications

- Meets FCC Docket 20780, Class A and VDE 0871, Class A
- UL 1950, CSA 22.2-950, CSA 22.2-234 (Pending)

Options

- Battery backup: Suffix BBU
- Auto line select: Suffix ALS
- O Ring diode main output: Suffix ORD
- -30 to +70°C full load operation: Suffix M
- Forced current sharing: Suffix FC

Protections

Overload and short circuit protection all outputs
Overvoltage: Recycle input to reset from latch
Fuse: 20A fuse at input
LED Indicators: Input AC Good
Output DC Good

Environmental

Operating Temperature: 0-55°C Ambient
(derate to 50% at 70°C)
Storage Temperature: -30°C to +80°C
Cooling: Internal fan

Mechanical Features

Size: 10.00" x 5.5" x 3.0"
Weight: 4.5 lbs. (2kg)

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HIGH RELIABILITY STANDARD & CUSTOM POWER SYSTEMS

MULTIPLE OUTPUT HIGH POWER SWITCHER

NTDM Series

(with optional features)

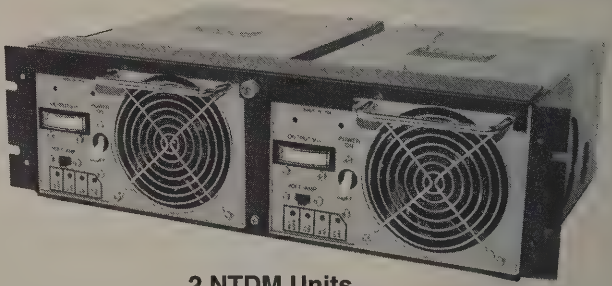
Battery Backup, Power Factor Correction, Universal Input Hot Plug-in, 3 Phase Input and (N + 1) Configuration

500W-2000W

APPLICATIONS: This universal power supply is suitable for uses in data processing, communications, telecom, instrumentation, automation equipment and robotics.

- Rugged construction for high shock and vibration
- Up to 3 powerful outputs
- MTBF exceeding 150,000 hours
- Full overload, overvoltage and overtemperature protection
- Can be supplied with battery backup feature
- Can be supplied with "power factor correction" feature
- Universal input option
- Hot plug-in, rack mounted (N + 1) configuration
- Available in militarized version
- Meters, circuit breaker
- Can be customized to meet customer specifications

Single Unit



2 NTDM Units in a Rack Mount Configuration

OPTIONS

UPS BATTERY BACKUP 48VDC	Applicable to all units: 1-3 outputs, up to 1000W and having no power factor correction option.
	Once placed in the unit, the battery backup module makes this switcher an uninterruptable system. Transfer to battery occur automatically and "glitchlessly". Accepts 48VDC input, and can support up to 1000W of total output. Charges the battery when AC is present.
	For battery backup option, add UPS as a suffix to the part number. Example: NTDM28-18A2B2-UPS.
POWER FACTOR CORRECTION (Accepts input of 90-264VAC)	Applicable to all units: 1-3 outputs, up to 1000W and having 4th output or UPS options.
	The power factor correction module reshapes the input current to a nearly perfect sinosoidal waveshape which has a power factor of .95 - .98.
	For this feature add PF as a suffix to the part number. Example: NTDM5-100A2B2-PF.
REDUNDANCY (N+1) CONFIGURATION HOT PLUGGABLE	Applicable to all units. Consult factory.
	The NTDM units may be optionally equipped with "O Ring" diodes on the outputs, thus enabling these units to be connected in parallel for (N+1) applications. A standard 19" rack mount is available to accomodate up to 3 units in one tray. The units may be removed or plugged into location without power removal.

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HIGH RELIABILITY STANDARD & CUSTOM POWER SYSTEMS

NTDM Series

SINGLE OUTPUT STANDARD MODEL NUMBERS

NOMINAL VOLTAGE (VDC)	500 WATT OUTPUT		1000 WATT OUTPUT		1500 WATT OUTPUT		2000 WATT OUTPUT	
	MAXIMUM CURRENT (ADC)	MODEL	MAXIMUM CURRENT (ADC)	MODEL	MAXIMUM CURRENT (ADC)	MODEL	MAXIMUM CURRENT (ADC)	MODEL
5.0	100	NTDM-5-100	200	NTDM-5-200	300	NTDM-5-300	SPECIAL MODELS CONSULT FACTORY	
12.0	42	NTDM-12-42	83	NTDM-12-83	125	NTDM-12-125		
15.0	33	NTDM-15-33	67	NTDM-15-67	100	NTDM-15-100		
24.0	21	NTDM-24-21	42	NTDM-24-42	62	NTDM-24-62	84	NTDM-24-84
28.0	18	NTDM-28-18	36	NTDM-28-36	54	NTDM-28-54	72	NTDM-28-72
48.0	10	NTDM-48-10	21	NTDM-48-21	31	NTDM-48-31	42	NTDM-48-42
110.0	4.5	NTDM-110-4.5	9	NTDM-110-9	14	NTDM-110-14	18	NTDM-110-18

MULTIPLE OUTPUT STANDARD MODEL NUMBERS

TABLE 1
FIRST OUTPUT

NOMINAL VOLTAGE (VDC)	MAXIMUM CURRENT (ADC)	MODEL CONFIGURATION
5.0	150	**NTDM-5-250**
12.0	65	**NTDM-12-100**
15.0	50	**NTDM-15-80**
24.0	40	**NTDM-24-50**
28.0	42	**NTDM-28-42**
48.0	25	**NTDM-48-25**
110.0	11	**NTDM-110-11**

TABLE 2
SECOND OUTPUT

NOMINAL VOLTAGE (VDC)	MAXIMUM CURRENT (ADC)	SUFFIX
5	15	**A1**
12	15	**A2**
15	15	**A3**
24	10	**A4**

TABLE 3
THIRD OUTPUT

NOMINAL VOLTAGE (VDC)	MAXIMUM CURRENT (ADC)	SUFFIX
-5	3	**B1**
-12	3	**B2**
-15	3	**B3**
-24	3	**B4**

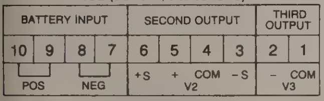
NOTE: Total combined output power of all outputs is limited to 1200W.

EXAMPLES: 1) NTDM28-42A2B2-UPS: NTDM Series, three output power supply with battery back-up.
2) NTDM5-150A3B3-PF: NTDM Series, three output power supply with Power Factor Correction.

* Output current may be optionally increased to 5A.

TERMINATIONS

TB2 (3/8" CTR, 6-32 SCREWS)

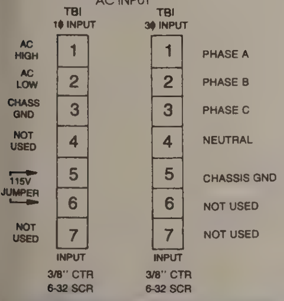

BATTERY INPUT
SECOND OUTPUT
THIRD OUTPUT
10
9
8
7
6
5
4
3
2
1
POS
NEG
+S
+
COM
-S
V2
-
COM
V3

J1 LOGIC CONNECTOR

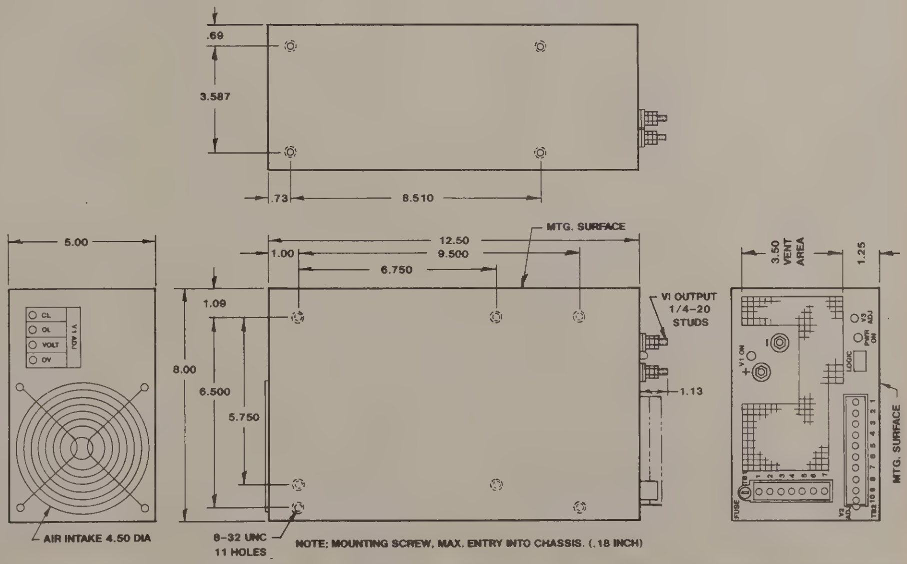
Connector P/N
AMP 74394-2

1	LOGIC GROUND
2	NEG SENSE OF MAIN OUTPUT
3	BATTERY LOW PENDING SHUTDOWN
4	POS SENSE OF MAIN OUTPUT
5	AC FAIL
6	INHIBIT
7	REMOTE PROGRAMMING
8	CURRENT SHARE BUS
9	OUTPUT GOOD

AC INPUT


TBI
1φ INPUT
TBI
3φ INPUT
AC HIGH
1
1
PHASE A
AC LOW
2
2
PHASE B
CHASS GND
3
3
PHASE C
NOT USED
4
4
NEUTRAL
115V JUMPER
5
5
CHASSIS GND
6
6
NOT USED
NOT USED
7
7
NOT USED
INPUT
3/8" CTR
6-32 SCR
INPUT
3/8" CTR
6-32 SCR

MECHANICAL OUTLINE


.69
3.587
.73
8.510
5.00
12.50
1.00
9.500
6.750
MTG. SURFACE
1.09
8.00
6.500
5.750
VI OUTPUT 1/4-20 STUDS
1.13
CL
OL
VOLT
OV
V1 ADJ
AIR INTAKE 4.50 DIA
8-32 UNC 11 HOLES
3.50 VENT AREA
1.25
V3 ADJ
PWR ON
V1 ON
LOGIC
TB
FUSE
V2 ADJ
TB2
MTG. SURFACE

NOTE: MOUNTING SCREW, MAX. ENTRY INTO CHASSIS. (.18 INCH)

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SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

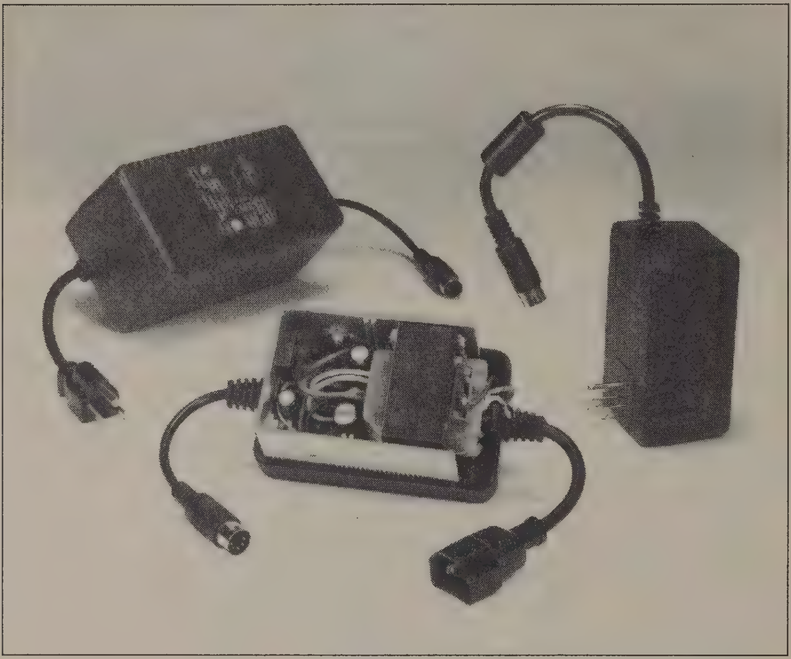
SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	$moles/dm^3$
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	$u.\upsilon$	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

apx TECHNOLOGIES INC.

REGULATED LINEAR EXTERNAL POWER SUPPLIES

Our products are manufactured in the **FAR EAST** and are competitively priced. We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.



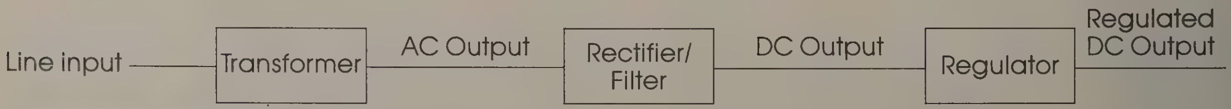
Specifications and Available Options:

- Typical Input Voltage Range: 105 To 132 VAC @ 60 Hz
- NEMA 5-15 P Plug with Ground Pin Available
- Single and Multiple Outputs
- Any Combination of Voltages and Currents
- Ripple and Noise: 10 mV P-P Typical
- Output Accuracy: ±5%
- Overvoltage Crowbar Protection Circuits Optional
- RFI/EMI and Transient Protection
- Switchable Input Available
- European IEC/VDE and U.K. BABT Equivalent Designs Available for Certification
- Typical Operating Temperature Range: 0°C—40°C
- Custom Colors: Plastics and Cables
- Custom Tooling and Molding of Enclosures
- All APX Enclosures Are Made of High Impact Plastics Meeting UL 1310/1012 and CSA 22.2-223
- Custom Tooling and Molding of Cables and Connectors
- Typical Breakdown Voltage: 1500 VAC
- Warranty: 1 Year

Class II Regulated Output Designs: Typical Model Selection Guide

APX Model No.	Output 1	Output 2	Output 3
APX 5R750	+5 @ 750		
APX 12R1200	+12 @ 1200		
APX 512R-01	+5 @ 500	+12 @ 1000	
APX 512R-02	+5 @ 600	+12 @ 1000	
APX 512R-03	+5 @ 700	+12 @ 700	
APX 515R-01	+5 @ 1000	+15 @ 1000	
APX 51212R-01	+5 @ 450	+12 @ 100	−12 @ 100
APX 51212R-02	+5 @ 750	+12 @ 700	−12 @ 100
APX 51212R-03	+5 @ 1000	+12 @ 1000	−12 @ 100
APX 51212R-04	+5 @ 1000	+12 @ 500	−12 @ 500
APX 51212R-05	+5 @ 1100	+12 @ 900	−12 @ 100
APX 51212R-06	+5 @ 1500	+12 @ 1100	−12 @ 100
APX 51212R-07	+5 @ 1500	+12 @ 600	−12 @ 600
APX 81212R-01	+8 @ 800	+12 @ 150	−12 @ 150
APX 81212R-02	+8 @ 850	+12 @ 200	−12 @ 100

See our Transformer Pages in Volume A Section 5600



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AC AND DC EXTERNAL POWER SUPPLIES–ADAPTERS

Our products are **engineered** domestically in the **U.S.** and manufactured in the **FAR EAST.** Selection available from a variety of designs which are **UL/CSA** listed or have our engineers help you select a custom design for your special application.

Class II
AC Output: Typical Model Selection Guide

APX Model No.	Typical Output Rating	Size Ref.
APX 6A500	6.0 VAC @ 500 mA	35
APX 8A1500	8.0 VAC @ 1500 mA	48
APX 8.5A1350	8.5 VAC @ 1350 mA	48
APX 9A400	9.0 VAC @ 400 mA	35
APX 9A700	9.0 VAC @ 700 mA	41
APX 9A1000	9.0 VAC @ 1000 mA	48
APX 9A1250	9.0 VAC @ 1250 mA	48
APX 9A1500	9.0 VAC @ 1500 mA	48
APX 12A300	12.0 VAC @ 300 mA	35
APX 12A1200	12.0 VAC @ 1200 mA	48
APX 14A2800	14.0 VAC @ 2800 mA	57
APX 16A1250	16.0 VAC @ 1250 mA	57
APX 18A200	18.0 VAC @ 200 mA	35
APX 18A350	18.0 VAC @ 350 mA	41
APX 19.6A850	19.6 VAC @ 850 mA	57
APX 20A500	20.0 VAC @ 500 mA	48
APX 20A700	20.0 VAC @ 700 mA	48
APX 20A800	20.0 VAC @ 800 mA	57
APX 21A500	21.0 VAC @ 500 mA	48
APX 21A600	21.0 VAC @ 600 mA	48
APX 24A150	24.0 VAC @ 150 mA	35
APX 24A600	24.0 VAC @ 600 mA	57
APX 26A2250	26.0 VAC @ 2250 mA	66

- Models available in wall plug in or desk top configuration depending on output power.

Class II
DC Output: Typical Model Selection Guide

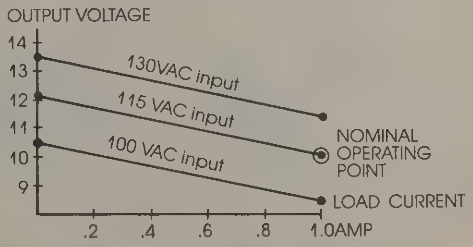
APX Model No.	Typical Output Rating	Size Ref.
APX 6D300	6.0 VDC @ 300 mA	35
APX 9D300	9.0 VDC @ 300 mA	35
APX 9D500	9.0 VDC @ 500 mA	41
APX 9D1000	9.0 VDC @ 1000 mA	48
APX 14D800	14.0 VDC @ 800 mA	48
APX 18D150	18.0 VDC @ 150 mA	35
APX 18D800	18.0 VDC @ 800 mA	57
APX 20D150	20.0 VDC @ 150 mA	41
APX 25D400	25.0 VDC @ 400 mA	48
APX 26D1500	26.0 VDC @ 1500 mA	66
APX 28D400	28.0 VDC @ 400 mA	48

MOST DESIGNS AGENCY APPROVED OR LISTED AS REQUIRED.

Specifications and Available Options:

- Typical Nominal Input: 120 VAC @ 60 Hz
- NEMA 5-15 P Plug with Ground Pin Available
- Switchable Input Voltages Available
- Typical Output Tolerance ±5%
- Typical DC Filtered Models with 1000 mfd Capacitor
- Models with Lower Ripple Available with Larger Value Capacitors
- Center Tap Designs Available on AC Models
- Standard and Custom Output Connectors
- Typical Operating Temperature Range: 0°C—40°C
- RFI/EMI and Transient Protection
- European IEC/VDE and U.K. BABT Equivalents Available
- Special Designs to Medical/Dental UL 544 Standards
- Custom Tooling and Molding Available for Plastics and Connectors
- All APX Enclosures are made of High Impact Plastics Meeting UL 1310/1012 and CSA C22.2 Number 223
- Typical Breakdown Voltage: 1500 VAC

TYPICAL OUTPUT LOAD CURVES for AC adapter nominal 10VAC @ 1 Amp



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EUROPEAN AND INTERNATIONAL DESIGNS

We are transformer specialists! You get technical assistance from our engineers here and top performance at low prices from our factories in the FAR EAST. We provide approval samples on quantity orders prior to production. TECHNICAL EXPERTISE, PERFORMANCE, PRICE…It's all here!

IEC BABT

AC Output: Typical Model Selection Guide

APX Model No.	Typical Output Rating
APX 10A600E	10 VAC @ 600 mA
APX 12A200E	12 VAC @ 200 mA
APX 16A850E	16 VAC @ 850 mA
APX 18A1300E	18 VAC @ 1300 mA
APX 19.5A850E	19.5 VAC @ 850 mA
APX 26A2250E	26 VAC @ 2200 mA

DC Output: Typical Model Selection Guide

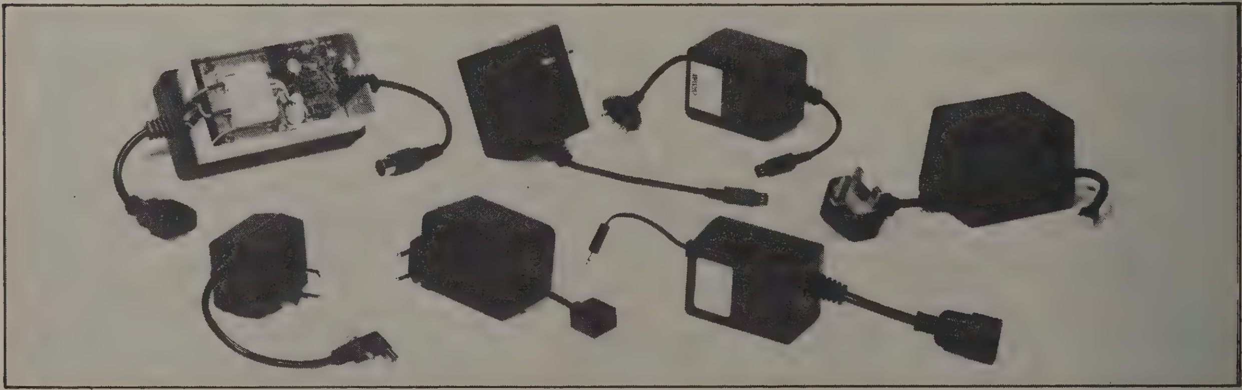
APX Model No.	Typical Output Rating
APX 5D500E	5 VDC @ 500 mA
APX 9D600E	9 VDC @ 600 mA
APX 9D1000E	9 VDC @ 1000 mA
APX 12D250E	12 VDC @ 250 mA
APX 12D800E	12 VDC @ 800 mA

Specifications and Available Options:

- Typical Input Voltage: 220-230 and 240 VAC @ 50 Hz
- Switchable Input Availability
- Grounded and Non-grounded Models Available
- Center Tap Designs Available on AC Models
- Any Combination of Output Voltages and Currents
- Overload and Shorted Output Protection
- Overvoltage Crowbar Protection Circuits Available on Regulated Units
- Thermal Protection
- Designed to Comply With IEC, VDE, BSI, BABT, SAA Standards
- Compliant to EN 60950/BS 7002 for EEC 92 STDS Quality Control STD BS 5750
- Typical Breakdown Voltage: 3750 VAC
- Warranty: 1 year

Typical Regulated Output Designs

APX Model No.	Output 1	Output 2	Output 3
APX 5R750E	+5 VDC @ 750 mA		
APX 512R-04E	+5 VDC @ 500 mA	+12 VDC @ 100 mA	
APX 512R-03E	+5 VDC @ 750 mA	+12 VDC @ 700 mA	
APX 51212R-01E	+5 VDC @ 450 mA	+12 VDC @ 100 mA	−12 VDC @ 100 mA
APX 51212R-04E	+5 VDC @ 1.0A	+12 VDC @ 500 mA	−12 VDC @ 500 mA
APX 51212R-03E	+5 VDC @ 1.0A	+12 VDC @ 1.0A	−12 VDC @ 100 mA



SOME MODELS CERTIFIED AS MEETING EEC 1992 STANDARDS.

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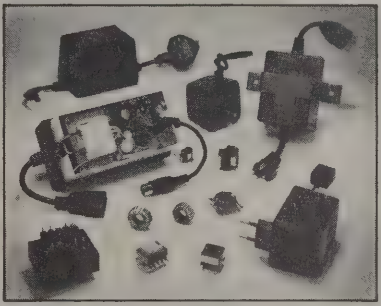
We are a manufacturer of **POWER SUPPLIES** and **MAGNETIC PRODUCTS** with engineering sales offices in the **U.S.** and manufacturing in the **Far East.**

Our Products Include:

- AC and DC External Power Supplies
- Regulated Linear Power Supplies
- Custom Made Specialized Power Supplies
- Battery Chargers
- Power, Pulse and Telecommunication Transformers
- Inductors and Specialized Magnetic Products



Typical Applications:

- Computers
- Telecommunications
- Modems
- Medical Equipment
- Computer Peripherals
- Bar Scanning Equipment
- Microprocessor Control Systems
- ATE and Security Systems

QUALITY — RELIABILITY — SERVICE — RESPONSE — WARRANTY and COMPETITIVE PRICING

Established in 1978 we have successfully worked with engineers, buyers and program managers supporting products and programs with 12 years of:

- **Product Analysis**
- **Design Engineering Support**
- **Custom Tooling and Packaging**
- **Custom Molding**
- **Domestic and International Agency Certifications**
- **BABT Approved Manufacturing Facility**

Battery Chargers:

- Standard and Custom Designs for Nickel Cadmium and Lead Acid Batteries
- Single and Dual Stage Charging Systems
- Standard and Regulated Outputs
- Designs are available to UL/CSA as well as European IEC/VDE Standards
- Designs to Medical/Dental UL544 Standards
- Wall Mount Plug- in and Desk Top Configurations Available
- Custom Enclosures

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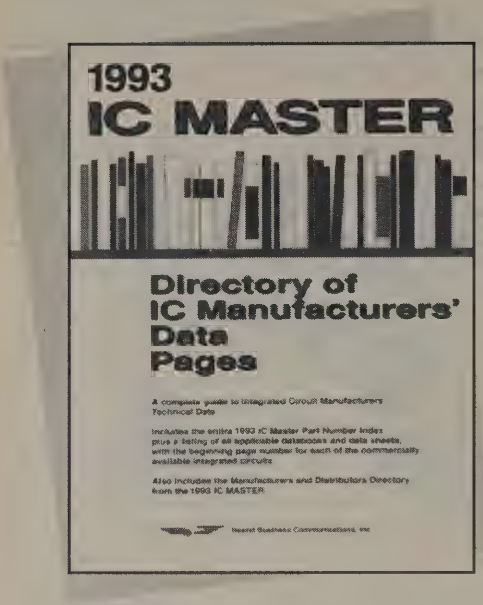

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Published annually in February

AC-DC/DC-DC MODULAR MINIATURIZED
SWITCHING POWER SUPPLIES

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EXPANDED CAPABILITY

CONFIGURE-YOUR-OWN

MIL SPEC • HIGH RELIABILITY

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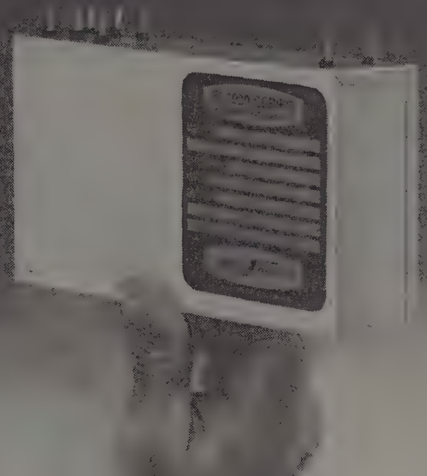

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Complete AC to DC and DC to DC multi output systems.

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- Efficiencies to 80% +.
- NOW 115/230 VAC strappable 1∅ input.
- NOW 120/208 VAC 3∅/4 wire Wye input.
- NOW 270 VDC input.
- NOW To 110 amps, 300 VDC and 580 watts total output.
- NOW Low noise options available.
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- Mil-Std 704A-D, 1399 and 1275 input surge and spike protection.
- Meets many provisions of Mil-Std-810D, Mil-E-5400T, Mil-E-16400, Mil-T-27, Mil-E-4158E (USAF) and Mil-Std-454J.

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ARNOLD MAGNETICS CORPORATION

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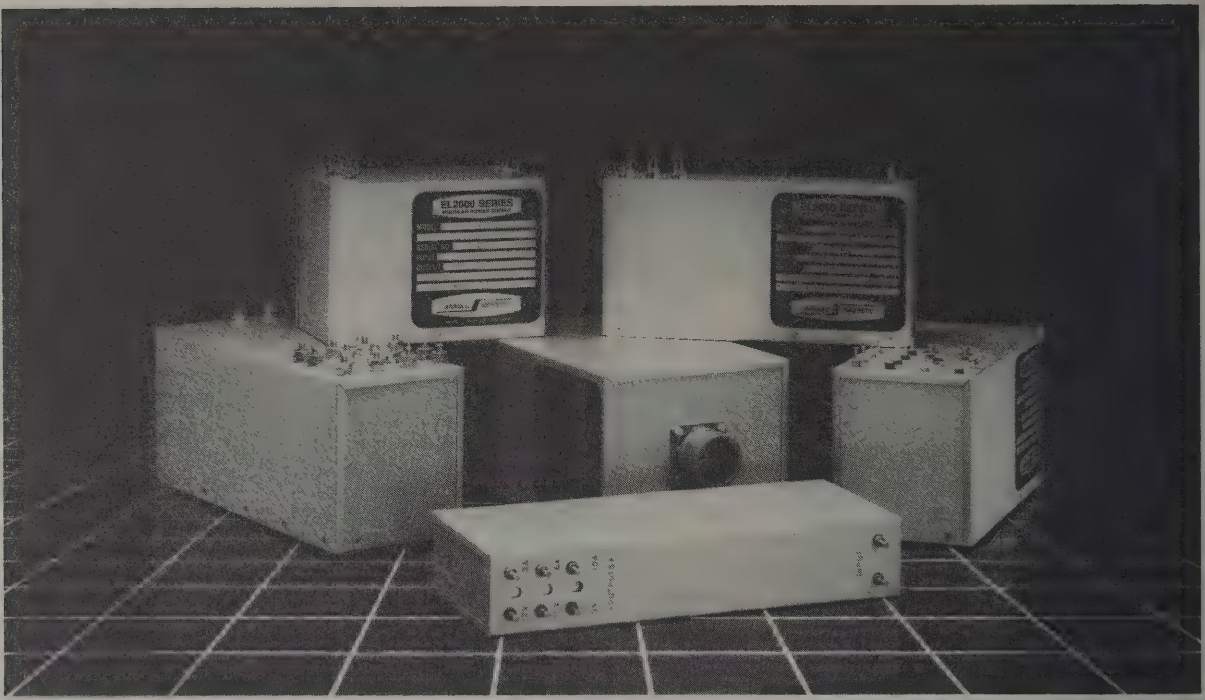
AC-DC/DC-DC MODULAR MINIATURIZED SWITCHING POWER SUPPLIES



WHY CHOOSE ARNOLD MAGNETICS?

SAVE SPACE… MINIATURIZED PACKAGES

Arnold's complete AC-DC and DC-DC Multi Output Systems are 50% to 75% smaller than previous generation power supplies, achieving densities of 5 to 8 watts per cubic inch. Our miniaturized packages, with their unique narrow footprints, provide more power in less space.

SAVE TIME… QUICK DELIVERIES

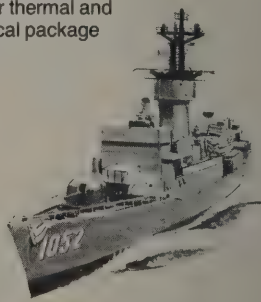
Arnold's unique design concept allows you to choose inputs and outputs from predesigned standard modules. You configure your own "custom" multi-output power supply system and get delivery in weeks…even with non-standard voltage combinations.

SAVE MONEY… LOWER PROGRAM COSTS

With Arnold, there is no additional charge for unique output voltage combinations. Non-recurring engineering and qualification expenses of custom designs are avoided. In addition, our standard modules provide lower cost for production quantities.

REDUCE RISK… HIGH RELIABILITY DESIGNS

Arnold's standard modules are proven thru thousands of hours of failure-free qualification before ever being shipped to our customers. NAVMAT derating and testing methods, along with standardized modular designs, ensure reliability and reduce the risk of failure inherent in new custom circuits or thermal and mechanical package designs.



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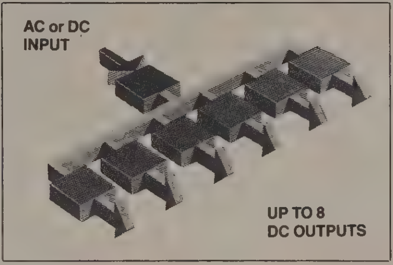
FROM STANDARD MODULES!

EL 2000 SERIES



1 OUTPUT SELECTION

Every standard output module may be specified to the exact nominal voltage and maximum current you require. The table of output regulators describes the range of voltages and currents available as standards. Please select the nominal voltage required for each output. All outputs are adjustable ±5% from nominal by means of an externally accessible potentiometer. Outputs are isolated and may be connected for positive or negative polarity. Ensure your required load is within the maximum current specified. You may have up to eight outputs per power supply.

OUTPUT REGULATORS

NOMINAL VDC OUTPUT (V)	MAXIMUM CURRENT OUTPUT (A)	EL-2000 MODEL	REGULATOR LENGTH (INCHES)	TYPICAL EFFICIENCY (%)	LINE/LOAD REGULATION (% Eo)[3]	V RMS RIPPLE/NOISE (% Eo)
From 4 to 6	2	ERA-6	0.6	80	0.10	0.15
	5	ERC-6	0.6	80	0.20	0.5
	10	ERF-6	0.6	85	0.20	0.5
	20	ERM-6	1.2	85	0.30	0.5
	45	ERP-6M[1]	2.7	80	0.50	0.5
	65	ERY-6M[1]	2.7DW[2]	80	0.50	0.5
	110	ERZ-6M[7]	3.6DW[2]	85	0.50	0.5
From 6.1 to 18	1	ERA-18	0.6	85	0.05	0.15
	3	ERC-18	0.6	90	0.10	0.3
	5	ERF-18	0.6	90	0.10	0.3
	10	ERM-18	1.2	90	0.15	0.3
	15	ERP-18M[1]	2.7	80	0.25	0.4
	20	ERY-18M[1]	2.4DW[2]	80	0.25	0.4
From 18.1 to 30	0.5	ERA-30	0.6	90	0.05	0.15
	1.5	ERC-30	0.6	95	0.10	0.15
	2.5	ERF-30	0.6	95	0.10	0.15
	5	ERM-30	1.2	95	0.10	0.15
	10	ERP-30M[1]	2.7	85	0.25	0.3
	12	ERY-30M[1]	2.4DW[2]	85	0.25	0.3
From 30.1 to 130	0.5	ERB-130	0.6	90	0.1	0.1
	1	ERK-130	1.2	90	0.1	0.1
From 130.1 to 200	0.35	ERB-200	0.6	95	0.1	0.1
	0.70	ERK-200	1.2	95	0.1	0.1
From 200.1 to 300	0.15	ERB-300	0.6	95	0.1	0.1
	0.30	ERK-300	1.2	95	0.1	0.1

OPERATING SPECIFICATIONS

- **TEMPERATURE COEFFICIENT:** 0.01%/°C. −55°C to +85°C.
- **OPERATING TEMPERATURE** (Baseplate): −40°C to +85°C (optional −55°C to +85°C)
- **STORAGE TEMPERATURE:** −65°C to +100°C.
- **SHORT CIRCUIT PROTECTION:** All outputs are short circuit protected and feature foldback current limiting. (ERP, ERY straight current limiting).
- **OUTPUT ADJUSTMENT RANGE:** All outputs are adjustable over a plus or minus 5% range.
- **SEMICONDUCTOR JUNCTION TEMPERATURE:** Maximum of 100°C at operating baseplate temperature of +85°C (derating per Navmat P4855-1 and Mil-Std-454J).
- **ISOLATION:** The inputs, case and outputs are isolated (floating) from each other. Output to case isolation test voltage is the greater of 50VDC or 1.3 x E out. Input to case 500VDC on 115VAC units, 50VDC on DC input units (to 30V). Input to output 250VDC on all units.

NOTES

1. M—Denotes Master Channel (max. of one per power supply); —10% minimum load (to 5 amps max.) required.
2. DW—Denotes Double Width design only.
3. Line/Load Regulation Band consists of high line to low line and 1/2 load to full load change.
4. Consult Factory.
5. No additional space required for Inrush/Transient Protection.
6. No additional space required for E & T options.
7. Use with EDC, EDD or EDM Input Sections only.
8. @ −55°C; 8.7 DW.
   For 187-265 V operation only; 7.7DW

2 INPUT SELECTION

Select the input section, AC or DC, with sufficient power to drive the output modules. This is determined from your worksheet calculations. We have provided conservative data for your analysis. The efficiencies shown in the Output Regulators table may vary with options such as wide input or extended temperature. Our factory applications engineers will be happy to assist you in evaluating various alternative configurations.

AC INPUT SECTION

INPUT VOLTAGE RANGE	EL-2000 MODEL	OUTPUT POWER RATING (WATTS)	MAXIMUM INPUT SECTION LENGTH (INCHES)
103-127 V 47-500 Hz 1⌀	EDAA	100	Note 4
	EDAB	200	6.9
	EDAC	300	6.9
	EDAD	400	7.2
	EDAE	500	7.2
103-127 V 340-500 Hz 1⌀	EDBA	100	Note 4
	EDBB	200	6.6
	EDBC	300	6.6
	EDBD	400	6.9
	EDBE	500	6.9
103-127V or 187-265V 1⌀ Strapable 47-500 Hz	EDCA	100	Note 4
	EDCB	200	Note 4
	EDCC	300	8.2DW[8]
	EDCD	400	8.2DW[8]
	EDCF	580	8.2DW[8]
120/208 3⌀/4W Wye 47-500 Hz	EDDA	100	Note 4
	EDDB	200	Note 4
	EDDC	300	6.9DW[2]
	EDDD	400	6.9DW[2]
	EDDF	580	6.9DW[2]
103-127 V 47-500 Hz 3⌀ DELTA	EDEA	100	Note 4
	EDEB	200	8.1
	EDEC	300	8.1
	EDED	400	8.4
	EDEE	500	8.4

DC INPUT SECTION

INPUT VOLTAGE RANGE	EL-2000 MODEL	OUTPUT POWER RATING (WATTS)	MAXIMUM INPUT SECTION LENGTH (INCHES)
24-30 VDC	EDHA	100	Note 4
	EDHB	200	6.9[6]
	EDHC	300	6.9[6]
	EDHD	400	8.4[6]
	EDHE	500	8.4[6]
105-125 VDC	EDKA	100	Note 4
	EDKB	200	5.4[5]
	EDKC	300	5.4[5]
	EDKD	400	5.7[5]
150-170 VDC	EDLA	100	Note 4
	EDLB	200	5.4[5]
	EDLC	300	5.4[5]
	EDLD	400	5.7[5]
	EDLE	500	5.7[5]
250-280 VDC	EDMA	100	Note 4
	EDMB	200	Note 4
	EDMC	300	6.9DW[2 & 6]
	EDMD	400	6.9DW[2 & 6]
	EDMF	580	6.9DW[2 & 6]

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ARNOLD MAGNETICS

AC-DC/DC-DC MODULAR MINIATURIZED
SWITCHING POWER SUPPLIES

3 CASE SELECTION

You have a variety of choices when selecting the package that best fits your space. Just add up your modules (Input Section, Regulators and Options) and pick the case that best fits your system needs.

Case Size	Total of Module Lengths (inches)	Base-plate Area	Maximum Case Dimensions (inches)			Mounting Holes (inches)			Final Unit Weight (oz.)	Figure No.
			Length (L)	Width (W)	Height (H)	M	N	Quan.		
ECAA	3.2	4.8 in²	3.5	1.63	3.63	1.125	2.750	4	25	1
ECBA	4.7	7.1 in²	5.0	1.63	3.63	1.125	4.250	4	35	1
ECCA	6.7	10.1 in²	7.0	1.63	3.63	1.125	2.750	6	45	1
ECFA	8.2	12.4 in²	8.5	1.63	3.63	1.125	3.500	6	60	1
ECDA	10.2	15.4 in²	10.5	1.63	3.63	1.125	4.500	6	70	1
"DOUBLE WIDE" Packages below allow modules to be mounted side by side.										
ECAB	2 x 3.2	9.7 in²	3.5	3.13	3.63	2.625	2.750	4	45	2
ECBB	2 x 4.7	14.2 in²	5.0	3.13	3.63	2.625	4.250	4	66	2
ECCB	2 x 6.7	20.2 in²	7.0	3.13	3.63	2.625	2.750	6	82	2
ECFB	2 x 8.2	24.8 in²	8.5	3.13	3.63	2.625	3.500	6	110	2
ECDB	2 x 10.2	30.8 in²	10.5	3.13	3.63	2.625	4.500	6	130	2
"TRIPLE WIDE" Packages below allow modules to be mounted three across.										
ECAC	3 x 3.2	14.4 in²	3.5	4.62	3.63	4.126	2.750	4	63	2
ECBC	3 x 4.7	21.3 in²	5.0	4.62	3.63	4.126	4.250	4	90	2
ECCC	3 x 6.7	30.3 in²	7.0	4.62	3.63	4.126	2 750	6	123	2
ECFC	3 x 8.2	37.2 in²	8.5	4.62	3.63	4.126	3.500	6	150	2
ECDC	3 x 10.2	46.2 in²	10.5	4.62	3.63	4.126	4.500	6	186	2

NOTE: All cases are gold anodized aluminum with turret-style solder terminals and Teflon insulation, 7/16 maximum height, except for ERP and ERY which has 1/4-28 threaded studs with a maximum height of 7/16 standard or 11/16 optional, (select).

Optional Threaded Terminals have maximum height of 1/2 or 5/8, (select).

FIGURE 1

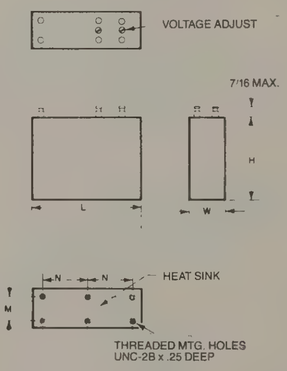
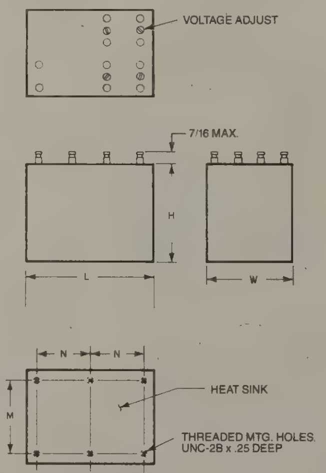


FIGURE 2



4 Contact Factory for assignment of final model number.

(For example ELBC-3001). This Model Number includes all voltage and current levels, options and package size information.

ELBC—3-001

Series and Input Section Indicator
No. of Outputs
Master List No.

OPTIONS

OPTION LETTER	DESCRIPTION
EA-V	**Output Over-Voltage Protection**—SCR type to 20A. All ERP and ERY use electronic control. 120% ±10% of nominal Eo, available on all Regulators except ERB and ERK. No additional length required for ERP and ERY. For others, please add 0.6" to length of Regulator.
EA-T	**Extended Temperature Operation**— −55°C to +85°C. Contact Factory for other requirements. Temp. range may affect Case Size and maximum output current.
EA-E	**Extended Input Voltage**—92-138 VAC and 18-36 VDC. For other ranges please contact Factory with your requirements. Input range may affect unit efficiency, case size and maximum output current.
EA-TP	**Input Transient Protection**—Conforms to the transient provision of MIL-STD 704A-D as well as MIL-STD 1275 and MIL-STD 1399. For undershoot and dropout contact Factory with specific requirements. Add 0.6" to Input Section length.
EA-R	**Remote Sense**—Maintains specified output voltage at remote load. Compensates for a voltage drop of .25V maximum. Available above 10A. Standard on master channels. Add 0.6" to Regulators, except ERP and ERY.
EA-A	**Remote Voltage Adjustment**—Terminals are provided for external potentiometer. Add 0.6" to Regulators.
EA-TS	**Over-Temperature Shutdown**—Unit will shut off during over-temp and automatically reset within specified range. Add 1.2" to Input Section length.
EA-ST	**Stud-Terminals**—8-32 threaded studs are provided for input and output terminations (maximum height of 5/8"). ERP and ERY regulators come standard with 1/4-28 stud terminals. Maximum torque of retaining nut: 15 inch-pound for 8-32 stud; 25 inch-pound for 1/4-28 stud.
EA-H	**Helicoil Mounting Inserts**—Locking or free running helicoil inserts are provided. Specify 6-32 or 8-32.
EA-LC	**TTL On/Off Control**—Logic signal will turn unit On or Off. Add 0.6" to Input Section length.
EA-D	**Power-Down Signal**—TTL signal warns of input power loss prior to outputs falling out of regulation. Add 0.6" to Input Section length.
EA-I	**Inrush Soft Start**—Unit inrush limited to 2 times steady state current at turn-on (AC only). Add 0.6" to Input Section length.

ENVIRONMENTAL SPECIFICATIONS

- **Temperature Range:** Operating Temperature: −40°C to +85°C Baseplate Temperature. Optional −55°C to +85°C range. Non-Operating Storage Temperature: −65°C to +100°C.
- **High Temperature:** Per MIL-STD-810, Method 501, Procedure II.
- **Low Temperature:** Per MIL-STD-810, Method 502, Procedure I.
- **Temperature-Altitude:** Per MIL-STD-810, Method 504, Procedure I; the following details apply: −40°C to +85°C (and −55°C to +85°C) at Altitude: Sea level to 70,000 ft.
- **Humidity:** Per MIL-STD-810, Method 507, Procedure I.
- **Acceleration:** Per MIL-STD-810, Method 513, Procedure I and II, at a test level of 14 G.
- **Vibration:** Per MIL-STD-810, Method 514, Procedure I, at a test level of 15 G.
- **Shock:** Per MIL-STD-810, Method 516, Procedures I, II, III, V, and VI at a test level of 40 G.

THERMAL INTERFACE

Arnold Magnetics Power Supplies are cooled by conduction. Always use thermal compound during installation. To assure reliability the thermal interface must be designed to maintain specified Baseplate Temperature under worst-case conditions. Heat transfer via forced air or natural convection will be minimal.

Please consult the Factory to discuss heat-sinking considerations.

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AC-DC/DC-DC MODULAR MINIATURIZED
SWITCHING POWER SUPPLIES

ARNOLD MAGNETICS

CONFIGURE-YOUR-OWN POWER SUPPLY WORKSHEET*

*For 7 or more output voltages use separate sheet.

	REGULATOR **MODEL**	VOLTS (Nominal)		AMPS (Maximum)		OUTPUT POWER		REGULATOR EFFICIENCY		REGULATOR POWER FROM INPUT SECTION	REGULATOR LENGTH **(Include Options)**	**PRICE (Include Options)**
1.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
2.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
3.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
4.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
5.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
6.	______	______VDC	×	______A	=	______Watts	÷	______%	=	______Watts	______Inches	$______
		TOTAL OUTPUT POWER				______Watts				______Watts	______Inches TOTAL REGULATORS (Include options)	$______ TOTAL REGULATOR
						POWER REQUIRED FROM INPUT SECTION						

INPUT SECTION	**MODEL**	RATED OUTPUT POWER
	______	______Watts

→ MUST BE 10% GREATER THAN** → POWER REQUIRED FROM INPUT SECTION

**Due to system configuration.

+ ______Inches
INPUT SECTION LENGTH (Include Options)

$______
INPUT SECTION PRICE

TOTAL MODULE LENGTH = ______Inches
Input Section & Regulators

$______
TOTAL PRICE

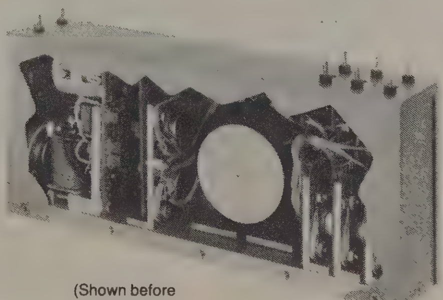
Select a case size that will accommodate the sum of all Regulators, Options and Input Section.

TOTAL MODULE LENGTH ______INCHES ≤ CASE______CONTAINING ______ TOTAL MODULE INCHES

RELIABILITY...FROM THE INSIDE OUT!

Modular Concept Provides Repeatability

Extra Protection Circuitry adds to True Reliability



Tantalum Capacitors for High Density

Conduction Cooled Additional Airflow is Rarely Required

Thermal Management Maintains Safe Operating Temperatures

(Shown before encapsulation)

MOSFET Designs for Minimum Switching Losses and Higher Efficiencies

Established Reliability Components for Higher MTBF

Fully Isolated Output Voltages

Heavy Brackets Resist Shock/Vibration

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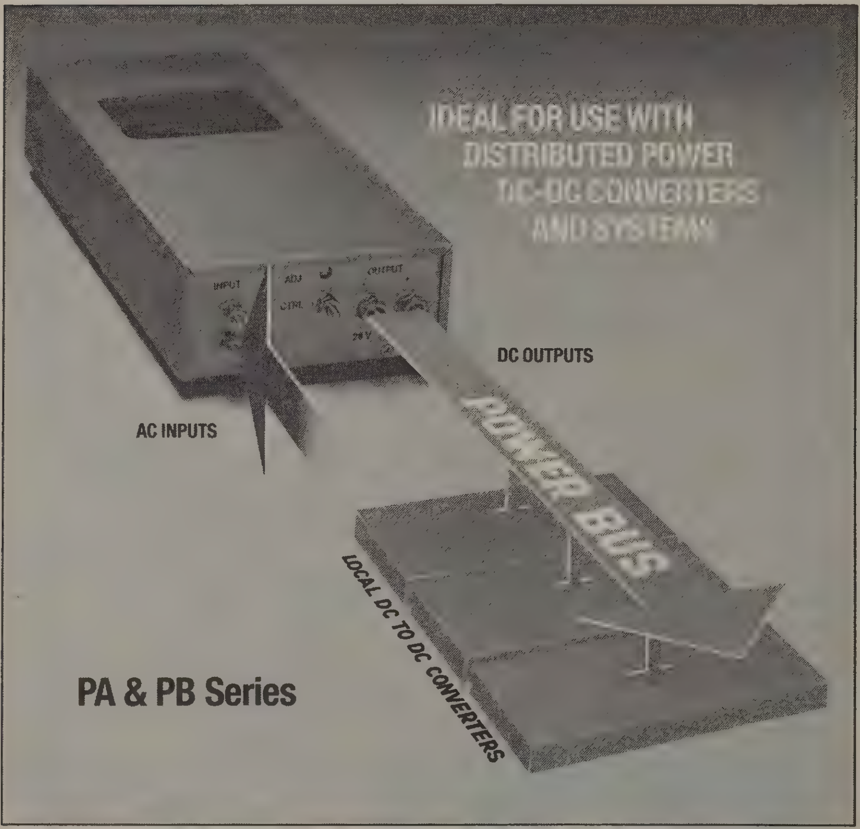
ARNOLD MAGNETICS

AC-DC
SWITCHING POWER SUPPLIES

CONDITIONED
"FRONT END" POWER

RUGGED AC-DC OFF LINE SOURCES


IDEAL FOR USE WITH DISTRIBUTED POWER DC-DC CONVERTERS AND SYSTEMS
INPUT
ADJ
CTRL
OUTPUT
DC OUTPUTS
AC INPUTS
POWER BUS
LOCAL DC TO DC CONVERTERS
PA & PB Series

FEATURES

- **.99 Power Factor Correction:** Active circuitry allows more usable power to be drawn from your source. Added benefits include low harmonic distortion, longer holdup times and simplified EMI filtering.
- **True N+1 Current Sharing:** Single wire connection allows current sharing for loads to kilowatts.
- **Line Isolation & EMI Filtering:** EMI suppression to RTCA Spec. DO-160C as well as Mil-Std-461C (including CE01, CE03, RE02).
- **Surge & Spike Protection:** Per Mil-Std-704D; Mil-Std-1399 Sect. 300A and RTCA Spec. DO-160C.

SINGLE PHASE

INPUT 1ø	PA SERIES MODELS	PB SERIES MODELS (NOTE 1)	NOMINAL VDC OUTPUT (V) (NOTE 2)	MAX CURRENT OUTPUT (A)
103-127 VAC 47-500 Hz	PAA-24	PBA-24	24	22
	PAA-28	PBA-28	28	20
	PAA-48	PBA-48	48	12.5
	PAA-155	PBA-155	155	4
	PAA-270	PBA-270	270	2.3

NOTE 1: PB Series Models include EMI Filter & Unity Power Factor Correction.

THREE PHASE

INPUT 3ø	PA SERIES MODELS	PB SERIES MODELS (NOTE 1)	NOMINAL VDC OUTPUT (V) (NOTE 2)	MAX CURRENT OUTPUT (A)
120/208 3ø/4W Wye 47-500 Hz	PAD-24	PBD-24	24	22
	PAD-28	PBD-28	28	20
	PAD-48	PBD-48	48	12.5
	PAD-155	PBD-155	155	4
	PAD-270	PBD-270	270	2.3

NOTE 2: For other output voltages consult factory.

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AC-DC
SWITCHING POWER SUPPLIES

ARNOLD MAGNETICS

OPERATING SPECIFICATIONS

LINE REGULATION: .1% E_0.

LOAD REGULATION: .25% E_0, 10% to full load.

TEMPERATURE COEFFICIENT: .01%/°C, –55°C to +85°C.

RIPPLE & NOISE: .15% E_0 RMS
.4% E_0 pk to pk–20 mHz BW with F option.

OPERATING TEMPERATURE RANGE (BASE PLATE): –40°C to +85°C. (Optional –55°C to +85°C–full output current available over entire operating range.)

STORAGE TEMPERATURE: –65°C to +100°C.

EFFICIENCY (TYPICAL): 75% to 80% depending on model and options required.

SHORT CIRCUIT PROTECTION: All outputs are short circuit protected with automatic electronic current limiting to preset value.

OUTPUT ADJUSTMENT RANGE: All outputs are adjustable over a ± 5% range.

SEMICONDUCTOR JUNCTION TEMPERATURE: Maximum of 100°C at operating base plate temperature of +85°C. (Derating per NAVMAT P4855-1A and Mil-Std-454K).

ISOLATION RATING: The inputs, case and outputs are isolated (floating) from each other.
Input to Case: 500 VDC (on 1ø); 1000 VDC (on 3ø)
Output to Case: 50 VDC or 1.3 X E_0, whichever is greater.
Input to Output: 500 VDC (on 1ø); 1000 VDC (on 3ø)

HOLD UP TIME: 20 milliseconds @ full load & nominal line typical.

MTBF: Greater than 350,000 hours as calculated per Mil Handbook 217E (40°C ground benign environment). For extended reliability designs or other environments consult factory.

N+1 CURRENT SHARING: All units have internal circuitry that allows units operated in parallel to share load current. A single control wire is needed between supplies.

INHIBIT: Output inhibit may be achieved by a TTL low signal applied to the control terminal.

TRANSIENT PROTECTION: Input surge & spike protection is provided which meets requirements of Mil-Std-704, Mil-Std-1399, Sect. 300A and RTCA Spec. DO-160C.

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE: Operating Temperature: –40°C to +85°C
Baseplate Temperature: Optional –55°C to +85°C range
Non-Operating Storage Temperature: –65°C to +100°C.

HIGH TEMPERATURE: Per Mil-Std-810, Method 501, Procedure II.

LOW TEMPERATURE: Per Mil-Std-810, Method 502, Procedure I.

TEMPERATURE-ALTITUDE: Per Mil-Std-810, Method 504, Procedure I; the following details apply: –40°C to +85°C (and –55°C to +85°C) at Altitude: Sea level to 70,000 ft.

HUMIDITY: Per Mil-Std-810, Method 507, Procedure I.

ACCELERATION: Per Mil-Std-810, Method 513, Procedure I and II, at a test level of 14 G.

VIBRATION: Per Mil-Std-810, Method 514, Procedure I, at a test level of 15 G.

SHOCK: Per Mil-Std-810, Method 516, Procedures I, II, III, V, and VI at a test level of 40 G.

PA/PB SERIES OPTIONS

OPTION LETTER	DESCRIPTION
E	**Extended Input Voltage**–92-138 1ø VAC 92-138/160-265 3ø VAC For other ranges please contact factory with your requirements. Input range may affect unit efficiency and/or maximum output current.
H	**Helicoil Mounting Inserts**–Locking or free running Helicoil inserts are provided (Specify 6-32 or 8-32.)
S	**Stud Terminals**–8-32 threaded studs are provided for input and control terminations–1/4″-28 threaded studs are provided for output terminations. **Note 1:** Units come standard with turret style solder terminals and Teflon insulation on all input & control connections as well as 155V & 270V output connections. Standard 24V, 28V & 48V output connections are 1/4″-28 threaded studs. **Note 2:** Maximum torque of retaining nut–15 inch-pounds for 8-32 studs; 25 inch-pounds for 1/4″-28 studs.
T	**Extended Temperature Range**–-55°C to +85°C. Contact factory for other requirements.
V	**Output Overvoltage Protection**–120% ± 10% of nominal E_0 electronic shutdown type.
F	**Filtering (Standard on PB Series)**–Provides EMI/RFI protection to Mil-Std-461C including CE01, CE03, RE02, CS06 as well as RTCA Spec. DO-160C.
U	**Unity Power Factor Correction (Standard on PB Series)**–Active circuits provide greater than .99 power factor and total harmonic distortion in compliance with IEC-555-2 & Mil-Std-1399 Sec. 300A.
I	**Inrush Soft Start**–Unit limited to 20A peak current at turn-on.
TS	**Thermal Shutdown**–Power Supply will shut off during over-temp condition and automatically reset within specified range.

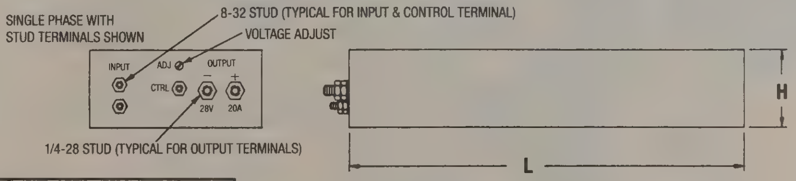
HOW TO ORDER

Consult Factory for Model Number, pricing and delivery information as needed.

PBA—28—H-S-V

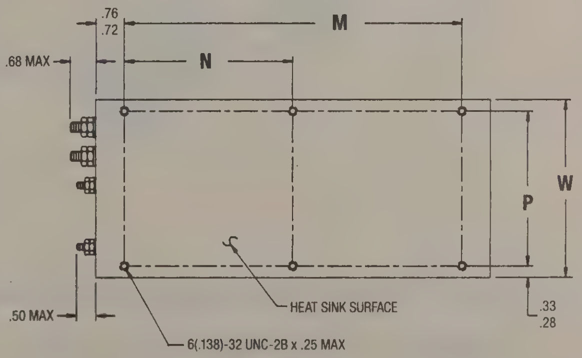
Series Designator · Input Voltage · Output Voltage · Options Included

MECHANICAL SPECIFICATIONS


SINGLE PHASE WITH
STUD TERMINALS SHOWN
8-32 STUD (TYPICAL FOR INPUT & CONTROL TERMINAL)
VOLTAGE ADJUST
INPUT
ADJ
OUTPUT
CTRL
–
+
28V
20A
1/4-28 STUD (TYPICAL FOR OUTPUT TERMINALS)
H
L

MODEL NO.		MAXIMUM CASE DIMENSIONS (INCHES)			MOUNTING HOLES (INCHES)			UNIT WT.
		L	W	H	M	N	P	(OZ.)
1ø	PAA	8	4.63	2	6.5	3.25	4	60
	PBA	10.5	4.63	2	9	4.5	4	80
3ø	PAD	8	6	2	6.5	3.25	5.4	86
	PBD	10.5	6	2	9	4.5	5.4	115

NOTE: Size dependent on options included.



THERMAL INTERFACE Arnold Magnetics Power Supplies are cooled by conduction. Always use thermal compound during installation. To assure reliability the thermal interface must be designed to maintain specified Baseplate Temperature under worst-case conditions. Heat transfer via forced air or natural convection will be minimal.

Please consult the Factory to discuss heat-sinking considerations.

Specifications subject to change without prior notice.

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POWER TECHNOLOGY INC.

CUSTOM POWER SUPPLIES

146 Adesso Drive · Concord · Ontario · L4K 3C3
Phone: (416) 660-9819 · Fax: (416) 660-9567
Area Code changes to 905 after October 3, 1993

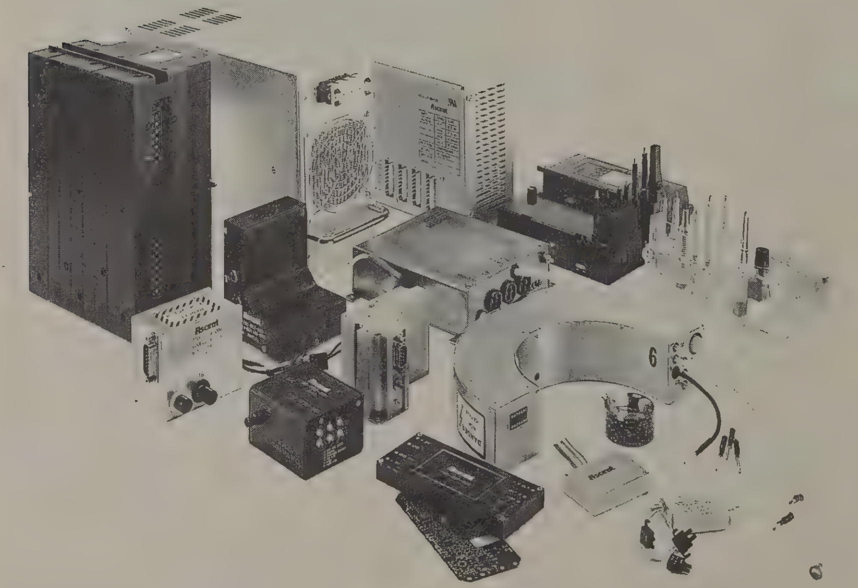
ISO CERTIFIED 9000

INTRODUCTION

With over 20 years of experience in the industry, and over 500 field proven custom power supply products for commercial, medical, military, and aerospace applications, Ascent Power Technology Inc. is the name to know.

Ascent is the proven performer that many of the most demanding Fortune 500 electronics companies turn to for their custom high reliability switching power conversion needs. Working as a strategic partner with your engineers, we can develop a cost effective high reliability product to precisely meet your needs.

Our commitment to quality is evident in our compliance to ISO 9000 standards. Our facility is now fully certified to ISO 9002 and has been approved by all of the major safety/regulatory agencies (UL, CSA, VDE/TUV, BABT).



- Commercial
- Medical
- Industrial
- Military
- Aerospace

For all your custom power switching needs, Ascent Power Technology Inc. is the name to know...

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POWER TECHNOLOGY INC.

CUSTOM POWER SUPPLIES

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LOW VOLTAGE AC-DC AND DC-DC CONVERTERS

Available Features:

- 1W TO 3KW POWER RANGE
- SURFACE MOUNT/HIGH DENSITY (50W/in^3)
- HIGH MTBF/LOW DPPM
- POWER FACTOR CORRECTION (IEC-555)
- LOW PROFILE (20W TO 200W)
- PARALLEL (N+1) REDUNDANCY
- HOT PLUGGABLE
- PROGRAMMABLE OUTPUTS
- LOW NOISE (<5mV p-p) OUTPUTS
- HIGH EFFICIENCY
- UNIVERSAL AC INPUT
- FCC/VDE LEVEL B EMI COMPLIANCE
- WIDE OPERATING TEMP. RANGE (-55°C TO 85°C)
- SYNCHRONIZATION

Applications:

Commercial
- WORKSTATIONS/DPE EQUIPMENT
- LASER PRINTERS
- PHOTOCOPIERS/FAX

Medical (UL-544/IEC-601)
- X-RAY SYSTEMS
- ULTRASOUND SYSTEMS

Industrial
- TELECOMMUNICATIONS
- INDUSTRIAL CONTROLLERS
- RF/VIDEO AMPLIFIERS
- SCIENTIFIC INSTRUMENTATION

Military
- AVIONICS
- DEFENSE SYSTEMS
- DISTRIBUTED POWER

HIGH VOLTAGE AC-DC AND DC-DC CONVERTERS

Available Features:

- UP TO 100KV
- SURFACE MOUNT AND HIGH DENSITY
- HIGH EFFICIENCY
- HIGH RELIABILITY
- LOW EMI AND RFI
- MULTIPLE OUTPUT VOLTAGES
- LOW NOISE OUTPUTS
- CONSTANT VOLTAGE OR CONSTANT CURRENT OPERATION
- WIDE INPUT RANGE
- WIDE OPERATING TEMP. RANGE (-55°C TO 85°C)
- OVERVOLTAGE PROTECTION
- FOLDBACK CURRENT LIMITING
- REMOTE ENABLE
- SHORT CIRCUIT PROTECTION
- REVERSE POLARITY PROTECTION

Applications:

Commercial
- LASER PRINTERS
- PHOTOCOPIERS/FAX
- HI-RES MONITORS

Medical (UL-544/IEC-601)
- X-RAY/BI-PLANE IMAGING SYSTEMS
- BLOOD ANALYZERS
- DEFIBRILLATORS
- CHROMATOGRAPHY SYSTEMS

Industrial
- LASER ALIGNMENT SYSTEMS
- ELECTRONICS BALLASTS
- AIR PURIFICATION SYSTEMS

Military
- CATHODE RAY TUBES
- AVIONICS COCKPIT DISPLAYS

CUSTOM PLASTIC OR METAL ENCLOSURES AVAILABLE ON ALL PRODUCTS

Please contact our factory for your local authorized manufacturers representative...

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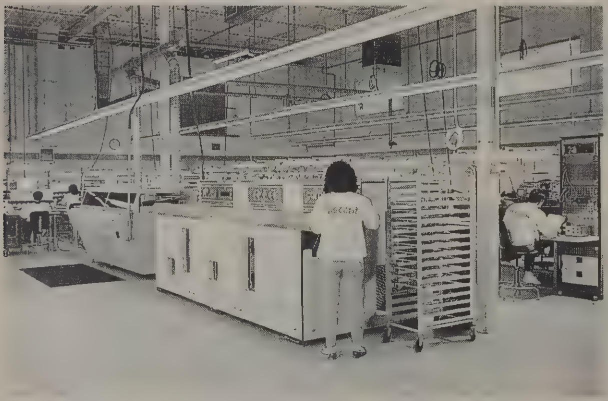
ENGINEERING

CAD/CAE

- PSPICE SIMULATION/CIRCUIT ANALYSIS
- CAD/CAE
- CONTINUED R&D PROGRAMS
- DESIGN FOR MANUFACTURABILITY
- STRINGENT COMPONENT DERATING CRITERIA USING NAVMAT-P-4855 AND BELLCORE GUIDELINES
- MTBF CALCULATIONS (PER MIL-HDBK-217)
- ADVANCED DESIGN TOPOLOGIES
- EXTENSIVE QUALIFICATION TESTING
- **UL**, **CSA**, **VDE**, **BABT** APPROVALS

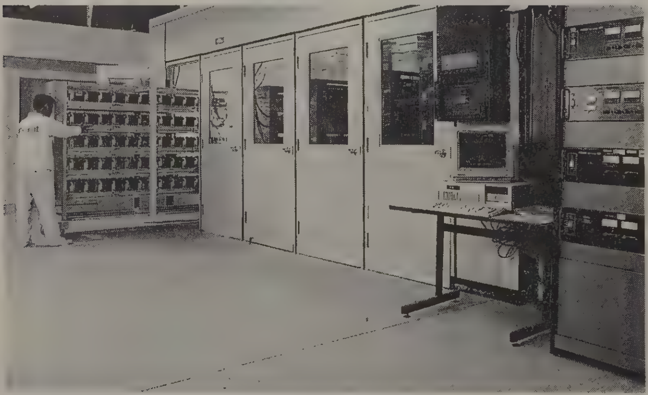
MANUFACTURING



EXTENSIVE PRODUCTION CAPABILITIES

- AUTOMATED LEADED AND SMD ASSEMBLY
- HIGH VOLTAGE ENCAPSULATION
- AUTOMATED MAGNETIC COIL WINDING
- AUTOMATED TEST FOR HIGH/LOW VOLTAGE
- COMPUTER CONTROLLED BURN-IN
- HIGH VOLUME (ISO-9002)
- LOW VOLUME (MIL-STD-2000)
- J.I.T. AND KANBAN DELIVERY

QUALITY



ENVIRONMENTAL STRESS SCREENING

- TOTAL QUALITY CONTROL (TQM)
- STATISTICAL PROCESS CONTROL (SPC)
- ISO 9002 **CERTIFIED** FACILITY
- MIL-I-45208/AQAP 4 (MILITARY) COMPLIANCE
- ADVANCED MRP-II SYSTEM
- EXPERIENCED PROGRAM MANAGERS
- EDI AND E-MAIL
- AUTOMATED TEST FOR HIGH AND LOW VOLTAGE

Quality, Ascent's true power!

MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

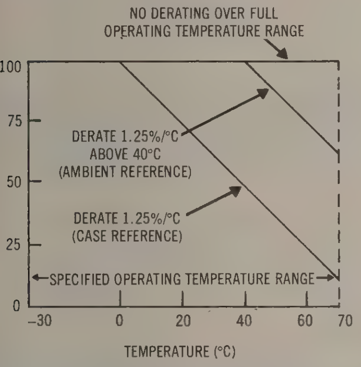


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

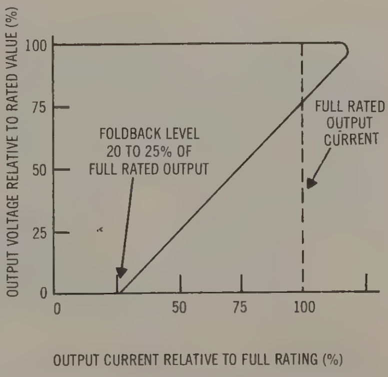


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

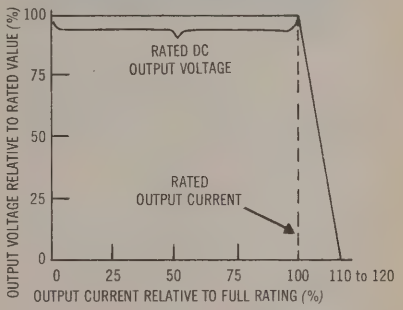


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(–) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

International
Power Sources, Inc.

Switching Power Supplies

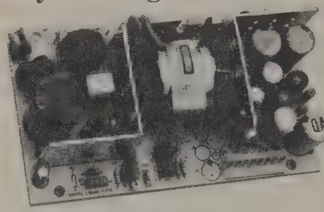
15 to 650 Watts

DC/DC Converters

1 Watt to 650 Watts

AC/DC POWER SUPPLIES

NEW! Low Profile Units Only 1.1" High



- Universal Inputs 85–264 Vac
- UL 1950, CSA & TUV Approved
- 100% Burn-In, 40,000 Hrs MTBF Fully Tested
- Open Frame, L-Bracket & Enclosed Versions
- OVP & Short Circuit Protection
- 3″×5″, 3.5″×6″, 5″×11″ Outlines

PU/PX Series— Low Cost Switching Power Supplies

Power	Model	Input	Output						
			+5V	+12V	-12V	+24V	-5V	+15V	-15V
40W	PU40-25S	Universal 85-264 Vac	3.0 A	—	—	1.0 A	—	—	—
	PU40-30S		3.0 A	2.0 A	—	—	0.3 A	—	—
	PU40-31S		3.0 A	2.0 A	0.3 A	—	—	—	—
	PU40-32S		3.0 A	—	—	—	—	2.0 A	0.3 A
65W	PU65-10	Universal 85-264 Vac	10.0 A	—	—	—	—	—	—
	PU65-12		—	5.5 A	—	—	—	—	—
	PU65-13		—	—	—	—	—	4.5 A	—
	PU65-14		—	—	—	3.0 A	—	—	—
	PU65-31		6.0 A	3.0 A	0.5 A	—	—	—	—
	PU65-40		6.0 A	3.0 A	0.5 A	—	0.5 A	—	—
110W	PU110-10A	Universal 85-264 Vac	22.0 A	—	—	—	—	—	—
	PU110-12A		9.0 A	—	—	—	—	—	—
	PU110-13A		7.5 A	—	—	—	—	—	—
	PU110-14A		4.5 A	—	—	—	—	—	—
	PU110-23A		10.0 A	5.0 A	—	—	—	—	—
	PU110-31A		10.0 A	5.0 A	1.0 A	—	—	—	—
	PU110-32A		10.0 A	—	—	—	—	4.0 A	1.0 A
	PU110-40A		10.0 A	5.0 A	1.0 A	—	1.0 A	—	—
	PU110-45A		10.0 A	5.0 A	1.0 A	1.0 A	—	—	—
	PU110-46A		10.0 A	—	—	—	1.0 A	4.0 A	1.0 A
100W	PX100-23	Selectable 110/220 Vac	10.0 A	5.0 A	—	—	—	—	—
	PX100-31		10.0 A	5.0 A	0.8 A	—	—	—	—
	PX100-40		10.0 A	4.0 A	0.8 A	—	0.8 A	—	—
	PX100-43		10.0 A	4.0 A	0.8 A	—	—	3.0 A	—
	PX100-45		10.0 A	4.0 A	0.8 A	3.0 A	—	—	—
125W	PX125-23	Selectable 110/220 Vac	15.0 A	5.0 A	—	—	—	—	—
	PX125-31		15.0 A	5.0 A	0.8 A	—	—	—	—
	PX125-40		15.0 A	4.0 A	0.8 A	—	0.8 A	—	—
	PX125-43		15.0 A	4.0 A	0.8 A	—	—	4.0 A	—
	PX125-45		15.0 A	4.0 A	0.8 A	4.0 A	—	—	—
200W	PX200-30	Selectable 110/220 Vac	20.0 A	6.0 A	—	—	1.0 A	—	—
	PX200-31		20.0 A	6.0 A	1.0 A	—	—	—	—
	PX200-40		20.0 A	6.0 A	1.0 A	—	1.0 A	—	—
	PX200-45		20.0 A	6.0 A	1.0 A	3.0 A	—	—	—
	PX200-50		20.0 A	6.0 A	1.0 A	—	1.0 A	4.0 A	—
	PX200-51		20.0 A	6.0 A	1.0 A	3.0 A	1.0 A	—	—

PUP55 Series — External Switching Power Supplies

- Universal Input Range 85–264 Vac
- Switching Power Supply Small Size
- UL 1950, CSA 1402C & IEC 950 Approved
- Enclosed Polycarbonate Case 94V-0 Rated
- Built-In EMI/RFI Filter VDE "A", FCC "B"
- IEC 320 Inlet, DIN Output Connectors

Power	Model	Input	Output						
			+5V	+12V	−12V	+24V	−5V	+15V	−15V
55W	PUP55-10	Universal 85–264 Vac	10.0A	—	—	—	—	—	—
	PUP55-12		—	4.6 A	—	—	—	—	—
	PUP55-13		—	—	—	—	—	3.7A	—
	PUP55-14		—	—	—	2.3 A	—	—	—
	PUP55-23		5.0 A	3.0 A	—	—	—	—	—
	PUP55-24		5.0 A	—	—	—	—	2.5 A	—
	PUP55-25		5.0 A	—	—	2.0 A	—	—	—
	PUP55-31		5.0 A	3.0 A	0.5 A	—	—	—	—
	PUP55-32		5.0 A	—	—	—	—	2.5 A	0.5 A

NEW! PUP30 Series Available November 1993

15–150 Watt AC/DC Power Supplies and DC/DC Converters

- Single, Dual, and Triple Outputs
- Compact Size/Light Weight
- 500 VDC Input/Output Isolation
- High Efficiency—80kHz Switcher

- Low Cost
- Fully Enclosed
- 8 Input Ranges

- No Minimum Load
- Same Size AC or DC Input

Series	Output Power
ACA/DCA	15 Watts
ACB/DCB	25 Watts
ACC/DCC	50 Watts
ACE/DCE	100 Watts
ACF/DCF	150 Watts

Input Voltage Ranges
90–132 VAC
180–264 VAC
12 volt nominal (9–16 VDC)
24 volt nominal (19–32 VDC)
48 volt nominal (38–63 VDC)
110 volt nominal (85–140 VDC)

International Power Sources. • 200 Butterfield Drive • Ashland, Massachusetts 01721
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A Division of ASTEC Europe Limited

HIGH VOLTAGE POWER SUPPLIES 100V—300kV, 100mW—60kW

HV Modules for High Resolution CRT Displays

836 Series: 30W rating

2836 Series:
Input 24V dc nominal (other ranges available)
Main output + 25kV, 1.2mA (adjustable + 22kV to + 28kV), G2 200 to 800V dc, DF 400V dc, Focus 5.1kV to 8.1kV

787 Series: 10W rating
Main output + 2kV to 5kV, 2mA ➪
+ 10kV to 20kV, 500μA

Features:
- Excellent response to pulsed loads
- Multiple outputs—can be tailored to suit CRT specification
- Dynamic focus available as an option
- Current limit protection
- Protection against tube flashover
- 2836 with UL, CSA, VDE approval

Miniature High Voltage Modules *(regulated output)*

390 Series: 5W rating
1.5V, 3mA ➪ 3.5kV, 1.5mA

590 Series: 5W rating
5kV, 1mA ➪ 10kV, 500μA

2590 Series: 10W rating
1kV, 10mA ➪ 10kV, 1mA

Features:
- Input 12V or 24V DC nominal
- Regulated output
- Positive and negative output versions
- Remote control option (0 to + 10V)
- Flashover protected
- Connections by flying leads
- Suitable for chassis or pcb mounting
- Fully encapsulated
- Metal case—fully screened

HV Modules for Photomultipliers *(regulated output)*

2478 Series: 10W rating
1kV, 10mA ➪ 2kV, 5mA

2479 Series: 7W rating
1.7kV, 4mA ➪ 3.5kV, 2mA

Features:
- Input 24V dc nominal
- Output adjustable 20-100% of nominal
- Remote programming
- Good line and load regulation
- Ripple 5mV pk/pk
- Positive and negative output versions

3478 Series: 1.5W rating
1.5kV, 1mA to 2.5kV, 0.5mA

Features:
- Input 15V dc
- Remote control (0 to + 10V)
- Pins for pcb mounting

3479 Series: 1.7W rating
300V, 2mA ➪ 1.7kV, 1mA

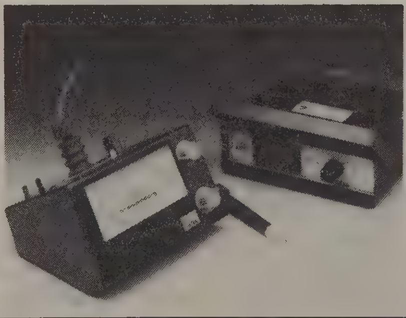
- 12V and 24V dc nominal
- Remote control (0 to + 10V)
- Low ripple and tempco
- Excellent line and load regulation
- Metal cased, for pcb or chassis mounting

High Voltage Meters *(with optional HV probes)*

Model 88:
Analogue DC High Voltage Meter 0-30kV

Model 109:
Analogue DC High Voltage Meter 0-40kV

Features:
- Battery powered
- Positive or negative reading (switched)
- Drain from test circuit < 1μA
- Accuracy better than 1% of f.s.d..
- Precision recorder output



Model 139:
Digital DC High Voltage Meter, dual range 0-20kV, 0-40kV

Features:
- Battery powered
- Switched ranges 0-20kV, 0-40kV
- Auto polarity
- Drain from test circuit < 2μA
- Resolution 10V (20kV), 20V (40kV)
- Accuracy 0.3% at 20kV
- Precision recorder output

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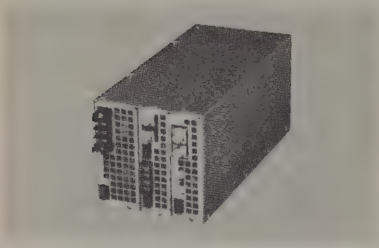
HIGH POWER

SPECTRUM SERIES

500 to 2000 WATTS SINGLE/MULTIPLE OUTPUTS



Spectrum is the first full-featured high power product with a PFC front end as a standard input. It is available in both single and multiple output versions and offers a very compact footprint. The 1200 watt package measures 5″×5″×11″, and the 2000 watt package measures 5″×8″×11″.

FEATURES

- Power factor correction
- IEC 555-2 compliance
- Current share on all outputs
- Remote sense on all outputs
- Overload protect on all outputs
- Voltage adjustment on all outputs
- Margining on all outputs
- Power fail signal
- Global DC output good
- DC Good signal and status indicator LED on all outputs
- Global and individual module inhibits
- Level B EMI filtering
- 3 year warranty

SAFETY

UL	UL1950
CSA	CSA22.2-950
IEC	IEC950, Class 1 SELV
VDE	EN60950
BABT	BS 6301

OUTPUT CURRENTS

Voltage Identification	Module Identification							
Main Output (=Output 1)	A (1 Slot) 300 W Single	B (1 Slot) 600 W Single	C (2 Slots) 900 W Single	D (2 Slots) 1200 W Single	E, F (1 Slot) 250 W Multi Main Output	G, H (1 Slot) 500 W Multi Main Output	K (1 Slot) 750 W Single	L (2 Slots) 1500 W Single
2 V 3.3 V 5 V	60 A 60 A 60 A	120 A 120 A 120 A	180 A 180 A 180 A	240 A 240 A 240 A	25 A 25 A 25 A	50 A 50 A 50 A	150 A 150 A 150 A	300 A 300 A 300 A
12 V 15 V 24 V	25 A 20 A 12.5 A	50 A 40 A 25 A	75 A 60 A 37.5 A	100 A 80 A 50 A	10.5 A 8.3 A 5.3 A	21 A 16.6 A 10.5 A	62.5 A 50 A 31.2 A	125 A 100 A 62.4 A
28 V 36 V 48 V	10.7 A 8.3 A 6.3 A	21.4 A 16.6 A 12.5 A	32.1 A 24.9 A 18.75 A	42.8 A 33.2 A 25 A	4.5 N/A N/A	9A N/A N/A	26.7 A 20.8 A 15.6 A	53.4 A 41.6 A 31.2 A
Auxiliary Output (=Output 2 & 3)	E 250 W Dual Aux. Output	F 250 W Multi Aux. Output	G 500 W Dual Aux. Output	H 500 W Multi Aux. Output				
2V - 3.3V 4.2 V-15.8 V 18 V-28 V	10 A 10 A 5 A	5 A 5 A 2.5 A	20 A 20 A 10 A	10 A 10 A 5 A				

SINGLES Pre Configured Model Numbers

Total Power	Volta/Amps	Size	Model No.
600	5/120	5x5x11	VS1-B2-00
750	5/150	5x5x11	VS1-K2-00
900	5/180	5x5x11	VS1-C2-00
1200	5/240	5x5x11	VS1-D2-00
1500	5/300	5x8x11	VS1-L2-00
2000	5/400	5x8x11	VS3-D2-D2-20

OTHER VOLTAGES AVAILABLE/Voltage Identification Code

2V	0	15V	4	36V	7
3.3V	1	24V	5	Special	8 (consult factory)
12V	3	28V	6	48V	9

For models with voltage other than 5, replace "2" in model number with voltage identification code.

MULTIPLE OUTPUT Pre Configured Model Numbers

Total Power	Output 1	Output 2	Output 3	Output 4	Output 5	Output 6	Size	Model No.
500W	5/50	12/10	12/10				5×5×11	VS1-H233-00
750W	5/50	12/10	12/10	15/8.3	15/5	5/5	5×5×11	VS1-H233-F442-00
800W	5/60	12/21	12/10	5/10			5×5×11	VS1-A2-H332-00
800W	5/60	12/21	12/10	24/5			5×5×11	VS1-A2-H335-00
800W	5/60	15/16.6	15/10	5/10			5×5×11	VS1-A2-H442-00
800W	5/60	15/16.6	15/10	24/5			5×5×11	VS1-A2-H445-00
800W	5/120	2/120					5×5×11	VS1-B2-B0-00
1000W	5/50	12/10	12/10	15/16.6	15/10	24/5	5×5×11	VS1-H233-H445-00
1000W	5/50	12/10	12/10	15/16.6	5/10	24/5	5×5×11	VS1-H233-H425-00
1100W	5/120	12/21	12/20				5×5×11	VS-B2-G33-00
1100W	5/120	12/21	12/10	5/10			5×5×11	VS1-B2-H332-00
1100W	5/170	12/10	12/10				5×5×11	VS1-B2-H233-10
1100W	5/120	15/16.6	15/10	5/10			5×5×11	VS1-B2-H442-00
1100W	5/120	15/16.6	15/10	24/5			5×5×11	VS1-B2-H445-00
1400W	5/180	12/21	12/20				5×8×11	VS3-C2-G33-00
1400W	5/180	12/21	12/10	5/10			5×8×11	VS3-C2-H332-00
1400W	5/240	2/120					5×8×11	VS3-D2-B0-00
1600W	5/170	12/20	12/21	5/20			5×8×11	VS3-B2-G23-G32-10
1700W	5/240	12/21	12/20				5×8×11	VS3-D2-G33-00
1700W	5/240	12/21	12/10	5/10			5×8×11	VS3-D2-H332-00
1900W	5/180	12/21	12/20	5/60	15/10	24/5	5×8×11	VS3-C2-G33-H245-00
2000W	5/240	12/21	12/20	5/60	15/10	24/5	5×8×11	VS3-D2-G33-H245-00
2000W	5/240	2/240					5×8×11	VS3-D2-D0-00

MODEL SELECTION

Slot #1 Slot #2 Slot #3 Slot #4

VS 1 - X555 - X555 - X555 - X555 - 40

Family Identification Code

Case and Input
1=5 inch, single phase, 1500 W max
2=5 inch, 3ø, 1500 W max
3=8 inch, single phase, 2000 W max
4=8 inch, 3ϕ, 2000 W max
5=5 inch case DC input
6=8 inch case DC input

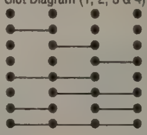
Voltage Identification

0=2 V	5=24 V
1=3.3 V	6=28 V
2=5 V	7=36 V
3=12 V	8=special voltage (consult factory)
4=15 V	9=48 V

Module Identification
A=300 W single 1 slot
B=600 W single 1 slot
C=900 W single 2 slot
D=1200 W single 2 slot
E=250 W dual 1 slot
F=250 W triple 1 slot
G=500 W dual 1 slot
H=500 W triple 1 slot
J=Battery Back-up Module 1 slot
K=750W single 1 slot
L=1500W single 2 slots

Paralleling Information
Code
0=no parallel
1=1 and 2
2=2 and 3
3=3 and 4
4=1 and 2 and 3
5=2 and 3 and 4
6=1 and 2 plus 3 and 4
7=1 and 2 and 3 and 4

Slot Diagram (1, 2, 3 & 4)



Option Code
0=no options
1=rear air exhaust (40°C max)
2=customer name & P/N
3=set unit for global enable
4=option package (items 1,2)
5=option package (items 1,2,3)
6=option package (items 2,3)
7=option package (items 1, 3)

1. Omit digits that do not apply.
2. Specify outputs from highest to lowest power increments. If power increments are equal, specify from highest to lowest current.
3. All model configurations created using this selection guide represent standard products with standard availability and lead times.

ASTEC

ASTEC STANDARD POWER
Division of Astec America Inc.
401 Jones Road
Oceanside, CA 92054-1216
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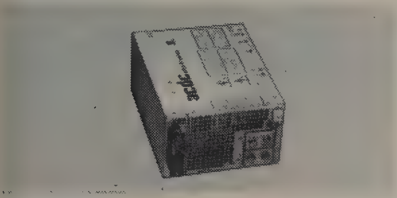
HIGH POWER

ACDC 2000 WATTS
Single output
2 to 48 VDC
Switchmode power supplies
JF201

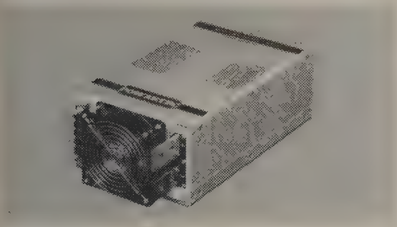


SPECIFICATIONS

Output Voltage	Total Power (Watts)	Volts/ Amps	Model Number
2V	800	2V/400A	JF201A-1000
5V	2000	5V/400A	JF201A-2000
12V	2000	12V/167A	JF201A-3000
15V	2000	15V/134A	JF201A-4000
24V	2000	24V/84A	JF201A-5000
28V	2000	28V/72A	JF201A-6000
48V	2000	48V/42A	JF201A-9000

FEATURES
- 2000 watts in 5″×8″×10″
- Three phase power factor correction to .9
- Three input models: three phase, single phase, DC
- Single wire paralleling
- Current monitor
- Internal EMI filter available: FCC and VDE “A”
- Phase loss protection
- Superior DC output interconnect
- UL/CSA/TUV

POWERTEC 3000 WATTS
Single output 2V to 48VDC
Switchmode power supplies
Superswitcher, Series 9R

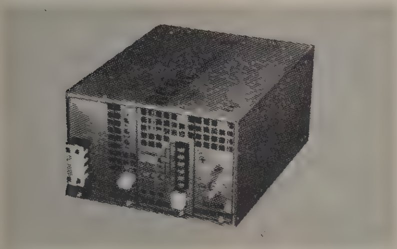


SPECIFICATIONS

Output Voltage	Total Power (Watts)	Volts/ Amps	Model Number
2V	1400	2V/700A	9R2-700-381
5V	3000	5V/600A	9R5-600-381
12V	3000	12V/250A	9R12-250-381
15V	3000	15V/200A	9R15-200-381
24V	3000	24V/130A	9R24-130-381
28V	3000	28V/105A	9R28-105-381
48V	3000	48V/65A	9R48-65-381

FEATURES
- 3000 watts in 5″×8″×15″
- Field selectable inputs
- EMI filter, FCC and VDE “A”
- UL/CSA/TUV
- Margining +/− 10%
- Soft start
- Full power outputs at 50°C

ACDC 500 WATTS
Single/Multiple Output
Switchmode power supplies
RSF Series



SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Output #4	Output #5	Case H″×W″×L″ (ins)	Model Number
500W	2/100A					5×7.1×10.2	RSF501B-1000
500W	5V/100A					5×7.1×10.2	RSF501B-2000
500W	12V/42A					5×7.1×10.2	RSF501B-3000
500W	15V/35A					5×7.1×10.2	RSF501B-4000
500W	24V/21A					5×7.1×10.2	RSF501B-5000
500W	28V/18A					5×7.1×10.2	RSF501B-6000
500W	5V/80A	2V/80A				5×8.0×10.2	RSF102B-2100
500W	5V/80A	5V/80A				5×8.0×10.2	RSF102B-2200
500W	5V/80A	12V/33A				5×8.0×10.2	RSF102B-2300
500W	12V/33A	12V/33A				5×8.0×10.2	RSF102B-3300
500W	5V/80A	2V/16A				5×8.0×10.2	RSF502B-2100
500W	5V/80A	12V/16A				5×8.0×10.2	RSF502B-2300
500W	12V/33A	12V/16A				5×8.0×10.2	RSF502B-3300
500W	5V/80A	5V/8A	12V/8A			5×8.0×10.2	RSF503B-2230
500W	5V/80A	12V/8A	12V/8A			5×8.0×10.2	RSF503B-2330
500W	5V/80A	15V/7A	15V/7A			5×8.0×10.2	RSF503B-2440
500W	5V/80A	2V/8A	12V/8A	12V/2A		5×8.0×10.2	RSF504B-2133
500W	5V/80A	5V/8A	12V/8A	12V/2A		5×8.0×10.2	RSF504B-2233
500W	5V/80A	12V/8A	12V/8A	5V/5A		5×8.0×10.2	RSF504B-2332
500W	5V/80A	12V/8A	12V/8A	24V/1A		5×8.0×10.2	RSF504B-2335
500W	5V/80A	12V/8A	12V/8A	24V/4A		5×8.0×10.2	RSF504B-2339
500W	5V/80A	15V/7A	15V/7A	5V/5A		5×8.0×10.2	RSF504B-2442
500W	5V/80A	15V/7A	15V/7A	24V/1A		5×8.0×10.2	RSF504B-2445

FEATURES
- Proven design
- One to four outputs from 2V to 28V
- Overvoltage protection
- Remote sense
- Inhibit function (logic ‘1’)
- Automatic thermal overload protection
- Overload protection
- Brownout protection
- Two year warranty
- 100% computer tested

ASTEC

ASTEC STANDARD POWER
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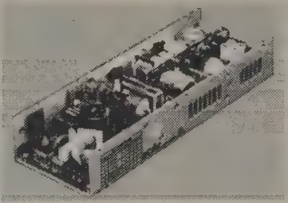
LOW/MEDIUM POWER

ACDC 220 TO 400 WATTS

RMV/RMC/RMF Series



FEATURES

- Optional universal input some models • Remote sense
- Electronic soft start
- AC input nominal 115/230 VAC field selectable
- EMI filter
- Overload/short circuit protection • Overvoltage/overtemperature protection
- Reverse voltage protection • UL, CSA IEC 380/VDE 0806 Certification
- No minimum load required on main output for full output on auxiliaries • Remote inhibit (main output)

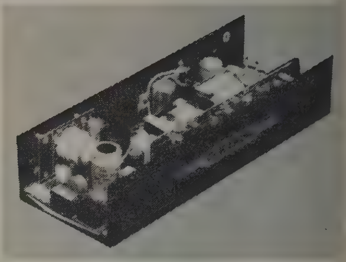
SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Output #4	Case H × W × L (ins)	Model Number
220W	5V/25A	12V/4A	12V/3A		2.5 × 4.8 × 14.0	RMV223B-2330
220W	5V/25A	12V/4A	12V/3A	5V/1.5A	2.5 × 4.8 × 14.0	RMV224B-2332
220W	5V/25A	12V/4A	12V/3A	12V/2A	2.5 × 4.8 × 14.0	RMV224B-2333
220W	5V/25A	12V/4A	12V/3A	24V/2A	2.5 × 4.8 × 14.0	RMV224B-2339
220W	5V/25A	15V/3A	15V/2A	5V/1.5A	2.5 × 4.8 × 14.0	RMV224B-2442
220W	5V/25A	15V/3A	15V/2A	24V/2A	2.5 × 4.8 × 14.0	RMV224B-2449
300W	5V/60A				2.5 × 5 × 12.0	RMC301B-2000-0000
300W	12V/25A				2.5 × 5 × 12.0	RMC301B-3000-0000
300W	15V/20A				2.5 × 5 × 12.0	RMC301B-4000-0000
300W	24V/12.5A				2.5 × 5 × 12.0	RMC301B-5000-0000
300W	5V/40A	12V/5A	12V/5A		2.5 × 4.8 × 14.0	RM(F or C) 303B-2330
300W	5V/40A	12V/5A	12V/5A	5V/2A	2.5 × 4.8 × 14.0	RM(F or C) 304B-2332
300W	5V/40A	12V/5A	12V/5A	12V/2A	2.5 × 4.8 × 14.0	RM(F or C) 304B-2333
300W	5V/40A	12V/5A	12V/5A	24V/3A	2.5 × 4.8 × 14.0	RM(F or C) 304B-2339
300W	5V/40A	15V/4A	15V/4A	5V/2A	2.5 × 4.8 × 14.0	RM(F or C) 304B-2442
300W	5V/40A	15V/4A	15V/4A	24V/3A	2.5 × 4.8 × 14.0	RM(F or C) 304B-2449
300W	5V/45A	12V/6A	12V/6A		2.6 × 7.0 × 14.0	RMV303B-2330
300W	5V/45A	12V/6A	12V/6A	5V/3A	2.6 × 7.0 × 14.0	RMV304B-2332
300W	5V/45A	12V/6A	12V/6A	12V/3A	2.6 × 7.0 × 14.0	RMV304B-2333
300W	5V/45A	12V/6A	12V/6A	24V/3A	2.6 × 7.0 × 14.0	RMV304B-2339
300W	5V/45A	15V/5A	15V/5A	5V/3A	2.6 × 7.0 × 14.0	RMV304B-2442
300W	5V/45A	15V/5A	15V/5A	24V/3A	2.6 × 7.0 × 14.0	RMV304B-2449
400W	5V/50A	12V/7A	12V/7A		2.6 × 7.0 × 14.0	RM(F or C) 403B-2330
400W	5V/50A	12V/7A	12V/7A	5V/5A	2.6 × 7.0 × 14.0	RM(F or C) 404B-2332
400W	5V/50A	12V/7A	12V/7A	12V/3A	2.6 × 7.0 × 14.0	RM(F or C) 404B-2333
400W	5V/50A	12V/7A	12V/7A	24V/4A	2.6 × 7.0 × 14.0	RM(F or C) 404B-2339
400W	5V/50A	15V/6A	15V/6A	5V/5A	2.6 × 7.0 × 14.0	RM(F or C) 404B-2442
400W	5V/50A	15V/6A	15V/6A	24V/4A	2.6 × 7.0 × 14.0	RM(F or C) 404B-2449

Output #1 is main output

POWERTEC 225 TO 300 WATTS

Series 29D



FEATURES

Series 29D

- 5 to 24 VDC outputs
- VDE, IEC, CSA, UL Safety Specs
- Isolated and Floating Outputs
- Automatic Current-Sharing*
- Internal Isolation Diodes* (option)
- Field Switchable 115/230 VAC
- Over Voltage Protection*
- Remote Sense*
- Five D.C. Outputs
- Automatic Thermal Shut-Down
- Remote Inhibit* – Logic High or Low
- Alarm Circuitry for "Input Power Fail" and "Output Good" Signals
- N+1 Redundancy
- Automatic Pre-Load (option)
- 100% Dynamic Burn-in: AC Cycled On and Off, Full Load to No Load to Short Circuit Cycling

*Provided on fully regulated outputs #1-#4

PowerSystems Enclosures

- Hot Plug-In/Replacement
- Holds up to Six 29D supplies
- Up to 1800 Watts
- User Configurable Backplane

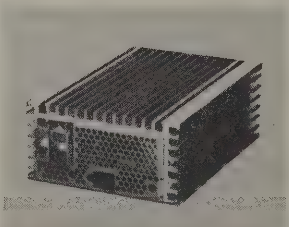
SPECIFICATIONS

	Output Ratings @ 50°C					
Total Power (Watts)	Volts/Amps					
	Output #1 (Main)	Output #2	Output #3	Output #4	Output #5	Model Number
300	5V/40A	12V/5A	12V/3A	5V/3A	24V/4A	29D5-A2A-371-3
300	5V/40A	12V/5A	12V/3A	5V/3A	24V/4A	29D5-A2A-371-FK-3
225	5V/30A	12V/3.75A	12V/2.25A	5V/2.25A	24V/3A	29D5-A2A-371-FIK-3
300	5V/40A	12V/5A	12V/3A	12V/3A	12V/6A	29D5-C2A-371-3
300	5V/40A	12V/5A	12V/3A	12V/3A	12V/6A	29D5-C2A-371-FK-3
225	5V/30A	12V/3.75A	12V/2.25A	12V/2.25A	12V/4.5A	29D5-C2A-371-FIK-3
300	5V/40A	12V/5A	12V/3A	12V/3A	24V/4A	29D5-D2A-371-3
300	5V/40A	12V/5A	12V/3A	12V/3A	24V/4A	29D5-D2A-371-FK-3
225	5V/30A	12V/3.75A	12V/2.25A	12V/2.25A	24V/3A	29D5-D2A-371-FIK-3
225	5V/30A	12V/3.75A	12V/2.25A	12V/2.25A	24V/3A	29D5-D2A-371-PFIK-3
300	5V/40A	15V/5A	15V/3A	15V/3A	24V/4A	29D5-J2A-371-FK-3
225	5V/30A	15V/3.75A	15V/2.25A	15V/2.25A	24V/3A	29D5-J2A-371-PFIK-3

ASTEC 300-350 WATTS

Single/multiple output Switch mode power supplies "Lightning" ALS Series

NEW



FEATURES

- Universal input
- >75% efficiency
- >3.3 Watts per inch³
- 200% self-protecting peak loading on two aux channels
- 20 ms full load holdover storage
- All outputs fully floating
- Overvoltage protection
- Overload protection
- Remote sensing
- Inhibit function
- Power fail signal
- Margining on main output
- Thermal overload protection
- Soft start circuitry
- Repositionable mounting holes

SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Output #4	Case (H"xW"xL")	Model Number
300W	5V/60A				2.5x5x6.5	ALS301C-2000
300W	12V/25A				2.5x5x6.5	ALS301C-3000
300W	15V/20A				2.5x5.6.5	ALS301C-4000
300W	24V/12.5A				2.5x5.6.5	ALS301C-5000
350W	5V @ 40A	12V @ 5A (10)	12V @ 5A(10)	—		ALS304C-2330
350W	5V @ 40A	12V @ 5A (10)	—	5V @ 10A		ALS304C-2302
350W	5V @ 40A	12V @ 5A (10)	—	24V @ 2A		ALS304C-2309
350W	5V @ 40A	12V @5A(10)	12V @ 5A(10)	12V @ 5A		ALS304C-2336
350W	5V @ 40A	15V @ 4A	15V @ 4A	12V @ 5A		ALS304C-2446
350W	5V/40A	12V/5A	12V/5A	5V/10A	2.5x5x8.5	ALS304C-2332
350W	5V/40A	12V/5A	12V/5A	24V/2A	2.5x5x8.5	ALS304C-2339
350W	5V/40A	15V/4A	15V/4A	5V/10A	2.5x5x8.5	ALS304C-2442
350W	5V/40A	15V/4A	15V/4A	24V/2A	2.5x5x8.5	ALS304C-2449

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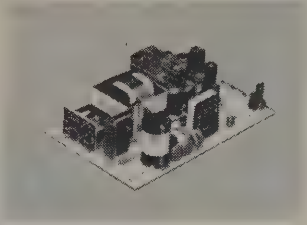
LOW/MEDIUM POWER RACKS

ACDC 40 TO 200 WATTS

RB SERIES



FEATURES

- Universal input
- 0° to 50°C full power operation
- 1 year warranty
- 100% computer final tested. Test data sheet furnished with each unit
- Installation and specification data included with each unit
- EMI filter
- Remote sense
- Short circuit protection
- Overvoltage protection
- UL, CSA, IEC certification

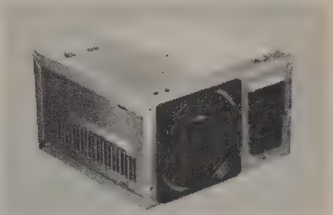
SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output#3	Output #4	Case HxWxL (ins)	Model Number
25W	5V/5A (8A)				1.26x 3.0x 4.0	RBS21
25W	12V/2A (3.2A)				1.26x 3.0x 4.0	RBS22
25W	24V/1.1A (1.8A)				1.26x 3.0x 4.0	RBS23
25W	5.1V/2A (4A)	12V/1A (1.5A)	-12V/0.3A (0.3A)		1.26x 3.0x 4.0	RBT21
25W	5.1V/2A (4A)	12V/1A (1.5A)	-12V/0.3A (0.3A)		1.26x 3.0x 4.0	RBT22
25W	5.1V/2A (4A)	12V/1A (1.5A)	-12V/0.3A (0.3A)		1.26x 3.0x 4.0	RBT23
40W	5V/6A (8A)				1.1x3.0x5.0	RBS42
40W	5V/3A (5A)	12V/2A (2A)	-12V/0.5A (0.5A)		1.165x3.0x5.0	RBT42
40W	12V/3A (4A)				1.1x3.0x5.0	RBS43
40W	5V/5A (6A)	12V/0.5A (.5A)	-12V/0.5A (0.5A)		1.165x3.0x5.0	RBT43
40W	15V/12.5A (3.3A)				1.1x3.0x5.0	RBS44
40W	5V/3A (5A)	12V/2A (2A)	-5V/0.5A (0.5A)		1.165x3.0x5.0	RBT44
40W	24V/1.5A (2A)				1.1x3.0x5.0	RBS45
40W	5V/3A (5A)	15V/2A (2A)	-15V/0.5A (0.5A)		1.165x3.0x5.0	RBT45
50W	5V/4A (6A)	12V/2A (2.5A)	-12V/0.5A (0.7A)		1.5x3.9x6.3	RBT52
50W	5V/5A (7A)	15V/2A (2.5A)	-15V/0.5A (0.7A)		1.5x3.9x6.3	RBT53
50W	5V/5A (7A)	12V/2A (2.5A)	-5V/0.5A (0.7A)		1.5x3.9x6.3	RBT54
50W	5V/4A (6A)	12V/2A (3.5A)	-12V/0.5A (1A)		1.5x3.9x6.3	RBT51-1
100W	5V/16A (20A)				1.72x3.8x6.8	RBS101
100W	5V/3A (5A)	12V/2A (2A)	-12V/0.5A (0.5A)	-5V/0.5A(0.75A)	1.72x3.8x6.8	RBQ101
100W	12V/7A (9A)				1.72x3.8x6.8	RBS102
100W	5V/7A (9A)	12V/3A (3.5A)	-12V/0.5A (0.75A)	12V/0.5A(0.75A)	1.72x3.8x6.8	RBQ102
100W	24V/3.3A (4A)				1.72x3.8x6.8	RBS103
100W	5V/7A (9A)	12V/0.5A (0.75A)	-12V/0.5A (0.75A)	24V/1.5A(1.75A)	1.72x3.8x6.8	RBQ103
100W	15V/5A (7.3A)				1.72x3.8x6.8	RBS105

Output #1 is main output *Universal input model

ASTEC PC SERIES 85 TO 300 WATTS

MULTIPLE OUTPUT SWITCH MODE POWER SUPPLIES



FEATURES

- High efficiency
- Built-in EMI filter
- UL, CSA, VDE approvals
- 100% burn-in
- Vacuum impregnated transformers
- Overvoltage protection
- Short circuit protection
- Dual input voltage (115/230 VAC)
- Compatible with PC applications
- Built-in fan, power switch, voltage select switch, cable harness or edge connector, AC receptacle, and convenience outlet
- Universal input on some models

OUTPUT CHARACTERISTICS

Output	Voltage	Regulation	Min. Load	Max. Load	Peak Load*	PARD (P-P)**	Model Number
V1	+5 V	±5%	3.0 A	22.0 A	–	50 mV	SA201-3440
V2	+12 V	±5%	0.0 A	8.0 A	9 A	120 mV	
V3	–12 V	±10%	0.0 A	0.5 A	–	120 mV	
V4	–5 V	±10%	0.0 A	0.5 A	–	70 mV	
V1	+5 V	±5%	2.0 A	32.0 A	–	50 mV	SA300-3400-288
V2	+12 V	±5%	0.0 A	10.0 A	15 A	100 mV	
V3	–12 V	±10%	0.0 A	1.0 A	–	100 mV	
V4	–5 V	±10%	0.0 A	1.0 A	–	100 mV	

*15 seconds maximum **See "Notes".

Total Power	Volts/Amps Output #1	Output #2	Output#3	Output #4	Case HxWxL (ins)	Model Number
150W	5V/20A (30A)				1.5x7.8x3.8	RBS152
150W	5V/12A (15A)	12V/1A	-12V/1A	24V/2A (3A)	1.5x7.8x3.8	RBQ152
150W	12V/8.3A (12A)				1.5x7.8x3.8	RBS153
150W	24V/4A (6A)				1.5x7.8x3.8	RBS155
150W	5V/12A (15A)	12V/1A	-12V/1A (1A)	-5V/1A (1A)	1.5x7.8x3.8	RBQ151
200W	5V/20A (25A)	12V/14A (5A)	-12V/1.5A (2A)	-5V/1.5A (2A)	2.0x8.0x4.5	RBQ202
200W	5V/20A (25A)	12V/4A (5A)	-12V/1.5A (2A)	12V/1.5A (2A)	2.0x8.0x4.5	RBQ203
200W	5V/20A (25A)	12V/1.5A (2A)	-12V/1.5A (2A)	24V/2A (3A)	2.0x8.0x4.5	RBQ204
200W	+5V/19.8A	+5V/7.3A	-12V/.3A	-5V/.3A	5.9x5.9x8.3	AA14500
230W	+5V/26A	+12V/8A	-12V/.3A	-5V/.3A	5.9x5.9x8.3	AA14620
40W	5V/5A	12V/3A	-12V/0.35A			SA40-1313
145W	+5V/18A	+12V/10A	-12V/0.3A	-5V/0.3A	3.4x5.5x5.9	SA145-3408
200W	+5V/22A	+12V/8A	-12V/.5A	-5V/.5A	3.4x5.5x5.9	SA201-3408*
300W	+5V/32A	+12V/10A	-12V/1A	-5V/1A	5.85x5.9x8.35	SA300-3400

Output #1 is main output *Universal input model

HOT PLUG RACKS

HIGH POWER

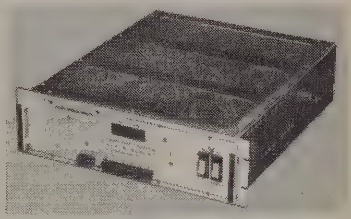
FEATURES

- Fault tolerant system
- No system down time
- Internal paralleling of outputs
- Automatic current sharing
- Internal isolation diodes
- Front panel status LED's
- Adjustment pots
- TTL alarm circuitry
- Easy connect/disconnect
- Remote sense on all outputs
- 500 to 1000 watts per module
- AC input with P.F.C.
- Up to six isolated outputs
- 48 Vdc input available
- Output meters available

Hot Plug Racks (HPR) from Astec offer high power hot plug capability for critical systems. Each HPR provides up to 3000 watts total. Three separate plug-in modules are internally paralleled and will automatically current share for load distribution. This system is designed for easy installation and maintenance. Defective modules can be replaced with no system down time. Each module can provide 500 to 1000 watts of power, which allows for cost effective system upgrades.

RACKS

RPS SERIES



The Astec RPS (Rack Power System) Series incorporates standard power supplies into RETMA enclosures to create custom power systems. Three standard RETMA configurations are available: 1) 5¼″×19″×21″, 2) 5¼″×19″×14″, and 3) 7″×19″×21″. Customized enclosures are also available to meet unique specifications. A wide range of standard options offers the benefit of maximum design flexibility. Astec provides full mechanical and electrical assembly system testing.

SPECIFICATIONS

Each Rack Power System (RPS) can provide up to twelve individual outputs from Astec's broad line of linear and switching power supplies. Your specific connectors and terminations can be incorporated into a custom rack design. Engineering support is available to assist you in specifying your RPS requirements.

BASIC RACK ASSEMBLY

RPS1-P3-115-XXX
- 5¼″×19″×14″ Rack
- Front panel with a lighted circuit breaker and handles
- The suffix 'XXX' denotes all customized features in your Rack Power System. Contact the factory for assistance.

ASTEC

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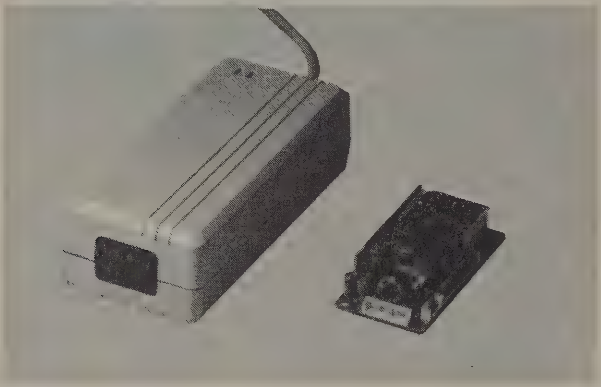
LAPTOP/NOTEBOOK SERIES

NOTEBOOK AND LAPTOP SERIES

The latest power suppy systems for today's smallest portable computers and instruments are now available through Astec Standard Power!

The Notebook and Laptop Series produce flexible, reliable power by combining an ultra-compact, versatile AC adapter with advanced DC/DC conversion technology.

NOTEBOOK SERIES



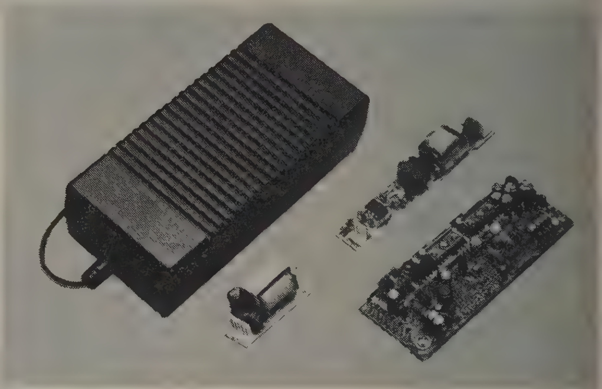
FEATURES

- High efficiency
- Ultra small size
- DC/DC conversion with 5V, 12V, –26V, CCFT outputs
- Multi-level battery charger
- Level B EMI filter
- Fully protected for overload and short circuit
- Wide-range AC input
- Fully regulated AC input
- Many status and control signals

SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Output #4	Output #5	Case Size H x W x L	Model Number
35 W	6V-11V	–	–	–	–	5.9 x 2.6 x 1.8 Inches	SA35-3100 AC Adapter
35 W	10V-16.7V	–	–	–	–		SA35-3101 AC Adapter
35 W	8V-16 3V	–	–	–	–		SA35-3102 AC Adapter
28 W	5V@3.75A	12.6V@0.1A	350V@5mA	–26V@40mA	350V@5mA	90 x 40 x 20	AA9090 DC/DC
28 W	5V@3.75A	18V@60mA	400V@8mA	–26V@40mA	–	90 x 40 x 20	AA90902 DC/DC
28 W	5.1@3.75A	18V@70mA	350V@7.5mA	–26V@40mA	–	90 x 40 x 20	AA90903 DC/DC
25 W	6V-12V	–	–	–	–	108 x 65 x 35	SA25-3100 AC Adapter
25 W	10V-20V	–	–	–	–	108 x 65 x 35	SA25-3101 AC Adapter
25 W	8V-16V	–	–	–	–	108 x 65 x 35	SA25-3102 AC Adapter
25 W	12 V-24 V	–	–	–	–	108 x 65 x 35	SA25-3103 AC Adapter
20 W	5.1@3.75A	12.6V@0.1A	–26V@40mA	–	–	90 x 40 x 13	AA9290 DC/DC
20 W	5.1@3.75A	12.6V@0.1A	–26V@40mA	–	–	90 x 40 x 13	AA92901 DC/DC
20 W	5.1@3.75A	12.6V@0.1A	–26V@40mA	–	–	90 x 40 x 13	AA92902 DC/DC
20 W	5.1@3.75A	12.6V@0.1A	–26V@40mA	–	–	90 x 40 x 13	AA92903 DC/DC

LAPTOP SERIES



FEATURES

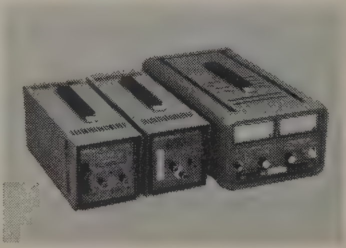
- High efficiency
- Small size
- DC/DC conversion with 5V, ±12V, –5V, –26V outputs
- CCFT and EL inverters
- Multi-level battery charger
- Level B EMI filter
- Fully protected for overload and short circuit
- Wide-range AC input
- Fully regulated AC input
- Many status and control signals

SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Outut #4	Output #5	Case HxWxL (ins)	Model Number
55 W	18V@3.1A	–	–	–	–	6.5x3.2x2.0 inches	SA55-3100 AC Adapter
43 W	5V@3.5A	12V@1.1A	–12V@80mA	–26V@40mA	–	120x45x20	AA9030 DC/DC
51 W	5V@3.8A	12V@1.5A	–12V@80mA	+32V@0.1A	–	120x45x20	AA90301 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@40mA	–26V@40mA	–5v@40mA	120x45x20	AA90302 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@40mA	–26V@40mA	–5V@40mA	120x45x20	AA90304 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@80mA	–26V@40mA	–	120x45x20	AA90305 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@80mA	–26V@40mA	–	120x45x20	AA90306 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@80mA	–26V@40mA	–	120x45x20	AA90307 DC/DC
43 W	5V@3.5A	12V@1.1A	–12V@40mA	–26V@40mA	–5V@40mA	120x45x20	AA90309 DC/DC
3.5 W	350V@5mA	350V@5mA	VS = 1000V	–	–	100x20x8.5	AA9042 CCFT Inverter
2.4 W	350V@7mA	–	VS = 1000V	–	–	100x20x8.5	AA9043 CCFT Inverter
1.75 W	350V@5mA	–	VS = 1520V	–	–	100x20x8.5	AA9044 CCFT Inverter
2.8 W	100VRMS	–	–	–	–	60x24x17	AA9072 EL Inverter

LOADS

EL Series



FEATURES

- Static or dynamic loading
- Single & multi channel
- RETMA rack or bench top configuration
- Parallel operation for increased capability

OPTIONS

Bench top case
Four-position rack
Blank dress panels
Ribbon cable
12″ line cord
Slides
Power strip
Load cables

SPECIFICATIONS

Model	Watts	Application	Capabilities
EL300N	300	Single	4.5 to 60 VDC/60A
EL300N & 301	300	Single	1.8 to 60 VDC/60A
EL311	600	Dual or 2 Singles	1.8 to 60 VDC/60 A/channel
EL750B	750	Single	1.8 to 55 VDC/150A
EL310	900	Triple or Single	1.8 to 60 VDC/60 A/channel 1.8 to 60 VDC/180 A (paralleled)
EL312	1200	Quad or Single	4.5 to 60 VDC/60 A/channel 4.5 to 60 VDC/240 A (paralleled)
EL750BR-2	1500	Dual or Single	1.8 to 55 VDC/150 A/channel 1.8 to 55 VDC/300 A (paralleled)

ASTEC

ASTEC STANDARD POWER
Division of Astec America Inc.
401 Jones Road
Oceanside, CA 92054-1216
Telephone: 619-757-1880
Facsimile: 619-439-4243

DISTRIBUTED POWER/LINEARS

AMPSS

AM80 Series
200 Watt Modules

The AMPSS AM80 Series of DC/DC modular power supplies is a family of highly efficient and fully featured modules with high power density operating at a 1 MHz fixed frequency.

This series offers high performance DC/DC power supplies in a low profile module with multiple safety isolated low-voltage secondary-side control and status functions. The series is aimed at a wide range of power system applications such as distributed power including N+1 redundant systems and modular power supplies.

The integration of a user-friendly linear programming technique, located on the safety isolated low-voltage secondary-side, greatly simplifies the interfacing of control, monitoring, and status signals involving applications such as multi-paralleled modules in distributed power systems.

FEATURES

- 1 MHz fixed frequency
- 11 safety isolated low voltage secondary-side control and status functions
- High efficiency −84% typical
- 100°C maximum baseplate temperature at full power without current derating
- No load operation; no minimum load or pre-loading required
- Unique ALP (Astec Linear Programming) control which is linear with external programming resistance or voltage
- Programmable output voltage
- Programmable current limit
- Programmable OVP margin automatically tracks output voltage setting
- Module to module current sharing with single wire connection
- TTL compatible enable-inhibit control
- Module output current monitor signal
- Module internal temperature monitor signal
- Remote sense • Floating output
- Output ripple and noise <1% typical
- Operating temperature −20°C to +100°C
- Multiple paralleled output pins for enhanced connection reliability

SPECIFICATIONS

Input Voltage	Output Voltage	Output Current	Model Number
300V	2.2V	60A	AM80A-300L-022F60
300V	3.3V	50A	AM80A-300L-033F50
300V	5V	40A	AM80A-300L-050F40
300V	12V	18A	AM80A-300L-120F18
300V	15V	16A	AM80A-300L-150F16
48V	1.2V	60A	AM80A-048L-012F60
48V	2.2V	60A	AM80A-048L-022F60
48V	3.3V	50A	AM80A-048L-033F50
48V	5V	40A	AM80A-048L-050F40
48V	12V	18A	AM80A-048L-120F18
48V	15V	16A	AM80A-048L-150F16

Contact factory for additional output voltages, power ranges, and configurations.

ACDC 15 TO 150 WATTS

SINGLE/MULTIPLE OUTPUT LINEAR POWER SUPPLIES ECV/ETV SERIES

FEATURES

- 100% Vacuum varnish impregnated transformers
- Cross references with all manufacturers
- Installation instructions/specification sheet with each unit
- World wide voltage taps. AC input nominal, 100/117/220/230/240VAC field selectable
- Remote sense
- Overload protection
- Overvoltage protection
- 0° to 50°C operating temperature
- Cooling – natural convection
- UL, CSA certification

SPECIFICATIONS

Total Power	Volts/Amps Output #1	Output #2	Output #3	Case H×W×L (ins)	Model Number
15W	5V/3A			2.0×4.0×4.84	ECV5N3-1
20W	12V/1.7A			2.0×4.0×4.84	ECV12N1.7
25W	15V/1.5A			2.0×4.0×4.84	ECV15N1.5
30W	24V/1.2A			2.0×4.0×4.84	ECV24N1.2
30W	5V/6A			2.9×4.8×5.59	ECV5N6-1
40W	12V/3.4A			2.9×4.8×5.59	ECV12N3.4
45W	5V/9A			3.3×4.8×6.97	ECV5N9-1
45W	15V/3A			2.9×4.8×5.59	ECV15N3
57W	24V/2.4A			2.9×4.8×5.59	ECV24N2.4
60W	5V/12A			3.3×4.8×8.98	ECV5N12-1
60W	12V/5A			3.3×4.8×6.97	ECV12N5
67W	15V/4.5A			3.3×4.8×6.97	ECV15N4.5
81W	12V/6.8A			3.3×4.8×8.98	ECV12N6.8
86W	24V/3.6A			3.3×4.8×6.97	ECV24N3.6
90W	15V/6A			3.3×4.8×8.98	ECV15N6
115W	24V/4.8A			3.3×4.8×8.98	ECV24N4.8
14W	+12V/1A	−5V/0.4A		2.0×4.0×6.50	ECV12D1
14W	+15V/0.8A	−5V/0.4A		2.0×4.0×6.50	ECV12D1
23W	+12V/1.7A	−5V/0.7A		2.9×4.8×6.97	ECV12D1.7
24W	+12V/1A	−12V/1A		2.0×4.0×6.50	ECV12D1
24W	+15V/0.8A	−15V/0.8A		2.0×4.0×6.50	ECV12D1
26W	+15V/1.5A	−5V/0.7A		2.9×4.8×6.97	ECV12D1.7
40W	+12V/1.7A	−12V/1.7A		2.9×4.8×6.97	ECV12D1.7
45W	+15V/1.5A	−15V/1.5A		2.9×4.8×6.97	ECV12D1.7
58W	+12V/4A	+5V/2A		3.3×4.8×6.97	ECV151
81W	+12V/3.4A	−12V/3.4A		3.3×4.8×9.37	ECV12D3.4
90W	+15V/3A	−15V/3A		3.3×4.8×9.37	ECV12D3.4
22W	5V/2A	12 to 15V/0.4A	−12 to −15V/0.4A	2.0×4.0×6.50	ETV251
22W	5V/2A	12 to 15V/0.4A	−5V/0.2A	2.0×4.0×6.50	ETV251
39W	5V/3A	12 to 15V/0.8A	−12 to −15V/0.8A	2.9×4.0×10.2	ETV351
39W	5V/3A	12 to 15V/0.8A	−5V/0.4A	2.9×4.0×10.2	ETV351
60W	5V/6A	12 to 15V/1A	−12 to −15V/1A	3.3×4.8×9.02	ETV401
60W	5V/6A	12 to 15V/1A	−5V/0.4A	3.3×4.8×9.02	ETV401
75W	5V/6A	12 to 15V/1.5A	−12 to −15V/1.5A	3.3×4.8×11.0	ETV451
75W	5V/6A	12 to 15V/1.5A	−5V/0.7A	3.3×4.8×11.0	ETV451
85W	5V/8A	12 to 15V/1.5A	−12 to −15V/1.5A	3.3×4.8×11.0	ETV551
85W	5V/8A	12 to 15V/1.5A	−5V/0.7A	3.3×4.8×11.0	ETV551
105W	5V/12A	12 to 15V/1.5A	−12 to −15V/1.5A	3.3×4.8×14.2	ETV651
105W	5V/12A	12 to 15V/1.5A	−5V/0.7A	3.3×4.8×14.2	ETV651

Output #1 is main output

AT&T
Microelectronics

POWER SUPPLIES dc

Board-Mounted Power Modules

AT&T
FE150A
DC-DC Power Module
48V 3.7A IN
MADE IN USA

AT&T's FE Series Board-Mounted Power Modules are a new and fast-growing family of dc-dc converters manufactured at AT&T's one million-square-foot facility in Dallas, Texas.

AT&T Power Range 0.5 W to 200 W

AT&T board-mounted power modules offer low-profile, high-power-density, off-the-shelf, dc-dc power conversion in module sizes of 0.5 W to 200 W. Known for reliability, AT&T board-mounted power modules feature a variety of design options with typical power efficiencies in excess of 80%.

Distributed Power Architecture for the '90s

Developed by AT&T Bell Laboratories to reduce the high first-cost of providing power and ensuring system reliability, distributed power architecture allows you to partition your system load into separate and distinct service groups, each with its own power conversion unit. Power modules are placed precisely where power conversion is needed. Distributed power architecture eliminates the need for both a large, multioutput power supply and power supply redundancy to gain system reliability. AT&T board-mounted power modules allow your computer and telecommunications applications to keep pace with power conversion trends throughout the '90s.

Features

- Electronic on/off
- Remote sensing
- Overcurrent protection
- Overvoltage protection
- Parallel operation with forced load sharing
- Isolated and nonisolated models
- Input/output filtering
- External synchronization
- Well-regulated output voltage
- Wide operating temperature ranges
- Three-year warranty

Applications

- Telecommunications
- Data processing systems
- Industrial electronics
- Test and measurement systems
- Uninterruptible power systems
- Aeronautics
- Robotics

Data Sheets Fast!

Full technical details on all products are available in data sheet and catalog form via mail or fax.

For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T
Microelectronics

POWER SUPPLIES dc

Board-Mounted Power Modules

Low-Power Product Matrix (0.5 W to 50 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (I_A)	Power, Watts (W)	Height (in.)	Length (in.)	Width (in.)	Ambient Temp. (°C)
112A2	5	4.5—5.5	12	0.041	0.5	0.440	0.96	0.70	–40 to +85
112C2	5	4.5—5.5	15	0.100	1.5	0.440	0.96	0.70	–40 to +85
112D2	5	4.5—5.5	25	0.030	0.75	0.440	0.96	0.70	–40 to +85
112E2	5	4.5—5.5	12	0.125	1.5	0.440	0.96	0.70	–40 to +85
113A2	5	4.5—5.5	–5	0.100	0.5	0.440	0.96	0.70	–40 to +85
113B2	5	4.5—5.5	–12	0.063	0.75	0.440	0.96	0.70	–40 to +85
113C2	5	4.5—5.5	–15	0.050	0.75	0.440	0.96	0.70	–40 to +85
113E2	5	4.5—5.5	–130	0.0005	0.065	0.440	0.96	0.70	–40 to +85
113F2	5	4.5—5.5	–5	0.300	1.5	0.440	0.96	0.70	–40 to +85
113G2	5	4.5—5.5	–12	0.125	1.5	0.440	0.96	0.70	–40 to +85
MA005A	12	10—15	5	1.0	5	0.500	2.000	1.100	–10 to +70
MA005B	12	10—15	12	0.42	5	0.500	2.000	1.100	–10 to +70
MA005C	12	10—15	15	0.33	5	0.500	2.000	1.100	–10 to +70
MA005BK	12	10—15	±12	0.21	5	0.500	2.000	1.100	–10 to +70
MA005CL	12	10—15	±15	0.17	5	0.500	2.000	1.100	–10 to +70
MA010A	12	10—15	5	2.0	10	0.500	2.000	1.600	–10 to +50
MA010B	12	10—15	12	0.83	10	0.500	2.000	1.600	–10 to +50
MA010C	12	10—15	15	0.67	10	0.500	2.000	1.600	–10 to +50
MA010BK	12	10—15	±12	0.42	10	0.500	2.000	1.600	–10 to +50
MA010CL	12	10—15	±15	0.33	10	0.500	2.000	1.600	–10 to +50
MC005A	28	18—36	5	1.0	5	0.460	2.000	1.100	–40 to +85
MC005B	28	18—36	12	0.42	5	0.460	2.000	1.100	–40 to +85
MC005C	28	18—36	15	0.33	5	0.460	2.000	1.100	–40 to +85
MC005BK	28	18—36	±12	0.21	5	0.460	2.000	1.100	–40 to +85
MC005CL	28	18—36	±15	0.17	5	0.460	2.000	1.100	–40 to +85
ME005A	48	39.5—60	5	1.0	5	0.460	2.000	1.100	–40 to +85
ME005B	48	39.5—60	12	0.42	5	0.460	2.000	1.100	–40 to +85
ME005BK	48	39.5—60	±12	0.21	5	0.460	2.000	1.100	–40 to +85
ME005C	48	39.5—60	15	0.33	5	0.460	2.000	1.100	–40 to +85
ME005CL	48	39.5—60	±15	0.17	5	0.460	2.000	1.100	–40 to +85
MW005A	48	36—72	5	1.0	5	0.460	2.000	1.100	–40 to +85
MW005B	48	36—72	12	0.42	5	0.460	2.000	1.100	–40 to +85
MW005BK	48	36—72	±12	0.21	5	0.460	2.000	1.100	–40 to +85
MW005C	48	36—72	15	0.33	5	0.460	2.000	1.100	–40 to +85
MW005CL	48	36—72	±15	0.17	5	0.460	2.000	1.100	–40 to +85
MC010A	28	18—36	5	2.0	10	0.500	2.000	1.600	–40 to +85
MC010B	28	18—36	12	0.83	10	0.500	2.000	1.600	–40 to +85
MC010BK	28	18—36	±12	0.43	10	0.500	2.000	1.600	–40 to +85
MC010C	28	18—36	15	0.67	10	0.500	2.000	1.600	–40 to +85
MC010CL	28	18—36	±15	0.33	10	0.500	2.000	1.600	–40 to +85
MW010A	48	36—72	5	2.0	10	0.500	2.000	1.600	–40 to +85
MW010B	48	36—72	12	0.83	10	0.500	2.000	1.600	–40 to +85
MW010BK	48	36—72	±12	0.43	10	0.500	2.000	1.600	–40 to +85
MW010C	48	36—72	15	0.67	10	0.500	2.000	1.600	–40 to +85
MW010CL	48	36—72	±15	0.33	10	0.500	2.000	1.600	–40 to +85
ME010A	48	39.5—60	5	2.0	10	0.500	2.000	1.600	–40 to +85

* Other voltages available.

For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

Low-Power Product Matrix (0.5 W to 50 W) (continued)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Height (in.)	Length (in.)	Width (in.)	Ambient Temp. (°C)
ME010B	48	39.5—60	12	0.83	10	0.500	2.000	1.600	–40 to +85
ME010BK	48	39.5—60	±12	0.43	10	0.500	2.000	1.600	–40 to +85
ME010C	48	39.5—60	15	0.67	10	0.500	2.000	1.600	–40 to +85
ME010CL	48	39.5—60	±15	0.33	10	0.500	2.000	1.600	–40 to +85
MH005A	5	4.5—5.5	5	1.00	5	0.500	2.000	1.100	–10 to +70
MH005B	5	4.5—5.5	12	0.42	5	0.500	2.000	1.100	–10 to +70
MH005C	5	4.5—5.5	15	0.33	5	0.500	2.000	1.100	–10 to +70
MH005BK	5	4.5—5.5	±12	0.21	5	0.500	2.000	1.100	–10 to +70
MH005CL	5	4.5—5.5	±15	0.17	5	0.500	2.000	1.100	–10 to +70
MH010A	5	4.5—5.5	5	2.00	10	0.500	2.000	1.600	–10 to +50
MH010B	5	4.5—5.5	12	0.83	10	0.500	2.000	1.600	–10 to +50
MH010C	5	4.5—5.5	15	0.67	10	0.500	2.000	1.600	–10 to +50
MH010BK	5	4.5—5.5	±12	0.42	10	0.500	2.000	1.600	–10 to +50
MH010CL	5	4.5—5.5	±15	0.33	10	0.500	2.000	1.600	–10 to +50
912A	48	39.5—60	12	1.0	12	0.610	3.000	2.200	0 to 70
915AW	48	39.5—60	5	3.0	15	0.500	2.700	2.100	–40 to +85
FC020A	28	18—36	5	4.0	20	0.500	3.620	1.900	–40 to +85
FC020B	28	18—36	12	1.67	20	0.500	3.620	1.900	–40 to +85
FC020C	28	18—36	15	1.33	20	0.500	3.620	1.900	–40 to +85
FE008AJ	48	39.5—60	5	1.2	8	0.500	2.000	2.000	–40 to +85
FE020A	48	39.5—60	5	4.0	20	0.500	3.620	1.900	–40 to +85
FE020B	48	39.5—60	12	1.67	20	0.500	3.620	1.900	–40 to +85
FE020C	48	39.5—60	15	1.33	20	0.500	3.620	1.900	–40 to +85
ME025ABK	48	40—60	5, ±12	4.0, 0.2	25	0.500	4.290	2.610	0 to 60
984A	48	38.7—60	5	6.0	30	0.750	3.630	2.030	–40 to +70
984D	48	40—60	12	2.5	30	0.750	3.630	2.030	–40 to +70
984B	48	39.5—60	5.2	6.0	31	0.750	3.630	2.030	–40 to +70
SK025A	48	38—72	5	5.0	25	0.45	3.64	1.90	–40 to +85
SK025B	48	38—72	12	2.0	25	0.45	3.64	1.90	–40 to +85
SK025C	48	38—72	15	1.6	25	0.45	3.64	1.90	–40 to +85
SK050A	48	38—72	5	10.0	50	0.75	3.35	2.30	–40 to +85

* Other voltages available.

High-Power Product Matrix (50 W to 150 W)

Features

- UL recognized (some models in submittal stage)
- Within FCC Class A
- Operating case temperature up to 90 °C
- Calculated MTBF of over 1 million hours
- Parallel for load sharing or true N+1 redundancy
- Hot insertion/extraction
- 33 W per cubic inch
- Remote sense
- Remote ON/OFF
- Current limit, overvoltage protection
- Output voltage adjust

AT&T
Microelectronics

POWER SUPPLIES dc

Board-Mounted Power Modules

High-Power Product Matrix (50 W to 150 W) (continued)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (I_A)	Power, Watts (W)	Height (in.)	Length (in.)	Width (in.)	Case Temp. (°C)
FC050F	28	18—36	3.3	10.0	33	0.500	4.800	2.500	0 to 90
FC050A	28	18—36	5	10.0	50	0.500	4.800	2.500	0 to 90
FC050B	28	18—36	12	4.2	50	0.500	4.800	2.500	0 to 90
FC050C	28	18—36	15	3.3	50	0.500	4.800	2.500	0 to 90
FC050R	28	18—36	28	1.8	50	0.500	4.800	2.500	0 to 90
FC100A	28	18—36	5	20.0	100	0.500	4.800	2.500	0 to 90
FC100B	28	18—36	12	8.3	100	0.500	4.800	2.500	0 to 90
FC100C	28	18—36	15	6.7	100	0.500	4.800	2.500	0 to 90
FC100R	28	18—36	28	3.6	100	0.500	4.800	2.500	0 to 90
FC150A	28	18—36	5	30.0	150	0.500	4.800	2.500	0 to 90
FC150C	48	38—60	15	10.0	150	0.500	4.800	2.500	0 to 90
FC150D	28	18—36	2	30.0	60	0.500	4.800	2.500	0 to 90
FC150F	28	18—36	3.3	30.0	100	0.500	4.800	2.500	0 to 90
FC150R	28	18—36	28	5.4	150	0.500	4.800	2.500	0 to 90
FC100F	28	18—36	3.3	20.0	66	0.500	4.800	2.500	0 to 90
FE050F	48	38—60	3.3	10.0	33	0.500	4.800	2.500	0 to 90
FE050A	48	38—60	5	10.0	50	0.500	4.800	2.500	0 to 90
FE050B	48	38—60	12	4.2	50	0.500	4.800	2.500	0 to 90
FE050D	48	38—60	2.0	10.0	20	0.500	4.800	2.500	0 to 90
FE050H	48	38—60	24	2.1	50	0.500	4.800	2.500	0 to 90
FE050N	48	38—60	5.2	9.6	50	0.500	4.800	2.500	0 to 90
FE100A	48	38—60	5	20.0	100	0.500	4.800	2.500	0 to 90
FE100B	48	38—60	12	8.3	100	0.500	4.800	2.500	0 to 90
FE100D	48	38—60	2.0	20.0	40	0.500	4.800	2.500	0 to 90
FE100F	48	38—60	3.3	20.0	66	0.500	4.800	2.500	0 to 90
FE100H	48	38—60	24	4.2	100	0.500	4.800	2.500	0 to 90
FE100N	48	38—60	5.2	19.2	100	0.500	4.800	2.500	0 to 90
FE150A	48	38—60	5	30.0	150	0.500	4.800	2.500	0 to 90
FE150B	48	38—60	12	12.5	150	0.500	4.800	2.500	0 to 90
FE150D	48	38—60	2	30.0	60	0.500	4.800	2.500	0 to 90
FE150F	48	38—60	3.3	30.0	100	0.500	4.800	2.500	0 to 90
FE150H	48	38—60	24	6.25	150	0.500	4.800	2.500	0 to 90
FE150N	48	38—60	5.2	28.8	150	0.500	4.800	2.500	0 to 90
FW050A	48	36—72	5.0	10.0	50	0.500	4.800	2.500	0 to 90
FW100A	48	36—72	5.0	20.0	100	0.500	4.800	2.500	0 to 90
FW150A	48	36—72	5.0	30.0	150	0.500	4.800	2.500	0 to 90
FE200A,F	48	40—60	5.0	40.0	200	0.500	4.800	2.500	0 to 80
			3.3	40.0	200	0.500	4.800	2.500	0 to 80

* Other voltages available.

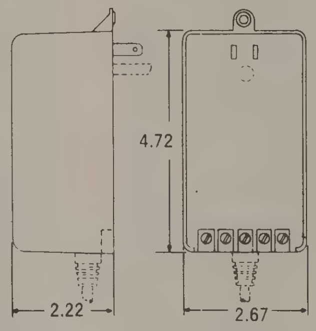
AT&T Built-in Quality

AT&T has built a reputation for technical excellence and a commitment to quality and reliability. We back our board-mounted power modules with our three-year warranty and quality commitment—a commitment for reliability and on-time delivery of the finished product.

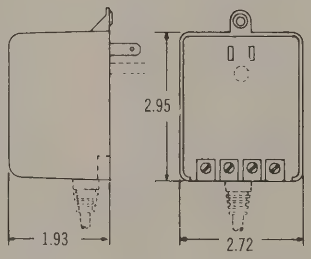
For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AULT INCORPORATED
EXTERNAL POWER SPECIALIST

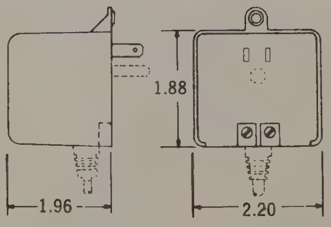
SWITCHER CASE SIZE LP8
5.87″ × 3.40″ × 2.00



CASE SIZE "7"



CASE SIZE "PS 5"



CASE SIZE "3"

WE POWER INNOVATION

EXTERNAL SWITCHER SPECIFICATIONS

SINGLE OUTPUT UNITS

MODEL	INPUT VOLTS	OUTPUT VOLT.	OUTPUT CURRENT	REGULATION %	RIPPLE MV P-P
9305-000-4XX	120	+ 5.0	5.0	4	50 MV P-P
9312-000-4XX	120	+12.0	2.0	2	50 MV P-P
9348-000-4XX	120	+48	0.5	2	50 MV P-P < 20 dBm
S60A SERIES	120	+48	1.25	2	50 MV P-P <30 dBm
SW106	90-264	+ 5	5.0	1	50 MV P-P
SW101	90-264	+12	3.5	1	100 MV P-P
SW103	90-264	+16	2.8	1	100 MV P-P
SW105	90-264	+24	2.0	1	100 MV P-P

MULTIPLE OUTPUT UNITS

MODEL	INPUT VOLTS	OUTPUT VOLT.	OUTPUT CURRENT	REGULATION %	RIPPLE MV P-P
9712-000-4XX	120	+12.0 −12.0	1.0 MAX 1.0 MAX	10 10	100 MV P-P 100 MV P-P
SW305 SERIES	90-264	+5.0 +12.0 −12.0	2.0 MAX 0.8 MAX 0.5 MAX 17 WATTS TOTAL MAXIMUM	4 -5,-10 6	50 MV P-P 100 MV P-P 100 MV P-P
SW300 SERIES	90-264	+5.0 +12.0 −12.0	4.0 MAX 1.0 MAX 0.6 MAX 25 WATTS TOTAL MAXIMUM	1 5 6	50 MV P-P 100 MV P-P 100 MV P-P
SW308 SERIES	90-264	+5.0 +12.0 −12.0	5.0 MAX 2.0 MAX 0.6 MAX 50 WATTS TOTAL MAXIMUM	1 2 6	50 MV P-P 100 MV P-P 100 MV P-P

Input: 90-130 VAC/47 to 63 Hz or 90-264 VAC/47 to 63 Hz

Operating Temperature: 0° to +50°C

Transient Response: 500 microseconds for 50% load change typical.

Protection: Overcurrent and short circuit protected, 5V overvoltage crowbar, automatic resetting from overcurrent.

EMI: Meets FCC Docket 20780 Class B and VDE 0871 Class B.

Enclosure: High impact resistant molded lexan plastic.

Weight: 13–20 oz.

Hold-up Time: 20–120 MS

Storage Temperature: −30 to +85°C

Safety Agencies: UL, CSA, TUV, B.S.I., IEC950

Warranty: 1 or 2 years

Short Circuit Protection: Indefinite at 50°C

Relative Humidity: 5% to 80% non-condensing

External transformers, battery chargers, linear and switching power supplies provide several advantages over conventional built in power sources as listed below:

FEATURES

- Wall plug-in and desktop styles
- Single and multiple output models available
- UL Listed safety agency approved
- Impact resistant Lexan thermoplastic enclosure
- AC blades zinc plated solid brass with tapered tip
- Available with input and/or output cord(s) and connector
- One or two year Warranty
- Sealed construction
- Private label hot stamping available
- Some available with 230V/50 Hz input for European use

BENEFITS

- Eliminate UL considerations because hazardous voltages are kept out of your product
- Increase space for other components in your product
- Increase aesthetic appearance and portability by reducing the size and weight of your product
- Keep power source heat out of your product for increased life
- Tamperproof power source
- Reduce design time for your product
- International uniformity of your product

BATTERY CHARGERS

Battery chargers for Gel-Cel and Sealed Lead Acid batteries are available in 6, 12 and 24 volt charge models for fixed voltage (float) and automatic fast charge applications. NiCd chargers also available.

FLOAT STYLE

BATTERY VOLTAGE	MAXIMUM FAST CHARGE	VOLTAGE AT END OF CHARGE	RATED CURRENTS AVAILABLE UL 1310	RATED CURRENTS AVAILABLE UL 544	CASE SIZE** (SAME ORDER)
6	None	6.9	.4, .6	.4, .5	3, 5, 3, 5
12	None	13.8	.3, .5	.3, .375	3, 5, 3, 5
24	None	27.6	.2	.2	3, 3

AUTOMATIC FAST CHARGE

	TYPE 1*	TYPE 2*				
6	7.2	7.45	6.9	.4, .6, 1.5, 3.0	.4, .5	3, 5, 7, 7, 3, 5
12	14.4	14.9	13.8	.3, .5, 1.25, 2.75	.3, 3.75	3, 5, 7, 7, 3, 5
24	28.8	29.8	27.6	.25, .5, 1.5	.2	3, 7, 7, 3

* Type 1: For Gel Cell Batteries. Type II: For Sealed Lead Acid Batteries.
** Case sizes are listed in the same order as the rated currents.

AULT INCORPORATED
Dept. EM, 7300 Boone Ave. N / Minneapolis, Minnesota 55428
Telephone: (612) 493-1900 / FAX (612) 493-1911

STANDARDS MODIFIED CUSTOMS

AULT INCORPORATED
EXTERNAL POWER SPECIALIST

CONSIDER THE ADVANTAGES OF EXTERNAL POWER

LINEAR DC POWER SUPPLIES

UL Listed, Input Voltage: 105-129 VAC, 60 Hz

Operating Temperature: 0° to +40°C
All UL Listed

SINGLE OUTPUT MODELS
10 MV RMS Ripple, ±5% Overall Reg.

MODEL	OUTPUT VDC	AMPS	CASE SIZE
3305-000-400	+5	.3	3
5305-000-400	+5	.5	5
7305-000-400	+5	1.25	7
H405-000-400	+5	3.0	7
7306-000-400	+6	1.2	7
3312-000-400	+12	.12	3
5312-000-400	+12	.4	5
7312-000-400	+12	.8	7
5324-000-400	+24	.25	5
7324-000-400	+24	.5	7
5348-000-400	+48	.1	5
7000-348-400	+48	.25	7

MULTIPLE OUTPUT MODELS-LINEAR
10 MV RMS RIPPLE, ±5% Overall Reg.

MODEL	OUTPUT VDC	AMPS	CASE SIZE
5712-000-400	±12	.2 ea.	5
5000-712-400	±12	.30 ea.	5
7712-000-400	±12	.4 ea.	7
5715-000-400	±15	.15 ea.	5
5324-110-400	24 10 VAC	.2 .1	5
5712-305-401	+5 ±12	.5 .130 ea.	5
7712-305-401	+5 ±12	.6 .2 ea.	7
7612-305-401	+5 ±12	1.0 .25 ea.	7
H712-305-401	+5 ±12	2.0 .20 ea.	7

OPTIONS: Input cord, output cord, output connector, ground pin, hot stamping, 220 VAC/50 Hz.

SINGLE OUTPUT MODELS
Unregulated-Filtered/3.2 V.P.P. RIPPLE

MODEL	OUTPUT VDC	AMPS	CASE SIZE
3312-000-000	12	.35	3
5312-000-000	12	1.2	5
5323-000-000	23	.5	5
5316-000-000	16	.8	5
7323-000-000	23	1.0	7

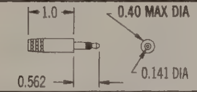
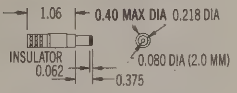
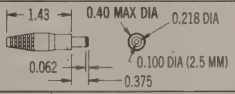
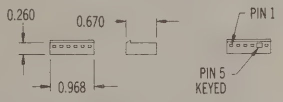
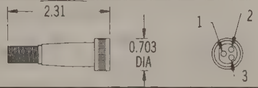
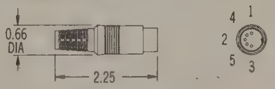
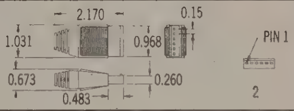
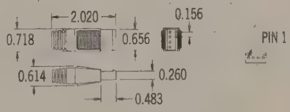
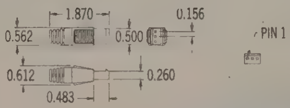
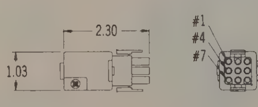
AC TRANSFORMERS—U.S. AND EUROPEAN WALL PLUG-IN OR DUAL CORD STYLES

The following are all available with optional input cord, output cord, connectors, earth ground, center tap and custom hot stamped with your company logo. Standard models have output screw terminals. All versions are UL 1310 listed, some are CSA Approved.

VA	VOLTAGES AVAILABLE	CASE SIZE
7.5	24	3
9.6	24	3
10	6, 7, 10, 12, 14, 16, 18, 20, 22, 24	3
11.3	22.5	3

VA	VOLTAGES AVAILABLE	CASE SIZE
12	18.5	3
16	10, 12, 14, 16, 18, 20, 22, 24	3
20	12, 14, 16, 18, 22, 24	3
40	10, 12, 14, 16, 18, 20, 24, 26	5

OUTPUT CONNECTORS

MODEL NO.	PROFILE & DIMENSIONS	PINOUT CODE	DESCRIPTION	MATING CONNECTOR
1		Tip: positive. Sleeve: negative	Switchcraft 750 plug	Switchcraft #41 jack
2	 1.06 0.40 MAX DIA 0.218 DIA INSULATOR 0.062 0.080 DIA (2.0 MM) 0.375	Center contact: positive	Switchcraft S760 plug	Switchcraft #722A or National Teltronics 6-205P-1 right angle P.C. mount
3	 1.43 0.40 MAX DIA 0.218 DIA 0.062 0.100 DIA (2.5 MM) 0.375	Center contact: positive	Switchcraft 760 plug	Switchcraft #712A jack
4		(1) Gnd (2) Com (3) +5V (4) −12V (5) Key (6) +12V	6-pin Molex connector (Housing 26-03-4061; Terminals 08-50-0187)	0.045 square pin on 0.156 centers. (Ref: Molex Series 2420, 2630)
6		(1) Gnd (2) Pos (3) Neg	3-pin female Slim-Line Series	Switchcraft SL Series
12		(1) Com (2) Gnd (3) +5V (4) −12V (5) +12V	5-pin DIN 180° male connector	Various styles of straight or right angle panel or p.c. mounted DIN connectors
17	 2.170 0.15 1.031 0.968 PIN 1 0.673 0.260 0.483 2	(1) Gnd (2) Com (3) +5V (4) −12V (5) Key (6) +12V	6-pin overmolded Molex connector (Housing 26-03-4061; Terminals 08-50-0187)	0.045 square pin on 0.156 centers. (Ref: Molex Series 2420, 2630)
20	 2.020 0.156 0.718 0.656 PIN 1 0.614 0.260 0.483	TRANSFORMER: (1) Gnd (2) AC (3) AC (4) CT POWER SUPPLY: (1) DC (2) Com (3) DC (4) Gnd	4-pin overmolded Molex connector (Housing 26-03-4041; Terminals 08-50-0187)	0.045 square pin on 0.156 centers. (Ref: Molex Series 2420, 2630)
21	 1.870 0.156 0.562 0.500 PIN 1 0.612 0.260 0.483	TRANSFORMER (1) AC (2) Gnd (3) AC POWER SUPPLY: (1) DC (2) Com (3) Gnd	3-pin overmolded Molex connector (Housing 26-03-4030; Terminals 08-50-0187)	0.045 square pin on 0.156 centers. (Ref: Molex Series 2420, 2630)
26		(1) +5V (2) +5V (3) −12V (4) (5) (6) Gnd (7) Com (8) Com (9) −12V	9-pin Amp Mate-N-Lok Connector	Amp 641971-1 pin header assembly

▲ Contact Factory for Exact Wire Size, Length & Insulation Color For Your Specific Application

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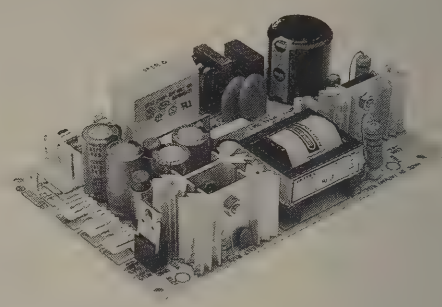
Fax: (805) 522-8777

AUTEC HIGHLIGHTS:

- High-Rel MOSFET Designs
- Current Mode Control
- 90 - 260 VAC Continuous Universal Input
- Complete Safety Agency Approvals
- Consistent On-time Delivery
- Extensive Engineering Capabilities
- Rapid Development of Custom Products ranging from 10 watts to 500 watts

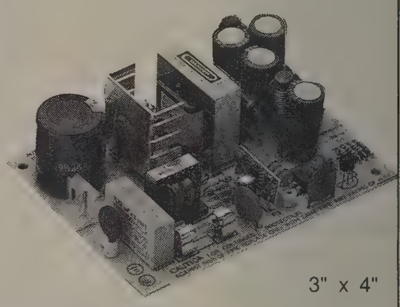
TÜV Rheinland



40 Watt UPS40-3003

SINGLE OUTPUT MODELS

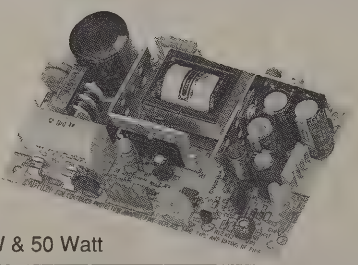
MODEL NUMBER	WATTS	OUTPUT	DIMENSIONS (inches)
UPS40-2051	40W	5V @ 8.0A	3 x 5 x 1.25"
UPS40-2091	40W	9V @ 4.4A	3 x 5 x 1.25"
UPS40-2121	40W	12V @ 3.5A	3 x 5 x 1.20"
UPS40-2151	40W	15V @ 2.5A	3 x 5 x 1.25"
UPS40-2241	40W	24V @ 1.5A	3 x 5 x 1.25"
UPS65-1051	65W	5V @ 13.0A	3.5 x 6 x 1.54"
UPS65-1121	65W	12V @ 5.5A	3.5 x 6 x 1.54"
UPS65-1151	65W	15V @ 4.5A	3.5 x 6 x 1.54"
UPS65-1241	65W	24V @ 2.8A	3.5 x 6 x 1.54"



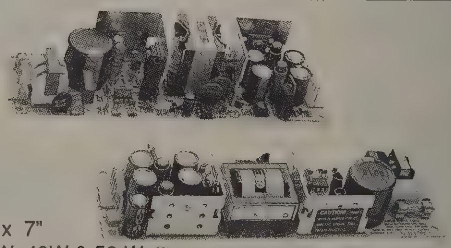
3" x 4"

20W TO 50 WATT DUAL AND TRIPLE OUTPUT MODELS

MODEL NUMBER	WATTS	OUTPUT 1	OUTPUT 2 (Peak)	OUTPUT 3	DIMENSIONS (inches)
UPS20-5002	20W	5V @ 1.6A	12V @ 1.0A (2.0A)		3 x 4 x 1.2"
UPS25-1002	25W	5V @ 1.0A	12V @ 1.5A (3.0A)		2 x 8 x 1.2"
UPS25-3002	25W	5V @ 1.0A	12V @ 1.5A (3.0A)		2 x 6 x 1.2"
UPS30-4003	30W	5V @ 1.5A	12V @ 1.5A (3.0A)	-12V @ 0.3A	5.12 x 2.76 x 1.3"
UPS30-5002	30W	5V @ 1.7A	12V @ 1.8A (3.0A)		3 x 4 x 1.5"
UPS40-1002	40W	5V @ 3.0A	12V @ 2.0A (4.5A)		2 x 7 x 1.2"
UPS40-2002	40W	5V @ 3.0A	12V @ 2.0A (4.5A)		3 x 5 x 1.2"
UPS40-2003	40W	5V @ 3.0A	12V @ 2.0A (4.5A)	-12V @ 0.3A	3 x 5 x 1.2"
UPS40-3003	40W	5V @ 3.0A	12V @ 2.0A (4.5A)	-12V @ 0.3A	5.40 x 3.55 x 1.24"
UPS50-1002	50W	5V @ 3.0A	12V @ 3.0A (5.0A)		2 x 7 x 1.57"
UPS50-2002	50W	5V @ 3.0A	12V @ 3.0A (5.0A)		3 x 5 x 1.2"
UPS51-2002	50W	5V @ 4.0A	15V @ 3.0A (5.0A)		3 x 5 x 1.2"



3" x 5"
20W, 40W & 50 Watt



2" x 7"
30W, 40W & 50 Watt

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AUTEC POWER SYSTEMS

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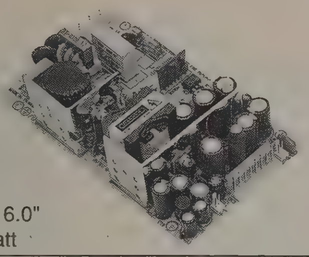
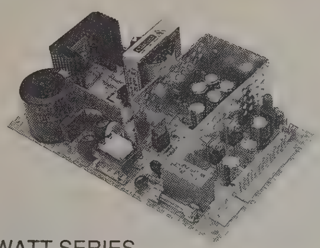


3.5" x 6.0"
65 Watt

E133148
UL1950

LR89164
1402C
LEVEL 3



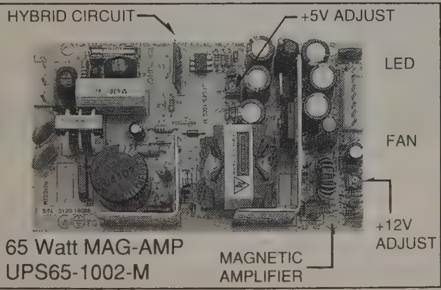
110 WATT SERIES

65 WATT MULTI OUTPUT MODELS Size: 6.0" x 3.5" x 1.54"

MODEL NUMBER	OUTPUT 1	OUTPUT 2 (Peak)	OUTPUT 3	OUTPUT 4
UPS65-1002	5V @ 3.5A	12V @ 4.0A (7.0A)		
UPS65-1002M	5V @ 3.5A	12V @ 4.0A (7.0A)		
UPS65-1004	5V @ 5.5A	12V @ 2.5A (6.0A)	-12V @ 0.5A	-5V @ 0.5A
UPS65-1004-1	5V @ 5.5A	15V @ 2.0A (4.0A)	-15V @ 1.0A	-5V @ 1.0A
UPS65-1004-2	5V @ 5.5A	12V @ 2.0A (4.0A)	-12V @ 1.0A	-5V @ 1.0A
UPS65-1004-C	5V @ 5.5A	15V @ 1.2A (2.0A)	-12V @ 1.0A	24V @ 0.51A (0.75A)

110 WATT MODELS Size: 7.0" x 4.25" x 1.87" *! NEW!*

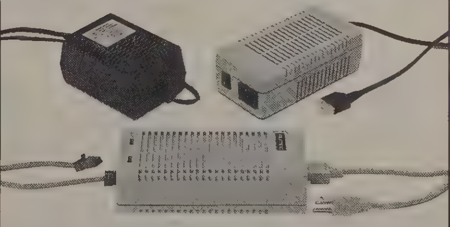
MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT - 85 WATT CONVECTION COOLED	OUTPUT CURRENT - 110 WATT FAN COOLED (20 CFM)	PEAK CURRENT <60 Sec 10% Duty Cycle
UPS110-1041	+5.1V Main +12V Aux 1 -12V Aux 2 -5V Aux 3	8.0A 4.5A 0.5A 0.5A	10.0A 5.0A 1.0A 1.0A	20.0A 9.0A 1.5A 1.5A
UPS110-1042	+5.1V Main +24V Aux 1 -12V Aux 2 -12V Aux 3	8.0A 3.5A 4.5A 0.5A	10.0A 4.5A 5.0A 1.0A	20.0A 4.5A 9.0A 1.5A
UPS110-1043	+5.1V Main +15V Aux 1 -15V Aux 2 -5V Aux 3	8.0A 4.0A 0.5A 0.5A	10.0A 5.0A 1.0A 1.0A	20.0A 7.5A 1.5A 1.5A
UPS110-104M Aus 1 is an adjustable Mag-Amp regulated output with 1% load regulation	+5.1V Main +12V Aux 1 -12V Aux 2 -5V Aux 3	8.0A 4.5A 0.5A 0.5A	10.0A 5.0A 1.0A 1.0A	20.0A 9.0A 1.5A 1.5A
UPS110-1051	5.1V	16.0A	20.0A	
UPS110-1121	12V to 14V	7.0A	9.0A	
UPS110-1151	15V to 18V	5.0A	7.3A	
UPS110-1241	24V to 30V	3.5A	4.5A	



65 Watt MAG-AMP
UPS65-1002-M

TÜV Rheinland
R98290
IEC950

VDE EN60950
APPROVAL ON
65 WATT MODELS



PLASTIC ADAPTER POWER SUPPLIES

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AUTEC POWER SYSTEMS

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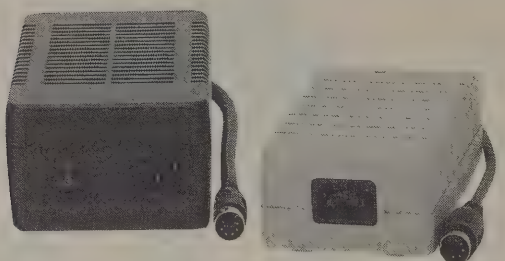
PLASTIC ADAPTER POWER SUPPLIES



FEATURES

- 90-260 VAC UNIVERSAL INPUT
- DPDT ON/OFF SWITCH (VDE APPROVED)
- UL LISTED, CSA CERTIFIED, TUV LICENSED
- CHOICE OF AC & DC CABLE (AC optional)
- SAFETY AGENCY APPROVALS

All models except LIN20-5120 have the following agency approvals:

UL CSA GS

OUTPUT TABLE

PWR	MODEL	V1	V2	V3	SIZE (inch)
17	LIN-5120	5V @ 1.0A	12V @ 1.0A		3.6" x 5.2" x 3.7"
20	UPS20-1002P	5V @ 1.2A	12V @ 1.2A		3.0" x 5.8" x 1.8"
20	UPS20-105P	5V @ 4.0A			3.0" x 5.8" x 1.8"
20	UPS20-109P	9V @ 2.3A			3.0" x 5.8" x 1.8"
20	UPS20-112P	12V @ 1.7A			3.0" x 5.8" x 1.8"
20	UPS20-115P	15V @ 1.4A			3.0" x 5.8" x 1.8"
20	UPS20-124P	24V @ 1.0A			3.0" x 5.8" x 1.8"
30	UPS30-V20P	5V @ 2.0A	12@ 1.5A		3.6" x 7.0" x 2.3"
30	UPS30-230P	5V @ 1.5A	12V @ 1.5A	-12V @ 0.3 A	3.6" x 7.0" x 2.3"
30	UPS30-205P	5V @ 6.0A			3.6" x 7.0" x 2.3"
30	UPS30-209P	9V @ 3.3A			3.6" x 7.0" x 2.3"
30	UPS30-212P	12V @ 2.5A			3.6" x 7.0" x 2.3"
30	UPS30-215P	15V @ 2.0A			3.6" x 7.0" x 2.3"
30	UPS30-224P	24V @ 1.3A			3.6" x 7.0" x 2.3"
54	UPS54-2009	9V @ 6.0A			3.4" x 7.8" x 2.2"
54	UPS54-2012	12V @ 4.5A			3.4" x 7.8" x 2.2"
54	UPS54-2015	15V @ 3.6A			3.4" x 7.8" x 2.2"
54	UPS54-2018	18V @ 3.0A			3.4" x 7.8" x 2.2"
54	UPS54-2018A	13.5V @ 4.0A			3.4" x 7.8" x 2.2"

DC CABLE TYPES

MINI DIN.

5 PIN DIN.

3 PIN HOSIDEN

BARREL JACK

5 PIN MOLEX

NORTH AMERICAN

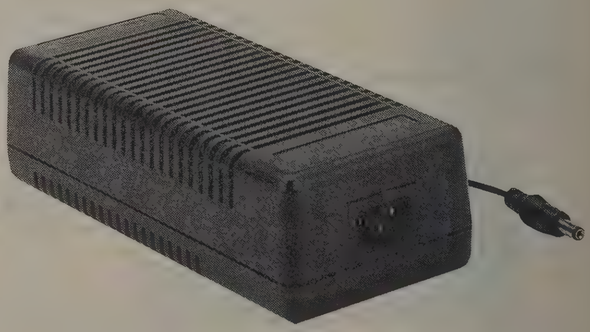
CONTINENTAL EUROPE

BRITISH

SWISS

ITALIAN

OPTIONAL AC CABLES


CUSTOM PRODUCTS

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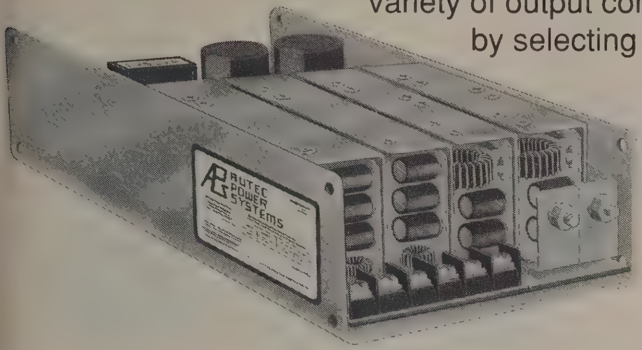
MPS MID-POWER SERIES

250 WATT 350 WATT 450 WATT

The MPS Series of Mid-Power Power Supplies is a modular power system which can be custom configured by inserting up to 4 DC output modules into a main chassis. A wide variety of output combinations, from 1 to 8 outputs, is available by selecting the appropriate combination of modules.



SYSTEM FEATURES INCLUDE:

- Universal Input
- UL CSA TUV
- FCC/VDE Level B EMI
- Inrush Limiting
- Remote Sense
- Adjustable Output Voltage
- Isolated Outputs
- Paralleling
- Output Inhibit
- Overvoltage/Overcurrent Protection

All models require forced air cooling for full power operation. Fan-In-Cover option available.

MPS 450

450 WATTS CONTINUOUS OUTPUT POWER

OUTPUT MODULES AVAILABLE FOR MPS 450:

OUTPUT VOLTAGE	OUTPUT CURRENT CONTINUOUS/PEAK	NUMBER OF SLOTS OCCUPIED
2V	25A / 35A	1
2V	70A / 90A	3
3.3V	25A / 35A	1
3.3V	70A / 90A	3
5V	25A / 35A	1
5V	70A / 90A	3
12V	10A / 16A	1
15V	8A / 14A	1
24V	5A / 8A	1
30V	4A / 6A	1
±5V (Dual)	3A (Each Output)	1
±12V (Dual)	3A (Each Output)	1
±15V (Dual)	3A (Each Output)	1
±24V (Dual)	2A (Each Output)	1

MPS 350

350 WATTS CONTINUOUS OUTPUT POWER

OUTPUT MODULES AVAILABLE FOR MPS 350:

OUTPUT VOLTAGE	OUTPUT CURRENT CONTINUOUS/PEAK	NUMBER OF SLOTS OCCUPIED
2V	25A / 35A	1
2V	50A / 70A	2
3.3V	25A / 35A	1
3.3V	50A / 70A	2
5V	25A / 35A	1
5V	50A / 70A	2
12V	8A / 12A	1
15V	6A / 10A	1
24V	4A / 6A	1
30V	3A / 5A	1
±5V (Dual)	3A (Each Output)	1
±12V (Dual)	3A (Each Output)	1
±15V (Dual)	3A (Each Output)	1
±24V (Dual)	2A (Each Output)	1

MPS 250

250 WATTS CONTINUOUS OUTPUT POWER

OUTPUT MODULES AVAILABLE FOR MPS 250:

OUTPUT VOLTAGE	OUTPUT CURRENT CONTINUOUS/PEAK	NUMBER OF SLOTS OCCUPIED
2V	15A / 20A	1
2V	30A / 40A	2
3.3V	15A / 20A	1
3.3V	30A / 40A	2
5V	15A / 20A	1
5V	30A / 40A	2
12V	5A / 8A	1
15V	4A / 6A	1
24V	2.5A / 4A	1
30V	2A / 3A	1
±5V (Dual)	1.5A (Each Output)	1
±12V (Dual)	1.5A (Each Output)	1
±15V (Dual)	1.5A (Each Output)	1
±24V (Dual)	1.5A (Each Output)	1

CONSULT FACTORY FOR NON-STANDARD MODULES AND CUSTOM REQUIREMENTS.

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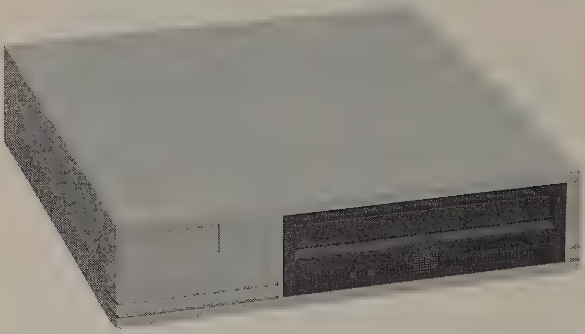
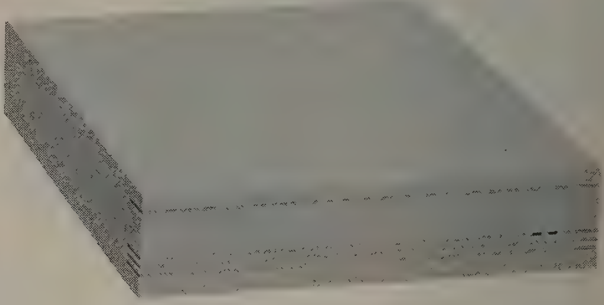
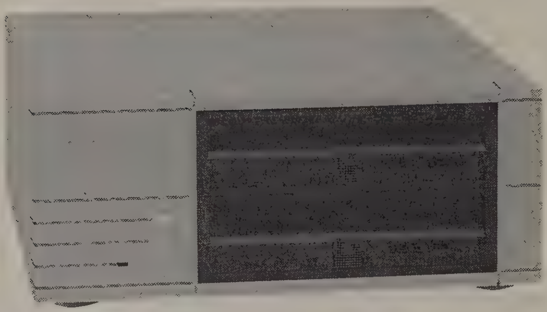
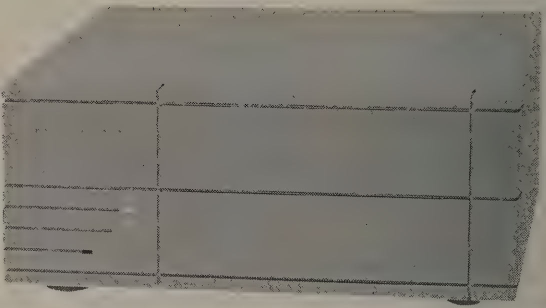
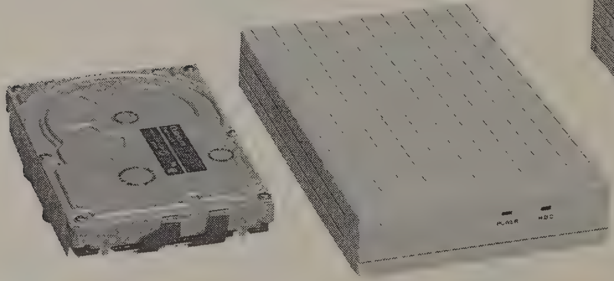
AUTEC'S ENCLOSURE PRODUCTS

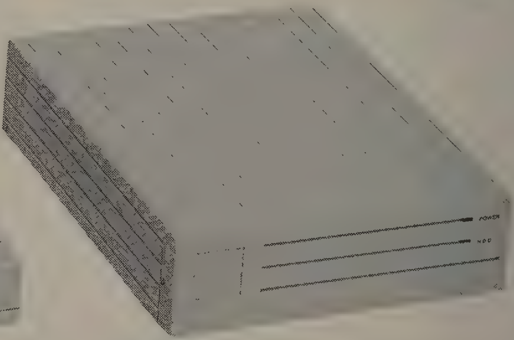












DESCRIPTION

AUTEC manufactures a wide assortment of external drive enclosures. All enclosures come complete with all internal cabling (*AC, DC, SCSI cables*). On/Off switch, AC input filtering, SCSI address ID switch, universal input power supply, LED's and mounting hardware. Removable media (*e.g. tape drives*) are accomodated by simply ordering an open front bezel. As an option, numerous standard external SCSI cables are available (*25:50, 50:50, 25:25 & SCSI II*). Custom sheet-metal, bezels and cables can also be quoted.

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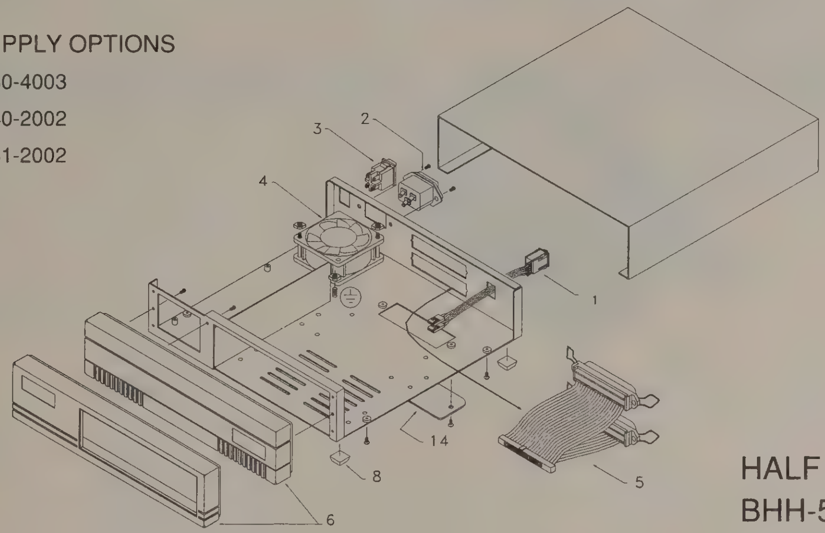
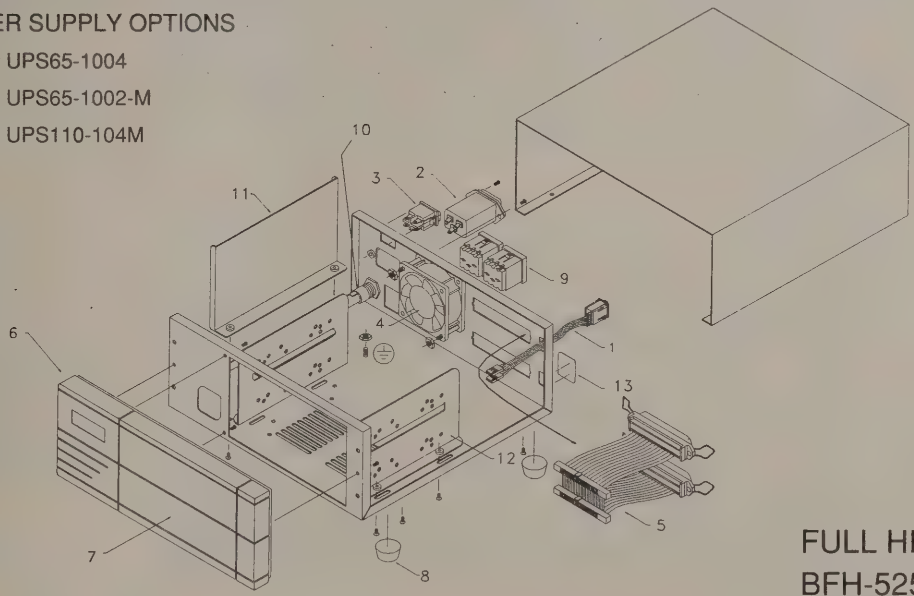
POWER SUPPLY OPTIONS
30 watt UPS30-4003
40 watt UPS40-2002
50 watt UPS51-2002



HALF HEIGHT
BHH-525X

POWER SUPPLY OPTIONS
65 watt UPS65-1004
65 watt UPS65-1002-M
85 watt UPS110-104M



FULL HEIGHT
BFH-525X

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	0-6 SCSI ID rotary switch	8	Rubber foot
2	AC input (filter or IEC receptacle)	9	Optional AC outlets
3	On / Off switch	10	Optional fuse for item 9
4	DC Fan	11	Power supply bracket
5	Internal SCSI loop cable	12	Drive mounting bracket
6	Front Bezel (UL 94VO ABS plastic)	13	SCSI ID hole label
7	Removable bezel insert	14	SCSI Termination access plate

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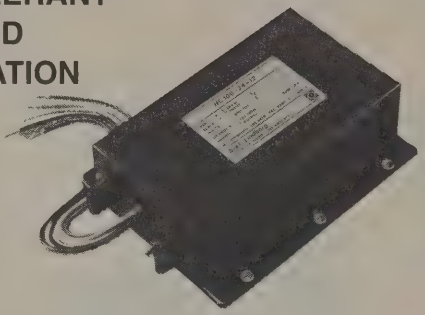
DC TO DC CONVERTERS...ASK AVEL

RUGGED CONSTRUCTION
MOISTURE RESISTANT
VIBRATION TOLERANT
FULLY ISOLATED
EASY INSTALLATION
VERY LOW RFI

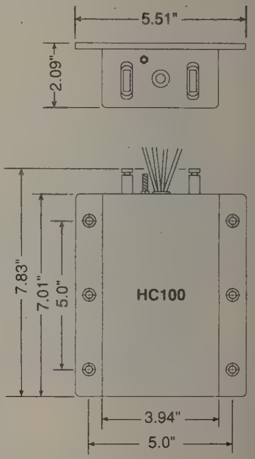


Avel's HC range of fully isolated power supplies were designed specifically for the mobile market. A high quality unit that will tolerate harsh environmental conditions including marine applications. Suitable for any equipment requiring a well regulated 12V dc or 24V dc supply and/or where radio frequency emission needs to be kept to a negligible minimum.

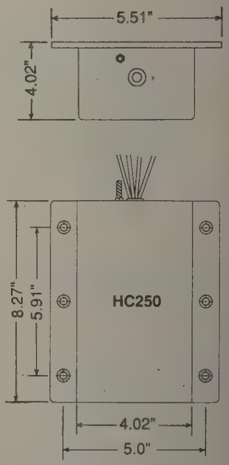
Two basic versions are available - the HC100 giving up to 140 watts of power and - the HC 250 for up to 250 watts of power. Both types are available with either 13.8V dc or 24.0V dc outputs.

All units are supplied with a remote low power switch, which eliminates the need for a high current switch or a relay.

TYPE HC100	HC100/24/12	HC100/24/24	HC100/48/12	HC100/48/24	HC100/110/12	HC100/110/24
Supply Voltage – Nom.	24V DC	24V DC	48V DC	48V DC	110V DC	110V DC
– Range	16V-50V	16V-50V	30V-70V	30V-70V	70V-140V	70V-140V
Output Voltage – Nom.	13.8V DC	24.0V DC	13.8V DC	24.0V DC	13.8V DC	24.0V DC
Output Current – Cont.	10A	5A	10A	5A	10A	5A
Output Voltage Regulation	<5%	<5%	<5%	<5%	<5%	<5%
Output Noise	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk
Efficiency	>80%	>80%	>80%	>80%	>80%	>80%
No Load Input Current	100mA	100mA	80mA	80mA	40mA	40mA
Protection – Input	Reverse polarity and fuse					
– Output	Foldback current limit circuit at approximately 120% plus an output overvoltage crowbar and fuse					
EMC	Fully comply to FCC Part 15 Class B, BS 6527, VDE 0879 Part 1 & 2					
Temperature	-25° C to +55°C					
Construction	Fully encapsulated in aluminum case					
Dimensions Baseplate	7.01" x 5.51" x 2.09"					
Weight	3.53#					
Connections	Flying leads					



TYPE HC250	HC250/24/12	HC250/24/24	HC250/48/12	HC250/48/24	HC250/110/12	HC250/110/24
Supply Voltage – Nom.	24V DC	24V DC	48V DC	48V DC	110V DC	110V DC
– Range	16V-50V	16V-50V	30V-70V	30V-70V	70V-140V	70V-140V
Output Voltage – Nom.	13.8V DC	24.0V DC	13.8V DC	24.0V DC	13.8V DC	24.0V DC
Output Current – Cont.	20A	10A	20A	10A	20A	10A
Output Voltage Regulation	<5%	<5%	<5%	<5%	<5%	<5%
Output Noise	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk	<100mV pk-pk
Efficiency	>80%	>80%	>80%	>80%	>80%	>80%
No Load Input Current	200mA	200mA	160mA	160mA	80mA	80mA
Protection – Input	Reverse polarity and fuse					
– Output	Foldback current limit circuit at approximately 120% plus an output overvoltage crowbar					
EMC	Fully comply to FCC Part 15 Class B, BS 6527, VDE 0879 Part 1 & 2					
Temperature	-25° C to +55°C					
Construction	Fully encapsulated in aluminum case					
Dimensions Baseplate	8.27" x 5.51" x 4.02"					
Weight	9.92#					
Connections	Flying leads					



Additional converters are also available with 12V dc input and 12/24V dc output.

Avel Transformers Inc.

47 South End Plaza, New Milford, CT 06776 • **203-355-4711-Fax: 203-354-8597**

SWITCHING POWER SUPPLIES FROM Basler Electric

The Electronic Product Group of Basler Electric designs and manufactures multi-output AC/DC Switching Power Supplies ranging from 200-1000 watts. Standards, modified standards, and customs are available to meet your power supply needs. Basler Electric power supplies emphasize quality, reliability, and high performance.

Power Factor Corrected Power Supplies Meeting IEC555-2

New! 300 Watts

Model NX300

Features

- Low Profile
- FCC/VDE Class "B" Input Filter
- Power Fail Warning Signal
- Remote Inhibit
- Active Current Share

SPECIFICATIONS

Model	+/-5V	+/-12V	+/-12V	+/-12V	+/-15V	+/-15V	+/-5V	+/-24V	L W H
NX300-U3A	45A	8A	8A						Without Cover 9.00" x 4.85" x 1.95" With Cover 9.00" x 4.85" x 1.99" With Fan Cover 9.00" x 4.85" x 3.29"
NX300-U3B	45A				8A	8A			
NX300-U4C	45A	8A	8A				3A		
NX300-U4D	45A	8A	8A					1.5A	
NX300-U4E	45A	8A	8A	3A					
NX300-U4F	45A				8A	8A	3A		
NX300-U4G	45A				8A	8A		1.5A	
NX300-U4H	45A	8A	3A		8A				

New! 400 Watts

Model PX400

Features

- Universal Input
- Up to 4 Fully Isolated Outputs
- 3.8 Watts per Cubic Inch
- Remote Sensing
- Active Current Share

SPECIFICATIONS

Model	+/-5V	+/-12V	+/-15V	+/-12V	+/-15V	+/-5V	+/-24V	+/-12V	+/-5.2V	L W H
PX400-U3A	70A	15A		15A						Without Cover 10.00" x 4.85" x 2.13" With Cover 10.00" x 4.85" x 2.19" With Fan Cover 10.00" x 4.85" x 3.49"
PX400-U3B	70A		15A		15A					
PX400-U4C	70A	12A		12A		3A				
PX400-U4D	70A	12A		12A			2A			
PX400-U4E	70A	12A		12A				3A		
PX400-U4F	70A		12A		12A	3A				
PX400-U4G	70A		12A		12A		2A			
PX400-U4H	70A	12A		12A					10A	
PX400-U4I	70A		12A		12A				10A	

500 Watts

Model KX500

Features

- 5 Watts per Cubic Inch
- Remote Sensing
- Universal Input
- Up to 5 Fully Isolated Outputs

SPECIFICATIONS

Model	+/-5V	+/-5V	+/-12V	+/-12V	+/-15V	+/-15V	+/-24V	+/-12V	L W H
KX500-F3A	80A		20A	20A					With Cover 10.00" x 5.00"x 2.00" With Fan Cover 10.00" x 5.00"x 3.30"
KX500-F3B	80A				20A	20A			
KX500-F5C	80A	6A	20A	20A			3A		
KX500-F5D	80A	6A	20A	20A				6A	
KX500-F5E	80A	6A			20A	20A	3A		
KX500-F5F	80A	6A			20A	20A		6A	

Redundant System

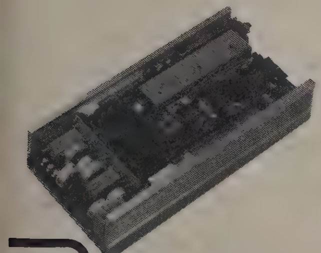
Features

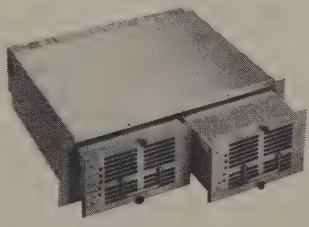
- Standard 19" Rack
- System Alarms and Visual Indicators

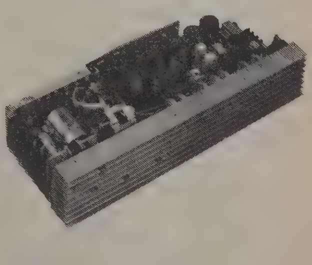
SPECIFICATIONS

Model	+5V	-5V	+12V	-12V	+15V	-15V	+24V	+12V	L W H
RJX4003A	68A		10A	5A				*	19.00" Rack Mount
RJX4003B	68A				10A	5A		*	5.25"H x 17.00"D

* Power Factor Corrected Units Available. For further output configurations, contact factory.







Basler Electric
Electronic Product Group
Box 269, Route 143, Highland, Illinois 62249
Phone: (618) 654-2341 • FAX: (618) 654-2351

Contact factory for non power factor corrected models and other products.

CALL 1-800-645-2074

BERTAN™
THE HIGH VOLTAGE PEOPLE™

SELECTION GUIDE

MODULES & INSTRUMENTS

	OUTPUT VOLTAGE (V)/CURRENT (mA)																FEATURES										INPUT	
Model/ Series	500	1000	1500	2000	2500	3000	5000	7500	10K	15K	20K	30K	50K	60K	75K	100K	REV.	CV/CL	CV/CC	VPROG	VMON	IPROG	IMON	METER	CBNY	IEEE	AC	DC
105		1000				333	200		100		50	33	20				●		●	●	●	●	●	D		○	●	
205B		30				10	5		2.5		1.0	0.5	0.3				●	●		●	●		●	D	○	○	●	
210		225		100		75	40		15		7	4.5	2.5		2.0	1.0	●	●		●	●		●	A	○	○	●	
225		30				10	5		2.5		1.0	0.5	0.3				●	●		●	●		●	D		●	●	
230		15				5	3		1.5		0.6	0.4					●	●			○		○	D			●	
602C		15	10			5	2		1	0.6	0.4							●		●	●		●				●	
603C		30	20			10	5		2	1.5	1	0.4						●		●	●		●				●	
605C			6			3	1.5		0.75	0.4								●		●	●		●					●
606C			20			10	5		2	1.5	1	0.4						●		●	●		●					●
612A											1	0.5	0.3					●		●	●		●				●	
720A									1.2			0.3						●		●	●							●
730A												0.5						●		●	●		●					●
740A												2	1					●		●	●		●					●
815			66			33	20		10		5	3.3	2	1.6					●	●	●	●	●			○	●	
825			133			66	40		20		10	6.6	4	3.3					●	●	●	●	●			○	●	
835			200			100	60		30		15	10	6	5					●	●	●	●	●			○	●	
CRT30		1							1			2						●		●	●		●	D		○	●	
CRT50		1							1				2					●		●	●		●	D		○	●	
EB/ IB-30A		0.05										0.5						●		●	●		●	D		○	●	
EB/ IB-50A				0.05									0.25					●		●	●		●	D		○	●	
EB/ IB-100A				0.05												0.1		●		●	●		●	D		○		
PMT	8	4	1	2	0.5	1.0	0.5	0.25										●		●	●							●

NIM MODULES

	OUTPUT VOLTAGE (V)/CURRENT (mA)																FEATURES										INPUT	
Model/ Series	500	1000	1500	2000	2500	3000	5000	7500	10K	15K	20K	30K	50K	60K	75K	100K	REV.	CV/CL	CV/CC	VPROG	VMON	IPROG	IMON	METER	CBNY	IEEE	AC	DC
301		3															●	●		●								●
303						1											●	●		●								●
305							0.5										●	●		●								●
310									0.25									●		●								
313B						10											●	●		●				A			●	
315B							5										●	●		●				A			●	
320									2									●		●							●	
323						10											●	●		●				D			●	
325							5										●	●		●				D			●	
342A				1													●	●		●				A				●
345A							0.3										●	●		●				A				●
362*				1													●	●		●				A				●
362/5*				1			0.3										●	●		●				A				●
365*							0.3										●	●		●				A				●
375*							0.5											●		●	●			A				●
377*								0.5										●		●	●			A				●
380*									0.3									●		●	●			A				●

*Dual output models
CV/CL-Constant Voltage Current Limit
CV/CC-Constant Voltage Constant Current

● — Standard A — Analog
○ — Optional D — Digital

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NUCLEAR MODULES

SERIES NIM

MODEL	VOLTAGE	CURRENT	RIPPLE	SIZE	NOTES	REV	CV/CL	VPROG	VMON	METER	INPUT AC	INPUT DC	DUAL OUTPUT
301	0 to ±1,000V	0 to 3mA	1mV	D	—	●	●	●				●	
342A	0 to ±2,000V	0 to 1mA	2mV	S	3	●	●	●		A		●	
362	0 to ±2,000V	0 to 1mA	2mV	S	—	●	●	●		A		●	●
303	0 to ±3,000V	0 to 1mA	3mV	D	—	●	●	●				●	
353	0 to ±3,000V	0 to 2mA	5mV	S	—	—	●	●			●		
313B	0 to ±3,000V	0 to 10mA	10mV	D	—	●	●	●		A	●		
323B	0 to ±3,000V	0 to 10mA	10mV	D	—	●	●	●		D	●		
345A	0 to ±5,000V	0 to 300μA	5mV	S	3	●	●	●		A		●	
305	0 to ±5,000V	0 to 500μA	5mV	D	—	●	●	●				●	
355	0 to ±5,000V	0 to 1mA	10mV	S	—	—	●	●			●		
365	0 to ±5,000V	0 to 1mA	5mV	S	—	●	●	●		A		●	●
362/5	0 to ±5,000V	0 to 1mA	2/5mV	S	1	●	●	●		A		●	●
315B	0 to ±5,000V	0 to 5mA	25mV	D	—	●	●	●		A	●		
325B	0 to ±5,000V	0 to 5mA	25mV	D	—	●	●	●		D	●		
375P,N,X	0 to 5,000V	0 to 500μA	50mV	D	2	—	●	●	●	A		●	●
377P,N,X	0 to 7,500V	0 to 500μA	50mV	D	2	—	●	●	●	A		●	●
380P,N,X	0 to 10,000V	0 to 300μA	50mV	D	2	—	●	●	●	A		●	●
310P,N	0 to 10,000V	0 to 250μA	20mV	D	—	—	●					●	
320P,N	0 to 10,000V	0 to 2mA	100mV	D	—	—	●	●			●		

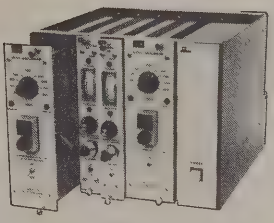
NOTES:
1. Model 362/5 is a dual output unit having one 0 to ±2,000V output and one 0 to ±5,000V output.
2. Output polarity: P=both positive, N=both negative, X=one positive, one negative.
3. 342A, 345A: Double output current is available with increased input.

Size: D: Double width:
2.7″W×8.7″H×9.7″D (69×221×246mm)
S: Single width:
1.35″W×8.7″H×9.7″D (34×221×246mm)

CV/CL: Constant Voltage Current Unit
CV/CC: Constant Voltage Constant Current

• Standard
A - Analog
D - Digital

SPECIFICATIONS ALL MODELS	
Regulation	0.001% line, 0.002% load
Stability	0.01%/hr., 0.02%/8 hrs.
Temp. Coeff	50ppm/ºC, 0 to +50ºC



- Models for all Detector Types
- Single and Dual Output Units
- Reversible Polarity
- High Stability
- ac Line Powered & dc Bin Powered

Bertan offers a complete line of high voltage power supplies in NIM configuration. Modules are available in single or dual width, single or dual output, and with ac or dc input. All models have reversible polarity (except 10 kV units), remote programming, arc and short circuit protection.

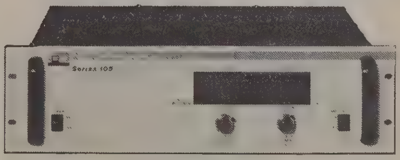
The Series MWPC supplies are designed specifically for multiwire proportional counter applications and include sensitive monitors, precision voltage control, fast and slow overcurrent detection.

Bertan also provides NIM mini-bin enclosures for convenient benchtop mounting of single or dual width NIM modules requiring ac or dc power.

PRECISION SWITCHING LABORATORY POWER SUPPLIES

SERIES 105 1KW

MODEL		OUTPUT	
SERIES 105	SERIES 106	VOLTAGE	CURRENT
105-01R	106-01R	0 to 1kV	0 to 1A
105-02R	106-02R	0 to 2kV	0 to 500mA
105-03R	106-03R	0 to 3kV	0 to 333mA
105-05R	106-05R	0 to 5kV	0 to 200mA
105-10R	106-10R	0 to 10kV	0 to 100mA
105-20R	106-20R	0 to 20kV	0 to 50mA
105-30R	106-30R	0 to 30kV	0 to 33mA
105-50P,N	106-50P,N	0 to 50kV	0 to 20mA



- **Constant Voltage/Constant Current**
- **Auto Crossover**
- **Reversible Polarity**
- **IEEE-488 Interface**

These precision switch mode power supplies have output voltages ranging from 1 to 75 kV. They feature constant voltage and constant current with automatic crossover. For safety and reliability, all models include remote interlock, slow start and power interrupt as well as arc, short and open circuit protection. Remote programming of the power supply output voltage and output current can be accomplished with a remote analog voltage, remote resistance or with an optional IEEE-488 interface (Model 105-C488).

For dedicated remote applications, units are available without front panel controls, digital metering and operating mode indicator lights (Series 106).

Input: 115/230 Vac, 50-60 Hz • **Voltage Regulation:** ±0.02% for ±10% line change, ±0.04% for NL/FL or FL/NL • **Ripple:** 0.1% of setting +0.1% of max. peak to peak • **Current Regulation:** ±0.1% for ±10% line change, ±0.2% for NL/FL or FL/NL • **Temperature Coefficient:** ±100 ppm for constant voltage, ±200 ppm for constant current • **Size:** 19″ x 5.2″ x 17″ (483 x 133 x 432mm) • **Weight:** 45.1 lbs. (20kg)

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PRECISION LINEAR LABORATORY POWER SUPPLIES

SERIES 210 100 to 200W

Model	OUTPUT		
	Voltage	Current	Ripple*
210-01R	0 to ±1kV	0 to 225mA	50mV
210-02R	0 to ±2kV	0 to 100mA	100mV
210-03R	0 to ±3kV	0 to 75mA	100mV
210-05R	0 to ±5kV	0 to 40mA	200mV
210-10R	0 to ±10kV	0 to 15mA	500mV
210-20R	0 to ±20kV	0 to 7mA	1V
210-30R	0 to ±30kV	0 to 4.5mA	1.5V
210-50P,N,R	0 to 50kV	0 to 2.5	5V
210-75P,N	0 to 75kV	0 to 2	5V
210-100P,N	0 to 100kV	0 to 1	10V

**Measured peak to peak at maximum output.*

- **Reversible Polarity**
- **Voltage and Current Metering**
- **Remote Programming and Monitoring**
- **IEEE-488 Interface Available**

The Series 210 is a family of fully enclosed, precision regulated, linear power supplies. They feature an analog meter for current and voltage, remote analog programming and monitoring, reversible polarity (up to 50kV), and direct reading calibrated front panel voltage control.

All models provide arc and short circuit protection for safe, reliable operation. Any model may be ordered with an optional 16 bit binary remote programming. An IEEE-488 interface is also available (Model 200-C488).

MODEL 210-30R

Input: 115/230 Vac, 50-60 Hz, **Line Regulation:** ±0.001% for ±10% line change • **Load Regulation:** ±0.005 for NL/FL or FL/NL • **Temperature Coefficient:** 50ppm per °C • **Remote Programming and Monitoring:** 0 to +5V • **Size:** up to 5kV - 19″ x 5.2″ x 11″ (483 x 133 x 279mm); 10kV-100kV - 19″ x 5.2″ x 16″ (483 x 133 x 406mm)

SERIES 205B/225 15 to 30W

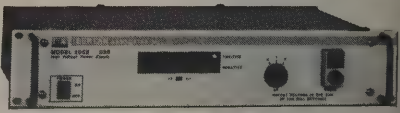
Model 205B/225	OUTPUT		
	Voltage	Current	Ripple*
-01R	0 to ±1kV	0 to 30mA	10mV
-03R	0 to ±3kV	0 to 10mA	30mV
-05R	0 to ±5kV	0 to 5mA	50mV
-10R	0 to ±10kV	0 to 2.5mA	100mV
-20R	0 to ±20kV	0 to 1mA	300mV
-30R	0 to ±30kV	0 to 0.5mA	400mV
-50R	0 to ±50kV	0 to 0.3mA	2V

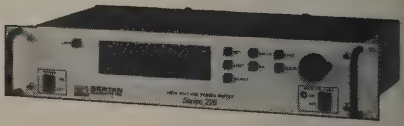
**Measured peak to peak at maximum output.*

- **Reversible Polarity**
- **Digital Voltage and Current Metering**
- **Remote Programming and Monitoring**
- **IEEE-488 Interface***

The Series 205B/225 are a family of fully enclosed, precision regulated, linear power supplies. They feature a digital LED meter for current and voltage, remote analog programming and monitoring, reversible polarity, and direct reading calibrated front panel voltage control.

The Series 206B/226 offers identical performance specifications but omits the front panel controls and meter of the Series 205B/225. All models provide arc and short circuit protection for safe, reliable operation. *An IEEE-488 interface is standard on the 225/226 (Model 200-C488).





Input: 115/230 Vac, 50-60 Hz • **Line Regulation:** ±0.001% for ±10% line change • **Load Regulation:** ±0.005% for NL/FL or FL/NL • **Temperature Coefficient:** 50ppm per °C •**Remote Programming and Monitoring:** 0 to +5 V • **Size:** up to 20 kV - 19″ x 3.5″ x 9.6″ (483 x 89 x 244mm) • **Weight:** 20.1 lbs (9.1kg); 30 kV, 50 kV 19″ x 5.25″ x 16″ (483 x 133 x 406mm)

SERIES 230 15W

Model	OUTPUT		
	Voltage	Current	Ripple*
230-01R	0 to ±1kV	0 to 15mA	10mV
230-03R	0 to ±3kV	0 to 5mA	30mV
230-05R	0 to ±5kV	0 to 3mA	50mV
230-10R	0 to ±10kV	0 to 1.5mA	500mV
230-20R	0 to ±20kV	0 to 600μA	2V
230-30R	0 to ±30kV	0 to 400μA	5V

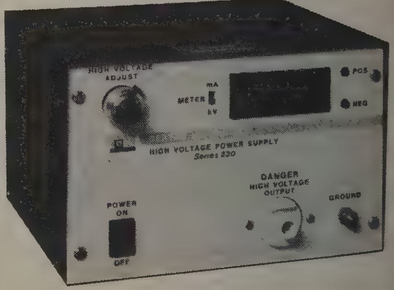
**Measured peak to peak at maximum output*

- **Reversible Polarity**
- **Digital Voltage and Current Meter**
- **Compact, Benchtop**
- **Low Ripple and Noise**

The Series 230 is a family of regulated, compact, precision high voltage power supplies, available with outputs up to 30 kV. Output polarity of all models is reversible. A 3$\frac{1}{2}$ digit LCD meter displays voltage or current (switch selectable). Automatic current limiting and arc protection assure safe, reliable operation.

REM option provides remote output voltage and current monitoring, remote interlock, and increased current limit sensitivity (25% of maximum rated output).

Input: 115/230 Vac, 50-60 Hz • **Line Regulation:** ±0.002% for ±10% line change • **Load Regulation:** ±0.01% for NL/FL or FL/NL • **Temperature Coefficient:** 100ppm per °C. • **Size:** 7.6″ x 7.5″ x 5.2″ (194 x 191 x 128mm) • **Weight:** 10.1 lbs. (4.5kg)


HIGH VOLTAGE ADJUST
mA
METER
kV
POS
NEG
HIGH VOLTAGE POWER SUPPLY Series 230
DANGER HIGH VOLTAGE OUTPUT
GROUND
POWER ON
OFF

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HIGH VOLTAGE SWITCHING MODULES

SERIES 800 100W, 200W and 300W

815, 825, 830		MAXIMUM OUTPUT CURRENT		
MODEL SUFFIX	OUTPUT VOLTAGE	100W SERIES 815	200W SERIES 825	300W SERIES 835
−0.5N,P	0 to 500V	200mA	400mA	600mA
−1N,P	0 to 1kV	100mA	200mA	300mA
−1.5N,P	0 to 1.5kV	66mA	133mA	200mA
−3N,P	0 to 3kV	33mA	66mA	100mA
−5N,P	0 to 5kV	20mA	40mA	60mA
−10N,P	0 to 10kV	10mA	20mA	30mA
−20N,P	0 to 20kV	5mA	10mA	15mA
−30N,P	0 to 30kV	3.3mA	6.6mA	10mA
−50N,P	0 to 50kV	2mA	4mA	6mA
−60N,P	0 to 60kV	1.6mA	3.3mA	5mA

- **Compact high performance models up to 75 kV**
- **Constant voltage/constant current-auto crossover**
- **High efficiency switch-mode technology**
- **Remote programming and monitoring**
- **Custom designs available**

The Series 815, Series 825 and Series 835 are three families of regulated, fixed output polarity, modular, switch mode, high voltage power supplies. Output voltages from 1 to 75 kV are available at up to 100 Watts for the Series 815, up to 200 Watts for the Series 825 and up to 300 Watts for the Series 835.

The user may configure the power supply for internal control or remote operation. Remote features include voltage and current programming, voltage and current monitoring, enable/trip control and operating mode indicator.

All models require 115/230 Vac, 50-60 Hz line power input. Appropriate mating connectors for line power, remote control, remote monitor and the high voltage output are provided.

Line Regulation: 0.02% • **Temperature Coefficient:** less than 100ppm/deg C. • **Ripple:** 0.05% pk-pk for the Series 810 and 0.2% pk-pk for the Series 835. • **Size:** 5 x 5½ x 11″ (127 x 140 x 280mm) for the Series 810 and 5 x 17 x 15″ (127 x 432 x 381mm) for the Series 830.

PHOTOMULTIPLIER MODULES

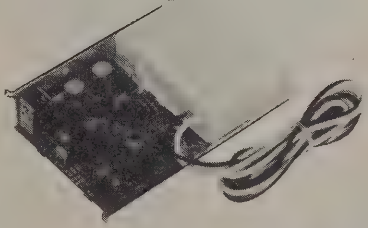
SERIES PMT

Model	OUTPUT		Ripple	Input
	Voltage	Current		
PMT-05C-P,N	0 to 500V	0 to 8mA	5mV	+24 Vdc or ± 12 Vdc
PMT-10C-P,N	0 to 1kV	0 to 4mA	4mV	
PMT-20C-P,N	0 to 2kV	0 to 2mA	2mV	
PMT-50A-P,N	0 to 5kV	0 to 500μA	10mV	
PMT-75A-P,N	0 to 7.5kV	0 to 250μA	100mV	
HV-1250N	0 to −1250V	0 to 2mA	0.001%	+24V ± 5%
HV-1250P	0 to +1250V	0 to 2mA	0.001%	+24V ± 5%
HV-1800N	0 to −1800V	0 to 1mA	0.001%	+24V ± 5%
HV-1800P	0 to +1800V	0 to 1mA	0.001%	+24V ± 5%

Specify output polarity (P or N) and input option: #1 (+24V to +30V) or #3 (± 12V to ± 18V)

- Internal Voltage Control
- Remote Voltage Programming
- Remote Voltage Monitoring
- Low Ripple and Noise
- Economical Small Size Unit
- Direct PC Board Mounting

The PMT Series is a family of high performance regulated dc to dc modular power supplies suitable for OEM or laboratory applications. They feature exceptionally low ripple and noise, local or remote voltage control, remote voltage monitoring, arc and short circuit protection.



SPECIFICATIONS ALL MODELS		
	PMT-05, 10, 20, 50, 75	HV-1250, 1800
Input	1: +24Vdc to +30Vdc 3: ± 12Vdc to ± 18Vdc	+24Vdc
Line Regulation	± 0.001% for ± 1% line change	± 0.001% for ± 1% line change
Load Regulation	± 0.001% for NL-FL or FL-NL	± 0.002% for NL-FL or FL-NL
Stability	0.005%/hr. 0.2%/8 hrs	same
Voltage Programming	0 to +9V or 5k ohm pot	0 to +5V
Voltage Monitor	1% or 0.1% of output voltage	0 to +5V
Size	3.88″ x 6.3″ x 1.25″ (99 x 160 x 32mm)	$2^{3}/_{16}$″ x 1″ x $4^{1}/_{2}$″ (71 x 25 x 114mm)

CAUTION HIGH VOLTAGE 0 TO 1kV @ 4mADC
MODEL PMT-10C

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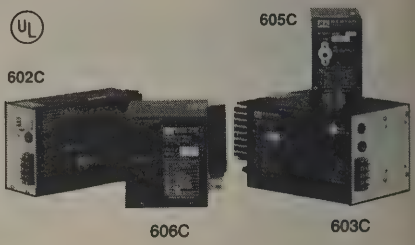
HIGH VOLTAGE LINEAR POWER SUPPLY MODULES

SERIES 600 9 to 30W

602C, 603C, 605C, 606C			MAXIMUM OUTPUT CURRENT			
			ac POWERED UNITS		dc POWERED UNITS	
MODEL SUFFIX	OUTPUT VOLTAGE	RIPPLE*	SERIES 602C	SERIES 603C	SERIES 605C	SERIES 606C
−10P,N	0 to 1kV	15mV	15mA	N.A.	N.A.	N.A.
−15P,N	0 to 1.5kV	15mV	10mA	20mA	6mA	20mA
−30P,N	0 to 3kV	30mV	5mA	10mA	3mA	10mA
−50P,N	0 to 5kV	50mV	2mA	5mA	1.5mA	5mA
−100P,N	0 to 10kV	200mV	1mA	2mA	.75mA	2mA
−150P,N	0 to 15kV	450mV	0.6mA	1.5mA	.4mA	1.5mA
−200P,N	0 to 20kV	800mV	0.4mA	1mA	N.A.	1mA
−300P,N	0 to 30kV	3.0V	N.A.	.4mA	N.A.	.4mA

**Measured peak to peak at maximum output.*



- Low Ripple and Noise
- ac or dc Powered
- Internal Control/Remote Programming
- Voltage and Current Monitoring

The Series 602C, 603C, 605C and 606C are four families of regulated, fixed output polarity modular high voltage power supplies.

The Series 602C and 603C require a standard line input of 115/230Vac (switch selectable), 50-60Hz. The Series 605C and 606C require a +24Vdc input (+28Vdc optionally-available). The units are fully enclosed and designed to satisfy system or bench top operation.

The output voltage is controlled internally by a multi-turn potentiometer. Remote analog voltage or resistance programming is included in all models. Analog monitor outputs are also included for remote monitoring of both the high voltage output and the output current. Remote control capability includes a remote ON/OFF logic input.

Line Regulation: ±0.001% for ±10% input line change. • **Load Regulation:** ±0.002% for 0 to maximum rated output current change. • **Temperature Coefficient (0 to 50°C):** 50ppm of maximum per °C. • **Stability (after ½ hr warm-up):** 0.01% per hour; 0.02% per 8 hours. • **Local Control:** Internal multi-turn potentiometer for 0 to maximum output voltage (±0.2%). • **Remote Programming:** 0 to +5 Volt dc analog input signal. • **Voltage Monitor:** 0 to +5 Volts proportional to 0 maximum output high voltage. • **Current Monitor:** 0 to +5 Volts proportional to 0 to maximum output current. • **Current Limit:** Short circuit current limiting to less than 110% of the maximum rated output current. • **Protection:** Arc and short circuit protected, self-restoring. The input ac line is fused.

MODEL	SIZE	WEIGHTS
602C	5″ x 3.1″ x 8.7″ (127 x 79 x 221mm)	6.75 lbs (3.1kg)
603C	5″ x 5.5″ x 8.5″ (127 x 140 x 216mm)	8.0 lbs (3.64kg)
605C	5″ x 2.75″ x 4.75″ (127 x 70 x 121mm)	3.2 lbs (1.45kg)
606C	5″ x 5.2″ x 4.5″ (127 x 140 x 114mm)	3.5 lbs (1.6kg)

PRECISION HIGH VOLTAGE POWER SUPPLY MODULES

SERIES 612 20W

Model	OUTPUT		
	Voltage	Current	Ripple*
612C-200P,N	0 to 20kV	0 to 1mA	200mV
612C-300P,N	0 to 30kV	0 to 0.5mA	300mV
612C-500P,N	0 to 50kV	0 to 0.3mA	800mV

**Measured peak to peak at maximum output.*

- **High Stability**
- **Low Ripple and Noise**
- **Internal and Remote Control**
- **Voltage and Current Monitoring**

The Series 612C is a family of regulated, fixed output polarity, modular high voltage power supplies. They provide exceptional performance and are ideally suited to many specialized requirements such as CRTs, imaging, ion beam and electron beam applications.

The Series 612C require a standard line voltage of 115/230 Vac (internally selectable), 50-60Hz. The units are fully enclosed and designed for system or bench top operation. Models are available from 20kV up to 50kV.

The output voltage is controlled locally by an internal multi-turn potentiometer. Provision for remote analog voltage or resistance programming is included in all models. Analog monitor outputs are also included for remote monitoring of both the high voltage and current outputs. All units are short circuit current limited and arc protected.

Input: 115 Vac ±10% @ 1A, 50-60 Hz., 230 Vac ±10% @ 0.5A, 50-60 Hz. • **Line Regulation:** ±0.001% of max. for ±10% line change • **Load Regulation:** ±0.002% of max. for 0 to max. rated output current change • **Temperature Coefficient:** 50 ppm of max. per °C • **Stability:** 0.01% per hour; 0.02% per 8 hours • **Local Control:** Internal multi-turn potentiometer for 0 to 102% of max. output voltage • **Remote Programming:** 0 to -5 Vdc analog input signal proportional to 0 to 102% of max. rated output. The programming input impedance is greater than 10 megohms • **Size:** 4.88″ x 8.38″ x 9.75″ (124 x 213 x 248mm) • **Weight:** 9 lbs. (4.1kg)

BERTAN High Voltage 121 New South Road, Hicksville, NY 11801 • **516-433-3110** • Fax: 516-935-1766

BERTAN™
THE HIGH VOLTAGE PEOPLE™

E-BEAM, I-BEAM, X-RAY, CRT AND OEM CUSTOM POWER SUPPLIES

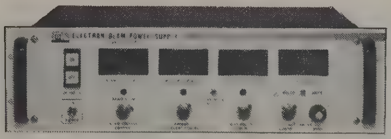
SERIES EB/IB

Model	Beam Power Supply		*Bias Power Supply	
	Voltage	Current	Voltage	Current
EB-30A	0 to −30kV	0 to 500μA	0 to −1000V	0 to 50μA
EB-50A	0 to −50kV	0 to 250μA	0 to −2000V	0 to 50μA
EB-100A	0 to −100kV	0 to 100μA	0 to −2000V	0 to 50μA
IB-30A	0 to +30kV	0 to 500μA	0 to +2000V	0 to 50μA
IB-50A	0 to +50kV	0 to 250μA	0 to +2000V	0 to 50μA
IB-100A	0 to +100kV	0 to 100μA	0 to +2000V	0 to 50μA

Series EB and Series IB are triple output high voltage power supply systems specifically developed for precision electron beam and ion beam applications. Each model contains three independently adjustable power supplies for beam acceleration, bias, and filament. The isolated bias and filament power outputs "float" on the high voltage acceleration output.

In addition to the standard models, custom designed units are available to meet specific requirements.

An IEEE-488 interface is available to provide full control and monitoring capability.



GENERAL SPECIFICATIONS	
*Filament	Voltage: 0 to 5Vdc Current: 0 to 5Adc
Input	115/230V ± 10%, 2A, 50-60Hz
Size	19″ x 5.25″ x 17″ (483 x 133 x 432mm)
Weight	55 lbs. (25kg)

**Bias and Filament "float" at Beam high voltage.*

SERIES XR

Model	TARGET	
	Voltage	Current
XR-20B	0 to 20kV	0 to 15mA
XR-30B	0 to 30kV	0 to 10mA
XR-50B	0 to 50kV	0 to 6 mA
XR-75B	0 to 75kV	0 to 4 mA

Specify target output voltage polarity when ordering.

- **Target Voltage/Current Control**
- **Front Panel/Remote Control**
- **IEEE-488 Interface Available**

The BERTAN Series XR is designed for the operation and control of filamentary X-RAY sources. All units include a regulated high voltage target power supply, an appropriately isolated filament power supply and the intelligent control circuitry to provide adjustable constant target current operation.

Custom designed units can be provided to meet specialized system, test or laboratory applications.

Input: 115/230V ± 10%, 8/4A, 50/60Hz • **Filament:** 0 to 3V @ 0 to 3A • **Size:** 19″ x 5.25″ x 18″ (483 x 133 x 457mm) • **Weight:** 48 lbs (22kg)

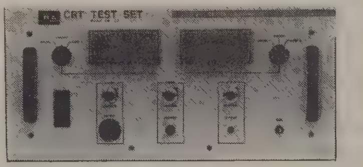
SERIES CRT 30/50

Model	OUTPUT		
	Voltage	Current	Ripple* pk-pk
Anode			
CRT-30	0 to +30kV	0 to 2mA	3V
CRT-50	0 to +50kV	0 to 1.5mA	5V
Focus	0 to +10kV	0 to 1mA	1V
G2	0 to +1kV	0 to 1mA	100mV

**Measured peak to peak at maximum output.*

- **CRT Test System**
- **IEEE-488 Interface Available**

The BERTAN CRT-30 and CRT-50 are three output high voltage power supply systems configured for versatile laboratory, CRT test, or system applications. Calibrated controls and digital displays provide independent control and monitoring of the anode, focus, and G2 voltages and currents. A wide range of options are available, including auxiliary outputs, dynamic focus, digital programming, and a comprehensive IEEE-488 Talker/Listener interface. Custom units can be provided to meet individualized system applications.



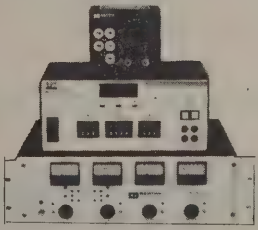
GENERAL SPECIFICATIONS	
Input	115/230V ± 10% 50-60 Hz
Regulation	.01% line, .01% load
Temp. Coeff.	100ppm/ºC, 0 to +50ºC
Accuracy	.25% +.2% of maximum
Size:	19″ x 8.75″ x 15″ (483 x 222 x 381mm)

SERIES OEM

- **Outputs up to 100kV, 1kW**
- **ac to dc, dc to dc**
- **Single or Multiple Output**
- **Microprocessor Control**
- **Analog and Digital Programming including IEEE-488**
- **Custom Interfacing**
- **UL/CSA/VDE APPROVALS**

BERTAN specializes in designing and producing custom and OEM systems with unique electrical and mechanical features. Our experienced engineering staff, equipped with the most advanced design and analytical tools, including CAD/CAM, enables us to provide cost effective, timely solutions to your particular power supply problems. Our modern 40,000 sq. ft. manufacturing facility is staffed and organized to satisfy both large and small quantity production requirements.

Complete in-house quality control accompanies each custom product. From the determination of specifications and configurations through full production and delivery, the utmost attention is given to optimizing quality and reliability while minimizing cost. Each power supply is fully burned in and tested to ensure that it meets or exceeds all performance requirements.



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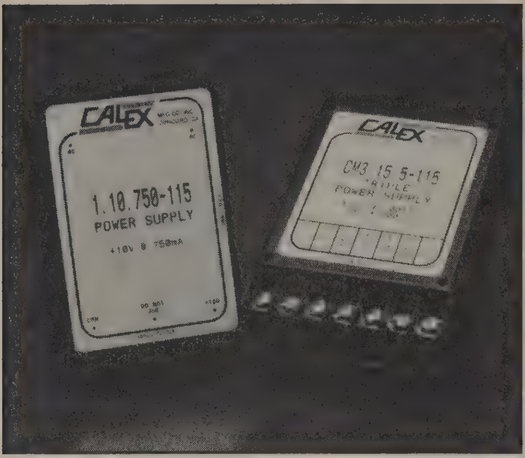
CALEX Encapsulated AC/DC Linear Power Supplies



All CALEX linear power supplies are built for excellent performance in even the most rugged environments. Their industry standard pin configurations make them ideal for use with most operational amplifiers, function modules and data conversion circuits.

COMMON SPECIFICATIONS

Input Voltage	100 ±10 VAC (add "-100" to model number) 115 ±10 VAC (add "-115" to model number) 220 ±20 VAC (add "-220" to model number) 230 ±20 VAC (add "-230" to model number) 240 ±20 VAC (add "-240" to model number)
Input Frequency Range	50 to 60 Hz
Input to Output Isolation	1000-2500 VRMS, depending on model
Input to Output Resistance	50 Megohms minimum
Capacitance	50-250 pF, depending on model
Overvoltage Protection	Standard on all 5 Volt singles except models 21-30 and 7009
Temperature Coefficient	+0.01%/°C typical
Storage Temperature	-25° to +85°C
Case Operating Temperature with No Derating	-25°C to +50°C
Short Circuit Protection	Foldback current limiting on all except models 21-12, 21-30 and 22-40, which have constant current limiting
Mounting Kits	Available for the PC board mountable cases

5 YEAR WARRANTY

CASE SIZE

CASE	CASE DIMENSION
A	3.0" x 2.0" x 1.0"
B1	3.5" x 2.5" x 0.875"
B2	3.5" x 2.5" x 1.25"
B3	3.5" x 2.5" x 1.56"
C	2.26" x 1.75" x 1.00"
CM	4.0" x 2.7" x 1.4"

PRINTED CIRCUIT BOARD MOUNTING CASES

OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	LINE & LOAD REGULATION	NOISE & RIPPLE mV RMS	CASE SIZE	MODEL NUMBER	PRICE (1-9)
SINGLE OUTPUT						
5	300	±0.20%	2	★C	21-30	$64.00
5	500	±0.10%	1	B1	1.5.500	$78.00
5	1000	±0.10%	1	B2	1.5.1000	$100.00
**5	1000	±0.10%	1	B2	1.5.1000-DV	$110.00
♦5	1000	±0.10%	1	B2	7009	$130.00
5	2000	±0.20%	2	B3	1.5.2000	$125.00
**5	2000	±0.20%	2	B3	1.5.2000-DV	$135.00
9	1000	±0.10%	2	B3	1.9.1000	$120.00
10	750	±0.10%	1	B3	1.10.750	$125.00
12	120	±0.20%	2	★C	21-12	$64.00
12	480	±0.04%	2	B2	1.12.480	$115.00
**12	480	±0.04%	2	B2	1.12.480-DV	$120.00
12	750	±0.04%	2	B3	1.12.750	$125.00
15	400	±0.04%	2	B2	1.15.400	$100.00
15	600	±0.04%	2	B3	1.15.600	$125.00
18	500	±0.04%	2	B3	1.18.500	$120.00
24	375	±0.04%	2	B3	1.24.375	$125.00
DUAL OUTPUT						
±5	±750	±0.10%	1	B3	2.5.750	$125.00
±12	±120	±0.04%	1	B1	2.12.120	$78.00
±12	±120	±0.04%	2	A	22-120	$87.00
±12	±240	±0.04%	1	B2	2.12.240	$100.00
**±12	±240	±0.04%	1	B2	2.12.240-DV	$110.00
±12	±360	±0.04%	2	B3	2.12.360	$125.00
±15	±50	±0.04%	1	B1	2.15.50	$70.00
±15	±50	±0.20%	2	★C	22-40	$64.00
±15	±100	±0.04%	1	B1	2.15.100	$78.00
±15	±100	±0.04%	2	A	22-100	$87.00
±15	±200	±0.04%	1	B2	2.15.200	$100.00
**±15	±200	±0.04%	1	B2	2.15.200-DV	$110.00
♦±15	±200	±0.04%	1	B2	7010	$145.00
±15	±350	±0.04%	2	B3	2.15.350	$125.00
TRIPLE OUTPUT						
±12 & 5	±100 & 600	*±0.10%	2	B2	3.12.5	$123.00
±15 & 5	±100 & 500	±0.10%	2	B2	3.15.5	$123.00
±12 & 5	±125 & 1000	±0.20%	2	B3	3.12.1000	$150.00
±15 & 5	±100 & 1000	±0.20%	2	B3	3.15.1000	$150.00

* The +5V output load regulation in the 3.12.5-100 and 3.12.5-115 models is ±0.2%

**Dual AC Input 115/230VAC

♦Recognized to UL 544 available in 115 VAC only

★ C case size units output current is ½ @ 50Hz

CHASSIS MOUNTING CASES

OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	LINE & LOAD REGULATION	NOISE & RIPPLE mV RMS	CASE SIZE	MODEL NUMBER	PRICE (1-9)
SINGLE OUTPUT						
5	500	±0.10%	1	CM	CM1.5.500	$88.00
5	1000	±0.10%	1	CM	CM1.5.1000	$115.00
10	400	±0.10%	1	CM	CM1.10.400	$115.00
12	500	±0.10%	1	CM	CM1.12.500	$115.00
15	400	±0.10%	1	CM	CM1.15.400	$115.00
250	30	±2.0%	5	CM	CM1.250.30	$115.00
DUAL OUTPUT						
±12	±120	±0.04%	1	CM	CM2.12.120	$88.00
±12	±240	±0.04%	1	CM	CM2.12.240	$115.00
±15	±50	±0.04%	1	CM	CM2.15.50	$84.00
±15	±100	±0.04%	1	CM	CM2.15.100	$88.00
±15	±200	±0.04%	1	CM	CM2.15.200	$115.00
TRIPLE OUTPUT						
±12 & 5	±100 & 600	±0.10%	2	CM	CM3.12.5	$134.00
±15 & 5	±100 & 500	±0.10%	2	CM	CM3.15.5	$134.00

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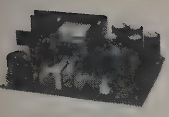
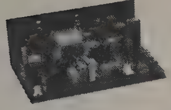
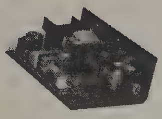
CHEROKEE INTERNATIONAL, INC.

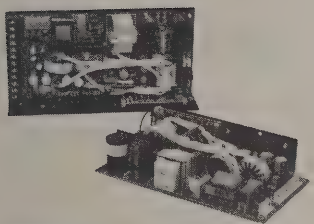
SWITCHING POWER SUPPLIES







QFI-24



QT1-16

QF7 35/43 Watts up to 3 Outputs

(3.00×5.25×1.65) Notes: 2, 4/Options: F

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	5	6	+12	1	1.5	−12	.5	1			
B	+5	5	6	+15	1	1.5	−15	.5	1			
C	+5	5	6	+12	1	1.5	− 5	.5	1			
D	+5	5	6	+24	1	1.0	−12	.5	1			
E	+5	5	6	+24	1	1.0	− 5	.5	1			

QF1 50/60 Watts up to 3 Outputs

(3.90×5.80×1.88) Notes: 1, 2, 3 5/Options: F/Weight: 14 oz.

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	4.0	5.0	+12	3.0	4.0	−12	0.5	1.0			
B	+5	4.0	5.0	+12	3.0	4.0	− 5	0.5	1.0			
C	+5	4.0	5.0	+24	2.0	2.5	−12	0.5	1.0			
D	+5	4.0	5.0	+24	2.0	2.5	− 5	0.5	1.0			
E	+5	4.0	5.0	+12	3.0	4.0	—	—	—			
F	+5	4.0	5.0	+24	2.0	2.5	—	—	—			
G	+5	4.0	5.0	+15	2.0	3.0	−15	0.5	1.0			
J	+5	6.0	8.0	—	—	—	—	—	—			

QF2, 50/60 Watts up to 4 Outputs

(3.90×5.80×1.88) Notes: 1, 2, 3 5/Options: F/Weight: 14 oz.

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	4.0	5.0	+12	3.0	4.0	−12	0.5	1.0	−5	0.1	—
B	+5	4.0	5.0	+12	3.0	4.0	− 5	0.5	1.0	—	—	—
C	+5	4.0	5.0	+24	2.0	2.5	−12	0.5	1.0	−5	0.1	—
D	+5	4.0	5.0	+24	2.0	2.5	− 5	0.5	1.0	—	—	—
E	+5	4.0	5.0	+12	3.0	4.0	—	—	—	—	—	—
F	+5	4.0	5.0	+24	2.0	2.5	—	—	—	—	—	—
G	+5	4.0	5.0	+15	2.0	3.0	−15	0.5	1.0	−5	0.1	—
J	+5	6.0	8.0	—	—	—	—	—	—	—	—	—
K	+5	4.0	5.0	+15	2.0	3.0	−15	0.5	1.0	—	—	—

QF22 and 23, 50/70 Watts up to 4 Outputs

(3.90×5.80×1.70) Weight: 11 oz.

QF22-FCC, VDE Level A
QF23-FCC, VDE Level B

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	10	12	+12	4	5	−12	1	—	5	1	—
B	+5	10	12	+24	2	2.5	−12	1	—	5	1	—
C	+5	10	12	+12	4	5	−12	1	—	12	1	—
D	+5	10	12	+15	4	5	−15	1	—	5	1	—
E	+5	10	12	—	—	—	−12	1	—	12	1	—
F	+5	10	12	+12	4	5	—	—	—	—	—	—
G	+5	14	16	—	—	—	—	—	—	—	—	—
H	+12	6	7	—	—	—	—	—	—	—	—	—
I	+5	4	—	+12	4	9	—	—	—	—	—	—

QF24 and 25, 65/85 Watts up to 4 Outputs

(4.08×5.90×2.25) Weight: 1 lb. 5 oz.

QF24-FCC, VDE Level A
QF25-FCC, VDE Level B

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	10	12	+12	4	5	−12	1	—	5	1	—
B	+5	10	12	+24	2	2.5	−12	1	—	5	1	—
C	+5	10	12	+12	4	5	−12	1	—	12	1	—
D	+5	10	12	+15	4	5	−15	1	—	5	1	—
E	+5	10	12	—	—	—	−12	1	—	12	1	—
F	+5	10	12	+12	4	5	—	—	—	—	—	—
G	+5	14	16	—	—	—	—	—	—	—	—	—
H	+12	6	7	—	—	—	—	—	—	—	—	—
I	+5	4	—	+12	4	9	—	—	—	—	—	—

QF3 70/85 Watts up to 3 Outputs

(4.08×5.90×2.25) Notes: 1, 2, 3/Options: F/Weight 1 lb., 5 oz.

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	7.5	9.0	+12	4.0	5.0	−12	0.5	1.0			
B	+5	7.5	9.0	+12	4.0	5.0	− 5	0.5	1.0			
C	+5	7.5	9.0	+24	2.5	3.0	−12	0.5	1.0			
D	+5	7.5	9.0	+24	2.5	3.0	− 5	0.5	1.0			
E	+5	7.5	9.0	+12	4.0	5.0	—	—	—			
F	+5	7.5	9.0	+24	2.5	3.0	—	—	—			
G	+5	7.5	9.0	+15	3.0	4.0	−15	0.5	1.0			
J	+5	10.0	12.0	—	—	—	—	—	—			

QF4, 70/85 Watts up to 4 Outputs

(4.08×5.90×2.25) Notes: 1, 2, 3/Options: F/Weight: 1 lb. 5 oz.

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	8.0	9.0	+12	4.0	5.0	−12	0.5	1.0	−5	0.1	—
B	+5	8.0	9.0	+12	4.0	5.0	− 5	0.5	1.0	—	—	—
C	+5	8.0	9.0	+24	2.5	3.0	−12	0.5	1.0	−5	0.1	—
D	+5	8.0	9.0	+24	2.5	3.0	− 5	0.5	1.0	—	—	—
E	+5	8.0	9.0	+12	4.0	5.0	—	—	—	—	—	—
F	+5	8.0	9.0	+24	2.5	3.0	—	—	—	—	—	—
G	+5	8.0	9.0	+15	3.0	4.0	−15	0.5	1.0	−5	0.1	—
J	+5	10.0	12.0	—	—	—	—	—	—	—	—	—
K	+5	8.0	9.0	+15	3.0	4.0	−15	0.5	1.0	—	—	—

QF6 100/125 Watts Single Outputs

(4.30×6.30×2.50) Notes: 2, 4/Options: F

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+2	25	25									
B	+5	25	25									
C	+5.2	25	25									
D	+12	10	10									
E	+15	9	9									
F	+24	4.5	4.5									
G	+28	4.5	4.5									
H	+48	2	2									

QT1 and 11 100/125 Watts up to 3 Outputs

(4.56×8.25×1.92) Notes: 1, 2, 3, 5/Options: A, B, F/Weight: 1 lb., 4 oz.

QT1 =MTA CONNECTOR
QT11=TERMINAL BLOCK

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	15.0	20.0	+12	4.0	8.0	−12	1.0	1.5			
B	+5	15.0	20.0	+12	4.0	8.0	− 5	0.5	1.0			
C	+5	15.0	20.0	+15	4.0	8.0	−15	1.0	1.5			
D	+5	15.0	20.0	+24	4.0	5.0	−25	1.0	1.5			
E	+5	20.0	25.0	—	4.0	—	—	—	—			
F	+5	15.0	20.0	+12	4.0	8.0	—	—	—			
I	+5	10.0	15.0	+24	4.0	6.0	—	—	—			

QT2 and 12 125/150 Watts up to 3 Outputs

(4.75×8.30×2.40) Notes: 1, 2, 3/Options: A, B, D, F/Weight: 2 lb., 8 oz.

QT2 =MTA CONNECTOR
QT12=TERMINAL BLOCK

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp
A	+5	20.0	25.0	+12	6.0	10.0	−12	1.0	1.5			
B	+5	20.0	25.0	+12	6.0	10.0	− 5	0.5	1.0			
C	+5	20.0	25.0	+15	6.0	10.0	−15	1.0	1.5			
D	+5	20.0	25.0	+24	4.0	5.0	−24	1.0	1.5			
E	+5	25.0	30.0	—	—	—	—	—	—			
F	+5	20.0	25.0	+12	6.0	10.0	—	—	—			
I	+5	10.0	15.0	+24	6.0	8.0	—	—	—			

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CHEROKEE INTERNATIONAL, INC.

SWITCHING POWER SUPPLIES

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp

QT3 and 13 100/125 Watts up to 4 Outputs

(4.56 x 8.25 x 1.92) Notes: 1, 2, 3, 5/Options: A, B, F/Weight: 1 lb., 14 oz.

QT3 = MTA CONNECTOR
QT13 = TERMINAL BLOCK

A	+5	15.0	20.0	+12	4.0	8.0	−12	1.0	1.5	− 5	0.5	1.0
B	+5	15.0	20.0	+24	3.0	5.0	−24	1.0	1.5	−12	0.5	1.0
C	+5	15.0	20.0	+15	4.0	8.0	−15	1.0	1.5	−12	0.5	1 0

QT4 and 14 125/140 Watts up to 4 Outputs

(4.75 x 8.30 x 2.40) Notes: 1, 2, 3/Options: A, B, D, F/Weight: 2 lbs., 8 oz.

QT4 = MTA CONNECTOR
QT14 = TERMINAL BLOCK

A	+5	20.0	25.0	+12	4.0	8.0	−12	1.0	1.5	− 5	0.5	1.0
B	+5	20.0	25.0	+24	3.0	5.0	−24	1.0	1.5	−12	0.5	1 0
C	+5	20.0	25.0	+15	4 0	8.0	−15	1 0	1.5	−12	0.5	1 0

QP-QC

QT5 and 15 125/150 Watts up to 4 Outputs

(4.71 x 9.40 x 1.92) Notes: 1, 2, 3, 5/Options: A, B, E, F/Weight: 2 lbs., 8 oz.

QT5 = MTA CONNECTOR
QT15 = TERMINAL BLOCK

A	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	24	4.0	8.0
B	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	12	4.0	8.0
C	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	5	4.0	8.0
D	+5	10.0	25.0	−12	4.5	5.0	—	—	—	+24	4.0	8.0
E	5	20.0	25.0	—	—	—	—	—	—	12	4.0	8.0
F	5	25.0	30.0	—	—	—	—	—	—	—	—	—
G	5	20.0	25.0	+24	1.0	1.5	−12	0.5	1.0	12	4.0	8.0
H	5	20.0	25.0	15	2.0	3.0	—	—	—	15	4.0	8.0
I	5	20.0	25.0	+15	2.0	3.0	−15	1.0	1.5	24	4.0	8 0

QT6 and 16 150/175 Watts up to 4 Outputs

(4.90 x 9.50 x 2.40) Notes: 1, 2, 3/Options: A, B, D, E, F/Weight: 3 lbs.

QT6 = MTA CONNECTOR
QT16 = TERMINAL BLOCK

A	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	24	5.0	8.0
B	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	12	6.0	8.0
C	5	20.0	25.0	+12	2.0	3.0	−12	1.0	1.5	5	6.0	8 0
D	+5	10.0	20.0	−12	4.5	5.0	—	—	—	+24	5.0	8.0
E	5	20.0	25.0	—	—	—	—	—	—	12	6.0	8.0
F	5	25.0	30.0	—	—	—	—	—	—	—	—	—
G	5	20.0	25.0	+24	1.0	1.5	−12	0.5	1.0	12	6.0	8.0
H	5	20.0	25.0	15	2.0	3.0	—	—	—	15	5.0	8.0
I	5	20.0	25.0	+15	3.0	—	−15	1.0	1.5	24	5.0	8.0

QX5-10

QT9 and 19 125/150 Watts up to 3 Outputs

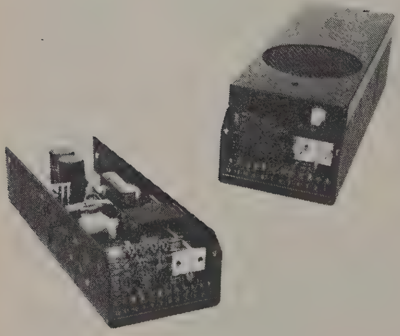
(4.75 x 8.30 x 2.40) Notes: 2, 4/Options: A, B, D, E, F

A	5	20	25	12	6	10	12	4.5	6			
B	5	20	25	12	6	10	5	4.5	6			
C	5	20	25	15	6	10	15	4.5	6			
D	5	20	25	24	4	5	12	3.0	4			

QC3 175/225 Watts up to 3 Outputs

(5.38 x 9.50 x 2.50) Notes: 1, 2, 3/Options: A, B, C, D, E, F, H, M, N/Weight: 3 lbs., 14 oz.

A	5	25	30	12	7.0	10.0	12	3.0	3.0			
B	5	25	30	12	7.0	10.0	5	3.0	3.0			
C	5	25	30	12	7.0	10.0	24	3.0	3.0			
D	5	25	30	24	6.0	8.0	12	3.0	3.0			
E	5	25	30	24	6.0	8.0	5	3.0	3.0			
F	5	25	30	5	7.0	10.0	12	3.0	3.0			
G	5	25	30	5	7.0	10.0	24	3.0	3.0			



QS3-4

QP1 175/200 Watts up to 3 Outputs

(4.25 x 10.00 x 2.50) Notes: 1, 2, 3/Options: A, C, D, F, G, R/Weight: 3 lbs., 3 oz.

A	5	20	25	12	2.5	3	12	6	10			
B	5	20	25	12	4.0	6	12	4	6			
C	5	10	15	12	2.5	3	12	6	10			
D	5	10	15	12	4.0	6	12	4	6			
E	5	20	25	5	2.5	3	12	6	10			
F	5	20	25	5	4.0	6	12	4	6			
G	5	10	15	24	2.5	3	12	6	10			
H	5	10	15	24	4.0	6	12	4	6			
I	5	10	15	12	2.5	3	24	6	10			
J	5	10	15	12	4.0	6	24	4	6			
K	5	20	25	12	4.0	6	5	6	10			
L	5	20	25	24	2.5	3	5	6	10			

QP2 225/250 Watts up to 3 Outputs

(4.25 x 10.00 x 2.50) Notes: 1, 2, 3/Options: A, C, D, F, G, R/Weight: 3 lbs., 4 oz.

A	5	40	45	12	2.5	3	12	6	10			
B	5	40	45	12	4.0	6	12	4	6			
C	5	40	45	5	2.5	3	12	6	10			
D	5	40	45	5	4.0	6	12	4	6			
E	5	40	45	24	2.5	3	12	6	10			
F	5	40	45	24	4.0	6	12	4	6			
G	5	40	45	12	2.5	3	24	6	10			
H	5	40	45	5	2.5	3	24	6	10			
I	5	40	45	5	4.0	6	24	4	6			
J	5	40	45	12	2.5	3	5	6	10			
K	5	40	45	24	2.5	3	5	6	10			

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SWITCHING POWER SUPPLIES

FEATURES/BENEFITS

- All products are warranted to be free of defects in materials and workmanship for a period of one year
- Custom and standard products
- Many models are available off-the-shelf for immediate delivery
- Engineering and manufacturing capacity to support major OEM programs
- 0°-70° operating ambient
- 75% efficiency typical
- All outputs are rated for nominal and peak current
- All models are rated for convection and forced air cooling
- Accommodates high peak drive requirements
- AC input provisions
  - —Power Factor Correction
  - —90-132/180-264 VAC, 37-440 Hz
  - —Jumper relocation for VAC range selection
  - —Input surge current limited
  - —Brown out protected
  - —Autoranging
- DC output provisions
  - —Complete overload protection
  - —Overvoltage protected
  - —Reverse voltage protected
  - —Low noise outputs
  - —High hold-up time
  - —Current sharing

Total Power (Watts) Convection/ Forced Air		Single Output	Dual Output	Triple Output	Quad Output	Five Output
35	43		QF7	QF7		
50	60	QF2	QF2	QF1/ QF2	QF2	
70	85	QF6	QF3/ QF4	QF3/ QF4	QF4	
100	125	QF6	QT1/ QT11	QT1/ QT11	QT3/ 13	
125	150	QT2/ QT12	QT2/ QT12	QT2/ QT12 QT9 QT19	QT4/ 14 QT5/ 15	
150	175	QT6/ QT16	QT6/ QT16	QT6/ QT16	QT6/ QT16	
175	200 225	QP2	QP2	QP1 QC3	QP3	
225	250	QX5	QP2	QP2 QP4	QP3	QX6
250	300 325	QX5	QX5 QX9 QX10	QX5 QX9 QX10	QX5 QX10	QX6
275	325	QX6	QX6	QX6	QX5	QX6
300	350	QS5	QP5	QP5	QS3	QS3
300	400	QS5	QS3	QS3	QS3	QS3
	400 (includes fan)	QD13	QX11 QD13	QX11 QD13	QD13	
	500 (includes fan)	QS6 QD4	QS4 QD4	QS4 QD4	QS4 QD4	QS4
	750	QD5	QD5	QD5	QD5	
	1000	QD6 QD16	QD6 QD16	QD6 QD16	QD6 QD16	
	1500	QD7	QD7	QD7	QD7	
	2000	QD8	QD8	QD8	QD8	

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Standard Output Combination	Output 1			Output 2			Output 3			Output 4			Output 5		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp

QP3 225/250 Watts up to 4 Outputs

(4.25 x 10.00 x 2.50) Notes: 1, 2, 3/Options: A, C, D, E, F, G, N, R/Weight: 3 lbs., 4 oz.

A	5	40	45	+12	2.0	3.0	−12	1.0	1.5	+ 5	6	10			
B	5	40	45	+12	2.0	3.0	−12	1.0	1.5	+12	6	10			
C	5	40	45	+12	2.0	3.0	−12	1.0	1.5	+24	6	10			
D	5	40	45	+ 5	2.0	3.0	− 5	1.0	1.5	+12	6	10			
E	5	40	45	+ 5	2.0	3.0	− 5	1.0	1.5	+24	6	10			
F	5	40	45	+24	1.0	1.5	−12	.1	.25	+12	6	10			
G	5	40	45	+24	1.0	1.5	−24	1.0	1.5	+12	6	10			
H	5	40	45	+24	1.0	1.5	− 5	.1	.25	+12	6	10			
I	5	40	45	+12	2.0	3.0	− 5	.1	.25	+24	6	10			

QP4 225/250 Watts up to 3 Outputs DC to DC

(4.25 x 10.00 x 2.50) Notes: 1, 2, 3/Options: A, C, D/Weight: 3 lbs., 5 oz.

A	5	40	45	12	2.5	3	12	6	10						
B	5	40	45	12	4.0	6	12	4	6						
C	5	40	45	5	2.5	3	12	6	10						
D	5	40	45	5	4.0	6	12	4	6						
E	5	40	45	24	2.5	3	12	6	10						
F	5	40	45	24	4.0	6	12	4	6						
G	5	40	45	12	2.5	3	24	6	10						
H	5	40	45	5	2.5	3	24	6	10						
I	5	40	45	5	4.0	6	24	4	6						
J	5	40	45	12	2.5	3	5	6	10						
K	5	40	45	24	2.5	3	5	6	10						

QP5 300/350 Watts up to 3 Outputs DC to DC

(4.25 x 10.00 x 3.50) Notes: 2, 4/Options: A, C, F, G, R

A	5	50	55	12	2.5	3	12	6	10						
B	5	50	55	12	4.0	6	12	4	6						
C	5	50	55	5	2.5	3	12	6	10						
D	5	50	55	5	4.0	6	12	4	6						
E	5	50	55	24	2.5	3	12	6	10						
F	5	50	55	24	4.0	6	12	4	6						
G	5	50	55	12	2.5	3	24	6	10						

QP6 300/350 Watts up to 3 Outputs

(4.25 x 10.00 x 3.50) Notes: 2, 4/Options: A, C, F, G, R

A	5	50	55	12	2.5	3	12	6	10						
B	5	50	55	12	4.0	6	12	4	6						
C	5	50	55	5	2.5	3	12	6	10						
D	5	50	55	5	4.0	6	12	4	6						
E	5	50	55	24	2.5	3	12	6	10						
F	5	50	55	24	4.0	6	12	4	6						
G	5	50	55	12	2.5	3	24	6	10						

QX5 250/300 Watts up to 4 Outputs

(5.00 x 13.50 x 2.50) Notes: 1, 2, 3/Options: A, B, C, D, F, H, K, N/Weight: 4 lbs., 13 oz.

A	5	50	60	+12	5	—	−12	3	—	Aux Rtn	—	—			
B	5	50	60	+12	5	—	−12	3	—	− 5	1	—			
C	5	50	60	+15	5	—	−15	3	—	Aux Rtn	—	—			
D	5	50	60	+15	5	—	−15	3	—	− 5	1	—			
E	5	50	60	+12	5	—	− 5	3	—	Aux Rtn	—	—			
F	5	50	60	+12	5	—	− 5	3	—	−12	1	—			
G	5	30	40	+24	5	—	−12	1.5	—	Aux Rtn	—	—			
H	5	30	40	+24	5	—	−12	1.5	—	+12	2.5	3.0			
I	5	30	40	+24	5	—	−12	1.5	—	− 5	1	1.3			
J	5	30	40	+12	5	—	−12	3	—	+24	1.0	3.0			
K	5	50	60	+12	5	—	—	3	—	−12	1	1.3			
M	+5	30	40	+12	6	8	−12	3	—	Aux Rtn	—	—			

QX6 275/325 Watts up to 5 Outputs

(5.00 x 13.50 x 2.50) Notes: 1, 2, 3/Options: A, B, C, D, F, K, N/Weight: 4 lbs., 13 oz.

A	5	50	60	+12	5	—	−12	2.5	3.0	Aux Rtn	—	—	+12	6	8
B	5	50	60	+12	5	—	−12	2.5	3.0	− 5	1	—	+12	6	8
C	5	50	60	+12	5	—	− 5	2.5	3.0	Aux Rtn	—	—	+12	6	8
D	5	50	60	+12	5	—	− 5	2.5	3.0	−12	1	—	+12	6	8
E	5	30	40	+12	5	—	−12	2.5	3.0	Aux Rtn	—	—	+24	6	8
F	5	30	40	+12	5	—	−12	2.5	3.0	− 5	1	—	+24	6	8
G	5	30	40	+12	5	—	− 5	2.5	3.0	Aux Rtn	—	—	+24	6	8
H	5	30	40	+12	5	—	− 5	2.5	3.0	−12	1	—	+24	6	8
I	5	30	40	+12	5	—	−12	2.5	3.0	Aux Rtn	—	—	+12	10	12
J	5	30	40	+12	5	—	−12	2.5	3.0	− 5	1	—	+12	10	12
K	5	30	40	+12	5	—	− 5	2.5	3.0	Aux Rtn	—	—	+12	10	12
L	5	30	40	+12	5	—	− 5	2.5	3.0	−12	1	—	+12	10	12
M	+5	30	40	+24	6	8	−12	2.5	3.0	Aux Rtn	—	—	+24	6	8

QX9 250/325 Watts up to 3 Outputs

(5.00 x 13.50 x 2.50) Notes: 1, 2, 3/Options: A, C, D, F, M, N/Weight: 4 lbs., 13 oz.

A	5	40	45	12	5	—	12	10	15						
B	5	30	45	12	5	—	24	8	12						
C	5	40	45	5	5	—	12	10	15						
D	5	30	45	5	5	—	24	8	12						
E	5	30	45	24	5	—	12	10	15						
F	5	20	45	24	5	—	24	8	12						
G	5	25	30	12	7	12	12	10	15						
H	5	15	20	12	7	12	24	8	16						

CHEROKEE INTERNATIONAL, INC.
SWITCHING POWER SUPPLIES

OPTIONS

- A) Remote On/Off
- B) Power Fail
- C) Thermal Shut Down
- D) EMI/Safety Cover
- E) Not Standard (Special per Series)*
- F) Wire for 230 VAC
- G) 115/230 VAC Remote Selection
- H) "L" Chassis Substitution for "U" Chassis
- J) AC Input in Same Side as DC Output
- K) ¼-20 Studs in lieu of Terminal Block on Output 1 (QX5 and QX6 only)
- L) ¼-20 Studs are not Applicable on Output 1 (QS3 and QS4 only)
- M) Internal VAC range Selection (QC3, QX9, QX10)
- N) Fan Output (QX5, QX6, QX9, QX10)
- P) Under Voltage Protection (QX9)
- R) Reverse Remote On/Off
- S) Reverse Power Fail
- T) Horizontal Output Studs (QS5-6)
- U) Fan at end, not top (QS6)

NOTES

1) UL Recognized, CSA Certified
2) TUV Approved
3) Fully compliant with FCC and VDE (Level A) standards for EMI
4) All EMI standards met with economical external filter
5) Increased output power can be obtained by appropriate heat sink mounting

ORDERING INFORMATION

OPTIONS*

QS 4 — A 1 A B C F J L

Series

Case/
Configuration

Output Combinations
(See AVAILABLE
OUTPUTS)

Version 1 = Standard)

Eliminate
Output 1
Studs

AC Input
at DC End
(See Photo)

Wire for
230 VAC

Thermal
Shutdown

Power Fail (Good)

Remote On/Off

*List all OPTIONS selected

Standard Output Combination	Output 1			Output 2			Output 3			Output 4			Output 5		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp

QX10 250/325 Watts up to 4 Outputs

(5.00 x 13.50 x 2.50) Notes: 1, 2, 3/Options: A, C, D, F, M, N/Weight: 4 lbs., 13 oz.

A	+5	20	25	−5	20	25	12	5	—	12	10	15			
B	+5	15	20	−5	15	20	12	5	—	24	8	12			
C	+5	15	20	−5	15	25	24	5	—	12	10	15			
D	+5	15	25	−5	15	25	24	5	—	24	8	12			
E	+5	15	25	−5	15	25	12	7	10	12	10	15			
F	+12	10	15	−12	10	15	24	5	—	5	10	15			
G	+24	8	12	−24	8	12	12	5	—	5	10	15			

QX11 400 Watts up to 3 Outputs

(5.00 x 13.50 x 3.40) Notes: 1, 2, 3/Options: A, C, D, F, M, N, R/Weight: 5 lbs., 6 oz.

A	5	40	45	12	5	—	12	12	14						
B	5	30	45	12	5	—	24	10	14						
C	5	40	45	5	5	—	12	12	14						
D	5	30	45	5	5	—	24	10	14						
E	5	30	45	24	5	—	12	12	14						
F	5	20	30	24	5	—	24	12	20						
G	5	20	30	12	7*	10	12	12	20						
H	5	20	30	12	7*	10	24	12	20						

*2% Load Regulation

QS3 300/400 Watts up to 5 Outputs

(5.00 x 14.95 x 3.12) Notes: 1, 2, 3/Options: A, B, C, D, E, F, L/Weight: 7 lbs., 11 oz.

B	5	80	90	+12	6	7	−12	6	7	−5	6	7	24	10	14
C	5	80	90	+15	6	7	−15	6	7	—	—	—	—	—	—
D	5	80	90	+12	6	7	−12	6	7	−5	6	7	12	12	18
E	5	80	90	+12	6	7	−12	6	7	−5	6	7	—	—	—
G	5	80	90	+12	6	7	−12	6	7	—	—	—	24	10	14
I	5	80	90	+12	6	7	−12	6	7	—	—	—	12	12	18
J	5	80	90	+12	6	7	−12	6	7	—	—	—	—	—	—
L	5	80	90	+24	5	6	−12	6	7	−5	6	7	12	12	18
M	5	80	90	—	—	—	−12	6	7	−5	6	7	24	10	14

QS4 500 Watts up to 5 Outputs

(5.00 x 14.95 x 4.13) Notes: 1, 2, 3/Options: A, B, C, D, F, J, L/Weight: 9 lbs., 2 oz.

B	5	80	90	+12	6	7	−12	6	7	−5	6	7	24	10	14
C	5	80	90	+15	6	7	−15	6	7	—	—	—	—	—	—
D	5	80	90	+12	6	7	−12	6	7	−5	6	7	12	12	18
E	5	80	90	+12	6	7	−12	6	7	−5	6	7	—	—	—
G	5	80	90	+12	6	7	−12	6	7	—	—	—	24	10	14
I	5	80	90	+12	6	7	−12	6	7	—	—	—	12	12	18
J	5	80	90	+12	6	7	−12	6	7	—	—	—	—	—	—
L	5	80	90	+24	5	6	−12	6	7	−5	6	7	12	12	18
M	5	80	90	—	—	—	−12	6	7	−5	6	7	24	10	14

QS5 300/400 Watts Single Output

(5.00 x 12.00 x 3.12) Notes: 1, 2, 3/Options: A, B, C, D, E, F, G, N, R, S, T/Weight: 6 lbs., 1 oz.

A	2	80	100												
B	5	80	100												
C	5.2	80	100												
D	12	33	40												
E	15	27	33												
F	24	17	21												
G	28	14	18												
H	48	9	11												

QS6 500 Watts Single Output

(5.00 x 12.00 x 4.12) Notes: 1, 2, 3/Options: A, B, C, E, F, G, J, R, S, T, U/Weight: 7 lbs., 2 oz.

A	2	100	110												
B	5	100	110												
C	5.2	100	110												
D	12	42	46												
E	15	34	37												
F	24	21	23												
G	28	18	20												
H	48	11	12												

- Many other output combinations also available; consult factory.
- Quasi regulated outputs available in some models for increased output power; consult factory.

Cherokee International, Inc.
2841 Dow Ave.
Tustin, CA 92680-7211
(714) 544-6665
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CHEROKEE INTERNATIONAL, INC.

SWITCHING POWER SUPPLIES

INTRODUCING! THE QD FAMILY/ HIGH FREQUENCY SWITCHERS

- **Power Factor Corrected**
- **Proprietary "Cascode" Technology combines the advantages of MOSFET speed and BiPolar reliability.**
- **Mag Amp auxiliaries for efficient, well regulated, high current outputs**
- **All outputs can be paralleled for load sharing or N+1 redundancy.**
- **Autoranging (115-230 VAC Selection) is available on all models.**
- **UL, CSA and TUV approvals in place for most models. Other models are pending. Consult factory for status.**
- **Cherokee's most efficient products: 80% typical.**

NEW STAND ALONE POWER FACTOR CORRECTION UNITS

Power Output: 1000 Watts Continuous
1300 Watts 10 Seconds **"PF-1"**

1500 Watts Continuous
1700 Watts 10 Seconds **"PF-2"**

Input Line Voltage: 90-264 VRMS. Single Phase
Line Frequency: 47-63Hz
Power Factor:
20% to 50% Rated Load Greater Than or Equal To 0.92
50% to 100% Rated Load Greater Than or Equal To 0.96
Line Current Harmonics: Per IEC555-2 Limits
DC Output Voltage: 375 ±5% Vdc
Efficiency @ 50% To 100% Load:
Greater Than Or Equal To 90% at 115V Input
Greater Than or Equal To 94% @ 230V Input
Ambient Temperature: 0-50°C
Cooling: Internal Fan
Physical Dimensions: 5″ × 11″ × 3″
EMI: Conducted. FCC Class "A"
Radiated. FCC Class "A"

Protection:
Over Voltage:
- Over Voltage Circuitry Will Shut Down The Converter Between 400 and 420 VDC.

Over Temperature:
- Supply Will Shut Down If Over Temperature Is Reached; It Will Restart Automatically After Cool Down.

Connectors:
- AC Input Connector:
6-32 Screw Terminal Barrier Block.
- DC-Output Connector:
6-32 Screw Terminal Barrier Block.

Safety:
Designed To Meet UL1950; CSA 1402C, C22.2 and IEC 950.

Standard Output Combination	Output 1			Output 2			Output 3			Output 4		
	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp	Volts	Rated Amp	Peak Amp

QD13 400 Watts up to 4 Outputs Fan Cooled

(5″×4″×10.5″) Notes: 1, 2, 3 Options: A, B, C, E, F, K, R, S Plus Autoranging (V) Weight: 4lbs. 1oz.

A	5	50	60	12	6	10	12	5	6	24	5	8
B	5	50	60	12	6	10	12	5	6	5	5	8
C	5	50	60	24	5	8	12	5	6	5	5	8
D	5	50	60	15	5	8	15	5	6	5	5	8
E	5	50	60	12	6	10	5	3	5	12	5	8
F	5	75	-									
G	12	33	-									

QD4 500 Watts up to 4 Outputs Fan Cooled

(4.125″×4″×11″) Notes: 1, 2, 3 Options: A, B, C, E, F. R, S Plus Autoranging (V) Panel mounted fuse (W) Weight: 4lbs. 9oz.

A	5	80	90	24	5	8	12	8	10	12	6	8
B	5	80	90	12	8	12	12	6	10	12	6	8
C	5	80	90	12	8	12	5	8	10	12	6	8
D	5	80	90	24	5	8	5	8	10	12	6	8
E	5	80	90	5	8	10	15	8	10	15	6	8
F	5	100	120									
G	12	42	50									
H	24	21	25									
I	28	20	23									

QD5 750 Watts up to 4 Outputs Fan Cooled

(4.75″×4.5″×11″) Notes: 1, 2, 3 Options: A, B, C, E, F, R, S Plus Autoranging (V) Panel mounted fuse (W) Weight: 5lbs.

A	5	120	150	24	6	10	12	12	16	12	8	10
B	5	120	150	12	12	16	12	12	16	12	8	10
C	5	120	150	12	12	16	12	12	16	5	8	10
D	5	120	150	24	6	10	12	12	16	5	8	10
E	5	120	150	5	12	16	15	12	16	5	8	10
F	5	150	175									
G	12	62	71									
H	24	31	36									
I	28	30	34									

QD6 1000 Watts up to 4 Outputs

(5″×5″×11″) Options: A, B, E, R, S Plus Autoranging (VAC) Weight: 10lbs.

A	5	150	175	12	12	16	12	12	16	24[1]	8	12
B	5	150	175	12	12	16	12	12	16	12	12	16
C	5	150	175	12	12	16	12	12	16	5	15	20
D	5	150	175	5	12	16	12	12	16	24[1]	8	12
E	5	150	175	15	12	16	15	12	16	5	15	20
F	5	200										
G	12	85										
H	24	42										
I	28	36										

Total (sum) of rated DC output power, maximum: 1000 Watts[2]

QD7 1500 Watts up to 4 Outputs

(5″×8″×12.25″) Options: A, B, R, S Power Factor Corrected Weight: 13lbs.

A	5	200	250	12	20		12	20		24[1]	10	
B	5	200	250	12	20		12	20		12	20	
C	5	200	250	12	20		12	20		5	20	
D	5	200	250	5	20		12	20		24[1]	10	
E	5	200	250	15	20		15	20		5	20	
F	5	300										
G	12	125										
H	24	65										
I	28	55										

Total (sum) of rated DC output power, maximum: 1500 Watts

QD8 2000 Watts up to 4 Outputs

(5″×8″×12.25″) Options: A, B, R, S Power Factor Corrected Weight: 15lbs.

A	5	300	350	12	20		12	20		24[1]	10	
B	5	300	350	12	20		12	20		12	20	
C	5	300	350	12	20		12	20		5	20	
D	5	300	350	5	20		12	20		24[1]	10	
E	5	300	350	15	20		15	20		5	20	
F	5	400										
G	12	168										
H	24	88										
I	28	72										
J	48	42										

Total (sum) of rated DC output power, maximum: 2000 Watts

QD16 1000 Watts up to 4 Outputs

(5″×8″×11″) Options: A, B, E, R, S Plus Autoranging Power Factor Corrected (VAC) Weight: 10lbs.

A	5	150	175	12	12	16	12	12	16	24	8	12
[illegible]	5	150	175	12	12	16	12	12	16	12	12	16
C	5	150	175	12	12	16	12	12	16	5	15	20
D	5	150	175	5	12	16	12	12	16	24	8	12
E	5	150	175	15	12	16	15	12	16	5	15	20
F	5	200										
G	12	85										
H	24	42										
I	28	36										

Total (sum) of rated DC output power, maximum: 1000 Watts

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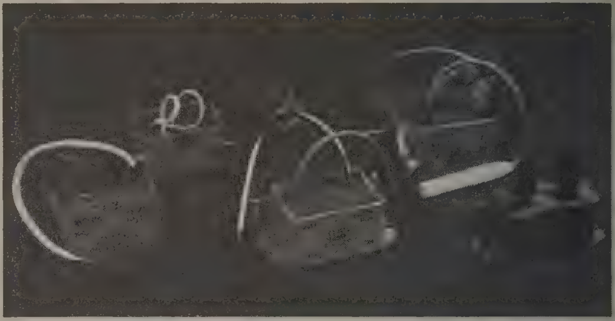


ELECTRONIC HIGH VOLTAGE POWER SUPPLIES

Model	Input Voltage	Output Voltage Range	Current Range	Typical Power	Applications
Unregulated					
CS2132	120/240 VAC	6-18 kV	1-5μA	60mW	• Laser Triggers • Ionizers • EOS/ESD • Ozonators • Electrostatic Speakers • Copiers • Duplicators • Home & Office Air Cleaners
CS2112	9-24VDC	3-20 kV	5-100μA	.5-1W	
CS2120	120/240 VAC	3kV-10kV*	1-10μA	100mW	
CS2091	120/240 VAC	6-30 kV	25-600μA	1-5W	
CS2095	120/240 VAC	5-15 kV	.8-1.5mA	5-10W	
Regulated					
CS2096	120/240 VAC	5-15 kV	1.0-2.5mA	10-20W	• Industrial Air Cleaners Light to Heavy Duty • Arc & Plasma Cutters/Welders • Laser Power Supplies
CS2094	120/240 VAC	5-15 kV	2.0-5.0mA	15-70W	
CS2097	120/240 VAC	1-5 kV	5.0-15.0mA	5-120W	
CS2100	120/240 VAC	5-15 kV	3.0-10.0mA	50-120W	
CS2098	120/240 VAC	10-20 kV	30-40mA	200-600W	

* Dual Output (Both Positive and Negative); grounded or ungrounded

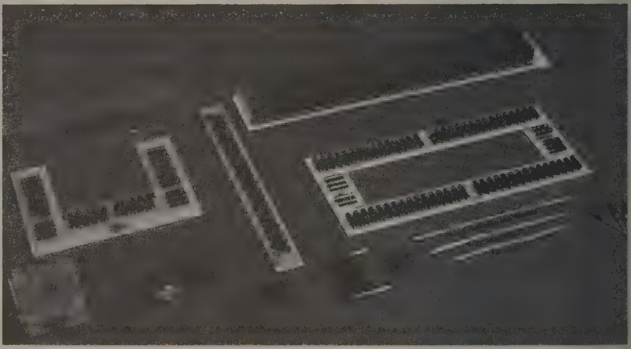
Custom variations are available on request. LED displays, bleeders, voltage clamps and output voltage adjustable controls can be included.

CUSTOM ENCAPSULATED MODULES (VersaMod)

Circuits	Applications
• MOV Assemblies 1Ø, 3Ø • Snubbers (C, RC, RCD, ZC) • Capacitors (EMI) Filters • Resistor(s) and/or Networks • Customer Designed Circuits	• UPS Systems • Welding Equipment • Motor Drives • Severe Vibration • Harsh Environments

HIGH VOLTAGE MULTIPLIERS

Custom designed to meet your requirements 5kV to 120kV DC output.	
Circuits	**Applications**
• Multi-stage Series or Parallel W or W/O Bleeder Resistors • Sensing Resistor Networks • Custom Designs From Multiple Wave Forms	• CRT • Copiers • X-Ray Equipment • Ionizers • Electrostatic Sprayers • HV Power Supplies



HIGH VOLTAGE DIODE/RECTIFIER ASSEMBLIES

Series Type	Repetitive Peak Reverse Voltage V_{RRM} (kV)	Average Forward Current I_O	Reverse Recovery Time t_{rr}	Applications
CS4500	4-16	15mA	<100 nsec	• High Voltage Power Supplies X-Ray (Medical & Industrial) Welding (Arc & Plasma) Laser • CRT Display • Electrostatic Equipment • Electron Beam Equipment
CS451	7-50	15mA	<100 nsec	
CS458	8-15	275-650mA	75nsec-2.5μs	
XRay	to 350	to 380mA	Std.	
High Power	to 200	to 1.5A	75nsec-2.5μs	
Bridges	All	to 3.0A	Any	

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NFS/NFN Universal Input Open Frame Switchers • Input Voltage: 90VAC to 240VAC

Ranging in output power from 25 to 350 watts, Computer Products' NFS series of switching power supplies incorporate advanced circuit topologies which allow them to accept universal inputs while simultaneously meeting required FCC and VDE conducted EMI specifications. All supplies are UL, CSA and VDE approved and have as standard features overvoltage and short circuit protection, resulting in a family of switchers that are globally accepted and second to none.

Medical versions of the NFS40, NFS50 and NFS110 series are UL544 and IEC601 approved, offering the reduced ground leakage current required in non-critical medical applications. These supplies provide all the size, weight and efficiency advantages of their non-medical NFS equivalents without the need for an expensive 60Hz isolation transformer.

Overall, the high quality and cost competitiveness of Computer Products switching power supplies have made them industry standards by which other supplies are judged.

Output Power	Output #1	Output #2	Output #3	Output #4	Safety Approvals	Size (L" x W" x H")	Model Number
NFS STANDARD PRODUCT SERIES SPECIFICATIONS							
NFS 25 Series • 25 Watts							
25	+5.1V @ 2.0A	+12V @ 1.5A			U C V	5.00 x 3.00 x 1.20	NFS25-7629
25	+5.1V @ 3.0A	+12V @ 0.2A▼	-12V @ 0.2A▼		U C V	5.00 x 3.00 x 1.20	NFS25-7628
25	+5.1V @ 2.0A	+12V @ 1.5A	-12V @ 0.2A▼		U C V	5.00 x 3.00 x 1.20	NFS25-7608
NFS 40/50 Series • 40/50 Watts							
30/40 (5)	+5.1V @ 8.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7605
40/50 (5)	+12V @ 4.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7612
40/50 (5)	+15V @ 3.3A				U C V	5.00 x 3.00 x 1.20	NFS40-7615
40/50 (5)	+24V @ 2.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7624
40/50 (5)	+5.1V @ 5.0A	-5.0V @ 0.5A▼	+12V @ 2.0A		U C V	5.00 x 3.00 x 1.20	NFS40-7607
40/50 (5)	+5.1V @ 5.0A	+12V @ 0.5A▼	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7628
40/50 (5)	+5.1V @ 5.0A	+12V @ 2.0A	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7608
40/50 (5)	+5.1V @ 5.0A	+15V @ 1.5A	-15V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7610
NFS 42 Series (7) • 40/50 Watts							
40/50 (5)	+5.0V @ 3.5A	+12V @ 2.5A	-12V @ 0.3A▼		U C V	6.30 x 3.94 x 1.50	NFS42-7608
40/50 (5)	+5.0V @ 3.5A	+15V @ 2.0A	-15V @ 0.3A▼		U C V	6.30 x 3.94 x 1.50	NFS42-7610
40/50 (5)	+5.0V @ 3.5A	-12V @ 0.3A▼	+24V @ 1.2A		U C V	6.30 x 3.94 x 1.50	NFS42-7627
NFS 50 Series • 40/50 Watts							
50/60 (5)	+5.1V @ 7.0A	+12V @ 2.5A	-12V @ 0.7A▼		U C V	6.30 x 3.94 x 1.50	NFS50-7608
50/60	+5.1V @ 7.0A	-5V @ 0.5A▼	+12V @ 2.5A	-12 @ 0.7A▼	U C V	6.30 x 3.94 x 1.50	NFS50-7601
NFS 75 Series • 75 Watts							
75	+5.0V @ 5.0A	+12V @ 3.0A	-12V @ 1.0A		U C V	6.50 x 4.00 x 1.80	NFS75-7608
NFS 80 Series • 80/110 Watts							
80/110 (5)	+5V @ 12A	+12V @ 3.0A✲	12V @ 3.0A(6)✲	+24V @ 2.5A	U C V	7.00 x 4.25 x 1.80	NFS80-7602
80/110 (5)	+5V @ 12A	+15V @ 3.0A✲	15V @ 3.0A(6)✲	+24V @ 2.5A	U C V	7.00 x 4.25 x 1.80	NFS80-7606
NFS 110 Series • 80/110 Watts							
80/110 (5)	5.1V @ 20A (6)				U C V	7.00 x 4.25 x 1.80	NFS110-7605
80/110 (5)	12V @ 9.0A (6)				U C V	7.00 x 4.25 x 1.80	NFS110-7612
80/110 (5)	15V @ 7.30A (6)				U C V	7.00 x 4.25 x 1.80	NFS110-7615
80/110 (5)	24V @ 4.5A (6)				U C V	7.00 x 4.25 x 1.80	NFS110-7624
80/110 (5)	+5.1V @ 10A	-5.0V @ 1.0A▼	+12V @ 5.0A✲	-12V @ 1.0A▼	U C V	7.00 x 4.25 x 1.80	NFS110-7601
80/110 (5)	+5.1V @ 10A	-5.0V @ 1.0A▼	+15V @ 5.0A✲	-15V @ 1.0A▼	U C V	7.00 x 4.25 x 1.80	NFS110-7604
80/110 (5)	+5.1V @ 10A	+12 @ 5.0A✲	-12V @ 1.0At	+24V @ 4.5A	U C V	7.00 x 4.25 x 1.80	NFS110-7602
NFS 200 Series • 200 Watts							
200	+5.1V @ 30A	+12.1V @ 8.0A†	-12.1V @ 4.0A†		U C V	9.00 x 5.00 x 2.50	NFS200-7608
200	+5.1V @ 30A	-5.2V @ 6.0A†	+12.1V @ 8.0A†	-12.1V @ 4.0A†	U C V	9.00 x 5.00 x 2.50	NFS200-7601
200	+5.1V @ 30A	+12.1V @ 8.0A†	-12.1V @ 4.0A†	12.1V @ 4.0A(6)†	U C V	9.00 x 5.00 x 2.50	NFS200-7603
200	+5.1V @ 30A	+12.1V @ 8.0A†	-12.1V @ 4.0A†	24V @ 3.0A(6)†	U C V	9.00 x 5.00 x 2.50	NFS200-7602
NFS 350 Series • 350 Watts							
350	+5.1V @ 50A	+12V @ 12A*	-12V @ 5.0A*		U C V	10.50 x 5.00 x 2.50	NFS350-7608
350	+5.1V @ 50A	5V @ 4A(3)*	+12V @ 12A*	-12V @ 5.0A*	U C V	10.50 x 5.00 x 2.50	NFS350-7625
350	+5.1V @ 50A	+12 @ 12A*	-12V @ 5.0A*	15V @ 4.0A(4)*	U C V	10.50 x 5.00 x 2.50	NFS350-7626

GOVERNOR'S AWARD FOR INDUSTRY QUALITY 1992

GOVERNOR'S AWARD FOR INDUSTRY PRODUCTIVITY 1992

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COMPUTER™ PRODUCTS
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- ▼ 120V-370V DC input voltage range
- ▼ 5V, 12V, 15V, and 24V outputs available
- ▼ Adjustable output voltage on selected models
- ▼ UL, CSA, VDE and BABT/BSI safety approvals
- ▼ Medical versions available on selected models
- ▼ Overvoltage and overcurrent protection
- ▼ Short circuit protection and auto-recovery

Output Power	Output #1	Output #2	Output #3	Output #4	Safety Approvals	Size (L" x W" x H")	Model Number
NFN REDUCED EMI PRODUCT SERIES [1] SPECIFICATIONS							
NFN 25 Series • 25 Watts							
25	+5.1V @ 2.0A	+12V @ 1.5A			U C V	5.00 x 3.00 x 1.20	NFN25-7629
25	+5.1V @ 3.0A	+12V @ 0.2A▼	-12V @ 0.2A▼		U C V	5.00 x 3.00 x 1.20	NFN25-7628
25	+5.1V @ 2.0A	+12V @ 1.5A	-12V @ 0.2A▼		U C V	5.00 x 3.00 x 1.20	NFN25-7608
NFN 40 Series • 40/50 Watts							
30/40 (5)	5.1V @ 8.0A				U C V	5.00 x 3.00 x 1.20	NFN40-7605
40/50 (5)	+12V @ 4.0A				U C V	5.00 x 3.00 x 1.20	NFN40-7612
40/50 (5)	+15V @ 3.3A				U C V	5.00 x 3.00 x 1.20	NFN40-7615
40/50 (5)	+24V @ 2.0A				U C V	5.00 x 3.00 x 1.20	NFN40-7624
40/50 (5)	+5.1V @ 5.0A	-5.0V @ 0.5A▼	+12V @ 2.0A		U C V	5.00 x 3.00 x 1.20	NFN40-7607
40/50 (5)	+5.1V @ 5.0A	+12V @ 0.5A▼	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFN40-7628
40/50 (5)	+5.1V @ 5.0A	+12V @ 2.0A	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFN40-7608
40/50 (5)	+5.1V @ 5.0A	+15V @ 1.5A	-15V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFN40-7610
NFS MEDICAL PRODUCT SERIES [2] SPECIFICATIONS							
NFS 40 Series • 40/50 Watts							
30/40 (5)	+5.1V @ 8.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7905
40/50 (5)	+12V @ 4.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7912
40/50 (5)	+15V @ 3.3A				U C V	5.00 x 3.00 x 1.20	NFS40-7915
40/50 (5)	+24V @ 2.0A				U C V	5.00 x 3.00 x 1.20	NFS40-7924
40/50 (5)	+5.1V @ 5.0A	-5.0V @ 0.5A▼	-12V @ 2.0A		U C V	5.00 x 3.00 x 1.20	NFS40-7907
40/50 (5)	+5.1V @ 5.0A	+12V @ 0.5A▼	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7928
40/50 (5)	+5.1V @ 5.0A	+12V @ 2.0A	-12V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7908
40/50 (5)	+5.1V @ 5.0A	+15V @ 1.5A	-15V @ 0.5A▼		U C V	5.00 x 3.00 x 1.20	NFS40-7910
NFS 50 Series • 50/60 Watts							
50/60 (5)	+5.1V @ 7.0A	+12V @ 2.5A	-12V @ 0.7A▼		U C V	6.30 x 3.94 x 1.50	NFS50-7908
NFS 110 Series • 80/110 Watts							
80/110 (5)	5.1V @ 20A				U C V	7.00 x 4.25 x 1.80	NFS110-7905
80/110 (5)	12V @ 9.0A				U C V	7.00 x 4.25 x 1.80	NFS110-7912
80/110 (5)	15V @ 7.3A				U C V	7.00 x 4.25 x 1.80	NFS110-7915
80/110 (5)	24V @ 4.5A				U C V	7.00 x 4.25 x 1.80	NFS110-7924
80/110 (5)	+5.1V @ 10A	-5.0V @ 1.0A▼	+12V @ 5.0A✲	-12V @ 1.0A▼	U C V	7.00 x 4.25 x 1.80	NFS110-7901
80/110 (5)	+5.1V @ 10A	-5.0V @ 1.0A▼	+15V @ 5.0A✲	-15V @ 1.0A▼	U C V	7.00 x 4.25 x 1.80	NFS110-7904
80/110 (5)	+5.1V @ 10A	+12V @ 5.0A✲	-12V @ 1.0A▼	+24V @ 4.5A	U C V	7.00 x 4.25 x 1.80	NFS110-7902

NOTES

1. The NFN Series are advanced, low-noise designs that reduce line-conducted noise to below FCC and VDE Limit B. **2.** The NFS 79XX Series are especially designed for medical applications with super-low leakage current. They are approved to UL544 and IEC601/VDE0750 medical supply standards. **3.** A floating output, adjustable from 4.5V to 16.5V @ 4.0A. **4.** A floating output adjustable from 15V to 30V @ 4.0A **5.** The higher power rating requires forced air cooling as follows: NFS/NFN 25-110 (20 CFM); NFS200 (30 CFM); NFS350 (350 LFM). **6.** Floating output which may be referenced as either positive or negative. **7.** Meets VDE B line-conducted noise limit. ▼ Linear regulated output using a 3-terminal regulator. † Magamp regulated output. * Output regulated by auxilliary switching regulator. ✲ Regulated output.

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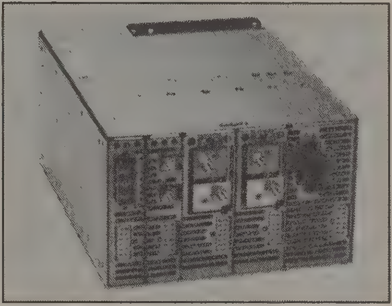
MPS SERIES • AC/DC MODULAR POWER SUPPLY

Autorangeing Input, Power Factor Corrected



MPS Series Features

- Meets IEC-555.2 line harmonic limits
- Modular construction: Up to 12 floating outputs from 6 plug-in slots
- 25 available modules
- Battery backup option
- Choice of VDE A/B input filter
- Parallelable outputs

MPS SERIES SPECIFICATIONS

Voltage & Current	Output Power	Voltage Adj. Range	Voltage & Current	Output Power	Voltage Adj. Range
2V @ 40A	80W	1.5-4.0	15V @ 16A	240W	10.8-16.5
2V @ 100A	200W	1.5-4.0	15V @ 40A	600W	10.8-16.5
3.3V @ 40V	132W	1.5-4.0	24V @ 5A	120W	20-30
3.3V @ 100V	330W	1.5-4.0	24V @ 10A	240W	20-30
5V @ 20A	100W	4.5-6.5	24V @ 25A	600W	20-30
5V @ 40A	200W	4.5-6.5	24V @ 50A	1200W	20-30
5V @ 100A	500W	4.5-6.5	28V @ 21.4A	600W	20-30
5V @ 200A	1000W	4.5-6.5	48V @ 5A	240W	43-53
12V @ 10A	120W	10.8-16.5	48V @ 12.5A	600W	43-53
12V @ 20A	240W	10.8-16.5	5V @ 5/A12V @ 5A	85W	±10%
12V @ 50A	600W	10.8-16.5	12V @ 5A/12V @ 5A	120W	±10%
12V @ 100A	1200W	10.8-16.5	12V @ 4A/15V @ 4A	120W	±10%
15V @ 8A	120W	10.8-16.5	Battery Backup		

Module (1)

FEATURES

AC Chassis	Output Modules	Battery Backup Module
Thermal Alarm	Load Current Monitor	Low Battery Voltage Alarm
AC Power Fail	Current-Share	Battery Charge Fault
Power System Inhibit	Module Inhibit	Battery Operation Inhibit
	DC Power Good	Charge Rate Alarm
	Remote Sense	Charge Current Monitor
	Remote Margin ±5%, ±10%	Battery Test
	OVP Alarm	Battery Voltage Monitor
	Current Share Fault Alarm	Battery Current Monitor

DIMENSIONS

L" X W" X H"

MPSA 11.00 X 8.00 X 5.00
MPSB 11.00 X 9.00 X 5.00

Notes:
1. Battery backup module requires user-supplied 48V lead-acid battery

COMPUTER PRODUCTS CUSTOM POWER SUPPLY DESIGN

Computer products' capability in custom product offerings represents a sophisticated approach to applications requiring unique power supply design. Our global engineering and manufacturing capabilities provide our customers with the flexibility necessary to address demanding power system requirements while ensuring the most cost-effective solution.

With hundreds of custom product designs successfully executed, Computer Products is uniquely qualified to address virtually any technical requirements. These designs satisfy demanding power system specifications in data processing, industrial process control, telecommunications, instrumentation, transportation, and medical equipment applications.

Our ISO9001 approved facilities ensure our customers of the high level of quality and consistency that they have come to expect. Conservative design techniques, including extensive design verification testing, ensures the highest reliability for years of continuous service. Full documentation, engineering controls, and environmental stress screening complement the total quality and statistical control policies that we have adopted to ensure superior performance.

The Computer Products' custom power supply design approach begins with an in-depth review of the customer's technical specifications. Field support personnel maintain a continuous dialog with customer engineers to ensure successful implementation of the design. Over twenty-five years of experience allow us to select the most suitable power supply topology and architecture to meet a particular requirement. Whether the application demands a forward converter, flyback, push-pull, half-bridge, or resonant circuit, our expertise enables us to quickly respond with proposed solutions Whether the requirement is for a centralized, modular or distributed power architecture, Computer Products' capability includes a collection of existing power solutions. Our design capability spans a broad range of AC/DC and DC/DC products from less than 1 watt to 1500 watts, from single to multiple outputs operating from any input voltage in the world.

A broad range of chassis configurations, features, interconnection options, and status circuitry are available to customer specification. Modification of existing standard product designs is an alternative to a total custom design.

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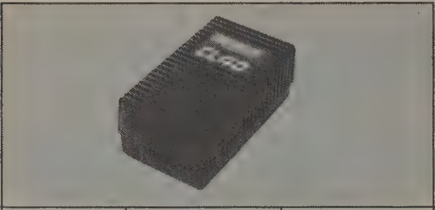

CL SERIES

EXTERNAL SWITCHING SUPPLY

Output Power	Output #1	Output #2	Output #3	Output #4	Output #5	Safety Approvals	Size (L" x W" x H")	Model Number
CL STANDARD PRODUCT FAMILY • Universal Input External Power Supplies • Input Voltage: 90VAC to 264VAC								
25	5.1V @ 5A(1)					U C V	6.3 x 3.3 x 1.7	CL25-7605
25	9.5V @ 2.5A(1)					U C V	6.3 x 3.3 x 1.7	CL25-7614
25	12V @ 2A(1)					U C V	6.3 x 3.3 x 1.7	CL25-7612
25	16V @ 1.5A(1)					U C V	6.3 x 3.3 x 1.7	CL25-7616
25	24V @ 1A(1)					U C V	6.3 x 3.3 x 1.7	CL25-7624
25	48V @ 0.5A					U C V	6.3 x 3.3 x 1.7	CL25-7617
25	+5V @ 2.5A	+12V @ 1A				U C V	6.3 x 3.3 x 1.7	CL25-7618
25	+5V @ 2.5A	+15V @ 0.8A				U C V	6.3 x 3.3 x 1.7	CL25-7619
25	+5V @ 2.5A	+24V @ 0.5A				U C V	6.3 x 3.3 x 1.7	CL25-7620
25	+5V @ 2.0A	+12V @ 0.3A	+24V @ 0.5A			U C V	6.3 x 3.3 x 1.7	CL25-7609
25	+5V @ 2.0A	+12V @ 1A	-12V @ 0.3A			U C V	6.3 x 3.3 x 1.7	CL25-7608
25	+5V @ 2.0A	-5V @ 0.3A	+12V @ 1A			U C V	6.3 x 3.3 x 1.7	CL25-7611
25	+5V @ 2.0A	+15V @ 0.5A	-15V @ 0.3A			U C V	6.3 x 3.3 x 1.7	CL25-7610
40	+5V @ 5A					U C V	6.5 x 3.9 x 2.75	CL40-7605
40	+12V @ 3.3A					U C V	6.5 x 3.9 x 2.75	CL40-7612
40	+13.5V @ 3A					U C V	6.5 x 3.9 x 2.75	CL40-7613
40	+15V @ 2.7A					U C V	6.5 x 3.9 x 2.75	CL40-7615
40	+16.5V @ 2.5					U C V	6.5 x 3.9 x 2.75	CL40-7616
40	+24V @ 1.6A					U C V	6.5 x 3.9 x 2.75	CL40-7624
40	+5V @ 3.5A	+12V @ 0.35A▼	-12V @ 0.35A▼			U C V	6.5 x 3.9 x 2.75	CL40-7628
40	+5V @ 3A	+12V @ 2A	-12V @ 0.35A▼			U C V	6.5 x 3.9 x 2.75	CL40-7608
40	+5.0V @ 3A	+15V @ 2A	-15V @ 0.35A▼			U C V	6.5 x 3.9 x 2.75	CL40-7610

▼ Linear regulated output **(1)** Available with optional Ni-Cad battery charger. Absence of a "+" or "-" indicates a floating output which can be referenced as either polarity.

HLS SERIES

USER - SELECTABLE INPUT, OPEN - FRAME LINEAR POWER SUPPLIES

Input Voltage: 100/120/220/240 VAC, User Selectable

Output Power	Output #1	Output #2	Output #3	Approvals	Safety L" X W" X H"	Size #	Model Notes
Single Output Models							
15W	5V @ 3.0A			U C T	4.84 X 3.99 X 1.62	HLS5-3/OVP	1,2,3,
30W	5V @ 6.0A			U C T	5.62 X 4.87 X 2.50	HLS5-6/OVP	1,2,3
45W	5V @ 9.0A			U C T	7.00 X 4.87 X 2.75	HLS5-9/OVP	1,2,3
60 W	5V @ 12.0A			U C T	9.00 X 4.87 X 2.75	HLS5-12/OVP	1,2,3
20W	12V @ 1.7A			U C T	4.84 X 3.99 X 1.62	HLS12-1.7	1,3
40W	12V @ 3.4A			U C T	5.62 X 4.87 X 2.50	HLS12-3.4	1,3
60W	12V @ 5.1A			U C T	7.00 X 4.87 X 2.75	HLS12-5.1	1,3,4
80W	12V @ 6.8A			U C T	9.00 X 4.87 X 2.75	HLS12-6.8	1,3
20W	15V @ 1.5A			U C T	4.84 X 3.99 X 1.62	HLS15-1.5	1,3
65W	15V @ 4.5A			U C T	7.00 X 4.87 X 2.75	HLS15-4.5	1,3,4
90W	15V @ 6.0A			U C T	9.00 X 4.87 X 2.75	HLS15-6.0	1,3
25W	24V @ 1.2A			U C T	4.84 X 3.99 X 1.62	HLS24-1.2	1,3
55W	24V @ 2.4A			U C T	5.62 X 4.87 X 2.50	HLS24-2.4	1,3
85W	24V @ 3.6A			U C T	7.00 X 4.87 X 2.75	HLS24-3.6	1,4
Dual Output Models							
30W	+5V @ 3.0A (5)	+12V @ 1.5A(5)		U C T	7.00 X 4.87 X 2.75	HLD30W	1,4
75W	+5V @ 6.0A(5)	+12V @ 3.4A(5)		U C T	9.00 X 4.87 X 2.75	HLD80W	1,3
25W	+12V @ 1.0A	-12V @ 1.0A		U C T	6.50 X 4.00 X 1.62	HLD12-1.0	1,4
40W	+12V @ 1.8A	-12V @ 1.8A		U C T	7.00 X 4.87 X 2.50	HLD12-1.8	1,4
80W	+12V @ 3.4A(5)	+12V @ 3.4A(5)		U C T	9.00 X 4.87 X 2.75	HLD12-3.4	1,3
25W	+15V @ 0.8A	-15V @ 0.8A		U C T	6.50 X 4.00 X 1.62	HLD15-0.8	1,4
45W	+15V @ 1.5A	-15V @ 1.5A		U C T	7.00 X 4.87 X 2.50	HDL15-1.5	1,4
90W	+15V @ 3.0A(5)	+15V @ 3.0A(5)		U C T	9.00 X 4.87 X 2.75	HDL15-3.0	1,3
Triple Output Models							
20W	+5V @ 2A(5)	+12V @ 0.4A(5)	+12V @ 0.4A(5)	U C T	6.50 X 4.00 X 1.62	HLT20W	1,2,3
40W	+5V @ 3A(5)	+12V @ 1.0A	-12V @ 1.0A	U C T	10.25 X 4.00 X 2.50	HLT40W	1,2,3
55W	+5V @ 6A	+12V @ 1.0A	-12V @ 1.0A	U C T	9.00 X 4.87 X 2.75	HLT60W	1,2,3
75W	+5V @ 6A(5)	+12V @ 1.8A	-12V @ 1.8A	U C T	11.00 X 4.87 X 2.75	HLT75W	1,2,3
85W	+5V @ 9A(5)	+12V @ 1.8A	-12V @ 1.8A	U C T	11.00 X 4.87 X 2.75	HLT80W	1,2,3
90W	+5V @ 3A	-5V @ 5.0A	+24V @ 3.0A(5)	U C T	11.00 X 4.87 X 2.75	HLT90W	1,2

Notes: 1. Adjustable output. **2.** With built-in OVP. **3.** With remote sense. **4.** Built-in OVP is available as an option. **5.** Floating output. **6.** These optional overvoltage protection modules may be used with any output NOT supplied with factory built-in OVP. Each is user adjustable from 6.2V to 34V.

For Sales or Technical Support, See Inside Front Cover of This Book.

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AC/DC POWER SUPPLIES

Output Power	Output #1	Output #2	Output #3	Output #4	Output #5	Safety Approvals	Size (L" x W" x H")	Model Number
XL FAMILY - USER SELECTABLE INPUT, OPEN-FRAME AND ENCLOSED SWITCHERS • Input Voltage: 115/220VAC User-Selectable								
60	+5.0V @ 6.0A	-5V @ 0.7A▼	+12V @ 3.0A	-12V @ 0.7A▼		U C V	7.75 x 4.25 x 2.00	XL50-3601
60	+5.0V @ 6.0A	-5V @ 0.7A▼	+15V @ 2.0A	-15V @ 0.7A▼		U T	7.75 x 4.25 x 2.00	XL50-3604
60	+5.0V @ 6.0A	+12V @ 3.0A	+12V @ 1.5A	-12V @ 0.7A▼		U V	7.75 x 4.25 x 2.00	XL50-3603
60	+5.0V @ 6.0A	+12V @ 0.7A▼	-12V @ 0.7A▼	+24V @ 2.0A		U C V	7.75 x 4.25 x 2.00	XL50-3602
100	+5.0V @ 10A	-5.0V @ 0.7A▼	+12V @ 4.0A	-12V @ 0.7A▼		U C V	10.30 x 4.75 x 2.00	XL100-3601
100	+5.0V @ 10A	+12V @ 4.0A	+12V @ 1.5A	-12V @ 0.7A▼		U C V	10.30 x 4.75 x 2.00	XL100-3603
100	+5.0V @ 10A	+12V @ 4.0A	-12V @ 0.7A▼	+24V @ 3A		U C V	10.30 x 4.75 x 2.00	XL100-3602
125	+5.0V @ 15A	-5.0V @ 0.7A▼	+12V @ 5.0A	-12V @ 0.7A▼		U C V	10.50 x 5.00 x 2.50	XL125-3601
125	+5.0V @ 15A	+12V @ 4.0A	+12V @ 1.5A▼	-12V @ 0.7A▼		U C V	10.50 x 5.00 x 2.50	XL125-3603
125	+5.0V @ 15A	+12V @ 4.0A	-12V @ 0.7A▼	+24V @ 4.0A▼		U C V	10.50 x 5.00 x 2.50	XL125-3602
130(2)	+5.1V @ 15A	+12V @ 5.0A	12V @ 1.0A▼(1)			U C V	8.45 x 4.68 x 2.40	XL120-3608
160/185(3)†	+5.0V @ 22A†	-5.0V @ 1.0A▼	+12V @ 5.0A†	-12V @ 2.5A†		U C V T	10.50 x 5.00 x 2.50	XL160-3401
160/185(3)†	+5.0V @ 22A†	+12V @ 5.0A†	+12V @ 2.5A†	-12V @ 2.5A†		U C V T	10.50 x 5.00 x 2.50	XL160-3403
160/185(3)†	+5.0V @ 22A†	+12V @ 5.0A†	-12V @ 2.5A†	+24V @ 2.5A†		U C V T	10.50 x 5.00 x 2.50	XL160-3402
160/185(3)†	+5.0V @ 22A†	+15V @ 4.0A†	-15V @ 2.5A†	+24V @ 2.5A		U C V	10.50 x 5.00 x 2.50	XL160-3405
180/210†	+5.0V @ 30A†	5.0V @ 4.0A(1)†	+12V @ 6.0A†	-12V @ 3.0A†		U C V	14.00 x 5.00 x 2.50	XL200-3601
180/210†	+5.0V @ 30A†	+12V @ 6.0A†	-12V @ 3.0A†	12V @ 3.0A(1)†		U C V	14.00 x 5.00 x 2.50	XL200-3603
180/210†	+5.0V @ 30A†	+12V @ 6.0A†	-12V @ 3.0A†	24V @ 5.0A(1)		U C V	14.00 x 5.00 x 2.50	XL200-3602
225(2)†	+5.0V @ 30A	5.0V @ 6.0A(1)	+12V @ 5.0A	12V @ 1.5A(1)†		U C V	10.50 x 5.00 x 2.50	XL220-3601
225(2)†	+5.0V @ 30A	+12V @ 5.0A	12V @ 5.0A(1)	12V @ 1.5A(1)†		U C V	10.50 x 5.00 x 2.50	XL220-3603
225(2)†	+5.0V @ 30A	12V @ 1.5A†	12V @ 5.0A	+24V @ 4.0A		U C V	10.50 x 5.00 x 2.50	XL220-3602
225(2)†	+5.0V @ 30A	15V @ 1.5A	15V @ 4.0A	+24V @ 4.0A		U C V	10.50 x 5.00 x 2.50	XL220-3605
180/250(2)	+5.0V @ 30A	5.0V @ 4.0A(1)	+12V @ 7.0A	-12V @ 3.5A		U C V	14.00 x 5.00 x 2.50	XL250-3601
180/250(2)	+5.0V @ 30A	+12V @ 7.0A	-12V @ 3.5A	12V @ 6.0A(1)		U C V	14.00 x 5.00 x 2.50	XL250-3603
180/250(2)	+5.0V @ 30A	+12V @ 7.0A	-12V @ 3.5A	24V @ 7.0A		U C V	14.00 x 5.00 x 2.50	XL250-3602
325(2)†	5.0V @ 45A(1)	12V @ 10A(1)	12V @ 10A(1)			U C V	14.00 x 5.50 x 2.50	XL325-3608
450(2)†	+5.0V @ 60A	-5.0V @ 4.0A	+12V @ 15A	+24V @ 12A	-12V @ 10A	U C V	16.75 x 5.20 x 2.50	XL450-3406
450(2)†	+5.0V @ 60A	-5.0V @ 4.0A	+15V @ 12A	+24V @ 12A	-15V @ 8.0A	U C V	16.75 x 5.20 x 2.50	XL450-3415
450(2)†	+5.0V @ 60A	+12V @ 15A	-12V @ 10A	+24V @ 12A	-24V @ 4.0A	U C V	16.75 x 5.20 x 2.50	XL450-3407
750	5.0V @ 100A	12V @ 10A	12V @ 10A			U C V T	13.70 x 8.00 x 5.10	XL750-4608
750	5.0V @ 100A	5.0V @ 10A	12V @ 10A	12V @ 6.0A		U C V T	13.70 x 8.00 x 5.10	XL750-4601
750	5.0V @ 100A	5.0V @ 10A	15V @ 8.0A	15V @ 8.0A		U C V	13.70 x 8.00 x 5.10	XL750-4604
750	5.0V @ 100A	12V @ 10A	12V @ 6.0A	24V @ 4.0A		U C V T	13.70 x 8.00 x 5.10	XL750-3602
750	5.0V @ 100A	5.0V @ 10A	12V @ 6.0A	12V @ 6.0A	24V @ 4.0A	U C V	13.70 x 8.00 x 5.10	XL750-4606
1000	5.0V @ 200A					U C T	11.00 x 8.00 x 5.00	HL1000-3605
1000	5.0V @ 150A	12V @ 20A	12V @ 20A			U C V	13.70 x 8.00 x 5.00	XL1000-4608
1000	5.0V @ 150A	5.0V @ 10A	12V @ 20A	12V @ 20A		U C V	13.70 x 8.00 x 5.00	XL1000-4601
1000	5.0V @ 150A	5.0V @ 10A	12V @ 20A	12V @ 20A	24V @ 4.0A	U C V	13.70 x 8.00 x 5.00	XL1000-4606
1500	5.0V @ 300A					U C V	11.00 x 8.00 x 5.00	HL1500-4605*

Output Power	Output #1	Output #2	Output #3	PM5xx	PM3xx
PM FAMILY • AC INPUT ENCAPSULATED LINEAR POWER SUPPLIES • Input: 115,220,240VAC					
1.3,2.5,5,10	5V @ 0.25,0.5,1,2 A			PM529,PM533,PM534,PM542,PM545	----,PM334,PM342,PM342
1.2,3,5,7	12V @ 100,240,400,600 mA			PM563,PM515,PM516,PM517	----,PM315,PM316,PM317
1.5	15V @ 100 mA			PM576	
1.2	24V @ 50 mA			PM585	
0.6,1.2	+12V @ 25,50 mA	-12V @ 25,50 mA		PM509,PM510	
2.9,5.8,9.6	+12V @ 0.12,0.24,0.4 A	-12V @ 0.12,0.24,0.4 A		PM536,PM537,PM597	PM336,PM337,PM397
0.8,2,4.5	+15V @ 25,65,150 mA	-15V @ 25,65,150 mA		PM538,PM553,PM570	
3,6,10.5	+15V @ 100,200,350 mA	-15V @ 100,200,350 mA		PM505,PM565,PM501	PM302,PM365,PM301
15	+15V @ 500 mA	-15V @ 500			PM396
5.8,5.4,8.6	5V @ 0.3,0.5,1.0 A	+12V @ 0.18,0.12,0.15 A	-12V @ 0.18, 0.12,0.15 A	PM595,PM591,PM592	PM395,PM391,PM392
6,5.5,9.5	5V @ 0.3,0.5,1.0 A	+15V @ 0.15,0.1,0.15 A	-15V @ 0.15, 0.1,0.15 A	PM594,PM590,PM593	PM394,PM390,PM393

Notes: PM500 Series are PCB-mount units and PM300 series are chasis-mount units.

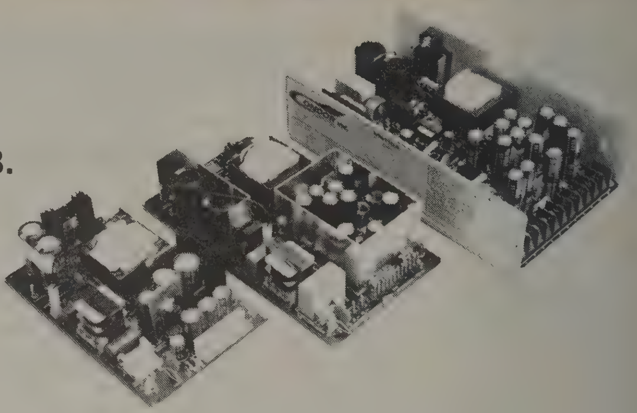
Output Power	Output	Size	PM5xx
HE FAMILY • AC-INPUT ENCAPSILATED LINEAR POWER SUPPLIES • Input: 115,220,240VAC			
25	5.0V @ 5 A	3.50 x 2.50 x 1.25	HE581
25	12V @ 2.2 A		HE583
25	15V @ 1.8 A		HE584
25	5.0V @ 5 A		HE381
25	12V @ 2.2A		HE383

Notes: HE500 Series are PCB-mount units and HE300 series are chasis-mount units.

For Sales or Technical Support, See Inside Front Cover of This Book.

WORLD CLASS MEDICAL

Condor's international medical multi-output switchers — designed to meet UL 544/IEC 601/CSA 1402-3.



Condor's medical switchers are designed to meet full international specifications, as well as European EMI specifications.

Medical switcher features:

- 16 models, 5 power levels, 30 to 110 watts
- Multi-output (up to 5 outputs)
- AC input: 90-132 VAC/180-264 VAC, 47-63 Hz
- Designed to meet toughest domestic and international medical safety specifications
- Proprietary low leakage — high attenuation EMI filter (patent pending)
- Less than 30μA leakage current
- Meets stringent FCC and VDE 0871 Class B EMI specs
- Power fail available on 110-watt units
- Versatile output configurations for wide variety of applications
- Industry standard packages
- 24-hour full load burn-in and 2-year warranty
- Covers available for all units

MEDICAL SWITCHER RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	TOTAL POWER, WATTS	SIZE, INCHES
MS 30A	+5V @ 3A	+12V @ 0.5A	−12V @ 0.5A	–	–	30	5.00 X 3.00 X 1.35
MS 30B	+5V @ 3A	+15V @ 0.5A	−15V @ 0.5A	–	–	30	5.00 X 3.00 X 1.35
MS 45A	+5V @ 4A	+12V @ 3A (3.5A PK)	−12V @ 0.8A	−5V @ 0.2A	–	45	6.30 X 3.90 X 1.65
MS 45B	+5V @ 4A	+15V @ 2A (2.5A PK)	−15V @ 0.7A	−5V @ 0.15A	–	45	6.30 X 3.90 X 1.65
MS 65A	+5V @ 6A	+15V @ 2A (3.5A PK)	−15V @ 0.7A	−5V @ 0.5A	–	65	7.75 X 4.25 X 1.90
MS 65B	+5V @ 6A	+15V @ 2A (3.5A PK)	−15V @ 0.7A	+24V @ 1.2A (2A PK)	–	65	7.75 X 4.25 X 1.90
MS 65C	+5V @ 6A	+12V @ 2.5A (4A PK)	−12V @ 1A	−5V @ 0.5A	–	65	7.75 X 4.25 X 1.90
MS 65D	+5V @ 6A	+12V @ 2.5A (4A PK)	−12V @ 1A	+12V @ 0.7A	–	65	7.75 X 4.25 X 1.90
MS 65E	+5V @ 6A	+12V @ 2A (3.5A PK)	−12V @ 0.7A	+24V @ 1.2A (2A PK)	–	65	7.75 X 4.25 X 1.90
MS 80A	+5V @ 9A	+12V @ 3A (5A PK)	−12V @ 2A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
MS 80B	+5V @ 9A	+12V @ 3A (5A PK)	−12V @ 1A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
MS 80C	+5V @ 9A	+15V @ 1A	−15V @ 1A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
MS 110A	+5V @ 12A	+12V @ 3A (5A PK)	+12V @ 3A (5A PK)*	−12V @ 3A	−5V @ 0.6A	110	8.80 X 4.95 X 2.45
MS 110B	+5V @ 12A	+12V @ 3A (5A PK)	+12V @ 3A (5A PK)*	−12V @ 1A	−5V @ 0.6A	110	8.80 X 4.95 X 2.45
MS 110C	+5V @ 12A	+12V @ 3A (5A PK)	+15V @ 1A*	−15V @ 1A	−5V @ 0.6A	110	8.80 X 4.95 X 2.45
MS 110D	+5V @ 12A	+12V @ 3A (5A PK)	+24V @ 1.5A (3A PK)*	−12V @ 3A	−5V @ 0.6A	110	8.80 X 4.95 X 2.45
MS 110H	+5V @ 12A	+15V @ 1A	−15V @ 1A*	+24V @ 2A (3A PK)	−5V @ 0.6A	110	8.80 X 4.95 X 2.45

*Isolated outputs.

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MEDICAL LINEAR RATINGS (cont.)

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	TYPE	CASE	SIZE, INCHES
MLL12-0.25-A	–	+12V @ 0.25A	–12V @ 0.25A	DUAL OUTPUT	L	4.25 X 3.25 X 1.80
MLL15-0.2-A	–	+15V @ 0.20A	–15V @ 0.20A	DUAL OUTPUT	L	4.25 X 3.25 X 1.80
MAA15-0.8-A	+12/15V @ 1.0/0.8A	–12/15V @ 1.0/0.8A	–	DUAL OUTPUT	AA	6.50 X 4.00 X 2.25
MBB15-1.5-A	+12/15V @ 1.7/1.5A	–12/15V @ 1.7/1.5A	–	DUAL OUTPUT	BB	7.00 X 4.88 X 2.95
MCC15-3-A	+12/15V @ 3.4/3.0A	–12/15V @ 3.4/3.0A	–	DUAL OUTPUT	CC	9.38 X 4.88 X 3.30
MAA512-A	5V @ 2.0A	9/15V @ 0.5A	–	DUAL OUTPUT	AA	6.50 X 4.00 X 2.25
MBB512-A	5V @ 3.0A	9/15V @ 1.25A	–	DUAL OUTPUT	BB	7.00 X 4.88 X 2.95
MCC512-A	5V @ 6.0A	9/15V @ 2.5A	–	DUAL OUTPUT	CC	9.38 X 4.88 X 3.30
MAA524-A	5V @ 2.0A	18/24V @ 0.3A	–	DUAL OUTPUT	AA	6.50 X 4.00 X 2.25
MBB524-A	5V @ 3.0A	18/24V @ 0.8A	–	DUAL OUTPUT	BB	7.00 X 4.88 X 2.95
MCC524-A	5V @ 6.0A	18/24V @ 2.0A	–	DUAL OUTPUT	CC	9.38 X 4.88 X 3.30
MCP323-A	12V @ 4.0A	5V @ 2.0A	–	DUAL OUTPUT	N	7.00 X 4.88 X 3.30
MCP510-A	12V @ 2.5A (7.5 PK)	5V @ 6.0A	–	DUAL OUTPUT	CP510	8.25 X 4.88 X 3.30
MTLL-5W-A	+5V @ 0.5A	+12/15V @ 0.1A	–12/15V @ 0.1A	TRIPLE OUTPUT	L	4.25 X 3.25 X 1.80
MTAA-16W-A	5V @ 2.0A	+12/15V @ 0.4A	–12/15V @ 0.4A	TRIPLE OUTPUT	AA	6.50 X 4.00 X 2.25
MBAA-40W-A	5V @ 3.0A	+12/15V @ 1.0/0.8A	–12/15V @ 1.0/0.8A	TRIPLE OUTPUT	BAA	10.25 X 4.00 X 2.95
MCAA-60W-A	5V @ 6.0A	+12/15V @ 1.0/0.8A	–12/15V @ 1.0/0.8A	TRIPLE OUTPUT	D	9.00 X 4.88 X 3.30
MCBB-75W-A	5V @ 6.0A	+12/15V @ 1.7/1.5A	–12/15V @ 1.7/1.5A	TRIPLE OUTPUT	CBB	11.00 X 4.88 X 3.30
MCP206-A	24V @ 3A (3.5 PK)	5V @ 3.0A	5V @ 1.0A	TRIPLE OUTPUT	CBB	11.00 X 4.88 X 3.30

MED 1 QUALITY PROGRAM

The MED 1 Quality Program is standard on all M-Series medical power supplies. It provides additional controls and testing which produces the extra level of quality that medical applications require. MED 1 is based in part on MIL-I-45208A, and includes the following procedures and tests in addition to the normal Condor quality assurance program.

1. **Lot Traceability:** Condor recordkeeping will include lot numbers, date of manufacture, test results and failure history. Each supply will be marked with a lot number and revision level.
2. **Extended Burn-In:** Burn-in duration is 24 hours for switching supplies and 8 hours for linear supplies. Test conditions are: full-rated load, room ambient temperature, and AC input power cycling.
3. **Safety Testing:** All units will be subjected to hipot and leakage current tests after burn-in. These tests are designed to identify potential failures that constitute the greatest risk of shock hazard in D.C. power supplies.
4. **Certificate of Conformance:** All power supplies shipped under the MED 1 program will be delivered with certificates of conformance to published specifications and the MED 1 Quality Program.

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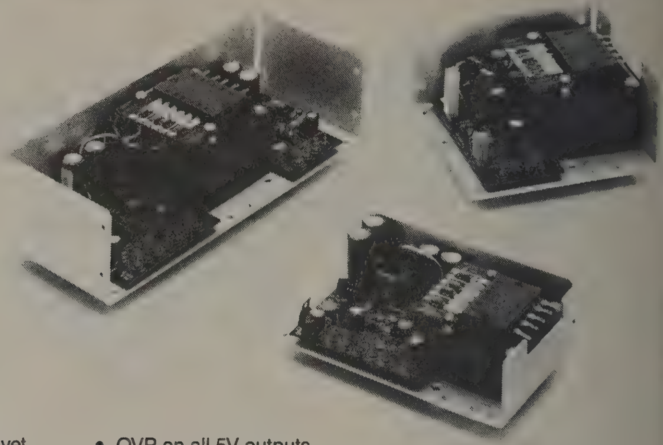

Condor's international medical linears, designed to meet UL 544/IEC 601/CSA 1402-3.

Condor's medical linear power supplies offer innovative yet cost-effective design solutions for both high- and low-volume users.

Medical linear features:

- 38 models (single, dual & triple output)
- 3 power levels (5 to 92 watts)
- AC input: 110/120/220/240 VAC, 47-63 Hz
- OVP on all 5V outputs
- Meets EMI per FCC/VDE B
- Hermetically sealed power transistors and IC's
- MTBF 200,000+ hours per Mil Handbook 217D
- 8-hour burn-in with cycling
- Full 3-year warranty

MEDICAL LINEAR RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	TYPE	CASE	SIZE, INCHES
ML5-1/OVP-A	5V @ 1.0A	–	–	SINGLE OUTPUT	L	4.25 X 3.25 X 1.80
MB5-3/OVP-A	5V @ 3.0A	–	–	SINGLE OUTPUT	B	4.88 X 4.00 X 2.25
MC5-6/OVP-A	5V @ 6.0A	–	–	SINGLE OUTPUT	C	5.63 X 4.88 X 2.95
MD5-12/OVP-A	5V @ 12.0A	–	–	SINGLE OUTPUT	D	9.00 X 4.88 X 3.30
ML12-0.5-A	12V @ 0.5A	–	–	SINGLE OUTPUT	L	4.25 X 3.25 X 1.80
MB12-1.7-A	12V @ 1.7A	–	–	SINGLE OUTPUT	B	4.88 X 4.00 X 2.25
MC12-3.4-A	12V @ 3.4A	–	–	SINGLE OUTPUT	C	5.63 X 4.88 X 2.95
MD12-6.8-A	12V @ 6.8A	–	–	SINGLE OUTPUT	D	9.00 X 4.88 X 3.30
ML15-0.4-A	15V @ 0.4A	–	–	SINGLE OUTPUT	L	4.25 X 3.25 X 1.80
MB15-1.5-A	15V @ 1.5A	–	–	SINGLE OUTPUT	B	4.88 X 4.00 X 2.25
MC15-3-A	15V @ 3.0A	–	–	SINGLE OUTPUT	C	5.63 X 4.88 X 2.95
MD15-6-A	15V @ 6.0A	–	–	SINGLE OUTPUT	D	9.00 X 4.88 X 3.30
ML24-0.3A	24V @ 0.3-A	–	–	SINGLE OUTPUT	L	4.25 X 3.25 X 1.80
MB24-1.2-A	24V @ 1.2-A	–	–	SINGLE OUTPUT	B	4.88 X 4.00 X 2.25
MC24-2.4-A	24V @ 2.4A	–	–	SINGLE OUTPUT	C	5.63 X 4.88 X 2.95
MD24-4.8-A	24V @ 4.8A	–	–	SINGLE OUTPUT	D	9.00 X 4.88 X 3.30
MB28-1-A	28V @ 1.0A	–	–	SINGLE OUTPUT	B	4.88 X 4.00 X 2.25
MC 28-2-A	28V @ 2.0A	–	–	SINGLE OUTPUT	C	5.63 X 4.88 X 2.95
MD28-4-A	28V @ 4.0A	–	–	SINGLE OUTPUT	D	9.00 X 4.88 X 3.30

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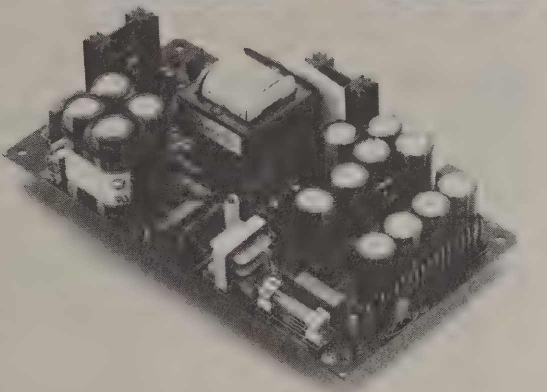
Condor's "V" Series — agency-approved power supplies with high peak power for starting loads.

Our "V" Series multiple output switching power supplies meet the toughest domestic and international safety requirements, and are UL, CSA and TUV/VDE certified. "V" Series units give you the performance you need, too, with peak power levels for starting loads ranging from 125 to 140 percent of full rated power.

"V" Series features:

- Low cost
- 6 power levels — 30 to 125 watts
- 26 models — 2 to 5 outputs
- AC input: 90-132/180-264 VAC, 47-63 Hz
- Clean, low-cost, open-frame design
- Fully-protected — adjustable current limit, built-in OVP and reverse voltage protection
- Full load burn-in and 2-year warranty
- High peak current disk drive outputs plus closely regulated 3-terminal-type outputs



- Extremely versatile output configurations for tough applications
- Very high value for your purchasing dollar
- Isolated outputs can be used for positive or negative sources or in series with other outputs
- Pass vibration and shock per MIL-STD 810D

For high performance and world-class value in switching power supplies, call Condor!

"V" SERIES OUTPUT RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	TOTAL POWER, WATTS	SIZE, INCHES
VBA 326	+5V @ 3A	+12V @ 0.5A	–12V @ 0.5A	–	–	30	5.00 X 3.00 X 1.35
VBA 323	+5V @ 3A	+15V @ 0.5A	–15V @ 0.5A	–	–	30	5.00 X 3.00 X 1.35
VCA 326	+5V @ 4A	+12V @ 3A (3.5A PK)	–12V @ 0.8A	–	–	45	6.30 X 3.90 X 1.65
VCA 420	+5V @ 4A	+12V @ 3A (3.5A PK)	–12V @ 1.8A	–5V @ 0.25A	–	45	6.30 X 3.90 X 1.65
VCA 423	+5V @ 4A	+15V @ 2A (2.5A PK)	–15V @ 0.7A	–5V @ 0.15A	–	45	6.30 X 3.90 X 1.65
VCA 426	+5V @ 4A	+12V @ 3A (3.5A PK)	–12V @ 0.8A	–5V @ 0.2A	–	45	6.30 X 3.90 X 1.65
VEA 405	+5V @ 6A	+15V @ 2A (3.5A PK)	–15V @ 0.7A	–5V @ 0.5A	–	65	7.75 X 4.25 X 1.90
VEA 424	+5V @ 6A	+15V @ 2A (3.5A PK)	–15V @ 0.7A	+24V @ 1.2A (2A PK)	–	65	7.75 X 4.25 X 1.90
VEA 417	+5V @ 6A	+12V @ 2.5A (4A PK)	–12V @ 1A	–5V @ 0.5A	–	65	7.75 X 4.25 X 1.90
VEA 412	+5V @ 6A	+12V @ 2.5A (4A PK)	–12V @ 1A	+12V @ 0.7A	–	65	7.75 X 4.25 X 1.90
VEA 436	+5V @ 6A	+12V @ 2A (3.5A PK)	–12V @ 0.7A	+24V @ 1.2A (2A PK)	–	65	7.75 X 4.25 X 1.90
VFA 420	+5V @ 8A	+12V @ 2.5A (4.5A PK)	+12V @ 2.5A (4.5A PK)*	–12V @ 2.5A	–	85	7.75 X 4.25 X 1.90
VFA 421	+5V @ 8A	+12V @ 2.5A (4.5A PK)	+12V @ 2.5A (4.5A PK)*	–5V @ 2.5A	–	85	7.75 X 4.25 X 1.90
VFA 423	+5V @ 6A	+15V @ 2.5A (3.5A PK)	+15V @ 2.5A (3.5A PK)*	–5V @ 2.5A	–	85	7.75 X 4.25 X 1.90
VFA 430	+5V @ 8A	+12V @ 2.5A (4.5A PK)	+24V @ 2A (4A PK)*	–12V @ 2.5A	–	85	7.75 X 4.25 X 1.90
VHA 420	+5V @ 10A	+12V @ 3A (4.5A PK)	12V @ 3A (4.5A PK)*	–12V @ 2A	–5V @ 0.5A	100	8.40 X 4.60 X 2.20
VHA 423	+5V @ 7A	+15V @ 2.5A (4A PK)	–	–15V @ 2.5A (4A PK)	–5V @ 0.2A	100	8.40 X 4.60 X 2.20
VHA 426	+5V @ 10A	+12V @ 3A (4.5A PK)	12V @ 1A*	–12V @ 1A	–5V @ 0.2A	100	8.40 X 4.60 X 2.20
VHA 427	+5V @ 10A	+12V @ 3A (4.5A PK)	15V @ 1A*	–15V @ 1A	–5V @ 0.2A	100	8.40 X 4.60 X 2.20
VHA 428	+5V @ 13A	–	12V @ 3A (4.5A PK)*	–12V @ 3A (4.5A PK)	–5V @ 0.5A	100	8.40 X 4.60 X 2.20
VHA 430	+5V @ 10A	+12V @ 3A (4.5A PK)	24V @ 2.5A (4A PK)*	–12V @ 2A	–5V @ 0.5A	100	8.40 X 4.60 X 2.20
VKA 420	+5V @ 15A	+12V @ 4A (6A PK)	12V @ 3A*	–12V @ 3A	–5V @ 0.5A	125	10.40 X 4.60 X 2.20
VKA 423	+5V @ 10A	+15V @ 3A (4A PK)	–	–15V @ 3A (4A PK)	–5V @ 0.4A	125	10.40 X 4.60 X 2.20
VKA 426	+5V @ 15A	+12V @ 4A (6A PK)	12V @ 1A*	–12V @ 1A	–5V @ 0.2A	125	10.40 X 4.60 X 2.20
VKA 427	+5V @ 15A	+12V @ 4A (6A PK)	15V @ 1A*	–15V @ 1A	–5V @ 0.2A	125	10.40 X 4.60 X 2.20
VKA 430	+5V @ 15A	+12V @ 4A (6A PK)	24V @ 3A (4.5A PK)*	–12V @ 3A	–5V @ 0.5A	125	10.40 X 4.60 X 2.20

*Isolated outputs.

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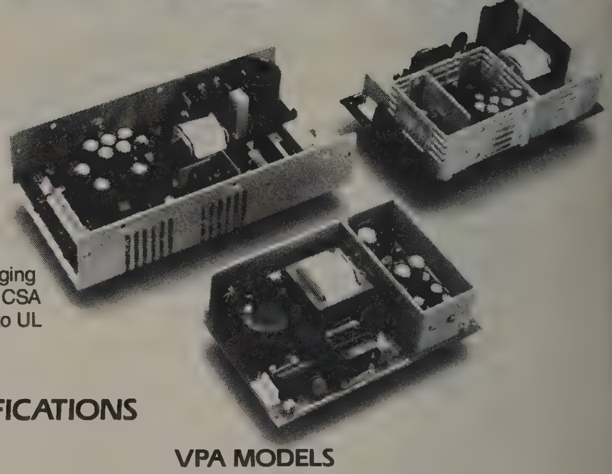

NEW FROM CONDOR!
Global Performance switching power supplies with the agency approvals you need.

Our new Global Performance Series switchers feature full-input autoranging (84-264V) and are approved to UL 1950, VDE level B EMI, IEC 950 and CSA TUV. All models also are available in medical configurations, approved to UL 544 and IEC 601.

SPECIFICATIONS

	GP MODELS	VPA MODELS
AC INPUT:	85-264 VAC, 47-63 Hz single phase.	90-132 VAC or 180-264 VAC, user selectable. 47-63 Hz single phase. (For optional or autoswitcher add "-AS" to model number).
DC OUTPUTS:	See output rating chart.	See output rating chart.
HOLD-UP TIME:	20 mS minimum @ full load and nominal line (115 VAC).	20 mS minimum at full load and nominal input voltage.
OVERLOAD PROTECTION:	Fully protected against short-circuit and output overload on all outputs. Short circuit protection is cycling type on most outputs; foldback on outputs with 3-terminal regulator post regulation. Overload protection recovery after removal of fault is automatic.	Fully protected against short-circuit and output overload with cycling-type overload protection. Automatic recovery after removal of fault.
MINIMUM LOAD:	Normal Operation: Output #1 and/or 2 combined load current must exceed 20% of total output power. Also, Output #1 must meet the minimums listed below for proper regulation of other outputs. See Output Ratings Chart for additional notes or conditions. GPx40 0.4A GPx55 0.7A GPx80 1.0A GPx130 3.0A GPx200 4.0A All single output models Not required	An 8-amp minimum load is required on output #1. A 20% minimum load is required on quasi-regulated outputs.
OUTPUT NOISE AND RIPPLE:	0.5% RMS, 1.5% PK-PK maximum on all outputs.	0.5% RMS, 1.5% PK-PK maximum on all outputs.
TRANSIENT RESPONSE:	+5V main output; 500 μS typical response time for a 50 to 100% or 100 to 50% load change. Maximum voltage deviation: 5.0%.	+5V main output; 500 μS typical response time for a 50 to 100% or 100 to 50% load change.
OVERVOLTAGE:	Built-in on +5 output with a firing point set at 6.2V ±0.6V.	Built-in on + output with a firing point set at 6.2V ±0.6V.
VOLTAGE ADJUSTMENT:	Built-in potentiometer adjusts voltage from 4.5V to OVP trip point (6.2V nominal) on main +5V output. A separate potentiometer adjusts output #2 ±5% minimum.	Built-in potentiometer adjusts voltage from 4.5V to OVP trip point (6.2V nominal) on main +5V output.
REVERSE VOLTAGE PROTECTION:	All outputs protected against inadvertent application of reverse voltage up to 1 times the rated current of the reversed output.	All outputs protected against inadvertent application of reverse voltage.
OVERSHOOT:	No output overshoot on turn on or turn off.	No output overshoot on turn on or turn off.
INPUT PROTECTION:	Internal A.C. fuse provided on all units. This fuse only blows if a catastrophic failure occurs in the unit; it does not blow on overload or short circuit. A.C. input protected from line transients by metal oxide varistors on all medical units.	Internal A.C. fuse provided on all units. This fuse only blows if a catastrophic failure occurs in the unit; it does not blow on overload or short circuit. A.C. input protected from line transients by metal oxide varistors.
TEMPERATURE COEFFICIENT:	0.03% per °C typical for all outputs.	0.03% per °C typical for all outputs.
TEMPERATURE RATING:	0 to 50 °C at full rated output power with natural convection cooling in a non-restricted environment. For operation in a confined space, moving air may be required. For operation above 50 °C, it is important that the cooling vs. load profile is such that the heatsinks do not operate above 90 °C for extended periods.	0 to 50 °C at full rated power with 26 FCM forced air cooling. Cooling air should be ducted directly over the unit. For less air, derate output power by 1% per CFM of air. For convection cooling @ 296 watts, unit must be installed if non-restrictive environment.
EMI SPECIFICATIONS:	All models include built-in EMI filters to meet or exceed the conducted emissions requirements of FCC 20870 Class B and VDE 0871 Class B.	All VPA models are designed with built-in EMI filters to meet or exceed the conducted emissions requirements of FCC 20870 Class B and VDE 0871 Class B.
SAFETY SPECIFICATIONS:	All commercial models are designed to meet UL 1950, CSA 22.2 Level 3, IEC 950 and VDE EN60950. All medical models are designed to meet UL 544, IEC 601-1 and VDE 0750.	All VPA models are designed to meet UL 1950, UL 508, CSA Bulletin 1402C Level 5, IEC 950.

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GLOBAL PERFORMANCE SERIES OUTPUT RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	TOTAL POWER, WATTS	SIZE, INCHES
GPx40A	+ 5.1V @ 4A (5 PK)	+12V @ 2A (3 PK)	−12V @ 0.4A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40B	+ 5.1V @ 4A (5 PK)	+15V @ 2A (3 PK)	−15V @ 0.4A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40D	+ 5.1V @ 4A (5 PK)	+24V @ 1A (1.5 PK)	−12V @ 0.4A (0.7 PK)	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40-5	+ 5V @ 8A (10 PK)	N/A	N/A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40-12	+12V @ 3.3A (4.2 PK)	N/A	N/A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40-15	+15V @ 2.7A (3.3 PK)	N/A	N/A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPx40-24	+24V @ 1.7A (2.1 PK)	N/A	N/A	N/A	N/A	40	3.00 X 5.00 X 1.28
GPC50A	+ 5V @ 5A (7 PK)	+12V @ 2A (3 PK)	−12V @ 0.5A (1 PK)	N/A	N/A	50	6.30 X 3.92 X 1.57
GPx55A	+ 5V @ 6A (8 PK)	+12V @ 3A (5 PK)			N/A	55	6.30 X 3.94 X 1.68
GPx55B	+ 5V @ 6A (8 PK)	+12V @ 3A (5 PK)	− 5V @ 1A	−12V @ 1A	N/A	55	6.30 X 3.94 X 1.68
GPx55D	+ 5V @ 6A (8 PK)	+24V @ 1.5A (2 PK)	+12V @ 1A	−12V @ 1A	N/A	55	6.30 X 3.94 X 1.68
GPx55E	+ 5V @ 6A (8 PK)	+24V @ 1.5A (2 PK)	+15V @ 1A	−15V @ 1A	N/A	55	6.30 X 3.94 X 1.68
GPx55-5	5V @ 11A (14 PK)	N/A	N/A	N/A	N/A	55	6.30 X 3.94 X 1.68
GPx55-12	12V @ 4.7A (5.8 PK)	N/A	N/A	N/A	N/A	55	6.30 X 3.94 X 1.68
GPx55-15	15V @ 3.7A (4.7 PK)	N/A	N/A	N/A	N/A	55	6.30 X 3.94 X 1.68
GPx55-24	24V @ 2.3A (2.9 PK)	N/A	N/A	N/A	N/A	55	6.30 X 3.94 X 1.68
GPC55-48	48V @ 1.5A (1.5 PK)	N/A	N/A	N/A	N/A	55	6.30 X 3.94 X 1.68
GPx80A	+ 5V @ 12A (16 PK)	+12V @ 3A (5 PK)	−12V @ 1A	+12V @ 1A	N/A	80	7.00 X 4.25 X 1.86
GPx80B	+ 5V @ 12A (16 PK)	+12V @ 3A (5 PK)	−12V @ 1A	− 5V @ 1A	N/A	80	7.00 X 4.25 X 1.86
GPx80C	+ 5V @ 12A (16 PK)	+12V @ 3A (5 PK)	−15V @ 1A	+15V @1A	N/A	80	7.00 X 4.25 X 1.86
GPx80D	+ 5V @ 12A (16 PK)	+24V @ 2A (4 PK)	−12V @ 1A	+12V @ 1A	N/A	80	7.00 X 4.25 X 1.86
GPx80E	+ 5V @ 12A (16 PK)	+24V @ 2A (4 PK)	−15V @ 1A	+15V @ 1A	N/A	80	7.00 X 4.25 X 1.86
GPx80P	+ 5V @ 12A (16 PK)	+24V @ 3.5A (4.5 PK)	−12V @ 1A	+12V @ 2A	N/A	80	7.00 X 4.25 X 1.86
GPx80-5	5V @ 16A (22 PK)	N/A	N/A	N/A	N/A	80	7.00 X 4.25 X 1.86
GPx80-12	12V @ 6.7A (9.2 PK)	N/A	N/A	N/A	N/A	80	7.00 X 4.25 X 1.86
GPx80-15	15V @ 5.3A (7.3 PK)	N/A	N/A	N/A	N/A	80	7.00 X 4.25 X 1.86
GPx80-24	24V @ 3.4A (4.6 PK)	N/A	N/A	N/A	N/A	80	7.00 X 4.25 X 1.86
GPx130A	+ 5V @ 20A (25 PK)	+12V @ 5A (8 PK)	−12V @ 1.2A	+12V @ 1.2A	N/A	130	8.50 X 4.50 X 2.00
GPx130B	+ 5V @ 20A (25 PK)	+12V @ 5A (8 PK)	− 5V @ 1.2A	−12V @ 1.2A	N/A	130	8.50 X 4.50 X 2.00
GPx130D	+ 5V @ 20A (25 PK)	+24V @ 3.5A (5 PK)	−12V @ 1.2A	+12V @ 1.2A	N/A	130	8.50 X 4.50 X 2.00
GPx130E	+ 5V @ 20A (25 PK)	+24V @ 3.5A (5 PK)	−15V @ 1.2A	+15V @ 1.2A	N/A	130	8.50 X 4.50 X 2.00
GPx140-5	5V @ 26A (32 PK)	N/A	N/A	N/A	N/A	130	8.50 X 4.50 X 2.12
GPx140-12	12V @ 11.7A (14.6 PK)	N/A	N/A	N/A	N/A	130	8.50 X 4.50 X 2.12
GPx140-15	15V @ 9.3A (11.7 PK)	N/A	N/A	N/A	N/A	130	8.50 X 4.50 X 2.12
GPx140-24	24V @ 5.8A (7.3 PK)	N/A	N/A	N/A	N/A	130	8.50 X 4.50 X 2.12
GPx200A	+ 5V @ 26A (32 PK)	+12V @ 8A (12 PK)	−12V @ 1.2A	12V @ 4A	***	200	9.00 X 5.00 X 2.50
GPx200B	+ 5V @ 26A (32 PK)	+12V @ 8A (12 PK)	− 5V @ 1.2A	12V @ 4A	***	200	9.00 X 5.00 X 2.50
GPx200D	+ 5V @ 26A (32 PK)	+24V @ 5A (6.5 PK)	−12V @ 1.2A	12V @ 4A	***	200	9.00 X 5.00 X 2.50
GPx200F	+ 5V @ 26A (32 PK)	+12V @ 8A (12 PK)	−12V @ 1.2A	5V @ 4A	***	200	9.00 X 5.00 X 2.50
VPA 420	+5V @ 60A	+12V @ 12A (16 PK)	12V @ 6A	12V @ 6A	5V @ 4A	400	13.00 X 5.00 X 2.50
VPA 423	+5V @ 60A	+12V @ 12A (16 PK)	15V @ 6A	15V @ 6A	5V @ 4A	400	13.00 X 5.00 X 2.50
VPA 430	+5V @ 60A	+24V @ 8A (10 PK)	12V @ 6A	12V @ 6A	5V @ 4A	400	13.00 X 5.00 X 2.50
VPA 433	+5V @ 60A	+24V @ 8A (10 PK)	15V @ 6A	15V @ 6A	5V @ 4A	400	13.00 X 5.00 X 2.50

* Replace "x" in Model No. as follows: M = Medical version
C = Standard version for data processing, control, etc applications

** Floating output
*** Optional 5th output up to 2 amps @ + or − 5, 12 or 15V; consult factory

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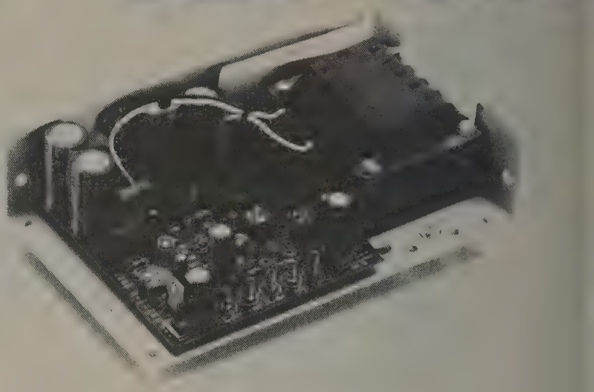
WORLD CLASS

Condor's International Plus Series linear power supplies — price, performance and the approvals you need.



Condor's *International Plus Series* D.C. power supplies virtually eliminate primary-secondary shorting because each coil uses a separate bobbin surrounded by two layers of glass-impregnated nylon, giving complete mechanical and electrical isolation.

The best low-noise 723 regulator chips are used throughout the line, together with proven, reliable semiconductors. TO3-cased pass elements are hermetically sealed, and the latest high-density, high-ripple current rating capacitors from proven, high-quality vendors ensure long life and reliability.

International Plus Series features:

- 9 power levels — 3 to 288W
- 75 models (single, dual & triple output)
- AC input: 100 / 120 / 220 / 230 / 240 VAC, 47-63 Hz
- OVP on all 5V outputs
- Meets EMI per FCC/VDE B (most units)
- Approved to IEC 950 and UL1950 with no D3 deviation.
- Hermetically sealed power transistors
- MTBF 200,000 + hours per Mil Hndbk 217D
- 2-hour burn-in with cycling
- Full 3-year warranty

Sixty-five *International Plus Series* models are approved to UL1950; UL478, CSA C22.2 and TUV certified to VDE 0806 and IEC 950.

INTERNATIONAL PLUS LINEAR RATINGS

SINGLE OUTPUT

MODEL NO.	VOLTAGE, VOLTS	CURRENT, AMPS	CASE	MODEL	VOLTAGE, VOLTS	CURRENT, AMPS	CASE
HA2-1.5-A+	2	1.5	A	HC15-3-A+	15	3.0	C
HB2-3-A+	2	3.0	B	HN15-4.5-A+	15	4.5	N
HC2-6-A+	2	6.0	C	HD15-6-A+	15	6.0	D
HN2-9-A+	2	9.0	N	HE15-9-A+	15	9.0	E
HD2-12-A+	2	12.0	D	F15-15-A+	15	15.0	F
HE2-18-A+	2	18.0	E	HA24-0.5-A+	24	0.5	B
HA5-1.5 / OVP-A+	5	1.2	B	HB24-1.2-A+	24	1.2	B
HB5-3 / OVP-A+	5	3.0	B	HC24-2.4-A+	24	2.4	C
HC5-6 / OVP-A+	5	6.0	C	HN24-3.6-A+	24	3.6	N
HN5-9 / OVP-A+	5	9.0	N	HD24-4.8-A+	24	4.8	D
HD5-12 / OVP-A+	5	12.0	D	HE24-7.2-A+	24	7.2	E
HE5-18 / OVP-A+	5	18.0	E	F24-12-A+	24	12.0	F
F5-25 / OVP-A+	5	25.0	F	HA24-0.5-A (28)+	28	0.5	B
G5-35 / OVP-A+	5	35.0	G	HB28-1.0-A+	28	1.0	B
CP197-A+	5	50.0	G	HC28-2-A+	28	2.0	C
HA15-0.9-A (12)+	12	0.9	B	HN28-3-A+	28	3.0	N
HB12-1.7A+	12	1.7	B	HD28-4-A+	28	4.0	D
HC12-3.4-A+	12	3.4	C	HE28-6-A+	28	6.0	E
HN12-5.1-A+	12	5.1	N	F24-12-A+	28	10.0	F
HD12-6.8-A+	12	6.8	D	HB48-0.5-A+	48	0.5	B
HE12-10.2-A+	12	10.2	E	HC48-1-A+	48	1.0	C
F15-15-A+	12	16.0	F	HD48-3-A+	48	3.0	D
HA15-0.9-A+	15	0.9	B	HE48-4-A+	48	4.0	E
HB15-1.5-A+	15	1.5	B	F48-6-A+	48	6.0	F

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WORLD CLASS

INTERNATIONAL PLUS LINEAR RATINGS

MULTIPLE OUTPUT

MODEL	OUTPUT 1	OUTPUT 2	OUTPUT 3	CASE
HAA5-1.5/OVP-A+	5V @ 1.5A	5V @ 1.5A	–	AA
HBB5-3/OVP-A+	5V @ 3A	5V @ 3A	–	BB
HCC5-6/OVP-A+	5V @ 6A	5V @ 6A	–	CC
HAA512-A+	5V @ 2A	9 to 15V @ 0.5A	–	AA
HBB512-A+	5V @ 3A	9 to 15V @ 1.25A	–	AA
HCC512-A+	5V @ 6A	9 to 15V @ 2.5A	–	CC
HAA524-A+	5V @ 2A	18 to 24V @ 0.3A	–	AA
HBB524-A+	5V @ 3A	18 to 24V @ 0.8A	–	BB
HCC524-A+	5V @ 6A	18 to 24V @2A	–	CC
HAD12-0.4-A+	+12 @ 0.4A	–12 @ 0.4A	–	B
HAD15-0.4A+	+15 @ 0.4A	–15V@ 0.4A	–	B
HAA15-0.8A+	+12 to 15V @ 1A/0.8A	–12 to 15V @ 1A/8A	–	AA
HBB15-1.5A+	+12 to 15V @ 1.7A/1.5A	–12 to 15V @ 1.7A/1.5A	–	BB
HCC-15-3-A+	+12 to 15V @ 3.4A/3A	–12 to 15V @3.4A/3A	–	CC
HDD15-5-A+	+12 to 15V @ 5A	–12 to 15V @ 5A	–	E
HAA24-0.6A+	+18 to 24V @ 0.4A/0.6A	+18 to 24V @ 0.4A/0.6A	–	AA
HTAA-16W-A+	5V @ 2A	+12 to 15V @ 0.4/0.4A	–12 to 15V @ 0.4/0.4A†	AA
HBAA-40W-A+	5V @ 3A	+12 to 15V @ 1/0.8A	–12 to 15V @ 1/0.8A†	BAA
HCBB-105W-A+	5V @ 3A	+12 to 15V @ 3.4/3.0A	–12 to 15V @ 3.4/3.0A†	CBB
HCAA-60W-A+	5V @ 6A	+12 to 15V @ 1/0.8A	–12 to 15V @ 1/0.8A†	D
HCBB-75W-A+	5V @ 6A	+12 to 15V @ 1.7/1.5A	–12 to 15V @ 1.7/1.5A†	CBB
CP131-A+	5V @ 9A	+12 to 15V @ 1.7/1.5A	–12 to 15V @ 1.7/1.5A†	NBB
HDBB-105W-A+	5V @ 12A	+12 to 15V @ 1.7/1.5A	–12 to 15V @ 1.7/1.5A†	DBB
HDCC-150W-A+	5V @ 12A	+12 to 15V @ 3.4/3A	–12 to 15V @ 3.4/3A†	DCC

SIZE CHART

CASE	SIZE, INCHES
B	4.88 X 4.00 X 2.25
C	5.63 X 4.88 X 2.95
N	7.00 X 4.88 X 3.30
D	9.00 X 4.88 X 3.30
E	14.00 X 4.88 X 3.55
F	16.75 X 4.88 X 5.00
G	16.75 X 4.88 X 5.30
AA	6.50 X 4.00 X 2.25
BB	7.00 X 4.88 X 2.95
CC	9.38 X 4.88 X 3.30
BAA	10.25 X 4.00 X 2.95
CBB	11.00 X 4.88 X 3.30
NBB	11.00 X 4.88 X 3.30
DBB	14.25 X 4.88 X 3.55
DCC	15.00 X 4.88 X 4.55
CP510	8.25 X 4.88 X 3.30

†No. 3 output usable at –5V, rate at ½ 15V current rating.

DISK DRIVE/PRINTER SERIES RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	CASE
CP206-A+	24V, 3A (3.5 PK)	5V, 3A	5V, 1A	CBB
CP323-A+	12V, 4A	5V, 2A	NA	N
CP510-A+	12V, 2.5/7.5 PK	5V, 6A	NA	CP510

FIXED DISK SERIES RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	CASE
CP379-A+	+5V @ 6A	+24V @ 3.5/8A PK	–5V or 12V @ 1.2A	NBB
CP498-A+	+5V @ 6A	+12V @ 5/10A PK	–5V or 12V @ 0.5A	NBB

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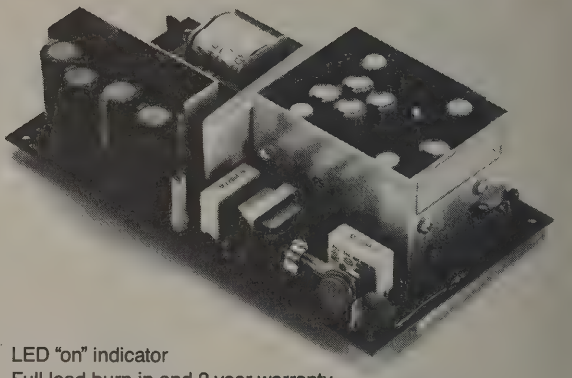

Condor's SDS and SDM Series power supplies meet FCC/VDE Level B and have agency safety approvals!

Every tough, versatile Condor single (SDS) or multiple (SDM) switching power supply meets the toughest domestic and international safety requirements, and is UL, CSA and TUV/VDE certified. All units also meet FCC 20870 Level B and VDE 0871 Class B above 150KHz.

SDS/SDM Series features:

- 5 power levels — 45 to 200 watts
- 20 single and 29 multiple-output models (up to 5 outputs)
- AC input: 90-132 VAC/180-264 VAC, 47-63 Hz
- Clean, low-cost, open-frame design
- Fully-protected — adjustable current limit, built-in OVP and reverse voltage protection
- LED "on" indicator
- Full load burn-in and 2-year warranty
- Powerfail signal and logic inhibit on 140 and 200W levels
- High peak current disk drive outputs plus closely regulated 3-terminal-type outputs
- Extremely versatile output configurations for tough applications
- Very high value for your purchasing dollar
- Isolated outputs can be used for positive or negative sources or in series with other outputs
- Pass vibration and shock per MIL-STD 810D

Condor SDS and SDM power supplies can meet your most demanding design requirements!

SDS SERIES SINGLE OUTPUT RATINGS

MODEL NO.	VOLTAGE, VOLTS	CURRENT, AMPS	TOTAL POWER, WATTS	SIZE, INCHES
SDS 45-5	5	9	45	6.30 X 3.94 X 1.825
SDS 45-12	12	3.8	45	6.30 X 3.94 X 1.825
SDS 45-15	15	3	45	6.30 X 3.94 X 1.825
SDS 45-24	24	1.9	45	6.30 X 3.94 X 1.825
SDS 80-5	5	16	80	7.75 X 4.25 X 1.90
SDS 80-12	12	6.7	80	7.75 X 4.25 X 1.90
SDS 80-15	15	5.3	80	7.75 X 4.25 X 1.90
SDS 80-24	24	3.4	80	7.75 X 4.25 X 1.90
SDS 110-5	5	22	110	8.80 X 4.75 X 1.90
SDS 110-12	12	9.2	110	8.80 X 4.75 X 1.90
SDS 110-15	15	7.3	110	8.80 X 4.75 X 1.90
SDS 110-24	24	4.6	110	8.80 X 4.75 X 1.90
SDS 140-5	5	28	140	10.30 X 4.75 X 2.20
SDS 140-12	12	11.7	140	10.30 X 4.75 X 2.20
SDS 140-15	15	9.4	140	10.30 X 4.75 X 2.20
SDS 140-24	24	5.9	140	10.30 X 4.75 X 2.20
SDS 200-5	5	40	200	12.80 X 4.75 X 2.45
SDS 200-12	12	16.7	200	12.80 X 4.75 X 2.45
SDS 200-15	15	13.4	200	12.80 X 4.75 X 2.45
SDS 200-24	24	8.4	200	12.80 X 4.75 X 2.45

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SDM SERIES MULTIPLE OUTPUT RATINGS

MODEL NO.	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	TOTAL POWER, WATTS	SIZE, INCHES
SDM 45A	+5V @ 5A	+12V @ 2A (4A PK)	−12V @ 1A	–	–	45	6.30 X 3.94 X 1.825
SDM 45B	+5V @ 5A	+12V @ 1A	−12V @ 1A	–	–	45	6.30 X 3.94 X 1.825
SDM 45F	+5V @ 5A	+15V @ 1A	−15V @ 1A	–	–	45	6.30 X 3.94 X 1.825
SDM 80A	+5V @ 9A	+12V @ 3A (5A PK)	−12V @ 2A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
SDM 80B	+5V @ 9A	+12V @ 3A (5A PK)	−12V @ 1A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
SDM 80C	+5V @ 9A	+12V @ 1A	−12V @ 1A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
SDM 80E	+5V @ 7A	+15V @ 3A (5A PK)	−15V @ 2A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
SDM 80F	+5V @ 9A	+15V @ 1A	−15V @ 1A	−5V @ 0.6A	–	80	7.75 X 4.25 X 1.90
SDM 110A	+5V @ 12A	+12V @ 3A (5A PK)	12V @ 3A (5A PK)*	−12V @ 3A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110B	+5V @ 12A	+12V @ 3A (5A PK)	12V @ 3A (5A PK)*	−12V @ 1A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110C	+5V @ 12A	+12V @ 3A (5A PK)	12V @ 1A*	−12V @ 1A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110D	+5V @ 12A	+12V @ 3A (5A PK)	5V @ 3A*	−12V @ 1A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110E	+5V @ 10A	+15V @ 3A (5A PK)	15V @ 3A (5A PK)*	−15V @ 3A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110F	+5V @ 12A	+12V @ 3A (5A PK)	15V @ 1A*	−15V @ 1A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 110G	+5V @ 12A	+12V @ 3A (5A PK)	24V @ 1.5A (3A PK)*	−12V @ 3A	−5V @ 0.6A	110	8.80 X 4.75 X 1.90
SDM 140A	+5V @ 15A	+12V @ 3A (5A PK)	12V @ 3A (5A PK)*	−12V @ 3A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 140B	+5V @ 15A	+12V @ 3A (5A PK)	12V @ 3A (5A PK)*	−12V @ 1A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM140C	+5V @ 15A	+12V @ 3A (5A PK)	12V @ 1A*	−12V @ 1A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 140D	+5V @ 15A	+12V @ 3A (5A PK)	5V @ 6A*	−12V @ 1A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 140E	+5V @ 12A	+15V @ 3A (5A PK)	15V @ 3A (5A PK)*	−15V @ 3A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 140F	+5V @ 15A	+12V @ 3A (5A PK)	15V / 1A*	−15V @ 1A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 140G	+5V @ 15A	+12V @ 3A (5A PK)	24V @ 2.5A (4A PK)*	−12V @ 3A	−5V @ 0.6A	140	10.30 X 4.75 X 2.20
SDM 200A	+5V @ 20A	+12V @ 5A (8A PK)	12V @ 5A (8A PK)*	−12V @ 3A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200B	+5V @ 20A	+12V @ 5A (8A PK)	12V @ 5A (8A PK)*	−12V @ 1.2A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200C	+5V @ 20A	+12V @ 5A (8A PK)	12V @ 1.2A*	−12V @ 1.2A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200D	+5V @ 20A	+12V @ 5A (8A PK)	5V @ 7A*	−12V @ 1.2A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200E	+5V @ 16A	+15V @ 5A (8A PK)	15V @ 5A (8A PK)*	−15V @ 5A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200F	+5V @ 20A	+12V @ 5A (8A PK)	15V @ 1A*	−15V @ 1A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45
SDM 200G	+5V @ 20A	+12V @ 5A (8A PK)	24V @ 4A (6A PK)*	−12V @ 5A	−5V @ 0.6A	200	12.80 X 4.75 X 2.45

* Isolated outputs.

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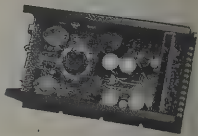
Converter Concepts invented universal input technology more than a decade ago. Although many power supply manufacturers have recently introduced products that imitat our performance, none can match our level of proven field

SWITCHING POWER SUPPLIES SELECTION GUIDE



SERIES	VL SERIES			WI SERIES			VT/VX SERIES					VF SERIES	
WATTS	10	40	50	25	40	60	15	25	50	75	100	65	100
UNIVERSAL INPUT	●	●	●	●	●	●	●	●	●	●	●	●	●
INPUT VOLTAGE:													
90-250 AC 100-350 DC				●	●	●	●	●	●	●	●	●	●
85-264 AC 120-365 DC	●	●	●										
10-40 DC→DC							●	●	●				
20-60 DC→DC	●						●	●	●	●	●	●	●
NUMBER OF OUTPUTS:													
1	●	●		●	●	●	●	●	●	●	●	●	●
2				●	●	●	●	●	●	●	●	●	●
3		●	●	●	●	●	●	●	●	●	●	●	●
4			●	●	●	●					●	●	●
PACKAGE:													
OPEN FRAME				●	●	●	●	●	●	●	●	●	●
ENCLOSED MODULE							●	●	●	●	●	●	●
PC BOARD	●	●	●										
SAFETY APPROVALS:													
UL		●	●	●				●	●	●			
CSA		●	●	●									
VDE		●	●	●									
FEATURES:	Features the application of surface mount technology in a low-cost PC board construction. Designed for high-volume applications requiring safety approvals and rigid EMI specifications. *VL Products feature a 1 year warranty.			Features the application of surface mount technology in an open frame switcher. The WI product line offers the user a flexible mounting scheme that provides excellent heat conduction to the mounting surface. *WI Products feature a 1 year warranty.			The versatile product easily modified to meet unique customer specifications. DC to DC models available in addition to Converter Concepts' universal AC input models. Rugged packaging in either open frame or enclosed package gives the VT/VX series maximum performance with a demonstrated MTBF in excess of 150,000 hrs. Many options available.					Features include a UPS (fail safe) system that allows operation from an AC power source or a DC power source. The VF also includes an integral battery charger. The VF product is a must if information retention is important during brown out of power line failures.	

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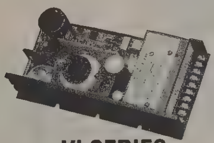
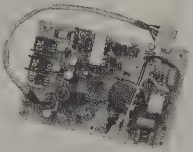
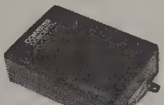
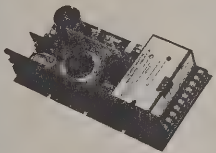
The standard power supplies listed below meet the demands of most design parameters. In applications that have specific performance requirements, Converter Concepts' engineers can design a power supply to meet your exact needs.

For more information, call (800) 253-5227.









VM SERIES	VI SERIES	CP SERIES	XT SERIES	HV SERIES
80	120	22	25	100
●	●	●	●	●
●	●	●		●
			●	
	●		●	
	●		●	●
	●		●	
●	●	●		
●	●			●
●	●		●	●
		●		
●		●	●	
		●	●	
		●	●	
Features UL 544 Recognition for use in medical applications, very flexible product with many options available.	Features output power capability up to 150 watts. Many output models available with many options possible. Excellent mounting scheme for either open frame or enclosed package.	Features an optional cable assembly, PC board construction and is designed for low power computer peripheral applications. *CP Products feature a 1 year warranty.	External, ultra-small design delivers improved line and load regulation, overcurrent/overvoltage protection plus surface mount technology. *XT Products feature a 1 year warranty.	Offers an automatic degausser circuit and is designed for high-resolution color monitors and gas discharge displays.

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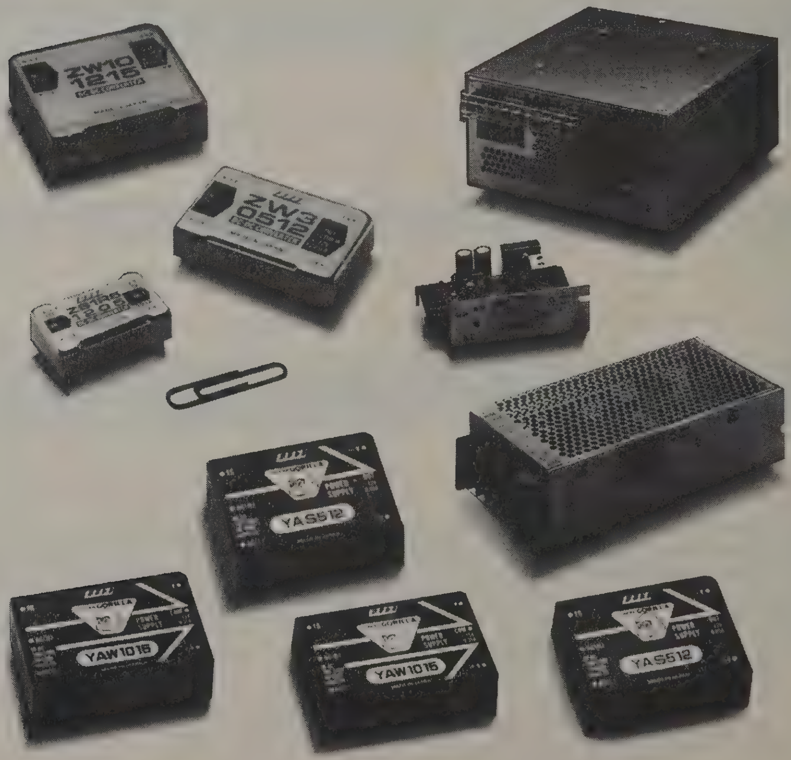
- ★ *On Board Type Switchers / 8 to 15 Watts*
- ★ *DC to DC Converters / 1.5 to 10 Watts*


ZW10
1215
ZW3
0512
ZS1R5
1205
YAS512
YAW1015
YAW1015
YAS512

(See our DC to DC Converters in section 4025, page D•2098)

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SWITCHING POWER SUPPLY

(SINGLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)				SIZE (W x H x D)		WEIGHT		SAFETY
			5V	12V	15V	24V	(mm)	(inch)	(kg)	(lb.)	
K	K10AU	AC 85~132V DC110~170V	2.0	0.9	0.7	0.5	27 x 74 x 68.0	1.06 x 2.91 x 2.67	0.15	0.33	UL CSA
	K15AU		3.0	1.3	1.0	0.7	35 x 97 x 99.5	1.37 x 3.81 x 3.91	0.30	0.66	
	K25AU		5.0	2.1	1.7	1.1	35 x 97 x 124.5	1.37 x 3.81 x 4.90	0.40	0.88	
	K50AU		10.0	4.2	3.4	2.1	37 x 97 x 161.0	1.45 x 3.81 x 6.33	0.45	0.99	
	K100AU		20.0	8.5	7.0	4.5	50 x 93 x 168.5	1.96 x 3.66 x 6.63	0.60	1.32	
	K150AU		30.0	13.0	10.0	6.5	65 x 93 x 179.0	2.55 x 3.66 x 7.04	0.95	2.09	
R	R15U	AC 85~132V DC110~170V	3.0	1.3	1.0	0.7	30 x 69 x 84.0	1.18 x 2.71 x 3.30	0.20	0.44	
	R25U		5.0	2.1	1.7	1.1	31 x 69 x 104.0	1.22 x 2.71 x 4.09	0.25	0.55	
	R50U		10.0	4.2	3.4	2.2	33 x 85 x 119.0	1.30 x 3.34 x 4.68	0.30	0.66	
P	P15E	AC 85~264V DC110~340V	3.0	1.3	1.0	0.7	35 x 97 x 99.5	1.37 x 3.81 x 3.91	0.30	0.66	UL CSA TÜV BAUART GEPRÜFT
	P30E		6.0	2.5	2.0	1.3	35 x 97 x 124.5	1.37 x 3.81 x 4.90	0.40	0.88	
	P50E	AC 85~132V AC170~264V	10.0	4.2	3.4	2.1	37 x 97 x 160.0	1.45 x 3.81 x 6.29	0.40	0.88	
	P100E		20.0	8.5	7.0	4.5	50 x 93 x 189.0	1.97 x 3.66 x 7.44	0.70	1.54	
	P150E		30.0	13.0	10.0	6.5	65 x 93 x 199.0	2.55 x 3.66 x 7.83	0.90	1.98	
	P300E		60.0	27.0	22.0	14.0	120 x 93 x 190.0	4.72 x 3.66 x 7.48	2.50	5.51	
	P600E		120.0	53.0	43.0	27.0	190 x 93 x 200.0	7.48 x 3.66 x 7.87	4.00	8.81	
	P1500E		300.0	125.0	100.0	65.0	200 x 97 x 300.0	7.87 x 3.81 x 11.81	7.00	15.43	

48V AVAILABLE ON ALL P SERIES. SAFETY APPROVALS ARE PENDING.

(MULTIPLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)			SIZE (W x H x D)		WEIGHT		SAFETY
			V1	V2	V3	(mm)	(inch)	(kg)	(lb.)	
MMB	MMB50U-1	AC 85~132V DC110~170V	5V3A	12V3A (3.6)	–	36 x 93 x 155	1.41 x 3.66 x 6.10	0.4	0.88	UL CSA
	MMB50U-2		5V5A	12V2.1A	–					
	MMB50U-3		5V3A	12V1.5A (1.8)	–					
	MMB50U-4		12V2.1A	12V2.1A	–					
	MMB50U-5		12V3A	12V1.5A	–					
	MMB50U-6		15V1.7A	15V1.7A	–					
	MMB75U-1		5V5A	12V4A	–	42 x 93 x 175	1.65 x 3.66 x 6.88	0.5	1.10	
	MMB75U-2		5V6A	24V2A	–					
MMC	MMC8U-1	AC 85~132V DC110~170V	5V1.2A	12V0.1A	–12V0.1A	27 x 74 x 68	1.06 x 2.91 x 2.67	0.15	0.33	UL CSA
	MMC8U-2		5V1.1A	15V0.1A	–15V0.1A					
	MMC8U-3		5V1.2A	15V0.1A	– 5V0.1A					
	MMC50U-1		5V5A	12V1.5A (2)	–12V0.5A	36 x 93 x 155	1.41 x 3.66 x 6.10	0.4	0.88	
	MMC50U-2		5V5A	15V1.2A	–15V0.5A					
	MMC50U-3		5V5A	12V1.5A (2)	– 5V0.5A					
	MMC50U-4		5V7A	12V1A (1.5)	–12V0.3A					
	MMC75U-1		5V8A	12V2.5A	–12V0.5A	42 x 93 x 175	1.65 x 3.66 x 6.88	0.6	1.32	
	MMC75U-2		5V8A	15V1.8A	–15V0.5A					
	MMC75U-3		5V8A	12V2.5A	– 5V0.5A					
	MMC75U-4		5V6A	12V3.2A	–12V0.5A					
	MMC100U-1		5V13A	12V2A	–12V1A	50 x 93 x 190	1.96 X 3.66 x 7.48	0.7	1.54	
	MMC100U-2		5V13A	15V1.5A	–15V1A					
	MMC100U-3		5V13A	12V2A	– 5V1A					
	MMC100U-4		5V8A	12V4A	–12V1A					
PMC	PMC15E-1	AC 85~264V DC110~340V	5V2A	12V0.3A	–12V0.2A	37 x 60 x 110	1.45 x 2.36 x 4.33	0.25	0.55	UL CSA TÜV BAUART GEPRÜFT
	PMC15E-2		5V2A	15V0.3A	–15V0.2A					
	PMC15E-3		5V2A	12V0.3A	– 5V0.2A					
	PMC30E-1		5V3A	12V1.2A	–12V0.3A	38.5 x 60 x 145	1.51 x 2.36 x 5.70	0.3	0.66	
	PMC30E-2		5V3A	15V0.7A	–15V0.5A					
	PMC50-1(*)	AC 85~132V/ AC170~264V	5V5A	12V1.5A (2)	–12V0.5A	30 x 93 x 185	1.18 x 3.66 x 7.28	0.4	0.88	
	PMC50-2(*)		5V5A	15V1.2A	–15V0.5A					
	PMC50-4(*)		5V7A	12V1A (1.5)	–12V0.3A					
	PMC75E-1		5V8A	12V2.5A	–12V0.5A	38 x 93 x 205	1.50 x 3.66 x 8.07	0.6	1.32	
	PMC75E-2		5V8A	15V1.8A	–15V0.5A					
	PMC75E-4		5V6A	12V3.2A	–12V0.5A					
	PMC100E-1		5V13A	12V2A	–12V1A	48 x 93 x 220	1.89 x 3.66 x 8.66	0.75	1.65	
	PMC100E-2		5V13A	15V1.5A	–15V1A					
	PMC100E-4		5V8A	12V4A	–12V1A					
KMC	KMC15U-1	AC 85~132V DC110~170V	5V2A	12V0.3A	–12V0.2A	33.5 x 92 x 120.5	1.31 x 3.62 x 4.74	0.4	0.88	UL CSA
	KMC15U-2		5V2A	15V0.2A	–15V0.2A					
	KMC30U-1		5V3A	12V1.2A	–12V0.3A	40.5 x 97 x 161.5	1.59 x 3.81 x 6.35	0.5	1.10	
	KMC30U-2		5V3A	15V0.5A	–15V0.5A					
RMC	RMC15U-1	AC 85~132V DC110~170V	5V2A	12V0.3A	–12V0.2A	28 x 80 x 100	1.10 x 3.14 x 3.93	0.25	0.55	
	RMC15U-2		5V2A	15V0.2A	–15V0.2A					
	RMC30U-1		5V3A	12V1.2A	–12V0.3A	31 x 80 x 135	1.22 x 3.14 x 5.31	0.35	0.77	
	RMC30U-2		5V3A	15V0.5A	–15V0.5A					

* E:with XULA

(See our DC to DC Converters in section 4025, page D•2098)

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ON BOARD SWITCHER

(SINGLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)		SIZE (W x H x D)		WEIGHT		SAFETY
			5V	12V	(mm)	(inch)	(kg)	(lb.)	
YS	YS5	AC 85~132V DC110~170V	1.0	0.45	60 x 18.5 x 43	1.97 x 0.73 x 1.69	0.065	0.14	ЯU CSA
	YS10		2.0	0.90	58 x 18.5 x 45	2.28 x 0.73 x 1.77	0.075	0.17	
	YS15		3.0	1.30	65 x 20.5 x 45	2.56 x 0.81 x 1.77	0.100	0.22	
YAS	YAS5	AC 85~264V DC110~340V	1.0	0.45	58 x 19.5 x 45	2.28 x 0.76 x 1.77	0.075	0.17	
	YAS10		2.0	0.90	65 x 21 x 45	2.56 x 0.82 x 1.77	0.100	0.22	

(MULTIPLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)		SIZE (W x H x D)		WEIGHT		SAFETY
			+/-12V (24V)	+/-15V (30V)	(mm)	(inch)	(kg)	(lb.)	
YW	YW5	AC 85~132V DC110~170V	0.22	0.17	50 x 18.5 x 43	1.97 x 0.73 x 1.69	0.065	0.14	ЯU CSA
	YW10		0.45	0.35	58 x 18.5 x 45	2.28 x 0.73 x 1.77	0.075	0.17	
	YW15		0.65	0.50	65 x 20.5 x 45	2.56 x 0.81 x 1.77	0.100	0.22	
YAW	YAW5	AC 85~264V DC110~340V	0.22	0.17	58 x 19.5 x 45	2.28 x 0.76 x 1.77	0.075	0.17	
	YAW10		0.45	0.35	65 x 21 x 45	2.56 x 0.82 x 1.77	0.100	0.22	

BOTH OUTPUT CONNECTED IN SERIES. YOU CAN MAKE SINGLE 24V AND 30V.

DC TO DC CONVERTER

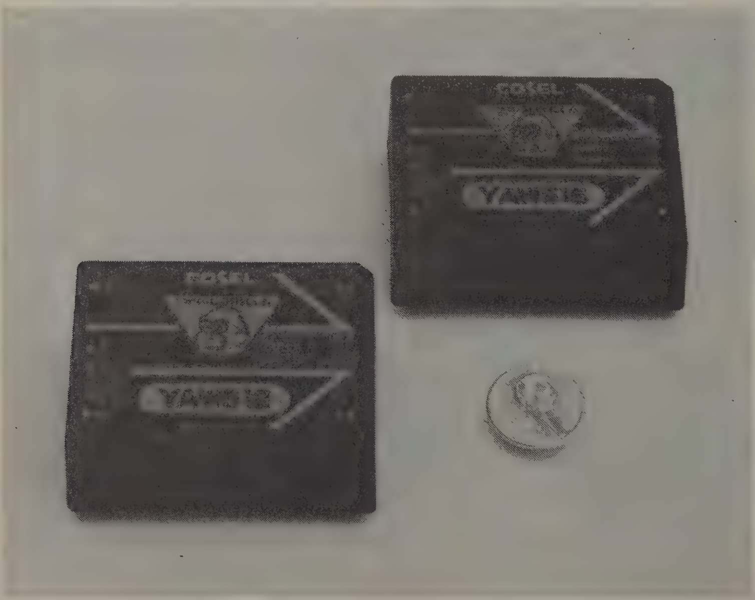
(SINGLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)			SIZE (W x H x D)		WEIGHT		SAFETY
			5V	12V	15V	(mm)	(inch)	(kg)	(lb.)	
ZS	ZS1R5	DC 4.5~6V (5)	0.25	0.12	0.1	33 x 10 x 21	1.30 x 0.39 x 0.83	0.025	0.06	
	ZS3	DC 10~15V (12)	0.5	0.25	0.2	47 x 10 x 30	1.85 x 0.39 x 1.18	0.035	0.08	
	ZS6	DC 20~30V (24)	1.0	0.50	0.4	47 x 14 x 42	1.85 x 0.55 x 1.65	0.070	0.15	
	ZS10	DC 35~63V (48)	1.6	0.70	0.6	47 x 14 x 42	1.85 x 0.55 x 1.65	0.075	0.17	

(MULTIPLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)		SIZE (W x H x D)		WEIGHT		SAFETY
			+/-12V	+/-15V	(mm)	(inch)	(kg)	(lb.)	
ZW	ZW1R5	DC 4.5~6V (5)	0.06	0.05	33 x 10 x 21	1.30 x 0.39 x 0.83	0.025	0.06	
	ZW3	DC 10~15V (12)	0.12	0.10	47 x 10 x 30	1.85 x 0.39 x 1.18	0.036	0.08	
	ZW6	DC 20~30V (24)	0.25	0.20	47 x 14 x 42	1.85 x 0.55 x 1.65	0.070	0.15	
	ZW10	DC 35~63V (48)	0.45	0.35	47 x 14 x 42	1.85 x 0.55 x 1.65	0.075	0.17	

Technical data sheets are available upon request.



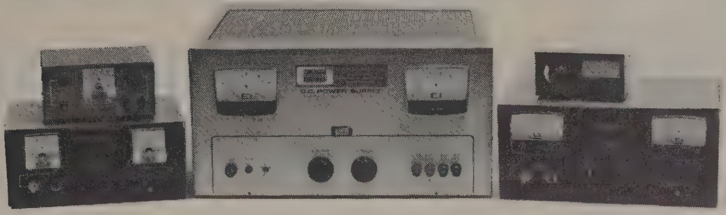
POWER GORILLA

- ★ *On Board Type*
- ★ *Single/Dual Output Switchers*
- ★ *5 to 10 Watts*

(See our DC to DC Converters in section 4025, page D•2098)

CRITERION

REGULATED DC POWER SUPPLIES



MODEL NUMBER	MAXIMUM VOLTAGE	MAXIMUM CURRENT
VR-5-20	5V	20A
VR-5-30	5V	30A
VR-5-40	5V	40A
VR-5-50	5V	50A
VR-5-100	5V	100A
VR-5-200	5V	200A
VR-5-500	5V	500A
VR-10-10	10V	10A
VR-10-20	10V	20A
VR-10-30	10V	30A
VR-10-40	10V	40A
VR-10-50	10V	50A
VR-10-100	10V	100A
VR-10-200	10V	200A
VR-20-5	20V	5A
VR-20-10	20V	10A
VR-20-20	20V	20A
VR-20-30	20V	30A
VR-20-40	20V	40A
VR-20-50	20V	50A
VR-20-100	20V	100A
VR-40-2	40V	2A
VR-40-5	40V	5A
VR-40-10	40V	10A
VR-40-20	40V	20A
VR-40-30	40V	30A
VR-40-40	40V	40A

MODEL NUMBER	MAXIMUM VOLTAGE	MAXIMUM CURRENT
VR-40-50	40V	50A
VR-60-1	60V	1A
VR-60-2	60V	2A
VR-60-5	60V	5A
VR-60-10	60V	10A
VR-60-20	60V	20A
VR-60-30	60V	30A
VR-60-40	60V	40A
VR-80-0.5	80V	0.5A
VR-80-1	80V	1A
VR-80-2	80V	2A
VR-80-5	80V	5A
VR-80-10	80V	10A
VR-80-20	80V	20A
VR-80-30	80V	30A
VR-100-0.5	100V	0.5A
VR-100-1	100V	1A
VR-100-2	100V	2A
VR-100-5	100V	5A
VR-100-10	100V	10A
VR-100-20	100V	20A
VR-150-0.2	150V	0.2A
VR-150-0.5	150V	0.5A
VR-150-1	150V	1A
VR-150-2	150V	2A
VR-150-5	150V	5A
VR-150-10	150V	10A

MODEL NUMBER	MAXIMUM VOLTAGE	MAXIMUM CURRENT
VR-200-0.1	200V	0.1A
VR-200-0.2	200V	0.2A
VR-200-0.5	200V	0.5A
VR-200-1	200V	1A
VR-200-2	200V	2A
VR-200-5	200V	5A
VR-200-10	200V	10A
VR-300-0.1	300V	0.1A
VR-300-0.2	300V	0.2A
VR-300-0.5	300V	0.5A
VR-300-1	300V	1A
VR-300-2	300V	2A
VR-300-5	300V	5A
VR-400-0.05	400V	0.05A
VR-400-0.1	400V	0.1A
VR-400-0.2	400V	0.2A
VR-400-0.5	400V	0.5A
VR-400-1	400V	1A
VR-400-2	400V	2A
VR-500-0.02	500V	0.02A
VR-500-0.05	500V	0.05A
VR-500-0.1	500V	0.1A
VR-500-0.2	500V	0.2A
VR-500-0.5	500V	0.5A
VR-500-1	500V	1A
VR-500-2	500V	2A

SPECIFICATIONS:

INPUT VOLTAGE: – 120 V, 60 Hz, single phase
– Unit will operate with ± 10% change in input voltage.

Output Voltage: – Continuously variable from zero to the maximum voltage indicated in above table.

Output Current: – Zero to maximum indicated in above table.
– Current is limited to approximately 10% greater than this, even on a short circuit.

Line Regulation: – If the input line voltage changes ± 10% from its nominal 120 V, the output voltage will change no more than ± 0.03% or ± 15 mV, whichever is greater (at any load current within rating).

Load Regulation: – For changes in load current from zero to rated maximum, the output voltage will change no more than 0.15% or 50 mV, whichever is greater (at any line voltage within rating).

Ripple: – The rms value of the ripple voltage will be no greater than 0.05% or 20 mV, whichever is greater (at any line voltage or load current within rating).

Short Circuit: Proof – Output may be shorted continuously without damage to the unit. Power supply recovers automatically to normal when short is removed.

For more information on power supplies with higher outputs please contact:

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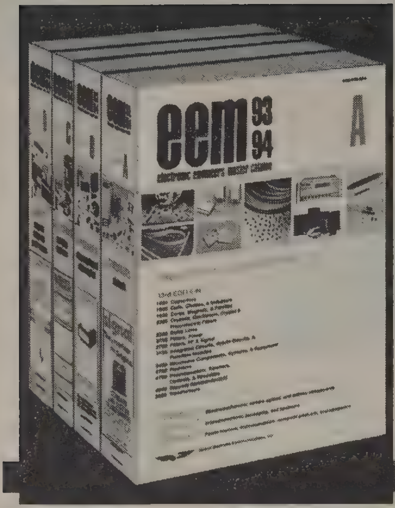

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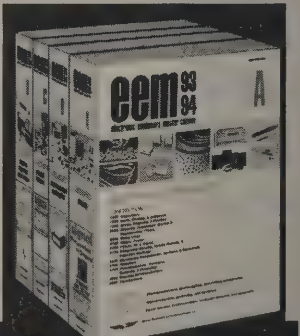

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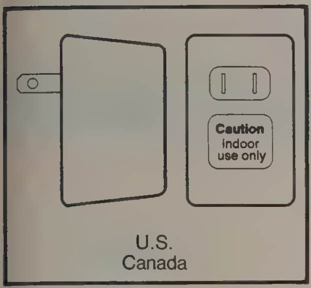

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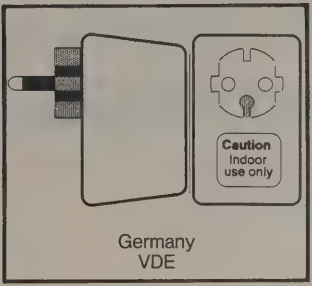

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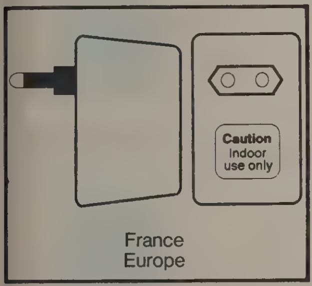

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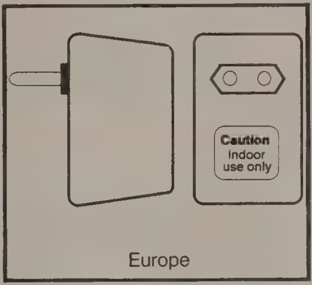

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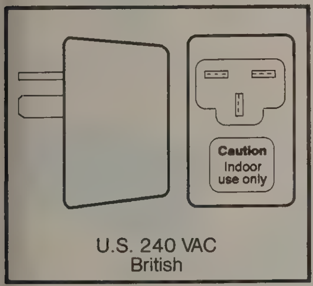
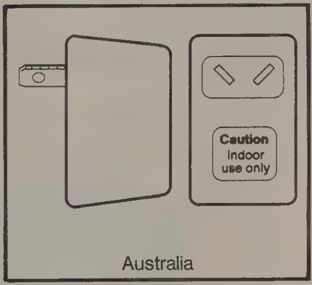


U.S. 240 VAC
British



Australia

Only a partial list of US/Canadian types are shown. Many other input & output configurations are available with international approvals.

MODEL #	V	mA	UL	CSA	MODEL #	V	mA	UL	CSA
DPD030010	3.0	100	Y	Y	DPD120300	12.0	300	Y	Y
DPD030020	3.0	200	Y	Y	DPD120040	12.0	400	Y	Y
DPD030030	3.0	300	Y	Y	DPD120050	12.0	500	Y	Y
DPD030040	3.0	400	Y	Y	DPD120060	12.0	600	Y	Y
DPD030050	3.0	500	Y	Y	DPD120070	12.0	700	Y	Y
DPD045010	4.5	100	Y	Y	DPD120080	12.0	800	Y	Y
DPD045020	4.5	200	Y	Y	DPA120083	12.0	830	Y	Y
DPD045030	4.5	300	Y	Y	DPA120100	12.0	1000	Y	Y
DPD045040	4.5	400	Y	Y	DPD120120	12.0	1200	Y	N
DPD045050	4.5	500	Y	Y	DPA130070	13.0	700	Y	Y
DPD045060	4.5	600	Y	Y	DPD150020	15.0	200	Y	Y
DPD045200	4.5	2000	Y	Y	DPD150030	15.0	300	Y	Y
DPD050200	5.0	2000	Y	N	DPD150040	15.0	400	Y	Y
DPD055050	5.5	500	Y	Y	DPD150050	15.0	500	Y	Y
DPD060010	6.0	100	Y	Y	DPD150060	15.0	600	Y	Y
DPD060020	6.0	200	Y	Y	DPD150070	15.0	700	Y	N
DPD060030	6.0	300	Y	Y	DPD150080	15.0	800	Y	N
DPD060040	6.0	400	Y	Y	DPD150090	15.0	900	Y	N
DPD060050	6.0	500	Y	Y	DPD160010	16.0	100	Y	Y
DPD060060	6.0	600	Y	Y	DPD160020	16.0	200	Y	Y
DPD060080	6.0	800	Y	Y	DPD160030	16.0	300	Y	Y
DPD060090	6.0	900	Y	Y	DPD160040	16.0	400	Y	Y
DPD060100	6.0	1000	Y	Y	DPD160050	16.0	500	Y	Y
DPA060150	6.0	1500	Y	Y	DPD160060	16.0	600	Y	Y
DPD060200	6.0	2000	Y	N	DPA160075	16.0	750	Y	Y
DPD075010	7.5	100	Y	Y	DPD180828	18.0	200	Y	Y
DPD075020	7.5	200	Y	Y	DPD180030	18.0	300	Y	Y
DPD075030	7.5	300	Y	Y	DPD180040	18.0	400	Y	Y
DPD075040	7.5	400	Y	Y	DPD180050	18.0	500	Y	Y
DPD075050	7.5	500	Y	Y	DPA180060	18.0	600	Y	Y
DPD075060	7.5	600	Y	Y	DPD180060	18.0	600	Y	N
DPD075070	7.5	700	Y	Y	DPD180070	18.0	700	Y	N
DPD075080	7.5	800	Y	Y	DPD180080	18.0	800	Y	N
DPD075090	7.5	900	Y	Y	DPD100010	20.0	100	Y	Y
DPA075150	7.5	1500	Y	Y	DPD200020	20.0	200	Y	Y
DPD090003	9.0	30	Y	Y	DPD200030	20.0	300	Y	Y
DPD090005	9.0	50	Y	Y	DPD200040	20.0	400	Y	Y
DPD090010	9.0	100	Y	Y	DPD200060	20.0	600	Y	N
DPD090020	9.0	200	Y	Y	DPD200070	20.0	700	Y	N
DPD090030	9.0	300	Y	Y	DPD220030	22.0	300	Y	Y
DPD090040	9.0	400	Y	Y	DPD220040	22.0	400	Y	Y
DPD090050	9.0	500	Y	Y	DPD220050	22.0	500	Y	N
DPD090060	9.0	600	Y	Y	DPD220060	22.0	600	Y	N
DPD090070	9.0	700	Y	Y	DPD240010	24.0	100	Y	Y
DPD090080	9.0	800	Y	Y	DPD240020	24.0	200	Y	Y
DPD090090	9.0	900	Y	Y	DPD240030	24.0	300	Y	Y
DPD090100	9.0	1000	Y	Y	DPD240040	24.0	400	Y	Y
DPD120005	12.0	50	Y	Y	DPA240045	24.0	450	Y	Y
DPD120100	12.0	100	Y	Y	DPD240050	24.0	500	Y	N
DPD120200	12.0	200	Y	Y	DPD240060	24.0	600	Y	N

Note: All models with a DPD prefix are available with approvals in both AC and DC output. Those with a DPA prefix are available only in AC output with approvals.

ORDERING INFORMATION

DP D 015 008 X

Model	Type	Volts	Current	Special
DP-Plug-in DT-Desk Top	A-A/C D-D/C R-Regulated D/C	Shown in 10ths (015=1.5V)	mA×10 (010=100mA)	G-Ground Pin C-Center tap D-Dual output S-Switchable input

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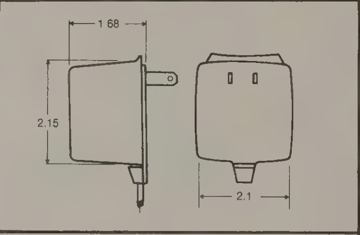

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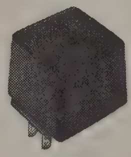
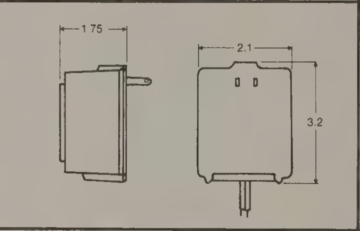


12 VA or 4 W max.



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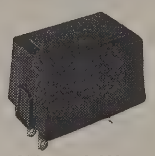
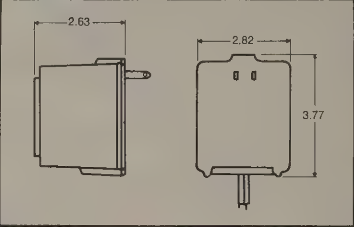


12 VA or 9 W max.



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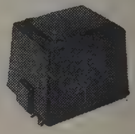
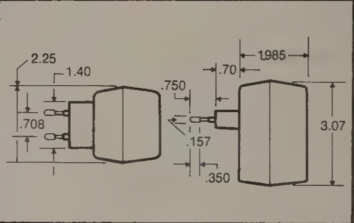
WALL PLUG-IN OR DESKTOP

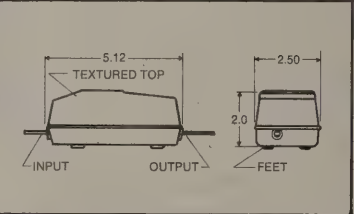


56 VA or 35 W max.

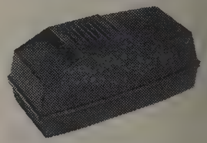


D 'EURO' WALLSTYLE

20 VA or 9 W max.



DPC DESK TOP



20 VA or 13 W max.

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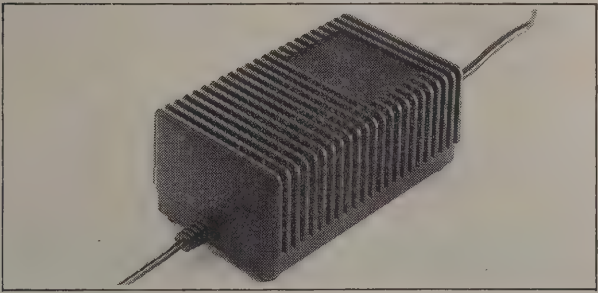

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Line Regulation	.1%
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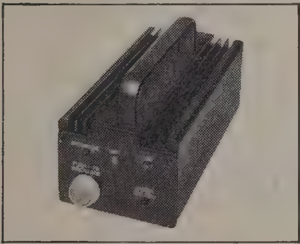

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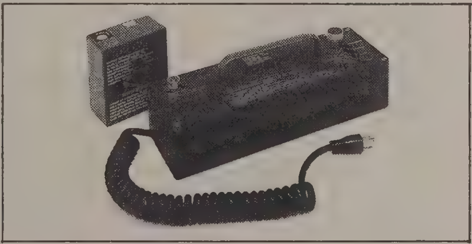

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Size: 19" rack mount, 7" high
17" - 32" deep

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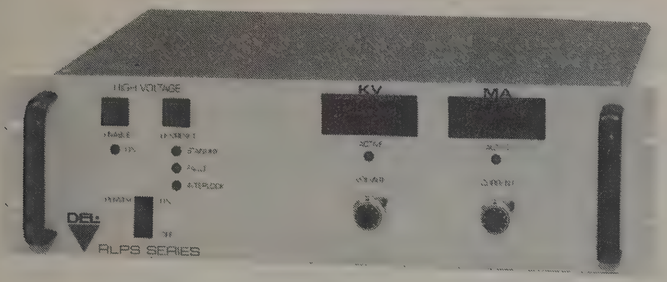

RLPS SERIES
RHVS SERIES
60-5000 WATTS

Regulated HV Power Supplies

Features

- Uses the most advanced resonant sine wave switching technology
- Voltage regulation better than 0.005% for load and line
- 0.05% RMS Ripple
- Low stored energy
- Provides high efficiency and stability
- Standard 19" Rack
- Available in 300, 500 and 1000 Watt models up to 125 kilovolts

Remote Capabilities

Remote Programming
Voltage and Current: 0 to 10 VDC, analog
Remote Monitor Output:
Voltage and Current: 0 to 10 VDC, analog, 1% accuracy
Remote Enable/Disable:
TTL compatible
External Interlock:
Dry contact closure
External Reference: 10.4 volts

Performance Specifications

Input: Selectable 115 or 220 VAC 50 or 60Hz
Output: Continuously adjustable from 0 to maximum rate output via local or remote controls. See chart below.
Voltage Regulation:
Line: ± 0.005% for a ± 10% line change
Load: ± 0.005% N.L. to full load change
Current Regulation:
Line: ± 0.05%
Load: ± 0.2%, 10% to full load
Ripple: 0.05% RMS at max. output
Stability: 0.01%/hr., 0.05%/8hrs after 1/2 hour
Temperature Range:
Operating: -20°C to 55°C
Storage: -40°C to 85°C
Temperature Co-efficient: 0.01°C
Output Protection: Overvoltage, arc and adjustable short circuit
Slow Start: 3 seconds (zero to max. output)

Physical Specifications

Front Panel Controls and Metering

1. HV ON push button with light
2. HV OFF/Reset push button with light
3. Voltage and current control by 10 turn potentiometers (0.1% Resolution)
4. 31/2 Digit LED Digital Panel Meters for both voltage and current, 1% accuracy
5. Voltage and current mode lights

Dimensions

RLPS and RHVS are 19" rack mountable units. The 60 - 500 Watt models are 5 1/4" high. 1 x W models are 10 1/3" high. Typical depth is 16".

Output Configurations

	OUTPUT POWER	OUTPUT VOLTAGE
RLPS SERIES	60 - 150 Watts	1 - 125kV
RHVS SERIES	300 - 5,000 Watts	1 - 125kV

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PMS SERIES

Photomultiplier Power Supplies

FEATURES

- Output isolated from Input
- Output proportional to Input
- Output momentary short circuit protected
- Reversible Polarity
- Temperature range O° to 60°C
- Small
- Lightweight
- Shielded

Description:

The DEL PMS Series is a family of highly reliable, compact, DC to DC proportional converters for use as power sources for photomultiplier and other tube applications. The series utilizes high frequency technology with low energy storage and arc protection.

Insulated, 8" - long, output high voltage leads are floating and fully isolated from the input leads and the case.

Shielding is provided by a steel case, except for the PC board mountable unit PMS 1-7-7 and PMS 1-23.

Specifications

Model	Input DC	Output Voltage	Output Current	Output Min. Load (Meg. OHMS)	Ripple P to P	Size L x W x H or Diameter x L	Mounting
PMS1-1	3-15V	300-1500V	1 mA	1.5	1.5V	1 x 2-1/4	Loop Clamp
PMS1-7-7	3-15V	300-1500V	1 mA	1.5	6.0V	2.4 x 1.5 x .81	P.C. Board
PMS1-23	3-15V	300-1500V	1 mA	1.0	6.0V	1.5 x 1.5 x .6	P.C. Board
PMS3-5	3-15V	300-1500V	0.5 mA	6.0	7.5V	1-1/4 x 2-3/8	8/32 Studs
PMS5-5	3-15V	500-5000V	0.5 mA	10.0	10.0V	1-7/16 x 3-1/8	8/32 Studs
PMS8-8	3-15V	800-8000V	0.8 mA	10.0	8.0V	2-1/2 x 3	8/32 Studs
PMS10-025*	3-10V	3kV-10kV	.025 mA	400.0	50.0V	2-1/16 x 2-5/16 x 3-1/8	4 Studs

Complete engineering specifications are yours on request.

DEL

Put Del Power to Work for You!

DEL ELECTRONICS CORP.

One Commerce Park, Valhalla, New York 10595
PHONE: 914/686-3600 FAX: 914/686-5424

MODULAR HV DC TO DC CONVERTERS

MLP SERIES
MHP SERIES
10-60 WATTS

Regulated Power Supplies

Applications

- **Image Intensifiers**
- **Mass Spectrometers**
- **Photomultipliers**
- **CRT's**
- **Electrophoresis**
- **Electrostatics**
- **Laboratory R & D**

Description

The MLP/MHP series are compact DC to DC converters that offers a versatile, highly regulated HV source for various laboratory and OEM applications. All units provide remote analog programming, test points and (TTL) enable. Units 3kV and below are sufficiently isolated from case, enabling the outputs to float or to be grounded in either direction, for easy polarity reversal. MLP's are immune to overload, sustained short circuits and arc over conditions.

Performance Specifications

Input: 24 to 32 Volts DC @ 1.0 amp max.
Output: Adjustable voltage from 0 to maximum rating via remote analog program.

Line Regulation:
±0.02% for a ±10% line change.
Load Regulation:
0.05% NL to FL (MLP)
0.02% NL to FL (MHP)
Ripple: 0.01% Pk to Pk (MLP)
Stability: 0.01%/hr after 1/2 hr. warm up, 0.02%/8 hrs.
Temperature Coefficient: 100ppm°C
Temperature:
A) Operating: – 20°C to 55°C
B) Storage: – 40°C to 85°C

Note: Specifications are held from 10% to maximum rated outputs.

Remote Interface:

Programming:
Voltage: 0 to 10V Analog, Ground Referenced

Test Points:
Voltage: 0 to 10V Analog, 5% accuracy

Current: 0 to 10V Analog, 15% accuracy on 3kV and below 1% accuracy on 6kV and above.

Enable: TTL low is active

Connections:
Output: 24" Flying Lead
Input: "Mini D" connector

Dimensions:
MLP - 3.75 x 2.625 x 1.75 or
5.69 x 5.63 x 2.06

MHP - 8 x 5.56 x 3.5

	OUTPUT VOLTAGE	OUTPUT POWER
MLP SERIES	1 - 30kV	10 - 30 Watts
MHP SERIES	1 - 60kV	40 - 60 Watts

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DYNAGE Power

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Canistota, SD 57012
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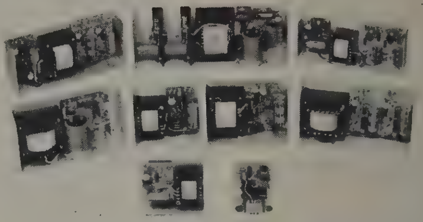
OPEN FRAME POWER SUPPLIES, Q SERIES (linear)

SINGLE OUTPUT MODELS		
Model	Rating	Price
		1-24
5 Volts		
QSA5 - 1 2 OVP	5V@ 1.2A	$23.95
QSB5 - 3.0 OVP	5V@ 3.0A	29.95
QSC5 - 6.0 OVP	5V@ 6 0A	51.95
QSN5 - 9.0 OVP	5V@ 9.0A	71.95
QSD5 - 12.0 OVP	5V@ 12.0A	81.95
12 Volts		
QSA12 - 0.5	12V@ 0.5A	$23.95
QSB12 - 1 7	12V@ 1 7A	29.95
QSC12 - 3.4	12V@ 3.4A	46.95
QSN12 - 5 1	12V@ 5 1A	66.95
QSD12 - 6.8	12V@ 6.8A	76.95
15 Volts		
QSA15 - 0.5	15V@ 0 5A	$23.95
QSB15 - 1.5	15V@ 1.5A	29.95
QSC15 - 3.0	15V@ 3.0A	46.95
QSN15 - 4.5	15V@ 4.5A	66.95
QSD15 - 6.0	15V@ 6.0A	76.95
24 Volts		
QSB24 - 1.2	24V@ 1 2A	$29.95
QSC24 - 2.4	24V@ 2 4A	46.95
QSN24 - 3.6	24V@ 3 6A	66.95
QSD24 - 4.8	24V@ 4 8A	76.95

Features:

- Low Cost
- 115,220,230 and 240 VAC, 47-63Hz/Input
- Overvoltage Protection for All 5V Outputs
- Transformer - 2500V Isolation with Primary to Secondary Shield
- Two Hour "burn-in" on all units.
- RFI/EMI Free Operation
- U.L. Recognized and CSA Approved
- 2 Year Warranty, Factory Repair Service
- Quantity-Volume Discounts

OVP-12 Overvoltage Protector	
1-24	$7.95



The Q Series line of open frame power supplies, introduced in 1980, supersede the previous open frame models that have been in production since 1971.

SPECIFICATIONS:

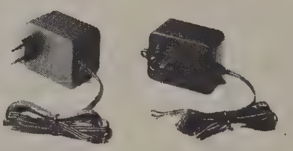
A.C Input	115. 220. 230. 240 volts ± 10% 50-400Hz. Load rating should be reduced by 10% when used at 50Hz
D.C. Output	5 volts to 24 volts (See tables)
Output Adjustment.	Minimum of ± 5%
Line Regulation:	< ± 0.05% for 10% line change
Load Regulation:	< ± 0 05% for 50% load change
Ripple & Noise:	Units up to 15 volts — < 1mV R M S Above 15 volts —< 3m R M S
Transient Response.	< 30p Secs for 50% load change
Overload Protection	Automatic Re-entrant current limit
Overvoltage Protection	Built into all 5v outputs Set at 6 2v ± 0 4 volts Other voltages optional "add-on" packages are available
Output Isolation.	All outputs isolated from each other Isolation output to frame. 30 megohms min . at 500 VDC
Remote Sensing:	All Models
Stability:	≤± 0.3% for 24 hours after warm up
Operating Temperature:	0°C to +50° full rating then linear derating to 40% at 70°C
Storage Temperature:	.55°C to + 85°C
Temperature Coefficient	± 0.03% °C
Efficiency:	5v units 45% 12 - 15v units 55% 24v units 60%
Vibration	Per MIL-STD-801B, Method 514 Procedure 1. curve AB (to 50Hz)
Shock:	Per MIL-STD-801B, Method 516 Procedure V
Burn-in:	Each unit undergoes a 2 hour burn-in and is fully re-tested before shipment
Packaging	All units individually boxed and labeled

DUAL OUTPUT MODELS (Outputs Isolated)			
Model	Ratings		Price
	Output #1	Output #2	1-24
QDA12 15	12V @ 1.0A, or 15V @ 0 8A	12V @ 1 0A, or 15V @ 0 8A	$40.95
QDB12 15	12V @ 1 7A, or 15V @ 1 5A	12V @ 1 7A, or 15V @ 1 5A	51.95
QDC12 15	12V @ 3 4A, or 15V @ 3 0A	12V @ 3 4A, or 15V @ 3 0A	84.95
QDB5 12	5V @ 3.0A	9-15V @ 1 25A	56.95
QDC5 12	5V @ 6.0A	9-15V @ 2 50A	91.95

TRIPLE OUTPUT MODELS (Outputs Isolated)				
Model	Ratings			Price
	Output #1	Output #2	Output #3	1-24
QTC1	5V @ 3 0A	12V @ 1 0A, or 15V @ 0 8A	12V @ 1 0A, or 15V @ 0 8A	$72 95
QTD1	5V @ 6 0A	12V @ 1 7A, or 15V @ 1 5A	12V @ 1 7A, or 15V @ 1 5A	96.95
QTD2	5V @ 2 5A	5V @ 0 5A	24V @ 3 0A (3 4 peak)	119.95
QTE1	5V @ 12 0A	12V @ 1 3A, or 15V @ 1 3A	12V @ 1 3A, or 15V @ 1 3A	240.00
QTG1	5V @ 12 0A	12V @ 2 8A, or 15V @ 2 8A	12V @ 2 8A, or 15V @ 2 8A	285.60

DIMENSIONS			
Case Size	Dimensions, inches	Case Size	Dimensions inches
QSA	3 75×3 00×1 25	QSD	9 00×4 87×2 75
QSB	4.87×4.00×1 62	QDC	9 38×4 87×2 75
QSC	5 62×4 87×2 50	QTC1	10 25×4 00×2 50
QDA	6 50×4 00×1 62	QTD1	11 00×4 87×2 75
QSN QDB	7 00×4 87×2 50	QTE1 QTG1	15 00×4 87×4 00

WALL PLUG-IN POWER SOURCES



- AC-AC
- AC-DC (Unreg.)
- AC-DC (Reg.)
- Low Pricing
- Both Domestic and European Types

These are ideal power sources for modern microcomputers, alarm equipment, microprocessor-based units, games, calculators, and other similar equipment.

Call us to discuss your specific needs.

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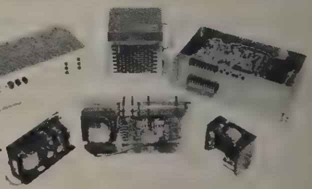
CUSTOM POWER SUPPLIES



- Switching
- Linear
- DC to DC Converter
- Ferroresonant

Dynage will design, to your specifications, for a wide range of applications.

At Dynage, custom power supplies are professionally designed and skillfully manufactured to achieve outstanding reliability and performance.

Call us to discuss your requirements. Our outstanding power supply design team offers seasoned engineering solutions to your power supply requirements.

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Contact DYNAGE for Your Custom Requirements Commerical or Military:

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- HIGH VOLTAGE MULTIPLIERS

APPLICATIONS INCLUDE:

LASER IGNITION
ELECTROSTATIC PRECIPITATORS
AIR CLEANERS
IONIZER SOURCES
OZONE GENERATOR SOURCES
CAPACITOR CHARGING
ARC LAMPS
X-RAY SOURCES
PULSED LASERS
CW LASERS

PHOTOMULTIPLIER TUBES
ION PUMPS
CRT'S
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OIL EXPLORATION
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ELECTROPHORESIS

Call us for your special requirements!

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- High Quality

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WALL PLUG-IN, DESK TOP, AND WALL MOUNT UNITS

AC/AC, AC/DC, and AC/DC Regulated

AC/AC ADAPTERS

Up to 14 case sizes are offered with a variety of output cord and connector configurations to meet your specific requirement. Units can be custom designed to meet your input and output ratings. Plug types for many different countries are available. Several standard models with UL, CSA and other approvals are offered.

Centertapped or multi-secondary versions with three or four conductor output cords are availalbe. Screw terminal outputs are also offered on some case sizes.

Wall plug-in units for North American receptacles.

AC/DC ADAPTERS

These adapters are unregulated, filtered, DC output units offered in up to 14 case sizes with a wide variety of output cord and connector configuation. Dual or triple DC outputs with three or four conductor output cords are available. Input plug types of many different countries are offered.

UL and CSA approved standard models are available. Units designed to meet VDE, TUV, and others are also offered.

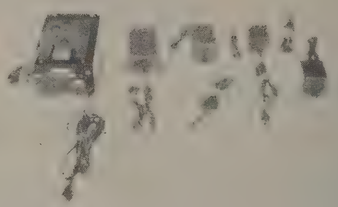
Wall plug-in units for various International receptacles.

LINEAR REGULATED POWER SUPPLIES

The larger case sizes are used for the linear regulated DC power supply units. Some of the larger cases are of the wall plug-in type mainly for North American receptacles. Most of the larger cases are of the desktop (or wall mount) style.

Single or multiple regulated outputs are offered with 2, 3, 4, or 5 conductor output cords available. Input cords for most countries are available in the desk top or wall mount units.

Custom designs can be made to meet your specific requirements.



Desktop and wall mount units with input cords for North American receptacles or various International receptacles.

SWITCHING POWER SUPPLIES

the switching regulated power supplies are offered primarily in the larger case sizes. Some versions are available in wall plug-in type cases but most offerings are in desk top units. Units are designed to meet EMI requirements per FCC Docket 20780 Class B. Wide input voltage ranges of 90--130 and 180-260 VAC are standard.

Custom designs can be made to meet your specific requirements.

- Low prices
- High quality.

- Custom designs to meet your exact requirements.
- Standard designs available with UL and CSA approvals.
- UL, CSA, and VDE submittals upon request.
- Quick delivery on preproduction units (made in USA)
- Plugs for Continental Europe, UK, Australia, North America, and others.

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DYNAGE Power

BATTERY CHARGERS

Ni-Cad – Gell Cell – Sealed Lead Acid – Others

NI-CAD CHARGERS*

Float Type - The least costly float charger design, with the C/10 charge rate usually recommended, require 14 to 16 hours for the batteries to charge from a full discharge. Specify the ampere-hour rating and the voltage rating of your nic-cad battery when ordering your low cost C/10 float charger. Float types with quick charge rates (4 to 5 hours) with C/3.33 or other charge rates are also available. Dual mode units for a combination of quick or fast charge and float charge are described below.

2-mode, time controlled, type - The chargers with time-controlled dual mode provide quick charge (C/3.33) for 4 hours and then revert to float charge (C/10, C/30, or C/50) continuously are availalbe. Internal timer is reset with external switch on charger unit to set charge at "quick rate" for fixed time period. The above time-controlled dual mode can also be applied to have C/10 float charge rates run for 16 hours and then revert to a C/30 or C/50 smaller float charge rate.

2-mode, temperature controlled types - The chargers with temperature controlled dual mode to provide fast charge (C/1) until battery temperature high limit is reached and then revert to float charge (C/10, C/30 or C/50) continuously are available. The temperature sensor must be assembled with the battery pack and connected with separate conductor of the output cord of the charger unit.

Custom Types - Contact us to design battery chargers to meet your requirements.

GELL CELL CHARGERS**

Float Type - These chargers with a single fixed voltage provide optimum battery life in standby type applications and will maintain a battery in the fully charged condition at the float voltage of 2.28 to 2.30 volts per cell. The float type charger delivers a constant potential to the battery and is current limited to 20% or less of the 20 hr capacity of the battery. This type is used for products that activate in the event of a power failure and for applications where the charger is always connected to the battery. These chargers can be simultaneously used as a power supply and a charger.

Cyclic (2-mode) Type - These chargers are designed to quickly recharge batteries without danger of overcharging and are suited for applications where batteries are repeatedly being discharged and recharged. The dual modes consist of (1) fast charge constant potential of about 2.50 volts per cell with current limit to 40% or less of the rated 20 hr capacity of the battery and (2) float charge constant potential of about 2.29 volts per cell with current limit to 20% or less of the rated 20 hr capacity of the battery. The automatic switchover from fast charge to float charge is initiated by sensing the charge current and switching to "Float" at a set point of about C/100 under the fast charge constant potential condition.

* Contact Sales Office for button cell chargers.

** Also starved electrolyte lead acid chargers.

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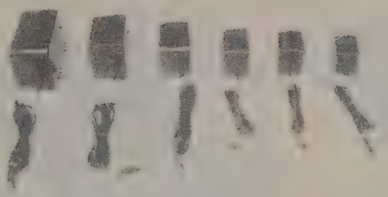
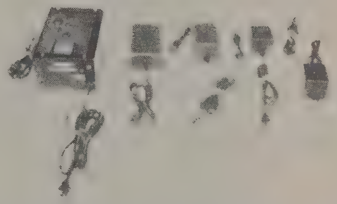


Wall plug-in units for North American receptacles.

Wall plug-in units for various International receptacles.



Desktop and wall mount units with input cords for North American receptacles or various International receptacles.

GATES SEALED (TO 50 PSI) LEAD ACID BATTERIES

Same as for Gell Cell except:

Float Type - Same as Gell Cell Charger except use constant potential of 2.3 to 2.4 volts per cell with current limit set at 200% or less of the rated 20 hr capacity.

Cyclic Type - Same as Gell Cell Charger except use constant potential up to 2.6 volts per cell with current limit set to 200% or less of the rated 20 hr capacity.

- **Low Prices** ● **High Quality** ● **Custom Designs**

Call or FAX us for your special requirements!

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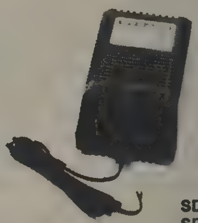
BATTERY CHARGERS - Sealed Lead Acid & Gel Cell

WB1E Series
WB2E Series
Case E

DB1E Series
DB2E Series
Case E

DB1FV Series
DB2FV Series
Case FV



SDB1ET Series
SDB2ET Series
Case ET

FLOAT CHARGERS - SINGLE MODE

Wall Plug - In Model No.	Desktop Model No.	Case Size	Input Voltage	Batt. Cells	End of Chg. Voltage	Max Chg. Curr. -A
WB1E4.6-3.1XXXX	DB1E4.6-3.1XXXX	E	Note 1	2	4.6	3.1
----	DB1FV4.6-4.5XXXX	FV	Note 1	2	4.6	4.5
----	DB1ET4.6-6.0XXXX	ET	90-265	2	4.6	6.0
WB1E6.9-2.4XXXX	DB1E6.9-2.4XXXX	E	Note 1	3	6.9	2.4
----	DB1FV6.9-3.8XXXX	FV	Note 1	3	6.9	3.8
----	DB1ET6.9-5.6XXXX	ET	90-265	3	6.9	5.6
WB1E13.8-1.5XXXX	DB1E13.8-1.5XXXX	E	Note 1	6	13.8	1.5
----	DB1FV13.8-2.5XXXX	FV	Note 1	6	13.8	2.5
----	DB1ET13.8-4.0XXXX	ET	90-265	6	13.8	4.0
WB1E27.6-0.8XXXX	DB1E27.6.-0.8XXXX	E	Note 1	12	27.6	0.8
----	DB1FV27.6-1.3XXXX	FV	Note 1	12	27.6	1.3
----	DB1ET27.6-2.0XXXX	ET	90-265	12	27.6	2.0

FAST CHARGERS - DUAL MODE

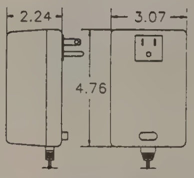
Wall Plug - In Model No.	Desktop Model No.	Case Size	Input Voltage	Batt. Cells	Fast Chg. State Max. Volt.	Fast Chg. State Max. Curr. -A	End of Chg. Voltage
WB2E4.9-3.1XXXX	DB2E4.9-3.1XXXX	E	Note 1	2	4.9	3.1	4.6
----	DB2FV4.9-4.5XXXX	FV	Note 1	2	4.9	4.5	4.6
----	DB2ET4.9-6.0XXXX	ET	90-265	2	4.9	6.0	4.6
WB2E7.3-2.4XXXX	DB2E7.3-2.4XXXX	E	Note 1	3	7.35	2.4	6.9
----	DB2FV7.3-3.8XXXX	FV	Note 1	3	7.35	3.8	6.9
----	DB2ET7.3-5.6XXXX	ET	90-265	3	7.35	5.6	6.9
WB2E14.7-1.5XXXX	DB2E14.7-1.5XXXX	E	Note 1	6	14.7	1.5	13.8
----	DB2FV14.7-2.5XXXX	FV	Note 1	6	14.7	2.5	13.8
----	DB2ET14.7-4.0XXXX	ET	90-265	6	14.7	4.0	13.8
WB2E29.4-0.8XXXX	DB2E29.-0.8XXXX	E	Note 1	12	29.4	0.8	27.6
----	DB2FV29.4-1.3XXXX	FV	Note 1	12	29.4	1.3	27.6
----	DB2ET29.4-2.0XXXX	ET	90-265	12	29.4	2.0	27.6

NOTES:

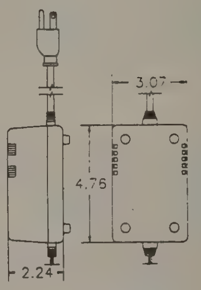
1) Select one (1) of these voltages when ordering: 100, 117, 220, 230, or 240 VAC (only 100 or 117 for wall plug in). Maximum charge current will be derated by 15% for 220, 230, and 240 VAC inputs and 50Hz inputs.
2) The suffixes xxxx are used to designate 1) Input plug type, 2) Input voltage level, 3) Output connector, 4) Output cord wire gauge, respectively. Only USA 2-prong and 3-prong plugs offered on wall plug- in models.
3) Same as (2) above except all types of input plugs and voltages are offered on desktop models.
4) Special models can be offered for any number of cells not listed under this heading.
5) Special models with slightly lower (or higher) maximum voltages if your battery requires.
6) Values of maximum currents are maximum for the case size. Lower limits can be provided if the maximum shown is too large for your battery.
7) Derate at 3% per °C above 35°C. Specify required maximum ambient temperature when ordering.

Other Specifications:

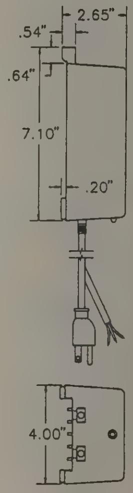
Input voltage ranges: ± 10%
Ambient Temperature: 0 to 35°C (Note 7)
Dielectric Withstand: 1500 volts on 100 and 117 VAC inputs
3750 Volts on 220, 230, and 240 VAC inputs.



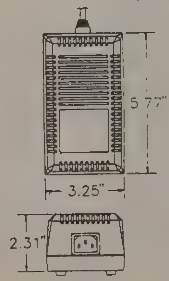
Case E (Wall Plug-In)



Case E (Desktop)



Case FV



Case E T

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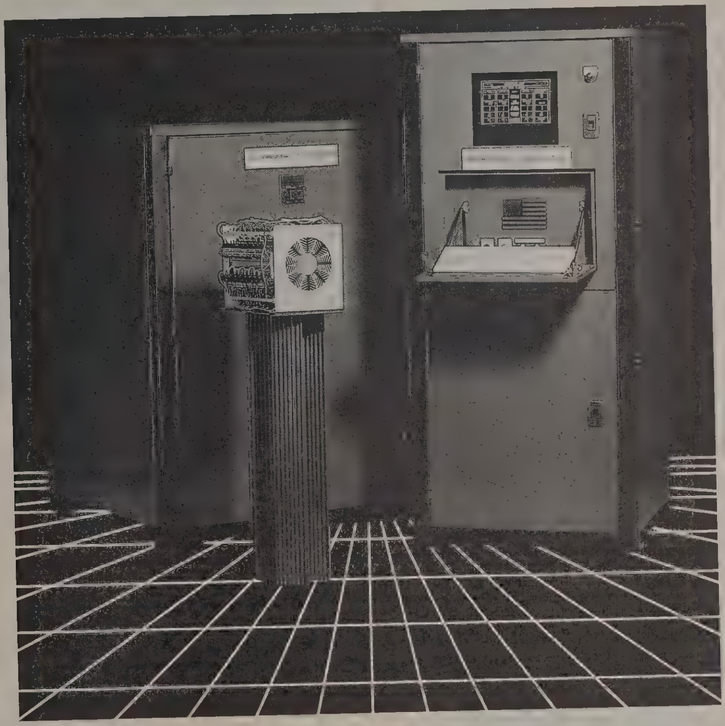
A Full Range of Power



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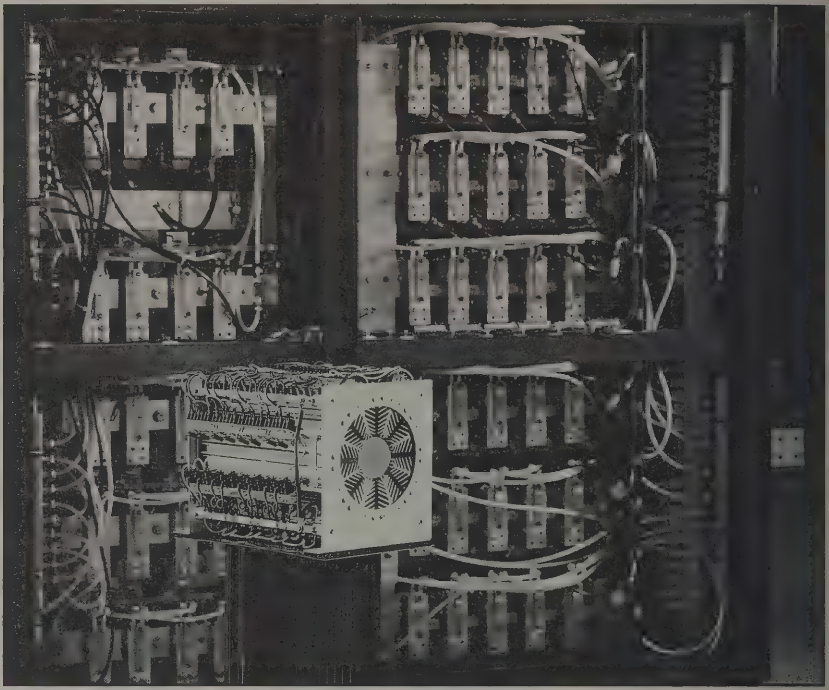
CORPORATION

The Precision Decision...



Our Laboratory Systems

Features

- Regulated Voltage
- Regulated Current
- Remote Current Programming
- Remote Voltage Programming
- Overvoltage Protection
- Constant Current Control
- Constant Voltage Control
- Automatic Crossover
- Step Start System
- Phase Loss Indication
- Overtemperature Protection
- Digital Meters
- 10 Turn Potentiometers

Operational Ranges

Output:

- Up to 30,000 A
- Up to 1,000 V
- Up to 1,000 kW systems

Input:

- 115-600 VAC
- Phase: 1 or 3
- 50 or 60 Hz
- Special inputs up to 25 kV

Operation

- Single Quadrant
- Bipolar
- Two Quadrant
- Four Quadrant
- Parallel
- Series

Specifications

Control

SCR– Primary or secondary SCR regulated units are available. These units feature dependable, reliable heavy duty construction.

SCR with transistor voltage bucker filter – Ultra low ripple with fast response time is achievable using an SCR supply followed by an active voltage bucker filter.

Transistor – Full series pass transistor regulators are available up to 10 kW. Also available in almost an unlimited range are full series pass transistor regulators with either SCR or variable autotransformer pre-regulators.

Regulation Range

Voltage Regulator (line effect)
.1% – .01% of rating
Voltage Regulator (load effect)
.1% – .01% of rating
Current Regulator (line effect)
.1% – .001% of rating
Current Regulator (load effect)
.1% – .001% of rating
Stability
.1% – .001%
Tempco better than 3 ppm per °C

Programming

Digital programming is achievable through IEEE 488, RS 232, RS 422 and RS 485 or custom designed interfaces. Programming is achievable with up to 18 bit resolution for current, voltage or both.

Systems

Dynapower has engineered and installed entire precision power systems for laboratories and research facilities around the world. This includes power supply design, system programming and on-site installation. Dynapower ensures that the power supply is capable of operating with a floating ground. All systems use ultra-stable components to ensure overall system stability. We welcome opportunities where special design and engineering are required.

Cooling

Forced Air

Special care is taken in the design of air-cooled rectifiers. Totally enclosed ball bearing motors are used to drive shrouded fan blades and deliver a maximum volume of air over the semiconductors and transformers. Electronic components are separated from the hot air flow by internal panels. This electronic and thermal isolation increases the life of the electronics and eases maintenance.

Liquid Cooling

Dynapower has led the industry in the development of liquid cooling. Only electrolytically pure copper components are used for heat sinks and busing. Dynapower manufactures all of its own copper heat sinks to ensure their reliability and long-term performance. Strict attention is given to design and construction to ensure that the maximum amount of heat is removed from each component.

Industrial Strength

Our Industrial Systems

Features

- Constant Current Control
- Constant Voltage Control
- Automatic Crossover
- Soft Start
- Remote Control Station
- Electrolytically Pure Copper Busing
- Electrolytically Pure Copper Transformers
- Heavy Duty Industrial Grade Construction
- Custom Designs Available

Operational Ranges

Output:
- Up to 75,000 A
- Up to 800 V
- Up to 5,000$^+$ kW systems

Input:
- 220/440 or high voltage
- 3 Phase
- 50/60 Hz
- Special input available

Protection Features

- Electronic Short Circuit Detection
- I^2T Current Limiting Fuses
- Electronic Phase Imbalance Detector
- Thermal Overload Relays
- Diode Overtemperature Detection
- Thyristor Overtemperature Detection
- Transformer Overtemperature Detection
- Electronic DC Overload Detection
- Liquid-Cooled Units Only:
  Liquid Flow Detector
  Liquid Leak Detector

DYNAPOWER
CORPORATION

Regulator Specifications

Low Voltage

Low voltage industrial rectifiers use primary thyristors for regulation. These thyristors are placed on the low current, high voltage primary side of the transformer. Each pair of devices is protected against voltage transients by a resistor capacitor snubber network.

High Voltage

High voltage industrial rectifiers use a number of parallel thyristors on the secondary side of the transformer. The thyristors are used at a minimum safety factor of 250% and are matched for similar current carrying characteristics. These techniques ensure efficiency and reliability.

Ripple

The DC output will contain a 5% RMS ripple when operated at rated voltage and rated current. Ripple filters are available to reduce output ripple.

Rating

All components are rated for 100% continuous full load service at 40°C ambient.

Power Factor

All units have a 90% power factor at rated output.

Cooling

Forced Air

Harsh industrial conditions require that special care is taken in the design of air-cooled rectifiers. A maximum volume of air is delivered by totally enclosed ball bearing motors that are used to drive shrouded blades. Semiconductors and transformers are cooled by this forced passage of air. Internal panels separate the electronic components from the flow of hot air. Thermal and electronic parts are isolated for easier maintenance and increased life of the system.

Liquid Cooling

A leader in the development of liquid cooling, Dynapower uses only the highest quality materials in its manufacturing. All heat sinks and busing are made of electrolytically pure copper components to give dependable long-term performance. The design and construction are critical to secure the removal of the maximum amount of heat from each component.

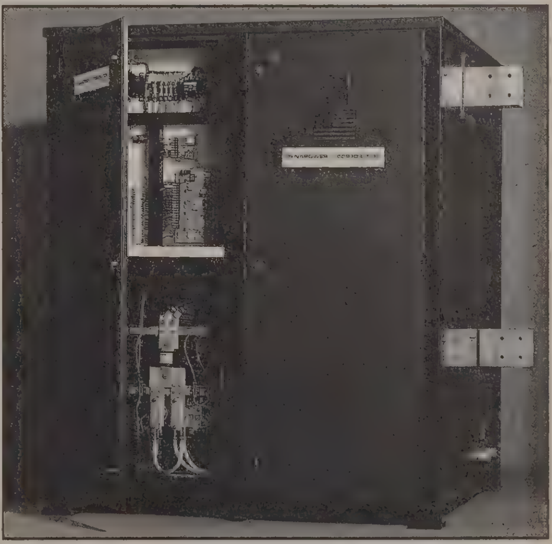
Heat Exchangers

The availability of clean, low conductivity water is a problem in some locations. A closed-loop heat exchanger can be used to ensure the integrity of the unit. Using either an air-to-liquid or liquid-to-liquid heat exchanger, the proper cooling for the unit is available while guaranteeing the circulation of clean, low conductivity cooling throughout the unit.

Pictured on Cover from Left to Right: 60 kW industrial grade DC power supply, 10 ppm regulated precision bipolar transistor bank, information management and data acquisition system with complete hardware and software.

Inside Left: (Rear) 180 kW full series pass transistor DC power supply regulated to 10 ppm. (Front) Bipolar transistor bank with regulation of 10 ppm.

Inside Right: 240 kW industrial grade DC power supply featuring complete solid state design, water cooling and heavy duty construction.



P.O. Box 9210 ■ South Burlington, VT 05407 ■ (802) 860-7200 ■ 1-800-292-6792 ■ FAX: (802) 864-3782
23890 Industrial Park Drive ■ Farmington Hills, MI 48335 ■ (313) 471-1800 ■ FAX (313) 471-1862

MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

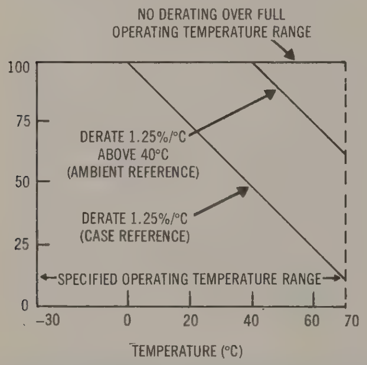


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

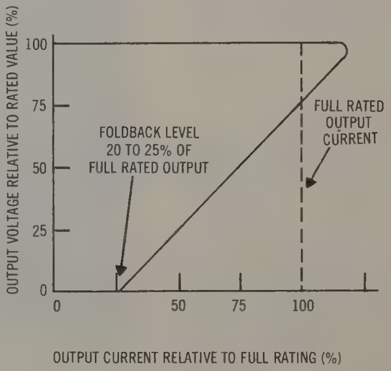


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

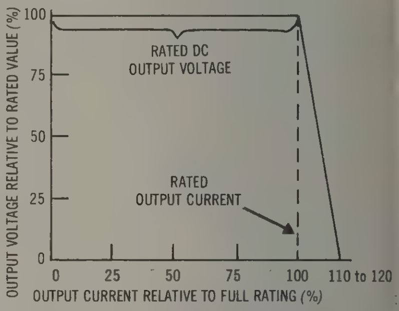


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(–) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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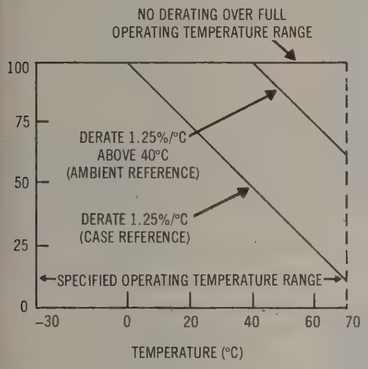

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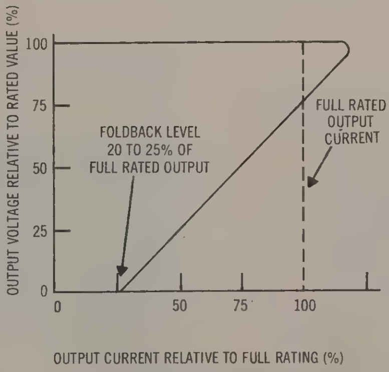

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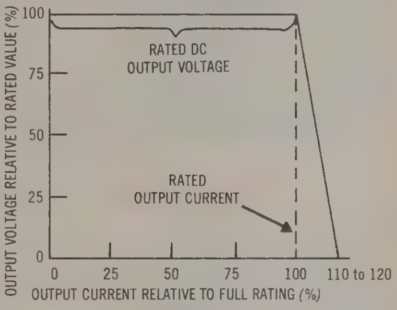

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Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

EG&G POWER SYSTEMS, INC.

MIL-Q-9858A
MIL-I-45208
MIL-STD-2000

LEADERSHIP in MILITARY and AEROSPACE Power Supplies

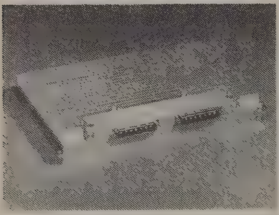
Custom and Standard Designs

- MILITARY
- SPACE
- FAA
- COMMERCIAL AIRCRAFT
- MEDICAL

Look to these pages for an introduction to our engineering/manufacturing solutions through a few specific product examples.

VME POWER SUPPLY

Model Number 2-21300 and 2-21350



Input: 270 VDC
Outputs: 5 VDC @ 100 A or
5 VDC @ 20 A
18 VDC @ 11.2 A
18 VDC @ 11.2 A
24 VDC @ 4 A
Size: 7" x 12" x 1.6"
Weight: 7.5 pounds
Air cooled up to 750 Watts.
EMI filtering.

HIGH ALTITUDE MISSILE POWER SUPPLY

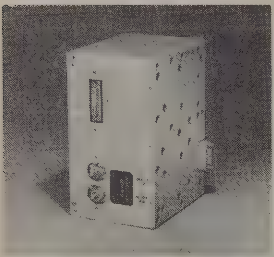
Model Number 2-22700

Input: 28 VDC w/ 10 ms hold-up
Outputs: 5 VDC @ 24 A
5 VDC @ 5.2 A
2 VDC @ 2 A
15 VDC @ 2.2 A
15 VDC @ .3 A
Size: 4" x 6" x 2" (maximum)
Weight: 1.6 pounds

Low noise and ripple outputs.
EMI filtering.

SPACE FLIGHT ELECTRONICS POWER SUPPLY

Model Number PB3535

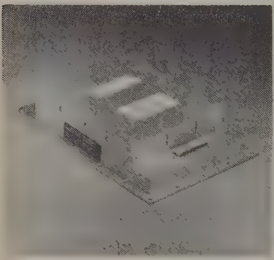


Input: 28 VDC
Outputs: 5 VDC @ 44 A
15 VDC @ 0.24 A
15 VDC @ 0.22 A
Size: 8.8" x 7.3" x 5"
Weight: 9 pounds

Meets traceability and S - level parts requirements.

RADIATION HARDENED AIRBORNE POWER SUPPLY

Model Number 2-18800



Input: 28 VDC
Outputs: 5 VDC @ 15 A
15 VDC @ 0.5 A
15 VDC @ 0.5 A
5.15 VDC @ 0.4 A
12.5 VDC @ 0.18 A
Environment: MIL-E-5400
Size: 10" x 7.6" x 2.7"
Weight: 7 pounds
Vibration: 10.7 GRMS random
MTBF: 201,000 hours @ 60°C, Aic
Nuclear hardened.

SEM–E AIRBORNE POWER SUPPLY

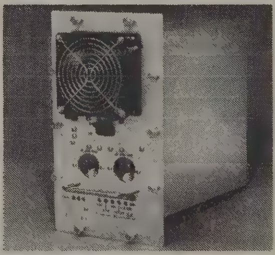
Model Number 2-22800 (Other models available)

Input: 28 VDC, MIL-STD-704A
Outputs: 5 VDC @ 30 A
15 VDC @ 1.5 A
15 VDC @ 1.5A
Size: .58" Width SEM–E
Weight: 1.5 pounds

Active, low-frequency, Tempest filtering.
EMI filtering.

FEDERAL AVIATION ADMINISTRATION (FAA) POWER SUPPLY

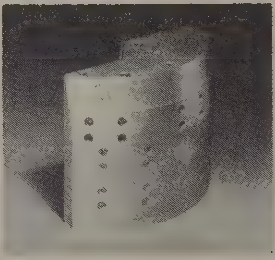
Model Number PB3562 and PB3561 (not shown)



Input: Redundant 208 single phase inputs
Outputs: 5 VDC @ 13 A
15 VDC @ 1.5 A
15 VDC @ 1.5 A
13.75 VDC @ 3 A
24 VDC @ 8 A
Weight: 15 pounds
Harmonic input currents limited to 5 percent of fundamental on both inputs. Features "hot" replacement packaging for redundant system applications.

BRILLIANT MUNITION POWER SUPPLY

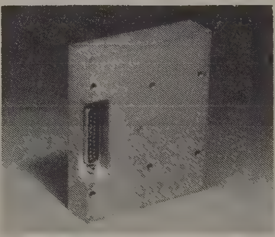
Model Number 13285590



Input Voltage: 56 VDC
Outputs: 5 VDC @ 7 A
15 VDC @ 0.5 A
15 VDC @ 0.5 A
5 VDC @ 1 A
5 VDC @ 3.5 A
15 VDC @ 2 A
15 VDC @ 0.6 A
Weight: 1.6 pounds
Vibration: 39.6 GRMS
High-volume, low cost, Surface Mount Technology production. Utilizes Application Specific Integrated Circuits (ASIC's).

RADIATION HARDENED ARMORED VEHICLE POWER SUPPLY

Model Number 2-21150 and 2-21115



Input: 28 VDC
Outputs: 5 VDC @ 15 A
or
15 VDC @ 2 A
15 VDC @ 2 A
10 VDC @ 1.2 A
Cooling: Conduction
Size: 4.66" x 3.68" x .94"
Qualified to ballistic and gunfire shock.

LEADERSHIP IN MILITARY QUALIFIED AND OTHER SEVERE ENVIRONMENT POWER SYSTEMS
For additional information or to speak with an Applications Engineer, Contact our Business Development Department at:
EG&G POWER SYSTEMS, INC. 1330 East Cypress Street, Covina, CA 91724 • Telephone: 818/967-9521 • FAX: 818/967-3151

EG&G POWER SYSTEMS, INC.

LEADERSHIP in MILITARY and AEROSPACE Power Supplies

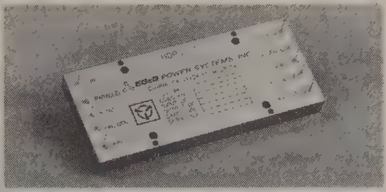
DC-DC CONVERTERS

High Density Power Converters (HDPC-2)

MILITARY DC-DC CONVERTER SERIES 125W (Nominal) and up to 30W/cu. in. @ 85°C Baseplate

DC INPUT VOLTAGE CHARACTERISTICS

Nominal	Minimum	Normal Range	Maximum	Applicable Specs
28	18	22-29	50	MIL-STD-704 MIL-STD-1275
270	125	250-280	440	MIL-STD-704



DC OUTPUT CHARACTERISTICS

No. of Outputs	Output No.	Output Voltage	Voltage Set Point	Rated Current	Current Limit, Max.	Ripple & Noise (0-20 MHz)	Overvoltage Protection	Load Regulation (No load to rated load)	Line Regulation
1	1	5V	5.05 ± .05	25.0A	38.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
	1	6V	6.0 ± .06	20.8A	31.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
	1	12V	12.0 ± .12	10.4A	15.6A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
	1	15V	15.0 ± .15	8.3A	12.5A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
	1	28V	28.0 ± .28	3.6A	5.4A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
	1	40V	40.0 ± .40	3.1A	4.7A	2% P-P, rated load	110%-135% V_O	0.5% V_O	0.5% V_O
2	1	+15V	15.0 ± .15	3.3A	5.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O cross regulated	0.5% V_O cross regulated
	2	-15V	15.0 ± .30	3.3A	5.0A	4% P-P, rated load	–		
3	1	5V	5.05 ± .05	9.8A (Note 1)	38.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O cross regulated	0.5% V_O cross regulated
	2,3	±19V		2.0A (Note 2)	3.0A	4% P-P, rated load	–		
	1	5V	5.05 ± .05	13.0A (Note 1)	38.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O cross regulated	0.5% V_O cross regulated
	2,3	±15V		2.0A (Note 2)	3.0A	4% P-P, rated load	–		
	1	5V	5.05 ± .05	15.4A (Note 1)	38.0A	2% P-P, rated load	110%-135% V_O	0.5% V_O cross regulated	0.5% V_O cross regulated
	2,3	±12V		2.0A (Note 2)	3.0A	4% P-P, rated load	–		

Note 1: 2 amp minimum load on Output 1; .3A minimum load on Outputs 2 and 3.
Note 2: Outputs 2 and 3 are isolated and parrallelable; Maximum combined output from Outputs 1, 2 and 3 is 125W.

Other DC Output Characteristics All Models

Output Transient Response (50% step load, normal line):
<150 µSec; Max Excursion ±10%V_O

Line Transient Response (min. to max. line):
<150 µSec; Max Excursion ±5%V_O

Turn-on/off Time (Power on/off and Remote on/off):
10 mSec

Output Adjust
±5% nominal V_O

Parallel Operation Current Sharing:
±10% rated load - Output 1

Output Sense Range:
0.5VDC from nominal - Output 1

Temperature Drift (average over operating range):
0.02% V_O/°C - Output 1

General Characteristics

Isolation:
Input to output and to chassis: 1 µA@ 750VDC
Output to chassis: 1 µA@ 50VDC

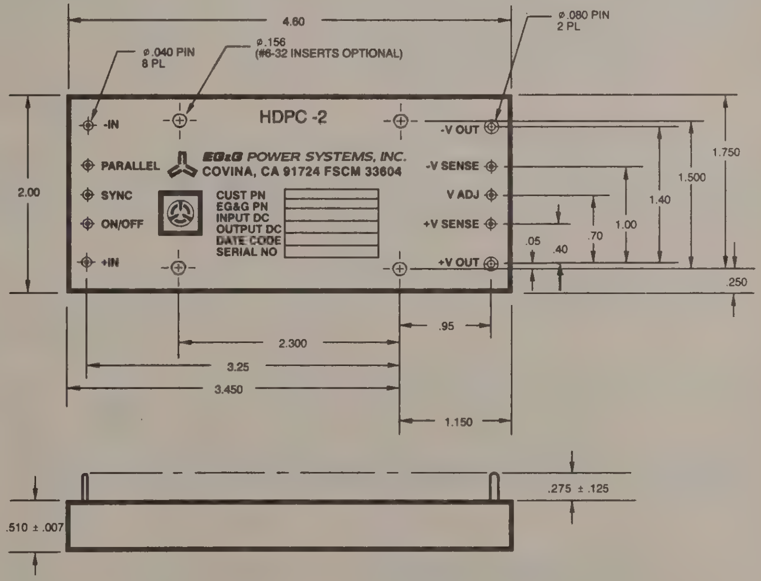
Operating Baseplate Temperature Range:
-55°C to +85°C

Efficiency (rated load):
80% minimum all outputs

Reliability Prediction: (single output configuration @ 100W, MIL HDBK 217E)
82,000 hours MTBF, 65°C baseplate, AUF
175,000 hours MTBF, 65°C baseplate, GM
315,000 hours MTBF, 65°C baseplate, NS
2,589,000 hours MTBF, 25°C baseplate, GB

Note: Consult factory for complete specification details for your application.

Mechanical Specifications (Single Output Shown, For Reference Only)



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Electromech

POWER SUPPLIES

WALL PLUG-IN/DESK TOP POWER SOURCES • TAILORED TO YOUR EXACT NEEDS

ELECTROMECH, INC
POWER SUPPLY

- **FULL ISOLATION**
- **AC/AC**
- **AC/DC (unreg)**
- **AC/DC (reg)**
- **BATTERY CHARGERS**
- **LINEAR SUPPLIES**

FEATURES

Power—.1VA to 40VA (WALL PLUG-IN)
.1VA to 1KVA (DESK TOP)

Input—100VAC to 240VAC

Freq.—47Hz to 400Hz

Output—.1V to 200V (WALL PLUG-IN)
.1V to 1KV (DESK TOP)

Current—.01A to 5A (WALL PLUG-IN)
.01A to 400A (DESK TOP)

Termination—CONNECTORS, SCREW TERM.
ETC.

SERVICES

- DESIGNED TO YOUR SPECIFICATIONS
- DESIGNED TO UL/CSA/VDE/IEC
- FIRST ARTICLE ENGINEERING SAMPLE WITHIN ONE (1) WEEK
- NO MINIMUM ORDER QUANTITY
- NO ENGINEERING CHARGE
- 100% Q.A.

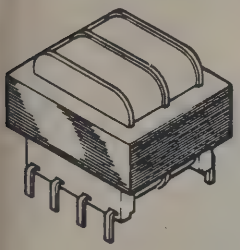
Electromech — **THE LAST WORD IN POWER SUPPLIES**

Electromech, Inc. • 2 Cordier Street • Irvington, New Jersey 07111 • (201) 318-7999 • FAX (201) 318-7995

ELECTRO-MECH CO.

POWER CONVERSION SPECIALISTS FOR OVER 20 YEARS!

Open Frame:
PC or Chassis Mount



A COMPLETE DESIGN RANGE OF BATTERY CHARGERS, POWER SUPPLIES AND TRANSFORMERS

- **WITH ELECTRO-MECH CO. you are free to choose from a wide selection of STANDARD POWER SUPPLIES, BATTERY CHARGERS, and TRANSFORMERS. But our specialty is CUSTOMIZING transformer units to match your exacting specifications. Whether you require multiple outputs, special output voltages, state of charge indicators, PC mounts or customized case colors and imprints, we will design and build them exactly to your requirements.**

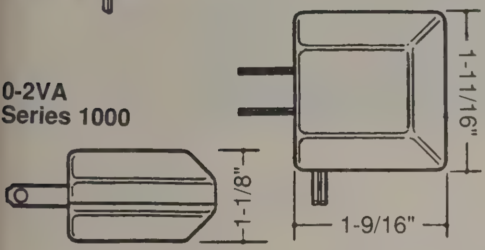
- **WITH ELECTRO-MECH CO., you not only get what you want, you get it when you want it. Our facilities at Colorado Springs and at Chihuahua, Mexico both employ automated and semi-automated instrumentation, resulting in high volume-production capacity.**

- **ENGINEERING DESIGN AND SUPPORT.**

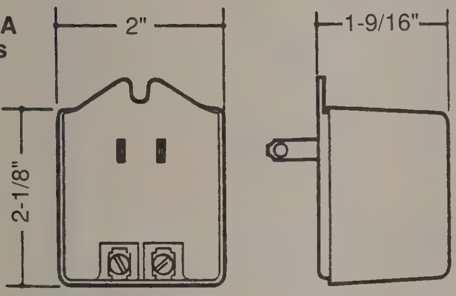
- **DESIGNED AND CONSTRUCTED TO MEET OR EXCEED UL AND CSA REQUIREMENTS.**

- **It is the bottom line that must be kept in mind. ELECTRO-MECH CO. knows that, and is COMPETITIVELY PRICED while continuing to provide a QUALITY PRODUCT. The economics are simple...get the most for your money.**

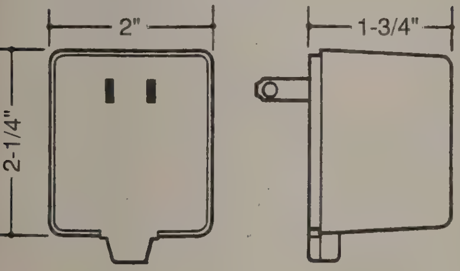
0-2VA
Series 1000



2-10VA
Series
1100



2-10VA Series 1200 w/cord



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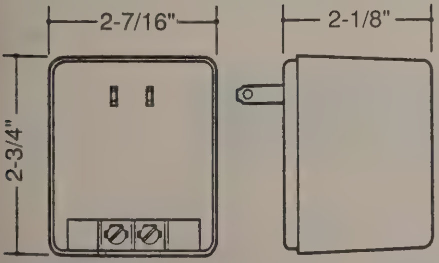
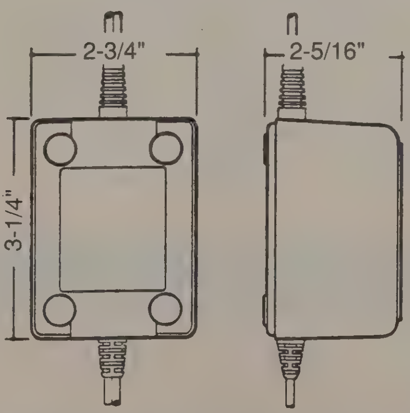
10-20VA Series 1300



20+ VA Series 1500



ELECTRO-MECH CO.
707 Hathaway Drive
Colorado Springs, CO 80915
Phone (719) 597-1620
Fax (719) 597-1628

PRODUCT SELECTOR

1ø SINGLE PHASE POWER TO 1ø

VDC OUT	100W	250W	600W	1000W	1800W	2500W
0-7.5		HCR7.530	EMSII 7.5-75 TCR7.5S70	EMSII 7.5-130 TCR7.5S115	TCR7.5S200	EMSII 7.5-300 TCR7.5S300
0-10		HCR10-25	EMSII 10-60 TCR10S50	EMSII 10-100 TCR10590	TCR10S165	EMSII 10-250 TCR10S240
0-15			TCR15S40	TCR15S60		
0-20		HCR20-13	EMSII 20-30 TCR20S30	EMSII 20-50 TCR20S50	TCR20S90	EMSII 20-125 TCR20S135
0-30		HCR30-8	EMSII 30-20 TCR30S20	EMSII 30-30 TCR30S30		EMSII 30-802
0-32	ATR100	ATR250				
0-40		HCR40-6	EMSII 40-15 TCR40S15	EMSII 40-25 TCR40S25	TCR40S45	EMSII 40-60 TCR40S70
0-60		HCR60-4	EMSII 60-10 TCR60S10	EMSII 60-18 TCR60S18	TCR60S30	EMSII 60-40 TCR60S45
0-64	ATR100B	ATR250B				
0-80		HCR80-3	EMSII 80-75 TCR80S8	EMSII 80-13 TCR80S13	TCR80S23	EMSII 80-30 TCR80S34
0-100			EMSII 100-7	EMSII 100-10		EMSII 100-25
0-128	ATR100C	ATR250C				
0-150		HCR150-2	TCR150S4	EMSII 150-7 TCR150S7	TCR150S12	EMSII 150-16 TCR150S18
0-300		HCR300-0.9	TCR300S2	EMSII 300-3.5 TCR300S3	TCR300S6	EMSII 300-8 TCR300S9
0-600			TCR600S1	TCR600S1.6	TCR600S3	TCR600S4.5

3ø THREE PHASE POWER TO 3ø

VDCOUT	2500W	5000W	10000W	20000W	30000W	60000W
6V		TCR6T600	TCR6T900			
7.5V	EMSII 7.5-300 TCR7.5T300	EMSII 7.5-600	EMSII 7.5-1000			
10	EMSII 10-250 TCR10T250	EMSII 10-500 TCR10T500	EMHP10-1000 TCR10T750 EMSII 10-1000	EMHP10-1500	EMHP10-3000	
20	EMSII 20-125 TCR20T125	EMSII 20-250 TCR20T250	EMSII 20-500 TCR20T500	EMHP20-750 EMHP20-1000	EMHP20-1500	
30	EMSII 30-80 TCR30T100	EMSII 30-165 TCR30T200	EMSII 30-33	EMHP30-600	EMHP30-800	EMHP30-1250
40	EMSII 40-60 TCR40T60	EMSII 40-125 TCR40T125	EMSII 40-250 TCR40T250	EMPH40-450	EMHP40-600	EMHP40-1000
50			TCR50T200			
80	EMSII 80-30 TCR80T30	EMSII 80-60 TCR80T60	EMSII 80-125	EMHP80-250	EMHP80-375	EMHP80-600
100	EMSII 100-25	EMSII 100-50	TCR100T100 EMSII 100-100	EMHP100-200	EMHP100-300	EMHP100-500
120	TCR120T20	TCR120T40				
150	EMSII 150-16	EMSII 150-33	EMSII 150-65	EMHP150-130	EMHP150-200	EMHP150-350
160	TCR160T15	TCR160T30	TCR160T60			
250	TCR250T10	TCR250T20	TCR250T40			
300	EMSII 300-8	EMSII 300-16	EMSII 300-33	EMHP300-60	EMHP300-100	EMHP300-200
500	TCR500T5	TCR500T10	TCR500T20			
600			EMSII 600-16	EMHP600-30	EMHP600-50	EMHP600-100

INPUT VOLTAGES:	1ø	3ø
STANDARDS	115VAC 50/60 HZ	208-220 VAC 50/60 HZ
OPTIONS*	220 VAC 50/60 HZ 100 VAC 50 HZ 200 VAC 50 HZ	380 VAC 50 HZ 415 VAC 50 HZ 440-400 VAC 50/60 HZ

*Not on all units.

ELECTRONIC MEASUREMENTS, INC.

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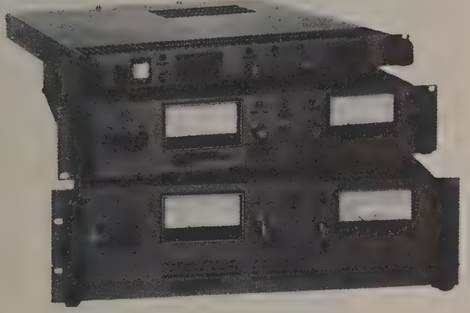
DC SWITCH MODE POWER SUPPLIES

EMS II SERIES



MAJOR SPECIFICATIONS

AC input voltage:
100-132/200-264 V, 47-63 Hz,
1Φ (600W & 1000W models)

190-253V, 46-63 Hz, 1Φ (2500W model)
190-253V, 45-63 Hz, 3Φ (2500W model)
190-253V, 46-63 Hz, 3Φ (5000W model)

DC output:
Zero to value shown in model designation (volts-amps. See chart.)

Mechanical Specifications:
600W & 1000W: 1¾″H x 19″ rack x 17″D 15 lbs.
4.4cm H x 48.3cm x 43.0cm D 7 kg
2500W: 3½″H x 19″ rack x 18″D 35 lbs.
8.9cm H x 48.3cm x 43.0cm D 15.9 kg
5000W: 5¼″H x 19″ rack x 22″D 60 lbs.
13.3cm H x 48.3cm x 55.9cm D 27 kg
10,000W: 8¾″H x 19″ rack x 22″D, 105 lbs.
15,000W: 8¾″H x 19″ rack x 22″D, 110 lbs.

1Φ SINGLE PHASE 1Φ

OUTPUT RATINGS (1)			(2) RIPPLE (MV) P-P CARRIER	MODEL NUMBER
WATTS	VOLTS (DC)	AMPS		
600	7.5	75	35	EMS II 7.5-75
1000	7.5	130	35	EMS II 7.5-130
2000	7.5	250	35	EMS II 7.5-250
2500	7.5	300	35	EMS II 7.5-300
600	10	60	35	EMS II 10-60
1000	10	100	35	EMS II 10-100
2000	10	200	35	EMS II 10-200
2500	10	250	35	EMS II 10-250
600	20	30	35	EMS II 20-30
1000	20	50	35	EMS II 20-50
2000	20	100	35	EMS II 20-100
2500	20	125	35	EMS II 20-125
600	30	20	35	EMS II 30-20
1000	30	33	35	EMS II 30-33
2000	30	65	35	EMS II 30-65
2500	30	80	35	EMS II 30-80
600	40	15	35	EMS II 40-15
1000	40	25	35	EMS II 40-25
2000	40	50	35	EMS II 40-50
2500	40	60	35	EMS II 40-60
600	60	10	40	EMS II 60-10
1000	60	18	40	EMS II 60-18
2000	60	33	40	EMS II 60-33
2500	60	40	40	EMS II 60-40
600	80	7.5	100	EMS II 80-7.5
1000	80	13	100	EMS II 80-13
2000	80	25	100	EMS II 80-25
2500	80	30	100	EMS II 80-30
1000	100	10	100	EMS II 100-10
2000	100	20	100	EMS II 100-20
2500	100	25	100	EMS II 100-25
1000	150	7	120	EMS II 150-7
2000	150	13	120	EMS II 150-13
2500	150	16	120	EMS II150-16
1000	300	3.5	150	EMS II 300-3.5
2000	300	6	150	EMS II 300-6
2500	300	8	150	EMS II 300-8
1000	600	1.6	250	EMS II 600-1.6
2000	600	3.3	250	EMS II 600-3.3
2500	600	4	250	EMS II 600-4

(1) Optional DC outputs are available at extra cost. Consult factory

3Φ THREE PHASE 3Φ

OUTPUT RATINGS (1)			(2) RIPPLE (MV) P-P CARRIER	MODEL NUMBER
WATTS	VOLTS (DC)	AMPS		
2500	7.5	300	35	EMS II 7.5-300
5000	7.5	600	35	EMS II 7.5-600
7500	7.5	1000	35	EMS II 7.5-1000
2500	10	250	35	EMS II 10-250
5000	10	500	35	EMS II 10-500
10000	10	1000	35	EMS II 10-1000
2500	20	125	35	EMS II 20-125
5000	20	250	35	EMS II 20-250
10000	20	500	35	EMS II 20-500
2500	30	80	35	EMS II 30-80
5000	30	165	35	EMS II 30-165
10000	30	333	35	EMS II 30-333
2500	40	60	35	EMS II 40-60
5000	40	125	35	EMS II 40-125
10000	40	250	35	EMS II 40-250
2500	60	40	40	EMS II 60-40
5000	60	80	40	EMS II 60-80
10000	60	165	40	EMS II 60-165
2500	80	30	40	EMS II 80-30
5000	80	60	40	EMS II 80-60
10000	80	125	40	EMS II 80-125
2500	100	25	100	EMS II 100-25
5000	100	50	100	EMS II 100-50
10000	100	100	150	EMS II 100-100
2500	150	16	120	EMS II 150-16
5000	150	33	120	EMS II 150-33
10000	150	66	150	EMS II 150-66
2500	300	8	150	EMS II 300-8
5000	300	16	150	EMS II 300-16
10000	300	33	150	EMS II 300-33
2500	600	4	250	EMS II 600-4
5000	600	8	250	EMS II 600-8
10000	600	16	250	EMS II 600-16

(1) Optional DC outputs are available at extra cost. Consult factory

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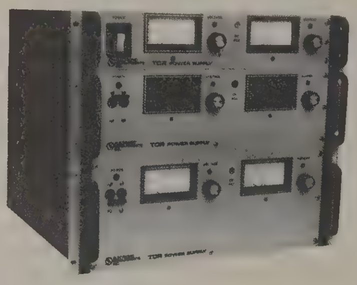
SCR-REGULATED DC POWER SUPPLIES

TCR SERIES SINGLE-PHASE MODELS



MAJOR SPECIFICATIONS

AC input voltage:
105-130V, 47-63 Hz (600, 1000 and 1800W Models)
190-253V, 47-63 Hz (2800W Model) 190-253V
Input options available on 600, 1000, and 1800W Models.

DC output:
Zero to value shown in model designation (volts-phase-amps). See chart. Regulation 0.1%.

Options:
Over voltage protection available on all units at additional cost. Digital panel meters available at no additional cost.

Sizes:
600 and 1000 watt: 3½″ High, 19″ rack by 18½″ Deep
1800 watt: 5¼″ High, 19″ rack by 18½″ Deep
2800 watt: 7″ High, 19″ rack by 18½″ Deep

Model	Ripple mV RMS
TCR 7.5S70	80
TCR 7.5S115	80
TCR 7.5S200	80
TCR 7.5S300	80
TCR 10S50	80
TCR 10S90	80
TCR 10S165	80
TCR 10S240	80
TCR 20S30	80
TCR 20S50	80
TCR 20S90	80
TCR 20S135	80
TCR 40S15	100
TCR 40S25	75
TCR 40S45	100
TCR 40S70	100

Model	Ripple mV RMS
TCR 60S10	120
TCR 60S18	75
TCR 60S30	90
TCR 60S45	90
TCR 80S8	150
TCR 80S13	80
TCR 80S23	120
TCR 80S34	100
TCR 150S4	300
TCR 150S7	150
TCR 150S12	200
TCR 150S18	200
TCR 300S2	500
TCR 300S3	250
TCR 300S6	300
TCR 300S9	300
TCR 600S1	1000
TCR 600S1.6	700
TCR 600S3	700
TCR 600S4.5	750

TCR SERIES THREE-PHASE MODELS

MAJOR SPECIFICATIONS

AC input voltage:
190-253 VAC 3ϕ50/60 Hz Standard. Optional nominal inputs 200V, 380V, 415V, 440/460/480.

DC output:
Zero to value shown in model designation (volts-phase-amps). See chart. Regulation 0.1%.

Options:
Over voltage protection available on all units at additional cost. Digital panel meters available at no additional cost.

Sizes:
2.5 KW: 7″ High, 19″ rack by 23.35 (includes output terminal)
5.0 KW: 8.75″ High, 19″ rack by 23.25 (includes output terminal)
10.0 KW: 12.25″ High, 19″ rack by 24.25 (includes output terminal)
15.0 KW: 17.5″ High, 19″ rack by 27.7″ (includes output terminal)

Model	Ripple mV RMS
TCR 7.5T300	30
TCR 6T600	30
TCR 6T900	30
TCR 10T250	35
TCR 10T500	35
TCR 10T750	35
TCR 20T125	20
TCR 20T250	20
TCR 20T500	20
TCR 20T750	20
TCR 30T100	15
TCR 30T200	15
TCR 30T500	15
TCR 40T60	15
TCR 40T125	15
TCR 40T250	15
TCR 40T375	15
TCR 50T200	16
TCR 50T300	18

Model	Ripple mV RMS
TCR 80T30	25
TCR 80T60	25
TCR 80T185	25
TRC 100T100	40
TCR 100T150	40
TCR 120T20	40
TCR 120T40	40
TCR 120T125	40
TCR 160T15	60
TCR 160T30	50
TCR 160T60	60
TCR 160T90	60
TCR 250T10	90
TCR 250T20	80
TCR 250T40	90
TCR 250T60	90
TCR 500T5	125
TCR 500T10	125
TCR 500T20	125
TCR 500T30	125

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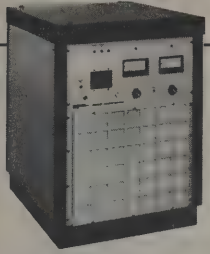
EMHP SERIES THREE-PHASE MODELS 20, 30, 60 KILOWATTS



APPLICATIONS

- Electromagnets
- Magnetic beam bending
- Cryogenic magnets
- Precision electroplating
- DC motor power
- Large relay systems
- Inverter power source
- High energy electronic systems
- Electrochemical processes
- High-power illumination systems
- Thermodynamic and thermonuclear research
- Battery charging
- Industrial DC power

FEATURES

- Low cost
- Quick delivery time
- High efficiency
- High performance

MAJOR SPECIFICATIONS

AC Input Voltage: 460 VAC ±10%, 60 Hz. Optional inputs available.

DC Output: regulation, 0.1%; stability, 0.05%.

Size 1:30″H × 22¼″W × 27¾″D
Size 2:34⅝″ × 27½″W × 29¼″D
Size 3: 44½″H × 27½″W × 33¼″D

Ripple	Voltage Model	Current (V)	Voltage Ripple (mV rms)	Current Ripple (A rms)
SIZE 1 (20 KW maximum)				
EMHP 10-1000	0-10	0-1000	50	5
EMHP 20-750	0-20	0-750	60	2.25
EMHP 30-600	0-30	0-600	70	1.4
EMHP 40-450	0-40	0-450	80	0.9
EMHP 60-300	0-60	0-300	100	0.5
EMHP 80-250	0-80	0-250	120	0.4
EMHP 150-130	0-150	0-130	180	0.2
EMHP 300-60	0-300	0-60	300	0.06
EMHP 600-30	0-600	0-30	400	0.02
SIZE 2 (30 KW maximum)				
EMHP 10-1500	0-10	0-1500	50	7.5
EMHP 20-1000	0-20	0-1000	60	3.0
EMHP 30-800	0-30	0-800	70	2.0
EMHP 40-600	0-40	0-600	80	1.2
EMHP 60-500	0-60	0-300	100	0.8
EMHP 80-375	0-80	0-375	120	0.6
EMHP 150-200	0-150	0-200	180	0.25
EMHP 300-100	0-300	0-100	300	0.10
EMHP 600-50	0-600	0-50	400	0.03
SIZE 3 (60 KW maximum)				
EMHP 10-3000	0-10	0-3000	50	15
EMHP 20-1500	0-20	0-1500	60	2.25
EMHP 30-1250	0-30	0-1250	70	3.0
EMHP 40-1000	0-40	0-1000	80	2.0
EMHP 60-750	0-60	0-750	100	1.3
EMHP 80-600	0-80	0-600	120	0.9
EMHP 150-350	0-150	0-350	180	0.42
EMHP 300-200	0-300	0-200	300	0.20
EMHP 600-100	0-600	0-100	400	0.07

ATR SERIES LINEAR POWER SUPPLIES

ATR-100

ATR-250

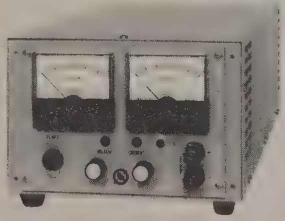
FEATURES:

ATR-100 and ATR-250 are 100 and 250 watt, wide range, linear, DC power supplies. Through a unique switching circuit these units produce essentially a constant power output capability so that as the output voltage requirement is lower the available current output is higher. The units are fully metered, programmable and have a self contained OVP circuit.

MODEL	OUTPUT RANGES		
ATR 100	0-8V 0-10A	8-18V 0-5A	18-32V 0-3A
ATR 100B	0-16V 0-5A	16-36V 0-2.5A	36-64V 0-1.5A
ATR 100C	0-32V 0-2.5A	32-64V 0-1.3A	64-128V 0-0.75A
ATR 250	0-8V 0-25A	8-18V 0-13A	18-32V 0-7A
ATR 250B	0-16V 0-12A	16-36V 0-6A	36-64V 0-3.5A
ATR 250C	0-32V 0-6A	32-64V 0-3.0A	64-128V 0-1.75A

Operating Temp: 0°C to +40°C at full rating
Storage Temp: −40°C to +85°C
Over Voltage Protection: Adjustable from 2.5V to 128V
Cooling: Fan cooled, thermostatically-protected
Weight: 18 lbs. (ATR-100); 32 lbs. (ATR-250)
Size: 4″Wx5″H × 18″D (ATR-100); 8″W × 5″H × 18″D (ATR-250)
Rack adapter systems available.

HCR SERIES DC MODELS - 250 WATTS



MAJOR SPECIFICATIONS

AC Input Voltage: 105-130V, 47-63 Hz or 190-253 V, 47-63 Hz. Optional inputs available.

DC Output: Regulation, voltage mode — ±0.1%; regulation, current mode - ±0.25%, 8 hours; temperature coefficient —0.02%/°C.

Weight: 45 lbs.

Size: 5″H × 7⅝″W × 18½″D

Rack Adaptors: Available for 1 & 2 units.

Output Voltage (V)	Output Current (A)	Voltage Ripple (mV rms)	Current Ripple (mA rms)	Model
0-7.5	0-30	80	450	HCR 7.5-30
0-10	0-25	80	55	HCR 10-25
0-20	0-13	80	55	HCR 20-13
0-20	0-8	90	45	HCR 30-8
0-40	0-6	100	27	HCR 40-6
0-60	0-4	120	15	HCR 60-4
0-80	0-3	150	9	HCR 80-3
0-150	0-2	300	3	HCR 150-2
0-300	0-0.9	500	1.5	HCR 300-0.9

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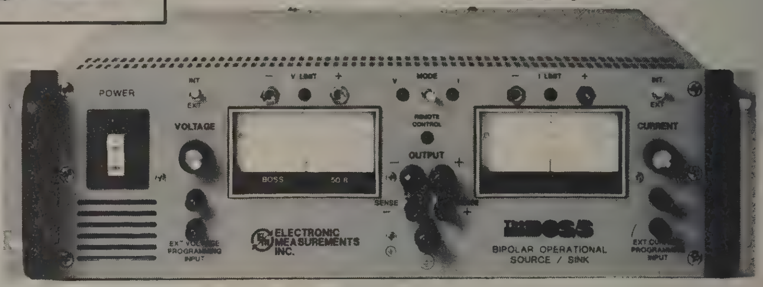
The BOS/S™

Bi-Polar Operational Source/Sink Power Supply


POWER
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VOLTAGE
V LIMIT
MODE
REMOTE CONTROL
OUTPUT
I LIMIT
CURRENT
BOSS
SENSE
EXT VOLTAGE PROGRAMMING INPUT
ELECTRONIC MEASUREMENTS INC.
The BOS/S
BIPOLAR OPERATIONAL SOURCE / SINK
EXT CURRENT PROGRAMMING INPUT

A Bipolar Operational Source/Sink power supply that provides a dozen functions in addition to delivering DC voltage and current.

More than a dozen functions

- DC power supply
- Electronic load
- Voltage source
- Power-pulse generator
- Current source
- Power-function generator
- Direct-coupled amplifier
- Variable-gain amplifier
- Fast-slewing power supply
- DC amplifier
- AC power supply
- Differential amplifier
- Signal-inverting amplifier

DYNAMIC SPECIFICATIONS

Model		DC Output Range Eo	DC Output Range Io	Bandwidth DC to F< 3 dB Full Power V	Bandwidth DC to F< 3 dB Full Power I	Slewing Rate Maximum Load 10 to 90% Swing V	Slewing Rate Maximum Load 10 to 90% Swing I
100 W							
BOS/S	20-5	±20 V	± 5	22 KHz	20 KHz	1.6V/µs	.4A/µs
BOS/S	50-2	±50 V	± 2	22 KHz	20 KHz	4V/µs	.15A/µs
BOS/S	100-1	±100 V	± 1	20 KHz	20 KHz	7V/µs	.08A/µs
200 W							
BOS/S	20-10	±20 V	±10A	22 KHz	20 KHz	1.6V/µs	.8A/µs
BOS/S	36-6	±36 V	± 6A	22 KHz	20 KHz	3V/µs	.5A/µs
BOS/S	50-4	±50 V	± 4A	25 KHz	20 KHz	4V/µs	.3A/µs
BOS/S	72-3	±72 V	± 3A	20 KHz	18 KHz	5.8V/µs	.25A/µs
BOS/S	100-2	±100 V	± 2A	15 KHz	15 KHz	6V/µs	.15A/µs
400 W							
BOS/S	20-20	±20 V	±20A	22 KHz	20 KHz	1.6V/µs	1.6A/µs
BOS/S	36-12	±35 V	±12A	22 KHz	20 KHz	3V/µs	1A/µs
BOS/S	50-8	±50 V	± 8A	25 KHz	20 KHz	4V/µs	.7A/µs
BOS/S	72-6	±72 V	± 6A	20 KHz	18 KHz	5.8V/µs	.5A/µs
BOS/S	100-4	±100 V	± 4A	15 KHz	15 KHz	6.0V/µs	.3A/µs
BOS/S	200-2	±200 V	± 2A	10 KHz	2 KHz	4.0V/µs	.05A/µs

REGULATION

Influence	Maximum Effect Voltage	Maximum Effect Current
Source Voltage (%)	0.005	0.005
Load change (100%)	0.005	1.0 mA
Time (8 hr. at ambient temperature, %	0.008	0.008
Temperature (%/C)	0.01	0.03
Ripple (RMS, return grounded)	3.00 mV	0.05%

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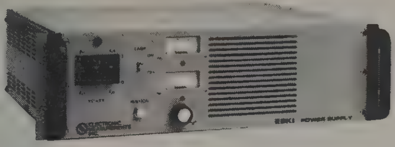
YAG DRIVE 6KW - 8KW -10KW SWITCHING POWER SUPPLY



ESKI SERIES

The ESKI series of power supplies is designed to power solid state Yag lasers. Utilizing a 20K HZ pulse-width-modulation technology the ESKI's provide a regulated current with a continuously variable output. Stable output and long lamp life is ensured as the output current is regulated to within 0.1% regardless of line fluctuations. Ripple is a maximum of 0.3% peak-to-peak, and with optical feedback, ripple can be further reduced by a factor of 3:1. The use of IGBT's as regulating elements provides high reliability, high efficiency, high packaging density and very light weight.

This power supply also provides the boost, or open circuit voltage required for lamp start, and incorporates a built-in, high voltage igniter assembly which is either pulsed automatically when the power supply is turned on or by customer control.

The power supply is of the non-line isolated type which reduces cost and weight but does require both lamp terminals to be insulated from ground. All controls, input programming and readbacks are, however, line isolated. Supply circuitry is highly isolated from chassis so that leakage currents are within medical application limits.

ESKI Series 6 kW, 8 kW and 10 kW Switching Power Supplies for Krypton Arc Lamps.

- Built-in Igniter
- 0.3% Light Ripple p-p
- 92% Efficiency
- Remote Programmable
- Leakage per U/L544/U/L1012
- 5.25″H x 19″W x 15″D
- Single Phase & Three Phase

XENON OR KRYPTON ARC LAMP REGULATED CURRENT SOURCES

EMKI SERIES

The EMKI series power supply is a completely solid-state regulated current source with a continuously variable output, designated particularly for supplying power to xeon or krypton arc lamps. Stable light output and long lamp life are ensured since the lamp current is regulated to within 1% regardless of line functions and the ripple current is less than 2%. The semiconductor circuitry allows instant start-up and the use of silicon controlled rectifiers as regulating elements provides high reliablity and high efficiency in a very compact unit.

This power supply also provides the boost or "open circuit" voltage required for starting arc lamps. In addition, it can pulse any standard igniter to permit a completely automated starting sequence, locally or remotely controlled.

The EMKI series power supply incorporates a built-in high-voltage igniter assembly which is pulsed automatically when the power supply is turned on.

☑ **Switch Mode Power Supplies**
for use with Mercury/Mercury Xenon lamps—35 W to 1000 W

☑ **Switch Mode Power Supplies**
for use with Krypton arc lamps — 6 kW, 8 kW & 10 kW

☑ **SCR**
primary control, 10 to 2500 W 30, 2500 W to 10,000 W for Mercury or Xenon arc lamps

☑ **Secondary Phase Control**
current sources, variable output from 120 V DC to 240 V DC with self-contained igniter and boost for Krypton lamps

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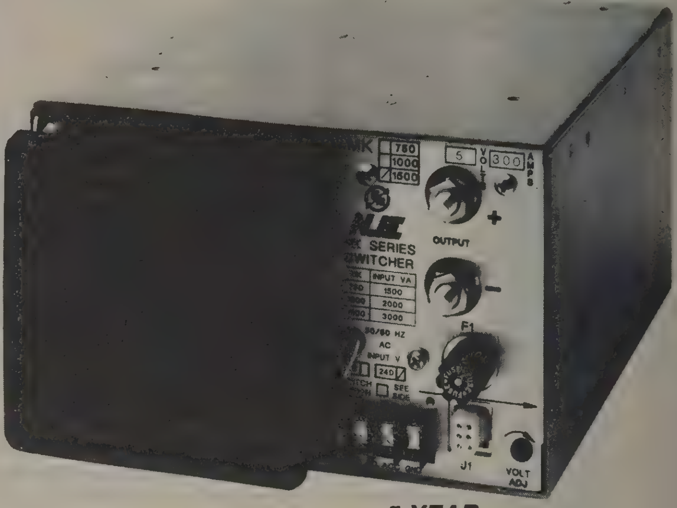
SWITCHERS



5-YEAR WARRANTY!

SPECIFICATIONS

Input
Single-phase standard, 3-phase optional.
MK750 and MK1000 units
120 VAC (+ 10% -25%), 47-63 Hz standard.
240 VAC (+ 10% -25%), 47-63 Hz optional.
120/240 VAC Switch Option available.
MK1500 units
240 VAC (+ 10% -25%), 47-63 Hz standard.
120 VAC optional.

Efficiency
Up to 85% depending upon model.

Protection
Voltage: Overvoltage shutdown standard, crowbar overvoltage optional.
Current: Automatic current limit/foldback.
Thermal: Automatic shutdown when internal heat sink temperature exceeds safe limit. Automatic restarting when temperature returns to normal.
Reverse Voltage: Supply is protected from damage due to reverse polarity voltage across DC output terminals.

Cooling
Integral fan provides forced air cooling.

Operating Temperature
0° TO 71°C ambient; full output to 50°C.
Derate 2% per °C to 71°C.

Mechanical
5 x 8 x 11″

Convenience Functions
Inhibit/Remote Shutdown
Margin Check
Power fall/output good signal

Agency Approvals
U.L. Recognized
C.S.A. Certified
TUV Approved (Specify MKA)

SINGLE-OUTPUT MODELS

MODEL	VOLTS	AMPS	MODEL	VOLTS	AMPS
MK750-2-150	2	150	MK750-21-40	21	40
MK1000-2-200	2	200	MK1000-21-53	21	53
MK1500-2-300	2	300	MK1500-21-80	21	80
MK750-5-150	5	150	MK750-24-35	24	35
MK1000-5-200	5	200	MK1000-24-47	24	47
MK1500-5-300	5	300	MK1500-24-70	24	70
MK750-12-65	12	65	MK750-28-30	28	30
MK1000-12-87	12	87	MK1000-28-40	28	40
MK1500-12-130	12	130	MK1500-28-60	28	60
MK750-15-55	15	55	MK750-36-24	36	24
MK1000-15-73	15	73	MK1000-36-33	36	33
MK1500-15-110	15	110	MK1500-36-48	36	48
MK750-18-46	18	46	MK750-48-18	48	18
MK1000-18-61	18	61	MK1000-48-25	48	25
MK1500-18-92	18	92	MK1500-48-36	48	36

NOTE: Consult factory for non-standard voltages.

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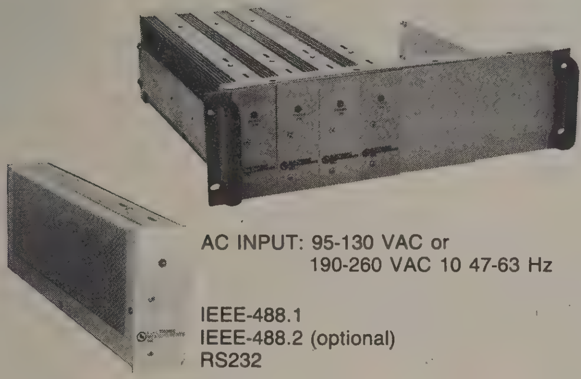
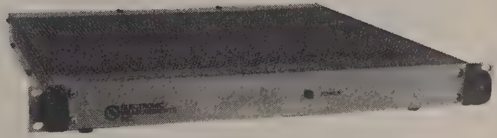
DIGITAL PROGRAMMING INTERFACES

RSTL SERIES
IEEE 488 & RS232





AC INPUT: 95-130 VAC or
190-260 VAC 10 47-63 Hz

IEEE-488.1
IEEE-488.2 (optional)
RS232

PROG. RESOLUTION:	12 BITS
READBACK RESOLUTION:	16 BITS
PLAIN ENGLISH FORMAT:	VOLTS / AMPS / % FULL SCALE / HEX
PROGRAMMING CALIB.:	SOFTWARE (USING TRIMDACS - NO POTS)
READBACK CALIB.:	SOFTWARE (NO POTS)
REMOTE SHUTDOWN:	DISABLE SUPPLY PWM

DIGITAL INPUT FLAGS:
(4) ISOLATED - TTL/CMOS COMPATIBLE

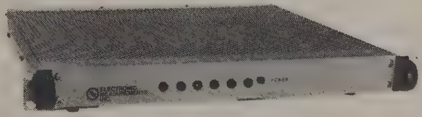
DIGITAL OUTPUTS:
(2) ABLE TO SINK 130MA

5 VOLT ANALOG OUTPUTS:
(1) DIFERENTIALLY BUFFERED
(2) COMMON GROUND

MODEL / SERIAL# INQUIRY
LAST COMMAND RECALL
PROGRAM AND TRIM INQUIRY
READY FOR COMMAND FLAG (OR SRQ)
LOCAL / REMOTE SWITCHING

OPTICALLY ISOLATED ANALOG PROGRAMMING INTERFACE

PIR SERIES
4-20mA, 0-5V, 0-10V



AC INPUT: 95-130 VAC or 190-260 VAC 1Ø 47-63 Hz

ONE TO SIX CHANNELS (V OR I CHANNEL ON SUPPLY)
ISOLATION 2000 VAC
NONLINEARITY 0.1%
ADJUSTABLE ZERO AND FULL SCALE (PROGRAM & READBACK)
LOCAL/REMOTE SWITCHING

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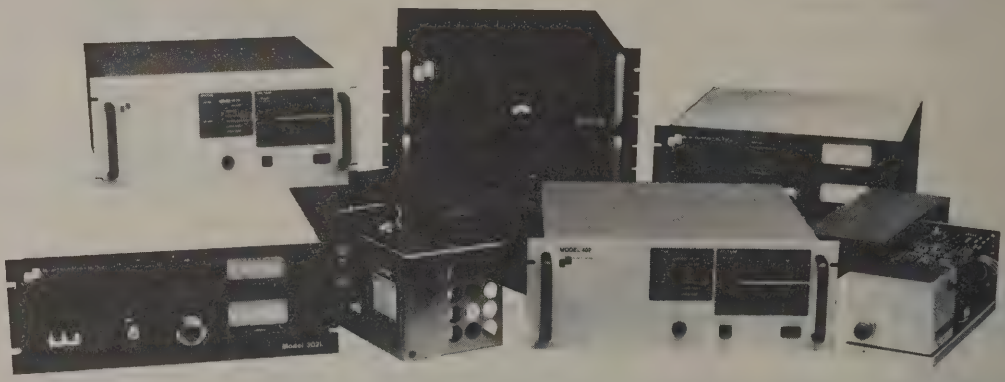
a.l.e. systems

HIGH VOLTAGE POWER SUPPLIES

A.L.E. is a leader in the design and manufacture of advanced switchmode power conversion systems for high power, high voltage applications. Our broad experience solving complex high voltage problems for the OEM and laboratory environments include power supplies for dye, excimer, TEA, vapor, Yag, CO_2, lasers and other pulsed power applications world wide.

Capacitor Charging Supplies: The A.L.E. Series of high voltage capacitor charging supplies is available with power outputs of 500 to 15,000 Joules per second. All units are available with full scale voltages to 50kV. Most models are available in both fully instrumented and OEM versions. All types are highly resistant to external electromagnetic interference.



Supplies for CO_2 Lasers: A.L.E.'s patented converter topology produces a controlled high voltage current source for operating CW CO_2 lasers. Available with output powers of 250W and 500W and operating voltages of 4.5kV to 24kV, these units allow ballastless operation of negative impedance discharges. A.L.E.'s CO_2 supplies provide strike potentials up to 40kV and can be operated in parallel for greater output.

High Voltage D.C. Supplies: A.L.E. also has the capability of producing high power D.C. supplies on a custom basis. Providing outputs of 2kW to 30kW and voltages to 80kV, A.L.E.'s converter capabilities encompass a broad range. Our proprietary high voltage conversion stages use a minimal number of multiplication stages resulting in very low levels of stored energy.

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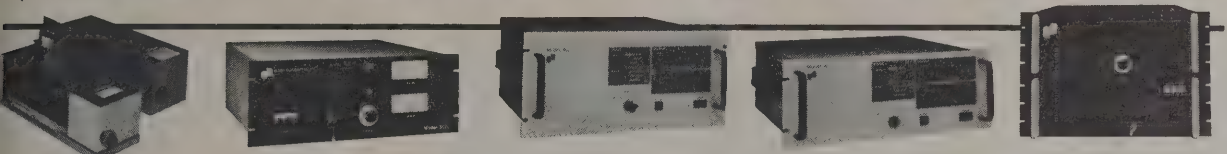
a.l.e. systems

HIGH VOLTAGE POWER SUPPLIES



Model	Average Power J/sec	Peak Charge Rate J/sec.	Size	Input Voltage
501	500	650	6 x 6 x 15	115/230
102	1000	1200	6 x 6 x 15	115/230
152	1500	2000	6 x 6 x 15	190-260
202	2000	2500	6 x 8 x 15	190-260
302	3000	4000	7 x 19 x 17	190-260
402	4000	5000	7 x 19 x 17	190-260 380-415
802	8000	9000	8.75 x 19 x 17	190-260 380-415
153	15000	20000	12.25 x 19 x 22	190-260
203	20000	25000	12.25 x 19 x 22	340-460
303	30000	37500	12.25 x 19 x 22	432-528

Most units are available with full scale output voltages of 1, 2, 4, 5, 10, 20, 30, 40, 50kV. Other voltages are available on request.

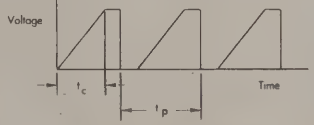
Capacitor Charging Power Supplies

500 J/s to 30kJ/S with IGBT Technology

Advanced high voltage current sources specifically designed to charge capacitors in discharge driven applications.

Capacitor charging supplies are rated in Joules per second. To determine the required supply capacity, multiply the energy storage ($CV^2/2$) by the pulse repetition frequency. For example a 90nF capacitor operating at 40kV and a 50Hz rate would require a 3600J/sec. supply.

All A.L.E. capacitor charging supplies are rated in both average and peak charge rate. The peak rating assures that the full average power of the unit is available when the requirement for transfer switch recovery time is taken into account.



$$\text{Peak charge rate} = \frac{1/2\,CV^2}{t_c}$$

$$\text{Average charge rate} = \frac{1/2\,CV^2}{t_p}$$

CW Arc Lamp Supplies

4, 6 and 8kW output

17 x 8.5 x 10.5

Active power factor correction available in the 4kW and 6kW PC models

The YAG Drive Series of switching power supplies are designed for Nd: YAG and other solid-state laser systems. Advanced IGBT technology, combined with high quality construction, yield an exceptionally small and reliable power supply. With integral igniter and boost circuitry, the YAG Drive provides a complete power system for krypton arc lamps. Short circuit, open circuit and arc lamp failures will not damage the power supply.

Output Power:
YD4-SC 150V, 35A, 4kW max.
YD4-PC 250V, 35A, 4kW max.
YD6-SC 150V, 50A, 6kW max.
YD6-PC 250V, 50A, 6kW max.
YD8-SC 250V, 50A, 8kW max.

Input Power Requirements
Voltage:
1 Phase 180-264VAC, 50/60Hz
3 Phase 180-264VAC, 50/60Hz

Current:
YD4-SC 1 Phase, 40A max.
3 Phase, 20A max.
YD4-PC 1 Phase, 40A max.
3 Phase, 20A max.
YD6-SC 3 Phase, 30A max.
YD6-PC 1 Phase, 40A max.
3 Phase, 25A max.
YD8-SC 3 Phase, 35A max.

Regulation
±1.0% over full line and load range

Ripple
DC to 1kHz: 750ma pk-pk max.
1kHz to 20MHz: 10% of Iout, pk-pk max.

Igniter
25kV

Boost
1kV

Efficiency
SC Models: 87%
PC Models: 85%

Inrush Current
Limited to below full power level

Pulsing
Up to 1kHz, 300 usec rise and fall times, 75% modulation

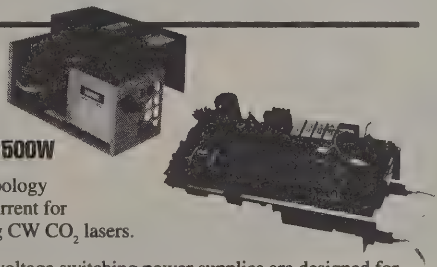
Precision High Power HVDC

Custom supplies from 2kW to 30kW

Highly regulated supplies for ion implantation, X-ray and other demanding high power applications. Basic voltage transformation to 40kV allows for a minimal number of multiplication stages and hence extremely low levels of stored energy.

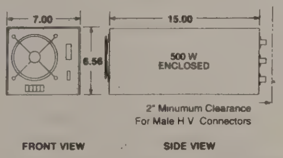
CO_2

Ballastless CO2 Supplies 250W and 500W



Patented converter topology provides controlled current for striking and sustaining CW CO_2 lasers.

The CO2 Series high voltage switching power supplies are designed for medical and industrial CO2 laser systems. The advanced "ballastless" design can increase laser system efficiency by 20%. Configured as either open-frame or enclosed chassis, the CO2 power supply is compact enough to be designed right into the laser head. Designed for continuous use, these air-cooled power supplies provide an average power of 250 Watts or 500 Watts, and status monitoring are easily accomplished with thestandard remote interface.



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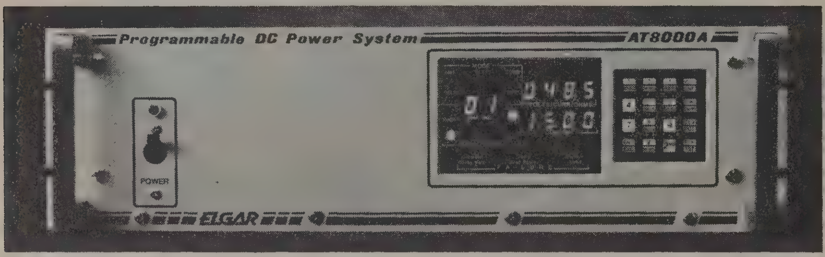
Programmable DC Power Systems

AT8000A Programmable DC Power System



- 16 channels, up to 19,200W at a single bus address
- 6 channels, up to 1200W, in a single 5.25" drawer
- Parallel programming
- Sub-modular construction
- Programmer, keyboard/display
- Confidence test on command
- Fault isolation to replaceable module level
- Qualifiable to MATE guidelines
- Programmable shut-down sequence

Elgar's AT8000A Programmable DC Power System holds from 1 to 6 totally independent channels of DC power in a 5.25" rack-mount chassis. By using expansion chassis, it can be expanded to 16 output channels controlled by an internal master programmer, either from the front-panel keyboard or remotely via IEEE-488 GPIB using one selectable bus address. It integrates programmer, power and load modules, built-in test equipment and all signal/load interfaces into the most compact and powerful package available.

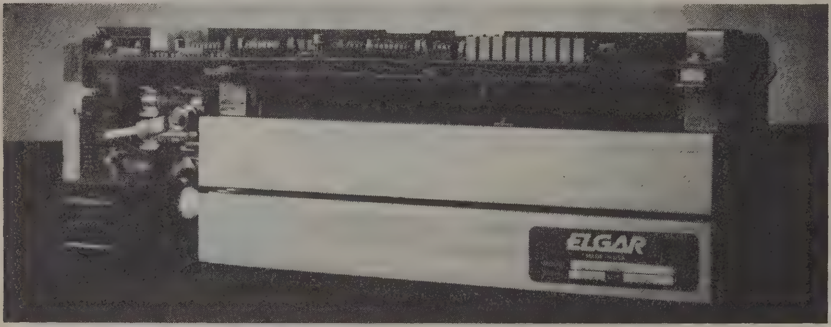
Using 200W modules, a single-chassis system can deliver up to 1,200W. Adding additional modules and chassis can raise total power to 19,200W at a single bus address. Programmable paralleling can provide any combination of 200W increments up to 1,200W per channel.

Front-panel Keyboard/Display includes a 16 pad, multilevel keyboard with increment/decrement keys plus an LED display to speed and simplify programming. The system can show programmed values or, with the built-in test option, actual measured values, as well as channel number, voltage and current. It allows complete local/ manual control of most functions, alerts the operator to identified system malfunctions and prompts the operator for ease of programming and operation.

Internal Programmer can employ either user-friendly ABLE (Atlas Based Language Extension) or optional CIIL (Control Interface Intermediate Language) for complete voltage, current and general system control.

DC Power Modules employ a high efficiency linear design for fast response and low noise. Eight standard output voltage ranges are available: 0 to 7, 10, 20, 32, 40, 80, 160 and 320 VDC — and the design makes modification to accommodate special voltage application requirements quick and easy. Outputs are completely isolated and all operate in programmable voltage or constant current mode. There's over current sensing and over voltage protection with SCR crowbar shutdown. Load isolation (confidence) relays are standard and polarity switching relays are optional.

NEW Electronic DC Load Modules



Elgar's versatile new 300W Electronic DC Load Modules can be installed in the AT8000A Programmable DC Power Systems to simulate all real-world characteristics for testing, evaluation and burn-in of DC power supplies, batteries, capacitors and other power components.

The DC load modes of operation are: constant current, constant voltage, constant resistance, short circuit, and transient operations.

Programmable slew rates automatically duplicate the dynamic behavior of real-world load conditions, while analog modulation with external input accurately duplicates complex load waveforms. Remote sensing capabilities increase flexibility while maximizing programming and readback accuracy.

Auxiliary Drive Module (ADM)

Elgar's Auxiliary Drive Module (ADM) is a digital-to-analog converter which adds two versatile functions to AT8000A Systems. It can act as:

- Two programmable analog signals to drive external AC or DC power sources or other electronic equipment.
- A programmable connect/disconnect relay driver for controlling an external power relay.

With an ADM, a non-Elgar external bulk supply can take on the same personality as an AT8000A DC module—extending the AT8000A's normal power-per-module from 200W. ADM's occupy a single AT8000A slot and are addressed as a single channel from the front panel keyboard or over the IEEE-488 bus. The ADM has 2 separate isolated outputs (one each for programming voltage and current) plus two programmable relays which can serve as contact closures to activate external high-power disconnect/isolation relays or serve as status indicators. Optional Built-In Test (BIT) for readback of voltage and current measurement of the external device is also available.

60LO1
Maximum power 300W continuous
Voltage range 3-60V
Current ranges 0-6A, 0-60A
Resistance range 0.1-100 ohm
Modes of operation Constant current, constant voltage, constant resistance, short circuit and transient operations

120LO1
Maximum power 300W continuous
Voltage range 3-120V
Current ranges 0-3A, 0-30A
Resistance range 0.1-1.0K ohm
Modes of operation Constant current, constant voltage, constant resistance, short circuit and transient operations

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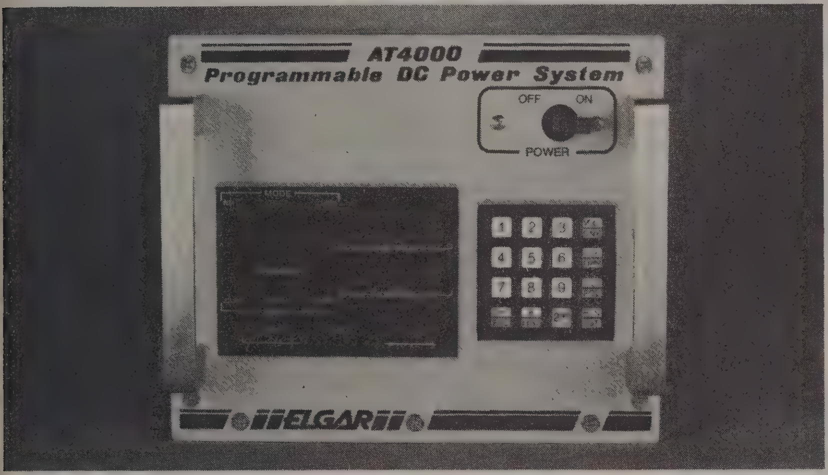
Programmable DC Power Systems

AT4000 Programmable DC Power System



Elgar's AT4000 Programmable DC Power System is a half-rack version of the AT8000A. It holds from 1 to 3 "instrument-on-a-card" DC power supplies in a 7" chassis. Each chassis can provide up to three 150W channels — for a maximum of 450W per chassis. As in the 6-channel AT8000A, it is controlled from either the front-panel keyboard or remotely via the IEEE-488 BUS using one selectable bus address.

SPECIFICATIONS:

Configuration 1 to 3 output channels per 7" high, half rack chassis

Full rated output power Up to 150W per channel

Other specifications See AT8000A section

The AT4000 integrates programmer, power modules, built-in test equipment and all interfaces into a compact, powerful package. Software can be developed in the laboratory with the AT4000 and then be transferred to AT8000A production systems with no modifications.

By adding virtually the same powerful capabilities offered by the AT8000A at a reduced size, the AT4000 can support requirements for smaller manual bench-top DC power supplies, programmable bench-top power sources, ATE production test systems and verification test systems.

VXP3000 Programmable Power System

VXP 3000
VXP 3000
VXP 3000
VXP 3000
VXP 3000
VXP 3000
VXP 3000
VXP 2000
ON
FAULT
750VA
ELGAR

Elgar's VXP3000 Programmable Power System is the state-of-the-art solution for test systems where high power density, small size and flexibility are the key priorities.

The unique chassis design employs 1.8 inch wide slots which accept one controller module and up to eight power modules or three 750VA AC modules. The ability to provide both AC and DC power in one chassis and at one GPIB address is further enhanced by an Auxiliary Drive Module (ADM). This module allows the VXP controller to program external bulk or high power DC power supplies as if they were standard VXP power modules.

CONTROLLERS

IEEE-488 controller With ABLE or CIIL (MATE) syntax

Slave controller for use with expansion chassis or as an interface to a VXP1000 power programmer located in a VXI chassis

DC POWER MODULES

Output voltage range 0-7, 10, 14, 20, 32, 40, 60, 100 and 200 VDC; 1.8" standard width (up to 8 modules per chassis)

Full rated output power 200W for 10, 14, 20, 32, 40, 60, 100 and 200 VDC modules; 140W for 7 VDC module; 1.5 KW, 4-wide module available at 100 VDC

Parallelable For load sharing (available for 140W and 200W modules)

Series connectable Up to 400 VDC

AC POWER MODULES

Full rated output power 750 VA

Output voltage range 0-135 VAC, 3.6" double-wide size

Frequency range 350-999.9 Hz (45-350 Hz with reduced specifications)

Configurable For up to 2250 VAC single-phase or up to 6750 VA three-phase

Parallelable For higher power requirements by using the special plug-in VXP-LSM module

Auxiliary output A 0-26 VAC/2A output proportional to the main output voltages provided. An optional 5 VAC/5A auxiliary output is available.

Fast current limit protection Against short circuits

Efficiency Over 80%

High Voltage Power Supplies

DC to DC Converters up to 75W

Applications

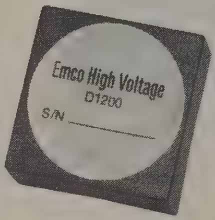
CRT,Photomultiplier,X-Ray, Spectroscopy, Ion Spectrometry, Analytical Spectrometers, Shadow Mask, Laser Interferometers, Color Graphics, Image Intensifiers/Analyzers, Capacitor Charging

Capabilities

INPUT VOLTAGE: 4 to 150 Volts DC
OUTPUT VOLTAGE: Up to 30,000 Volts DC
OFF THE SHELF PRICING AND DELIVERY FOR STANDARD MODELS. CUSTOM DESIGNS FOR YOUR SPECIFIC REQUIREMENT. ONE YEAR WARRANTY. FULL TECHNICAL SERVICE

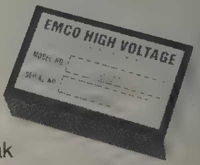
Miniature Converter "D" Series

Input Voltage:	10 Volts DC
Output Voltage:	Up to 2,400 Volts DC
Output Current:	50 to 250 µA
Regulation:	Output follows input
Ripple:	0.5% Peak to Peak
Package Size:	1.5" x 1.5" x .63"



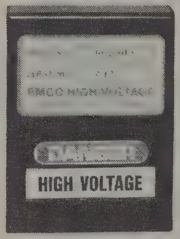
Proportional PC Module "E" Series

Input Voltage:	4 to 12 Volts DC
Output Voltage:	Up to 10,000 Volts DC
Output Current:	0.2 to 10 mA
Regulation:	Output follows input
Ripple:	.01% to 1% Peak to Peak
Package Size:	1.5" x 2.5" x .85"



PC Mount PMT Supply "PC" Series

Input Voltage:	15 Volts DC
Output Voltage:	Adj. up to 2,500 Volts DC
Output Current:	0.5 to 1 mA
Regulation:	0.004%
Ripple:	0.001%
Package Size:	2.6" x 3.5" x 1.0"



HeNe Laser Power Supply "LP" Series

Input Voltage:	12 Volts DC
Output Voltage:	Up to 2,500 Volts DC
Output Current:	2.5 to 7.0 mA
Regulation:	0.5%
Ripple:	3% RMS
Package Size:	1.5" x 3.75" x 1.0"

HIGH VOLTAGE

Precision PMT Supply "PD" Series

Input Voltage:	24 to 30 Volts DC
Output Voltage:	Up to 3,000 Volts DC
Output Current:	3 to 10 mA
Regulation:	0.001%
Ripple:	0.0002%
Package Size:	5.1" x 4.1" x 1.5"

HIGH VOLTAGE

Regulated CRT Supply "6000"Series

Input Voltage:	24 Volts DC
Output Voltage:	Up to 18,000 Volts DC
Output Current:	0.55 to 1.25 mA
Regulation:	0.1%
Ripple:	0.033%
Package Size:	4.1" x 3.1" x 1.4"

HIGH VOLTAGE

EMCO

Emco High Voltage Company

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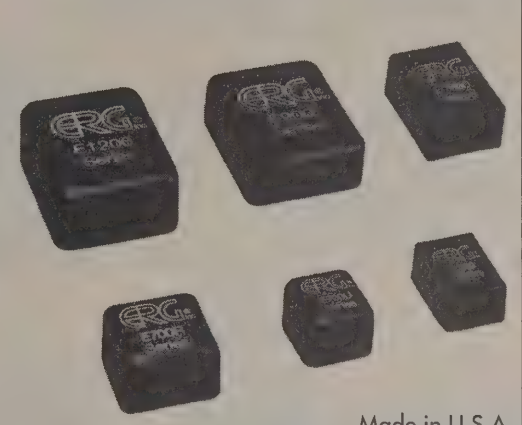
SUTTER CREEK, CA 95685

The U.S. Power Supply Source for Information Displays

DC-DC CONVERTERS

DC-DC Converters for Gas Discharge Displays up to 25W

Convert low DC line voltage to the higher voltage levels required to activate multi-segment plasma gas dicharge displays (including bar graphs). ERG Converters eliminate the need for 200-250 vdc line.


Made in U.S.A.

Contact Factory for Voltage Requirements:

- Custom Design Variations for multi-segment, bar graph and dot matrix gas discharge and vacuum flourescent displays
- Inputs from 5 vdc to 28 vdc
- Outputs from 5 vdc to 1,500 DC
- Single and dual outputs (up to 25W total)
- Regulated and unregulated
- Center Tap (voltages)

General Specifications

Converter Series	Input	Output	Size	Weight	Package
E700U	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.1" (27.94 mm)X 1.2" (30.48 mm)X .91" (23.11 mm) max. high	30 gms.	Plastic
E700R (Regulated)	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.43" (36.32 mm)X 1.5" (38.10 mm)X 1.03" (26.16 mm) max. high	40 gms.	Plastic
E500*	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.00" (25.40 mm)X 1.38" (35.05 mm)X 0.70" (17.78 mm) high	20 gms.	Plastic
E1600	5, 9, 12, 15 vdc	Up to 6W unregulated (i.e. 200 vdc @ 24 ma)	1.30" (33.02 mm)X 1.88" (63.50 mm)X 0.82" (24.9 mm) high	44 gms.	Plastic
E900	5, 9, 12, 15 vdc	Up to 12W total, with single or dual outputs, unregulated; (i.e. Single: 250 vd: @ 30 ma Dual: 250 vdc @ 30 ma and -16 vdc @ up to 200 ma to power the drive electronics in many applications.	2" (50.80 mm)X 2.5" (63.50 mm)X .98" (24.9 mm) high	122 gms.	Aluminum
E1200	12, 15 vdc standard (others to your spec)	Up to 25W unregulated (i.e. 250 vdc @ 100 ma)	2" (50.80 mm)X 2.5" (63.50 mm)X 1.19" (30.23 mm) high	185 gms.	Aluminum

* For high-volume requirements, E500 delivers same performance as E700 at significantly lower unit cost!

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 600V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0-70°C standard. Wider ranges available. 85°C case max.

Endicott Research Group, Inc.

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Phone 607 754-9187 • FAX 607 754-9255

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EPD
ELECTRONICS INC.

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16921 S. Western Ave., No. 300, Gardena, CA 90247
(310) 515-4996

FULLY REGULATED DC POWER SUPPLY

CONVERTS 117AVC INTO 13.8V WITH:
- AUTOMATIC CUTOFF RESETABLE SHORT PROTECTION
- FUSE PROTECTION • LED INDICATOR

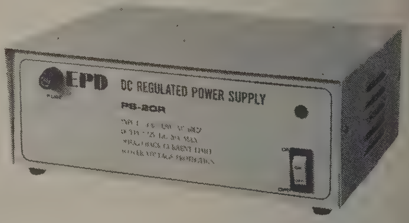
EPD
3
EPD
REGULATED DC POWER SUPPLY
6
EPD
REGULATED DC POWER SUPPLY
10

EPD 312 INPUT: 117VAC 60HZ
OUTPUT: 13.5VDC
3A CONSTANT
5A SURGE CURRENT

EPD 612 INPUT: 117VAC 60HZ
OUTPUT: 13.5VDC
6A CONSTANT
8A SURGE CURRENT

EPD 1012 INPUT: 117VAC 60HZ
OUTPUT: 13.8VDC
10A CONSTANT
12A SURGE

HIGH POWER REGULATED DC POWER SUPPLY



PS-20R
INPUT: 117VAC 60HZ
OUTPUT: 13.8VDC
20 AMPERE MAX.
FUSE PROTECTION
OVERVOLTAGE PROTECTION
WEIGHT 12 LBS.
SIZE 4.4″H × 11.2″W × 10″D

WALL MOUNT AC-DC ADAPTORS

EPD
BATTERY ELIMINATOR

DV6-W3 MULTI-VOLTAGE (6) 300MA. 12W
INPUT: 117VAC 60HZ
OUTPUT: 3V 4.5V 6V 7.5V 9V 12V
POLARITY SWITCHABLE UNIVERSAL PLUG

DV6-W5 MULTI-VOLTAGE (6) 500MA. 12W
INPUT: 117VAC 60HZ
OUTPUT: 3V 4.5V 6V 7.5V 9V 12V
POLARITY SWITCHABLE UNIVERSAL PLUG

DV-6500
INPUT: 117VAC
OUTPUT: 6VDC 500MA. MINI PLUG

DV-9300
INPUT: 117VAC
OUTPUT: 9VDC 300MA. MINI PLUG

DV-9500
INPUT: 117VAC 60HZ
OUTPUT: 9VDC 500MA. MINI PLUG

DV-1250
INPUT: 117VAC 60HZ
OUTPUT: 12VDC 500MA. MINI PLUG

DV-1280
INPUT: 117VAC 60HZ
OUTPUT: 12VDC 800MA. MINI PLUG

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Since 1936

REGULATED & SEMI-REGULATED POWER SUPPLIES

Ruggedly-constructed, low voltage D.C. power supplies for use in design, development, testing of transistor circuitry . . . for servicing and operating auto, aircraft, marine-craft radio, electronic equipment . . . for production line testing, industrial and educational laboratory work and many other applications.

Precision made and engineered to give unequalled performance life per dollar. Features include: Voltage regulation, AC ripple filtering, adjustable output voltage, large easy-to-read meters, isolated output terminals, 1-year warranty.

INPUT—*Regulated Models:* 105-125 V. AC. 60 Hz *Industrial and General Purpose Models:* 117 V. AC 60 Hz. Models available to fit W.E. and EIA racks. Custom-design or modification of standard units to your specs.

INVERTER — Transistorized. Converts 12 V. DC to 117 V. AC, 60 Hz to operate equipment from car, truck or boat battery, or other 12 V. DC source for camping, traveling, boating. Reverse polarity and short circuit protection.

REGULATED

Model	Figure	Output		Line Reg.**	Load Reg.*	Max. Ripple, RMS	Meters††	DC Imp. Ohms*	Size (H x W x C)	Wt. Lbs.	Net Price
		DC Volts	Current								
PSR-12-25	A	0-25	0-500mA	0.01% + 2mV	0.01%	100μV	0-30V/600mA	.006	5¼ x 3⅛ x 9⅛	6	$259.50
PSR-12-50	A	0-50	0-250mA	0.01% + 2mV	0.01%	100μV	0-60V/300mA	.02	5¼ x 3⅛ x 9⅛	6	259.50

INDUSTRIAL

Model	Figure	Output		Load Regulation* (V/A)†	Max. Ripple %	Meters††	DC Impedance Ohms*	Size (H x W x D)	Wt. Lbs.	Net Price
		DC Voltage	Amps.							
EF	B	0-28 0-14	0-5 0-5	0.9 (1-5A) 0.6 (1-5A)	1.0 1.0	0-50V, 0-6A	0.9 (1-5A) 0.6 (1-5A)	7 x 12 x 8½	21	$327.50
EFB	B	0-32 0-16	0-4 0-8	1.25 1.0	0.1 0.1	0-40/20V, 0-10A	1.25 1.0	7 x 12 x 8½	26	370.50
EFBR‡		0-32 0-16	0-4 0-8	1.25 1.0	0.1 0.1	0-40/20V, 0-10A	1.25 1.0	8¾ x 19 x 8½	34	429.50
GFL	C	0-125	0-5	1.5	0.5	0-150V, 0-5A	1.5	9¾ x 14¼ x 14¼	88	797.50
GFLR‡	H	0-125	0-5	1.5	0.5	0-150V, 0-5A	1.5	10½ x 19 x 14¼	100	867.50
NFB	C	0-32	0-15	0.4	0.75	0-50V, 0-25A	0.4	9¾ x 14¼ x 14¼	84	745.50
NFBR‡	H	0-32	0-15	0.4	0.75	0-50V, 0-25A	0.4	10½ x 19 x 14¼	97	797.50
PS-5	C	0-55	0-10	0.8	0.5	0-75V, 0-15A	0.7	9¾ x 14¼ x 14¼	70	709.50
PS-5R‡	H	0-55	0-10	0.8	0.5	0-75V, 0-15A	0.7	10½ x 19 x 14¼	89	765.50
PS-1000-32	D	0-32	0-30	0.2	0.75	0-50V, 0-30A	0.2	9¾ x 14¼ x 19¼	113	1035.50
PS-1000-55	D	0-55	0-20	0.5	0.5	0-75V, 0-30A	0.5	9¾ x 14¼ x 19¼	113	1035.50
PS-1000-125	D	0-125	0-8A	1.0	Less than 1%	0-150V, 0-10A	1.0	9¾ x 14¼ x 19¼	113	1035.50
GENERAL PURPOSE										
D-612T	B	0-16 0-8	0-10 0-10	0.44 (3-10A) 0.3 (3-10A)	0.5 @ 5A 2 @ 10A	0-20V, 0-10A	0.44 (3-10A) 0.3 (3-10A)	7 x 12 x 8½	22	$249.50
H	B	12 (adj.) 6 (adj.)	0-10 0-20	0.23 (3-10A) 0.15 (3-20A)	5 5	0-20V, 0-30A	0.23 (3-10A) 0.15 (3-20A)	7 x 12 x 8½	30	279.50
EC-1	E	12 (adj.)	0-5	1.4	0.5	None	1.4	10¾ x 4⅜ x 6½	11	119.50
EC-2	E	0-16	0-5	1.8	0.5	0-20V, 10A	1.8	10¾ x 4⅜ x 6½	11	185.50
PS-30	F	12 (adj.)	0-30	0.12 (6-30A)	1	0-20V, 0-50A	0.27	9¾ x 14¼ x 14¼	68	557.50
PS-50	F	12 (adj.)	0-50	0.17	0.5	0-20V, 0-50A	0.17	9¾ x 14¼ x 19¼	106	755.50
INVERTER										
TI250B	J	**Input:** 12 vdc. **Output:** 117 vac, 60 Hz, 250 **VA** max. **Voltage Regulation:** 15% max. no load to full load constant battery voltage. **Frequency Regulation:** 4 Hz max. no load to full load.						4½ x 10 x 7½	13	207.50

‡Rack mounted version.
*No-load to full-load unless otherwise specified.

†Output voltage change for each ampere of output current change, except on regulated units, % applies for either line or load.
††All 2% accuracy except 5% for general purpose units. Rectifiers: Selenium and Silicon ("avalanche" characteristics on Industrial units).
**From 105-125 VAC.

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Hearst Engineering Software

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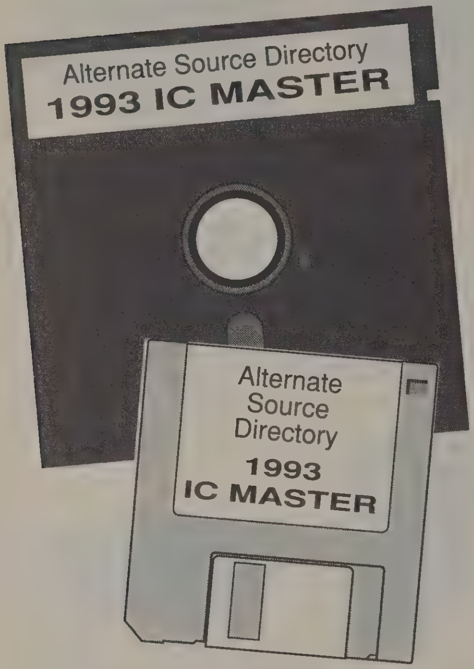

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Published annually in March

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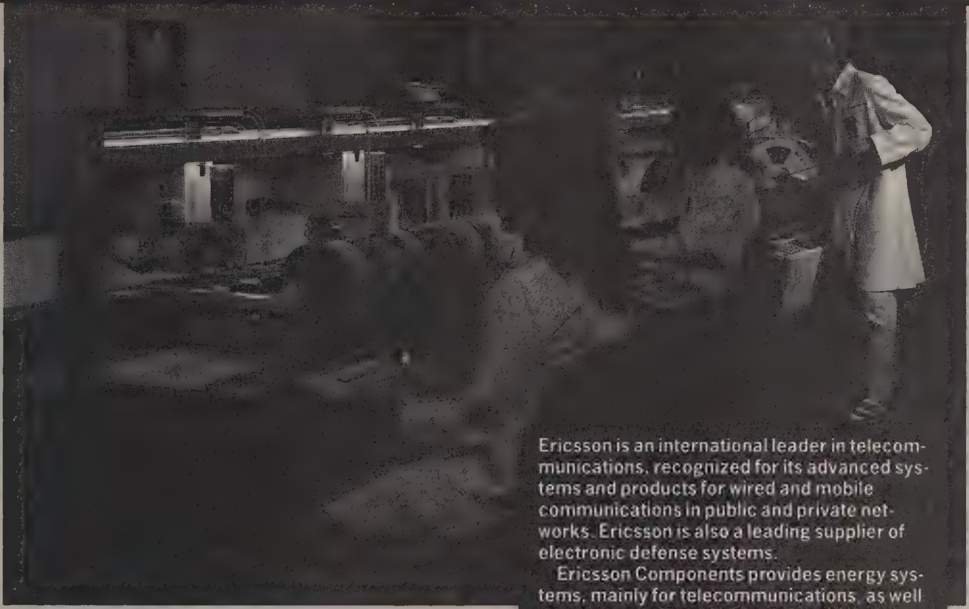

Ericsson is an international leader in telecommunications, recognized for its advanced systems and products for wired and mobile communications in public and private networks. Ericsson is also a leading supplier of electronic defense systems.

Ericsson Components provides energy systems, mainly for telecommunications, as well as advanced microelectronics, cables and distribution of components.

The Energy Systems Division provides a full range of power products and systems, as well as cooling and energy management systems. Ericsson has designed, manufactured and marketed power products for more than 100 years, and the Energy Systems Division is active in some 90 countries.

- **DC/DC Converters for Distributed Power Architectures**
- **Manufactured by World Class Automation Process**
- **Operations Certified in Accordance with ISO 9001**

Ericsson Components, Energy Systems

– The Power in Telecommunications –

Ericsson Components' Energy Systems Division has been in the forefront of electronic power supply development for over four decades. Ericsson Components, which includes activities for power, microelectronics and fibre optical circuits and modules, is a strategically important company within the internationally renowned Ericsson group.

Throughout the group's history, which dates back to 1876, Ericsson has been involved in the challenging and fast moving field of telecommunications. It's a sector which demands a combination of innovation, high reliability and commercially competitive business practice in order for companies to survive and grow. The group's success in this area is clearly demonstrated by its current position in world markets – sales of $7 billion, activities in 100 countries and 66,000 employees (1992).

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Each one is able to provide a high level of technical and applications advice to customers, as well as affording a local point of contact for sales enquiries and orders.

As a major part of Ericssons power supplies is exported, the company is geared to providing an efficient and rapid service to customers, wherever they may be located.

Innovative design, quality of products and dedication to service are the hallmarks of Ericsson Components Energy Systems.

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ERICSSON

DC/DC Converters 25–40 W
PKE 4000-Series

- *No derating of output power within –45 °C to +85 °C ambient temperature range*
- *10.7 mm (0.42") height allows 0.8" board spacing*
- *1 500 Vdc In/Out isolation conforming to EN 41003 and UL 1459*
- *MTBF > 2,000,000 hours at +45 °C per MIL-HDBK 217E*
- *Efficiency 83–85%*
- *Complete, no extra filters or heatsinks required*

(UL 1950)

Low Profile Power Modules for non-controlled environments

The 25–40 watts PKE 4000 series hybrid DC/DC Power Modules are especially designed for decentralized 48/60 Vdc power distribution systems with distributed on-board DC/DC converters in applications with extra high temperature and isolation requirements. Their low profile allows very narrow board pitches and slim designs. By using a thickfilm technology, which provides a high degree of integration as well as an efficient thermal management and by utilizing a 300 kHz switching frequency technology based on proprietary drive & control chips, these highly reliable products conform to standard telecom and datacom requirements in non-controlled environment applications. Input to output isolation is 1,500 Vdc to meet increasing demands on isolation voltages in accordance with EN 41003 and UL 1459. The mechanical ruggedness – in conformance with IEC 68-2 – is close to the requirements for discrete components. The converters can operate with full output power in ambient temperatures from –45 to +85 °C making the products ideal in most demanding applications. To meet generic requirements for power supplies, the products are also UL recognized and CSA certified.

The PKE 4000 Power Modules are manufactured in highly automated production lines, using all SMD mount, laser trimming and an 100% burn-in and ATE final inspection.

Ericsson Components AB is an ISO 9001 certified supplier since 1991.

V_{in}	V_o/I_o max			P_o max	Isolated On-Card
	O/P 1	O/P 2	O/P 3		
48/60 V =	3.3 V/7.6 A			25 W	PKE 4210 PI
	5 V/5.0 A			25 W	PKE 4211 PI
	+ 5 V/5.0 A	+12 V/1.0 A	–12 V/1.0 A	25 W	PKE 4231 PI
	+ 5 V/5.0 A	+15 V/0.8 A	–15 V/0.8 A	25 W	PKE 4232 PI
	+ 5 V/5.0 A	+12 V/1.0 A	– 5 V/3.0 A	25 W	PKE 4235 PI
	12 V/2.0 A		12 V/2.0 A	30 W	PKE 4323 PI
	15 V/1.6 A		15 V/1.6 A	30 W	PKE 4325 PI
	+ 5 V/8.0 A	+12 V/2.0 A	–12 V/2.0 A	40 W	PKE 4431 PI

For complete specification request full line catalog.

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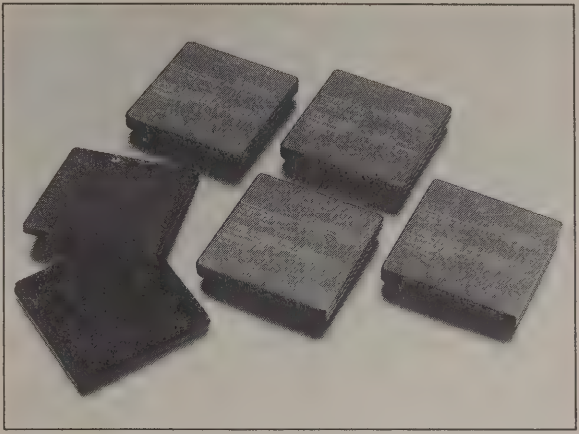
Fax (214) 680-1059

ERICSSON

DC/DC Converters 25–30 W
PKE 4000E-Series

- *No derating of output power within −10 °C to +70 °C ambient temperature range*
- *10.7 mm (0.42") height allows 0.8" board spacing*
- *500 Vdc In/Out isolation*
- *MTBF > 2,000,000 hours at +45 °C ambient and full load – equal to +75°C baseplate temp*
- *Efficiency typically 85% at full load. No extra heat-sink needed at +70 °C free convection – max. baseplate temperature +100 °C*



Low Profile Power Modules for controlled environments

The 25–30 watts PKE 4000E series hybrid DC/DC Power Modules are especially designed for decentralized 48/60 Vdc power distribution systems with distributed on-board DC/DC converters in applications with standard temperature and isolation requirements. Their low profile allows very narrow board pitches and slim designs. By using a thickfilm technology, which provides a high degree of integration as well as an efficient thermal management and by utilizing a 300 kHz switching frequency technology based on proprietary drive & control chips, these highly reliable products conform to standard telecom and datacom requirements in controlled environment applications. Input to output isolation is 500 Vdc and mechanical ruggedness – in conformance with IEC 68-2 – is close to the requirements for discrete components. The converters can operate with full output power in ambient temperatures from −10 to +70 °C making the products ideal for normal temperature requirements in most applications.

The PKE 4000E Power Modules are manufactured in highly automated production lines, using all SMD mount, laser trimming and an 100% burn-in and ATE final inspection.

Ericsson Components AB is an ISO 9001 certified supplier since 1991.

Note! – For increased temperature range and input/output isolation, UL recognition and CSA certification please refer to PKE 4000 data sheet.

V_{in}	V_o/I_o max			P_o max	Isolated On-Card
	O/P 1	O/P 2	O/P 3		
48/60 V =	5 V/5.0 A			25 W	PKE 4211E PI
	12 V/2.0 A		12 V/2.0 A	30 W	PKE 4323E PI
	15 V/1.6 A		15 V/1.6 A	30 W	PKE 4325E PI
	+ 5 V/5.0 A		±12 V/1.0 A	25 W	PKE 4231E PI
	+ 5 V/5.0 A		±15 V/0.8 A	25 W	PKE 4232E PI
	+ 5 V/5.0 A	+12 V/1.0 A	– 5 V/3.0 A	25 W	PKE 4235E PI

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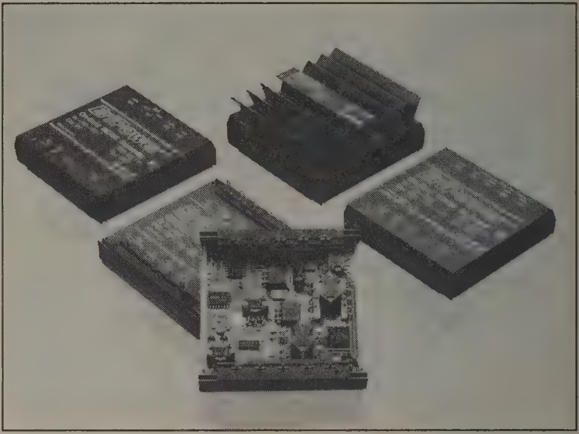
ERICSSON

DC/DC Converters 25–40 W
PKA-Series

- *No derating of output power within –45 °C to +85 °C ambient temperature range*
- *+115 °C max. case temperature*
- *MTBF >2,000,000 hours at +45 °C per MIL-HDBK 217E*
- *Efficiency 80–85%*
- *500 Vdc isolated or non-isolated models*
- *Complete, no extra filters or heatsinks required*
- *Compact, 3" × 3" × 0.7"*



Compact On/Off-Card hybrid power modules

The PKA-series of DC/DC converters consists of 45 models, available in non-isolated or 500 Vdc input/output isolated versions. The single, dual and triple output converters with input ratings of 19–35 Vdc or 39–64 Vdc and with an output power of 25–40 W, are recognized as the industry standard for miniaturized On-Card converters. The ambient temperature range is –45 °C to +85 °C without derating. Low profile 40 W models with an additional height of only 2 mm (compared to the 25–30 W models) have a temperature range of –45 °C to +65 °C. Using thickfilm hybrid technology, very efficient thermal management combined with a 300 kHz switching frequency has made it possible to achieve a verified MTBF of >200 years. Two transistor topologies based upon proprietary drive and control circuits have facilitated the use of only highly reliable ceramic capacitors instead of electrolytics (one of the keys to the MTBF-figures). The reliability makes them ideal in Telecom, Datacom and Medical applications. Their low weight and height in addition to their electrical and mechanical ruggedness offer possibilities for use as distributed power sources directly on PCB:s (On-Card) or Chassis (Off-Card) mounted in Industrial, Airborne and other demanding applications. Special design care has been taken regarding the mechanical performance. Consequently, the vibration, shock and bump specifications normally associated with components such as resistors and capacitors. Output characteristics together with accurate laser trimming of output voltages in the highly automated production line makes it possible to parallel the PKA:s in great numbers.

V_{in}	V_o/I_o max		P_o max	Non-Isolated		Isolated	
	O/P 1	O/P 2 & 3		On-Card	Off-Card	On-Card	Off-Card
24 V =	5 V/5.0 A		25 W	PKA 2212 P	PKA 2212 C	PKA 2211 PI	PKA 2211 CI
	12 V/2.5 A		30 W	PKA 2314 P	PKA 2314 C		
	5 V/8.0 A		40 W			PKA 2411 PI, PIL	PKA 2411 CI
	12 V/2.0 A	12 V/2.0 A	30 W			PKA 2323 PI	PKA 2323 CI
	15 V/1.6 A	15 V/1.6 A	30 W			PKA 2325 PI	PKA 2325 CI
	+ 5 V/5.0 A	±12 V/1.0 A	25 W	PKA 2231 P	PKA 2231 C	PKA 2231 PI	PKA 2231 CI
	+ 5 V/5.0 A	±15 V/0.8 A	25 W	PKA 2232 P	PKA 2232 C	PKA 2232 PI	PKA 2232 CI
48 V =	5 V/5.0 A		25 W	PKA 4211 P	PKA 4211 C	PKA 4211 PI	PKA 4211 CI
	5 V/8.0 A		40 W	PKA 4411 P, PL	PKA 4411 C	PKA 4411 PI, PIL	PKA 4411 CI
	+12 V/2.5 A		30 W	PKA 4313 P	PKA 4313 C		
	+12 V/2.0 A	−12 V/2.0 A	30 W	PKA 4321 P	PKA 4321 C		
	12 V/2.0 A	12 V/2.0 A	30 W			PKA 4323 PI	PKA 4323 CI
	5 V/5.0 A	±12 V/1.0 A	25 W	PKA 4231 P	PKA 4231 C	PKA 4231 PI	PKA 4231 CI
	+ 5 V/5.0 A	±15 V/0.8 A	25 W	PKA 4232 P	PKA 4232 C	PKA 4232 PI	PKA 4232 CI

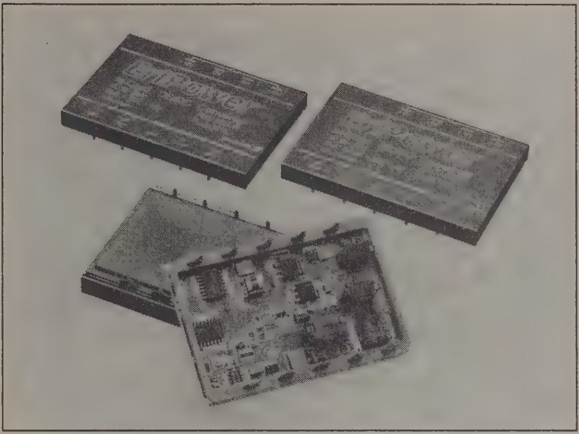
For complete specification request full line catalog.

Ericsson Components, Inc.
403 International PKWY. Richardson, TX. 75081
Tel (214) 669-9900 or (214) 997-6561 (direct)
Fax (214) 680-1059

ERICSSON

DC/DC Converters 15–18 W
PKC-Series

- *No derating of output power within –45 °C to +85 °C ambient temperature range*
- *+115 °C max. case temperature*
- *MTBF >2,000,000 hours at +45 °C per MIL-HDBK 217E*
- *Efficiency 80–87%*
- *500 Vdc isolation*
- *Complete, no extra filters or heatsinks required*
- *Compact, 2.16" × 3.15" × 0.42"*



Compact On/In-Card hybrid power modules

The PKC-series of DC/DC converters consists of 14 models with input ratings of 18–36 Vdc or 36–72 Vdc and with an output power of 15–18 W. They are specifically designed for distributed power supply requirements and their outputs can easily be paralleled for power upgrading or redundancy. The ambient temperature range is –45 °C to +85 °C without derating. The converters can either be mounted as In-Card with a maximum height over the PCB of 10.7 mm/0.42" or as In-Card, i.e. into a punched hole in the PCB, with a height over the board of 8.5 mm/0.33" thus allowing 3TE/0.6" board spacing in a rack. The PKC-series converters has up to three well regulated outputs which will stay within 3% of their nominal voltage for all specified load, line and temperature ranges.

The PKC-series of DC/DC converters does normally not require external components even when used in sensitive applications. Conducted RFI is within the VDE 0871 curve A and FCC 20780 class A. The mechanical design conforms to the IEC 68-2 specifications, normally applicable to discrete components such as resistors and capacitors.

Surface mount hybrid technology provides excellent thermal management and with the 300 kHz switching frequency it has been possible to use ceramic capacitors only within the design, thus achieving an MTBF >200 years. Together with the low weight (50 g/1.76 ozs.) this makes them ideal for Telecom, Datacom, Airborne Industrial and Medical applications.

V_{in}	V_o/I_o max			P_o max	Article
	O/P 1	O/P 2	O/P 3		
24 V =	5 V/3.0 A			15 W	PKC 2111 PI
	12 V/1.5 A			18 W	PKC 2113 PI
	+12 V/1.2 A		–12 V/1.2 A	18 W	PKC 2121 PI
	+15 V/1.0 A		–15 V/1.0 A	18 W	PKC 2126 PI
	+ 5 V/3.0 A	+12 V/0.6 A	–12 V/0.6 A	15 W	PKC 2131 PI
	+ 5 V/3.0 A	+15 V/0.5 A	–15 V/0.5 A	15 W	PKC 2132 PI
	+ 5 V/3.0 A	+12 V/0.6 A	– 5 V/1.0 A	15 W	PKC 2135 PI
48 V =	5 V/3.0 A			15 W	PKC 4111 PI
	12 V/1.5 A			18 W	PKC 4113 PI
	+12 V/1.2 A		–12 V/1.5 A	18 W	PKC 4121 PI
	+15 V/1.0 A		–15 V/1.0 A	18 W	PKC 4126 PI
	+ 5 V/3.0 A	+12 V/0.6 A	–12 V/0.6 A	15 W	PKC 4131 PI
	+ 5 V/3.0 A	+15 V/0.5 A	–15 V/0.5 A	15 W	PKC 4132 PI
	+ 5 V/3.0 A	+12 V/0.6 A	– 5 V/1.0 A	15 W	PKC 4135 PI

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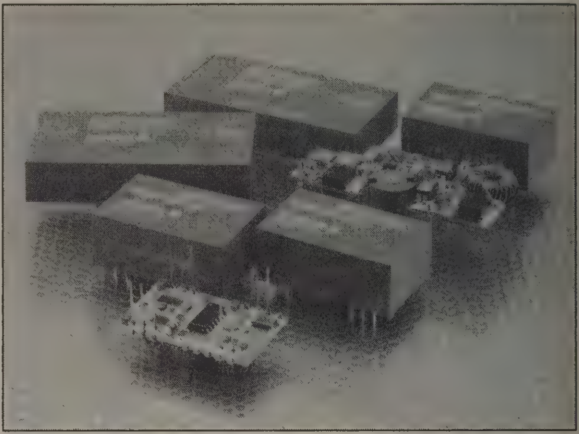
Fax (214) 680-1059

ERICSSON

DC/DC Converters 0.3–9 W
PI/PKV-Series

- *MTBF >200,000 hours at +30 °C*
- *Thickfilm hybrid or SMD*
- *Isolation voltage 500–1 000 Vdc*
- *High power density and low heat dissipation*
- *Input filters and short circuit protection*
- *Wide input and high efficiency models*
- *Operating temperature −25 °C to +70 °C (−40 °C for 2PKV/7PKV)*



Miniature DC/DC power modules

PI/PKV are the product names of a range of DC/DC converters in thickfilm hybrid or SMD technology meeting the growing demand for PCB voltage conversion or circuit isolation in high quality telecom and industrial circuits.
High switching frequencies and an efficient thermal management bring high power densities. All types (except 1PIN) are designed with high attenuation input filters. There is short circuit protection with foldback characteristics for all types except 1PIN for which the protection is limited to 10 s.
2PKV and 7PKV are very high efficiency and wide input range converters with excellent line regulation and a very low No Load input current.
The converters are encapsulated with an epoxy filled plastic box. The encapsulation is self-extinguishing meeting UL requirements.

Product program, Non Regulated Types

Type and power range	Input V =	Output Vdc/mA (types with spec. output current are standard)					
		5 V mA	9 V mA	12 V mA	15 V mA	±12 V mA	±15 V mA
1PIN 0.3 to 0.7 W	5 V 12 V 24 V	60 80 80		33 41 41	26 33 33	±30 ±30 ±30	
2PIN 1 to 2 W	5 V 12 V 24 V	200 200 200	250 250	80 80 80	65 65 65	±40 ±40 ±40	±33 ±33 ±33

Product program, Regulated Types

Type and power range	Input V =	Output Vdc/mA (types with spec. output current are standard)					
		5 V mA	12 V mA	15 V mA	±5 V mA	±12 V mA	±15 V mA
2 PIR 0.5 to 2 W	5 V 12 V 24 V	100 100 100	100 100 100	100 100 100		± 80 ± 80 ± 80	± 65 ± 65 ± 65
3PIR 2.5 W	5 V 12 V 24 V 48 V	500 500 500 500					
4PIR 2 to 3 W	5 V	400	210	165		±105	± 85
2PKV 2.5 to 3 W	24 V (9–36) 48 V (18–72)	500 500	250 250	200 200	±250 ±250	±125 ±125	±100 ±100
7PKV 7.5 to 9 W	12 V (9–18) 24 V (18–36) 48 V (36–72)	1500 1500 1500	750 750 750	600 600 600	±750 ±750 ±750	±375 ±375 ±375	±300 ±300 ±300

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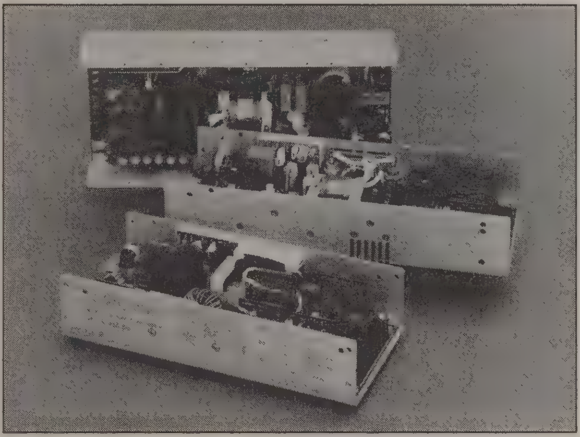
ERICSSON

AC/DC Switching Power Supplies 150–400 W
PLY-Series

- *Quad independent regulated and adjustable outputs*
- *1.5 ×rated current for disc drives start-up surge current*
- *Designed to CSA 22.2, UL 478, UL 1012 and VDE 0806 plus IEC 380/950*
- *RFI suppression in conformance to FCC subpart 15J and VDE 0871 curve B*
- *Protected against: Overload, Over-voltage, Overcurrent, Overheating, No Load, Reverse Voltage, Short Circuit and Brownouts*



Quad Output Switchers in standard footprint

The PLY series of regulated quad output switchers constitutes a series of versatile standard open frame power supplies. Standard footprints and a very wide range for adjusting the outputs, make them ideal not only for substituting an existing power supply but also for applications requiring “odd” voltages. Combining and adjusting the outputs makes possible to meet almost every voltage needed.

High frequency MOSFET switching, surface mounting and a compact design contribute to the attractively small dimensions. Output 2–4 are post regulated and floating, giving possibilities for series connections of selected outputs. The voltages can be adjusted within a wide range and for one of the outputs as much as from 11.5 Vdc to 26 Vdc. An attractive feature is the outputs possibility for surge current (1.5 times max. continuous) which allows start-up of disc drives.

The products are approved from major safety agencies, offering a security to the user in his application for such safety approval of the complete equipment. The PLY 47 have universal input voltage, making it possible to connect them either to 115 V ac or 230 V ac without selecting the input while the PLY 48/49 are user selectable by means of a strap.

A power OK signal is available as well as the possibility for remote control and remote sense.

An MTBF figure of 150.000 hours makes these switchers ideal for applications within computers, communications and industrial systems.

Model number	Max output power W	Output Volts/ampéres (max. continuous at forced air cooling, +40 °C)				Weight	Cooling CFM
		O/P 1	O/P 2	O/P 3	O/P 4		
PLY 4743 A	150	5 V/20 A	10–15 V/3.0 A (Peak 4.5 A)	10–15 V/3.0 A (Peak 4.5 A)	5 V/2 A	1.8 kg (4.0 lb)	5
PLY 4743 B	175	5 V/25 A	10–15 V/3.5 A (Peak 5.3 A)	10–15 V/3.5 A (Peak 5.3 A)	5 V/2 A	1.8 kg (4.0 lb)	15
PLY 4743 C	200	5 V/30 A	10–15 V/4.0 A (Peak 6.0 A)	10–15 V/4.0 A (Peak 6.0 A)	5 V/2 A	1.8 kg (4.0 lb)	15
PLY 4844 A	250 (Peak 300)	5 V/35 A	11.5–26 V/4.0 A (Peak 6.0 A)	4.75–16 V/4.0 A (Peak 6.0 A)	4.75–16 V/3.0 A (Peak 4.5 A)	2.3 kg (5.0 lb)	20
PLY 4844 B	300 (Peak 360)	5 V/45 A	11.5–26 V/6.0 A (Peak 9.0 A)	4.75–16 V/8.0 A (Peak 12.0 A)	4.75–16 V/4.0 A (Peak 6.0 A)	2.3 kg (5.0 lb)	25
PLY 4944	400 (Peak 480)	5 V/55 A	11.5–26 V/7.0 A (Peak 10.5 A)	4.75–16 V/10.0 A (Peak 15.0 A)	4.75–16 V/6.0 A (Peak 9.0 A)	3.2 kg (7.0 lb)	30

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ERICSSON

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

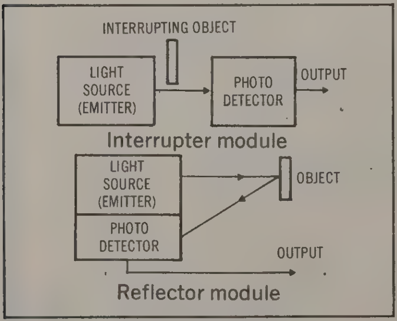
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

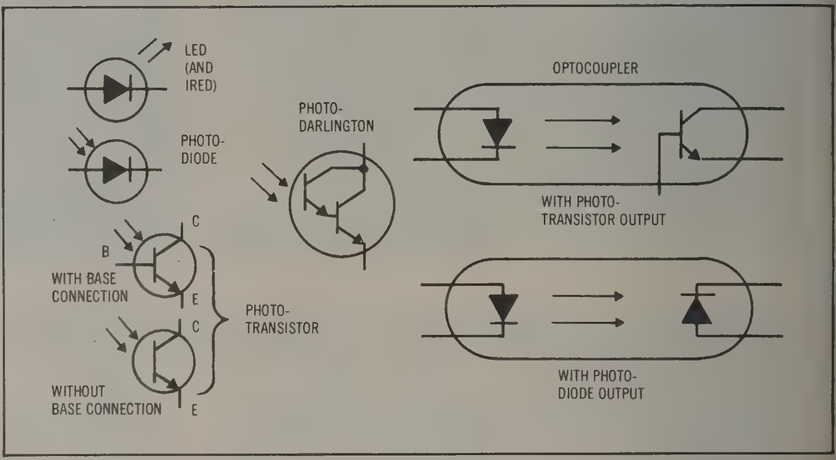
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

FARNELL ADVANCE POWER

(216) 349-0755 FAX (216) 349-0142

Multi-output Switch Mode Power Supplies 30-1500 Watts

The Company

Farnell Advance Power is a division of Farnell Instruments Ltd., with over 20 years of experience in producing quality power supplies.

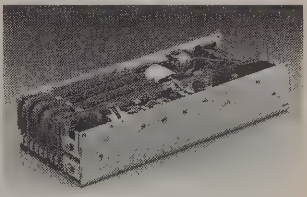
Product Line

Farnell products include open frame and enclosed switch mode power supplies with single and multiple outputs ranging up to 2500 watts, linear power supplies, and a wide range of telecommunications products. Farnell power supplies are manufactured in the UK; designed and, in many cases, listed to international standards including BS, UL, VDE, CSA, IEC, BT and BABT.

Availability

Inventories of Farnell power supplies are maintained in the U.S.A. for prompt shipment. For complete specifications and the name of your nearest Farnell Advance sales representative, contact Farnell Advance, 32111 Aurora Road, Solon, Ohio 44139. **PHONE (216) 349-0755. FAX (216) 349-0142.**

NEW. Compact U-shape 350-watt switcher with universal input, multiple outputs.



Compact 2-1/2" x 5" x 12" U-shape chassis simplifies cost, design and service problems. New AF/AR series offers up to nine outputs per unit, current share N+1 redundancy, and automatic adjustment to all A.C. inputs from 90 to 264 volts, 45 to 440 hz. Built-in cooling optional. Call today.

A.C. Input/Fixed Outputs

Output Power	Cooling	Output Rating					Model Number
30W	C	+5V 3A	+12V 2A	-12V 0.3A			NU030P300
30W	C	+5V 3A	+12V 2A	+24V 0.3A			NU030P301
30W	C	+5V 3A	+15V 2A	-15V 0.3A			NU030P302
40W	C	+5V 6A	+12V 2A	-12V 0.5A			NU040P300
40W	C	+5V 6A	+12V 2A	+24V 0.5A			NU040P301
40W	C	+5V 6A	+15V 2A	-15V 0.5A			NU040P302
55W	C	+5V 3.5A	+12V 3A	-(+)12V 1A			NA055P300
55W	C	+5V 3.5A	+12V 3A	+(-)24V 1A			NA055P301
55W	C	+5V 3.5A	+15V 3A	-(+)15V 1A			NA055P302
55W	C	+5V 6A	F5V 1A	+12V 3A	F12V 2A		NA055P401
55W	C	+5V 6A	+12V 3A	F12V 1A	F12V 1A		NA055P413
55W	C	+5V 6A	+12V 3A	F12V 2A	F24V 1A		NA055P400
55W	C	+5V 6A	+15V 3A	F15V 2A	F24V 1A		NA055P403
75W	C	+5V 8A	+12V 3A	F12V 2A			NA075P300
75W	C	+5V 8A	-5V 1A	+12V 3A	+12V 1A		NA075P414
75W	C	+5V 8A	F5V 1A	+12V 3A	F12V 2A		NA075P401
75W	C	+5V 8A	+12V 3A	+(F)12V 2A	-(F)12V 0.5A		NA075P402
75W	C	+5V 8A	+12V 3A	F12V 2A	F24V 1A		NA075P400
75W	C	+5V 8A	+12V 3A	F15V 2A	F24V 1A		NA075P403
110W	C	+5V 12A	+12V 6A	-(+)12V 3A			NA110P300
110W	C	+5V 12A	+15V 6A	-(+)15V 3A			NA110P302
110W	C	+5V 12A	-(+)5V 1A	+12V 5A	-(+)12V 2A		NA110P401
110W	C	+5V 12A	+12V 5A	+(-)12V 3A	-(+,F)12V 2A		NA110P402
110W	C	+5V 12A	+12V 5A	-(+)12V 2A	+(-,F)24V 2A		NA110P400
110W	C	+5V 12A	+15V 5A	-(+)15V 2A	+(-,F)24V 2A		NA110P403
110W	C	+5V 12A	-(+)5V 1A	+12V 5A	+(-)12V 2A	-(+,F)12V 2A	NA110P501
110W	C	+5V 12A	-(+)5V 1A	+12V 5A	-(+)12V 2A	+(-,F)24V 2A	NA110P500
110W	C	+5V 12A	-(+)5V 1A	+15V 5A	-(+)15V 2A	+(-,F)24V 2A	NA110P503

Cooling: C – Convection, F – Forced Air, I – Integral Fan. Polarities in Parentheses ( ) indicate alternatives which are available by special order. Many other combinations are available by special order. For custom power supplies or information about any supplies listed, **CONTACT FARNELL ADVANCE, (216) 349-0755, FAX (216) 349-0142.**

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FARNELL ADVANCE POWER

(216) 349-0755 FAX (216) 349-0142

Multi-output Switch Mode Power Supplies 30-1500 Watts

Output Power	Cooling	Output Ratings					Model Number
140W	C	+5V 17A	+12V 7A	F12V 3A			NA140P300
140W	C	+5V 17A	F5V 1.5A	+12V 5A	F12V 3A		NA140P401
140W	C	+5V 17A	+12V 5A	F12V 3A	F12V 1.5A		NA140P402
140W	C	+5V 17A	+12V 5A	F12V 3A	F24V 3A		NA140P400
140W	C	+5V 17A	F5V 1A	+12V 5A	F12V 3A	F12V 1.5A	NA140P501
140W	C	+5V 17A	F5V 1A	+12V 5A	F12V 3A	F24V 3A	NA140P500
140W	C	+5V 17A	F5V 1A	+15V 5A	F15V 3A	F24V 3A	NA140P503
200W	C	F5V 30A	F12V 5A	F12V 5A			NA200R300
200W	C	+5V 30A	+12V 7A	F12V 5A			NA200P300
200W	C	F5V 30A	F12V 5A	F24V 3A			NA200R301
200W	C	F5V 30A	F15V 4.5A	F15V 4.5A			NA200R303
200W	C	F5V 30A	F24V 3A	F24V 3A			NA200R304
200W	C	+5V 30A	F5V 1A	+12V 7A	F12V 5A		NA200P401
200W	C	+5V 30A	+12V 7A	F12V 5A	F12V 1.5A		NA200P402
200W	C	+5V 30A	+12V 7A	F12V 5A	F24V 3A		NA200P400
200W	C	+5V 30A	F5V 1A	+12V 7A	F12V 5A	F12V 5A	NA200P501
200W	C	+5V 30A	F5V 5A	+12V 7A	F12V 5A	F12V 5A	NA200P502
200W	C	+5V 30A	F5V 1A	+12V 7A	F12V 5A	F24V 3A	NA200P500
200W	C	+5V 30A	F5V 1A	+15V 7A	F15V 5A	F24V 3A	NA200P503
250W	C	F5V 30A	F5 - 15V 4A	F12 - 16V 10A	F12 - 16V 6A	F12 - 24V 6A	NF500R500M
250W	C	F5V 30A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF500R505M
250W	C	F5V 50A	F5V 1.5A	F12V 6A	F12V 6A	F24V 5A	NA300R500M
250W	C	F5V 50A	F5V 1.5A	F12V 6A	F12V 6A	F48V 2.5A	NA300R505M
250W	C	F5V 50A	F5V 1.5A	F15V 6A	F15V 6A	F24V 5A	NA300R503M
250W	C	F5V 50A	F5V 1.5A	F12V 6A	F15V 6A	F48V 2.5A	NA300R506M
270W	C	F5V 35A	F5 - 15V 4A	F12 - 16V 6A	F12 - 16V 6A	F12 - 24V 6A	NF350R500
270W	C	F5V 35A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F12 - 56V 5A	NF350R505
300W	C	F5V 36A	F5 - 15V 4A	F12 - 16V 10A	F12 - 16V 6A	F12 - 24V 6A	NF500R500
300W	C	F5V 36A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF500R505
300W	F	+5V 40A	-5V 1A	+12V 5A	-12V 5A	+24V 5A	N300R113U
300W	F	+5V 40A	-5V 1A	+15V 5A	-15V 5A	+24V 5A	N300R135U
300W	F	F5V 40A	F5 - 15V 4A	F12 - 16V 6A	F12 - 16V 6A	F12 - 24V 6A	NF350R500M
300W	F	F5V 40A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F12 - 56V 5A	NF350R505M
300W	C	F5V 50A	F5V 1.5A	F12V 6A	F12V 6A	F24V 5A	NA300R500
300W	C	F5V 50A	F5V 1.5A	F12V 6A	F12V 6A	F48V 2.5A	NA300R505
300W	C	F5V 50A	F5V 1.5A	F15V 6A	F15V 6A	F24V 5A	NA300R503
300W	C	F5V 50A	F5V 1.5A	F12V 6A	F15V 6A	F48V 2.5A	NA300R506

Cooling: C – Convection, F – Forced Air, I – Integral Fan. Polarities in Parentheses ( ) indicate alternatives which are available by special order. Many other combinations are available by special order. For custom power supplies or information about any supplies listed, **CONTACT FARNELL ADVANCE, (216) 349-0755, FAX (216) 349-0142.**

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FARNELL ADVANCE POWER

(216) 349-0755 **FAX (216) 349-0142**

Multi-output Switch Mode Power Supplies 30-1500 Watts

Output Power	Cooling	Output Ratings					Model Number
350W	F	F5V 50A	F5 - 15V 4A	F12 - 16V 6A	F12 - 16V 6A	F12 - 24V 6A	NF350R500
350W	I	F5V 50A	F5 - 15V 4A	F12 - 16V 6A	F12 - 16V 6A	F12 - 24V 6A	NF350R500W
350W	F	F5V 50A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF350R505
350W	I	F5V 50A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48- 56V 5A	NF350R505W
400W	F	F5V 48A	F5 - 15V 4A	F12 - 16V 10A	F12 - 16V 6A	F12 - 24V 6A	NF500R500M
400W	F	F5V 48A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF500R505M
500W	F	F5V 60A	F5 - 15V 4A	F12 - 16V 10A	F12 - 16V 6A	F12 - 24V 6A	NF500R500
500W	I	F5V 60A	F5 - 15V 4A	F12 - 16V 10A	F12 - 16V 6A	F12 - 24V 6A	NF500R500W
500W	F	F5V 60A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF500R505
500W	I	F5V 60A	F5 - 15V 4A	F12 - 16V 6A	F12 - 24V 6A	F48 - 56V 5A	NF500R505W

D.C. Input/Fixed Outputs – 180, 300 Watts

Output Power	Cooling	Output Ratings					Model Number
180W	C	+5V 20A	-5V 1A	+12V 5A	-12V 5A	+24V 2A	ND180P500
180W	C	+5V 20A	-5V 1A	+15V 5A	-15V 5A	+24V 2A	ND180P810
300W	C	+5V 40A	-5V 1A	+12V 5A	-12V 5A	+24V 5A	ND300P500
300W	C	+5V 40A	-5V 1A	+15V 5A	-15V 5A	+24V 5A	ND300P505

A.C. Input/Configurable Output Power Supplies

Output Power	Cooling	Main Output (One per unit. Adj. Range)	Auxiliary Outputs (Up to four per unit. Adj. Range)	Model Number
350W	F OR I	5V 60A, 12V 25A, 15V 23A, 24V 13A	2V 6A, 2V 10A, 5V 6A, 5V 10A, 12V 6A, 12V 10A, 15V 6A,15A 10A, 24V 3A,48V 2A, DUAL 12V 2A	AF350
350W	F OR I	-5V 50A, +5V 50A, or +12V 20A, or +24V 11A, or +48V 5A	-2V 7A, +2V 7A, -5V 7A, +5V 7A, -8V 7A, +8V 7A, -12V 7A, +12V 7A, -15V 7A, +15V 7A, -18V 5A, +18V 5A, -24V 5A, +24V 5A, -36V 2.5A, +36V 2.5A, -38V 2.5A, +48V 2.5A, +48V 3A	P350 series
500W	F OR I	-5V 60A, +5V 60A, or +12V 25A, or +24V 13A, or +48V 6A		P500 series
750W	I	3.3V 125A, 5V 125A, 12V 60A, 24V 30A	3.3V 15A, 5V 15A, 12V 15A, 15V 12A, 24V 6A, 48V 3A DUAL 12V 6A, DOUBLE SLOT CARDS: 5V 30A, 12V 30A, 15V 24A, 24V 15A, 48V 8A	AF750
1000W	I	5V 150A	5V 15A, 12V 15A, 24V 8A, 48V 5A	P1000
1500W	I	5.0V 170A, 5.2V 170A, 5.5V 170A	2.5V 20A, 5V 20A, 12V 15A, 15V 12A, 18V 10A, 24V 7.5A, 28V 6.4A, 36V 4.5A, 48V 3.4A, 54V 3.4A	KXA series
1500W	I	5.0V 200A, 5.2V 200A, 5.5V 200A		KXF series
1500W	I	12V 70A, 13V 70A, 14V 70A, 15V 65A, 18V 56A, 24V 42A, 26V 38.5A, 28V 36A, 30V 33A, 48V 21A, 50V 20A, 52V 19A, 54V 18.5A, 56V 18A, 60V 16.5A		KXA series

Cooling: C – Convection, F – Forced Air, I – Integral Fan. Polarities in Parentheses ( ) indicate alternatives which are available by special order. Many other combinations are available by special order. For custom power supplies or information about any supplies listed, **CONTACT FARNELL ADVANCE, (216) 349-0755, FAX (216) 349-0142.**

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FARNELL ADVANCE POWER

(216) 349-0755 FAX (216) 349-0142

Telecom Rectifiers

Single-output Switch Mode Power Supplies 25-2500 Watts

TELECOM RECTIFIERS – A.C. INPUT

Nominal Voltage	Adjustment Range	Maximum Current	Model Number
27V	22-30V	50A	27-50
27.4V	23-28.5V	50A	F2705SC
27.4V	23-28.5V	55A	F2705SCC
27V	25-29V	56A	F2905SC
27.4V	23-28.5V	75A	F2900SC
54V	48-58V	20A	R160A
54V	48-58V	28A	R160
54.5V	48-58V	12A	F2805XAS
54.5V	48-58V	12A	F2805XA
54.5V	52-56V	20A	F20005
54.5V	48-58V	28A	F2705SX
54.5V	48-58V	28A	F2705X
54.9V	52-58V	28A	F2905SXE
54.9V	50-58V	38A	F2900SXH

OUTPUTS BELOW 15V – A.C. INPUT

Nominal Voltage	Adjustment Range	Maximum Current	Model Number
2V	1.5-2.5V	300A	A1500/02
5V	4.0-5.1V	11A	NS055005
5V	4.0-5.1V	15A	NS075005
5V	4.0-5.1V	22A	NS110005
5V	4.0-5.1V	28A	NS140005
5V	4.0-5.1V	30A (F)	NS110005
5V	4.0-5.1V	48A	NS240005
5V	4.75-5.25V	60A	NS400005
5V	4.0-5.1V	72A	NS360005
5V	4.75-5.25V	80A	NS400005
5V	4.75-5.25V	120A (F)	NS400005
5V	4.75-5.25V	150A (I)	NS400005W
5V	4.5-5.5V	200A	A1000/05
5V	3.0-5.8V	300A	KXFBAS160H
5V	4.4-5.5V	300A	A1500/05
5V	3.0-5.8V	300A	KXABAS160H
5.2V	3.0-5.8V	300A	KXABBS160H
5.5V	3.0-5.8V	300A	KXABCS160H
12V	9.6-12.25V	4.6A	NS055012
12V	9.6-12.25V	6.25A	NS075012
12V	9.6-12.25V	9.2A	NS110012
12V	9.6-12.25V	12A	NS140012
12V	9.6-12.25V	12.5A (F)	NS110012
12V	9.6-12.25V	20A	NS240012
12V	9.6-12.25V	30A	NS360012
12V	11-13V	45A	NS700012
12V	11-13V	55A	NS700012W
12V	11-13V	60A (F)	NS700012
12V	11-13V	60A (I)	NS700012W
12V	11-16V	90A	A1000/12
12V	11-16V	125A	A1500/12
12V	8.5-14.25V	133A	KXADAS160H
13V	8.5-14.25V	123A	KXADBS160H
14V	8.5-14.25V	114A	KXADCS160H

(F) - Forced air cooling required
(I) - Integral fan

For information about these power supplies and available variants,
CONTACT FARNELL ADVANCE, (216) 349-0755, FAX (216) 349-0142.

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FARNELL ADVANCE POWER

(216) 349-0755 FAX (216) 349-0142

Single-output Switch Mode Power Supplies 25-2500 Watts

OUTPUTS 15V AND ABOVE – A.C. INPUT

Nominal Voltage	Adjustment Range	Maximum Current	Model Number
15V	12-15.3V	3.7A	NS055015
15V	12-15.3V	5A	NS075015
15V	12-15.3V	7.5A	NS110015
15V	12-15.3V	10A	NS140015
15V	12-15.3V	10A (F)	NS110015
15V	12-15.3V	16A	NS240015
15V	12-15.3V	24A	NS360015
15V	11-16V	45A	NS700015
15V	11-16V	60A (F)	NS700015
15V	11-16V	60A (I)	NS700015W
15V	12-18.5V	105A	KXAEAS160H
18V	12-18.5V	88A	KXAEBS160H
24V	19.2-24.5V	2.3A	NS055024
24V	19.2-24.5V	3.2A	NS075024
24V	19.2-24.5V	4.6A	NS110024
24V	19.2-24.5V	6A	NS140024
24V	19.2-24.5V	6.2A (F)	NS110024
24V	19.2-24.5V	10A	NS240024
24V	19.2-24.5V	15A	NS360024
24V	21-25V	24A	NS700024
24V	21-25V	36A (F)	NS700024
24V	16-29V	36A (I)	NS700024W
24V	18-31V	45A	A1000/24
24V	18-33V	65A	A1500/24
24V	16.5-31.6V	66A	KXAFAS160H
26V	16.5-31.6V	61A	KXAFBS160H
28V	21-30V	18A	NS700028
28V	21-30V	24A (F)	NS700028
28V	21-30V	36A (F)	NS700028
28V	21-30V	36A (I)	NS700028W
28V	16.5-31.6V	57A	KXAFCS160H
28V	25-28V	100A	A20006

Nominal Voltage	Adjustment Range	Maximum Current	Model Number
30V	24-30.6V	2.5A	NS075030
30V	24-30.6V	3.7A	NS110030
30V	24-30.6V	5A	NS140030
30V	24-30.6V	5A (F)	NS110030
30V	24-30.6V	8A	NS240030
30V	24-30.6V	12A	NS360030
30V	16.5-31.6V	53A	KXAFDS160H
48V	38.4-49V	1.15A	NS055048
48V	38.4-49V	1.6A	NS075048
48V	38.4-49V	2.3A	NS110048
48V	38.4-49V	3A	NS140048
48V	38.4-49V	3.1A (F)	NS110048
48V	45.6-50.4V	5A	MG48-5C
48V	38.4-49V	5A	NS240048
48V	38.4-49V	7.5A	NS360048
48V	47-53V	12A	NS700048
48V	47-53V	20A(F)	NS700048
48V	47-53V	20A (I)	NS700048W
48V	45-58V	23A	A1000/48
48V	30-57.5V	33A	KXAJAS160H
48V	45-53V	35A	A1500/48
50V	30-57.5V	32A	KXAJBS160H
52V	30-57.5V	31A	KXAJCS160H
54V	30-57.5V	30A	KXAJDS160H
55V	52-56V	50A	F20006
56V	45-57V	1A	NS055056
56V	45-57V	1.4A	NS075056
56V	45-57V	2.0A	NS110056
56V	45-57V	2.5A	NS140056
56V	45-57V	2.7A (F)	NS110056
56V	48-57V	4.5A	NS240056
56V	48-57V	6.5A	NS360056
56V	47-60V	12A	NS700056
56V	47-60V	20A (F)	NS700056
56V	47-60V	20A (I)	NS700056W
56V	30-57.5V	29A	KXAJES160H
60V	47-63V	6A	MG60-6
60V	56-63V	25A	A1500/60
60V	50-70V	27A	KXALAS160H
100V	80-102V	0.55A	NS055100

(F) - Forced air cooling required

For information about these power supplies and available variants,
CONTACT FARNELL ADVANCE, (216) 349-0755, FAX (216) 349-0142.

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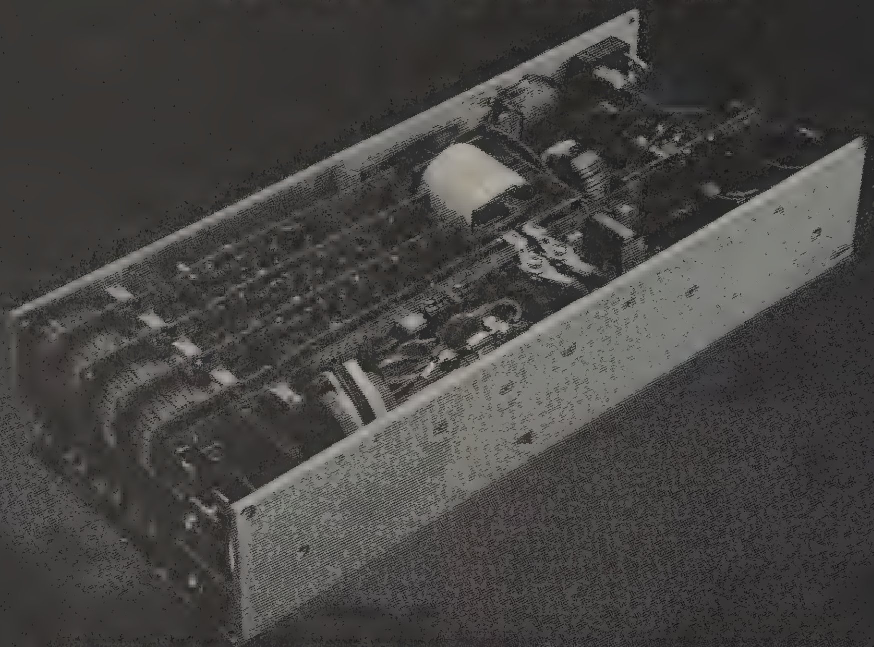
FARNELL ADVANCE POWER

(216) 349-0755 **FAX (216) 349-0142**

Multi-output & Single-output Switch Mode Power Supplies

Calm, Cool and Corrected.



Farnell Advance switching power supplies with power factor correction

Quality switch mode power supplies from Farnell Advance produce dependable, regulated DC power with low heat losses, minimal noise and ripple and power factor corrections as high as .99.

This broad line of single- and multiple-output, high-density power supplies ranges up to 2700 watts. Multiple units may be connected for higher voltages or used in current share mode for n+1 redundancy.

Units feature universal input, making them ideal for use with the worldwide range of line voltages and frequencies. International approvals received or pending include UL, CSA, VDE, IEC, BSI and BABT.

Convection or integral fan-cooled units are ideal for computers, peripherals, telcom and other applications requiring high efficiency and dependable power.

Multiple-output, modular power supplies have a standard footprint and offer a broad range of output cards, allowing custom configurations.

For more information, contact Farnell Advance Power, Inc., 32111 Aurora Road, Solon, OH 44139.

Phone (216) 349-0755. Fax (216) 349-0142.

eem

MINIGLOSSARY

BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In

(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon

<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
—	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

GAMMA HIGH VOLTAGE RESEARCH INC.

Designers/Manufacturers—High Voltage Power Supplies

1096 North US Hwy. #1, Ormond Beach, FL 32174 • TEL. 904-677-7070 • FAX. 904-677-3039

HIGH VOLTAGE POWER SUPPLIES

REGULATED CONSTANT VOLTAGE CONSTANT CURRENT

1KV to 400KV
30 WATTS to 3000 WATTS

NEW

SERIES RR

FEATURES

LOW STORED ENERGY: The use of high frequency (>20KHz), high voltage power supply techniques allows stored energy to be minimized thus insuring maximum safety to operating personnel and sensitive loads.

PROGRAMMING OUTPUT VOLTAGE & OUTPUT CURRENT: This feature allows output voltage or output current to be remotely programmed from either an external voltage source or with external potentiometers from the internal reference voltage. A zero to +5V voltage source is required for full scale programming. Internal circuitry insures that the output voltage and output current cannot be externally programmed beyond the maximum settings of the front panel controls.

CONSTANT VOLTAGE/CONSTANT CURRENT WITH AUTOMATIC CROSSOVER: Dual control loops allow either voltage or current to be precisely regulated. Each parameter is controlled and limited by a ten-turn potentiometer on the front panel. The constant voltage/constant current automatic crossover feature allows the power supply to be used as a voltage regulated current limited system or as a current regulated voltage limited system. Thus, both output voltage and output current are totally under operator control under all load conditions, including overload and arc-over conditions.

OVERLOAD, ARC-OVER & SHORT CICRUIT PROTECTION: Full protection against any overload condition is inherent in the constant voltage/constant current design concept. This is augmented by the liberal use of surge limiting resistors and reactive limiting. On 600W, 1KW and 3KW units customer may select either constant current or a variable overload trip by means of a front panel mounted switch.

VOLTAGE REGULATION: Line and load regulation is better than 0.005%. Note: On 1000 watt and 3000 watt units load regulation is better than 0.01%.

CURRENT REGULATION: Current regulation is better than 75uA.

RIPPLE: At 150 watts ripple of 0.02%. At 300, 600 and 1000 watts ripple of 0.05%. At 3000 watts ripple of 0.1%.

EFFICIENCY: Efficiency is typically greater than 75% at full load.

EXTERNAL POLARITY REVERSAL (Reversible Units Only): A reversing switch mechanism located at the rear of the power supply facilitates polarity reversal.

EXTERNAL INTERLOCK/OUTPUT INHIBIT: Circuitry is provided so that the user can, if desired, inhibit output voltage. External contact closure located on the rear terminal strip will enable the power supply. Open contacts will inhibit the power supply.

FLOATING GROUND: This feature allows the low end return of the power supply to be isolated with respect to chassis ground. Consult factory.

REMOTE OUTPUT VOTAGE & CURRENT MONITORING: Voltage monitoring and true output current conitoring signals are provided at the rear terminal strip.

MODULAR CONSTRUCTION: Modular construction techniques are used throughout this design thus reducing downtime in critical applications.

OPTIONS

ZERO VOLTAGE START INTERLOCK (ZVS): To prevent accidental damage to loads, the output voltage control must be set to zero before the high voltage can be applied.

VARIABLE OVERVOLTAGE PROTECTION (VOV): This option causes the power supply to shut down when the output voltage exceeds the setting of the overvoltage control potentiometer located at the rear of the power supply. (adjustable from 20% to 110% of maximum rated output voltage.)

VARIABLE OVERLOAD TRIPOUT (VOL): This option causes the power supply to shut down when the output current equals the setting of the front panel current control (adjustable from 20% to 110% of maximum output current of the power supply.) Standard feature on 600W, 1000W and 3000W units. Front panel control allows user to activate this feature when desired.

DIGITAL PANEL METER: SINGLE METER (SDPM) — TWO METERS (DDPM): A Single 3½ digit meter reading both voltage and current is available. This meter replaces the two analog meters normally provided. Two 3½ digit meters can also be provided in place of the two analog meters normally provided.

SLOW START (SS): The slow start option enables the output voltage of the power supply to ramp to its maximum output voltage setting at a linear rate. This rate can be factory set from one to fifteen seconds.

SLAVED BI-POLAR OPERATION (SBP): Any two power supplies of the same voltage rating may be operated as a Bi-Polar pair. One power supply acting as the master controller will control both power supplies from zero to maximum rated output voltage. The output voltages of both supplies will track each other within 2% from 10% to maximum rated output voltage. Each power supply is also capable of operating independently.

TTL (TTL): Compatible "enable" line.

AUXILIARY OUTUT/FOCUS TAP (FT): This option provides an independent auxiliary output which is variable from zero to maximum rated voltage up to 15KV to 300uA maximum. Control is achieved via front panel mounted potentiometer. For other voltages and power levels consult factory. Multiple auxiliary outputs are also available. Consult factory.

REMOTE CONTROL PANEL (RCP): Any standard model can be supplied with a control panel remote from the basic power supply. 20 feet of appropriately shielded interconnection is provided. This remote control panel replaces the front panel normally provided on standard units.

220 VOLT INPUT — 50/60 Hz (220): 220 volt, 50/60 Hz. Input is available.

BENCH CABINET (BC): A deluxe style cabinet is available for all models.

ORDERING INFORMATION: *ADD LETTERS IN PARENTHESIS AS SUFFIX TO MODEL NUMBER.*

SIZE/WEIGHT: 60, 150 & 300 WATT UNITS: 16″ DEEP X 19″ WIDE
600, 1000 & 3000 WATT UNITS: 17″ DEEP X 19″ DEEP

	60 WATT UNITS			150 and 300 WATT UNITS		
HEIGHT	FIXED	REVERSIBLE	WEIGHT	FIXED	REVERSIBLE	WEIGHT
5¼"	Up to 125kV	Up to 40kV	35 lbs. max.	Up to 125kV	Up to 40kV	35 lbs. max.
10½"	—	50 to 100kV	70 lbs. max.	—	50 to 100kV	70 lbs. max.
5¼" OPEN STACK	—	—	—	150 to 400kV	N/A	25 lbs. max. (Plus H.V. Assembly)

	600 and 1000 WATT UNITS			3000 WATT UNITS		
HEIGHT	FIXED	REVERSIBLE	WEIGHT	FIXED	REVERSIBLE	WEIGHT
5¼"	Up to 125kV	Up to 20kV	35 lbs. max.	—	—	—
10½"	—	30 to 100kV	85 lbs. max.	—	—	—
5 1/4 " OPEN STACK	150 to 400kV	N/A	25 lbs. max. (Plus H.V. Assembly)	—	—	—
15¾"	—	—	—	Up to 125kV	Up to 100kV	100 lbs. max.
10½" OPEN STACK	—	—	—	150 to 400kV	N/A	70 lbs. max. (Plus H.V. Assembly)

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HIGH VOLTAGE POWER SUPPLIES

NEW

1KV to 400KV
30 WATTS to 3000 WATTS

REGULATED CONSTANT VOLTAGE
CONSTANT CURRENT

SERIES RR TO 300 WATTS

SPECIFICATIONS

INPUT VOLTAGE: 105-125V RMS at 5 Amps maximum (50-60 Hz)

OUTPUT VOLTAGE: Continuously adjustable from zero to maximum output voltage ratings of power supply. See Model selection guide.

***VOLTAGE REGULATION:** Line: Better than ±0.005% over specified input range.
Load: 0.005% for full load change.

***CURRENT REGULATION:** Line: Better than ±0.005% over specified input range.
Load: Better than 75uA for a 75% change in compliance voltage.

‡RIPPLE: 60 and 150 Watt units: 0.02%
300 Watt units: 0.05%

***TEMPERATURE COEFFICIENT:** 100ppm/°C over the range of 0 to 60°C.

***STABILITY:** 0.01%/hour. 0.03%/8 hours.

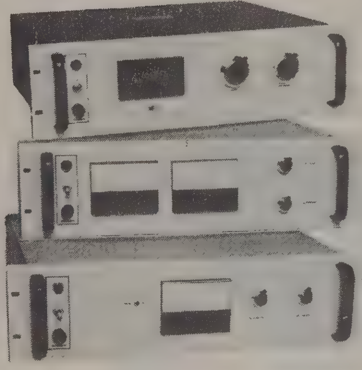
CONTROLS:
1. Power (HV ON)
2. Output Voltage (10-turn potentiometer)
3. Output Current (10-turn potentiometer)

INDICATORS:
1. Power (HV ON)
2. Output Voltage (meter ±2% of full scale)
3. Output Current (meter ±2% of full scale)

CONNECTORS:
1. High Voltage: All models are provided with 6 feet of shielded high voltage cable. The cables are fitted with bushings to mate with a re-entrant receptacle.
2. Input: 3-wire line cord.
3. Low Voltage. Rear mounted barrier terminal block for:
   a) External Interlock
   b) Voltage Programming
   c) Current Programming
   d) V/I Monitors

MODEL SELECTOR GUIDE†

OUTPUT VOLTAGE (kV)	60 WATT MODELS		150 WATT MODELS		300 WATT MODELS	
	Model	(mA) Rating	Model	(mA) Rating	Model	(mA) Rating
0-1.5	RR1.5-40	40	RR1.5-100	100	—	—
0-3	RR3-20	20	RR3-50	50	RR3-100	100
0-5	RR5-12	12	RR5-30	30	RR5-60	60
0-10	RR10-6	6	RR10-15	15	RR10-30	30
0-15	RR15-4	4	RR15-10	10	RR15-20	20
0-20	RR20-3	3	RR20-7.5	7.5	RR20-15	15
0-30	RR30-2	2	RR30-5	5	RR30-10	10
0-40	RR40-1.5	1.5	RR40-3.75	3.75	RR40-7.5	7.5
0-50	RR50-1.25	1.25	RR50-3	3	RR50-6	6
0-60	RR60-1	1	RR60-2.5	2.5	RR60-5	5
0-80	RR80-.75	0.75	RR80-1.8	1.8	RR80-3.75	3.75
0-100	RR100-.6	0.6	RR100-1.5	1.5	RR100-3	3
0-125	RR125-.5	0.5	RR125-1.2	1.2	RR125-2.5	2.5
0-150	N/A		RR150-1	1	RR150-2	2
0-200	N/A		RR200-.75	0.75	RR200-1.5	1.5
0-300	N/A		RR300-.5	0.5	RR300-1	1
0-400	N/A		RR400-.375	0.375	RR400-.75	0.75



SERIES RR TO 300 WATTS

*For voltage range from 10% to 100% of rated output. ‡For voltages 150KV and above consult factory. †Lower and higher power models are available. Consult factory.
All units are available in positive or negative polarity. Units up to 100kV are also available in reversible polarity. Add P, N or R as suffix to Model Number to indicate polarity desired.

SERIES RR 600 WATTS, 1000 WATTS, 3000 WATTS

SPECIFICATIONS

INPUT VOLTAGE: 600W: 105-125 RMS at 7 Amps maximum (50-60 Hz)
1000W: 220V RMS at 7 Amps maximum (50-60 Hz)
3000W: 220V RMS at 17 Amps maximum (50-60 Hz)
Also available with 3 ϕ input.

OUTPUT VOLTAGE: Continuously adjustable from zero to maximum output voltage rating of power supply. See Model selection guide.

***VOLTAGE REGULATION:** Line: Better than ±0.005% over specified input range.
Load: 600W: 0.005% for full load change.
IKW & 3KW: 0.01% for full load change.

***CURRENT REGULATION:** Line: Better than ±0.005% over specified input range.
Load: Better than 75uA for a 75% change of compliance voltage.

‡RIPPLE: 600, 1KW units: 0.05%
3000 Watt units: 0.1%

***TEMPERATURE COEFFICIENT:** 100ppm/°C over the range of 0 to 60°C.

***STABILITY:** 0.01%/hour. 0.03%/8 hours.

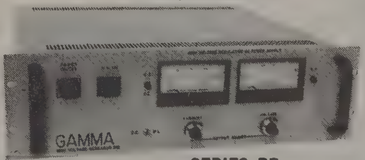
CONTROLS:
1. Power (HV ON)
2. Output Voltage (10-turn potentiometer)
3. Output Current (10-turn potentiometer)

INDICATORS:
1. Power (HV ON)
2. Output Voltage (meter ±2% of full scale)
3. Output Current (meter ±2% of full scale)
4. Mode of operation

CONNECTORS:
1. High voltage: All models are provided with 6 feet of shielded high voltage cable. The cables are fitted with bushings to mate with a re-entrant receptacle.
2. Input: 3-wire line cord.
3. Low Voltage: Rear mounted barrier terminal block for:
   a) External Interlock
   b) Voltage Programming
   c) Current Programming
   d) V/I Monitors

MODEL SELECTOR GUIDE†

OUTPUT VOLTAGE (kV)	600 WATT MODELS		1000 WATT MODELS		3000 WATT MODELS	
	Model	(mA) Rating	Model	(mA) Rating	Model	(mA) Rating
0-1.5	—	—	—	—	—	—
0-3	RR3-200	200	RR3-333	333	RR3-1000	1000
0-5	RR5-120	120	RR5-200	200	RR5-600	600
0-10	RR10-60	60	RR10-100	100	RR10-300	300
0-15	RR15-40	40	RR15-65	65	RR15-200	200
0-20	RR20-30	30	RR20-50	50	RR20-150	150
0-30	RR30-20	20	RR30-33	33	RR30-100	100
0-40	RR40-15	15	RR40-25	25	RR40-75	75
0-50	RR50-12	12	RR50-20	20	RR50-60	60
0-60	RR60-10	10	RR60-17	17	RR60-50	50
0-80	RR80-7.5	7.5	RR80-12.5	12.5	RR80-37.5	37.5
0-100	RR100-6	6	RR100-10	10	RR100-30	30
0-125	RR125-4.8	4.8	RR125-8	8	RR125-24	24
0-150	RR150-4	4	RR150-6.6	6.6	RR150-20	20
0-200	RR200-3	3	RR200-5	5	RR200-15	15
0-300	RR300-2	2	RR300-3.3	3.3	RR300-10	10
0-400	RR400-1.5	1.5	RR400-2.5	2.5	RR400-7.5	7.5



SERIES RR
600 WATTS/1000 WATTS/3000 WATTS
MODEL RR50-20P

*For voltage range from 10% to 100% of rated output. ‡For voltages 150KV and above consult factory. †Lower and higher power models are available. Consult factory.
All units are available in positive or negative polarity. Units up to 100kV are also available in reversible polarity. Add P, N or R as suffix to Model Number to indicate polarity desired.

GAMMA HIGH VOLTAGE RESEARCH INC.

Designers/Manufacturers—High Voltage Power Supplies

1096 North US Hwy. #1, Ormond Beach, FL 32174 • TEL. 904-677-7070 • FAX. 904-677-3039

HIGH VOLTAGE POWER SUPPLIES MODULAR

SERIES MC

9 Models Covering the Range of 50VDC to 15,000VDC

ELECTRICAL CHARACTERISTICS:

Input Voltage:	1.75 to 12VDC
Input Current:	400mA
Output Voltage:	Proportional to Input (see table)
Output Current:	3 Watts maximum (see table)
Load Regulation:	5% (½ load to full load)
Ripple:	1% p-p (typical)
Insulation Strength:	5000V Input/Output

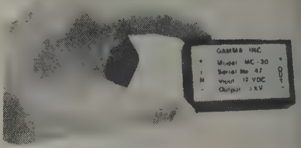
PHYSICAL CHARACTERISTICS:

Dimensions:	1.5" x 2.5" x 0.75" (up to 5KV) 1.5" x 2.5" x 1.5" (10KV & 15KV)
Volume:	2.8 cu. in. (up to 5KV) 5.6 cu. in. (10KV & 15KV)
Weight:	4 oz.
Packaging:	Solid encapsulation
Terminations:	4 PC pins (.043 dia holes) (up to 5KV) 3 PC pins (.043 dia holes) (10KV & 15KV)

ENVIRONMENTAL CHARACTERISTICS:

Temperature Range: −20°C to +60°C

MINIATURE HIGH VOLTAGE POWER SUPPLIES



ELECTRICAL SPECIFICATIONS:

OUTPUT MODEL	OUTPUT VOLTAGE RANGE	OUTPUT POLARITY	CURRENT
MC-5	50VDC to 500VDC	Reversible	6mA
MC-15	150VDC to 1500VDC	Reversible	2mA
MC-30	300VDC to 3000VDC	Reversible	1mA
MC-50R	500VDC to 5000VDC	Reversible	200µA
MC-100P	1000VDC to 10,000VDC	Positive	100µA
MC-100N	1000VDC to 10,000VDC	Negative	100µA
* MC-100R	1000VDC to 10,000VDC	Reversible	100µA
† MC-150P	1500VDC to 15,000VDC	Positive	100µA
† MC-150N	1500VDC to 15,000VDC	Negative	100µA

*: SIZE: 4.5 X 1.437 X 1.375
†:INPUT: 15VDC

SERIES RC

7 Models Covering the range of 0-3KV to 0-30KV at 10 Watts

ELECTRICAL CHARACTERISTICS:

Input Voltage:	+28VDC ±10%
Output Voltage:	Programmable from zero to maximum rated voltage from either an external 5K ohm potentiometer or a zero to +10 volt low voltage ground referenced source
Output Current:	10 Watts maximum
Line Regulation:	0.01% maximum
Load Regulation:	0.01% maximum
Ripple:	0.05% maximum
Temp. Coefficient:	0.01%°C
Stability:	0.01%/8 hours
Monitor Outputs:	1) Voltage Monitor (Optional) 2) Current Monitor (Optional)
Programming:	
Method 1.	Resistance: External 5K ohm potentiometer
Method 2.	Voltage: Zero to +10 Volts

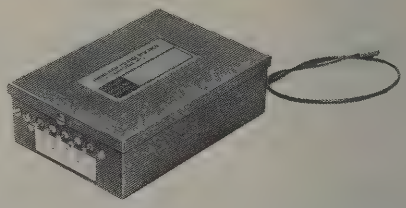
PHYSICAL CHARACTERISTICS:

Dimensions:	3½" x 5⅛" x 1 9/16" (up to 15KV) 3¾" x 6" x 2¾" (20 & 30KV)
Weight:	2½ lbs (up to 15KV) 3½ lbs (20 & 30KV)
Packaging:	Solid encapsulation, metal case with metal inserts in base
Input Connector:	Terminal strip
Output Termination:	12" flying lead

ENVIRONMENTAL CHARACTERISTICS:

Temperature Range: 0 to 50°C

REGULATED DC/DC HIGH VOLTAGE POWER SUPPLIES



MODEL GUIDE:

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT
RC10-3	0-3KV	3.3mA
RC10-5	0-5KV	2.0mA
RC10-10	0-10KV	1.0mA
RC10-15	0-15KV	0.66mA
RC10-20	0-20KV	0.5mA
RC10-25	0-25KV	0.4mA
RC10-30	0-30KV	0.33mA

All units are available in positive or negative polarity. Add P or N as suffix to Model Number to indicate polarity desired.

SERIES UC

7 Models Covering the range of 0-3KV to 0-30K at 5 Watts

ELECTRICAL CHARACTERISTICS:

Input Voltage:	+24VDC ±10%
Input Current:	400mA maximum
Output Voltage:	Adjustable from zero to rated voltage by adjustment of DC input voltage
Output Current:	5 Watts maximum (see table)
Load Regulation:	20% maximum (½ load to full load)
Ripple:	0.1% per watt

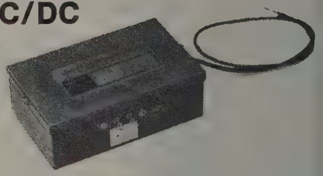
PHYSICAL CHARACTERISTICS:

Dimensions:	2¾" x 4½" x 1 9/16" (up to 15KV) 3½" x 5⅛" x 1 9/16" (20, 25 & 30KV)
Weight:	1½ lbs. (up to 15KV) 2½ lbs. (20, 25 & 30KV)
Packaging:	Solid encapsulation, metal case with metal inserts in base
Terminations:	Two terminals for DC input. 12" flying lead for H.V. output

ENVIRONMENTAL CHARACTERISTICS:

Temperature Range: 0 to 50°C

PROPORTIONAL DC/DC HIGH VOLTAGE POWER SUPPLIES



MODEL GUIDE:

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT
UC5-3	0-3KV*	1.6mA
UC5-5	0-5KV*	1.0mA
UC5-10	0-10KV*	0.5mA
UC5-15	0-15KV	0.33mA
UC5-20	0-20KV	0.25mA
UC5-25	0-25KV	0.2mA
UC5-30	0-30KV	0.166mA

All Models available in positive or negative polarity. Add P or N as suffix to Model Number to indicate polarity desired. *3KV, 5KV and 10KV Models can be provided with reversible polarity (consult factory).

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HIGH VOLTAGE POWER SUPPLIES MODULAR

SERIES PMT

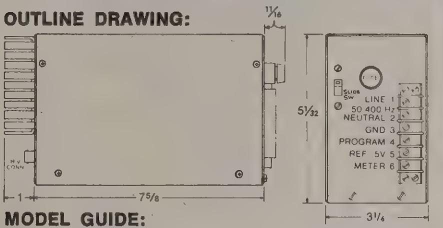
10 Models Covering the range of 0-1.5KV to 0-10KV

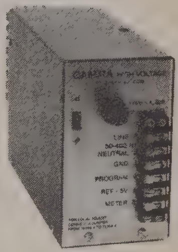
ELECTRICAL CHARACTERISTICS:

Input Voltage:	115/230 VAC±10% 50 to 400 Hz
Output Voltage:	Continuously adjustable from zero to maximum output rating
Output Current:	See ratings of individual models
Regulation:	0.001% for ±10% line change 0.002% for NL-FL or FL-NL
Ripple:	0.001% peak-to-peak
Stability:	0.01%/hour, 0.02%/8 hours
Temp. Coefficient:	50ppm/°C over, the range of 0 to 50°C
Monitor Output:	0 to 5V/100µA for zero to maximum output voltage
Control:	Local: 20 turn potentiometer for zero to maximum output voltage Remote: Voltage (0 to –5V) or resistance for full range
Connections:	Input line, programming and metering via Terminal Block. Alternate connectors available
Output Connector:	Up to 5KV: MHV type connector 10KV: Alden type
Size:	5-1/32" H x 3-1/16" W x 8-5/8" L

PHOTOMULTIPLIER TUBE HIGH VOLTAGE POWER SUPPLIES

OUTLINE DRAWING:





MODEL GUIDE:

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT
PMT 1.5-10	0-1.5KV	10mA
PMT 2-5	0-2KV	5mA
PMT 3-5	0-3KV	5mA
PMT 5-2	0-5KV	2mA
PMT 10-1	0-10KV	1mA

All units are available in Positive or Negative polarity. Add P or N as suffix to Model number to indicate polarity desired.

SERIES XRM 10 Models covering the range of 0-1.5KV to 0-60KV up to 60 Watts

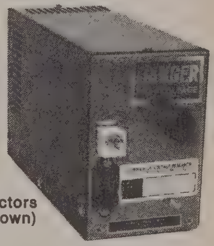
ELECTRICAL CHARACTERISTICS:

Input Voltage:	105-125 VAC 50 to 400 Hz
Output Voltage:	Continuously adjustable from zero to max output volt
Output Current:	See ratings of individual models
Voltage Regulation:	Line: ±0.005% over specified input range Load: ±0.01% for full load change
Current Regulation:	Better than ±0.005% over specified input range
Load Regulation:	Better than 50µA for a 75% change in compliance volt
Ripple:	0.05%
Temp. Coefficient:	100ppm/°C over the range of 0 to 60°C
Stability:	0.01%/hour; 0.03%/8 hours
Programming Output Voltage and Output Current:	The output voltage or output current can be remotely programmed from either an external volt source or external potentiometers from the internal reference volt. A zero to +5 source is required to full scale programming.

PHYSICAL CHARACTERISTIC:

Dimensions:	6″ H x 4″ x W x 10″ L
Weight:	10 lbs.
Packaging:	Modular construction with high voltage section encapsulated in a silicone elastomer
Input Connector:	D-Subminiature 25 pin connector
Output Termination:	Re-entrant type bushing is standard, with mating output cable provided Customer specified output connectors can be provided

REGULATED, LINE OPERATED MODULAR HIGH VOLTAGE POWER SUPPLIES



(Non-Standard Connectors on Unit shown)

MODEL GUIDE:

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT
XRM1.5	0-1.5KV	33.0mA
XRM3	0-3KV	15.0mA
XRM5	0.5KV	10.0mA
XRM10	0-10KV	5.0mA
XRM15	0-15KV	3.5mA
XRM20	0-20KV	2.5mA
XRM30	0-30KV	2.0mA
XRM40	0-40KV	1.5mA
XRM50	0-50KV	1.0mA
XRM60	0-60KV	1.0mA

All units are available in positive or negative polarity. Add P or N as suffix to Model Number to indicate polarity desired.

HIGH VOLTAGE DIVIDER

SERIES HVD

MODEL HVD-100 SPECIFICATIONS:

Input Voltage:	100KVDC maximum
Input Impedance:	200 megohms
Output Impedance:	20,000 ohms
Output Taps·	1 volt/100KV
Temp. Coefficient:	75 ppm
Accuracy:	0.2%
Size:	17½″ high (maximum). Termination 10″ toroid
Output Connector:	BNC

MODEL HVD-100-S SPECIFICATIONS:

Model HVD-100-S is identical to Model HVD-100 with the exception of accuracy which is 0.1% and temperature coefficient which is 25ppm.

MODEL HVD-200 SPECIFICATIONS:

Input Voltage:	200KVDC maximum
Input Impedance:	4000 megohms
Output Impedance:	40,000 ohms
Output Taps:	2V 1 (volt/100KV)
Temp. Coefficient:	75ppm
Accuracy:	0.2%
Size:	30″ high (maximum). Termination 12″ toroid
Output Connector:	BNC

MODEL HVD-200-S SPECIFICATIONS:

Model HVD-200-S is identical to Model HVD-200 with the exception of accuracy which is 0.1% and temperature coefficient which is 25ppm.

HVD-100

HIGH FREQUENCY DIVIDER NEW

MODEL HFD-60

Capability of measuring pulses wtih rise time of less than 20nS at voltages to 60KV.

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2 m\upsilon^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	second^{-1}	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

Glassman High Voltage DC Power Supplies ...

Since its inception in 1977, Glassman High Voltage has been committed to producing superior DC high voltage power supplies at an affordable price. That goal has been met by a careful choice of innovative design technology and manufacturing flexibility. Glassman pioneered in the use of air as the primary dielectric medium, avoiding the weight and serviceability problems associated with other dielectrics. Pulse-width modulation using off-the-line switching techniques and full-wave/symmetrical cascade high voltage multipliers, with surge limiting resistors, contribute to high efficiency and reliability. Extensive use of interchangeable modules reduces production costs and allows the rapid assembly and shipment of a wide range of models.

Glassman High Voltage supplies find applications across many different fields of interest. A few examples include analytical, biochemical, CRT displays, E-beam, electro-optical, medical, power generation and transmission, semiconductor, and X-ray applications.

This catalog details 15 different series of regulated high voltage power supplies, with many models within each series covering various voltage ranges. In total, voltage ranges extend from 0 to 1 kV through 0 to 500 kV with available output power from 15 W to 15 kW. All supplies have a number of common features ...lowest possible stored energy for safety and automatic crossover from constant-voltage regulation to constant-current regulation for overload protection. All, except the EL Series, offer local and remote operation, external voltage/current monitoring, TTL enable/disable, and safety interlock terminals. Many are available with a choice of front panels ... dual analog voltage and current meters, dual digital meters, or blank panels for OEM/system applications. Most Glassman supplies provide significant size and weight advantages over competing units.

In addition to this broad base of standard models, we welcome the opportunity to discuss your requirements for special OEM designs or modifications of standard models to meet specific applications.

Warranty

Glassman High Voltage, Inc. warrants standard power supplies to be free from defects in materials and workmanship for three years from date of shipment. OEM and modified standard power supplies are warranted for one year from date of shipment. The Company agrees to replace or repair any power supply that fails to perform as specified within the warranty period. A formal warranty is available.

FEATURES/OPTIONS	MJ	MK	MR	EL	EH	ER	WR	EW	WK	PG	WX	LX	LT	PKCP	PK
Remote Voltage Program	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
Remote Voltage Monitor	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
Remote Current Program	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
Remote Current Monitor	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
Voltage Adjust	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Current Adjust	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
Shielded Output Cable	S	S	O	S	S	S	S	S	S	S	S	S	S	S	S
Digital Panel Meters	N/A	N/A	N/A	O	O	O	O	O	O	O	O	O	O	S	S
Analog Panel Meters	N/A	N/A	N/A	S	S	S	S	S	S	S	S	S	S	N/A	N/A
External Interlock Terminals	S	S	S	N/A	S	S	S	S	S	S	S	S	S	S	S
TTL Enable/Disable	S	S	S	N/A	S	S	S	S	S	O	S	S	S	S	S
Zero Start Interlock	N/A	N/A	N/A	O	O	O	O	O	O	O	O	O	O	O	O
Slow Start	N/A	N/A	O	O	O	O	O	O	O	O	O	O	O	O	O
Current Trip	N/A	N/A	S	O	O	O	O	O	O	O	O	O	O	S	S
Blank Front Panel	N/A	N/A	N/A	N/A	N/A	O	O	O	O	N/A	O	O	O	N/A	N/A
48-420 Hz	S	S	O	S	S	O	O	O	O	O	N/A	N/A	N/A	N/A	N/A
90-110 V Input, 48-63 Hz (Single Phase)	O	O	O	O	O	O	O	O	O	O	N/A	O	N/A	N/A	N/A
200-264 V Input, 48-63 Hz (Single Phase)	O	O	O	O	O	O	O	O	O	O	S	O	S	N/A	N/A

S = Standard O = Optional N/A = Not Available As Standard Options

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Standard Glassman Power Supplies.

The following selection tables summarize the range of standard Glassman supplies. If standard models do not match your requirements, please contact the factory. Most models can be modified to meet particular applications.

Maximum Voltage/Current by Series

Voltage (kV)	Current (mA)														
	MJ pg.3	MK pg.4	MR pg. 5	EL pg.6	EH pg.7	ER pg.8	WR pg.9	EW* pg.10	WK* pg.11	PG pg.12	WX pg.13	LX** pg.14	LT pg.15	PKCP pg.16	PK pg.17
1		75	300		100	300		600			1000	2000	2000		
1.5		50	200		65	200		400			700	1300	1300		
2		37.5	150		50	150		300			500	1000	1000		
3	5	25	100	15	33	100		200			350	660	660	650 1300	1300 2600
5	3	15	60	8	20	60		120			200	400	400		
6						50						330	330	325 650	650 1300
7								85							
8												250	250	225 450	450 900
10	1.5	7.5		4	10	30		60			100	200	200	200 400	400 800
12												165	165	165 330	330 660
15	1	5		3	6	20		40			70	132	132	130 260	260 520
20	0.7	3.7		2	5	15		30			50	100	100	100 200	200 400
25		3			4			24							
30	0.4	2.5		1.5	3	10		20			35	66	66	65 130	130 260
35		2													
40		1.8		1	2.5	7.5		15			25	50	50	50 100	100 200
50		1.5		0.8	2	6		12			20	40	40	40 80	80 160
60		1.2		0.6	1.5	5		10			15	33	33	32.5 65	65 130
75						4					12			25 50	50 100
80									7.5			25	25	25 50	50 100
85							3.5								
100							2.5		6			20	20	20 40	40 80
125							2		5			16	16	15 30	30 60
150												6	10		

Open Stack Version

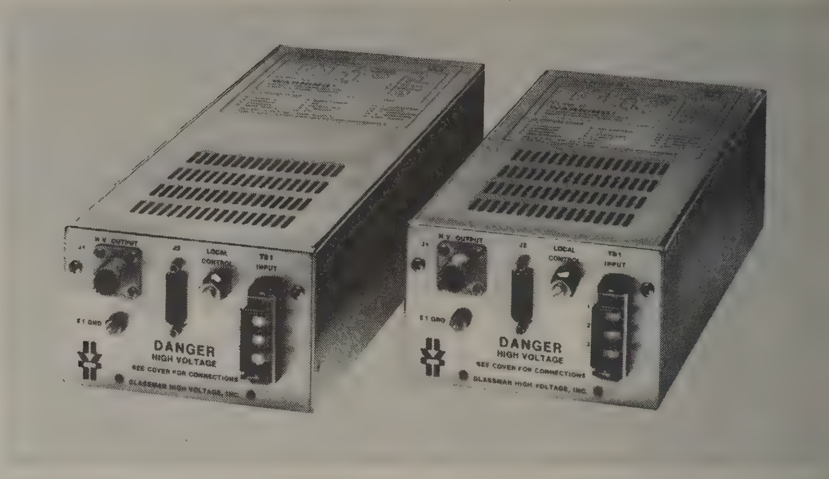
100										5 10					
150										3 6				12.5 25	25 50
200										2.5 5				9 18	18 36
250										1 2				7 14	14 28
300										1 2				5 10	10 20
350														4 8	8 16
400										1				3 6	6 12
500														2 4	4 8

* For EW and WK Series, simultaneous voltage and current limited to 500 W maximum.

** For LX Series, simultaneous voltage and current limited to 1000 W maximum.

MJ Series 15 Watt Regulated High Voltage DC Modules

Premium Performance... Small Size and Weight... Low Cost



The MJ Series provides premium 15 W performance at low cost in a small and lightweight package. This series, with air insulation for easy serviceability, should not be confused with competitive encapsulated units that must be discarded if faulty. Voltage ranges, depending on model, are from 0 to 3 kV through 0 to 30 kV.

Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-420 Hz, <0.25 A. 3-position terminal block with cover.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometer, or case-mounted 10-turn potentiometer with 0.05% resolution. Accuracy, 1% rated +1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
<200 millijoules, 15 kV model; <400 millijoules, 30 kV model.

VOLTAGE REGULATION:
Better than 0.005% from no-load to full load and over specified input range.

RIPPLE:
<0.05% RMS of rated voltage at full load. Ripple proportional to load, decreasing to approximately 0.01% at no load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading +1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical (100 ms max.) with a 50% resistive load using either TTL on/off or remote control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive or negative with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
DB15S D-subminiature with mating plug is provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Output Voltage	Output Current	Output Cable	Case Size
MJ3P5000	MJ3N5000	0-3 kV	0-5 mA	RG-8U	A
MJ5P3000	MJ5N3000	0-5 kV	0-3 mA	RG-8U	A
MJ10P1500	MJ10N1500	0-10 kV	0-1.5 mA	RG-8U	A
MJ15P1000	MJ15N1000	0-15 kV	0-1 mA	RG-8U	A
MJ20P700	MJ20N700	0-20 kV	0-0.7 mA	RG-8U	B
MJ30P400	MJ30N400	0-30 kV	0-0.4 mA	RG-8U	B

Case Size: A: 3.25 x 5.25 x 11.5", 6.5 lbs.
B: 3.25 x 5.25 x 13.75", 7.5 lbs.

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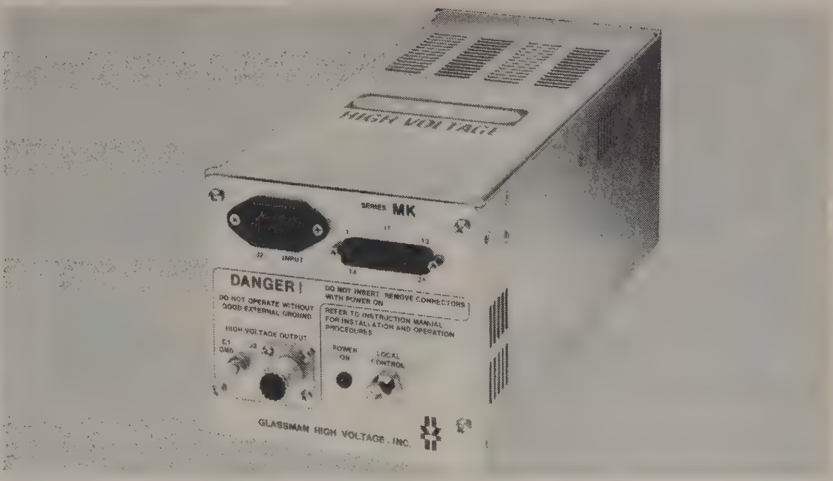
MK Series 75 Watt Regulated High Voltage DC Modules

High Power... Premium Performance... Low Cost

The MK Series offers premium 75 W performance at low cost. Like their lower power brothers, the MJ Series, they are air-insulated and should not be compared with "throw-away" supplies. MK Series feature easy serviceability. Voltage ranges, depending on model, are from 0 to 1 kV through 0 to 60 kV.


HIGH VOLTAGE
SERIES MK
INPUT
DANGER!
DO NOT OPERATE WITHOUT GOOD EXTERNAL GROUND
DO NOT INSERT REMOVE CONNECTORS WITH POWER ON
REFER TO INSTRUCTION MANUAL FOR INSTALLATION AND OPERATION PROCEDURES
HIGH VOLTAGE OUTPUT
POWER ON
LOCAL CONTROL
GLASSMAN HIGH VOLTAGE, INC.

Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-420 Hz, <1.5 A. Connector per IEC 320/C14 with mating line cord.

EFFICIENCY:
Better than 75% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometer, or case-mounted 10-turn potentiometer with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
200 millijoules, 10 kV model; 1 Joule, 50 kV model.

VOLTAGE REGULATION:
Better than 0.005% RMS +1 mV/mA from no-load to full load and over specified input range.

RIPPLE:
<0.03% RMS of rated voltage + 0.5 V at full load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical (100 ms max.) with a 75% resistive load using either TTL on/off or remote control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive or negative with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
DB25S D-subminiature with mating plug is provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Output Voltage	Output Current	Output Cable	Case Size
MK1P75L	MK1N75L	0-1 kV	0-75 mA	RG-59U	A
MK1.5P50L	MK1.5N50L	0-1.5 kV	0-50 mA	RG-59U	A
MK2P37.5L	MK2N37.5L	0-2 kV	0-37.5 mA	RG-59U	A
MK3P25L	MK3N25L	0-3 kV	0-25 mA	RG-59U	A
MK5P15L	MK5N15L	0-5 kV	0-15 mA	RG-59U	A
MK10P7.5	MK10N7.5	0-10 kV	0-7.5 mA	RG-8U	A
MK15P5	MK15N5	0-15 kV	0-5 mA	RG-8U	A
MK20P3.7	MK20N3.7	0-20 kV	0-3.7 mA	RG-8U	A
MK25P3	MK25N3	0-25 kV	0-3 mA	RG-8U	A
MK30P2.5	MK30N2.5	0-30 kV	0-2.5 mA	RG-8U	A
MK35P2	MK35N2	0-35 kV	0-2 mA	RG-8U	A
MK40P1.8	MK40N1.8	0-40 kV	0-1.8 mA	RG-8U	A
MK50P1.5	MK50N1.5	0-50 kV	0-1.5 mA	RG-8U	A
MK60P1.2	MK60N1.2	0-60 kV	0-1.2 mA	RG-8U	A

Case Size A: 4.75 x 5.19 x 11", 11 lbs.

MR Series 300 Watt Regulated High Voltage DC Modules

Complies With IEC & CSA 950 And UL 1950 Standards As A Power Supply Component

The MR Series, with outputs from 0 to 1 kV through 0 to 5 kV, is designed to meet international safety approvals. It is packaged as a space-saving module that avoids the cost of expensive panels and displays. However, no compromises in performance and operating features have been made. The result is a power supply that offers outstanding value for a wide range of demanding applications.

Specifications

INPUT:
103 -132 V RMS standard, single-phase, 48-63 Hz, <6 A. Connector per IEC 320/V1 with mating line cord.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage and current through a combination of mounted 10-turn potentiometer, external 0 to 10 V, or external potentiometers. Repeatability, <0.1% fs. Accuracy, 0.25% of rated + 1% of setting. Resolution is a function of programming method.

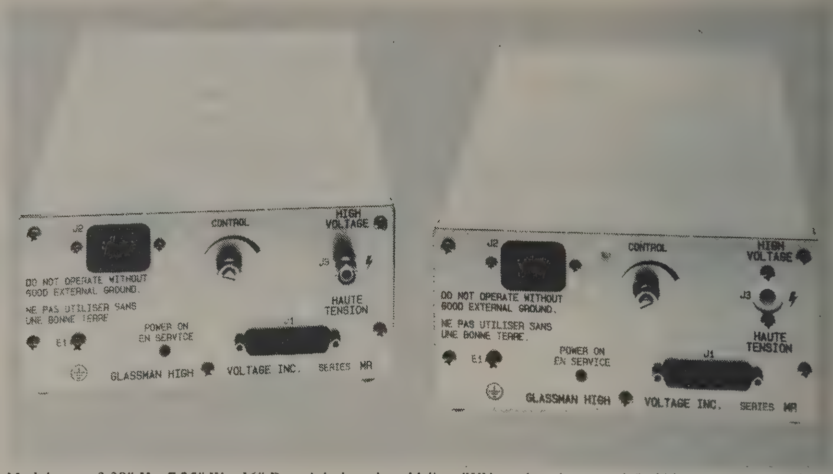
STORED ENERGY:
<0.5 joules.

VOLTAGE REGULATION:
<0.005% for line variations. For load variations, add 1 mV/mA.

RIPPLE:
<0.02% RMS of rated voltage + 300 mV RMS

CURRENT REGULATION:
<0.1% of rated current from short circuit to rated voltage at any set current.

VOLTAGE MONITOR:
0 to 10 V for zero rated voltage. Accuracy, 1% reading + 0.25% of rated voltage.


J2
CONTROL
HIGH VOLTAGE
J3
DO NOT OPERATE WITHOUT GOOD EXTERNAL GROUND.
NE PAS UTILISER SANS UNE BONNE TERRE
HAUTE TENSION
POWER ON EN SERVICE
J1
E1
GLASSMAN HIGH VOLTAGE INC. SERIES MR

Modules are 3.38" H x 7.25" W x 16" D, weight less than 11 lbs. SHV version shown on left, Alden connector on right

CURRENT MONITOR:
0 to 10 V for zero to rated current. Accuracy, 1% reading + 0.05% of rated current.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

OUTPUT VOLTAGE TIME CONSTANT:
Typically 50 ms rise or decay time constant using TTL on/off or remote voltage control with a minimum of 15% resistive load.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +40 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive or negative with respect to chassis ground.

PROTECTION:
User-selected automatic current regulation or current trip protects against all overloads, including arcs and short circuits. Fuses, surge-limiting resistors, and low-energy components provide ultimate protection.

ACCESSORIES:
Detatchable 8-foot HV cable (see Models chart for choice of output connector and wire type) and 6-foot detachable line cord provided.

REMOTE CONNECTIONS:
Common, +10 V reference, interlock, current program, current monitor, voltage program, voltage monitor, TTL HV enable, current regulation/trip, and chassis ground.

EXTERNAL INTERLOCK:
Open off, closed on.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models (Alden connector)

Positive Polarity	Negative Polarity	Output Voltage	Output Current	Output Cable
MR1P300	MR1N300	0-1 kV	0-300 mA	Silicone wire
MR1.5P200	MR1.5N200	0-1.5 kV	0-200 mA	
MR2P150	MR2N150	0-2 kV	0-150 mA	
MR3P100	MR3N100	0-3 kV	0-100 mA	
MR5P60	MR5N60	0-5 kV	0-60 mA	

Models (SHV connector)

Positive Polarity	Negative Polarity	Output Voltage	Output Current	Output Cable
MR1P300L	MR1N300L	0-1 kV	0-300 mA	RG - 59
MR1.5P200L	MR1.5N200L	0-1.5 kV	0-200 mA	
MR2P150L	MR2N150L	0-2 kV	0-150 mA	
MR3P100L	MR3N100L	0-3 kV	0-100 mA	
MR5P60L	MR5N60L	0-5 kV	0-60 mA	

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EL Series 40/45 Watt Regulated High Voltage DC Power Supplies

Laboratory Performance... Economical Price

The EL Series provides laboratory performance at the lowest possible price. Voltage ranges are from 0 to 3 kV through 0 to 60 kV. Unlike other Glassman supplies, no remote monitoring or control capability is provided. This series is available with positive, negative, or reversible polarity. Panel height is 3.5 inches and maximum weight is 12 lbs.

POWER
SERIES EL
GLASSMAN HIGH VOLTAGE, INC.
VOLTAGE

Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-420 Hz, <1 A. Connector per IEC 320/C14 with mating line cord.

EFFICIENCY:
Better than 75% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage by a front panel 10-turn potentiometer with locking vernier. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs. Dual analog meters display voltage and current to an accuracy of 2% fs.

STORED ENERGY:
200 millijoules, 10 kV model; 1 Joule, 50 kV model.

VOLTAGE REGULATION:
Better than 0.005% +1 mV/mA from no-load to full load and over specified input range.

RIPPLE:
<0.03% RMS of rated voltage + 0.5 V at full load.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible polarity with respect to chassis ground.

PROTECTION:
Automatic current limiting protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
EL3P15L	EL3N15L	EL3R15L	0-3 kV	0-15 mA	RG-59U	3.5 in.
EL5P8L	EL5N8L	EL5R8L	0-5 kV	0-8 mA	RG-59U	3.5 in.
EL10P4	EL10N4	EL10R4	0-10 kV	0-4 mA	RG-8U	3.5 in.
EL15P3	EL15N3	EL15R3	0-15 kV	0-3 mA	RG-8U	3.5 in.
EL20P2	EL20N2	EL20R2	0-20 kV	0-2 mA	RG-8U	3.5 in.
EL30P1.5	EL30N1.5	EL30R1.5	0-30 kV	0-1.5 mA	RG-8U	3.5 in.
EL40P1	EL40N1	EL40R1	0-40 kV	0-1 mA	RG-8U	3.5 in.
EL50P0.8	EL50N0.8	EL50R0.8	0-50 kV	0-0.8 mA	RG-8U	3.5 in.
EL60P0.6	EL60N0.6	EL60R0.6	0-60 kV	0-0.6 mA	RG-8U	3.5 in.

EH Series 100 Watt Regulated High Voltage DC Power Supplies

Laboratory Performance... Enhanced Features... Economical Price

The EH Series combines the performance of a laboratory-grade power supply with the added flexibility of remote programming and monitoring capabilities. Voltage ranges are from 0 to 1 kV through 0 to 60 kV. Panel height is 3.5 inches and maximum weight is 13 lbs.

POWER
CURRENT
VOLTAGE
SERIES EH
GLASSMAN HIGH VOLTAGE, INC.

Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-420 Hz, <1.5 A. Connector per IEC 320/C14 with mating line cord.

EFFICIENCY:
Better than 75% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
200 millijoules, 10 kV model; 1 Joule, 50 kV model.

VOLTAGE REGULATION:
Better than 0.005% +1 mV/mA from no-load to full load and over specified input range.

RIPPLE:
<0.03% RMS of rated voltage + 0.5 V at full load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated. Reversible models, 1% reading +5 microamperes.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
60 ms typical (100 ms max.) with a 75% resistive load using either TTL on/off or remote control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
EH1P100L	EH1N100L	EH1R100L	0-1 kV	0-100 mA	RG-59U	3.5 in.
EH1.5P65L	EH1.5N65L	EH1.5R65L	0-1.5 kV	0-65 mA	RG-59U	3.5 in.
EH2P50L	EH2N50L	EH2R50L	0-2 kV	0-50 mA	RG-59U	3.5 in.
EH3P33L	EH3N33L	EH3R33L	0-3 kV	0-33 mA	RG-59U	3.5 in.
EH5P20L	EH5N20L	EH5R20L	0-5 kV	0-20 mA	RG-59U	3.5 in.
EH10P10	EH10N10	EH10R10	0-10 kV	0-10 mA	RG-8U	3.5 in.
EH15P6	EH15N6	EH15R6	0-15 kV	0-6 mA	RG-8U	3.5 in.
EH20P5	EH20N5	EH20R5	0-20 kV	0-5 mA	RG-8U	3.5 in.
EH25P4	EH25N4	EH25R4	0-25 kV	0-4 mA	RG-8U	3.5 in.
EH30P3	EH30N3	EH30R3	0-30 kV	0-3 mA	RG-8U	3.5 in.
EH40P2.5	EH40N2.5	EH40R2.5	0-40 kV	0-2.5 mA	RG-8U	3.5 in.
EH50P2	EH50N2	EH50R2	0-50 kV	0-2 mA	RG-8U	3.5 in.
EH60P1.5	EH60N1.5	EH60R1.5	0-60 kV	0-1.5 mA	RG-8U	3.5 in.

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ER Series 300 Watt Regulated High Voltage DC Power Supplies

Laboratory Performance... High Power Density... Enhanced Features

The ER Series is a sophisticated, medium power, high voltage power supply. With a choice of three panel configurations ... dual analog voltage and current meters, dual digital meters, or a blank panel for OEM/system applications ... it is adaptable to most environments. Voltage ranges are 0 to 1 kV through 0 to 75 kV. Panel height is 3.5 inches and maximum weight is 18 pounds.

GLASSMAN HIGH VOLTAGE INC
GLASSMAN HIGH VOLTAGE INC
POWER
SERIES ER
GLASSMAN HIGH VOLTAGE, INC.

Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-63 Hz, <6 A. Connector per IEC 320/C14 with mating line cord.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
1.5 Joules, 20 kV model; <4 Joules, 60 kV model.

VOLTAGE REGULATION:
Better than 0.005% +1 mV/mA from no-load to full load and over specified input range.

RIPPLE:
<0.02% RMS of rated voltage + 0.5 V at full load; models 1.5 kV and lower, 400 mV (500 mV, Japan.)

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
60 ms typical (300 ms for 75 kV model) with a 75% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		ER1R300	0-1 kV	0-300 mA	RG-59U	3.5 in.
		ER1.5R200	0-1.5 kV	0-200 mA	RG-59U	3.5 in.
		ER2R150	0-2 kV	0-150 mA	RG-59U	3.5 in.
		ER3R100	0-3 kV	0-100 mA	RG-59U	3.5 in.
		ER5R60	0-5 kV	0-60 mA	RG-59U	3.5 in.
		ER6R50	0-6 kV	0-50 mA	RG-58U	3.5 in.
ER10P30	ER10N30	ER10R30	0-10 kV	0-30 mA	RG-8U	3.5 in.
ER15P20	ER15N20	ER15R20	0-15 kV	0-20 mA	RG-8U	3.5 in.
ER20P15	ER20N15	ER20R15	0-20 kV	0-15 mA	RG-8U	3.5 in.
ER30P10	ER30N10	ER30R10	0-30 kV	0-10 mA	RG-8U	3.5 in.
ER40P7.5	ER40N7.5	ER40R7.5	0-40 kV	0-7.5 mA	RG-8U	3.5 in.
ER50P6	ER50N6	ER50R6	0-50 kV	0-6 mA	RG-8U	3.5 in.
ER60P5	ER60N5	ER60R5	0-60 kV	0-5 mA	RG-8U	3.5 in.
ER75P4	ER75N4	ER75R4	0-75 kV	0-4 mA	DS2124	3.5 in.

WR Series 250 Watt Regulated High Voltage DC Power Supplies

Up to 125 kV, 5.25 Inch Panel Height... Laboratory Performance... Enhanced Features

The WR Series provides voltage ranges from 0 to 85 kV through 0 to 125 kV. It is available with dual analog voltage and current meters, dual digital meters, or with a blank panel for OEM/system applications. Panel height is only 5.25 inches and maximum weight is less than 40 pounds.

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POWER
WR
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Specifications

INPUT:
105-125 V RMS standard, single-phase, 48-63 Hz, <6 A. Connector per IEC 320/C14 with mating line cord.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
11 Joules, maximum.

VOLTAGE REGULATION:
Better than 0.005% from no-load to full load and over specified input range.

RIPPLE:
<0.05% RMS of rated voltage at full load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
400 ms typical with a 25% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
WR85P3.5	WR85N3.5	WR85R3.5	0-85 kV	0-3.5 mA	DS2121	5.25 in.
WR100P2.5	WR100N2.5	WR100R2.5	0-100 kV	0-2.5 mA	DS2121	5.25 in.
WR125P2	WR125N2	WR125R2	0-125 kV	0-2 mA	DS2121	5.25 in.

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EW Series Extended Current 500 Watt Regulated High Voltage DC Power Supplies

Up to 60 kV, 3.5 Inch Panel Height... Laboratory Performance... Enhanced Features

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KILOVOLTS
POWER
SERIES EW
GLASSMAN HIGH VOLTAGE, INC.

The EW Series is a 500 watt regulated high voltage DC power supply with an important difference ... maximum current ratings are equivalent to a 600 W supply! This maximum current, which is available for all output voltages up to 84% of rated voltage, should be of significant interest for many applications. Voltage ranges are 0 to 1 kV through 0 to 60 kV. Series EW is offered with dual analog voltage and current meters or, optionally, with dual digital meters or with a blank panel for OEM/systems applications. Maximum weight is 18 lbs.

Specifications

INPUT:
102-132 V RMS standard, single-phase, 48-63 Hz, <10 A. Connector per IEC 320/C14 with mating line cord, terminated with NEMA 5-15 plug.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
<1.5 Joules, 20 kV; <4 Joules, 60 kV.

VOLTAGE REGULATION:
Better than 0.005% for specified line variations and 0.005% + 1 mV/mA for load variations.

RIPPLE:
<0.02% of rated voltage + 0.5 V RMS at full load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated for single polarity, 1% reading + 0.1% rated for reversible polarity.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical with a 30% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +40 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		EW1R600	0-1 kV	0-600 mA	RG-59U	3.25 in.
		EW1.5R400	0-1.5 kV	0-400 mA	RG-59U	3.25 in.
		EW2R300	0-2 kV	0-300 mA	RG-59U	3.25 in.
		EW3R200	0-3 kV	0-200 mA	RG-59U	3.25 in.
		EW5R120	0-5 kV	0-120 mA	RG-59U	3.25 in.
EW7P85	EW7N85	EW7R85	0-7 kV	0-85 mA	RG-8U	3.25 in.
EW10P60	EW10N60	EW10R60	0-10 kV	0-60 mA	RG-8U	3.25 in.
EW15P40	EW15N40	EW15R40	0-15 kV	0-40 mA	RG-8U	3.25 in.
EW20P30	EW20N30	EW20R30	0-20 kV	0-30 mA	RG-8U	3.25 in.
EW25P24	EW25N24	EW25R24	0-25 kV	0-24 mA	RG-8U	3.25 in.
EW30P20	EW30N20	EW30R20	0-30 kV	0-20 mA	RG-8U	3.25 in.
EW40P15	EW40N15	EW40R15	0-40 kV	0-15 mA	RG-8U	3.25 in.
EW50P12	EW50N12	EW50R12	0-50 kV	0-12 mA	RG-8U	3.25 in.
EW60P10	EW60N10	EW60R10	0-60 kV	0-10 mA	RG-8U	3.25 in.

Note: Product of voltage and current automatically limited to 500 W maximum.

WK Series Extended Current 500 Watt Regulated High Voltage DC Power Supplies

Up To 125 kV...
5.25 Inch Panel Height...
Laboratory Performance...
Enhanced Features

The WK Series is a 500 watt regulated DC power supply offering output voltage ranges from 80 kV to 125 kV and an interesting "plus." Maximum current ratings are equivalent to a 600 W supply up to 84% of rated voltage! Panel height is only 5.25 inches and weight is less than 30 pounds. The WK Series is available with dual analog output meters or, optionally, with digital meters or a blank panel for OEM/system applications.

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Specifications

INPUT:
105-125 V RMS, 48-63 Hz single phase, <10 A. Connector per IEC 320/VI with mating line cord and NEMA 5-15 plug.

EFFICIENCY:
Typically 83% at full load.

OUTPUT:
Continuous, stable adjustment from zero to rated voltage and current via 10-turn potentiometers, external 0 to 10 V, or external potentiometers. Linearity, <1% fs. Repeatability, <0.1% fs. Accuracy, 0.25% of rated + 1% of setting. Resolution is a function of programming method.

STORED ENERGY:
9 J, 80 kV; 11 J, 100 kV; 14.5 J, 125 kV.

VOLTAGE REGULATION:
<0.005%, line or load.

RIPPLE:
<0.1% RMS of rated voltage at full load.

CURRENT REGULATION:
<0.1% of full scale (rated voltage) from short circuit to rated voltage.

VOLTAGE MONITOR:
0 to +10 V DC for zero to rated voltage. Accuracy, 1% of reading + 1% of rated voltage.

CURRENT MONITOR:
0 to +10 V DC for zero to rated current. Accuracy, 1% of reading + 0.05% (0.1% for reversible model) of rated current.

STABILITY:
0.01% per hour after 1/2 hour warmup. 0.05% per 8 hours.

OUTPUT VOLTAGE TIME CONSTANT:
Typically 400 ms rise or decay time constant for 125 kV model, using TTL on/off or remote voltage control, with 15% resistive load.

TEMPERATURE COEFFICIENT:
0.01%/degree C.

AMBIENT TEMPERATURE:
-20 to +40 degrees C, operating; -40 to +85 degrees C, storage.

POLARITY:
Positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low-energy components provide ultimate protection.

ACCESSORIES:
Detachable 8-foot shielded HV coaxial cable (see Model Chart for cable type) and 6-foot detachable line cord provided.

REMOTE CONTROLS:
Terminal block provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except on blank panel version where it is non-latching.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable
WK80P7.5	WK80N7.5	WK80R7.5	0-80 kV	0-7.5 mA	DS2121
WK100P6	WK100N6	WK100R6	0-100 kV	0-6 mA	DS2121
WK125P5	WK125N5	WK125R5	0-125 kV	0-5 mA	DS2121

Note: Product of voltage and current automatically limited to 500 W maximum.

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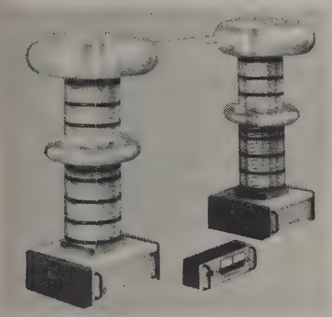
PG Series 500/1000 Watt Regulated High Voltage DC Power Supplies

PG-LR Series 250/500 Watt Low Ripple Regulated High Voltage DC Power Supplies

100 kV to 400 kV...



The PG Series is available in two configurations ... as a standard PG Series or as an ultra-low ripple PG-LR Series for demanding applications, such as particle accelerators. Shown is the dual-stack PG-LR Series with remote control unit. One stack serves as a high voltage multiplier while the second stack provides an additional lowpass ripple filter. The standard PG Series is supplied with only the multiplier stack and remote control unit.

Specifications

INPUT:
105-125 V RMS, single-phase, 48-63 Hz, <15 A. *Series PG-LR: 208 V RMS +/- 10%, 3-phase, 48-63 Hz, <5 A.*

EFFICIENCY:
Typically 75% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage and current by means of front panel 10-turn potentiometers, external zero to +10 V signals, or external potentiometers. Linearity to within 1% of full scale.

VOLTAGE REGULATION:
Better than 0.005% + 1 V, line or load.

RIPPLE:
Better than 0.1% of rated voltage at full load. *Series PG-LR: See models chart.*

CURRENT REGULATION:
Better than 100 μA from short circuit to rated voltage for any load condition; 0.005% + 1 μA for line variations.

VOLTAGE/CURRENT MONITOR:
Zero to +10 V signal for zero to rated voltage/current.

STABILITY:
0.01% + 1 V per hour after 1/2 hour warmup, 0.05% + 2 V per 8 hours.

TEMPERATURE COEFFICIENT:
0.01% per degree C + 1 V.

AMBIENT TEMPERATURE:
-20 to +60 degree C, operating; -40 to +85 degree C, non-operating.

POLARITY:
Available with either positive, negative, or reversible (PG only) polarity with respect to chassis ground.

PROTECTION:
Automatic current regulation protects the power supply against all overload conditions, including arcs and short circuits. Fuses, surge-limiting resistors, and low energy components provide the ultimate protection.

EXTERNAL INTERLOCK:
Open off, closed on.

PG Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Panel Height	Stack Height
PG100P5	PG100N5	PG100R5	0-100 kV	0-5 mA	5.25 in	22.75 in
PG100P10	PG100N10	PG100R10	0-100 kV	0-10 mA	5.25 in	22.75 in
PG150P3	PG150N3	PG150R3	0-150 kV	0-3 mA	5.25 in	29.75 in
PG150P6	PG150N6	PG150R6	0-150 kV	0-6 mA	5.25 in	29.75 in
PG200P2.5	PG200N2.5	PG200R2.5	0-200 kV	0-2.5 mA	5.25 in	34.75 in
PG200P5	PG200N5	PG200R5	0-200 kV	0-5 mA	5.25 in	34.75 in
PG250P1	PG250N1	PG250R1	0-250 kV	0-1 mA	5.25 in	40.50 in
PG250P2	PG250N2	PG250R2	0-250 kV	0-2 mA	5.25 in	40.50 in
PG300P1	PG300N1	PG300R1	0-300 kV	0-1 mA	5.25 in	50.88 in
PG300P2	PG300N2	PG300R2	0-300 kV	0-2 mA	5.25 in	50.88 in
PG400P1	PG400N1	PG400R1	0-400 kV	0-1 mA	5.25 in	63.25 in

PG-LR Models (same panel and stack heights as above)

Positive Polarity	Negative Polarity	Output Voltage	Output Current	Ripple (V p-p)	
				Typ.	Max.
PG100P2.5-LR	PG100N2.5-LR	0-100 kV	0-2.5 mA	2	4.5
PG100P5-LR	PG100N5-LR	0-100 kV	0-5 mA	4	7
PG150P2-LR	PG150N2-LR	0-150 kV	0-2 mA	3	5
PG150P3-LR	PG150N3-LR	0-150 kV	0-3 mA	6	9
PG200P1-LR	PG200N1-LR	0-200 kV	0-1 mA	3.5	5
PG200P2-LR	PG200N2-LR	0-200 kV	0-2 mA	7	10
PG250P1-LR	PG250N1-LR	0-250 kV	0-1 mA	4.5	6.5
PG250P2-LR	PG250N2-LR	0-250 kV	0-2 mA	8.5	12.5
PG300P1-LR	PG300N1-LR	0-300 kV	0-1 mA	5	7.5
PG300P2-LR	PG300N2-LR	0-300 kV	0-2 mA	10	15
PG400P1-LR	PG400N1-LR	0-400 kV	0-1 mA	7	10

WX Series 1000 Watt Regulated High Voltage DC Power Supplies

Up to 75 kV, 5.25 Inch Panel Height... Laboratory Performance... Enhanced Features

The WX Series provides 1000 watts of output power with voltage ranges from 0 to 1 kV through 0 to 75 kV in a rack-panel height of only 5.25 inches. Standard models have dual analog voltage and current meters. As an option, WX is available with dual digital meters or with a blank panel for OEM/system applications. Local front panel and full remote controls are standard. Maximum weight is 30 lbs.

Specifications

INPUT:
198-242 V RMS standard, single-phase, 48-63 Hz, <9.5 A. Connector per IEC 320/C14 with mating line cord, terminated with NEMA 6-15 plug.

EFFICIENCY:
Typically 83% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
6 Joules, maximum, up to 50 kV; 9 Joules, maximum, 60 and 75 kV.

VOLTAGE REGULATION:
Better than 0.005% for specified line variations and 0.01% + 1 mV/mA for load variations.

RIPPLE:
<0.05% of rated voltage + 0.5 V RMS at full load.

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

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POWER
SERIES WX
GLASSMAN HIGH VOLTAGE, INC.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hour.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical with a 50% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +50 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available either positive, negative, or reversible with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads. including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal blocks provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

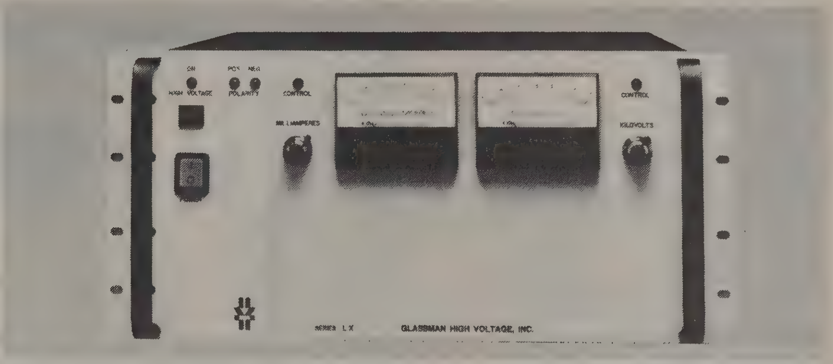
TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		WX1R1000	0-1 kV	0-1000 mA	RG-59U	5.25 in.
		WX1.5R700	0-1.5 kV	0-700 mA	RG-59U	5.25 in.
		WX2R500	0-2 kV	0-500 mA	RG-59U	5.25 in.
		WX3R350	0-3 kV	0-350 mA	RG-59U	5.25 in.
		WX5R200	0-5 kV	0-200 mA	RG-59U	5.25 in.
WX10P100	WX10N100	WX10R100	0-10 kV	0-100 mA	RG-8U	5.25 in.
WX15P70	WX15N70	WX15R70	0-15 kV	0-70 mA	RG-8U	5.25 in.
WX20P50	WX20N50	WX20R50	0-20 kV	0-50 mA	RG-8U	5.25 in.
WX30P35	WX30N35	WX30R35	0-30 kV	0-35 mA	RG-8U	5.25 in.
WX40P25	WX40N25	WX40R25	0-40 kV	0-25 mA	RG-8U	5.25 in.
WX50P20	WX50N20	WX50R20	0-50 kV	0-20 mA	RG-8U	5.25 in.
WX60P15	WX60N15	WX60R15	0-60 kV	0-15 mA	RG-8U	5.25 in.
WX75P12	WX75N12	WX75R12	0-75 kV	0-12 mA	DS2124	5.25 in.

LX Series Extended Currrent 1000 Watt Regulated High Voltage DC Power Supplies

Up To 150 kV... 8.75 Inch Panel Height



The LX Series is a 1000 watt regulated high voltage DC power supply with an important difference ... maximum current ratings are equivalent to a 2000 W supply! This maximum current, which is available for all output voltages up to 50% of rated voltage, should be of significant interest for many applications.

Specifications
(from 5 to 100% of rated voltage)

INPUT:
102-132 V RMS standard, single-phase, 48-63 Hz, <20 A. 3-position terminal block with protective cover.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
<15 Joules, 60 kV; <30 Joules, 125 kV.

VOLTAGE REGULATION:
Better than 0.005% for specified line variations and 0.005% + 1 mV/mA for load variations.

RIPPLE:
<0.03% of rated voltage + 1 V RMS at full load, 0.1% (150 kV).

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current. Accuracy, 1% reading + 0.05% rated for single polarity, 1% reading + 0.1% rated for reversible polarity.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical to 60 kV (400 ms for higher voltages) with a 30% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +40 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available with either positive, negative, or reversible polarity with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block is provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

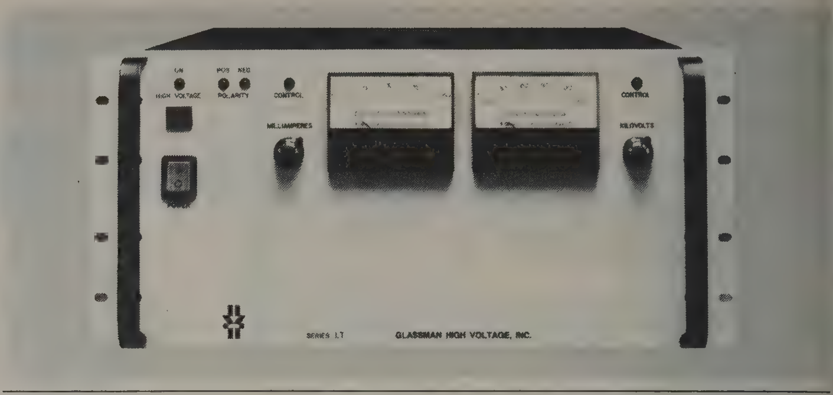
TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		LX1R2000	0-1 kV	0-2000 mA	RG-59	8.75 in.
		LX1.5R1300	0-1.5 kV	0-1300 mA	RG-59	8.75 in.
		LX2R1000	0-2 kV	0-1000 mA	RG-59	8.75 in.
		LX3R660	0-3 kV	0-660 mA	RG-59	8.75 in.
		LX5R400	0-5 kV	0-400 mA	RG-59	8.75 in.
		LX6R330	0-6 kV	0-330 mA	RG-58	8.75 in.
LX8P250	LX8N250	LX8R250	0-8 kV	0-250 mA	RG-8U	8.75 in.
LX10P200	LX10N200	LX10R200	0-10 kV	0-200 mA	RG-8U	8.75 in.
LX12P165	LX12N165	LX12R165	0-12 kV	0-165 mA	RG-8U	8.75 in.
LX15P132	LX15N132	LX15R132	0-15 kV	0-132 mA	RG-8U	8.75 in.
LX20P100	LX20N100	LX20R100	0-20 kV	0-100 mA	RG-8U	8.75 in.
LX30P66	LX30N66	LX30R66	0-30 kV	0-66 mA	RG-8U	8.75 in.
LX40P50	LX40N50	LX40R50	0-40 kV	0-50 mA	RG-8U	8.75 in.
LX50P40	LX50N40	LX50R40	0-50 kV	0-40 mA	RG-8U	8.75 in.
LX60P33	LX60N33	LX60R33	0-60 kV	0-33 mA	RG-8U	8.75 in.
LX80P25	LX80N25	LX80R25	0-80 kV	0-25 mA	DS 2124	8.75 in.
LX100P20	LX100N20	LX100R20	0-100 kV	0-20 mA	DS 2124	8.75 in.
LX125P16	LX125N16	LX125R16	0-125 kV	0-16 mA	DS 2121	8.75 in.
LX150P6	LX150N6	LX150R6	0-150 kV	0-6 mA	DS 2121	8.75 in.

Note: Product of voltage and current automatically limited to 1000 W maximum .

LT Series 2000 Watt Regulated High Voltage DC Power Supplies



Up To 150 kV...
8.75 Inch Panel Height
Laboratory Performance
Enhanced Features

The LT Series is a 2000 watt regulated high voltage DC power supply with voltage ranges from 0 to 1 kV through 0 to 150 kV. Rack-panel height is only 8.75 inches. The LT is offered with dual analog voltage and current meters or, optionally, with dual digital meters or a blank panel for OEM/systems applications.

Specifications
(from 5 to 100% rated voltage)

INPUT:
198-264 V RMS standard, single-phase, 48-63 Hz, <20 A. 3-position terminal block with protective cover.

EFFICIENCY:
Typically 85% at full load.

OUTPUT:
Continuous, stable adjustment from 0 to rated voltage/current by external 0 to +10 V signal, external potentiometers, or panel-mounted 10-turn potentiometers with 0.05% resolution. Accuracy, 1% rated + 1% setting. Repeatability better than 0.1% fs.

STORED ENERGY:
<15 Joules, 60 kV; <30 Joules, 125 kV.

VOLTAGE REGULATION:
Better than 0.005% for specified line variations and 0.005% + 1 mV/mA for load variations.

RIPPLE:
<0.03% of rated voltage + 1 V RMS at full load, 0.1% (150 kV).

CURRENT REGULATION:
Better than 0.05% from short circuit to rated voltage at any load condition.

VOLTAGE MONITOR:
0 to +10 V equivalent to 0 to rated voltage. Accuracy, 1% reading + 1% rated.

CURRENT MONITOR:
0 to +10 V equivalent to 0 to rated current.

Accuracy, 1% reading + 0.05% rated for single polarity, 1% reading + 0.1% rated for reversible polarity.

STABILITY:
0.01% per hour after 1/2 hour warmup, 0.05% per 8 hours.

VOLTAGE RISE/DECAY TIME CONSTANT:
50 ms typical to 60 kV (400 ms for higher voltages) with a 30% resistive load using either TTL on/off or remote programming control.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +40 degree C, operating; -40 to +85 degree C, storage.

POLARITY:
Available with either positive, negative, or reversible polarity with respect to chassis ground.

PROTECTION:
Automatic current regulation protects against all overloads, including arcs and shorts. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.

REMOTE CONTROLS:
Terminal block is provided for all remote functions, including common, +10 V reference, interlock, voltage and current program/monitor, TTL, ground, and local control.

EXTERNAL INTERLOCK:
Open off, closed on. Normally latching except for blank panel version where it is non-latching.

TTL ENABLE/DISABLE:
0-1.5 V off, 2.5-15 V on.

Models

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		LT1R2000	0-1 kV	0-2000 mA	RG-59	8.75 in.
		LT1.5R1300	0-1.5 kV	0-1300 mA	RG-59	8.75 in.
		LT2R1000	0-2 kV	0-1000 mA	RG-59	8.75 in.
		LT3R660	0-3 kV	0-660 mA	RG-59	8.75 in.
		LT5R400	0-5 kV	0-400 mA	RG-59	8.75 in.
		LT6R330	0-6 kV	0-330 mA	RG-58	8.75 in.
LT8P250	LT8N250	LT8R250	0-8 kV	0-250 mA	RG-8U	8.75 in.
LT10P200	LT10N200	LT10R200	0-10 kV	0-200 mA	RG-8U	8.75 in.
LT12P165	LT12N165	LT12R165	0-12 kV	0-165 mA	RG-8U	8.75 in.
LT15P132	LT15N132	LT15R132	0-15 kV	0-132 mA	RG-8U	8.75 in.
LT20P100	LT20N100	LT20R100	0-20 kV	0-100 mA	RG-8U	8.75 in.
LT30P66	LT30N66	LT30R66	0-30 kV	0-66 mA	RG-8U	8.75 in.
LT40P50	LT40N50	LT40R50	0-40 kV	0-50 mA	RG-8U	8.75 in.
LT50P40	LT50N40	LT50R40	0-50 kV	0-40 mA	RG-8U	8.75 in.
LT60P33	LT60N33	LT60R33	0-60 kV	0-33 mA	RG-8U	8.75 in.
LT80P25	LT80N25	LT80R25	0-80 kV	0-25 mA	DS 2124	8.75 in.
LT100P20	LT100N20	LT100R20	0-100 kV	0-20 mA	DS 2124	8.75 in.
LT125P16	LT125N16	LT125R16	0-125 kV	0-16 mA	DS 2121	8.75 in.
LT150P10	LT150N10	LT150R10	0-150 kV	0-10 mA	DS 2121	8.75 in.

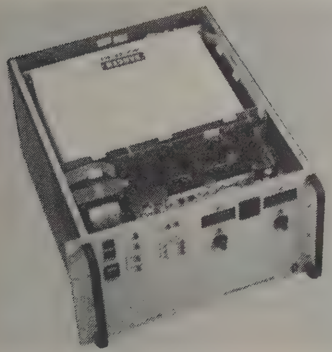
PKCP Series 2/4/6/8 kW Regulated DC High Voltage Power Supplies

PKCP Series, with CP denoting Constant Power, are similar to the PK Series and are available with the same range of output voltages but a reduced power of 2/4/6/and 8 kW. From 0 to 50% of rated voltage they behave the same as the PK Series. From 50 to 100% of rated voltage the maximum available current is reduced producing, in effect, a region of constant power.

Specifications

INPUT:
198-250 V, single-phase, 48-63 Hz.

OTHER SPECIFICATIONS:
Identical to the PK Series, see page 17.



Internal Construction Features Easy Accessibility.

Models, 2 kW, Fully Enclosed

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		PKCP3R	0-3/1.5 kV	0-650/1300 mA	RG-59U	10.5 in.
		PKCP6R	0-6/3 kV	0-325/650 mA	RG-58U	10.5 in.
PKCP8P	PKCP8N	PKCP8R	0-8/4 kV	0-225/450 mA	DS2124	10.5 in.
PKCP10P	PKCP10N	PKCP10R	0-10/5 kV	0-200/400 mA	DS2124	10.5 in.
PKCP12P	PKCP12N	PKCP12R	0-12/6 kV	0-165/330 mA	DS2124	10.5 in.
PKCP15P	PKCP15N	PKCP15R	0-15/7.5 kV	0-130/260 mA	DS2124	10.5 in.
PKCP20P	PKCP20N	PKCP20R	0-20/10 kV	0-100/200 mA	DS2124	10.5 in.
PKCP30P	PKCP30N	PKCP30R	0-30/15 kV	0-65/130 mA	DS2124	10.5 in.
PKCP40P	PKCP40N	PKCP40R	0-40/20 kV	0-50/100 mA	DS2124	10.5 in.
PKCP50P	PKCP50N	PKCP50R	0-50/25 kV	0-40/80 mA	DS2124	10.5 in.
PKCP60P	PKCP60N	PKCP60R	0-60/30 kV	0-32.5/65 mA	DS2124	10.5 in.
PKCP75P	PKCP75N	PKCP75R	0-75/37.5 kV	0-25/50 mA	DS2124	10.5 in.
PKCP80P	PKCP80N	PKCP80R	0-80/40 kV	0-25/50 mA	DS2121	15.75 in.
PKCP100P	PKCP100N	PKCP100R	0-100/50 kV	0-20/40 mA	DS2121	15.75 in.
PKCP125P	PKCP125N	PKCP125R	0-125/62.5kV	0-15/30 mA	DS2121	15.75 in.

Maximum weight is 62 lbs. to 75 kV, 85 lbs. to 125 kV.

Models, 2 kW, Open Stack

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Panel Height	Stack Height
PKCP150P	PKCP150N	PKCP150R	0-150/75 kV	0-12.5/25 mA	5.25 in.	35.1 in.
PKCP200P	PKCP200N	PKCP200R	0-200/100 kV	0-9/18 mA	5.25 in.	40.1 in.
PKCP250P	PKCP250N	PKCP250R	0-250/125 kV	0-7/14 mA	5.25 in.	45.9 in.
PKCP300P	PKCP300N	PKCP300R	0-300/150 kV	0-5/10 mA	5.25 in.	60.2 in.
PKCP350P	PKCP350N	PKCP350R	0-350/175 kV	0-4/8 mA	5.25 in.	68.6 in.
PKCP400P	PKCP400N	PKCP400R	0-400/200 kV	0-3/6 mA	5.25 in.	68.6 in.
PKCP500P	PKCP500N	PKCP500R	0-500/250 kV	0-2/4 mA	5.25 in.	75.9 in.

Maximum weight is 125 lbs.

Models, 4 kW, Fully Enclosed (for models to 8 kW, consult factory)

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		PKCP3R	0-3/1.5 kV	0-1300/2600 mA	RG-59U	21 in.
		PKCP6R	0-6/3 kV	0-650/1300 mA	RG-58U	21 in.
PKCP8P	PKCP8N	PKCP8R	0-8/4 kV	0-450/900 mA	DS2124	21 in.
PKCP10P	PKCP10N	PKCP10R	0-10/5 kV	0-400/800 mA	DS2124	21 in.
PKCP12P	PKCP12N	PKCP12R	0-12/6 kV	0-330/660 mA	DS2124	21 in.
PKCP15P	PKCP15N	PKCP15R	0-15/7.5 kV	0-260/520 mA	DS2124	21 in.
PKCP20P	PKCP20N	PKCP20R	0-20/10 kV	0-200/400 mA	DS2124	21 in.
PKCP30P	PKCP30N	PKCP30R	0-30/15 kV	0-130/260 mA	DS2124	21 in.
PKCP40P	PKCP40N	PKCP40R	0-40/20 kV	0-100/200 mA	DS2124	21 in.
PKCP50P	PKCP50N	PKCP50R	0-50/25 kV	0-80/160 mA	DS2124	21 in.
PKCP60P	PKCP60N	PKCP60R	0-60/30 kV	0-65/130 mA	DS2124	21 in.
PKCP75P	PKCP75N	PKCP75R	0-75/37.5 kV	0-50/100 mA	DS2124	21 in.
PKCP80P	PKCP80N	PKCP80R	0-80/40 kV	0-50/100 mA	DS2121	31.5 in.
PKCP100P	PKCP100N	PKCP100R	0-100/50 kV	0-40/80 mA	DS2121	31.5 in.
PKCP125P	PKCP125N	PKCP125R	0-125/62.5 kV	0-30/60 mA	DS2121	31.5 in.

Maximum weight is 125 lbs. to 75 kV, 170 lbs. to 125 kV.

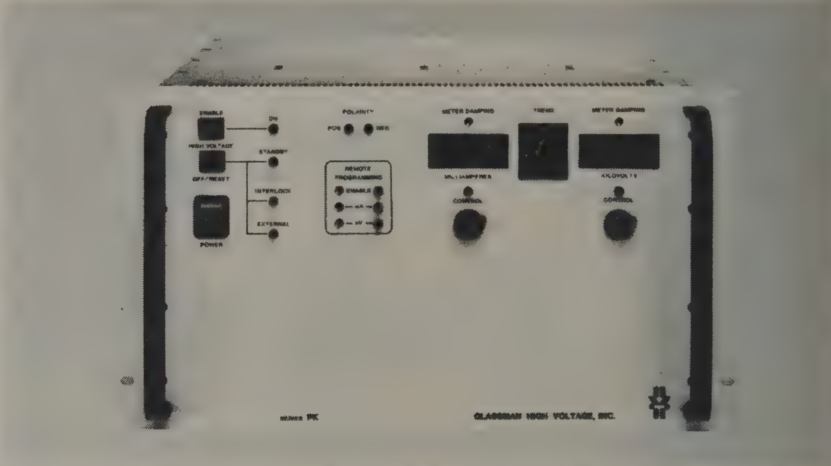
Models, 4 kW, Open Stack

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Panel Height	Stack Height
PKCP150P	PKCP150N	PKCP150R	0-150/75 kV	0-25/50 mA	5.25 in.	35.1 in.
PKCP200P	PKCP200N	PKCP200R	0-200/100 kV	0-18/36 mA	5.25 in.	40.1 in.
PKCP250P	PKCP250N	PKCP250R	0-250/125 kV	0-14/28 mA	5.25 in.	45.9 in.
PKCP300P	PKCP300N	PKCP300R	0-300/150 kV	0-10/20 mA	5.25 in.	60.2 in.
PKCP350P	PKCP350N	PKCP350R	0-350/175 kV	0-8/16 mA	5.25 in.	68.6 in.
PKCP400P	PKCP400N	PKCP400R	0-400/200 kV	0-6/12 mA	5.25 in.	68.6 in.
PKCP500P	PKCP500N	PKCP500R	0-500/250 kV	0-4/8 mA	5.25 in.	75.9 in.

Maximum weight is 200 lbs.

PK Series 4/8/12/15 kW Regulated DC High Voltage Power Supplies

Models 8 kW and higher are obtained by paralleling 4 kW models in a "master/slave" configuration. Slave panels have separate AC power inputs and switches, and annunciators for power on, tracking, overvoltage, and bias. Models from 0 to 3 kV through 0 to 500 kV.



Specifications.

AC INPUT:
4, 8, and 12 kW models; 3-phase, 208 V RMS +/- 10%, 48-63 Hz. Output power derated for line unbalance > 2%. 5-position terminal block (1 position not used) with protective cover. Fused for 20 A, phase or line. 8 kW and higher models have an additional terminal block for each slave unit.

DC OUTPUT:
Continuous, stable adjustment from zero to rated voltage and current by means of separate 10-turn front panel controls, with locking vernier dials, or external (switch selected) 0 to +10 V signals. Panel controls have resolution and readability better than 500 ppm, linear to 1%, repeatable to 0.1% fs. Accuracy, 1% of rated + 1% of setting.

VOLTAGE/CURRENT OUTPUT METERS:
Dual 3-1/2 digit LCDs with on/off damping, accuracy 1% fs + 1% rdg.; dual 10-segment bar-graphs.

VOLTAGE REGULATION:
Load, better than +/- 0.01% + 0.5 mV/mA for full load variation; line, better than +/- 0.01% over specified input range.

RIPPLE:
Better than 0.1% RMS of rated voltage at full load for models to 125 kV, better than 0.05% for models 150 kV and higher.

CURRENT REGULATION:
Load, better than +/- 0.1% + 100 µA from short circuit to rated voltage at any rated load condition; line, better than +/- 0.01% over specified input range.

STABILITY:
0.01% per hour after 1/2 hour warmup; 0.05% per 8 hours.

TEMPERATURE COEFFICIENT:
0.01% per degree C.

AMBIENT TEMPERATURE:
-20 to +50 degrees C, operating; -40 to +85 degrees C, storage.

PROTECTION:
Automatic current regulation protection reduces output voltage as required for all arc, overload, and short circuit conditions. Fuses, surge-limiting resistors, and low stored energy provide the ultimate protection.

ACCESSORIES:
Detachable 8-foot shielded high voltage coaxial cable provided for models up to 125 kV (See models chart for cable type.) 8 kW and higher models, up to 125 kV, are provided with an additional coaxial cable for each slave unit. Harness and/or interconnection cables supplied for multi-chassis supplies. 25-pin D-subminiature connector provided for customer interface.

ANALOG MONITORS:
Current and voltage, 0 to 10 V, directly proportional, 10 k ohms +/-1% source impedance.

DIGITAL MONITOR SIGNALS:
4 functions; Milliampere Control, Kilovolt Control, High Voltage Enable, and No Fault. High active, TTL or 5 V CMOS compatible. Source, 1.0 mA at 2.5 V; sink, 2.6 mA at 0.4 V.

continued on page 18

Models, 4 kW, Fully Enclosed

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		PK3R1300	0-3 kV	0-1300 mA	RG-59U	10.5 in.
		PK6R650	0-6 kV	0-650 mA	RG-58U	10.5 in.
PK8P450	PK8N450	PK8R450	0-8 kV	0-450 mA	DS2124	10.5 in.
PK10P400	PK10N400	PK10R400	0-10 kV	0-400 mA	DS2124	10.5 in.
PK12P330	PK12N330	PK12R330	0-12 kV	0-330 mA	DS2124	10.5 in.
PK15P260	PK15N260	PK15R260	0-15 kV	0-260 mA	DS2124	10.5 in.
PK20P200	PK20N200	PK20R200	0-20 kV	0-200 mA	DS2124	10.5 in.
PK30P130	PK30N130	PK30R130	0-30 kV	0-130 mA	DS2124	10.5 in.
PK40P100	PK40N100	PK40R100	0-40 kV	0-100 mA	DS2124	10.5 in.
PK50P80	PK50N80	PK50R80	0-50 kV	0-80 mA	DS2124	10.5 in.
PK60P65	PK60N65	PK60R65	0-60 kV	0-65 mA	DS2124	10.5 in.
PK75P50	PK75N50	PK75R50	0-75 kV	0-50 mA	DS2124	10.5 in.
PK80P50	PK80N50	PK80R50	0-80 kV	0-50 mA	DS2121	15.75 in.
PK100P40	PK100N40	PK100R40	0-100 kV	0-40 mA	DS2121	15.75 in.
PK125P30	PK125N30	PK125R30	0-125 kV	0-30 mA	DS2121	15.75 in.

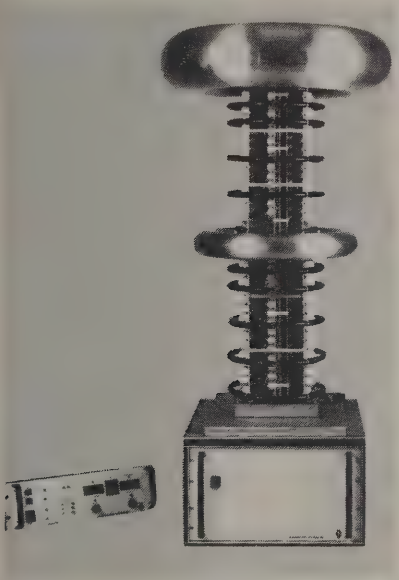
Maximum weight is 62 lbs.to 75 kV, 85 lbs. to 125 kV.

Specifications... *continued*

OPTO-ISOLATED OUTPUT:
Opto-isolated NPN transistor output, controlled by any one of the digital monitor signals. Not to be used for high voltage isolation.

DIGITAL HV ON/OFF CONTROL:
2 inputs; Enable, to activate high voltage, switch selected, high on, low off and External, to disable high voltage, overrides local or remote enable, high for disable. External has 2 programmable modes, level-controlled interrupt or edge-triggered shutdown.
Both inputs are TTL or 5 V CMOS compatible. Input active with 2-15 V signal. Impedance, 100 k ohms at 0-5 V, 10 k ohms at 15 V, approximate.

INTERLOCK:
Open off, closed on.



Typical Open Stack Configuration
for Series PKCP and Series PK.

Models, 4 kW, Open Stack

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Panel Height	Stack Height
PK150P25	PK150N25	PK150R25	0-150 kV	0-25 mA	5.25 in.	35.1 in.
PK200P18	PK200N18	PK200R18	0-200 kV	0-18 mA	5.25 in.	40.1 in.
PK250P14	PK250N14	PK250R14	0-250 kV	0-14 mA	5.25 in.	45.9 in.
PK300P10	PK300N10	PK300R10	0-300 kV	0-10 mA	5.25 in.	60.2 in.
PK350P8	PK350N8	PK350R8	0-350 kV	0-8 mA	5.25 in.	68.6 in.
PK400P6	PK400N6	PK400R6	0-400 kV	0-6 mA	5.25 in.	68.6 in.
PK500P4	PK500N4	PK500R4	0-500 kV	0-4 mA	5.25 in.	75.9 in.

Maximum weight is 125 lbs.

Models, 8 kW, Fully Enclosed (for models to 15 kW, consult factory)

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Output Cable	Panel Height
Reversible Only		PK3R2600	0-3 kV	0-2600 mA	RG-59U	21 in.
		PK6R1300	0-6 kV	0-1300 mA	RG-58U	21 in.
PK8P900	PK8N900	PK8R900	0-8 kV	0-900 mA	DS2124	21 in.
PK10P800	PK10N800	PK10R800	0-10 kV	0-800 mA	DS2124	21 in.
PK12P660	PK12N660	PK12R660	0-12 kV	0-660 mA	DS2124	21 in.
PK15P520	PK15N520	PK15R520	0-15 kV	0-520 mA	DS2124	21 in.
PK20P400	PK20N400	PK20R400	0-20 kV	0-400 mA	DS2124	21 in.
PK30P260	PK30N260	PK30R260	0-30 kV	0-260 mA	DS2124	21 in.
PK40P200	PK40N200	PK40R200	0-40 kV	0-200 mA	DS2124	21 in.
PK50P160	PK50N160	PK50R160	0-50 kV	0-160 mA	DS2124	21 in.
PK60P130	PK60N130	PK60R130	0-60 kV	0-130 mA	DS2124	21 in.
PK75P100	PK75N100	PK75R100	0-75 kV	0-100 mA	DS2124	21 in.
PK80P100	PK80N100	PK80R100	0-80 kV	0-100 mA	DS2121	31.5 in.
PK100P80	PK100N80	PK100R80	0-100 kV	0-80 mA	DS2121	31.5 in.
PK125P60	PK125N60	PK125R60	0-125 kV	0-60 mA	DS2121	31.5 in.

Maximum weight is 125 lbs. to 75 kV, 170 lbs. to 125 kV.

Models, 8 kW, Open Stack

Positive Polarity	Negative Polarity	Reversible Polarity	Output Voltage	Output Current	Panel Height	Stack Height
PK150P50	PK150N50	PK150R50	0-150 kV	0-50 mA	5.25 in.	35.1 in.
PK200P36	PK200N36	PK200R36	0-200 kV	0-36 mA	5.25 in.	40.1 in.
PK250P28	PK250N28	PK250R28	0-250 kV	0-28 mA	5.25 in.	45.9 in.
PK300P20	PK300N20	PK300R20	0-300 kV	0-20 mA	5.25 in.	60.2 in.
PK350P16	PK350N16	PK350R16	0-350 kV	0-16 mA	5.25 in.	68.6 in.
PK400P12	PK400N12	PK400R12	0-400 kV	0-12 mA	5.25 in.	68.6 in.
PK500P8	PK500N8	PK500R8	0-500 kV	0-8 mA	5.25 in.	75.9 in.

Maximum weight is 200 lbs.

GlobTek, Inc.

POWER SUPPLY & ADAPTORS

UL CSA VDE / TUV FCC FTZ
Switching Power Supplies

ISO-9000 Certified Factory

UNIT: mm

Model: 302

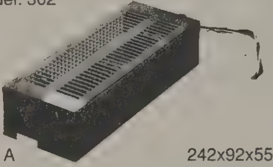


Fig. A 242x92x55

Model: 303

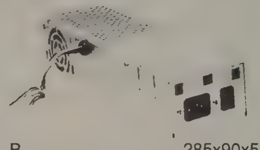


Fig. B 285x90x55

Model: 807

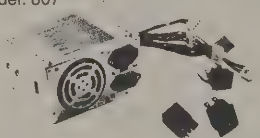


Fig. C 150x140x86

Open PCB

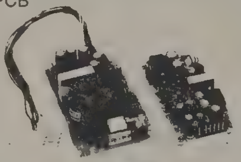


Fig. D

Model: 502

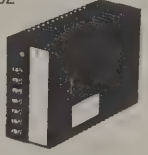


Fig. E 140x50x95

Model: 602

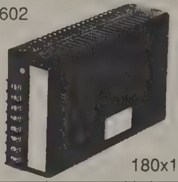


Fig. F 180x150x110

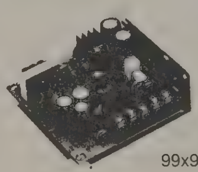


Fig. G 99x97x35

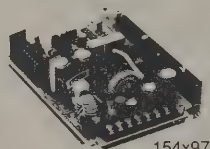


Fig. H 154x97x37

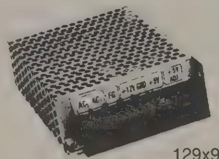


Fig. I 129x98x38

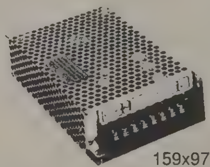


Fig. J 159x97x38

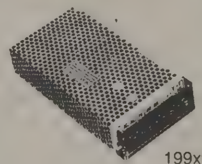


Fig. K 199x98x38

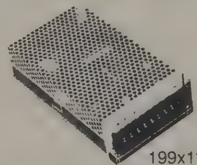


Fig. L 199x110x50

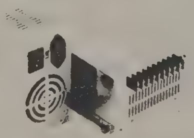


Fig. M 150x140x86

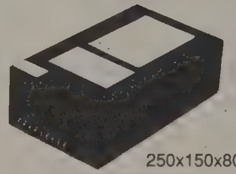


Fig. H 250x150x80

COMPATIBLE SERIES

MODEL	MAX. O/P (WATTS)	+5V	+12V	-5V	-12V	FIG.
MWP-302	60W	5.5	2	0.5	0.5	A
MWP-303	60W	5	2.5	0.5	0.5	B
MWP-807	180W	18	7	0.5	0.5	C

SINGLE OUTPUT

MODEL	MAX. O/P (WATTS)	+5V	+7.5V	+12V	+15V	+24V	FIG.
S-15	15	3		1.3	1	0.7	G
S-35	35	7		3		1.5	I
S-50	50	10		4.2	3.4	2.1	J
S-100	100	20	13.5	8.5	6.7	4.5	K
S-200	200	40		16.5		8.3	M
S-300	300			25		12.5	N

DUAL OUTPUT

MODEL	MAX. O/P (WATTS)	+5V	+12V	+24V	FIG.
D-30A	30	4	1		I
D-30B	30	2.2		1	I
D-50A	50	6	2		J
D50B	50	6		1	J
D55F	60	6	2.5		H
D-100A	100	10	4		L
D-100B	100	6		3	L
D-300A	300	20	16.5		N

TRIPLE OUTPUT

MODEL	MAX. O/P (WATTS)	+5V	+12V	+15V	+24V	-5V	-12V	-15V	FIG.
T-30A	30	3	1			0.5			I
T-30B	30	3	1				0.5		I
T-50A	50	7	1			1			J
T-50B	50	5	1				1		J
T-50C	50	4		1				1	J
T-100C	100	10		2.5				1	L
T-100D	100	6	2		2				L

QUAD OUTPUT

MODEL	MAX. O/P (WATTS)	+5V	+12V	+24V	-5V	-12V	FIG.
Q-55	55	7	1		0.5	0.5	J
Q-100H	100	13	2		1	1	L
Q-100B	100	8	1	2		0.5	L
Q-180	180	8	2	4		1	M

TV GAME SERIES

MODEL	MAX. O/P (WATTS)	+5V	+12V	-5V	-12V	FIG.
MWP-502	55	8	1	1		E
MWP-602	100	15	2	1		F
MWP-701	50	7	1	1		J
MWP-702	100	13	2	1	1	L

OPEN PCB

	FIG.
20W-200W 1-4 Way Output AC Input 110/220 Selected or Auto Change Design to Meet Customers' Requirements	D

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CAUTION

Features
- Universal Input 90-260V 50/60Hz.
- UL, CSA, TUV Certified.
- Low Minimum Load.
- High Efficiency.
- Output Short Circuit Protection.
- Over Voltage Protection.
- 30 KHz Minimum Switching Frequency.

Applications
- Industrial Equipment.
- Instrumentation.
- Hard Disk Subsystems.
- External Floppy Disk Systems.
- External Tape Backup Units.
- Laptop or Notebook Computer.

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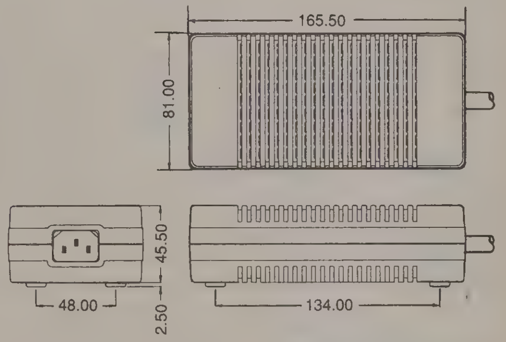
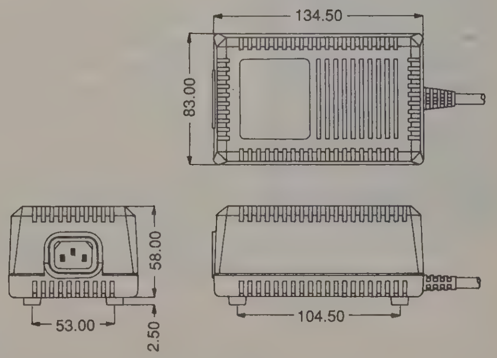
- **Wall Plug In Models Also Available**

MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT			REGULATION		RIPPLE AND NOISE	REMARK
		MIN.	MAX.	PEAK	LINE	LOAD		
DSA-3001	+5V	0.2A	2.5A	2.5A	±1%	±5%	50mV	FIG A
	+12V	0A	1.5A	3A	±1%	±5%	100mV	
	-12V	0A	0.3A	0.3A	±1%	±10%	150mV	
DSA-3002	+5V	0.2A	2.5A	2.5A	±1%	±5%	50mV	FIG A
	+12V	0A	1.5A	3A	±1%	±5%	100mV	
	-5V	0A	0.3A	0.3A	±1%	±10%	150mV	
DSA-3003	+5V	0.2A	2.5A	2.5A	±1%	±5%	50mV	FIG A
	+15V	0.1A	1A	2A	±1%	±5%	100mV	
	-15V	0.1A	0.3A	0.3A	±1%	±10%	150mV	
DSA-3004	+5V	0.2A	2A	2A	±1%	±5%	50mV	FIG A
	+24V	0.1A	0.8A	1.5A	±1%	±5%	200mV	
	-12V	0A	0.3A	0.3A	±1%	±10%	100mV	
DSA-3005	+5V	0.2A	2.5A	2.5A	±1%	±5%	50mV	FIG A
	+12V	0A	1.5A	3A	±1%	±5%	100mV	
DSA-3006	+5V	0.2A	6A	8A	±1%	±1%	50mV	FIG B or A
DSA-3007	+12V	0.1A	2.5A	3.5A	±1%	±1%	100mV	FIG B or A
DSA-3008	+15V	0.1A	2A	2.5A	±1%	±1%	150mV	FIG B or A
DSA-3009	+16V	0.1A	2.5A	3A	±1%	±1%	150mV	FIG B or A
DSA-3010	+18V	0.1A	2A	2.5A	±1%	±1%	200mV	FIG B or A
DSA-3011	+24V	0.1A	1.3A	2A	±1%	±1%	200mV	FIG B or A



A

MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT			REGULATION		RIPPLE AND NOISE	REMARK
		MIN.	MAX.	PEAK	LINE	LOAD		
DSA-1501	+5V	0.2A	3A	5A	±1%	±5%	50mV	FIG B
DSA-1502	+5V	0.2A	2A	3A	±1%	±5%	50mV	FIG B
	+12V	0A	0.5A	1A	±1%	±5%	100mV	
DSA-1503	+5V	0.2A	1.8A	3A	±1%	±5%	50mV	FIG B
	+12V	0A	0.4A	1A	±1%	±5%	100mV	
	-12V	0A	0.1A	0.3A	±1%	±10%	150mV	
DSA-1504	+5V	0.2A	1.8A	3A	±1%	±5%	50mV	FIG B
	+12V	0A	0.25A	1A	±1%	±5%	100mV	
	-12V	0A	0.25A	1A	±1%	±10%	150mV	
DSA-1505	+12V	0.1A	1.2A	2.5A	±1%	±5%	100mV	FIG B
DSA-1506	+15V	0.1A	1A	1.5A	±1%	±5%	150mV	FIG B
DSA-1507	+18V	0.1A	0.8A	1.5A	±1%	±5%	180mV	FIG B
DSA-1508	+24V	0.1A	0.62A	1A	±1%	±5%	240mV	FIG B
DSA-1509	+5V	0.1A	0.8A	1.5A	±1%	±5%	50mV	FIG B
	+15V	0.1A	0.75A	1A	±1%	±5%	150mV	
DSA-1511	+5V	0.2A	1.8A	3A	±1%	±5%	50mV	FIG B
	+12V	0A	0.1A	0.3A	±1%	±10%	150mV	
	-12V	0A	0.5A	1A	±1%	±5%	100mV	



B

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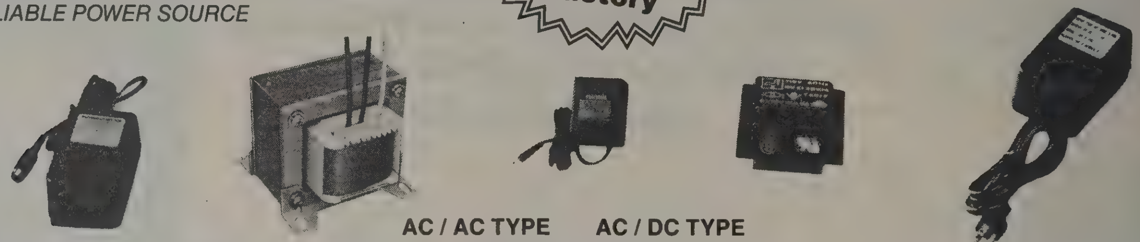
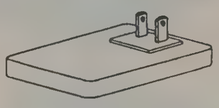
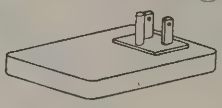
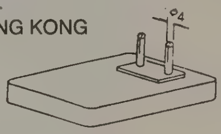
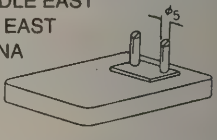
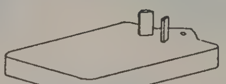
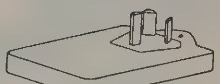
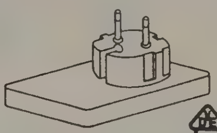
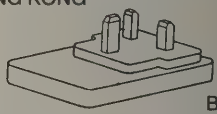
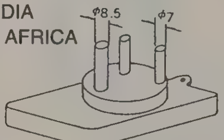
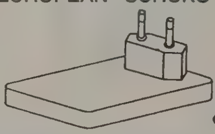
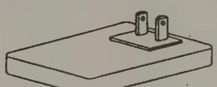
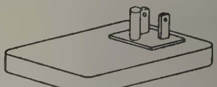
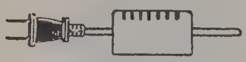
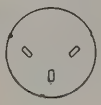
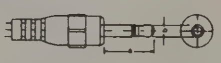


AC / AC TYPE AC / DC TYPE

N. AMERICAN 	N. AMERICAN 	U.K. HONG KONG 	MIDDLE EAST FAR EAST CHINA 
AUSTRALIA/NEW ZEALAND 	AUSTRALIA/NEW ZEALAND 	EUROPEAN "SCHUKO"  Ⓢ Ⓓ Ⓝ Ⓕ	UNITED KINDOM HONG KONG  BSI
INDIA S. AFRICA 	EUROPEAN "SCHUKO"  Ⓢ Ⓓ Ⓝ Ⓕ	JAPAN MITI 	JAPAN MITI 
 ☐ SPECIFY INLET/OUTLET ☐ SPECIFY INPUT/OUTPUT CABLE	ISRAEL 	POWER TRANSFORMERS ☐ VDE 0550 ☐ UL ☐ CSA	☐ IEC 380/435/950 ☐ IEC 601/NATIONAL ST. ☐ VDE 0551 ☐ IEC 65/335/338 ☐ UL ☐ CSA ☐ TUV GS ☐ VDE GS

Globtek's new 208-pg. Component and Engineering Services Catalog contains technical information on North American and international cable and cord sets, AC and DC plugs and connectors, appliance couplers, power entry modules, line filters, circuit breakers, switches and voltage selectors, fuse holders, surge protection, fans, capacitors, relays, external power supplies and transformers, DC/DC converters, OEM subcontract assemblies, safety test equipment.



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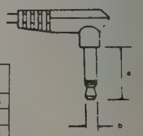
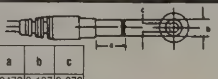
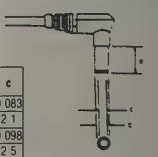
OP-01	.0453 11 5	0 098 2 5
OP-02	0 571 14 5	0 138 3 5



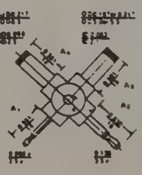
TYPE	a	b
OP-03	0492 12 5	0 098 2 5
OP-04	0 571 14 5	0 138 3 5



TYPE	a	b	c
OP-05	0472 12 0	0 197 5 0	0 079 2 0
OP-06	0.472 12 0	0 197 5 0	0 098 2 5
OP-07-1	0.472 12.0	0.217 5.5	0 098 2.5
OP-07-2	12.0	5 5	2.1

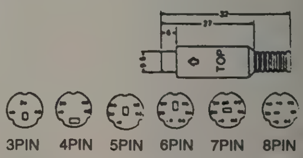


TYPE	a	b	c
OP-08	0472 12 0	0 197 5 0	0 083 2 1
OP-09	0 453 11·5	0 217 5 5	0 098 2 5



TYPE	A3 PLUG SIZE
OP-16	0197 x0 083 5 0 x 21
OP-17	0 217 x0 83 5 5 x 21

MINI DIN PLUG



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MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

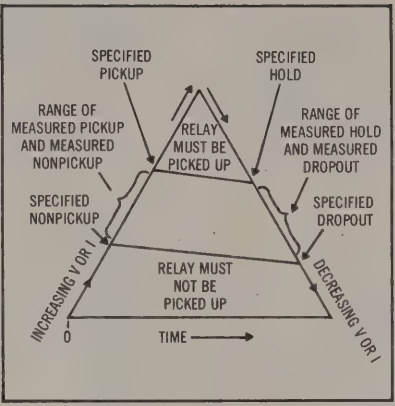
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

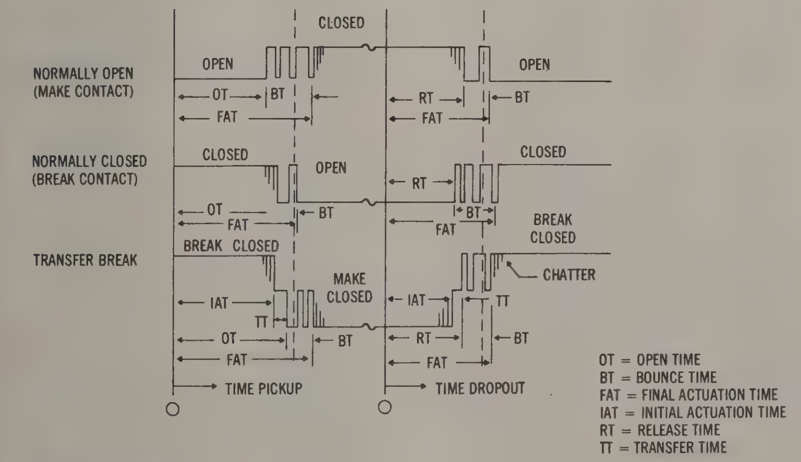

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OPEN
OT
BT
FAT
RT
BT
FAT
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
CLOSED
RT
OT
FAT
BT
BT
FAT
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
IAT
TT
OT
BT
RT
BT
FAT
FAT
TIME PICKUP
TIME DROPOUT
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

GPE
Golden Pacific Electronics, Inc.
560 SOUTH MELROSE STREET • PLACENTIA, CA 92670
PHONE: (714) 993-6970 • FAX: (714) 993-6023

Linear Regulated External (Wall Plug-In & Desk-Top) Power Supplies

- **Input Voltage:** 120VAC ± 10%, 60Hz
- **Input Connection:** (1) Wall Plug-In—2 prong or 3-prong (2) Desk-Top—6 FT cord with 2-prong or 3-prong plug
- **Line Regulation:** ±3% Max.
- **Load Regulation:** ±5% Max.
- **Storage Temperature:** 20°C ~ +85°C
- **Operating Temperature:** 0°C ~ +50°C
- **Safety Agency:** Meet or exceed UL1012 & CSA 22.2 standards, see table below for individual approvals.
- **Housing:** Black impact-resistant thermoplastic, see table below for types and sizes.
- **Storage Humidity:** 10 ~ 90% RH, non-condensing
- **Operating Humidity:** 10-75% RH, non-condensing
- **Applications:** Computer, data communication, telecommunication, industrial controls, battery chargers, consumer products.
- **Output Tolerance:** ±5% full load 120V input
- **Output Connection:** (1) Single output—PL01 ~ PL-06 (2) Multiple outputs—PL08 ~ PL10
- **Ripple & Noise:** 50 mV p-p Maximum
- **Transient Response:** 50% ~ 100% load change, recovery time 500 µS, overshoot 2% Max.

DESK TOP

PRODUCT NO.	OUTPUTS						APPROVALS	
	#1		#2		#3			
	VDC	A	VDC	A	VDC	A	UL	CSA
PD5010AR	5	1.0					✓	
PD5015AR	5	1.5					✓	
PD5020AR	5	2.0					✓	✓
PD6010AR	6	1.0					✓	✓
PD1210AR	12	1.0					✓	
PD1212AR	12	1.2					✓	✓
ML-6022-1	5	1.0	12	0.20	-12	0.20	✓	✓
ML-6522	5	1.5	12	0.20	-12	0.20	✓	✓

WALL PLUG

PRODUCT NO.	OUTPUTS						APPROVALS	
	#1		#2		#3			
	VDC	A	VDC	A	VDC	A	UL	CSA
PD3350R	3	0.35					✓	
PD5300R	3	0.30					✓	✓
PD5700R	5	0.70					✓	✓
PD6600R	6	0.60					✓	✓
PD8500R	8	0.50					✓	✓
PD9200R	9	0.20					✓	
PD9400R	9	0.40					✓	✓
PD9500R	9	0.50					✓	✓
PD9800R	9	0.80					✓	✓
PD9010AR	9	1.00					✓	
PD1220R	12	0.20					✓	
PD1240R	12	0.40					✓	✓
PD2425R	24	0.25					✓	✓
DT-1230F			12	0.30	-12	0.30	✓	✓
ML-5822	5	0.80	12	0.10	-12	0.10	✓	✓

Plug-in AC/DC Unregulated Power Supplies (For AC/AC, Please Contact Factory)

PRODUCT NO.	OUTPUT		APPROVAL	
	VDC	MA	UL	CSA
PD-1100	1.5	125	✓	
PD-2500	2.5	500	✓	✓
PD-3200	3	200	✓	
PD-3400	3	400	✓	✓
PD-3500	3	500	✓	✓
PD-4120	4.5	120	✓	✓
PD-4200	4.5	200	✓	✓
PD-4300	4	300	✓	✓
PD-4400	4.4	400	✓	✓
PD-5500	5.5	500	✓	✓
PD-6030	6	30		✓
PD-6100	6	100	✓	✓
PD-6200	6	200	✓	✓
PD-6300	6	300	✓	✓
PD-6400	6	400	✓	✓
PD-6500	6	500	✓	✓
PD-6600	6	600	✓	✓
PD-6700	6	700	✓	✓
PD-6800	6	800	✓	✓
PD-6900	6	900	✓	✓
PD-6010A	6	1000	✓	✓
PD-6011A	6	1100	✓	
PD-9030	9	30		✓
PD-9050	9	50	✓	✓
PD-9100	9	100	✓	✓
PD-9120	9	120	✓	
PD-9200	9	200	✓	✓
PD-9300	9	300	✓	✓
PD-9400	9	400	✓	✓
PD-9500	9	500	✓	✓
PD-9600	9	600	✓	✓
PD-9700	9	700	✓	✓
PD-9800	9	800	✓	✓
PD-9900	9	900	✓	✓
PD-9010A	9	1000	✓	✓
PD-9012A	9	1200	✓	✓

PRODUCT NO.	OUTPUT		APPROVAL	
	VDC	MA	UL	CSA
PD-1205	12	50		✓
PD-1210	12	100	✓	✓
PD-1215	12	150	✓	✓
PD-1220	12	200	✓	✓
PD-1230	12	300	✓	✓
PD-1235	12	350	✓	✓
PD-1240	12	400	✓	✓
PD-1250	12	500	✓	✓
PD-1260	12	600	✓	✓
PD-1270	12	700	✓	✓
PD-1280	12	800	✓	✓
PD-1290	12	900	✓	
PD-1210A	12	1000	✓	✓
PD-1211A	12	1100	✓	
PD-1212A	12	1200	✓	
PD-1321A	13.5	2100	✓	✓
PD-1510	15	100	✓	
PD-1515	15	150		✓
PD-1520	15	200	✓	✓
PD-1525	15	250	✓	✓
PD-1530	15	300	✓	✓
PD-1535	15	350	✓	✓
PD-1540	15	400	✓	✓
PD-1550	15	500	✓	✓
PD-1560	15	600	✓	✓
PD-1570	15	700	✓	✓
PD-1580	15	800	✓	
PD-1590	15	900	✓	
PD-1510A	15	1000	✓	✓

For European power supplies, please contact factory.

PRODUCT NO.	OUTPUT		APPROVAL	
	VDC	MA	UL	CSA
PD-1605	16	50		✓
PD-1610	16	100	✓	✓
PD-1615	16	150		✓
PD-1620	16	200		✓
PD-1625	16	250	✓	✓
PD-1630	16	300	✓	✓
PD-1635	16	350	✓	✓
PD-1640	16	400	✓	✓
PD-1645	16	450	✓	✓
PD-1650	16	500	✓	✓
PD-1655	16	550	✓	✓
PD-1660	16	600	✓	
PD-1670	16	700	✓	
PD-1680	16	800	✓	
PD-1690	16	900	✓	
PD-1610A	16	1000		
PD-1810	18	100	✓	
PD-1830	18	300	✓	
PD-1850	18	500	✓	✓
PD-1880	18	800	✓	
PD-1813A	18	1300	✓	
PD-1820A	18	2000	✓	✓
PD-2410	24	100	✓	✓
PD-2415	24	150		✓
PD-2420	24	200	✓	✓
PD-2425	24	250	✓	✓
PD-2430	24	300	✓	✓
PD-2435	24	350		✓
PD-2440	24	400	✓	
PD-2450	24	500	✓	
PD-2460	24	600	✓	
PD-2410A	24	1000	✓	
PD-2415A	24	1500	✓	✓

SPECIFICATION SUBJECT TO CHANGE WITHOUT NOTICE.

Golden Pacific Electronics, Inc.
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Universal Input Switching Power Supply

GENERAL SPECIFICATIONS

Input voltage	100VAC to 250VAC
Input frequency	50 Hz to 60 Hz
Inrush current	15A at 110VAC 30A at 230VAC
Operating temperature	0°C to 40°C
Storage temperature	–30°C to +75°C
Temperature coefficient	+/– 0.02% C
Efficiency	73% Min.
Cooling	Free air convection

Hold up time	20mS
Overvoltage protection type	Crowbar
At main rated output	+15%
Overcurrent protection	Hiccup at 150% load
Safety standard	UL 1012 CSA C22.2 NO 950/14020 VDE EN60950
EMI	Meets FCC 15 class "B" VDE 0871 class "B"
MTBF	Greater than 40,000 hours

Detachable IEC Input cord

SINGLE OUTPUT (*25W UNIT)

PRODUCT NO.	OUTPUT VOLTAGE	LOAD MIN.	LOAD RATED	TOLERANCE +/–	RIPPLE & NOISE P-P MAX.	REGULATION +/–
PS-5038A*	+ 5.0V	0.6A	3.8A	5%	50mV	5%
PS-5060A	+ 5.0V	1.2A	6.0A	5%	50mV	5%
PS-9047A	+ 9.0V	0.5A	4.7A	5%	90mV	5%
PS-1236A	+12.0V	0.3A	3.6A	5%	120mV	5%
PS-1332A	+13.5V	0.5A	3.2A	5%	135mV	5%
PS-1527A	+15.0V	0.5A	2.7A	5%	150mV	5%
PS-1626A	+16.7V	0.5A	2.6A	5%	165mV	5%
PS-1824A	+18.0V	0.5A	2.4A	5%	180mV	5%
PS-2220A	+22.0V	0.4A	2.0A	5%	200mV	5%
PS-2418A	+24.0V	0.4A	1.8A	5%	240mV	5%

DUAL OUTPUT (*25W UNIT IF MAX O/P IS REQUIRED. TOTAL O/P POWER CANNOT EXCEED 25W)

PRODUCT NO.	OUTPUT VOLTAGE	LOAD MIN.	LOAD RATED	LOAD MAX.	TOLERANCE +/–	RIPPLE & NOISE P-P MAX.	REGULATION +/–
PS-202*	+ 5V	0.4A	2.5A	4.0A	5%	50mV	5%
	+12V	0.2A	1.0A	1.8A	5%	120mV	5%
PS-203*	+ 5V	0.4A	2.0A	3.0A	5%	50mV	5%
	+15V	0.2A	1.0A	1.5A	5%	150mV	5%
PS-204*	+ 5V	0.4A	2.0A	3.0A	5%	50mV	5%
	+24V	0.1A	0.6A	1.0A	5%	240mV	5%
PS-205*	+15V	0.2A	0.8A	1.2A	5%	150mV	5%
	– 15V	0.2A	0.8A	1.2A	5%	150mV	5%

TRIPLE OUTPUT (43W UNIT IF MAX O/P IS REQUIRED. TOTAL O/P POWER CANNOT EXCEED 43W)

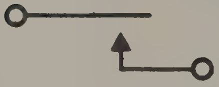
PRODUCT NO.	OUTPUT VOLTAGE	LOAD MIN.	LOAD RATED	LOAD MAX.*	TOLERANCE +/–	RIPPLE & NOISE P-P MAX.	REGULATION +/–
PS-303-2	+ 5.0V	0.6A	3.0A	5.0A	5%	50mV	5%
	+12.0V	0.3A	2.0A	2.0A	5%	100mV	5%
	–12.0V	—	0.3A	0.5A	10%	100mV	10%
PS-304	+ 5.0V	0.5A	3.0A	6.8A	5%	50mV	5%
	– 5.0V	—	0.3A	—	5%	50mV	5%
	+12.0V	0.5A	2.0A	4.0A	10%	120mV	10%
PS-305	+ 5.0V	0.5A	4.0A	8.0A	5%	50mV	5%
	– 5.0V	—	0.3A	—	5%	50mV	5%
	+15.0V	0.4A	1.0A	2.5A	10%	150mV	10%
PS-306	+ 5.0V	0.5A	3.0A	6.0A	5%	50mV	5%
	+15.0V	0.4A	1.6A	3.0A	10%	150mV	5%
	–15.0V	—	3.0A	—	10%	150mV	10%
PS-307	+ 5.0V	0.5A	4.0A	8.0A	5%	50mV	5%
	–12.0V	—	0.3A	—	10%	120mV	10%
	+15.0V	0.4A	1.0A	2.5A	10%	120mV	10%

eem

MINIGLOSSARY
RELAY CONTACT FORMS

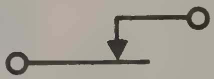
A

Make
SPST-NO



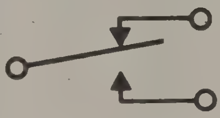
B

Break
SPST-NC



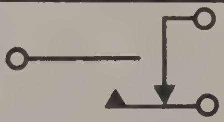
C

Break, Make
(Transfer)
SPDT



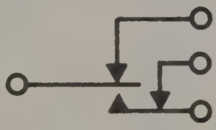
D

Make, Break
(Continuity
Transfer)



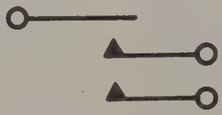
E

Break,
Make,
Break



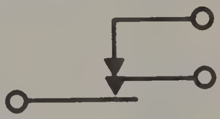
F

Make,
Make



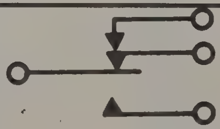
G

Break,
Make



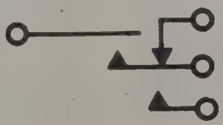
H

Break,
Break,
Make



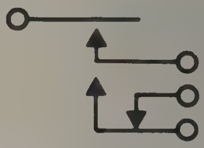
I

Make,
Break,
Make



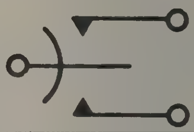
J

Make,
Make,
Break



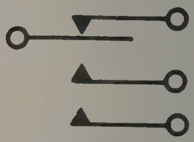
K

Center off
SPDT



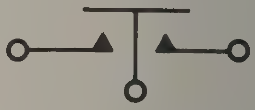
L

Break,
Make,
Make



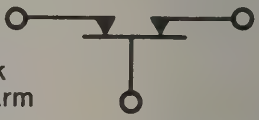
U

Double
make
Contact
on arm



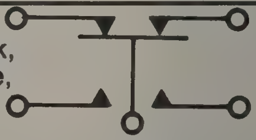
V

Double break
Contact on arm



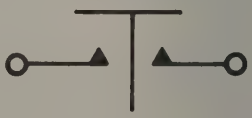
W

Double break,
Double make,
Contact
on arm



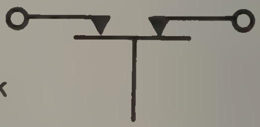
X

Double
make



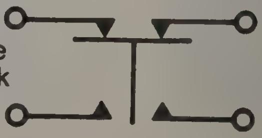
Y

Double break



Z

Double make
Double break
SPDT-DB

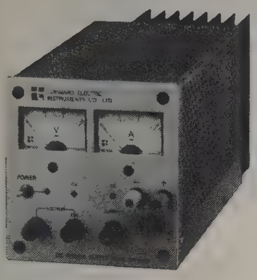


HauMan, Inc.

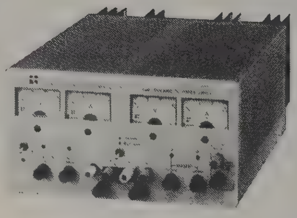
2031 Ringwood Ave., San Jose, CA 95131 • (408) 434-0888 • FAX: 408-434-9832

LABORATORY DC POWER SUPPLIES—TPS2000/4000 SERIES

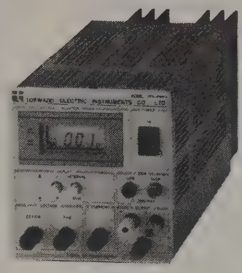
TPS-2000



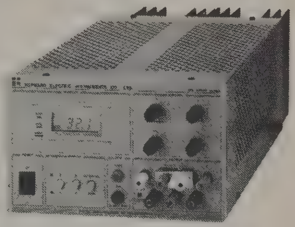
TPS-4000



TPS-2000D



TPS-4000D



SPECIFICATIONS FOR ALL MODELS

	TPS-2000 SERIES	TPS-4000 SERIES
Ripple & Noise	CV 0.5mVms or 4mVp-p CC 0.5mArms or 4mAp-p	
Line Regulation	CV 0.02% + 2mV CC 0.2% + 250µA	
Load Regulation	CV 0.2% + 2mV CC 0.02% + 500µA	
Output Impedance	5mΩ + 2µH	
Tracking Error—Dual Output Model Only		±(0.2% + 5mV)
5V/3A Output—Triple Output Model Only		
Output Voltage		5V + 5% (Fixed)
Output Current		3A (Max.)
Ripple & Noise		<2mVms
Regulation		0.1% + 5mV
Dimension	125(W) x 140(H) x 300(D)mm	250(W) x 140(H) x 363(D)mm
Weight	4.1Kg(TPS-2303)	8.9Kg(TPS-4303)
Power	115V/230V ± 10%, 50/60Hz	
Accessory	ACS-002 x 1, Banana-Clip	ACS-002 x 2, Banana-Clip

FEATURES FOR ALL MODELS

- Constant Voltage, Constant Current Mode Operation
- Short Circuit Protection Standard
- Compact aluminum case for excellent heat dissipation
- Built in separate Voltage and Current meters for analog modules
- 3 1/2 digit auto Ranging Panel Meters for Voltage or Current display in digital models
- Single, Dual, Triple Models, available
- Fully Variable Voltage and current set point control
- Excellent Ripple and Noise, Line/Load Regulations
- Unsurpassed Price/Performance Ratio
- Immediate Delivery

SPECIFICATIONS FOR MODEL 2000D/4000D SERIES

	TPS-2000D SERIES	TPS-4000D SERIES
Display	3½ LCD display with unit indicator	
Output Voltage Monitor	199.9mV, 1.999V, 19.99V, 199.99V 4 Auto-Ranges	
Ouput Current Monitor	19.99A	
DVM	±199.99mV, ±1.999V, ±19.99V, ±199.9V 4 Auto-Ranges	
Accuracy	±(0.2% + 2d)	

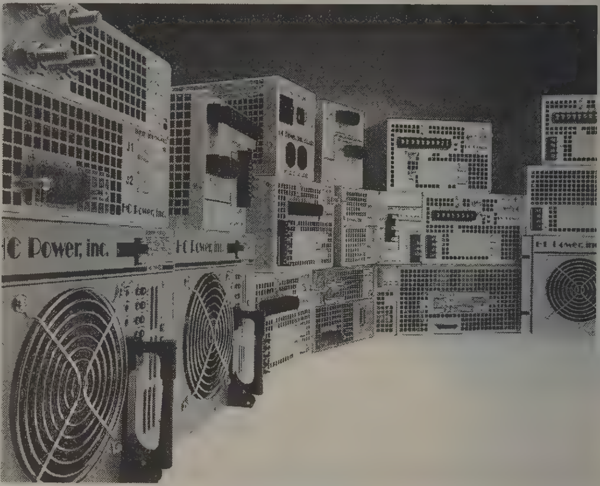
ORDERING INFORMATION

	PART #	DESCRIPTION	PRICE	PART #	DESCRIPTION	PRICE
ANALOG	1810	0-18V/0-10A DC POWER SUPPLY	395.00	2601	0-60V0-1A DC POWER SUPPLY	260.00
	2203	0-20V/0-3A DC POWER SUPPLY	255.00	2603	0-60V/0-3A DC POWER SUPPLY	440.00
	2302	0-30V/0-2A DC POWER SUPPLY	255.00	4302	0-30V/0-2A x 2, 5V/3A TRIPLE OUTPUT SUPPLY	440.00
	2303	0-30V/0-3A DC POWER SUPPLY	275.00	4303	0-30V/0-3A x 2, 5V/3A TRIPLE OUTPUT SUPPLY	520.00
	2306	0-30V/0-6A DC POWER SUPPLY	430.00	4306	0-30V/0-6A x 2, DUAL OUTPUTS POWER SUPPLY	760.00
	23010	0-30V/0-10A DC POWER SUPPLY	690.00	4603	0-60V-3A x 2, DUAL OUTPUTS POWER SUPPLY	760.00
DIGITAL	2302D	0-30V/0-2A DIGITAL DC POWER SUPPLY	300.00	4302D	0-30V/0-2A x2, 5V/3A TRIPLE DIGITAL	495.00
	2303D	0-30V/0-3A DIGITAL DC POWER SUPPLY	340.00	4303D	0-30V/0-3A x2, 5V/3A TRIPLE DIGITAL	575.00

SEE OUR OTHER DATA PAGE IN SECTION 2900

HC—For World Class Power. . .

500 to 4000W HiRel MOSFET Switchers; Meet IEC 555-2 Performance Standards



- **Absolute Current Sharing of Parallel Outputs with No Minimum Load**
- **.99 Power Factor Correction Eliminates Line Harmonics and Improves Performance**
- **Meets All Applicable Safety and Emissions Standards**
- **Provides Complete Protection from Over Voltage, Over Current, Over Temperature and Reverse Polarity.**

Selling your products in a world market requires a switch mode power supply with world-class performance and reliability, *including* compliance with the stringent new safety and performance standards imposed by the European Community.

HC Power offers you the widest selection of catalog standard, high power switchers *in the world.* We offer you thoughtfully-engineered solutions to real-world operating problems, ranging from our exclusive HotSwap™ redundant power systems to new answers for power conditioning and power factor correction.

Specifications

INPUT SPECIFICATIONS

AC Input Range: 90-264 VAC, 47-63 Hz, single phase. 400 Hz available.

Inrush current: ≤nominal full load running current at 115 VAC.

DC Input Range: 120 to 370 VDC.

Fusing: All units are fused internally.

Line Transient: Meets ANSI C62.41 (Formerly IEEE-587-1980)

Line Filtering: Complies with Level A of Docket 20780 and VDE 0871.

Power Factor: ≥.99 at full load.

Total Harmonic Distortion: <5%.

OUTPUT SPECIFICATIONS

Voltage Adjust Range: ±10%.

Line Regulation: 0.2% over entire AC input range.

Load Regulation: ±0.2% no load to full load.

Cross Regulation: 0.1% maximum.

Ripple and Noise: (PARD) 1% or 50 mV, whichever is greater.

Turn On Delay: Under full load conditions all outputs will be in regulation in less than 1 second at 115 VAC line input.

Output Polarity: All outputs are floating.

Minimum Load: *No* minimum load is required on any output.

LOGIC AND CONTROL

Remote Sense.
Remote Margin.
Remote Inhibit.
AC Power Fail Warning.
Current Sharing.
Current Monitor.
DC-OK.

PROTECTION

Over Voltage Protection.
Over Current.
Thermal Shutdown.
Reverse Polarity.

HC Power Switcher Selection Suide—500 to 4000 Watts, 1 to 5 Outputs.

SINGLE					
	500W	750W	1000W	1500W	1800W
V1*	2V, 120A 5V, 100A 12V, 42A 15V, 34A 18V, 28A 24V, 21A 28V, 18A 36V, 14A 48V, 11A	2V, 175A 5V, 150A 12V, 63A 15V, 50A 18V, 42A 24V, 31A 28V, 27A 36V, 21A 48V, 16A	2V, 230A 5V, 200A 12V, 83A 15V, 67A 18V, 56A 24V, 42A 28V, 36A 36V, 28A 48V, 21A	2V, 340A 5V, 300A 12V, 125A 15V, 100A 18V, 83A 24V, 63A 28V, 54A 36V, 42A 48V, 31A	2V, 360A 5V, 360A 12V, 150A 15V, 120A 18V, 100A 24V, 75A 28V, 65A 36V, 50A 48V, 38A

DUAL					
	500W	750W	1000W	1250W	1500W
V1*	5V, 80A	5V, 110A	5V, 150A	5V, 200A	5V, 230A
V2	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 6A	2V, 15A 5V, 15A 12V, 15A 15V, 10A 24V, 10A	2V, 50A 5V, 50A 12V, 33A 15V, 27A 24V, 17A	2V, 100A 5V, 100A 12V, 42A 15V, 34A 24V, 21A	2V, 100A 5V, 100A 12V, 42A 15V, 34A 24V, 21A

TRIPLE					
	500W	750W	1000W	1250W	1500W
V1	5V, 80A	5V, 110A	5V, 150A	5V, 200A	5V, 230A
V2	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 6A	2V, 15A 5V, 15A 12V, 15A 15V, 10A 24V, 10A	2V, 20A 5V, 20A 12V, 15A 15V, 15A 24V, 10A	2V, 50A 5V, 50A 12V, 35A 15V, 28A 24V, 18A	2V, 50A 5V, 50A 12V, 35A 15V, 28A 24V, 18A
V3	2V, 5A 5V, 5A 12V, 5A 15V, 5A 24V, 3A	2V, 5A 5V, 5A 12V, 5A 15V, 5A 24V, 3A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A

*V1 output can be any output voltage. Please contact factory.

HI-POWER SINGLE				HI-POWER DUAL		
	2000W	3000W	4000W		3000W	4000W
V1*	2V, 400A 5V, 400A 12V, 167A 15V, 134A 18V, 111A 24V, 84A 28V, 72A 36V, 56A 48V, 42A	2V, 600A 5V, 600A 12V, 250A 15V, 200A 18V, 166A 24V, 125A 28V, 107A 36V, 83A 48V, 63A	2V, 800A 5V, 800A 12V, 333A 15V, 267A 18V, 222A 24V, 167A 28V, 143A 36V, 111A 48V, 84A	V1 AND V2	2V, 300A 5V, 300A 12V, 125A 15V, 100A 18V, 83A 24V, 63A 28V, 54A 36V, 42A 48V, 31A	2V, 400A 5V, 400A 12V, 167A 15V, 134A 18V, 111A 24V, 84A 28V, 72A 36V, 56A 48V, 42A

QUAD/PENTA					
	500W	750W	1000W	1250W	1500W
V1*	5V, 80A	5V, 110A	5V, 150A	5V, 200A	5V, 230A
V2	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 6A	2V, 15A 5V, 15A 12V, 15A 15V, 10A 24V, 10A	2V, 20A 5V, 20A 12V, 15A 15V, 15A 24V, 12A	2V, 50A 5V, 50A 12V, 35A 15V, 28A 24V, 18A	2V, 50A 5V, 50A 12V, 35A 15V, 28A 24V, 18A
V3	2V, 5A 5V, 5A 12V, 5A 15V, 5A 24V, 3A	2V, 5A 5V, 5A 12V, 5A 15V, 5A 24V, 3A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A	2V, 10A 5V, 10A 12V, 10A 15V, 8A 24V, 5A
V4	2V, 3A 5V, 3A 12V, 3A 15V, 2A 24V, 2A	2V, 3A 5V, 3A 12V, 3A 15V, 2A 24V, 2A	2V, 5A 5V, 5A 12V, 5A 15V, 3A 24V, 3A	2V, 5A 5V, 5A 12V, 5A 15V, 3A 24V, 3A	2V, 5A 5V, 5A 12V, 5A 15V, 3A 24V, 3A
V5	12V, 5A/8A† 24V, 5A/8A†	12V, 7A/10A† 24V, 7A/10A†	12V, 8A/12A† 24V, 8A/12A†	Contact Factory	Contact Factory

Request Individual Data Sheet for Desired Power Range and Number of Outputs. Other Output Voltages and Currents area Available In Addition to those Shown. Call Factory.

DEDICATED TO THE DESIGN AND MANUFACTURE OF HIGH POWER SWITCHERS.

HC Power, inc.

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Call Toll Free: (800) 486-4427 • FAX (714) 261-6584

Guaranteed 250,000 Hr. MTBF

New ECT Series Switchers Accept Both European & US Three-Phase Inputs; Delivers .92 Power Factor Correction

- **Eliminates Need for Step-Down Transformer**
- **Eliminates Need for Rewiring for Single-Phase 240 VAC Operation on European Systems**
- **Accepts Either 380/415 VAC (European) or 208 VAC (USA) Three-Phase Delta Inputs**
- **No Neutral Required**
- **Outputs Range from 2V @ 400A to 48V @ 42A (Standard)**

Available in both 1500 and 2000 watt versions which incorporate the unique HC Power MOSFET design, this new line solves a major problem faced by companies selling systems both domestically and in the European Community obtaining: a universally adaptable power source for *both* markets.

Every supply in the ECT Series may be externally strapped for operation on either US 208VAC or European 380/415VAC three-phase delta inputs, and *problems associated with neutral are totally eliminated.*

ECT Series Single Output Switchers

ECT15 VDC @A	ECT 21 VDC @A
2 @ 340	2 @ 400
3.3 @ 340	3.3 @ 400
4.5 @ 300	4.5 @ 400
5 @ 300	5 @ 400
5.2 @ 280	5.2 @ 380
12 @ 125	12 @ 167
15 @ 100	15 @ 137
18 @ 83	18 @ 111
24 @ 63	24 @ 84
28 @ 54	28 @ 72
36 @ 42	36 @ 56
48 @ 31	48 @ 42

New HCT Series Offers Economical Three-Phase Input and Power Factor Correction for Domestic Applications

This new line features a power MOSFET design with current control mode and a unique two-stage current limit that allows for momentary overloads but will shut down prior to damage to costly backplanes and wiring. Available in 1500 and 2000W Series.

These new switch mode supplies operate on 180-264 VAC, 47-63Hz three phase input, while offering .92 (typical) power factor correction.

Choose from one to four outputs in the HTC 15 Series and single output only in the HCT21 Series. Contact applications engineering.

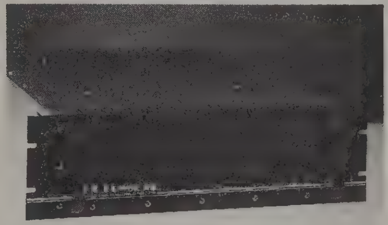
HotSwap™ Redundant Power Systems
See Next Right Hand Page

Power Conditioning & Battery Chargers
See Following Page

DEDICATED TO THE DESIGN AND MANUFACTURE OF HIGH POWER SWITCHERS.

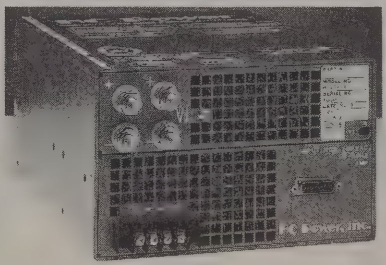
SPECIALTY POWER PRODUCTS
Custom Rack Assemblies

These rack-mounted custom power assemblies can be economically packaged to satisfy your specific power requirements, while enhancing systems reliability and reducing total power system cost. Each custom rack assembly is fully tested, and is designed to achieve higher power densities while maintaining long-term reliability. Select from any standard power modules. Consult Applications Engineering for full details.



MG Series Quasi-MIL Power Supplies

Available in 500, 1000, 1500 and 2000 watt configurations, these single- and multiple-output power supplies meet the environmental specifications of MIL-STD-810D. Derived from a proven line of switch mode power supplies with a field-demonstrated MTBF of more than 250,000 hours, the MG Series has been environmentally-enhanced to provide reliable operation under the most demanding conditions, at a cost substantially less than a full MIL-Spec supply.



ECT/HTC Specifications

INPUT SPECIFICATIONS

AC Input Range: HCT - 180-264 VAC, 47-63 Hz, three phase delta. **ETC** - 180-264 VAC, or 360-500 VAC, 47-63 Hz, three phase delta. Externally selectable.

Power Factor: .92 typical. (.90 minimum at 1/2 load or greater.)

Inrush current: Limited to 40A RMS maximum for 20 milliseconds.

Fusing: All units are fused internally.

Line Transient: Meets ANSI C62.41 (formerly IEEE-587-1980)

OUTPUT SPECIFICATIONS

Voltage Adjust Range: ± 10%

Load Regulation: 0.2% no load to full load.

Line Regulation: 0.2% over full input range.

Ripple and Noise: 1% or 50 mV, whichever is greater, when measured at the power supply terminals with a 20 MHz scope.

Turn On Delay: Under full load conditions the output will be in regulation in less than 500 milliseconds.

Output Polarity: The output is floating and may be referenced as desired by the user.

Minimum Load: *No* minimum loading is required.

LOGIC AND CONTROL

Remote Sense.
Remote Margin.
Remote Inhibit.
AC Power Fail Warning.
Current Sharing.
Current Monitor.
DC-OK.

PROTECTION

Over Voltage.
Over Current.
Thermal Shutdown.
Reverse Polarity.

HC Power, inc.

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Call Toll Free: (800) 486-4427 • FAX (714) 261-6584

New Answers in Power Conditioning

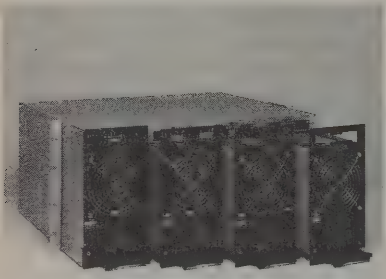
OFF ON
AC LINE
HC Power, Inc.
AC LOAD
AC LOAD
LINE
LOAD

PowerMiser™ .98 Power Factor Corrector Eliminates Harmonic Distortion

- **Meets IEC 555-2 & DOD-STD-1399**
- **Output Power Range from 500-4000W**
- **AC In/AC Out Stand-Alone Devices**
- **Ideal for Switcher-Powered Systems Operating on Line Voltage**
- **Complies with UL & IEC Safety Standards**

These versatile, stand-alone power factor correctors permit you to add .98 PF to an existing power system. This new concept assures safe, reliable operation of computers, business and medical equipment while reducing AC input by 30%.

PowerMiser converts the AC input current pulse typical of switching regulated power supplies to a wave form which closely approximates a sine wave. This enables *your* power system to be classified and tested as a Class A device under IEC-555-2, rather than the more restrictive Class D limits.

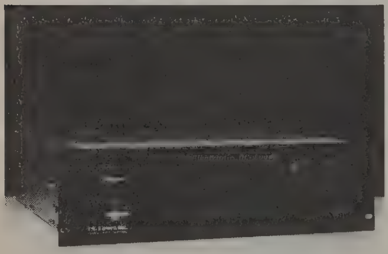


High Current Battery Charger System Uses 100 Amp Modules

- **Space-Saving Modular Design Combines High Performance with Light Weight**
- **Shelf-Mounted, Totally-Pluggable Switch Mode Rectifiers.**
- **Active Power Factor Correction**
- **Absolute Current Sharing between Modules and Power Shelves; Infinitely Expandable**
- **Choose from +24VDC or −48VDC**

The totally-modular design of these shelf-mounted rectifiers make them an ideal choice for battery charging systems. They are completely factory-assembled, wired and tested. Modules can be easily replaced while the system is in operation. System complies with IEC 555-2.

Automatic low voltage disconnect is available.



2500 Watt High Power DC Electronic Load for Bench, Burn-In and ATE Testing of Power Supplies

- **2500 Watts Capability**
- **1.75 Volt to 75 Volt Range; 500 Amps Maximum Current**
- **True Parallel Operation for Even Higher Current Requirements**
- **High Performance at Lowest Possible Cost**

HCL Series Electronic Loads have been specifically designed so they can be used for bench testing, intalled within 50°C burn-in chambers, or used in ATE systems. Load current can be adjusted by a manual control on the front panel or remotely by use of a D to A converter. These low cost, electronic loads will test power supplies with output voltages between 1.7 volts and 75 volts and with output currents up to 500 amps!

Only 5-1/4″ (3U) high they can be easily stacked in a 19″ rack. Depth is 21″ plus terminations. Front panel load connections, a manual current control, a digital panel meter, and an AC input switch with indicator light are all standard.

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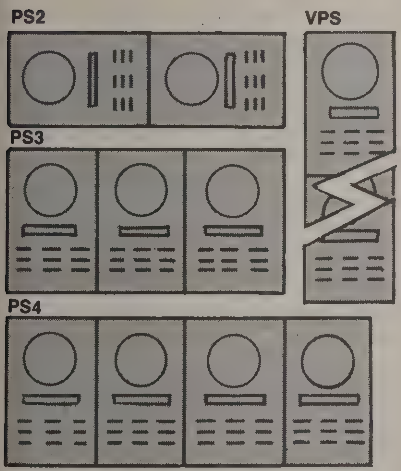
Glitch-Free Power Supply Replacement in Seconds!

- **500 to 40,000 Watts in Standard Racks; Custom Configurations Available.**
- **Wide Selection of Single and Multiple Output Power Modules, with Absolute Current Sharing.**
- **AC or DC Inputs**
- **1.2V to 48V Outputs**
- **19″, 24″ and Space-Saving Vertical Rack Mounting Systems**
- **Proven Reliability and .99 Power Factor Correction**

The HC Power HotSwap™ concept lets you replace power supplies quickly and easily, *without* shutting down your system. Select from literally hundreds of *standard,* high reliability HC power modules. We'll help you configure them in a standard, turn-key assembly—completely wired internally—that will satisfy your most demanding redundant power requirement.

The HotSwap system assures absolute current sharing between modules, while enhancing systems reliability. They have been field-proven by some of America's leading manufacturers of communications, process control and computer systems.

Best of all, the price of a HotSwap redundant power system is surprisingly low. Call today for details.



STANDARD HC POWER SHELVES

PS2 (19″x7″x18″ Typ)
PS3 (19″x10-1/2″x18″ Typ)
PS4 (24″x10-1/2″x18″ Typ)
VPS (5.5″w Vertical - Special)

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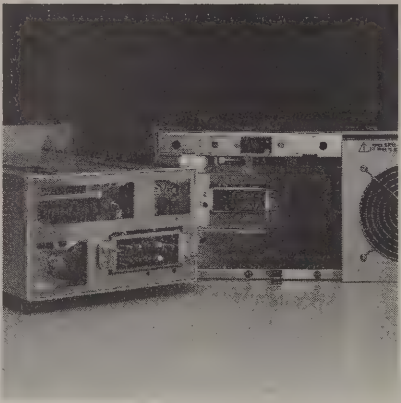
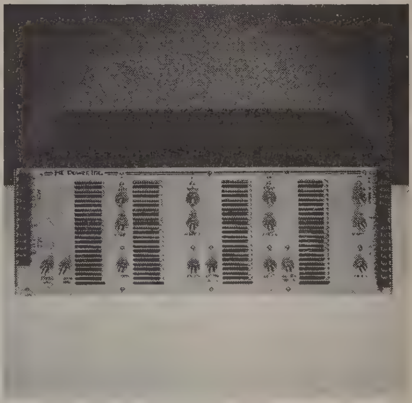
Swap it Hot!

HotSwap™ Redundant Power Supplier

HC Power, inc.
HC Power, inc.





PS Series—The Fault Tolerant Solution

This technically-advanced line of redundant power systems has been thoughfully designed for exceptional safety, error-free replacement in just seconds and the highest levels of systems reliability. No special adjustments or tools are required. The proprietary HC Power design eliminates *any* chance of wiring errors.

HOW TO ORDER

Select your required power supply module from the HC Power Switcher Selection Guide on the preceding page. Power modules from 500 to 2000 watts can be used in the PS2, PS3, PS4 and VP5 power shelves. 3000 and 4000 watt moduels can be used in the special HPS power shelf (Consult factory).

For Power Module Selection See Preceding Two Page Spread

Standard HotSwap Features

- **Input Power Breaker**
- **Voltage Adjustment Potentiometer—Each Output**
- **Voltage Test Points—Each Output**
- **Input & DC-OK Indicator Lights**
- **Heavy-Duty Barrier Strip or Studs for Input Power**
- **Studs for Hi-Current DC Outputs**
- **Barrier Strips for Auxiliary Output Voltage and Interface Signals**

HC Power, inc.

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Call Toll Free: (800) 486-4427 • FAX (714) 261-6584

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	second^{-1}	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

HITRAN

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components, power supplies and
control systems for over 40 years.

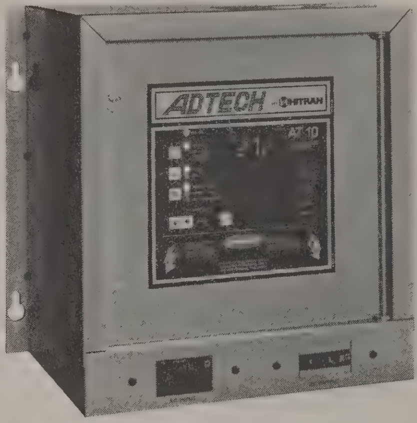
DC POWER SYSTEMS DC BATTERY CHARGERS

Also see our catalog pages under AC POWER SUPPLIES and TRANSFORMERS

AT10 SERIES STATIONARY FLOAT BATTERY CHARGERS

***AT10 SERIES** chargers and rectifiers are self-contained, constant potential, DC power supplies designed for floating and charging stationary batteries and/or supplying power to utility, communication and industrial type loads.*

***AT** means **Advanced Technology** microprocessor control.*



Design Features:

- Modular Construction – Rectifier, microprocessor control, input/output, power transformer, filter and alarm assemblies are all modular and easily replaceable.
- Long Life – All units are engineered for 30 years life with a MTBF of 60,000 hours (6.85 years)
- Field Serviceable – For fast service, enclosure and instrument panel are easily removable without disturbing chassis or installed conduit. Schematic and diagnostic information plates are mounted on enclosure. Modular construction and self diagnostics result in an MTTR of less than 60 minutes.
- Installation & Field Adjustment – Units are easily wall mounted. Control, alarm and operating level set points are adjusted digitally from the front panel while on-line, without the need to vary loads or external conditions.
- Safety – Units are designed and tested to Underwriter's Laboratory Standard UL-1564 and are UL listed.

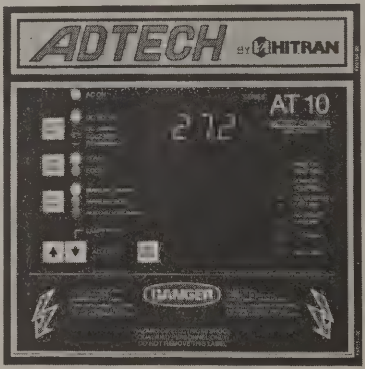
Specifications:

AC Input

- Voltage:120/208/240Volts +10%, -12%, single phase, 60Hz ±5%
- Power Factor: 0.80 typical at full load
- Efficiency: 85–90% (typical at 130Vdc) at 50–100% load

DC Output

- Voltage Ratings: 12, 24, 48, or 130Vdc nominal
- Current Ratings: 6, 12, 16, 20 or 25Adc
- Voltage Regulation: ±0.25% for line, load and temperature variations
- Current Limit: Adjustable from 50% to 110% of rated output current. Factory set to 110%
- Continuous Rating: 110% output at maximum equalize volts and at 50°C
- Electrical Noise: 30mVrms/32dBrnC weighted maximum on filtered units
- Surge Withstand Capability: Meets IEEE-472/ANSI C37.90a



All modes, operating level set points, and alarms can be set through front panel switches while on-line. LEDs and digital display show status at all times.

Models With Higher Ratings:

- SCR/SCRF series models are available with single or three phase AC input ratings up to 600V and DC output ratings to 800Adc at 12, 24, 48, 130 or 260Vdc nominal. Ask for detailed literature and specifications.

Standard Features:

- 1% Digital LED display meter for Vdc, Adc, timer hours and alarm levels
- AC input and DC output circuit breakers
- Float/Equalize selector switch with indicator lights
- Manual equalize timer (0–255 hr.) with indicator light
- AC line failure automatic equalize timer (0–255 hr.) with indicator light
- Local or remote voltage sense
- High DC voltage shut-down
- Reverse polarity protection
- Front panel controls can be disabled for security
- MOV surge supressors
- I/O compression lugs
- Switchboard wire, UL VW-1
- Membrane front panel
- ANSI 61 gray baked epoxy finish

Options/Accessories:

- Output filter for 30mVrms ripple
- Battery eliminator filter
- Alarm assembly with local LED's and summary relay contact for AC failure, DC failure, High Vdc, Low Vdc, Positive and Negative ground fault
- Alarm contacts for each alarm
- 480 Volt single phase, 60Hz input
- 50Hz input
- Input lightning arrestor
- Medium/High AIC circuit breakers
- Temperature compensation via remote probe
- Ground pad with #4 AWG lug
- Fungus proofing (Tropicalization)
- Floor stand or rack mounting
- Drip shield
- Cabinet heater
- NEMA 4 or NEMA 12 enclosures
- Provision for locking front panel

Enclosure Size (inches):

- 12V:6 to 25A; 24V: 6 to 25A; 48V: 6 to 12A; and 130V: 6A models:

  15.5 H x 16.25 W x 10.75 D
- 48V: 16 to 25A; and 130V: 12 to 25A models:

  17.75 H x 19.5 W x 13.25 D

Designs and specifications subject to change without notice.

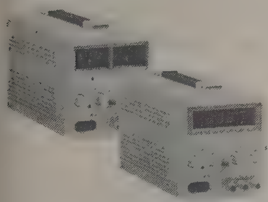
362 Highway 31 • Flemington, New Jersey 08822 • Tel: 908/782-5525 • Fax: 908/782-9733

INSTEK CORPORATION

1205 JOHN REED COURT, CITY OF INDUSTRY, CA 91745
TEL: 818-336-6537/FAX: 818-369-1748

ELECTRONIC TEST INSTRUMENTS

DC Power Supply



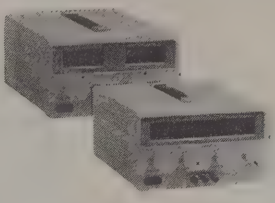
PS- Small Series (Analog/Digital)

• External programmable and remote control • Continuous or Dynamic load for internal selectable • Low ripple and noise • 0.01% high regulation • Overload and Reverse polarity protection • Series or Parallel operation function • Light and compact design • Constant voltage and constant current modes • 3 ½ Digits 0.5" LED display (Digital type only)

SPECIFICATIONS

CONSTANT VOLTAGE MODE:
Regulation: Line regulation ≤0.01% + 3mV. Load regulation ≤0.01% + 3mV (rating current >3A). ≤0.01% + 5mV (rating current >3A). **Ripple & Noise:** ≤0.5mVrms 5Hz~1MHz (rating current ≤3A). **Recovery Time:** ≤100us (50% load change, minimum load 0.5A). **Temp. Coefficient:** ≤300PPM/°C. **Output Range:** 0 to rating voltage continuously adjustable.
CONSTANT CURRENT MODE:
Regulation: Line regulation ≤0.2% + 3mA. Load regulation ≤0.2% + 3mA.. **Ripple Current:** ≤3mA rms. **Output Range:** 0 to rating current continuously adjustable.
METER:
Analog: Voltmeter and Ammeter each one pc. 2.5 class. Dimensions 50 x 50mm. **Digital:** 3 1/2 Digits 0.5" LED display (voltage and current switchable). Accuracy ±(0.5% of rdg + 2 digits).
INSULATION:
Chassis and Terminal: 20mΩ or above (DC 500V). **Chassis and AC Cord:** 30mΩ or above (DC 500V).
POWER SOURCE:
AC 100V, 120V, 220V, 240V ±10% 50/60Hz (External switchable).

DC Power Supply



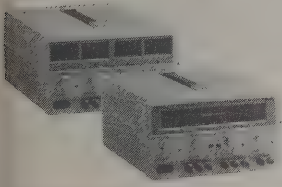
PR-Middle Series (Analog/Digital)

• Continuous or Dynamic load for internal selectable • Low ripple and noise • 0.01% high regulation • Overload and Reverse polarity protection • Constant voltage and constant current modes • 3½ Digits 0.5" LED display (Digital type only)

SPECIFICATIONS

CONSTANT VOLTAGE MODE:
Regulation: Line regulation ≤0.01% + 3mV. Load regulation ≤0.01% + 5mV (<10A). ≤0.02% + 5mV (≥10A). **Ripple & Noise:** ≤1mVrms, 5Hz~1MHz. **Recovery Time:** 100μs (50% load change, minimum load 0.5A). **Output Range:** 0 to rating volts continuously adjustable.
CONSTANT CURRENT MODE:
Regulation: Line regulation ≤0.2% + 3mA. Load regulation ≤0.2% + 3mA.. **Ripple Current:** ≤3mA rms. **Output Range:** 0 to rating current continuously adjustable.
METER:
Analog: Voltmeter and Ammeter each one. 2.5 class. Dimensions 60 x 80mm. **Digital:** 3 ½ Digits 0.5" LED display. Accuracy ±(0.5% of rdg + 2 digits).
INSULATION:
Chassis and Terminal: 20mΩ or above (DC 500V). **Chassis and AC Cord:** 30mΩ or above (DC 500V).
POWER SOURCE:
AC 100V, 120V, 220V, 240V ±10% 50/60Hz. (External switchable).
ACCESSORIES:
Test Lead GTL-105 x 1 or GTL-104 x 1 (>3A). Instruction manual x 1.

Triple-Output Power Supply



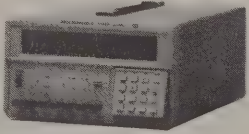
PC-3030/PC-3030D (Analog/Digital)

• Auto tracking • Auto series and parallel operation • Continuous or Dynamic load for internal selectable • Low ripple and noise • Overload and Reverse polarity protection • Constant voltage and constant current modes • Two digital pannel meters (PC-3030D) • Four analog meters (PC-3030)

SPECIFICATIONS

OPERATION MODE:
Independent: Two independent outputs and 5V fixed output. Output from 0 to rating volts and 0 to rating amperes. **Series:** Output from 0 to ± rating volts at rating amperes each. Output from 0 to double rating volts at rating amperes. **Parallel:** Output from 0 to double rating amperes at rating volts.
CONSTANT VOLTAGE MODE:
Regulation: Line regulation ≤0.01% + 3mV. Load regulation ≤0.01% + 3mV. **Ripple & Noise:** ≤1mVrms, 5Hz~1MHz. **Recovery Time:** ≤100μs (50% load change, minimum load 0.5A)
CONSTANT CURRENT MODE:
Regulation: Line regulation ≤0.2% + 3mA. Load regulation ≤0.2% + 3mA.. **Ripple Current:** ≤3mA rms.
TRACKING OPERATION:
Tracking Error: ≤0.5% + 10mV of the master. **Series Regulation:** ≤300mV.
METER:
Analog: Voltmeter and Ammeter each two pc. 2.5 class. Dimensions 50 x 50 mm. **Digital:** 3 1/2 Digits panel meter x 2. 0.5" LED display. Accuracy ±(0.5% of rdg + 2 digits).

Programmable Power Supplies



PPT-3615

- **Easy Operation,with UP/DOWN key**
- **High Stability, Low`Drift • High Resolution: 10mV, 1 mA • 4 Digit Display • Over Voltage Protection, Over Current Protection**
- **Memory Store and recall 100 points for PPS-3635. 50 points for PPT-3615**
- **Self Test, Confirm Performance**
- **FRONT/REAR switch select (output)**
- **Triple Output (for PPT-3615 only)**
- **Auto Tracking (for PPT-3615 only)**
- **Auto Series and Parallel Operation (for PPT-3615 only) • Every STEP with a timer • IEEE-488.2 (Option)**

SPECIFICATIONS:
Independent Mode: 3 independent outputs
Outputs from: (0-36V, 0-1.5A) x 2
0-8V, 0-3A
Series output: 0-±72V, 0-1.5A
Parallel output: 0-36V, 0-3A
Constant Voltage Mode:
Line Regulation: ≤ 3mV
Load Regulation: ≤ 3mV
Ripple & Noise:
Voltage: 1mVrms/3mVp-p
Noise: 2mVrms/30mVp-p
Current: ≤ 3mArms

Read back resolution:
V=10Mv,C=≤.2%+10mA
Readback Voltage ACC:
V=≤.05%+25mV, C=≤.2%+10mA
Response Time:
Voltage up: ≤100 ms
No Load: ≤100ms
Voltage down: Full load ≤150ms
Light load ≤150ms
Memory: PPT 3615=50 points;
PPS3635=100 points
Timer: 1sec.-255min., Resolution: 1sec.
Function: output loop, **Meter:** 4 digit display

With over fifteen years of manufacturing experience - **INSTEK** offers a complete family of test instruments which are manufactured under the compliance of the new *ISO9000 Regulations*.

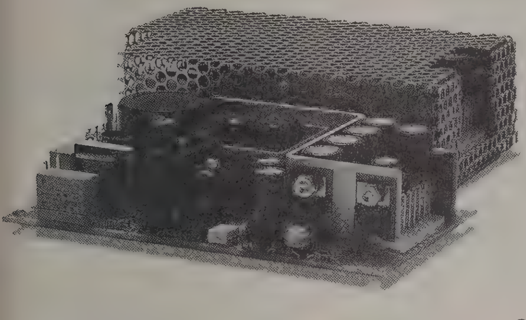
These instruments range from: **Hand Held Multimeters** (5 different models) to bench top **DMM's** (from 3½ to 5½ digits with IEEE); **Oscilloscopes** from 20MHz to 100MHz (with and without Cursors and Readouts); **Function Generators** (some with built-in Frequency Counters); **Frequency Counters** from 0.01Hz to 1.3GHz; **DC Power Supplies** (from Single Outputs to Triple Outputs - voltages from DC to 1000V available with Currents from 0 to 100 Amps; **HI-POT TESTERS:** AC/DC capabilities in one box, from manual to automatics; Ground Continuity Testers as well.

THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

ALL MODELS ARE SAFETY AGENCY APPROVED

Universal Input AC/DC Power Supplies



SRW SERIES FEATURES:

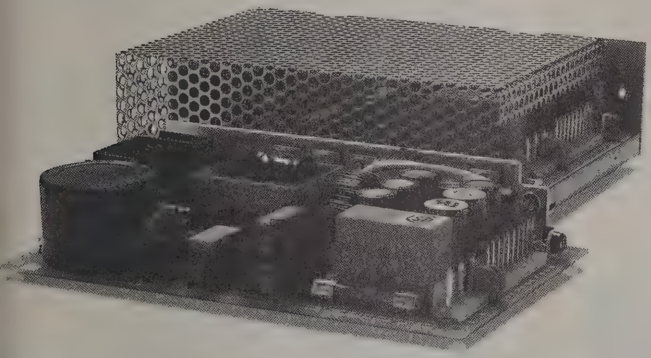
- ☐ Low Profile
- ☐ One to Four Outputs
- ☐ FCC/VDE Level "B" Input Filter
- ☐ All Models UL, CSA and TUV Certified
- ☐ Optional Chassis & Cover

Compact 3" x 5" x 1.1" size

45 watt SRW-45

	Model No.	Output 1	Output 2	Output 3	Output 4
QUADS	SRW-45-4001	+5V@5A	-5V@2A	+12V@0.7A	-12V@0.7A
	SRW-45-4002	+5V@5A	-5V@2A	+15V@0.7A	-15V@0.7A
	SRW-45-4003	+5V@5A	+24V@1A	+12V@0.7A	-12V@0.7A
	SRW-45-4004	+5V@5A	+24V@1A	+15V@0.7A	-15V@0.7A
	SRW-45-4005	+5V@5A	+24V@1A	-12V@0.7A	-5V@0.7A
	SRW-45-4006	+5V@5A	+15V@2A	-15V@0.7A	-15V@0.7A
TRIPLES	SRW-45-3001	+5V@5A	+12V@3A		-12V@0.7A
	SRW-45-3002	+5V@5A	+15V@2A		-15V@0.7A
	SRW-45-3003	+5V@5A	+24V@1.5A		-12V@0.7A
DUALS	SRW-45-2001	+5V@5A	+12V@3A		
	SRW-45-2002	+5V@5A	-5V@4A		
	SRW-45-2003	+5V@5A	+24V@1.5A		
	SRW-45-2004	+12V@3A	-12V@2A		
	SRW-45-2005	+15V@2.5A	-15V@2A		
SINGLES	SRW-45-1001	+5V@9A			
	SRW-45-1002	+12V@3.75A			
	SRW-45-1003	+15V@3A			
	SRW-45-1004	+24V@1.9A			

Other output combinations available, please consult factory

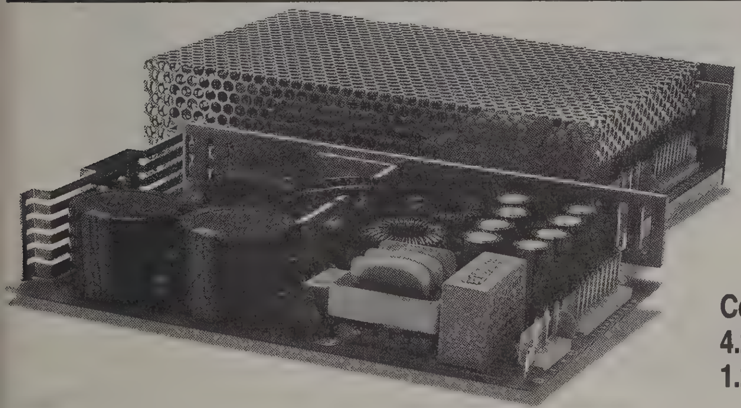


Compact 4"x 6" x 1.1" size

65 watt SRW-65

	Model No.	Output 1	Output 2	Output 3	Output 4
QUADS	SRW-65-4001	+5V@5A	-5V@3A	+12V@2A	-12V@2A
	SRW-65-4002	+5V@5A	+12V@1A	+12V@2A	-12V@2A
	SRW-65-4003	+5V@5A	+24V@1A	+12V@2A	-12V@2A
	SRW-65-4004	+5V@5A	-5V@3A	+15V@2A	-15V@2A
	SRW-65-4005	+5V@5A	+24V@1A	+12V@2A	-5V@2A
	SRW-65-4006	+5V@5A	+24V@1A	+15V@2A	-15V@2A
TRIPLES	SRW-65-3001	+5V@5A		+12V@3A	-12V@1A
	SRW-65-3002	+5V@7A		+12V@2A	-12V@2A
	SRW-65-3003	+5V@7A		+15V@2A	-15V@2A
	SRW-65-3004	+5V@5A	-5V@4A	+12V@2A	
	SRW-65-3005	+5V@5A	-5V@4A	+24V@1A	
DUALS	SRW-65-2001	+5V@7A			-5V@5A
	SRW-65-2002	+5V@7A		+12V@3A	
	SRW-65-2003	+12V@3A			-12V@2.5A
	SRW-65-2004	+15V@2.5A			-15V@2A
	SRW-65-2005	+5V@7A		+24V@1.5A	
SINGLES	SRW-65-1001	+5V@13A			
	SRW-65-1002	+12V@5.4A			
	SRW-65-1003	+15V@4.3A			
	SRW-65-1004	+24V@2.7A			

Other output combinations available, please consult factory



Compact 4.25" x 7"x 1.2" size

115 watt SRW-115

	Model No.	Output 1	Output 2	Output 3	Output 4
QUADS	SRW-115-4001	+5V@12A	-5V@4A	+12V@4A (6Apk)	-12V@2A
	SRW-115-4002	+5V@12A	+24V@1A	+12V@4A (6Apk)	-12V@2A
	SRW-115-4003	+5V@12A	-5V@4A	+15V@3A (4Apk)	-15V@2A
	SRW-115-4004	+5V@12A	+24V@1A	+15V@3A (4Apk)	-15V@2A
	SRW-115-4005	+5V@12A	+12V@1A	+24V@3A	-12V@1A
TRIPLES	SRW-115-3001	+5V@12A		+12V@4A (6Apk)	-12V@2A
	SRW-115-3002	+5V@12A		+15V@4A (6Apk)	-15V@2A
	SRW-115-3003	+5V@12A		+24V@3A	-12V@1A
DUALS	SRW-115-2001	+5V@12A		+24V@3A	
	SRW-115-2002	+12V@5A			-12V@5A
	SRW-115-2003	+15V@5A			-15V@5A
	SRW-115-2004	+24V@2.5A			-24V@2.5A

Other output combinations available, please consult factory

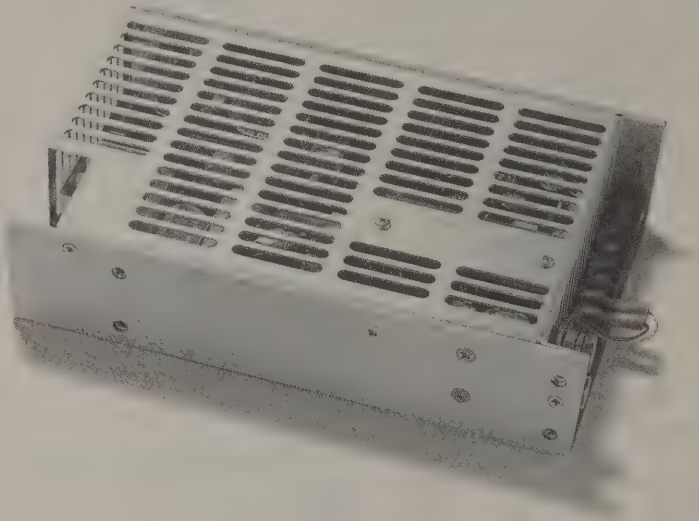
INTEGRATED POWER DESIGNS

Reserve your evaluation units or get additional information on our ready-to-ship universal input switchers.

300 Stewart Road, Wilkes-Barre, PA 18706 • Phone: (717) 824-4666 • Fax: (717) 824-4843

Universal Input AC/DC Power Supplies

SRW-200 SERIES



200 watt SRW-200

Model No.	Output 1	Output 2	Output 3	Output 4	Output 5
SRW-200-5001	5V/25A	24V/4A(6Apk)	12V/3A(4Apk)	12V/2A	5V/1A
SRW-200-5002	5V/25A	24V/4A(6Apk)	15V/3A(4Apk)	15V/2A	5V/1A
SRW-200-5003	5V/25A	12V/6A(8Apk)	12V/3A(4Apk)	24V/2A	5V/1A
SRW-200-5004	5V/25A	15V/4A(6Apk)	15V/3A(4Apk)	24V/2A	5V/1A
SRW-200-5005	5V/25A	24V/4A(6Apk)	24V/2A(3Apk)	12V/2A	12V/1A
SRW-200-4001	5V/25A	12V/6A(8Apk)	5V/3A(4Apk)	12V/2A	
SRW-200-4002	5V/25A	24V/4A(6Apk)	12V/3A(4Apk)	12V/2A	
SRW-200-4003	5V/25A	24V/4A(6Apk)	15V/3A(4Apk)	15V/2A	
SRW-200-4004	5V/25A	12V/6A(6Apk)	24V/2A(3Apk)	24V/2A	
SRW-200-4005	24V/5A	12V/6A(8Apk)	5V/3A(4Apk)	12V/2A	
SRW-200-3001	5V/25A	12V/6A(8Apk)	12V/3A(4Apk)		
SRW-200-3002	12V/10A	12V/6A(8Apk)	5V/3A(4Apk)		
SRW-200-2001	5V/25A	24V/4A(6Apk)			
SRW-200-2002	12V/10A	12V/6A(8Apk			
SRW-200-2003	15V/8A	15V/4A(6Apk			
SRW-200-2004	24V/5A	24V/4A(6Apk			

Additional combinations available, please consult factory

SRW-200 SERIES FEATURES:

❑ Universal Input ❑ Two to Five Outputs ❑ All Outputs Regulated
❑ Short Circuit Protected ❑ All Outputs Isolated ❑ Level "B" EMI Filter
❑ Remote Sense ❑ High Efficiency ❑ Compact 8.5" x4.9" x 1.9"size

SRW-300 SERIES

300 watt SRW-300

Model No.	Output 1	Output 2	Output 3	Output 4	Output 5
SRW-300-5001	5V/40A	24V/4A(6Apk)	12V/4A(6Apk)	12V/2A	5V/1A
SRW-300-5002	5V/40A	12V/8A(12Apk)	12V/4A(6Apk)	24V/2A	5V/1A
SRW-300-5003	5V/40A	15V/6A(8Apk)	15V/3A(4Apk)	24V/2A	5V/1A
SRW-300-5004	5V/40A	24V/4A(6Apk)	24V/2A(3Apk)	12V/2A	12V/1A
SRW-300-5005	24V/8A	12V/8A(12Apk)	5V/4A(5Apk)	15V/2A	15V/1A
SRW-300-4001	5V/40A	12V/8A(12Apk)	12V/4A(5Apk)	5V/2A	
SRW-300-4002	5V/40A	24V/4A(6Apk)	12V/4A(6Apk)	12V/2A	
SRW-300-4003	5V/40A	24V/4A(6Apk)	15V/3A(4Apk)	15V/2A	
SRW-200-4004	24V/8A	12V/8A(12Apk)	5V/4A(6Apk)	12V/2A	
SRW-300-3001	5V/40A	12V/8A(12Apk)	12V/4A(6Apk		
SRW-300-3002	12V/16A	12V/8A(12Apk)	5V/4A(6Apk)		
SRW-300-2001	5V/40A	24V/4A(6Apk)			
SRW-300-2002	12V/16A	12V/8A(12Apk			
SRW-300-2003	15V/13A	15V/6A(10Apk			
SRW-300-2004	24V/8A	24V/4A(6Apk			

Additional combinations available, please consult factory

SRW-300 SERIES FEATURES:

❑ Universal Input ❑ Two to Five Outputs ❑ All Outputs Regulated
❑ Short Circuit Protected ❑ All Outputs Isolated ❑ Level "B" EMI Filter
❑ Remote Sense ❑ High Efficiency ❑ Compact 8.5" x4.9" x 1.9"size

INTEGRATED POWER DESIGNS

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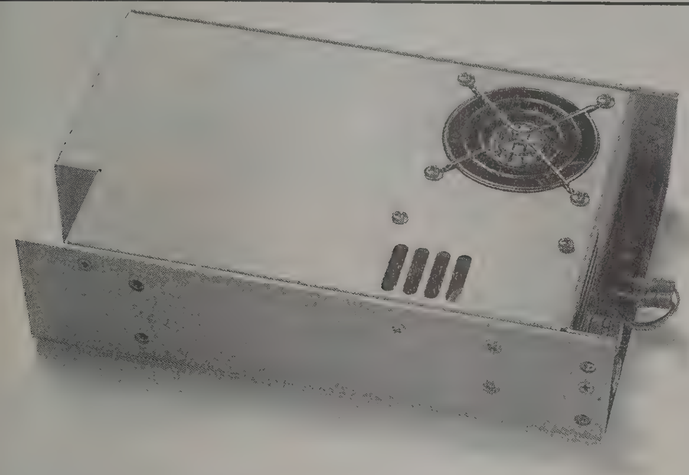
Universal Input Power Factor Corrected AC/DC Power Supplies

PFC-300 SERIES



300 watt **PFC-300**

Model No.	Output 1	Output 2	Output 3	Output 4	Output 5
PFC-300-5001	5V/40A	24V/4A(6Apk)	12V/4A(6Apk)	12V/2A	5V/1A
PFC-300-5002	5V/40A	12V/8A(12Apk)	12V/4A(6Apk)	24V/2A	5V/1A
PFC-300-5003	5V/40A	15V/6A(8Apk)	15V/3A(4Apk)	24V/2A	5V/1A
PFC-300-5004	5V/40A	24V/4A(6Apk)	24V/2A(3Apk)	12V/2A	12V/1A
PFC-300-5005	24V/8A	12V8A(12Apk)	5V4A(5Apk)	15V/2A	15V/1A
PFC-300-4001	5V/40A	12V8A(12Apk)	5V/4A(5Apk)	12V/2A	
PFC-300-4002	5V/40A	24V/4A(6Apk)	12V/4A(6Apk)	12V/2A)	
PFC-300-4003	5V/40A	24V/4A(6Apk)	15V3A(4Apk)	15V/2A	
PFC-300-4004	24V/8A	12V/8A(12Apk)	5V4A(6Apk)	12V/2A	
PFC-300-3001	5V/40A	12V/8A(12Apk)	12V/4A(6Apk)		
PFC-300-3002	12V/16A	12V/8A(12Apk)	5V/4A(6Apk)		
PFC-300-2001	5V/40A	24V/4A(6Apk)			
PFC-300-2002	5V/40A	12V/8A(12Apk)			
PFC-300-2003	15V/13A	15V/6A(10Apk)			
PFC-300-2004	24V/8A	24V/4A(6Apk)			

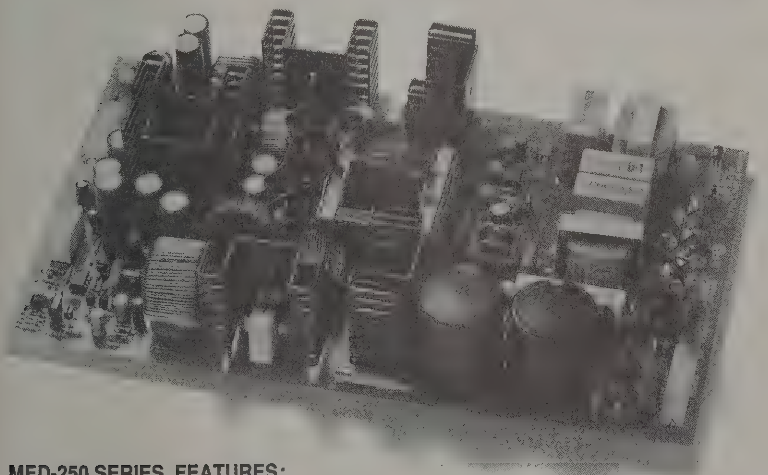
Additional combinations available, please consult factory

PFC-300 SERIES FEATURES:

☐ 0.99 Power Factor ☐ Low Harmonic Distortion ☐ Meets IEC 555-2
☐ Universal Input ☐ Two to Five Outputs ☐ All Outputs Regulated
☐ Short Circuit Protected ☐ All Outputs Isolated ☐ Level "B" EMI Filter
☐ Remote Sense ☐ Compact 8.5" x4.9" x 1.9"size ☐ Internal Fan

Universal Input Medical AC/DC Power Supplies

MED-250 SERIES



250 watt **MED-250**

Model No.	Output 1	Output 2	Output 3	Output 4
MED-250-001	+5V/12A	+12V/2A	-12V/1.5A	24V/6A
MED-250-002	+5V/12A	+24V/2A	-12V/1.5A	24V/6A
MED-250-003	+5V/12A	+12V/2A	-5V/1.5A	24V/6A
MED-250-004	+5V/12A	+12V/2A	-5V/1.5A	12V/6A
MED-250-005	+5V/12A	+15V/2A	-15V/1.5A	12V/6A
MED-250-006	+5V/12A	+15V/2A	-15V/2A	24V/6A
MED-250-007	+5V/12A		-12V/1.5A	12V/6A
MED-250-008	+5V/12A		-15V/1.5A	15V/6A
MED-250-009	+12V/12A		-12V/1.5A	5V/6A

Additional combinations available, please consult factory

Models 001 and 002 recognized UL544, certified CSA 22.2 No. 234 and TUV certified to IEC 601 and VDE 0750 TI / 5.82

Remaining models pending approvals.

MED-250 SERIES FEATURES:

☐ Universal Input ☐ Low Leakage Current ☐ Input Transient Protection
☐ Level "B" EMI Filter ☐ Three or Four Outputs ☐ All Outputs Regulated
☐ Short Circuit Protected ☐ Over Voltage Protected ☐ Thermal Protection
☐ Remote Sense ☐ Remote On/Off ☐ High Efficiency

IPD INTEGRATED POWER DESIGNS

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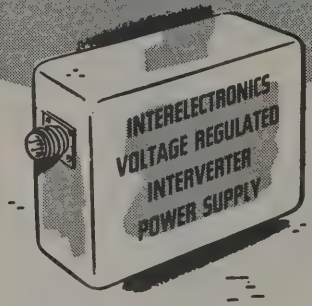
PROVEN RELIABILITY–

DC-DC, DC-AC, SOLID-STATE POWER INVERTERS

over 260,000 logged hours– voltage-regulated, frequency-controlled, for missile, telemeter, ground-support, 135°C all-silicon units available now–



Interelectronics all-silicon thyratron-like gating elements and cubic-grain toroidal magnetic components convert DC to any desired number of AC or DC outputs from 1 to 10,000 watts.

Ultra-reliable in operation (over 260,000 logged hours), no moving parts, unharmed by shorting output or reversing input polarity. High conversion efficiency (to 92%, including voltage regulation by Interelectronics patented reflex high-efficiency magnetic amplifier circuitry).

Wide input voltage range (1 to 250 volts DC). Wide input voltage regulation (output voltage maintained with variations up to 50% in input voltage).

Light weight (to 6 watts/oz.), compact (to 8 watts/cu. in.), low ripple (to 0.01 mv. p-p), excellent voltage regulation (to 0.1%), precise frequency control (to 0.2%) with Interelectronics extreme environment magnetostrictive standards or to 0.0001% with fork or piezoelectric standards.

Complies with MIL specs. for shock (100G 11 misc.), acceleration (100G 15 min.), vibration (100G 5 to 5,000 cps.), temperature (to 150 degrees C), RF noise (I-26600).

AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver up to ten times rated line current into a short circuit to actuate MIL type magnetic circuit breakers or fuses, will start gyros and motors with starting current surges up to ten times normal operating line current.

Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equipment. Single and polyphase units now power airborne and marine missile gyros, synchros, servos, magnetic amplifiers.

Interelectronics—first and most experienced in the solid-state power supply field produces its own all-silicon solid-state gating elements, all high flux density magnetic components, high temperature ultra-reliable film capacitors and components, has complete facilities and know how—has designed and delivered more working KVA than any other firm!

For complete engineering data, write Interelectronics today, or call (914) EL 8-8000 in Congers.

INTERELECTRONICS CORPORATION

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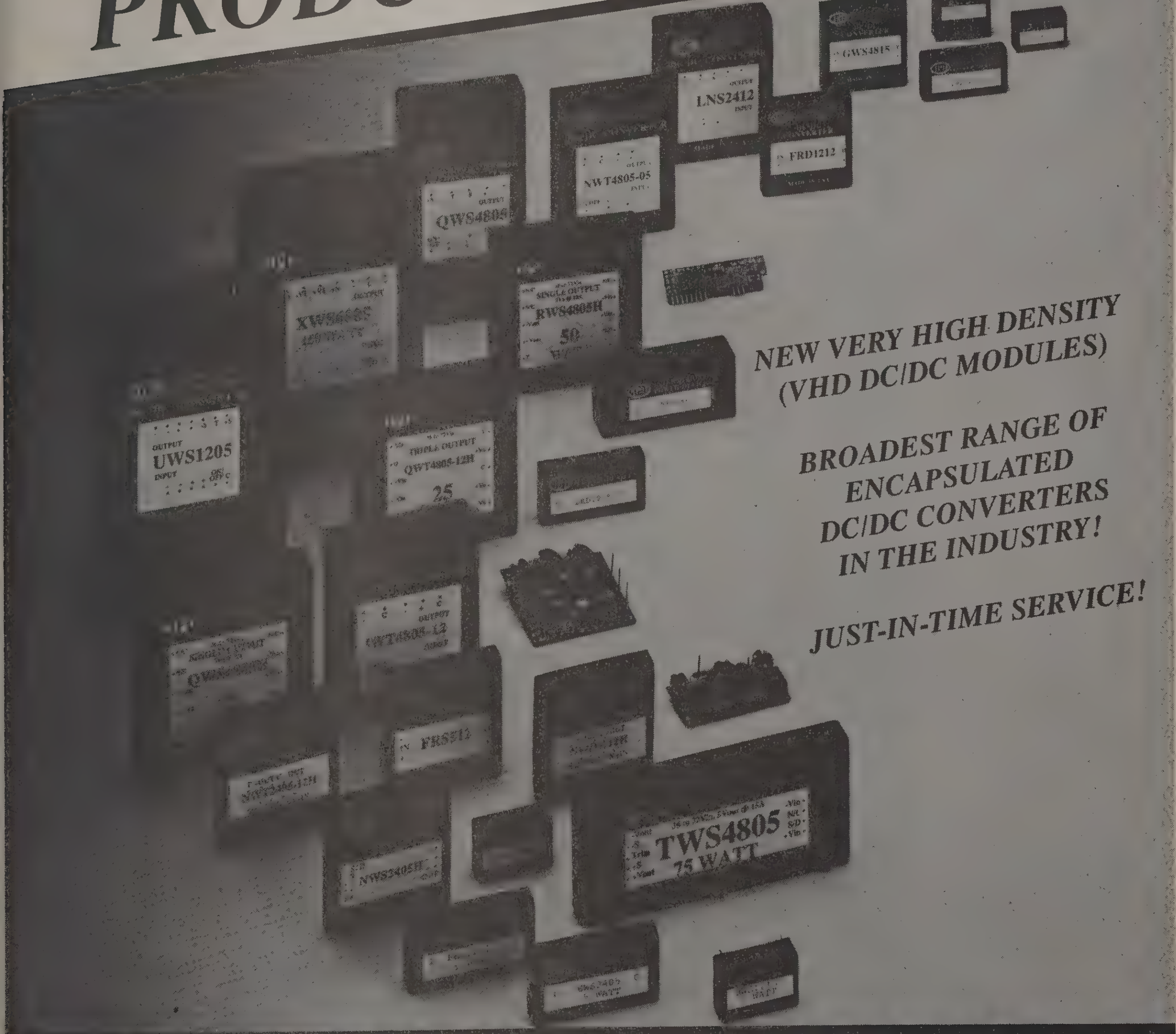
IPD™

INTERNATIONAL POWER DEVICES, INC.
PRODUCT SUMMARY


GWS4815
LNS2412
FRD1212
NWT4805-05
QWS4805
XWS
RWS4805H
50
UWS1205
QWT4805-12H
25
QWT4805-12
FRS
NWS2405H
TWS4805
75 WATT

NEW VERY HIGH DENSITY
(VHD DC/DC MODULES)

BROADEST RANGE OF
ENCAPSULATED
DC/DC CONVERTERS
IN THE INDUSTRY!

JUST-IN-TIME SERVICE!

0.5 TO 500 WATT STANDARD, MODIFIED AND CUSTOM

DC/DC CONVERTERS

INTERNATIONAL POWER DEVICES, INC.

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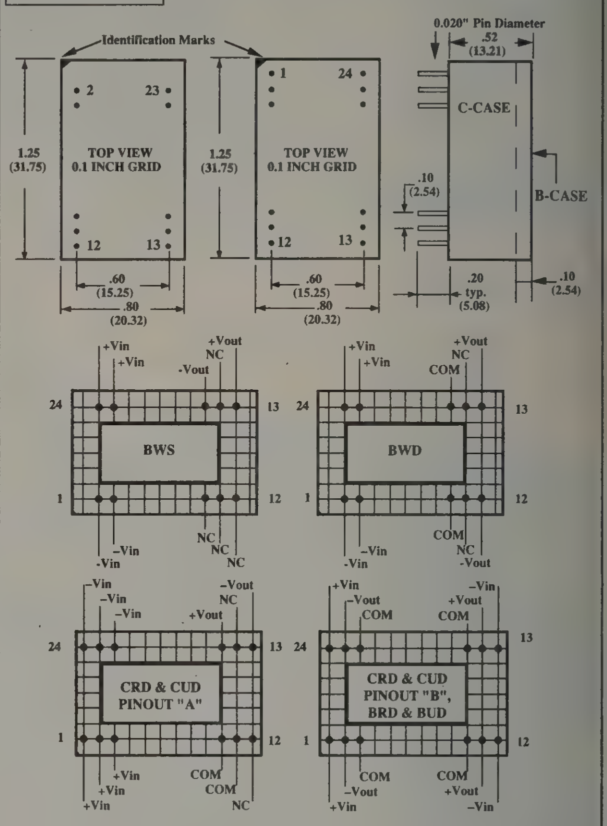
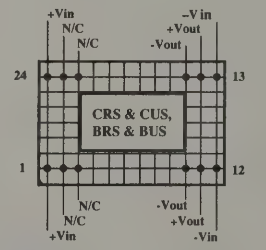
FEATURES	Vin	Vout/Iout	Eff	Case	Model
TO 1 WATT Regulated, Single & Dual Outputs 24-pin DIP Package	4.65 - 5.50	5V/100mA	32	C	CRS505
		12V/80mA	46		CRS512
		15V/65mA	53		CRS515
		±12V/±40mA	50		CRD512
		±15V/±33mA	50		CRD515
	10.9 - 13.2	5V/100mA	34	C	CRS1205
		12V/80mA	50		CRS1212
		15V/65mA	53		CRS1215
		±12V/±40mA	50		CRD1212
		±15V/±33mA	50		CRD1215
TO 2 WATT Unregulated, Single & Dual Outputs 24-pin DIP Package	4.5 - 5.5	5V/220mA	60	C	CUS505
		9V/150mA	64		CUS509
		12V/125mA	70		CUS512
		15V/100mA	72		CUS515
		±12V/±62mA	73		CUD512
		±15V/±50mA	73		CUD515
	10.8 - 13.2	5V/220mA	64	C	CUS1205
		9V/150mA	72		CUS1209
		12V/125mA	78		CUS1212
		15V/100mA	73		CUS1215
		±12V/±62mA	75		CUD1212
		±15V/±50mA	75		CUD1215
TO 2.4 WATT Regulated, Single & Dual Outputs	4.65 - 5.50	5V/300mA	50	C	BRS505
		9V/200mA	55		BRS509
		12V/150mA	57		BRS512
		15V/120mA	57		BRS515
		±5V/±100mA	53		BRD505
		±12V/85mA	58		BRD512
		±15V/70mA	60		BRD515
TO 3.6 WATT Unregulated, Single & Dual Outputs	4.65 - 5.50	5V/600mA	70	B	BUS505
		9V/330mA	75		BUS509
		12V/300mA	76		BUS512
		15V/240mA	78		BUS515
		±5V/±300mA	71		BUD505
		±12V/±150mA	77		BUD512
		±15V/±120mA	80		BUD515
TO 3 WATT Regulated, Single & Dual Outputs Wide Input Range 24-pin DIP Package	4.5 - 9.0	3.3V/450mA	70	C	BWS503.3
		5V/500mA	73		BWS505
		12V/250mA	79		BWS512
		15V/200mA	79		BWS515
		±5V/±250mA	73		BWD505
		±12V/±125mA	79		BWD512
		±15V/±100mA	79		BWD515
	9 - 18	5V/500mA	70	C	BWS1205
		12V/250mA	79		BWS1212
		15V/200mA	79		BWS1215
		±5V/±250mA	73		BWD1205
		±12V/±125mA	79		BWD1212
		±15V/±100mA	79		BWD1215
	18 - 36	5V/500mA	75	C	BWS2405
		12V/250mA	79		BWS2412
		15V/200mA	79		BWS2415
		±5V/±250mA	75		BWD2405
		±12V/±125mA	79		BWD2412
		±15V/±100mA	79		BWD2415
	36 - 72	5V/500mA	76	C	BWS4805
		12V/250mA	79		BWS4812
		15V/200mA	79		BWS4815
		±5V/±250mA	76		BWD4805
		±12V/±125mA	79		BWD4812
		±15V/±100mA	79		BWD4815
TO 2 WATT Regulated, Single & Dual Outputs	4.65 - 5.50	5V/250mA	43	D	DRS505
		12V/160mA	57		DRS512
		15V/130mA	58		DRS515
		±12V/±80mA	60		DRD512
		±15V/±65mA	64		DRD515
	10.9 - 13.2	5V/250mA	43	D	DRS1205
		12V/160mA	57		DRS1212
		15V/130mA	60		DRS1215
		±12V/±80mA	60		DRD1212
		±15V/±65mA	60		DRD1215
	21.6 - 26.4	5V/250mA	45	D	DRS2405
		12V/160mA	50		DRS2412
		15V/130mA	60		DRS2415
		±12V/±80mA	59		DRD2412
		±15V/±65mA	63		DRD2415
	25.2 - 30.8	5V/250mA	45	D	DRS2805
		12V/160mA	50		DRS2812
		15V/130mA	55		DRS2815
		±12V/±80mA	62		DRD2812
		±15V/±65mA	63		DRD2815
	43.2 - 52.8	5V/250mA	40	D	DRS4805
		12V/160mA	50		DRS4812
		15V/130mA	55		DRS4815
		±12V/±80mA	50		DRD4812
		+15V/±65mA	50		DRD4815
TO 6 WATT Unregulated, Single & Dual Outputs	4.65 - 5.50	5V/1000mA	76	D	DUS505
		12V/500mA	80		DUS512
		±12V/±250mA	80		DUD512
		±15V/±200mA	80		DUD515
		±18V/±165mA	79		DUD518
	10.9 - 13.2	5V/1000mA	79	D	DUS1205
		12V/500mA	85		DUS1212
		±12V/±250mA	80		DUD1212
		±15V/±200mA	81		DUD1215
		±18V/±165mA	82		DUD1218

B and C CASE



Identification Marks
0.020" Pin Diameter
.52 (13.21)
1.25 (31.75)
TOP VIEW 0.1 INCH GRID
1.25 (31.75)
TOP VIEW 0.1 INCH GRID
2
23
1
24
12
13
C-CASE
B-CASE
.10 (2.54)
.60 (15.25)
.80 (20.32)
.20 typ. (5.08)
.10 (2.54)
+Vin
+Vin
-Vout
NC
+Vout
BWS
-Vin
-Vin
NC
NC
NC
BWD
COM
-Vout
24
13
1
12
-Vin
-Vout
+Vout
CRD & CUD PINOUT "A"
+Vin
COM
CRD & CUD PINOUT "B", BRD & BUD



+Vin
N/C
N/C
-Vin
+Vout
-Vout
24
13
1
12
CRS & CUS, BRS & BUS

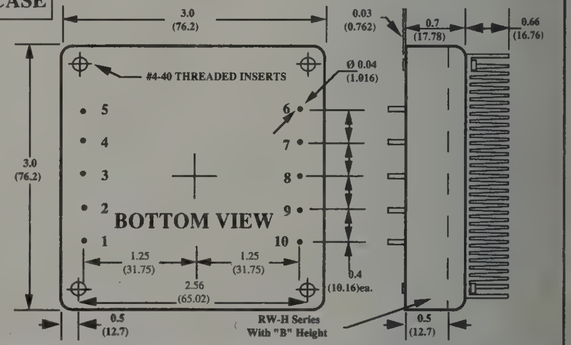
GRID SIZE IS 0.10 INCHES

TOP VIEW

THESE FAMILIES ARE ENCAPSULATED IN PHENOLIC CASES

* SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

R CASE



3.0 (76.2)
0.03 (0.762)
0.7 (17.78)
0.66 (16.76)
#4-40 THREADED INSERTS
Ø 0.04 (1.016)
3.0 (76.2)
BOTTOM VIEW
1
2
3
4
5
6
7
8
9
10
1.25 (31.75)
1.25 (31.75)
2.56 (65.02)
0.4 (10.16)ea.
0.5 (12.7)
RW-H Series With "B" Height
0.5 (12.7)

THESE MODULES ARE SHOWN WITH OPTIONAL HEATSINKS

Pin #	RWS-H	RWD-H	RWT-H
1	S/D	S/D	S/D
2	Case	Case	Case
3	+Vin	+Vin	+Vin
4	-Vin	-Vin	-Vin
5	No Pin	No Pin	No Pin
6	N/C	-Vout	-Vout 3
7	N/C	Common	+ Vout 2
8	-Vout	Common	Common
9	+Vout	+Vout	+Vout 5V
10	Trim	Trim	Trim

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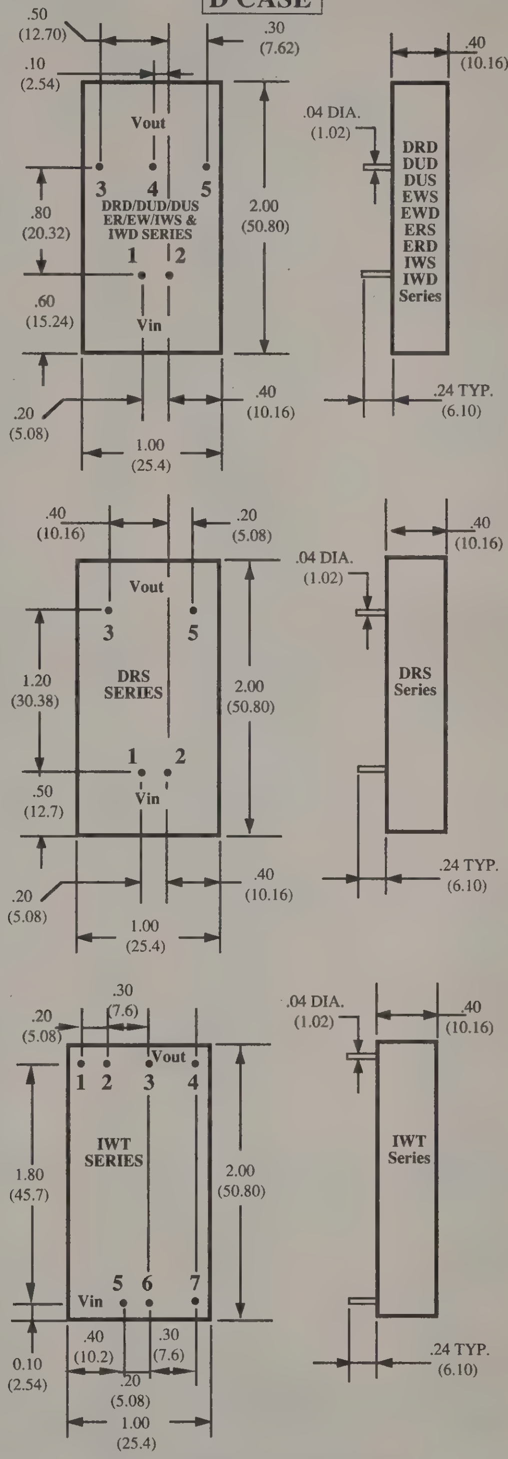
FEATURES	Vin	Vout/Iout	Eff	Case	Model
Continued from Page 1	21.6 - 26.4	5V/1000mA	80	D	DUS2405
	25.2 - 30.8	5V/1000mA	80		DUS2805
	43.2 - 52.8	5V/1000mA	81		DUS4805
TO 6 WATT Regulated, Single & Dual Outputs	4.65 - 5.50	5V/1000mA	64	F	FRS505
		12V/470mA	71		FRS512
		15V/400mA	70		FRS515
		±12V/±230mA	65		FRD512
		±15V/±190mA	66		FRD515
	10.9 - 13.2	5V/1000mA	61	F	FRS1205
		12V/470mA	68		FRS1212
		15V/400mA	67		FRS1215
		±12V/±230mA	66		FRD1212
		±15V/±190mA	67		FRD1215
	21.6 - 26.4	5V/1000mA	59	F	FRS2405
		12V/470mA	66		FRS2412
		15V/400mA	69		FRS2415
		±12V/±230mA	67		FRD2412
		±15V/±190mA	65		FRD2415
	25.2 - 30.8	5V/1000mA	66	F	FRS2805
		12V/470mA	74		FRS2812
		15V/400mA	66		FRS2815
		±12V/±230mA	65		FRD2812
		±15V/±190mA	65		FRD2815
	43.2 - 52.8	5V/1000mA	68	F	FRS4805
		12V/470mA	65		FRS4812
		15V/400mA	69		FRS4815
		±12V/±230mA	65		FRD4812
		±15V/±190mA	66		FRD4815
TO 10 WATT Unregulated, Single & Dual Outputs	4.65 - 5.50	5V/1500mA	80	F	FUS505
		12V/830mA	84		FUS512
		15V/670mA	84		FUS515
		±5V/±750mA	80		FUD505
		±12V/±415mA	83		FUD512
		±15V/±330mA	83		FUD515
		±18V/±300mA	84		FUD518
	10.9 - 13.2	5V/1500mA	80	F	FUS1205
		12V/830mA	84		FUS1212
		±5V/±750mA	80		FUD1205
		±12V/±415mA	84		FUD1212
		±15V/±330mA	84	F	FUD1215
	21.6 - 26.4	5V/1500mA	83	F	FUS2405
	43.2 - 52.8	5V/1500mA	76	F	FUS4805
		±5V/±750mA	80		FUD4805
TO 6 WATT Regulated, Single & Dual Outputs	4.65 - 5.50	5V/1000mA	60	D	ERS505
		12V/416mA	65		ERS512
		15V/333mA	70		ERS515
		±5V/±500mA	60		ERD505
		±12V/±208mA	70		ERD512
		±15V/±165mA	70		ERD515
NEW! TO 33 WATT Regulated, Non-Isolated Outputs	4.65 - 5.50	1.2V/10A	70	I	INS501.2
		1.5V/10A	72		INS501.5
		2.1V/10A	77		INS502.1
		3.3V/10A	85		INS503.3
TO 6 WATT High-Density Wide Input, Regulated, Single & Dual Outputs	4.5 - 9.0	5V/900mA	70	D	EWS505
		12V/400mA	73		EWS512
		15V/300mA	76		EWS515
		±5V/±450mA	72		EWD505
		±12V/±200mA	77		EWD512
		±15V/±150mA	77		EWD515
	9 - 18	5V/1000mA	73	D	EWS1205
		12V/500mA	80		EWS1212
		15V/400mA	82		EWS1215
		±5V/±500mA	73		EWD1205
		±12V/±250mA	80		EWD1212
		±15V/±200mA	83		EWD1215
	18 - 36	5V/1000mA	75	D	EWS2405
		12V/500mA	80		EWS2412
		15V/400mA	82		EWS2415
		±5V/±500mA	76		EWD2405
		±12V/±250mA	80		EWD2412
		±15V/±200mA	83		EWD2415
	36 - 72	5V/1000mA	79	D	EWS4805
		12V/500mA	82		EWS4812
		15V/400mA	83		EWS4815
		±5V/±500mA	80		EWD4805
		±12V/±250mA	80		EWD4812
		±15V/±200mA	83		EWD4815
7.5 to 45 Watt Non-Isolated, Regulated, Ultra-Wide Vin, Single Outputs	7 - 40	5V/5000mA	77	N	LKS705
	8 - 32	5V/1500mA	75	F	HNS1205
	9 - 40	5V/4000mA	75	N	LNS1205
	16 - 32	12V/700mA	83	F	HNS2412
	16 - 40	12V/3000mA	85	N	LNS2412
	19 - 32	15V/600mA	85	F	HNS2415
	19 - 40	15V/3000mA	87	N	LNS2415

Our products can be procured directly, or through the Distribution and/or Representative Network (For the list, please consult factory).

D CASE


.50
(12.70)
.30
(7.62)
.10
(2.54)
.40
(10.16)
Vout
3 4 5
DRD/DUD/DUS
ER/EW/IWS &
IWD SERIES
1 2
Vin
.80
(20.32)
2.00
(50.80)
.60
(15.24)
.04 DIA.
(1.02)
DRD
DUD
DUS
EWS
EWD
ERS
ERD
IWS
IWD
Series
.20
(5.08)
.40
(10.16)
1.00
(25.4)
.24 TYP.
(6.10)
.40
(10.16)
.20
(5.08)
Vout
3 5
DRS
SERIES
1 2
Vin
1.20
(30.38)
2.00
(50.80)
.50
(12.7)
.04 DIA.
(1.02)
.40
(10.16)
DRS
Series
.20
(5.08)
.40
(10.16)
1.00
(25.4)
.24 TYP.
(6.10)
.30
(7.6)
.20
(5.08)
Vout
1 2 3 4
IWT
SERIES
5 6 7
Vin
1.80
(45.7)
2.00
(50.80)
0.10
(2.54)
.40
(10.2)
.30
(7.6)
.20
(5.08)
1.00
(25.4)
.04 DIA.
(1.02)
.40
(10.16)
IWT
Series
.24 TYP.
(6.10)

BOTTOM VIEW

Pin #	DUS/ERS/EWS/IWS	All Dual Output Models	DRS	IWT
1	+Vin	+Vin	-Vin	+V2 Out
2	-Vin	-Vin	+Vin	+5V Out
3	+Vout	+Vout	-Vout	Common
4	NO PIN	Comm. Out	NO PIN	-V3 Out
5	-Vout	-Vout	+Vout	+Vin
6				-Vin
7				S/D (Optional)

2*

* SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

INTERNATIONAL POWER DEVICES, INC.

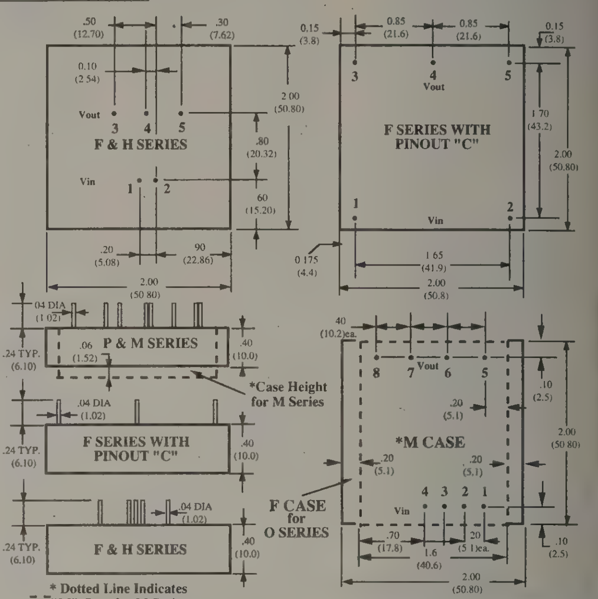
20 Linden St., Boston, MA 02134 • Phone: (617)782-3331 • Fax: (617)782-7416

FEATURES	Vin	Vout/Iout	Eff	Case	Model
NEW! TO 12 WATT High Density, High Isolation, Regulated, Single, Dual & Triple Outputs	4.5 - 9.0	3.3V/3300mA	74	D	IWS503.3
		5V/2000mA	78		IWS505
		12V/1000mA	80		IWS512
		15V/±750mA	82		IWS515
		24V/500mA	83		IWS524
		48V/250mA	84		IWS548
		±5V/±1000mA	74		IWD505
		±12V/500mA	78		IWD512
		±15V/±375mA	82		IWD515
		+5/±12V@+1.5A/±0.31A	78		IWT505-12
		+5/±15V@+1.5A/±0.25A	78		IWT505-15
	9 - 36	3.3V/3300mA	75	D	IWS2403.3
		5V/2000mA	80		IWS2405
		12V/1000mA	82		IWS2412
		15V/±750mA	84		IWS2415
		24V/500mA	85		IWS2424
		48V/250mA	86		IWS2448
		±5V/±1000mA	80		IWD2405
		±12V/500mA	82		IWD2412
		±15V/±375mA	84		IWD2415
		+5/±12V@+1.5A/±0.31A	80		IWT2405-12
		+5/±15V@+1.5A/±0.25A	80		IWT2405-15
	18 - 72	3.3V/3300mA	75	D	IWS4803.3
		5V/2000mA	80		IWS4805
		12V/1000mA	82		IWS4812
		15V/±750mA	84		IWS4815
		24V/500mA	85		IWS4824
		48V/250mA	86		IWS4848
		±5V/±1000mA	80		IWD4805
		±12V/500mA	82		IWD4812
		±15V/±375mA	84		IWD4815
		+5/±12V@+1.5A/±0.31A	81		IWT4805-12
		+5/±15V@+1.5A/±0.25A	81		IWT4805-15
	50 - 90	3.3V/3300mA	75	D	IWS7003.3
		5V/2000mA	82		IWS7005
		12V/1000mA	83		IWS7012
		15V/±750mA	84		IWS7015
		24V/500mA	85		IWS7024
		48V/250mA	90		IWS7048
		±5V/±1000mA	82		IWD7005
		±12V/500mA	83		IWD7012
		±15V/±375mA	84		IWD7015
		+5/±12V@+1.5A/±0.31A	82		IWT7005-12
		+5/±15V@+1.5A/±0.25A	82		IWT7005-15
15 WATT Ultra-Wide Input, High-Density Regulated, Single, Dual & Triple Outputs	9 - 27	5V/3000mA	78	M	MWS2405
		12V/1250mA	80		MWS2412
		15V/1000mA	81		MWS2415
		±5V/±1500mA	78		MWD2405
		±12V/±625mA	82		MWD2412
		±15V/±500mA	83		MWD2415
		+5/±12V@+1.5A/±0.31A	79		MWT2405-12
		+5/±15V@+1.5A/±0.25A	82		MWT2405-15
	20 - 60	5V/3000mA	82	M	MWS4805
		12V/1250mA	85		MWS4812
		15V/1000mA	86		MWS4815
		±5V/±1500mA	82		MWD4805
		±12V/±625mA	84		MWD4812
		±15V/±500mA	85		MWD4815
		+5/±12V@+1.5A/±0.31A	82		MWT4805-12
		+5/±15V@+1.5A/±0.25A	84		MWT4805-15
NEW! TO 30 WATT Ultra-Wide Input, Regulated, Single, Dual & Triple Outputs	9 - 36	5V/5000mA	81	Q	QES2405
		12V/2500mA	83		QES2412
		15V/2000mA	83		QES2415
		±5V/±2.5A	80		QED2405
		±12V/±1.25A	82		QED2412
		±15V/±1.0A	82		QED2415
		+5/±12V @ +3.8/±0.31A	80		QET2405-12
		+5/±15V @ +3.8/±0.25A	82		QET2405-15
		+12/±5V@+1.5/+1.0/-1.0A	82		QET2412-05
	18 - 72	5V/5000mA	82	Q	QES4805
		12V/2500mA	84		QES4812
		15V/2000mA	84		QES4815
		±5V/±2.5A	81		QED4805
		±12V/±1.25A	83		QED4812
		±15V/±1.0A	83		QED4815
		+5/±12V @ +3.8/±0.31A	81		QET4805-12
		+5/±15V @ +3.8/±0.25A	83		QET4805-15
		+12/±5V@+1.5/+1.0/-1.0A	83		QET4812-05
NEW! 25 WATT Wide Input, High-Density Regulated, Single, Dual & Triple Outputs	9 - 18	5V/5000mA	80	F	PWS1205
		12V/2083mA	83		PWS1212
		15V/1666mA	84		PWS1215
		±5V/2500mA	80		PWD1205
		±12V/1048mA	84		PWD1212
		±15V/±830mA	85		PWD1215
		+5/±12V@+3.5/±0.31A	81		PWT1205-12
		+5/±15V@+3.5/±0.25A	83		PWT1205-15
	18 - 36	5V/5000mA	83	F	PWS2405
		12V/2083mA	85		PWS2412
		15V/1666mA	86		PWS2415
		±5V/2500mA	83		PWD2405
		±12V/1048mA	85		PWD2412
		±15V/±830mA	86		PWD2415
		+5/±12V@+3.5/±0.31A	84		PWT2405-12
		+5/±15V@+3.5/±0.25A	84		PWT2405-15
	36 - 72	5V/5000mA	84	F	PWS4805
		12V/2083mA	86		PWS4812

3

F and M CASE

BOTTOM VIEW



.50 (12.70)
.30 (7.62)
0.10 (2.54)
Vout
3 4 5
F & H SERIES
Vin
1 2
2.00 (50.80)
.80 (20.32)
60 (15.20)
.20 (5.08)
90 (22.86)
2.00 (50.80)
0.15 (3.8)
0.85 (21.6)
0.85 (21.6)
0.15 (3.8)
3 4 5
Vout
F SERIES WITH PINOUT "C"
1.70 (43.2)
2.00 (50.80)
1 2
Vin
0.175 (4.4)
1.65 (41.9)
2.00 (50.8)
.04 DIA (1.02)
.06 (1.52)
P & M SERIES
.24 TYP. (6.10)
.40 (10.0)
*Case Height for M Series
.04 DIA (1.02)
F SERIES WITH PINOUT "C"
.24 TYP. (6.10)
.40 (10.0)
.04 DIA (1.02)
F & H SERIES
.24 TYP. (6.10)
.40 (10.0)
40 (10.2)ea.
8 7 Vout 6 5
.10 (2.5)
.20 (5.1)
*M CASE
2.00 (50.80)
.20 (5.1)
.20 (5.1)
4 3 2 1
Vin
F CASE for O SERIES
.70 (17.8)
1.6 (40.6)
20 (5.1)ea.
.10 (2.5)
2.00 (50.80)

* Dotted Line Indicates "M" Case for M Series

Pin #	PWS/ MWS	PWD/ MWD	MWT	PWT	FRS/ FUS	FRD/ FUD	HNS
1	S/D	S/D	S/D	S/D	+Vin	+Vin	+Vin
2	N/C	N/C	N/C	N/C	-Vin	-Vin	Com In
3	-Vin	-Vin	-Vin	-Vin	+Vout	+Vout	+Vout
4	+Vin	+Vin	+Vin	+Vin	N/C	Comm	Trim
5	Trim	Trim	+5Vout	-Aux. Out	-Vout	-Vout	Com Out
6	-Vout	-Vout	Common	Common			
7	+Vout	Comm	+Aux. Out	+5Vout			
8	N/C	+Vout	-Aux. Out	+Aux. Out			

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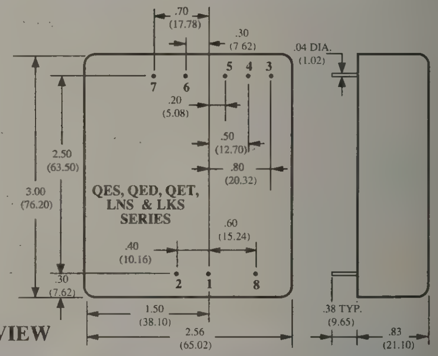
Q CASE



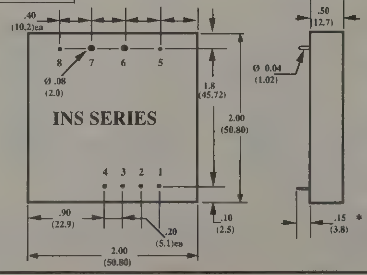
.70 (17.78)
.30 (7.62)
.04 DIA. (1.02)
5 4 3
7 6
.20 (5.08)
.50 (12.70)
.80 (20.32)
2.50 (63.50)
3.00 (76.20)
QES, QED, QET, LNS & LKS SERIES
.60 (15.24)
.40 (10.16)
.30 (7.62)
2 1 8
1.50 (38.10)
2.56 (65.02)
.38 TYP. (9.65)
.83 (21.10)

BOTTOM VIEW

Pin #	LKS/LNS/QES	QED	QET
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
3	+Sense Out	+Vout	+Vout
4	Trim	Common	Common
5	-Sense Out	-Vout	-Vout
6	-Vout	N/C	+5Vout
7	+Vout	N/C	N/C
8	S/D (Optional)	S/D	S/D

* SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

I CASE



.40 (10.2)ea
8 7 6 5
Ø .08 (2.0)
INS SERIES
1.8 (45.72)
2.00 (50.80)
4 3 2 1
.90 (22.9)
.20 (5.1)ea
.10 (2.5)
2.00 (50.80)
.50 (12.7)
Ø 0.04 (1.02)
.15 (3.8)

Pin #	INS
1	S/D
2	N/C
3	-Vin
4	+Vin
5	-Sense
6	-Vout
7	+Vout
8	+Sense

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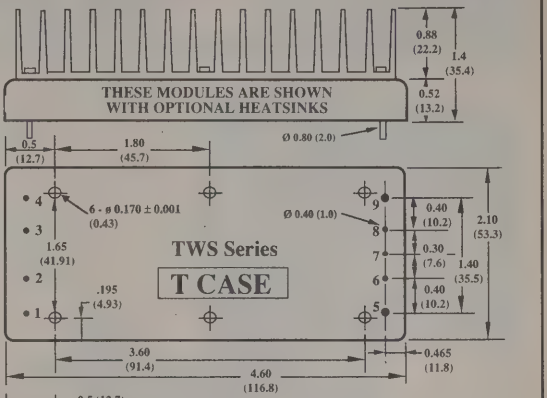
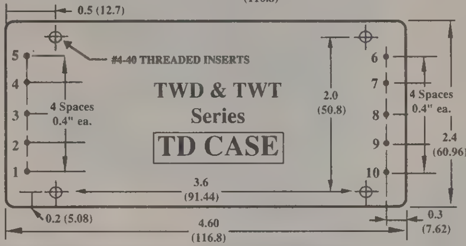
INTERNATIONAL POWER DEVICES, INC.

20 Linden St., Boston, MA 02134 • Phone: (617)782-3331 • Fax: (617)782-7416

FEATURES	Vin	Vout/Iout	Eff	Case	Model
CONTINUED: High-Density Regulated, Single, Dual & Triple Outputs	36 - 72	15V/1666mA	86	F	PWS4815
		±5V/2500mA	83		PWD4805
		±12V/1048mA	85		PWD4812
		±15V/±830mA	85		PWD4815
		+5/±12V@+3.5/±0.31A	81		PWT4805-12
		+5/±15V@+3.5/±0.25A	83		PWT4805-15
TO 60 WATT Wide Input, High-Density Regulated, Single, Dual & Triple Outputs	9 -18	5V/10A	80	R	RWS1205H
		12V/5A	82		RWS1212H
		15V/4A	81		RWS1215H
		±5V/±5A	80		RWD1205H
		±12V/±2.5	82		RWD1212H
		±15V/±2A	81		RWD1215H
	18 - 36	5V/10A	80	R	RWS2405H
		12V/5A	83		RWS2412H
		15V/4A	83		RWS2415H
		±5V/±5A	81		RWD2405H
		±12V/±2.5	83		RWD2412H
		±15V/±2A	82		RWD2415H
	36 - 72	5V/10A	80	R	RWS4805H
		12V/5A	84		RWS4812H
		15V/4A	83		RWS4815H
		±5V/±5A	82		RWD4805H
		±12V/±2.5	83		RWD4812H
		±15V/±2A	82		RWD4815H
	10 - 20	+5/±12V@+5/±1.25A	79	R	RWT1205-12H
		+5/±15V@+5/±1A	81		RWT1205-15H
	18 - 36	+5/±12V@+5/±1.25A	82	R	RWT2405-12H
		+5/±15V@+5/±1A	82		RWT2405-15H
	36 - 72	+5/±12V@+5/±1.25A	83	R	RWT4805-12H
		+5/±15V@+5/±1A	83		RWT4805-15H
TO 100 WATT Wide Input, High-Density Regulated, Single, Dual & Triple Outputs	10 - 20	5V/10A	80	T	TWS1205
		12V/4.1A	82		TWS1212
		15V/3.33A	82		TWS1215
		±5V/±5A	80	TD	TWD1205
		±12V/±2.05A	82		TWD1212
		±15V/±1.67A	81		TWD1215
	18 - 36	5V/15A	79	T	TWS2405
		12V/8.3A	82		TWS2412
		15V/6.6A	82		TWS2415
		±5V/±7.5A	83	TD	TWD2405
		±12V/±3.12A	82		TWD2412
		±15V/±2.5A	84		TWD2415
	36 - 72	5V/15A	80	T	TWS4805
		12V/8.3A	84		TWS4812
		15V/6.6A	84		TWS4815
		±5V/±7.5A	82	TD	TWD4805
		±12V/±3.12A	84		TWD4812
		±15V/±2.5A	84		TWD4815
	10 - 20	+5/±12V@+5/±1.25A	80	TD	TWT1205-12
		+5/±15V@+5/±1A	82		TWT1205-15
	18 - 36	+5/±12V@+7.5/±1.56A	85	TD	TWT2405-12
		+5/±15V@+7.5/±1.25A	86		TWT2405-15
	36 - 72	+5/±12V@+7.5/±1.56A	85	TD	TWT4805-12
		+5/±15V@+7.5/±1.25A	86		TWT4805-15
TO 200 WATT Wide Input, High-Density Regulated, Single, Dual, Triple and Quad Outputs	10 - 20	5V/20A	79	U	XWS1205
		12V/10.4A	81		XWS1212
		15V/8.3A	82		XWS1215
		24V/5A	84		XWS1224
		±5V/±10A	79		XWD1205
		±12V/±5.2A	81		XWD1212
		±15V/±4.15	82		XWD1215
		+12/-5V/+4.1/-10A	80		XWD1205-12
		+15/-5V/+3.2/-10A	80		XWD1205-15
	18 - 36	5V/30A	84	U	XWS2405
		12V/15A	85		XWS2412
		15V/10A	86		XWS2415
		24V/7.5A	86		XWS2424
		±5V/±15A	84		XWD2405
		±12V/±7.5A	85		XWD2412
		±15V/±5A	85		XWD2415
		+12/-5V/+6.15/-15A	84		XWD2405-12
		+15/-5V/+4.8/-15A	84		XWD2405-15
	20 - 60	5V/30A	80	U	XWS6005
		12V/15A	80		XWS6012
		15V/10A	81		XWS6015
		24V/7.5A	82		XWS6024
	36 - 72	5V/30A	84	U	XWS4805
		12V/15A	85		XWS4812
		15V/10A	85		XWS4815
		24V/7.5A	86		XWS4824
		±5V/±15A	82		XWD4805
		±12V/±7.5A	83		XWD4812
		±15V/±5A	83		XWD4815
		+12/-5V@+6.15/-15A	82		XWD4805-12
		+15/-5V@+4.8/-15A	82		XWD4805-15
	10 - 20	+5/±12V @ +10/±2.1A	79	U	XWT1205-12
		+5/±15V @ +10/±1.65A	81		XWT1205-15
		±5/±12V @ ±5/±2.1A	80		XWQ1205-12
		±5/±15V @ ±5/±1.65A	80		XWQ1205-15
	18 - 36	+5/±12V @ +15/±3.2A	83	U	XWT2405-12
		+5/±15V @ +15/±2.5A	83		XWT2405-15
		±5/±12V @ ±7.5/±2.1A	81		XWQ2405-12
		±5/±15V @ ±7.5/±1.65A	81		XWQ2405-15
	36 - 72	+5/±12V @ +15/±3.2A	84	U	XWT4805-12
		+5/±15V @ +15/±2.5A	85		XWT4805-15
		±5/±12V @ ±7.5/±2.1A	84		XWQ4805-12
		±5/±15V @ ±7.5/±1.65A	85		XWQ4805-15

4

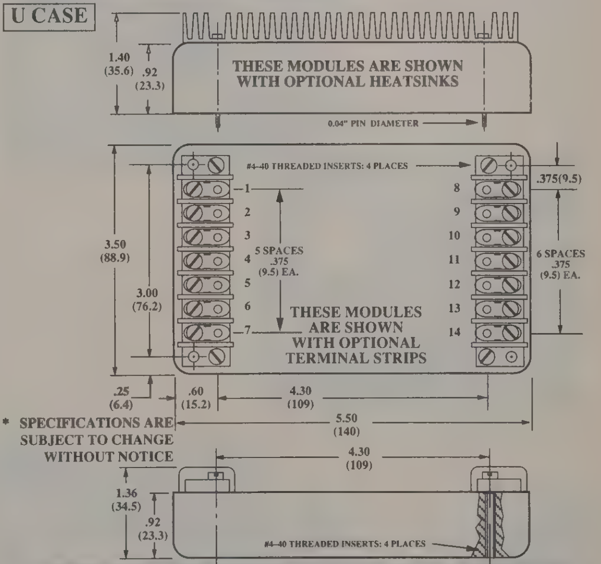

THESE MODULES ARE SHOWN WITH OPTIONAL HEATSINKS
0.88 (22.2)
1.4 (35.4)
0.52 (13.2)
Ø 0.80 (2.0)
0.5 (12.7)
1.80 (45.7)
6 - ø 0.170 ± 0.001 (0.43)
Ø 0.40 (1.0)
1.65 (41.91)
.195 (4.93)
TWS Series
T CASE
0.40 (10.2)
0.30 (7.6)
0.40 (10.2)
1.40 (35.5)
2.10 (53.3)
3.60 (91.4)
4.60 (116.8)
0.465 (11.8)
1 2 3 4 5 6 7 8 9


0.5 (12.7)
#4-40 THREADED INSERTS
4 Spaces 0.4" ea.
TWD & TWT Series
TD CASE
2.0 (50.8)
4 Spaces 0.4" ea.
2.4 (60.96)
3.6 (91.44)
0.2 (5.08)
4.60 (116.8)
0.3 (7.62)
1 2 3 4 5 6 7 8 9 10

Pin #	TWS	TWD	TWT
1	+Vin	S/D	S/D
2	S/D	Case	Case
3	N/C	+Vin	+Vin
4	-Vin	-Vin	-Vin
5	+Vout	No Pin	No Pin
6	+Sense	-Vout	- Auxiliary
7	Trim	Common	+Auxiliary
8	-Sense	Common	Common
9	-Vout	+Vout	+5Vout
10	---	Trim	Trim

* SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

U CASE


THESE MODULES ARE SHOWN WITH OPTIONAL HEATSINKS
1.40 (35.6)
.92 (23.3)
0.04" PIN DIAMETER
#4-40 THREADED INSERTS: 4 PLACES
.375(9.5)
3.50 (88.9)
3.00 (76.2)
5 SPACES .375 (9.5) EA.
6 SPACES .375 (9.5) EA.
THESE MODULES ARE SHOWN WITH OPTIONAL TERMINAL STRIPS
1 2 3 4 5 6 7 8 9 10 11 12 13 14
.25 (6.4)
.60 (15.2)
4.30 (109)
5.50 (140)
4.30 (109)
1.36 (34.5)
.92 (23.3)
#4-40 THREADED INSERTS: 4 PLACES

* SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

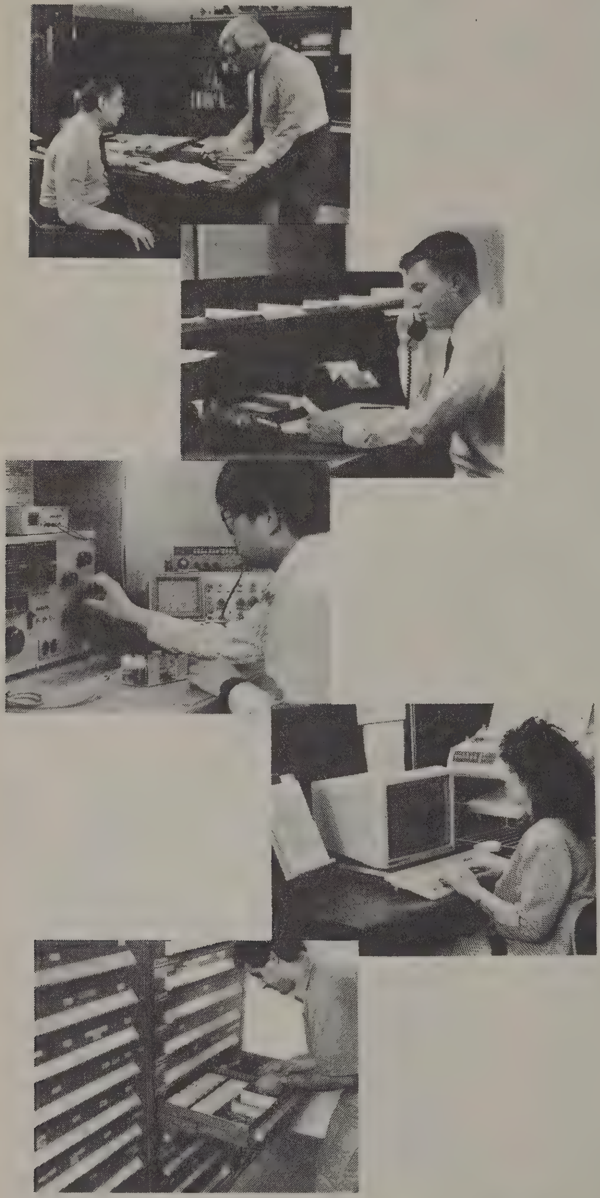
Pin #	Single Out	Dual Out	Triple Out	Quadruple Out
1	No Pin	No Pin	No Pin	No Pin
2	-Vin	-Vin	-Vin	-Vin
3	-Vin	-Vin	-Vin	-Vin
4	+Vin	+Vin	+Vin	+Vin
5	+Vin	+Vin	+Vin	+Vin
6	S/D	S/D	S/D	S/D
7	Case	Case	Case	Case
8	-Vout	-Sense 1	-Sense 1	-Vout 1
9	-Vout	-Vout 1	-Vout 1	Common
10	+Vout	+Vout 1	+Vout 1	+Vout 2
11	+Vout	+Sense 1	+Sense 1	Trim
12	-Sense	-Vout 2	-Vout 2	-Vout 3
13	Trim	Trim	Common 2 & 3	Common
14	+Sense	+Vout 2	+Vout 3	+Vout 4

JEROME INDUSTRIES CORPORATION

POWER SUPPLIES/BATTERY CHARGERS/TRANSFORMERS

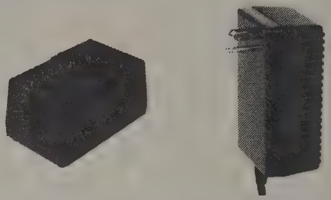
EXTERNALLY MOUNTED — WALL PLUG-IN/DESKTOP

Made in the USA
DESIGNED
FOR THE WORLD



JEROME INDUSTRIES WORLD CLASS MANUFACTURER OF CUSTOM DESIGNED

- LINEAR POWER SUPPLIES
- SWITCHMODE TECHNOLOGY POWER SUPPLIES
  - UNIVERSAL WIDE RANGE INPUT
  - DC TO DC CONVERTERS
- FAST-CHARGE BATTERY CHARGERS
  - NI-CAD CELLS
  - NICKEL-METAL HYDRIDE CELLS
- DUAL STEP LEAD ACID/GEL CELL CHARGERS
- FLOAT MODE LEAD ACID/GEL CELL CHARGERS
- TRANSFORMERS



WE ARE EXPERTS IN ENGINEERING POWER SOURCES FOR:

- Data Communications
- Medical
- Computers
- Industrial Controls
- Telecommunications
- Instrumentations
- Electronics

WHY INVEST IN JEROME...

- We've been a USA Manufacturer for over 25 years!
- Engineering, Production, and Customer Service are all located in same facility.
- Custom Designs
- In-House Engineering
- On-Time Delivery
- Deal Direct With Us

CALL OR FAX US FOR A QUICK QUOTATION ON YOUR REQUIREMENTS.

See page D•1760 for Cords, Plugs, and Case Styles

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POWER SUPPLIES/BATTERY CHARGERS/TRANSFORMERS

EXTERNALLY MOUNTED — WALL PLUG-IN/DESKTOP

JEROME
INDUSTRIES
CORPORATION

CUSTOM DESIGN FEATURES - SWITCHMODE AND LINEAR REGULATED POWER SUPPLIES

- International input configurations: 100 VAC 50 HZ, 120 VAC 50 HZ, 120 VAC 50/60 HZ, 220 VAC 50 HZ, 240 VAC 50 HZ, 90-260 VAC, 47-63 HZ.
- Switchable Inputs: 120/240 VAC 50/60 HZ or any other configuration • Power ON switch available.
- Input Surge Protection option.
- Input Noise Filter option.
- Ground available to core and/or output.
- Dielectric Withstand Voltage: up to 4000 VAC RMS
- Single and Multiple Output designs.
- Output Voltage: Up to 120 VDC.
- Output Power: 120 watts max.
- Operating temperature: 0° to 60°C.
- Output Ripple: 2 MV RMS max each output.
- Combined Regulation: 5% standard 1% available.
- Short Circuit and Overload protection.

SWITCHMODE POWER SUPPLIES

- UNIVERSAL WIDE RANGE INPUT
- DC TO DC CONVERTERS
- LAPTOP POWER SUPPLIES

STANDARD FEATURES

Input:

- Voltage: 90-130 VAC, 47-63 HZ.
- Ground available.

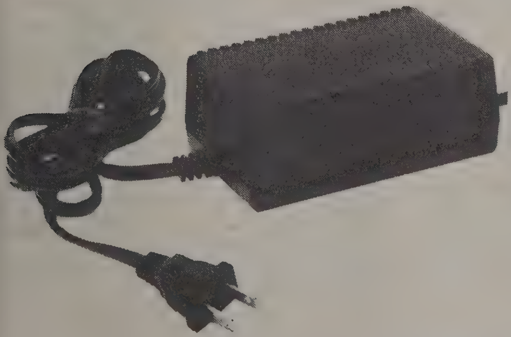
Output:

- Operating temperature: 0° to 40°C.
- Continuous Duty.
- Combined Regulation: 5% Max.
- No minimum load required for regulation.
- Output Ripple: 50 MV P-P max.
- Transient Response: 100 microseconds for 50% loadchange typical.
- Overcurrent and Short Circuit protected.
- Auto reset from overcurrent.
- Holdup Time: 32 MSec min at 120 VAC.
- Conducted EMI: meets FCC Class B. Radiated EMI: designed to FCC Class B.

Switchmode Power Supply Partial Listing - Others Available

WALL PLUG-IN	DESKTOP	CASE	VDC	AMPS
SL101	SLD101	L	5.0	4.0
SZ101	SZD101	Z	5.0	8.0
SL102	SLD102	L	12.0	2.0
SZ102	SZD102	Z	12.0	4.0
SL105	SLD105	L	15.0	1.6
SZ105	SZD105	Z	15.0	3.2
SL103	SLD103	L	24.0	1.0
SZ103	SZD103	Z	24.0	2.0
SL130	SLD130	L	30.0	.8
SZ130	SZD130	Z	30.0	1.6
SL109	SLD109	L	48.0	.5
SZ109	SZD109	Z	48.0	1.0

Optional Input Voltages Available



REGULATED LINEAR POWER SUPPLIES

STANDARD FEATURES

Input

- Voltage: 105-130 VAC, 60HZ.
- Ground available to core and/or output.
- Dielectric Withstand Voltage: 1500 VAC RMS

Output

- Operating Temperature: 0°C to 40°C
- Continuous Duty
- Output Ripple: 10 MV RMS MAX
- Combined Regulation: 5% Max.
- Thermal Current Limit or Foldback Limit
- Short Circuit and Overload Protection
- No Minimum Load Required For Regulation

Wall Plug-In Partial Listing

PRODUCT	CASE	VDC	AMPS
PIDB-218	B	5.0	.10
RH101L	H	5.0	.70
RH110L	H	5.0	1.00
RF101L	F	5.0	1.2
RK101F	K	5.0	1.40
RK110F	K	5.0	2.00
PIDV-216	B	9.0	.25
RH104L	H	9.0	.60
RK104F	K	9.0	1.00
PIDB-201	B	12.0	.30
RH102L	H	12.0	.50
RK102F	K	12.0	1.00
RH105L	H	15.0	.50
RK105F	K	15.0	.80
RK103F	K	24.0	.50
RK109F	K	48.0	.25
RK207F	K	7.0 -8.0	1.2 .1
PIDF-60	F	9.0 -9.0	+.5 -.15
PIDH-50	H	12.0 -12.0	.20 .20
RK202L	K	12.0 -12.0	.50 .50
RK205L	K	15.0 -15.0	.40 .40
RK221F	K	5.0 12.0	1.20 .30
RH303L	H	5.0 12.0 -12.0	.50 .10 .10
RF305L	F	5.0 12.0 -12.0	.75 .20 .20
RK303F	K	5.0 12.0 -12.0	.60 .20 .20
RK302F	K	5.0 12.0 -12.0	.75 .30 .10
RK301F	K	5.0 12.0 -12.0	1.00 .20 .20

Desktop Partial Listing

PRODUCT	CASE	VDC	AMPS
RKD101F	K	5.0	1.40
RKD110F	K	5.0	2.00
RXD101F	X	5.0	3.00
RYD101F	Y	5.0	3.50
RKD104F	K	9.0	1.00
RYD104F	Y	9.0	2.20
RKD102F	K	12.0	1.00
RXD102F	X	12.0	1.50
RYD102F	Y	12.0	2.00
RYD121F	Y	13.8	1.60
RKD105F	K	15.0	0.80
RYD105F	Y	15.0	1.60
RKD103F	K	24.0	0.50
RYD103F	Y	24.0	1.00
RKD119L	K	40.0	0.25
RKD109F	K	48.0	0.25
RYD109F	Y	48.0	0.50
RKD201F	K	5.0	1.20
RKD202L	K	12.0 -12.0	0.50 0.50
RYD232F	Y	12.0 -12.0	1.00 1.00
RKD205L	K	15.0 -15.0	0.40 0.40
RYD205L	Y	15.0 -15.0	0.80 0.80
RKD221F	K	5.0 12.0	1.20 0.30
RYD302F	Y	5.0 12.0 -12.0	2.00 .35 .35
RYD301F	Y	5.0 12.0 -12.0	2.50 .25 .25
RYD305F	Y	5/0 12.0 -12.0	3.00 .10 .10
RYD310F	Y	5.0 12.0 -12.0	3.00 .30 .10

See page D•1760 for Cords, Plugs, and Case Styles

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JEROME INDUSTRIES CORPORATION

POWER SUPPLIES/BATTERY CHARGERS/TRANSFORMERS

EXTERNALLY MOUNTED — WALL PLUG-IN/DESKTOP

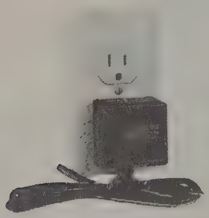
Made in the USA
DESIGNED
FOR THE WORLD

UNREGULATED POWER SUPPLIES

SPECIFICATION

Input:
- 120 VAC 60 Hz
- 120 VAC 50/60 HZ
- 240 VAC-50/60 HZ
- 120-240 VAC-50/60 HZ
- Switchable

Output:
- Voltage: 90 VDC max.
- Power: 160 watts max.
- Operating temperature: 0° to 40°C.
- Continuous Duty.



Partial Listing — Others Available.

Part No.	Output Vdc	Output Amps	VA	Case Size
PIDE-9A	9	0.1	0.9	E
PIDB-15	9	0.2	1.8	B
PIDB-158	9	0.25	2.5	B
PIDB-28	9	0.5	4.5	B
PIDB-112	9	0.6	5.4	B
PIDH-16	9.5	0.9	8.5	H
PIDH-26	10.5	0.75	8.1	H
PIDE-110	12	0.1	1.2	E
PIDB-204	12	0.3	3.6	B
PIDB-205	12	0.5	6	B
PIDH-104	12	0.65	8	H
PIDH-108	12	1	12	H
PIDF-24	12	1.75	21	F
PIDK-3	12	2	24	K
PIDH-105	15	0.85	13	H
PIDB-163	16	0.33	5.5	B
PIDB-207	18	0.25	4.5	B
PIDH-106	18	0.71	13	H
PIDH-92	21.8	0.32	7.2	H
PIDH-107	24	0.5	12	H
PIDH-4	+8	1	8.8	H
	-8	0.1		H

TRANSFORMERS

ELECTRICAL SPECIFICATION:

Input:
- 120 VAC 60 Hz
- 120 VAC 50/60 HZ
- 240 VAC-50/60 HZ
- 120-240 VAC-50/60 HZ
- Switchable

Output Transformers:
- Up to 250 Watts (isolation)
- Up to 400 Watts (auto)

Partial Listing — Others Available.

Part No.	Output Vdc	Output Amps	VA	Case Size
PITB-63	7.5	1.5	11.5	B
PITG-34	7.5	3.5	26	G
PITB-162	8	0.1	0.6	B
PITF-56	5	2	15	F
PITB-10	10	0.5	5	B
PITB-125	10	0.75	7.5	B
PITH-15	10	1.5	15	H
PITB-28	12	0.25	3	B
PITB-134	12	0.45	5.4	B
PITB-140	12	1.25	15	B
PITF-23	12	2	24	B
PITH-25	14	1.43	20	H
PITB-152	15	0.65	9.5	B
PITB-185	16 ct	0.625	10	B
PITH-40	16 ct	1.25	20	H
PITB-161	19.5 ct	0.3	6	B
PITF-22	25.4 ct	1	25.5	F
ILTF-9	12.5	2.5	31	F
ILTX-40	12	3.5	42	X
ILTX-11	16	3	48	X
ILTY-10	12	4	48	Y
ILTY-11	16	3.5	54	Y
ILTY-12	24	2.5	60	Y
ILTF-26	27	1	27	F

FAST-CHARGE BATTERY CHARGERS

NICKEL-CADMIUM (NI-CAD) NICKEL-METAL HYDRIDE CELLS

- **DELTA-V**
- **DELTA-T**
- **TIMER CIRCUIT**

STANDARD FEATURES

- Voltage 120VAC 60 HZ
- Ground available to core and/or output
- Dielectric withstand Voltage 1500VAC RMS
- Power: 90 Watts Max.
- Operating Temperature: 0-40 Degrees Celsuis
- Continuous Duty
- C/1 to C/4 charge rates Depending on number of cells to be charged

CUSTOM DESIGN FEATURES

- Internal input configurations… 100VAC 50HZ, 120VAC 50HZ, 120VAC 50/60HZ, 220VAC 50HZ, 240VAC 50HZ
- LED to indicate High Charge
- LED to indicate Full Charge

RAPID CHARGE TYPES - Δ V (Partial Listing - Others available)

PRODUCT	CASE	CHRG. VOLTS-DC	CHRG. CUR.-MA	CELL TYPE	CELLS
PICK-30	K	9.0	750	SUB C 1.5 AH	6
PICK-31	K	12.0	600	SUB C 1.5 AH	8
PICK-51	K	15.0	500	SUB C 1.5 AH	10
PICK-50	K	18.0	500	SUB C 1.5 AH	12

LEAD ACID/GEL CELL CHARGERS

CUSTOM DESIGN FEATURES ALL BATTERY CHARGERS

- International input configurations: 100VAC 50 HZ, 120 VAC 50 HZ, 120 VAC 50/60 HZ, 220 VAC 50 HZ, 240 VAC 50 HZ.
- Switchable Inputs: 120/240 VAC 50/60 HZ or any other configuration.
- Power ON switch available.
- Power ON indicator LED option.
- Output Voltage: Ratings available for 4V, 6V, 8V, 12V, 18V, and 24V batteries.
- Output Power: 24 watts max.
- Operating temperature: 0° to 50°C.
- Continuous Duty.
- Dual rate charging design available.
- END OF CHARGE indicator LED option.
- Regulated constant current charging available in addition to the standard regulated end of charge voltage.
- Ground available to core and/or output.
- Dielectric Withstand Voltage: up to 4000 VAC RMS.

STANDARD FEATURES

Input:
- Voltage: 120 VAC, 60 HZ.
- Ground available to core and/or output.
- Dielectric Withstand Voltage: 1500 VAC RMS.

Output:
- Voltage: For batteries rated 4V, 6V, 8V, 12V, 18V, and 24V.
- Power : 24 watts max.
- Operating temperature: 0° to 40°C.
- Continuous Duty.
- Output Voltage Tolerance: ±1%.

FLOAT CHARGES (Partial Listing - Others available)

WALL PLUG-IN	DESKTOP	CASE	CELLS	END OF CHARGE VOLTAGE	AVERAGE CHARGE CURR.-A
PCIB-201	--	B	2	4.6	.35
PICH-201	ILCH-201	H	2	4.6	.70
PICF-201	ILCF-201	F	2	4.6	1.00
PICK-201	ILCK-201	K	2	4.6	1.50
--	ILCY-201	Y	2	4.6	3.00
PICB-202	--	B	3	6.9	.35
PICH-202	ILCH-202	H	3	6.9	.70
PICF-202	ILCF-202	F	3	6.9	1.00
PICK-202	ILCK-202	K	3	6.9	1.50
--	ILCY-202	Y	3	6.9	3.00
PICB-203	--	B	4	9.2	.30
PICH-203	ILCH-203	H	4	9.2	.60
PICF-203	ILCF-203	F	4	9.2	.80
PICK-203	ILCK-203	K	4	9.2	1.20
--	ILCY-203	Y	4	9.2	2.50
PICB-204	--	B	6	13.8	.25
PICH-204	ILCH-204	H	6	13.8	.50
PICF-204	ILCF-204	F	6	13.8	.70
PICK-204	ILCK-204	K	6	13.8	1.00
--	ILCY-204	Y	6	13.8	2.00

DUAL MODE — FAST CHARGE

WALL PLUG-IN	DESKTOP	CASE	CELLS	END OF CHG VOLT.	HIGH CHG STATE VOLT.	AVG CHG CURR.-A
PICH-205	ILCH-205	H	2	4.6	4.8	0.7
PICF-205	ILCF-205	F	2	4.6	4.8	1.0
PICK-205	ILCK-205	K	2	4.6	4.8	1.5
PICH-206	ILCH-206	H	3	6.9	7.2	0.7
PICF-206	ILCF-206	F	3	6.9	7.2	1.0
PICK-206	ILCK-206	K	3	6.9	7.2	1.5
PICH-207	ILCH-207	H	4	9.2	9.6	0.6
PICF-207	ILCF-207	F	4	9.2	9.6	0.8
PICK-207	ILCK-207	K	4	9.2	9.6	1.2
PICH-208	ILCH-208	H	6	13.8	14.4	0.5
PICF-208	ILCF-208	F	6	13.8	14.4	0.7
PICK-208	ILCK-208	K	6	13.8	14.4	1.0
--	ILCY208	Y	6	13.8	14.4	2.0

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EXTERNALLY MOUNTED — WALL PLUG-IN/DESKTOP

JEROME INDUSTRIES CORPORATION

INTERNATIONAL EXTERNALLY MOUNTED POWER SOURCES

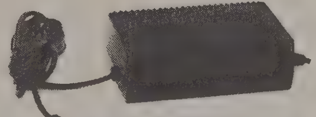
EUROPE IEC DESIGN ASIA

INTERNATIONAL DESIGNED WALL PLUG-IN AND DESKTOP PRODUCTS DEDICATED TO ISO 9000

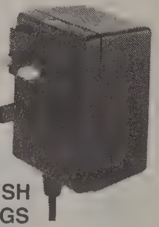
STANDARD FEATURES

- Operating Temperature: 0° - 40°C.
- Combined Regulation: ±5%
- Output Ripple: 10 MV RMS Max Each Output
- Short Circuit and Overload Protection
- No Minimum Load Required for Regulation
- Designed to IEC Specifications
- Switchable Input Units are also Designed to UL and CSA Specifications
- Input Mode — IEC 320 Jack

AUSTRALIAN BLADES AS 3112

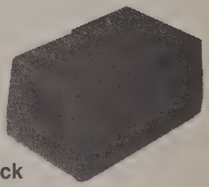


Schuko Plug



ENGLISH PRONGS BS 1362

EUROPEAN TURRET CEE 7/16



IEC 320 Jack

INTERNATIONAL REGULATED POWER SUPPLIES

DESKTOP - EUROPEAN - BRITISH - AUSTRALIAN

PRODUCT	CASE SIZE	INPUT VOLTAGE RANGE	INPUT FREQUENCY	VDC	AMPS	TUV-IEC	UL	CSA
EKD101L	K	200-260	50	5.0	1.0	—	—	—
EKD151L	K	100-130 200-260	50/60	5.0	.70	YES	YES	
EXD151L	X	85-132 170-264	50/60	5.0	.85	YES	YES	YES
EXD101F	X	200-260	50	5.0	1.25	YES		
EXD110F	X	200-260	50	5.0	1.75			
EYD151F	Y	100-130 200-260	50/60	5.0	2.50			
EKD104L	K	200-260	50	9.0	.70			
EKD154L	K	100-130 200-260	50/60	9.0	.60			
EYD104L	Y	200-260	50	9.0	1.5			
EKD102L	K	200-260	50	12.0	.6			
EKD152L	K	100-130 200-260	50/60	12.0	.5			
EXD102F	X	200-260	50	12.0	1.0	YES		
EYD102F	Y	200-260	50	12.0	1.5			
EXD305F	X	200-260	50	5.0 12.0 -12.0	1.5 .20 .20	YES		
EXD306F	X	200-260	50	5.0 12.0 -12.0	1.5 .10 .10	YES		
EYD353F	Y	100-130 200-260	50/60	5.0 12.0 -12.0	1.5 .12 .12		YES	YES

*Auxilliary mounted AC output available.

OTHER AVAILABLE INTERNATIONAL PRODUCTS

- LINEAR POWER SUPPLIES
- SWITCHMODE TECHNOLOGY POWER SUPPLIES
  - UNIVERSAL WIDE RANGE INPUT
  - DC TO DC CONVERTERS
- FAST-CHARGE BATTERY CHARGERS
  - NI-CAD CELLS
  - NICKEL-METAL HYDRIDE CELLS
- DUAL STEP LEAD ACID/ GEL CELL CHARGERS
- FLOAT MODE LEAD ACID/ GEL CELL CHARGERS
- TRANSFORMERS

WALL PLUG-IN AND DESKTOP CONFIGURATION

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POWER SUPPLIES/BATTERY CHARGERS/TRANSFORMERS

EXTERNALLY MOUNTED — WALL PLUG-IN/DESKTOP

Made in the USA
DESIGNED
FOR THE WORLD

CASE STYLES

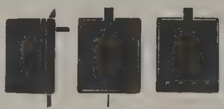
WALL PLUG-IN

STYLES B + D
2.18 L x 2.06 W x 1.71 H
55 x 52 x 43 mm

STYLE E
1.94 L x 1.82 W x 1.45 H
49 x 46 x 37 mm

STYLES H + J
3.12 L x 2.35 W x 1.85 H
79 x 60 x 49 mm

STYLE K
4.75 L x 3.00 W x 2.25 H
121 x 76 x 57 mm



STYLES F + G
3.25 L x 2.72 W x 2.25 H
83 x 69 x 57 mm

STYLE L
4.75 L x 3.00 W x 1.89 H
121 x 76 x 35 mm

DESKTOP

STYLE X
6.50 L x 3.75 W x 2.56 H
165 x 95 x 65 mm
STYLE Y
6.50 L x 3.75 W x 2.89 H
165 x 95 x 73 mm

STYLE K
4.75 L x 3.00 W x 2.25 H
121 x 76 x 57 mm

STYLE L
4.75 L x 3.00 W x 1.89 H
121 x 76 x 35 mm

STYLE Z
6.50 L x 3.75 W x 2.17 H
165 x 95 x 55 mm

STANDARD CORDS AND PLUGS

Partial Listing — Others Available.

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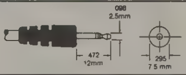
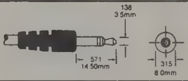
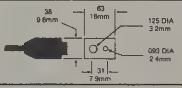
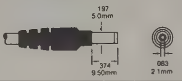
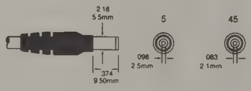
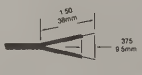
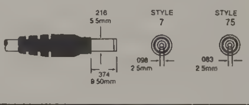
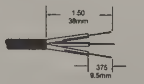
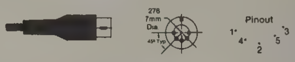
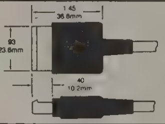
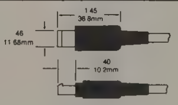
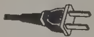
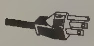
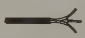
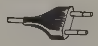
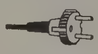
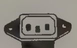
1	 098 2.5mm 472 12mm 295 7.5 mm	6 FT. BLACK 22 AWG 2 CONDUCTOR
2	 138 3.5mm 571 14.50mm 315 8.0mm	6 FT. BLACK 22 AWG 2 CONDUCTOR
3	 38 9.6mm 63 16mm 125 DIA 3.2mm 093 DIA 2.4mm 31 7.9mm	6 FT. BLACK 18 AWG 2 CONDUCTOR
4	 197 5.0mm 374 9.50mm 083 2.1mm	6 FT. BLACK 22 AWG 2 CONDUCTOR
5 45	 2.16 5.5mm 5 45 098 2.5mm 083 2.1mm 374 9.50mm	6 FT. BLACK 5 = 22 AWG 2 CONDUCTOR 45 = 22 AWG 2 CONDUCTOR
6 9	 1.50 38mm 375 9.5mm	6 FT. BLACK 6 = 22 AWG 2 CONDUCTOR 9 = 18 AWG 2 CONDUCTOR
7 75	 216 5.5mm STYLE 7 STYLE 75 098 2.5mm 083 2.5mm 374 9.50mm	6 FT. BLACK 7 = 18 AWG 2 CONDUCTOR 75 = 18 AWG 2 CONDUCTOR
8 14	 1.50 38mm 375 9.5mm	6 FT. BLACK 8 = 22 AWG 23CONDUCTOR 14 = 18 AWG 3 CONDUCTOR

STYLE NUMBER	OUTPUT CORD AND CONNECTOR DATA	DESCRIPTION
10 11	 278 7mm Dia. 45° Typ Pinout 1 2 3 4 5	10 = 22 AWG 3 CONDUCTOR 5 PIN DIN PLUG 11 = 18 AWG—3 COND. 22 AWG—2 COND. 5 PIN DIN PLUG
12	 1.45 36.8mm 93 23.6mm 40 10.2mm	7 FT. BLACK 18 AWG 3 CONDUCTOR 22 AWG 2 CONDUCTOR MOLEX 2139 6 PIN CONNECTOR
13	 1.45 36.8mm 46 11.68mm 40 10.2mm	7 FT. BLACK 18 AWG 3 CONDUCTOR MOLEX 2139 3 PIN CONNECTOR

STYLE NUMBER	INPUT CONFIGURATIONS	DESCRIPTION
91	 NEMA 1-15P	2 CONDUCTOR, 18AWG, SPT-2, 6 FEET, BLACK PLUG - NEMA 1-15P
92	 NEMA 5-15P	3 CONDUCTOR, 18AWG, SPT-2, 6 FEET, BLACK PLUG - NEMA 5-15P, GROUNDED
93		3 CONDUCTOR, 18AWG, 6 FEET, HARMONIZED, BLACK, EUROPEAN COLOR CODE, STRIPPED AND TINNED
94	 CEE 7/16	2 CONDUCTOR, 18AWG, 6 FEET, HARMONIZED, BLACK, EUROPEAN COLOR CODE, EUROPLUG
95	 CEE 7/7	3 CONDUCTOR, 18AWG, 6 FEET, HARMONIZED, BLACK, EUROPEAN COLOR CODE, CEE 7/7 SCHUKO PLUG
IEC 320		MALE, 3 CONDUCTOR, IEC 320 UNIVERSAL CONNECTOR

CORDS: • Cord and Plug assemblies to customer specifications. • Plugs and Jacks used on end product must be evaluated by customer.

See previous 4 pages for Product Information

CALL CUSTOMER SERVICE 908-353-5700

Jerome Industries Corporation/730 Division St., Elizabeth, NJ 07201/908-353-5700/FAX: 908-353-1021

MINIGLOSSARY
SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

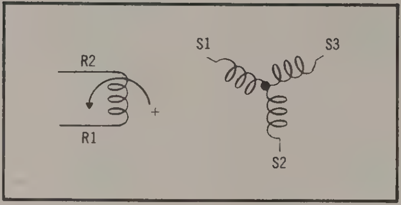
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

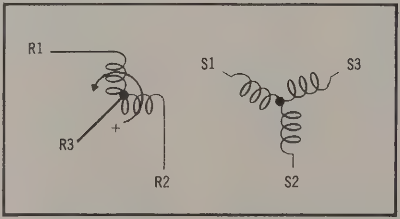
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

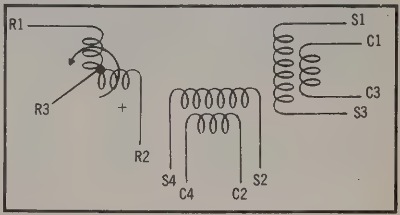
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

JETA

HIGH CURRENT POWER SUPPLIES to 3KW

500 to 3000W SINGLE

POWER	OUTPUT RATINGS (max)		INPUT VAC	CASE SIZE	MODEL
	CURRENT	VOLTAGE			
500W	100A	2 to 48 VDC	115/230 1Ø	5"x8"x10"	A501
800W	160A				A801
1000W	200A				A1001
1200W	240A				A1201
1500W	300A		115/230 1 or 3Ø	5"x8"x11"	G1501
1800W	360A				G1801
2000W	400A		230, 1Ø OR 208, 3Ø	5"x8"x11"	L2001
3000W	600A			5"x8"x13.5"	M3001

500 to 700W MULTI

POWER	OUTPUT RATINGS (max)				INPUT VAC	CASE SIZE	MODEL
	V1	V2	V3	V4			
	2 to 24VDC						
500W	60A 300W	10A 150W	5A 100W	3A 72W	115/230 1Ø	5"x8"x10"	B504
700W	100A 500W	10A 240W	7A 168W	5A 100W			B704

1000W to 2000W PFC MULTI

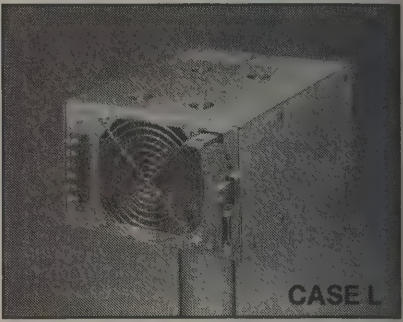
POWER	OUTPUT RATINGS (max)				INPUT VAC	CASE SIZE	MODEL
	V1	V2	V3	V4			
	2 to 48VDC						
1000W	150A 750W	30A 360W	15A 175W	15A 100W	90-264 1Ø	5"x8"x11"	N1004
1200W	200A 1000W	40A 480W	20A 240W	20A 240W			N1204
2000W	200A 1300W	115A 625W	5A 75W	NA	180-264 1Ø		N2003

1200W PFC MULTI with BATTERY BACKED MODULE

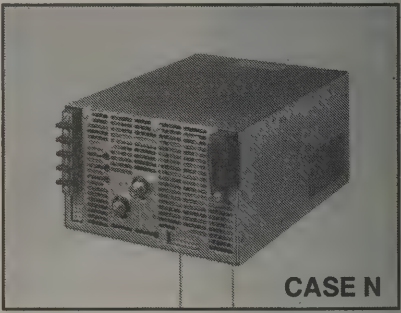
POWER	OUTPUT RATINGS (max)				INPUT VAC	CASE SIZE	MODEL
	V1	V2	V3	V4			
	2 to 48 VDC						
1000W	150A 750W	30A 360W	15A 175W	15A 100W	90-264 1Ø with 48VDC	5"x8"x15"	P1004
1200W	200A 1000W	40A 480W	20A 240W	20A 240W			P1204

750W MULTI with BATTERY BACKED MODULE

POWER	OUTPUT RATINGS (max)				INPUT VAC	CASE SIZE	MODEL
	V1	V2	V3	V4			
	2 to 24VDC			2-48V			
750W	120A 600W	20A 150W	5A 75W	1A 24W	115/230 1Ø with 48VDC	5"x8"x13"	H754


CASE L

CASE B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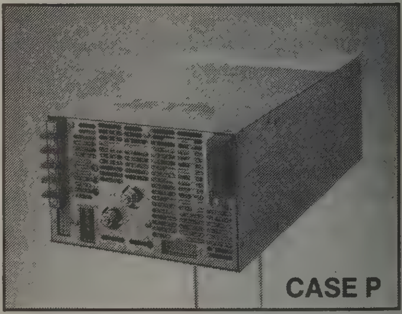
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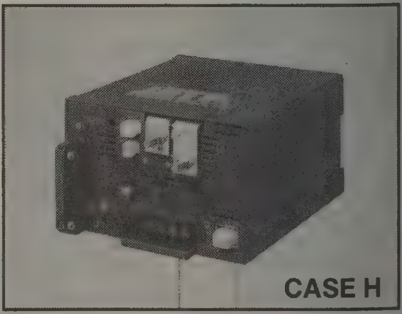

CASE H

DISTINGUISHING FEATURES and BENEFITS

500 to 3000 WATTS:

A wide choice in high current DC power supplies enables you to minimize over-specification and make a selection closest to the applications needs. Models are available with 500, 800, 1000, 1200, 1500, 1800, 2000 and 3000 watt outputs in single output configurations.

ONE to FOUR OUTPUTS:

Your system's multiple DC voltage needs may be satisfied with a main output channel and selection of up to three auxiliary outputs. A variety of power levels for the main and auxiliary outputs, from 180 amps down to 3 amps, are available.

CURRENT to 600 AMPS and MORE:

High current needs may probably be satisfied in only one package but, should higher currents be needed, all JETA power supplies are automatically parallelable and capable of operation in fault tolerant (N+1) systems.

POWER FACTOR CORRECTION:

Many JETA products are available with PFC which meet the proposed IEC harmonics standard 555-2. The 1000W unit meets UL requirements for a maximum line current of 12A from a 15A, 115V service. The PFC line conditioner changes the high current pulses into a sinusoidal waveform in phase with the line voltage, thus reducing the rms line current and harmonics.

BATTERY BACKED MODULES:

Available up to 1200 watts, JETA's battery backed power supplies integrate proven high current, multiple output, switcher designs with a dual stage battery charger and a boost converter. The battery backed module, driven by a 48 volt battery, delivers highly reliable power even during brownouts and blackouts. Battery operation time is unrestricted. Models are also available with 0.995 PFC, ideal for high wattage office business systems.

INTERFACE SIGNALS and CUSTOMIZATION:

A variety of standard interface signals that are costly options elsewhere are provided enabling greater system utility. These include: power fail detection; remote inhibit; current monitor; remote programming; remote voltage adjust; and DC OK. In fact, JETA can fashion to your particular needs; OVP actuated,logic inverses or even reverse air flow. JETA can also start at the foundation and make electrical and mechanical modifications.

RELIABILITY THROUGH DESIGN:

JETA focuses on achieving the highest reliability in commercial and industrial products through: a unique hybrid thermal design (patent pending) that maintains the lowest component-to-ambient temperature gradient; a MOSFET based switching design that reduces the component count; high voltage transistor reshaping for safe area operation; fault tolerant design that provides protection for the system and the power supply; and the use of well established, conservative half-bridge, full-bridge and forward converter circuit designs. All ensure that the highest attainable reliability is replicated throughout the entire product line.

RELIABILITY THROUGH MANUFACTURING:

Reliability is not only a priority; it is ***the*** priority. JETA practices design for manufacturability (DFM) principles while designing its products and continuously monitors processes via statistical process controls (SPC) to intercept any undesirable trends on a real time basis.

STRESS TESTING:

Each unit is subject to our in-house vigorous stress tests. They consist of turning the unit on into short circuit and no-load conditions and shorting the outputs after the unit is on and loaded. This verifies the effectiveness of the circuitry and quality of components under abnormal conditions.

BURN-IN and GUARANTEE:

All products undergo a 24 hour cyclical burn-in prior to shipment. Infant mortality is eliminated, thus insuring that the most reliable product is delivered to you. And then, JETA guarantees the product for two full years for parts and labor. You will find no double standard, but one unvarying, inflexible standard for reliability.

PROTECTION and SAFETY CERTIFICATION:

Protective features for both the power supply and the system include overvoltage, thermal, overload, no-load, in-rush current, line fusing, AC ground termination, output isolation, brown-out, open and reverse sense leads and reverse voltage protection. In addition, JETA complies with the safety requirements of UL, CSA, IEC and VDE enabling the OEM speedy certification.

CUSTOM PRODUCTS:

Unique requirements for output power ratings, input voltage, package configuration, PFC and battery backup may be accomodated with JETA's modified standard product or unique custom capability. Contact JETA for a quotation today.

CALL or FAX JETA FOR CUSTOM SPECIFICATIONS or COMPLETE PRODUCT LITERATURE

JETA POWER SYSTEMS, INC.
2675 Junipero Avenue ■ Signal Hill, CA 90806 ■ 310/427-0095 ■ FAX: 3104262417

eem

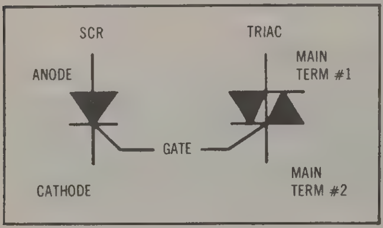
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

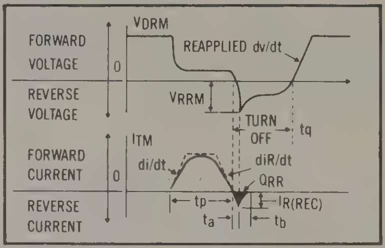


Fig. 1. Concurrent voltage and current waveforms

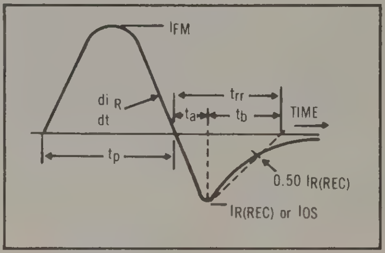


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$: *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

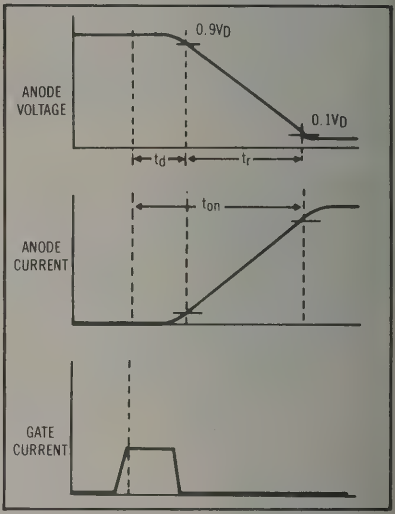


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

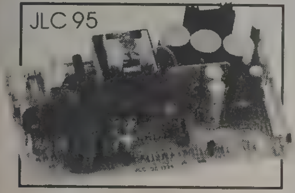
V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

HIGH PERFORMANCE
OEM POWER SUPPLIES

We've got the power

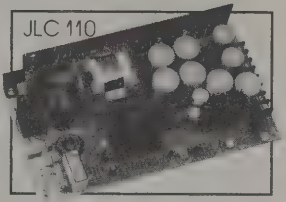
At Joule Power, we've got the power supplies to meet your needs. We use only high quality components and employ advanced design techniques which demand fewer parts for a clean layout. We offer a variety of configurations for multiple applications and flexibility.


JLC 95

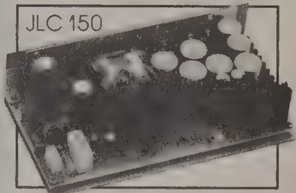
Input: 110 VAC / 220 VAC
Strappable
Size: 7.75″ x 4.25″ x 2.0″

JLC 100

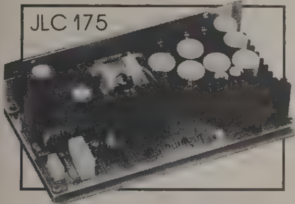
Input: 110 VAC / 220 VAC
Strappable, 12 VDC
Size: 6.0″ x 6.5″ x 2.0″


JLC 110

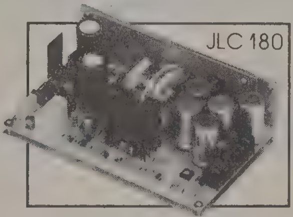
Input: 110 VAC / 220 VAC
Strappable
Size: 9.5″ x 4.75″ x 2.0″


JLC 150

Input: 110 VAC / 220 VAC
Strappable
Size: 9.5″ x 5.0″ x 2.5″
w / cover: 9.5″ x 5.0″ x 2.7″


JLC 175

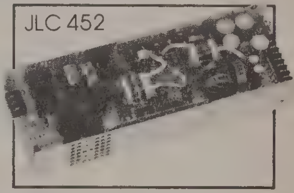
Input: 110 VAC / 220 VAC
Strappable
Size: 9.5″ x 5.0″ x 2.5″
w / cover: 9.5″ x 5.0″ x 2.7″


JLC 180

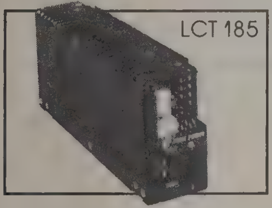
Input: 110 VAC / 220 VAC
Strappable
Size: 8.0″ x 5.0″ x 2.5″

JLC 451

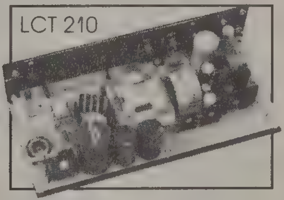
Input: 110 VAC / 220 VAC
Strappable
Size: 12.5″ x 5″ x 2.5″


JLC 452

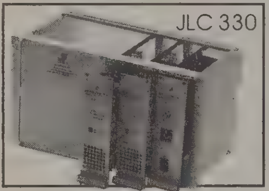
Input: Auto Ranging,
85 — 264 VAC
Size: 14.0″ x 5.0″ x 2.5″


LCT 185

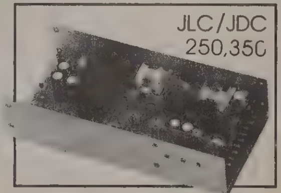
Input: 110 VAC / 220 VAC
Strappable
Size: 10.0″ x 4.40″ x 2.4″
w / cover: 10.15″ x 4.45″ x 2.54″


LCT 210

Input: 110 VAC / 220 VAC
Strappable
Size: 10.5″ x 4.8″ x 2.65″


JLC 330

Input: 110 VAC / 220 VAC
Strappable, 48 VDC
Rack mount
Size: 6U high x 220mm
deep x 12 HP wide


JLC / JDC
250,350

Input: 110 VAC / 220 VAC
Strappable, 48 VDC
Size: 10.5″ x 5.0″ x 2.5″

Joule Power has the ability to tailor all our standard products to meet various requirements of our customers, such as:

- Output Voltages from 5V to 48V
- Single or Multiple Outputs
- Auto Ranging Inputs
- UL 544 (Non Patient Connect)
- Power Factor Correction
- On/Off Switch
- Redundant Rack Mount Supplies (N+1 with Current Sharing)
- 2-Year Warranty

For more information call:

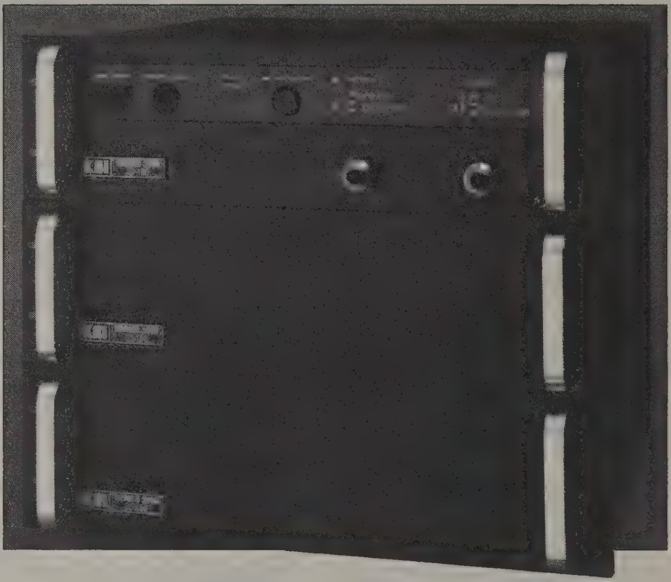
Joule Power, Inc.

Joule Power, Inc.

Joyce Industrial Park
Summer Road
Boxborough, MA 01719
(508) 263-9712
FAX (508) 263-9071

KSI

High Voltage Power Supplies



Reliable Power from the Reliable Source

Kaiser Systems, Inc. designs, builds, and sells high performance, highly reliable power supplies that are engineered to protect themselves and the systems they power. From initial concept through prototype and production units, our employees are concerned with more than just the specs. **Quality, Performance, Cost,** and **Delivery** are also part of the design.

Quality starts with good people doing a good job. Designing reliable circuits that utilize high quality components. Adhering to stringent QA standards in manufacturing. Making sure that each and every KSI power supply meets or exceeds the published specs.

Performance depends on how well the design is thought out. Is the circuit optimized? Have all fault conditions been considered? Can it be manufactured consistently? At KSI, performance means the product still conforms to the original specs, long after the warranty runs out.

Cost to manufacture is a function of application, design, production methods and quality control. Cost to the customer is the sum of acquisition and ownership expenses. KSI produces products knowing that cost must be in relation to value, and that the customer must get the best value possible for the amount spent.

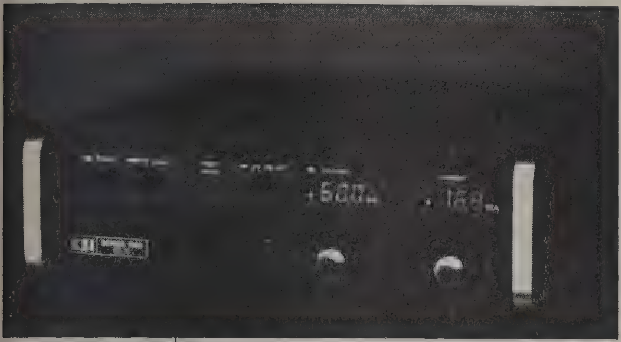
Delivery is just as important as product performance. Without it there's nothing but excuses. At KSI, our MRP II operates at Class A level. That means we know what we're doing, when we're doing it and, most importantly, how we're doing it. It also means we have an on-time delivery record of 98%!

When we say Reliable Power from the Reliable Source , we mean it. Try us!

KSI Kaiser Systems, Inc.

126 Sohier Road, Beverly, MA 01915 • Phone: (508) 922-9300 • FAX: (508) 922-8374

Standard High Voltage Power Supplies



The SERIES 1000 answers user needs for a multi-purpose, laboratory grade HV power supply with superior performance and unprecedented reliability.

Benefits:

High Frequency Switching Design

- Low stored energy for operator and equipment safety
- High efficiency and minimal heat dissipation
- Reduced size of internal components for smaller overall size
- Air-insulated for the lowest possible weight

Advanced Quasi-Resonant Inverter

- Greater reliability due to fewer components
- Better output regulation through optimized design
- Withstands minor fault conditions without system shut-down
- Control linearity with zero over-shoot
- Open and short circuit protected

Standard Features

- Constant voltage/constant current with automatic crossover and current limiting
- Full programming and monitoring from front panel or remote control
- Digital panel meters for voltage and current
- Soft start
- Self locking primary contactor
- Thermal overload protection
- Typical efficiency greater than 80%
- 5 year warranty

Optional Features

- OEM/Remote configuration
- Slaved bipolar operation
- IEEE-488 and RS-232C interface
- 220 Vac 50/60 Hz input

Performance Specifications Summary

- Voltage regulation: load and line better than ±0.005%
- Current regulation: load better than 100 microamps; line better than ±0.005%
- Ripple better than 0.1% rms, full load, dc to 100 kHz
- Stability better than 0.01% per hour, 0.05% per 8 hours, after ½ hour warm-up
- Transient response better than 3 ms with no overshoot, no load to full load change

Request Technical Specifications sheets for detailed specifications.

SERIES 1000 Standard Models

Output Voltage	Output Power (Watts)	Panel Height (Inches)
Choose from standard rated outputs: 5, 10, 20, 40, 60, 80, or 100 kV Negative or positive polarity	500	5¼
	1000	5¼
	2000	10½
	3000	15¾

All models have continuously adjustable voltage and current from zero to full rated output.

Request SERIES 1000 Technical Specifications Sheet for specific model numbers and rated outputs.

KSI Kaiser Systems, Inc.

126 Sohier Road, Beverly, MA 01915 • Phone: (508) 922-9300 • FAX: (508) 922-8374

Standard High Voltage Power Supplies

SERIES 5000
3 kW and 5 kW Models

The SERIES 5000 sets new standards for compact size and high performance in medium power high voltage supplies:
- Models available with outputs from 1kV to 60 kV at 3kW or 5kW continuous power ratings
- All models only 5-1/4 inches high in a standard 19 inch rack mount design
- Stable, well regulated output
- High immunity to noise, EMI, transients
- Extensive fault protection for dependable operation

Features

- Advanced high frequency switchmode design with low stored energy
- Constant voltage/constant current with automatic crossover
- Open and short circuit protected
- Arc-over protected
- Full front panel controls with digital meters
- Complete remote control and monitoring

Optional Features

- Constant power
- Parallel operation for increased output power
- ArcQuench™ arc suppression circuitry
- Adjustable overload trip
- Low output ripple (0.05% peak-to-peak)
- EMI filter
- OEM/Remote configuration for remote-only operation

Performance Specifications Summary

- Input: 187-264 Vac, three phase, 50/60 Hz
- Voltage and current regulation better than ±0.01%
- Ripple less than 0.1% peak-to-peak
- Stability better than 0.01% per hour, 0.05% over 8 hours, after one-half hour warm-up
- Temperature coefficient better than 0.01% per °C
- Efficiency better than 85%

Contact KSI for detailed model and specification data.

SERIES 6000
6kW and Higher

The SERIES 6000 is a family of highly reliable, high performance dc power supplies with output power ratings of 6 kW and higher. Customized for each application, they are the best choice for your toughest application.
- Output voltages from 50 V to 200 kV
- Modular design for packaging flexibility and compact size
- Tight regulation, low drift operation
- Extensive fault protection for long term dependability

Features

- Advanced high frequency switchmode design
- Low stored energy
- Separate converter and output chassis for installation flexibility
- Fully protected against fault conditions
- Control and monitoring per customer requirements
- ArcQuench™ arc suppression circuitry

Typical Specifications

- Voltage and current regulation better than ±0.01%
- Ripple less than 0.05% peak-to-peak
- Stability better than 0.01% per hour, 0.05% over 8 hours, after one-half hour warm-up
- Forced air or water cooling

Contact KSI for detailed model and specification data.

Reliable Power from the Reliable Source®

KSI Kaiser Systems, Inc.

126 Sohier Road, Beverly, MA 01915 • Phone: (508) 922-9300 • FAX: (508) 922-8374

Capacitor Charging Power Supplies

LS1500
1500 J/s and Higher

The LS1500 series of capacitor charging power supplies offer unprecedented levels of reliability and dependability for lasers and other pulsed power applications.

- Models available with outputs from 1 kV to 40 kV at 1500 J/s average power
- Rack mounted or modular packaging
- High immunity to noise, EMI, transients

Features

- Advanced quasi-resonant high frequency converter utilizing IGBTs
- Open and short circuit protected, arc-over protected
- Rack mount chassis has full front panel control and monitoring with digital meters, plus full remote control interface
- Modular design is compact and air cooled
- Units can be operated in parallel for higher output power

Optional Features

- Custom interfaces, output configurations and performance specifications are available
- Modular units are available with output connector on top or rear
- EMI filter
- OEM/Remote rack mount configuration for remote-only operation

Performance Specifications Summary

- Voltage regulation better than ±0.5% at rep rates up to 200 Hz
- Fully protected against external open and short circuits, arc-overs, overvoltage and overtemperature
- Efficiency better than 85%

Contact KSI for detailed model and specification data.

LS5000
5000 J/s and Higher

The LS5000 series of capacitor charging power supplies offer the same high reliability as the LS1500 family, but at higher output power levels.

- Models available with outputs from 1 kV to 40 kV at 5000 J/s average power
- Only 5-1/4 inches high in a 19 inch rack mount design
- High immunity to noise, EMI, transients
- Compact, air cooled design

Features

- Advanced quasi-resonant high frequency converter utilizing IGBTs
- Open and short circuit protected, arc-over protected
- Full front panel control and monitoring with digital meters
- Full remote control and monitoring via standard 25 pin connector
- Units can be operated in parallel for higher output power

Optional Features

- OEM version with blank front panel
- Master/slave configurations for parallel operation
- EMI filter
- Custom interfaces, output configurations and performance specifications are also available

Performance Specifications Summary

- Voltage regulation better than ±0.5% at rep rates up to 200 Hz
- Fully protected against external open and short circuits, arc-overs, overvoltage and overtemperature
- Efficiency better than 85%

Contact KSI for detailed model and specification data.

Reliable Power from the Reliable Source®

KSI Kaiser Systems, Inc.

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KELTRON
CORPORATION
225 Crescent Street, Waltham, MA 02154 (617) 894-8700 / Fax (617) 899-9602

HIGH VOLTAGE OEM

Your Customs are Our Standards

Keltron is the only manufacturer prepared to deliver both standard and fully customized high voltage power sources, in small quantities and OEM production volumes — rapidly, with reliable deliveries and to meet your exact specifications.

Here's How

Each Keltron Series Power Supply is designed around a common PC board and basic chassis. This, coupled with effective use of CAE, allows rapid deliveries of both standard and wholly customized models — with excellent price/performance.

Common to All Keltron HV Power Supplies

- Excellent line and load regulation characteristics; Low Ripple; High Efficiency Converters
- Designed to meet applicable UL and CSA requirements. Many of these power supplies are recognized by UL, CSA, IEC, TUV
- Protection against arcs/shorts of unlimited duration

Among the Applications

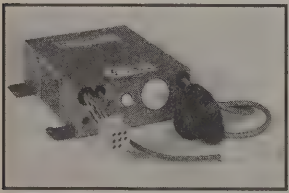
Video Projection • Beam Penetration Color Displays • Computer/ Film Recorders • Medical X-Ray Image Intensifiers • Dual Focus • Shadow Mask Color • Computer Graphics • TV Studio Monitors • HDTV

STANDARD SERIES

Keltron offers the following "standard" designs intended for timely and economical custom adaption to a wide variety of CRT display applications.

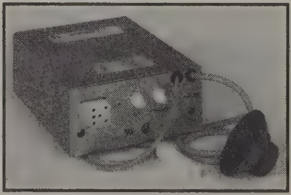
HX Series

HX Series: **For high-resolution color shadow-mask and high power monochrome CRT Monitors.** Quickly reconfigurable to a wide range of requirements. Anode outputs to 27 KV, 35 watts total power, with 5.5 to 9.0 KV focus, plus standard options for dynamic focus, G1 and G2; only 4.5" x 6" x 2.1". Supersedes Keltron's HR Series. UL and CSA 950 recognized.



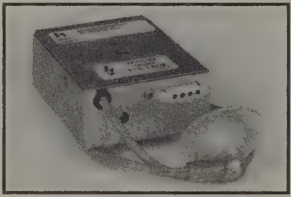
LP Series

LP Series: **Low-profile, low-cost supply for high-resolution color shadow-mask and high power monochrome CRT monitors.** Anode outputs to 25 KV, 35 watts total power, with adjustable focus to 9.0 KV, plus standard options for dynamic focus, G1 and G2, all in a 4.5" x 6" x 1.75" package. UL and CSA 950 recognized.



LH Series

LH Series: Similar to the LP Series, but **designed for lower anode ripple at voltages between 21 KV and 25 KV.** Package measures 4.5" x 6" x 2.1". UL and CSA 950 recognized.

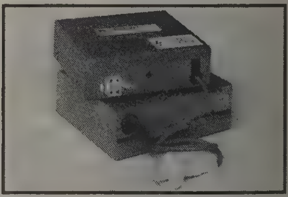


P500 Series

P500 Series: **Low cost, miniature supply for monochrome high-resolution CRT monitors.** Rated to 20 KV at 10 watts, plus standard options for G1 and G2, measures 3.1" x 4.1" x 1.4." UL and CSA recognized.

P400 Series: **For monochrome, high-resolution CRT monitor applications.** Similar to the P500 Series but optimized for very low anode ripple. Features filtered input leads, standard options for G1, G2 and Focus B+, superb load transient performance. Rated to 20 KV at 12 watts, measures 3.8" x 5" x 1.4". UL and CSA recognized.

HDF Series: **Dynamic focus supplies providing static focus voltages from 1.4 to 9.0 KV** with added wide-band dynamic focus voltage up to 500 V; internal dynamic focus amplifier with direct-coupled gain of 30; UL recognized.



Dynamic Focus: F600 top; HDF bottom

F600 Series: **Dynamic focus supplies,** similar to the HDF Series but **without the internal amplifier;** adds a dynamic focus input signal up to 400 V directly to the static focus voltage.

KELTRON CORPORATION

225 Crescent Street, Waltham, MA 02154 (617) 894-8700 / Fax (617) 899-9602

POWER SUPPLIES

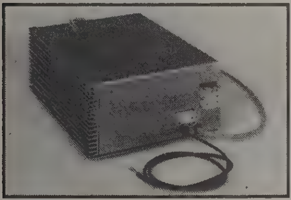
CUSTOM DESIGNS

Keltron is uniquely equipped to provide cost-effective, custom engineered models. These are examples of field proven Keltron custom designs.

PROJECTION

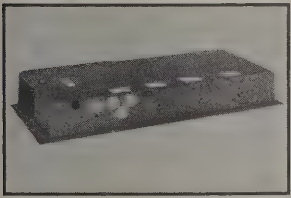
Anode and focus supplies for CRT projection; 20 to 50 KV, 40 to 250 watts. These utilize Keltron's proprietary Resonant Flyback technology, a converter topology which brings the advantages of switch-mode power conversion to high voltage. All designs are suitable for UL, CSA and TUV approval.

HP340535 - **34 KV, 3.0 mA nominal, 15.0 mA peak anode,** 10.5 KV focus, 800 V G1, 110/220 VAC input, measures 9" x 6.5" x 3.2".



HP340545

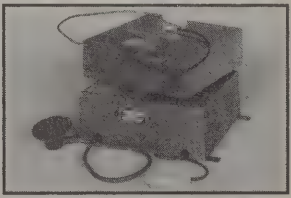
HVS00576 - **Power supply for flight simulator application** has a 32 KV, 6.5 mA nominal, 15.0 mA peak anode output with a built-in splitter for three tubes. Included in the package are three separate dynamic focus modules with programmable 7.5 KV to 10 KV outputs. Dynamic focus amplifiers provide DC-coupled 500 V peak-to-peak output, with a slew rate of 250 V/µS. Modular configuration for simplified field repair.



HVS00576

FILM RECORDING

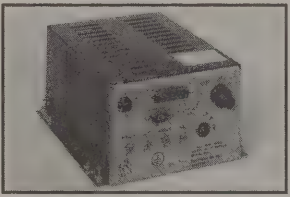
HVS00464 - **Low temperature coefficient outputs:** 25 KV, 100 µA anode; 5.5 KV to 6.5 KV, 600 µA focus; 300 V to 800 V G2. Built-in DC-coupled amplifier provides 200 V of dynamic focus with a small signal bandwidth of 200 KHz. Features logic circuits for tube protection.



Film Recording

HVS00574 - **Ultra-high resolution film recorder power supply:** 20 KV at 25 µA anode, 4.2 KV to 6.0 KV at 200 µA focus, 800 V G2 and -150 V G1. Features built-in 300 V DC-coupled dynamic focus amplifier and logic circuits for tube protection.

HVS00529 - **Complete power supply system for film recorder CRT.** Provides rock solid voltages for long exposure times. 3 of the 4 outputs are regulated. Very low noise, 18 KV anode; 2.5 to 3.3 KV DC focus with 300 Vp-p dynamic to 100 KHz. Regulated G2, adjustable from 700 to 1300 V. G1 output is -147 V @ 25 mA. Input ±15 V, extremely low conducted EMI. UL 1950 and CSA 950 approved.

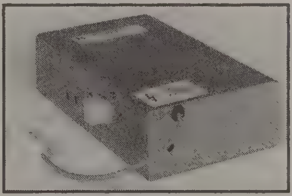


HVS00424

FAA DISPLAYS

HVS00424 and HVS00375 - **Self-contained high voltage supply provides anode, focus, G2 outputs, as well as dynamic focus.** DF amplifier boasts 1000 V/µS slew rate, up to 500 Vp-p, DC-coupled. Modular design for ease of field repair.

HDF50600 - **Dynamic focus module for raster display** provides 3.5 KV to 5.0 KV @ 1.0 mA and up to 800 V of dynamic focus correction.



HDF50600

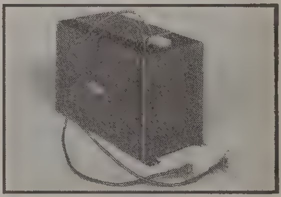
Includes separate amplifiers for vertical and horizontal dynamic focus, each capable of 400 V swings.

DUAL FOCUS DIRECT VIEW

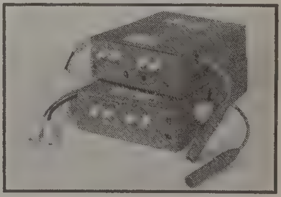
A family of custom designed supplies for DAF (Dynamic Astigmatism and Focus) applications, featuring two focus outputs, with or without internal horizontal and vertical amplifiers. Options include: DC restorer, overvoltage and overload protection, UL and CSA 950 approval, remote brightness control, and remote off/on.

BEAM-PENETRATION COLOR

For high-resolution color vector display using double anode penetron CRTs for up to 120 4-color fields per second; second anode 8 - 17 KV, first anode 15 KV, with dynamic focus and G1 and G2 voltages. Digital programming to 4 adjustable levels. Switching times: 125 µS max. for 3 KV; 300 µS max. for 9 KV; slew and recovery with 500 to 1350 pf load. First anode voltage: 15.0 KV @ 100 µA. Focus voltage: 2.2 to 3.5 KV, plus 300 V dynamic @ 300 µA. Grid voltage: -35 V @ 25 µA; turn-off blanking. Power input: +24 VDC ±15%. Designed for UL, CSA acceptance. Fault overvoltage: Active circuit latch-off.



Beam Penetration Color



Dual Focus View

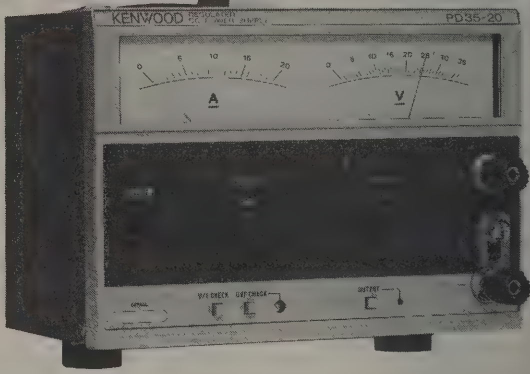
KENWOOD POWER SUPPLIES

PD SERIES

Advanced Technology Throughout, Including Unique Phase Control Technique

The Phase Control Technique enables High-Stability and Large Capacity.

PD18-10
18V/10A
PD18-20
18V/20A
PD18-30
18V/30A
PD35-10
36V/10A
PD35-20
36V/20A
PD56-6
56V/6A
PD56-10
56V/10A
PD110-3
110V/3A
PD110-5
110V/5A
PD18-10D
18V/10A
PD18-20D
18V/20A
PD18-30D
18V/30A
PD35-10D
36V/10A
PD35-20D
36V/20A
PD56-6D
56V/6A
PD56-10D
56V/10A
PD110-3D
110V/3A
PD110-5D
110V/5A



The PD Series power supply is employing a unique phase control technique which enables high-stability and large-capacity. There are two types of display you can choose, meter indicators or digital displays, for the purpose of usage. The remote control function is also provided and it enables easy use in applications such as R&D, aging and as a system power supply. By using GP-610, GPIB Adaptor, most of the functions are controlled by computer.

- **Excellent temperature characteristics and transient response.**
- **Detection of over-voltage, over-current and over-heating conditions protects power supply circuitry.**
- **Three-terminal floating output.**
- **Forced-air fan cooling.**

High stability and large capacity: A unique phase control method which used a built-in pre-regulator ensures fast response and efficient high-stability supply of high currents.
High efficiency and reliability: The phase control method is combined with a choke-input filter to provide excellent regulation, low ripple and low noise–all at a high efficiency level.
High-accuracy voltage setting: The output voltage is settable using a ten-turn potentiometer, enabling smooth, high-precision setting.
Remote sensing: A remote sensing function is provided to compensate for the voltage drop in the resistance of the leads from the power supply to the load.
Remote control: The output voltage (and current) can be controlled by means of an external voltage (or resistance), enabling remote control of output.
Over-voltage protection: Over-voltage protection shuts the power off and disconnects the load to prevent damage caused by misoperation.
Voltage/current limiting: The voltage or current to be limited is presettable and LED shows in operational area.
Series and parallel connectable: Several power supplies can be connected in series to boost output voltage capability, or in parallel to boost output current capability. In addition, with either connection method, master-slave operation enables the output to be controlled from just one of the thus-connected supplies.
Output voltage on/off: The output switch can be used to electrically turn the output voltage on and off.

Specifications

Model	PD18-10 &PD18-10D	PD18-20 &PD18-20D	PD18-30 &PD18-30D	PD35-10 &PD35-10D	PD35-20 &PD35-20D	PD56-6 &PD56-6D	PD56-10 &PD56-10D	PD110-3 &PD110-3D	PD110-5 &PD110-5D
Output voltage	0~18V			0~36V		0~56V		0~110V	
Output current	0~10A	0~20A	0~30A	0~10A	0~20A	0~6A	0~10A	0~3A	0~5A
• Voltage regulation characteristics									
Line regulation	0.005%+1mV								
Load regulation	0.005%+1mV	0.005%+2mV		0.005%+1mV	0.005%+2mV	0.005%+1mV	0.005%+2mV	0.005%+1mV	
Ripple/noise	0.5mVrms								
• Current regulation characteristics									
Line regulation	1mA	5mA		1mA	5mA	1mA	3mA	1mA	
Load regulation	5mA								
• Meter									
Voltmeter	0~18Vf.s.			0~36Vf.s.		0~56Vf.s.		0~110Vf.s.	
Ammeter	0~10Af.s.	0~20Af.s.	0~30Af.s.	0~10Af.s.	0~20Af.s.	0~6Af.s.	0~10Af.s.	0~3Af.s.	0~5Af.s.
• Digital meter display (D type only)									
Voltage display	Max. 19.99V/199.9V two automatically switched ranges								
Current display	Max. 19.99A or 9.99A fixed range								
	19.99A	99.9A		19.99A	99.9A	19.99A			
• Power Consumption									
VA/Watts	530VA/360W	1000VA/620W	1400VA/930W	830VA/560W	1600VA/1000W	800VA/500W	1250VA/800W	800VA/500W	1250VA/800W
• Line voltage									
Voltage	100/120/220/240VAC ±10%, 50/60Hz								
• Dimensions & Weight									
Dimensions	I size	III size	IV size	I size	III size	I size	II size	I size	II size
Weight	12kg	19kg	24kg	14kg	23kg	14kg	18kg	14kg	18kg
• Prices									
Prices:	935./1.091.	1403./1559.	1559/1716.	1039./1195.	1455./1611.	1039./1195.	1299./1455.	1247./1403.	1559./1715

I size 208(W)x147(H)x300(D) mm Max. 208(W)x168(H)x346(D) mm
II size 208(W)x147(H)x348(D) mm Max. 208(W)x168(H)x394(D) mm
III size 208(W)x147(H)x420(D) mm Max. 208(W)x168(H)x483(D) mm
IV size 208(W)x147(H)x457(D) mm Max. 208(W)x168(H)x520(D) mm

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KENWOOD POWER SUPPLIES

PWR PW SERIES

Microcomputer Control, Dual-Tracking, and Multiple Outputs

Two Series to Select from Four Models of the PWR Series for Systems Use and Four Models of the PW Series for Stand-alone Use.

PWR18-1.8Q
±18V/±1.8A, 8V/2A, –6V/–1A

PWR18-1T
±18V/±1A, 6V/5A

PWR18-2
±18V/±2A

PWR18-2TP
+18V/+2A, +36V/+1A, +8V/+2A

PWR18-2P
+18V/+2A

PWR36-1
±36V/±1A

PW18-1.8Q
±18V/±1.8A, 8V/2A, -6V/–1A

PW18-1T
±18V/±1A, 6V/5A

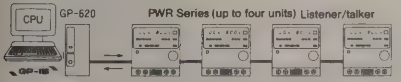
PW18-2
±18V/±2A

PW36-1
±36V/±1A

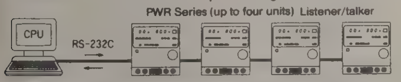
The PWR/PW Series power supplies are multi-function, dual-tracking CV/CC power supplies featuring a built-in micro-processor. And they provide multiple-output performance for experimental and systems use that rivals the previous approach of using several single-output supplies. The PW Series consists of highly versatile stand-alone power supplies, and the PWR Series provides in addition a listener function that enables digital-signal remote control of all functions and a talker function enables readback of not only all setting conditions, but of output voltage and current as well. This makes the PWR power supplies fully remotely controllable, multiple-output regulated-voltage/current power supplies.

The PWR system enables flexible configurations to suit a wide range of applications.

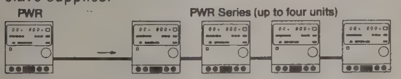
Expandable to systems applications using GPIB control: The GP-620 GPIB Adaptor can be added to adapt PWR supplies into systems application, providing listener/talker capability that enables not only full control of all power supply functions, but readout of output voltage and current values. By using IDs, control of up to four power supplies is possible, enabling a highly safe system configuration.



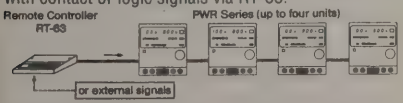
Expandable to computer-controlled programmable operation: By making direct connection to an external computer, it is possible to use these power supplies as programmable power supplies for application such as simulation testing. This simplifies the job of implementing a power supply system with all functions remotely controlled and readout of output voltage and current.



Master-slave operation: When including these supplies as part of a system, single control is possible by assigning one unit of a number of similar supplies as the master supply to control all functions of up to four slave supplies.



External remote control: By adding the RT-63 Remote Controller, it is possible to remotely switch the preset (output values), the outputs, and the output protect on/off of up to four units from a remote controller. It is also possible to perform remote control with contact or logic signals via RT-63.



Specifications

Model	PWR18-1.8Q & PW18-1.8Q	PWR18-1T & PW18-1T	PWR18-2 & PW18-2	PWR18-2TP	PWR18-2P	PWR36-1 & PW36-1
Output voltage	0~±18V 0~+8V 0~–6V	0~±18V 0~+6V	0~±18V	0~+18V 0~+36V 0~+8V	0~+18V 0~+18V	0~±36V
Output current	0~±1.8A 0~+2A 0~–1A	0~±1A 0~±5A	0~±2A	0~+2A 0~+1A 0~+2A	0~+2A	0~±1A
• Voltage regulation characteristics						
Line regulation	1mV			1mV (+18V), 2mV (+36V), 1mV (+8V)	1mV	2mV
Load regulation	3mV	2mV	3mV	3mV (+18V), 2mV (+36V), 3mV (+8V)	3mV	2mV
Ripple/noise	0.5mVms					
• Current regulation characteristics						
Line regulation	2mA (typ.)					
Load regulation	10mA (typ.)					
• Digital meter display						
Voltage display	Max. 19.99V (fixed range: LED)			Max. 19.99V (39.99V/+36V) (Fixed range: LED)		Max.19.99V/99.9V Autoranging
Current display	Max. 9.99A (fixed range: LED)					
• Power consumption						
VA/Watts	240VA/213W	210VA/176W	210VA/165W	253VA/208W	210VA/165W	190VA/145W
• Line voltage						
Voltage	100/120/220/240VAC ±10% (max. 250V), 50/60Hz					
• Dimensions & Weight						
Dimensions	II size		I size	II size	III size	II size
Weight	8.2kg	8.1kg	6.4kg	8.1kg	6.4kg	
• Prices						
Price	1122./862.	1081./821.	1008./748.	1008.		999./748.

I size	104(W)x147(H)x330(D) mm	Max. 109(W)x167(H)x350(D) mm
II size	138(W)x147(H)x372(D) mm	Max. 143(W)x167(H)x392(D) mm
III size	104(W)x147(H)x300(D) mm	Max. 109(W)x167(H)x350(D) mm

The PWR/PW Series Combines Advanced Functions with Amazingly Simple Operation and Safety

Dual tracking: In addition to dual tracking, in which positive and negative voltages track from zero volts simultaneously, positive and negative voltages can be set independently.

Simultaneous digital display of voltage and current: Output voltage and current are indicated simultaneously on red LED displays, providing an easily readable display not possible in dark locations with dim LCDs.

Presetting of voltage and current value pairs (3 points): Three sets of frequently used voltages and currents (V-A pairs) can be preset, thereby enabling quick setup of the power supply output. (The PWR18-1.8Q,PWR18-1T,PW18-1.8Q and PW18-1T additionally feature presettable on/off delay time.)

One-dial control: To simplify operation, all condition settings are selected at push of a button. With a single dial being used to set all values. In addition, output voltage and current can be set to resolutions of 10mV and 10mA, respectively. The selected key is indicated by an LED.

Key-lock: A key-lock function can be used to forcibly hold all setting values, thereby preventing the inadvertent changes of values during testing when you leave the power supply unattended.

Dual safety: When the output is on, if a preset switch or variable switch is changed or tracking switch is set to on, a protection circuit cuts off the supply output, to prevent output of unexpected voltages and currents (when the output protect switch is set to on.)

Delay time: For multiple-output power supplies, when more than one of the outputs are switching on or off simultaneously, the testing device or circuit being supplies may be influenced unexpectedly, running the risk of damage. To prevent this, the delay time feature enables you to turn on a given output only after a delay time, and turn this output off this same delay time before the other outputs (The PWR18-1.8Q, PWR18-1T, PW18-1.8Q and PW18-1T only.).

Natural Cooling: An energy-efficient design has minimized the temperature rise within these supplies, this combining with a carefully thought-out structure to eliminate the need for a cooling fan, thereby reducing noise, vibration, and pull-in of dust.

Rack-size package: On the assumption that these power supplies will be used in testing and systems application, they have been designed in a case that meets EIA rack standards.

Last-one memory: A backup function holds setting values, so that when the power is switched on the values in effect when power was switched off are set automatically, eliminating the need to make setting once again.

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KENWOOD POWER SUPPLIES

PAR PA SERIES

Compact, High-Performance CV/CC Power Supplies

The PA Series Has Five Versions That Show What Power Supply Reliability and Stability Are All About.

PAR18-5
18V/5A
PAR36-3
36V/3A
PA18-1.2
18V/1.2A
PA18-3
18V/3A
PA36-1.2
36V/1.2A
PA36-3
36V/3A
PA70-1
70V/1A
PA250-0.4A
250V/0.4A

Designed to provide both compactness and high reliability, the PA Series of series-regulated constant-voltage/current power supplies provides simultaneous digital display of both output voltage and current. There are two 18V types, two 36V types, on 70V type, and one 250V type, enabling selection for a variety of applications. The outputs can be boosted by single-control serial and parallel connections, and remote control enables easy use of these compact power supplies in applications such as R&D, aging and as a system power supplies. The PAR Series is a micro-computer controlled versatile CV/CC power supply which incorporates reliable power remote sensing terminals.

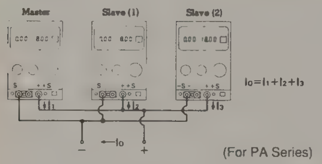
Low ripple and noise: Series regulation achieves extremely low ripple and noise, as well as excellent temperature characteristics and electrical performance.

Simultaneously digital readout of both voltage and current: Voltage is displayed on a 3-1/2 digit LED display (autoranging, maximum display: 19.99V), and current is displayed on a 3-digit LED display, enabling checking of both voltage and current settings simultaneously. Constant-voltage and constant-current operation is indicated by green and red LEDs, respectively.

Series and parallel connectable: Several power supplies can be connected in series to boost output voltage capability, or in parallel to boost output current capability. In addition, with either connection method, master-slave operation enables the output to be controlled from just one of the thus-connected supplies.

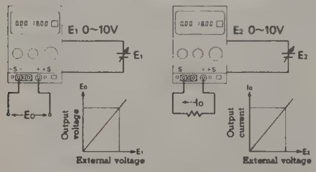
Floating output: Because the output terminals are floating, operation is possible as either a positive or negative supply. Output sensing terminals are provided on the front panel for precise setting of the voltage actually applied to the load.

• Single-Control Parallel Operation


Master
Slave (1)
Slave (2)
Io=I1+I2+I3
Io

(For PA Series)

• Control by an External Voltage


E1 0~10V
E1
E2 0~10V
E2
Eo
Io
Output voltage
External voltage
Output current
External voltage

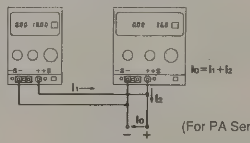
(For PA Series)

Specifications

Model	PA18-1.2	PA18-3	PA36-1.2	PA36-3	PA70-1	PA250-04A	PAR18-5	PAR36-3
Output voltage	0~18V		0~ 36V		0~70V	0~250V	0~+18V	0~+36V
Output current	0~1.2A	0~3A	0~1.2A	0~3A	0~1A	0~0.4A	0~+5A	0~+3A
• Voltage regulation characteristics								
Line regulation	1mV		2mV		5mV	15mV	2mV	
Load regulation	2mV	3mV	2mV	4mV	5mV	15mV	5mV	4mV
Ripple/noise	0.5mVms				1mVrms	2.5mVrms	0.5mVrms	
• Current regulation characteristics								
Line regulation	2mA					1mA	4mA (Type)	3mA (Type)
Load regulation	10mA			15mA	10mA	5mA	20mA (Type)	15mA (Type)
• Digital meter display								
Voltage display	Max. 19.99V (fixed range)		Max. 19.99V /99.9V (Autoranging)			Max. 199.9V/ 990V (Autoranging)	Max. 19.99V (Fixed: LED)	Max. 39.99V Fixed: LED)
Current display	Max. 9.99A (fixed range)					Max. 999mA	Max. 9.99A (fixed LED)	
• Power consumption								
VA/Watts	62VA/45W	140VA/105W	105VA/80W	250VA/185W	150VA/113W	187VA/150W	264VA/213W	
• Line voltage								
Voltage	100/120/220/240VAC ±10% (max. 250V), 50/60Hz							
• Dimensions & Weight								
Dimensions	S size	M size	S size	L size	M size	L size	K size	
Weight	4.0kg	5.9kg	4.6kg	8.6kg	6.0kg	7.0kg	8.0kg	
• Prices								
Prices	380.	470.	420.	560.	530.	800.		

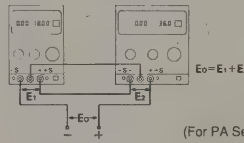
S size 104(W)x147(H)x180(D) mm Max. 108(W)x161(H)x200(D) mm
M size 104(W)x147(H)x215(D) mm Max. 108(W)x167(H)x265(D) mm
L size 138(W)x147(H)x230(D) mm Max. 142(W)x167(H)x290(D) mm
K size 138(W)x147(H)x372(D) mm Max. 143(W)x167(H)x392(D) mm

• Parallel Connection


Io=I1+I2
I1
I2
Io

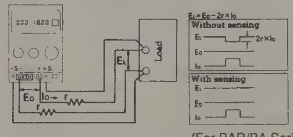
(For PA Series)

• Series Connection


Eo=E1+E2
E1
E2
Eo

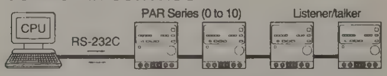
(For PA Series)

• Remote Sensing

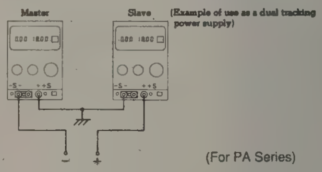

EL=Eo-2r×Io
Without sensing
With sensing
Load
EL
Eo
Io
r

(For PAR/PA Series)

• COMPUTER CONTROL

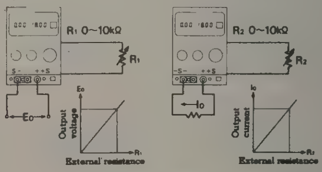

CPU
RS-232C
PAR Series (0 to 10)
Listener/talker

• Single-Control Series Operation


Master
Slave
(Example of use as a dual tracking power supply)

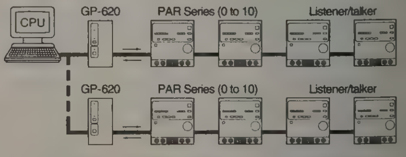
(For PA Series)

• Control by an External Resistance


R1 0~10kΩ
R1
R2 0~10kΩ
R2
Eo
Io
Output voltage
External resistance
Output current
External resistance

(For PA Series)

• GPIB CONTROL


CPU
GP-620
PAR Series (0 to 10)
Listener/talker
GP-620
PAR Series (0 to 10)
Listener/talker

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KENWOOD POWER SUPPLIES

PR SERIES

Compact and Cost-Efficient

Ten Types of PR Series Power Supplies

PR18-1.2
18V/1.2A

PR-18-3
18V/3A

PR18-5
18V/5A

PR36-1.2
36V/1.2A

PR36-3
36V/3A

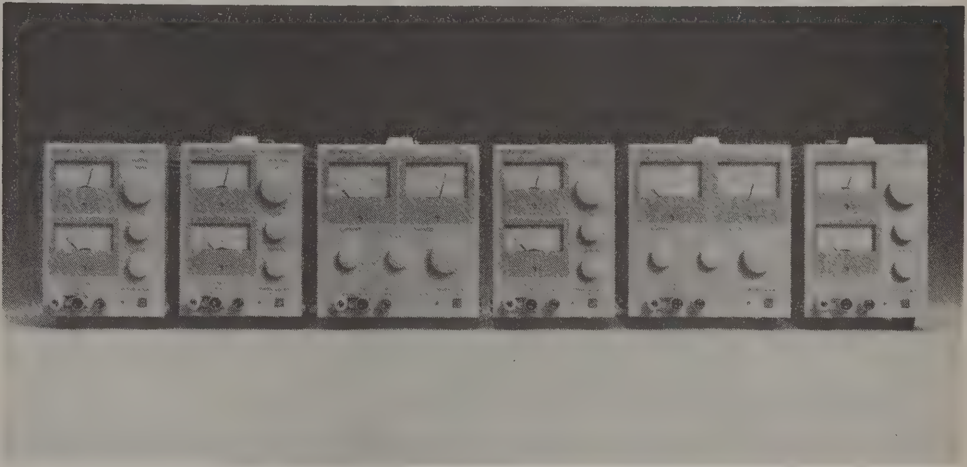
PR70-1
70V/1A

PR30-3P
30V/3A

PR30-6P
30V/6A

PR30-3W
±30V/±3A

PR250-0.4A
250V/0.4A



The PR Series of dropper-type CV/CC power supplies is designed to provide a compact power supply package with high performance, and ensures excellent reliability and superb design. Six types are available for a variety of requirements, three 18V types, three 30V types, two 36V types, one 70V type and one 250V type. Whether used individually or connected in series or parallel for greater capacity, the PR Series ensures excellent performance. These power supplies are housed in a compact rack-mount package and can be used on the benchtop as well.

Specifications

Model	PR18-1.2	PR18-3	PR18-5	PR30-3W	PR30-6P	PR30-3P	PR36-1.2	PR36-3	PR70-1	PR250-0.4A
Output voltage	0~18V			0~+30V/ 0~–30V	0~30v	0~30V	0~36V		0~70V	0~250V
Output current	0~1.2A	0~3A	0~5A	0~3A	0~6A	0~3A	0~1.2A	0~3A	0~1A	0~0.4A
• Voltage regulation characteristics										
Line regulation	0.01%+2mV			2mV			0.01%+2mV			2mV
Load regulation	0.01%+2mV		0.01%+3mV	5mV	6mV	5mV	0.01%+2mV			2mV
Ripple/noise	0.5mVms								1mVrms	2.5mVrms
• Current regulation characteristics										
Line regulation	2mA									
Load regulation	6mA	10mA	15mA	10mA					15mA	10MA
• Meter										
Voltmeter	0~18Vf.s.			±30V Changeable	30V		0~36Vf.s.		0~70Vf.s.	250V
Ammeter	0~1.2Af.s.	0~3Af.s.	0~5Af.s.	±3A Changeable	6A	3A	0~1.2Af.s.	0~3Af.s.	0~1Af.s.	0.4A
• Power consumption										
VA/Watts	60VA/45W	140VA/105W	230VA/175W	350VA/290W	370VA/290W	175VA/140W	105VA/79W	250VA/185W	150VA/113W	185VA/145W
• Line voltage										
Voltage	100/120/220/240VAC ±10% (max. 250V), 50/60Hz									
• Dimensions & Weight										
Dimensions	S size	M size	L size	LL size	LL size	L size	S size	L size	M size	L size
Weight	3.8kg	5.7kg	8.1kg	13kg	13kg	6.8kg	4.4kg	8.6kg	5.8kg	7kg
• Prices										
Prices:	209..	303.	387.					387.	356.	

S size	104(W)x147(H)x180(D) mm	Max. 108(W)x161(H)x200(D) mm
M size	104(W)x147(H)x215(D) mm	Max. 108(W)x167(H)x265(D) mm
L size	138(W)x147(H)x230(D) mm	Max. 142(W)x167(H)x290(D) mm
LL size	210(W)x147(H)x245(D) mm	Max. 214(W)x167(H)x320(D) mm

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MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

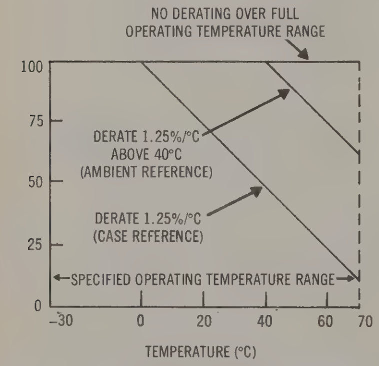

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

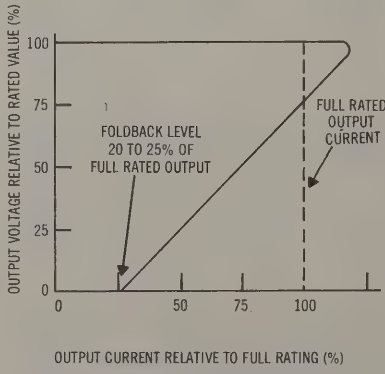

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

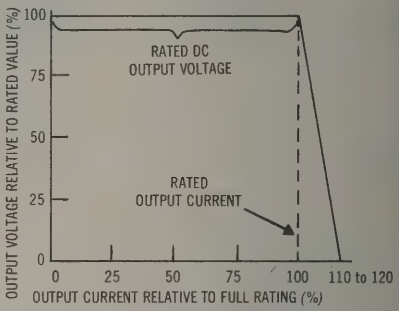

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

DC Power Supplies 3W-1500W Modular and Instrumentation Styles

KEPCO®
THE POWER SUPPLIER™
SINCE 1946

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KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, NY 11352 USA • (718) 461-7000 • FAX: (718) 767-1102 • Easylink (TWX): 710-582-2631

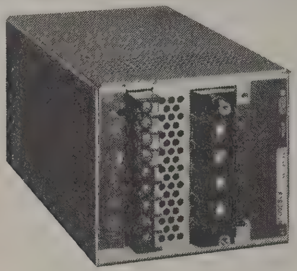
KEPCO® **THE POWER SUPPLIER™**

HEAVY DUTY INDUSTRIAL GRADE SWITCHING MODULES

150KHz FET-BASED a-c to d-c SWITCHING POWER SUPPLIES

RAX™
115/230V a-c input

These single output a-c to d-c switching power supplies employ FETs operating at 150 KHz to provide a low profile (4.3″) package that fits easily behind standard 5¼″ panels. Reliability is assured by a low parts count that results from extensive use of custom hybrid microcircuits using surface mount components. Available sizes: 50W, 100W, 175W, 300W, and 1500W.



Shown:
300-Watt Model RAX 24-12K (24V/12A) supplied fully enclosed for industrial applications.

Features:

- **"Power-OK" LED**
- **Remote on/off:** Optically isolated logic signal.
- **Active soft-start circuit.** Limits initial input current surge.
- **Remote error sensing:** Compensates for voltage drops between power supply and load.
- **Remote voltage control:** Adjust output setting with external resistance.
- **Adjustable voltage:** Internal trimmer accessible through case.
- **Overvoltage protection.**
- **Undervoltage protection in 300W and 1500W models:** Shuts down for voltage below 70% of nominal after 20 seconds.
- **Rectangular current limiting** so you can drive non-linear loads.
- **Parallel operation:** Units may be paralleled for increased current. The 1500W models feature automatic current sharing.
- **Holding time:** 30 milliseconds typically, 20 milliseconds minimum.
- **Fan cooling in 300W and 1500W models:** Other models employ convection. No external heat sinks required.
- **Built-in EMI filter** attenuates conducted noise below the requirements of FCC 20780, Class A.
- **Safety:** All models recognized by UL 478 (4,5); UL 1950. Certified by CSA 1402 level 3. Approved by TÜV Rheinland IEC 380 & 950, VDE 0806, EN 60 950. Also certified to meet the MIL STD 810D environment.
- **Produced in** ISO 9001 certified facility.

50 WATT MODELS

MODEL	OUTPUT, VOLTS	ADJUSTMENT RANGE	OVP SETTING VOLTS Nom. input, 25°C	OUTPUT CURRENT, AMPS			SW RIPPLE mV typ	NOISE (Spike) max mV
				50°C	60°C	71°C		
RAX 3.3-10K	3.3	1.8~ 3.6	3.9~ 4.8	10.0	7.0	4.0	<25	100
RAX 5-10K	5	4.0~ 5.5	6.0~ 6.9	10.0	7.0	4.0	<25	100
RAX 12-4.2K	12	8.4~13.2	13.7~15.7	4.2	2.9	1.7	<25	170
RAX 15-3.4K	15	12.0~16.5	17.0~19.5	3.4	2.4	1.4	<25	200
RAX 24-2.1K	24	16.8~26.4	27.0~30.5	2.1	1.5	0.8	<25	290
RAX 28-1.8K	28	19.6~30.8	32.0~35.0	1.8	1.3	0.7	<25	330
RAX 48-1K	48	32.6~52.8	55.0~63.0	1.0	0.7	0.4	<25	530

Case Size: 4.3″H × 1.8″W × 7.5″D Net Weight: 1.8 lbs.

100 WATT MODELS

RAX 3.3-20K	3.3	1.8~ 3.6	3.9~ 4.8	20.0	14.0	8.0	<25	100
RAX 5-20K	5	4.0~ 5.5	6.0~ 6.9	20.0	14.0	8.0	<25	100
RAX 12-8.3K	12	8.4~13.2	13.7~15.7	8.3	5.8	3.3	<25	170
RAX 15-6.6K	15	12.0~16.5	17.0~19.5	6.6	4.6	2.6	<25	200
RAX 24-4.2K	24	16.8~26.4	27.0~30.5	4.2	2.9	1.7	<25	290
RAX 28-3.5K	28	19.6~30.8	32.0~35.0	3.5	2.5	1.4	<25	330
RAX 48-2K	48	32.6~52.8	55.0~63.0	2.0	1.4	0.8	<25	530

Case Size: 4.3″H × 2.6″W × 7.9″D Net Weight: 2.9 lbs.

175 WATT MODELS

RAX 3.3-35K	3.3	1.8~ 3.6	3.9~ 4.8	35.0	24.5	14.0	<25	100
RAX 5-35K	5	4.0~ 5.5	6.0~ 6.9	35.0	24.5	14.0	<25	100
RAX 12-14K	12	8.4~13.2	13.7~15.7	14.0	9.8	5.6	<25	170
RAX 15-11K	15	12.0~16.5	17.0~19.5	11.0	7.7	4.4	<25	200
RAX 24-7.2K	24	16.8~26.4	27.0~30.5	7.2	5.0	2.9	<25	290
RAX 28-6.2K	28	19.6~30.8	32.0~35.0	6.2	4.3	2.5	<25	330
RAX 48-3.6K	48	32.6~52.8	55.0~63.0	3.6	2.5	1.4	<25	530

Case Size: 4.3″H × 3.9″W × 8.7″D Net Weight: 4 lbs.

300 WATT MODELS

MODEL	OUTPUT, VOLTS	ADJUSTMENT RANGE	OVP SETTING VOLTS Nom. input, 25°C	OUTPUT CURRENT, AMPS			SW RIPPLE mV typ	NOISE (Spike) max mV
				50°C	60°C	71°C		
RAX 5-60K	5	4.0~ 5.5	6.0~ 6.9	60.0	42.0	24.0	<25	100
RAX 12-25K	12	8.4~13.2	13.7~15.7	25.0	17.5	10.0	<25	170
RAX 15-20K	15	12.0~16.5	17.0~19.5	20.0	14.0	8.0	<25	200
RAX 24-12K	24	16.8~26.4	27.0~30.5	12.0	8.4	4.8	<25	290
RAX 28-10K	28	19.6~30.8	32.0~35.0	10.0	7.5	4.3	<25	330
RAX 48-6K	48	32.6~52.8	55.0~63.0	6.0	4.2	2.4	<25	530

Case Size: 4.3″H × 5.1″W × 8.66″D Net Weight: 5.5 lbs.

1500 WATT MODELS

RAX 5-300K	5	4.0~ 5.5	6.0~ 6.9	300.0	210.0	120.0	<50	200
RAX 12-125K	12	8.4~13.2	13.7~15.7	125.0	87.5	50.0	<60	250
RAX 24-65K	24	16.8~26.4	27.0~30.5	65.0	45.5	26.0	<60	300
RAX 48-30K	48	32.6~52.8	55.0~59.0	30.0	21.0	12.0	<70	500

Case Size: 4.3″H × 8.0″W × 12.6″D Net Weight: 17.6 lbs.

This KEPCO product is backed by a firm
5-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED TUV APPROVED

For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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KEPCO. **THE POWER SUPPLIER™**

HEAVY DUTY INDUSTRIAL GRADE SWITCHING MODULES

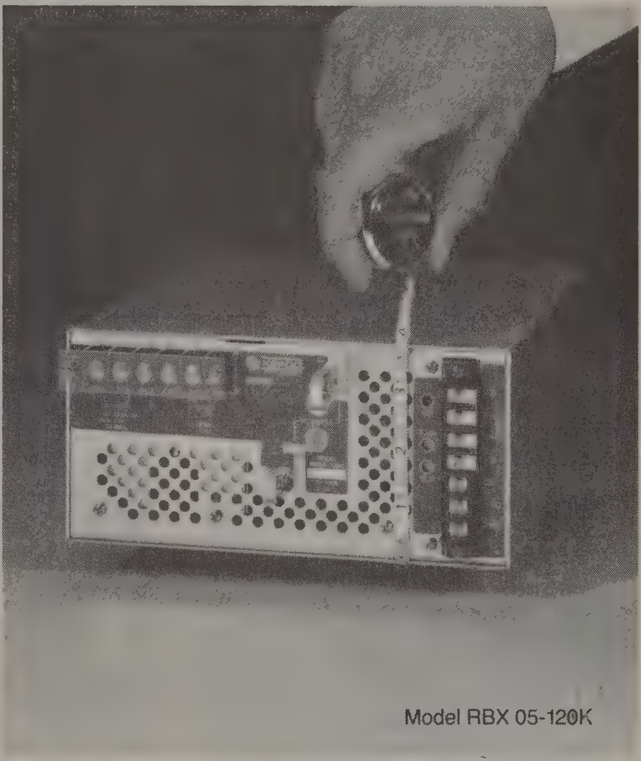
600 WATT, 150KHz a-c to d-c SWITCHING POWER SUPPLIES

RBX™ 115/230V a-c input

These single output a-c to d-c switchers squeeze 600 Watts of stabilized power into a low profile package only 3¾″ high. Series RBX operates FETs at 150 KHz for high efficiency. The extensive use of custom hybrid microcircuits and a unique output power assembly contribute to high reliability by reducing the parts count well below that of conventional designs.

Features:

- **"Power-OK" LED**
- **Active soft-start circuit:** Limits a-c turn-on surge.
- **Remote error sensing:** Compensates for voltage drops between power supply and load.
- **Remote voltage control:** Adjust output setting with external resistance.
- **Adjustable voltage:** Internal trimmer accessible through case.
- **Overvoltage protection.** (See table)
- **Undervoltage protection:** Shuts down for voltage below 70% of nominal after 20 seconds.
- **Rectangular current limiting:** So you can drive non-linear loads.
- **Parallel operation:** Units may be paralleled for increased current. Provision is made for current sharing.
- **Holding time:** 30 milliseconds typically, 20 milliseconds minimum.
- **Fan cooling:** "Fan ok" circuit inhibits Power FET drive and turns off output if fan fails to operate.
- **EMI:** Auxiliary filter (FLA 250-20) available to meet FCC 20780 for Class B computing devices.
- **Safety:** All models recognized by UL and certified by CSA. Also certified to meet the MIL STD 810D Environment.
- **Produced in** ISO 9001 certified facility.



Model RBX 05-120K

600 WATT MODELS

MODEL	OUTPUT VOLTS	MAX POWER	ADJUSTMENT RANGE	OVP SETTING VOLTS Nom. input, 25°C	OUTPUT CURRENT AMPS			RIPPLE (source & sw) mV		NOISE (spike) mV
					50°C	60°C	71°C	typ	max	max
RBX 02-120K	2	240	1.6- 2.2	2.6~ 2.8	0-120	0-84	0-48	<10	< 50	<100
RBX 05-120K	5	600	4.0- 5.5	6.0~ 6.5	0-120	0-84	0-48	<20	<100	<200
RBX 12-50K	12	600	9.6-13.2	14.0~14.5	0-50	0-35	0-20	<25	<100	<250
RBX 24-25K	24	600	19.0-26.5	27.0~27.5	0-25	0-17.50	0-10	<25	<100	<250
RBX 48-12.5K	48	600	38.4-52.8	55.0~57.0	0-12.5	0-8.75	0-5	<50	<200	<500

Case Size: 3.75″H × 7.9″W × 8.66″D Net Weight: 2V model 8.6 lbs.; 5V, 12V, 24V & 48V models 9.3 lbs.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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KEPCO THE POWER SUPPLIER™

HEAVY DUTY INDUSTRIAL GRADE SWITCHING MODULES

RCW™

85-264V a-c
125-370V d-c

750 WATT SWITCHING POWER SUPPLY, UNIVERSAL INPUT, POWER FACTOR CORRECTED

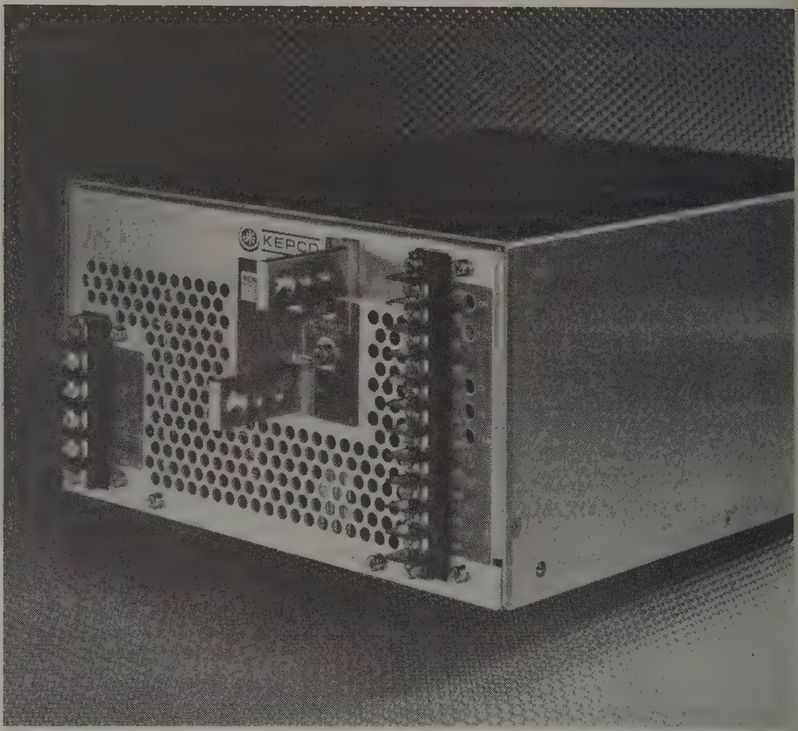
Operating at 60 KHz, these converters provide high efficiency at either 240V a-c source voltage, or 120V a-c. The user need do no switching to select input. The wide-range input accepts any mains voltage from 85 to 264 Volts.

To allow for paralleling, a current-share circuit is provided to equalize the outputs from as many as three of the 750 watt RCW models connected together.

Mechanically, RCW is a low-profile design measuring only 4.3" high on a 7.9" x 9.5" footprint. Delivering full power (750W) up to 50°C, at a modest cost, these 750 watt models are ideal systems power supplies for your demanding applications.

Features:

- **Low profile:** 4.3" high x 7.9" x 9.5" footprint.
- **85-264V a-c wide-range input, 125-370V d-c input.**
- **Power factor correction,** PF = 0.99 (meets IEC 555-2).
- **Current sharing** for N+1 redundancy.
- **EMI filter** meets FCC 20780 Class A.
- **Approved by** TÜV/UL/CSA to IEC 950.
- **Produced in** ISO 9001 certified facility.



Model RCW 24-31K

This KEPCO product is backed by a firm 5-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED TUV APPROVED

750 WATT MODULAR STYLE MODELS

SPECIFICATION	OUTPUT VOLTAGE		OVP SETTING	OUTPUT CURRENT			RIPPLE		NOISE	EFFICIENCY
Unit	Volts		Volts	Amps			mV p-p		mV p-p	Percent, typ
Condition	Factory Set	Adjustment Range	Nominal Input 25°C	50°C	60°C	71°C	Source max	SW max	(Spike) 20MHz	50-100% Load 120/240V
RCW 3.3-150K	3.3	2.7-3.6	3.8-4.6	150	105	60	20	50	200	71/73
RCW 5-150K	5	4.0-5.5	6.0-6.9	150	105	60	20	50	200	76/79
RCW 12-62K	12	8.4-13.2	13.7-15.7	62.5	43.7	25	20	80	250	77/80
RCW 15-50K	15	12.0-16.5	17.0-19.5	50	35	20	20	80	250	78/81
RCW 24-31K	24	16.8-26.4	27.0-30.5	31.3	21.9	12.5	20	120	300	79/82
RCW 28-26K	28	25.2-30.8	31.4-34.5	26.8	18.7	10.7	20	120	300	80/84
RCW 48-15K	48	32.6-52.8	54-59	15.7	11	6.3	20	200	500	82/85

Case Size: 4.3" x 7.9" x 9.5" **Net Weight:** 11 lbs.

For complete specifications send for Series RCW Brochure 146-1797 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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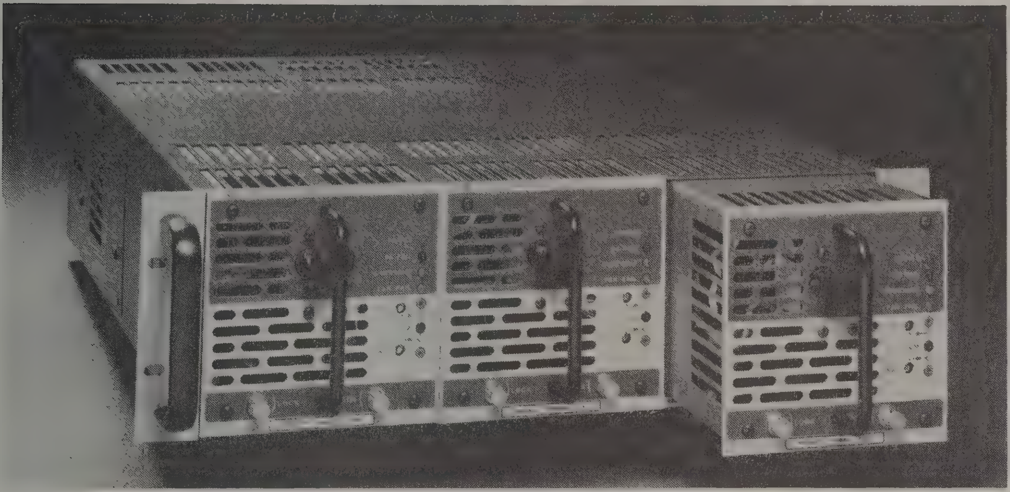
KEPCO. **THE POWER SUPPLIER™**

HEAVY DUTY INDUSTRIAL GRADE SWITCHING MODULES

HOT SWAPPABLE, 1000W POWER SUPPLIES



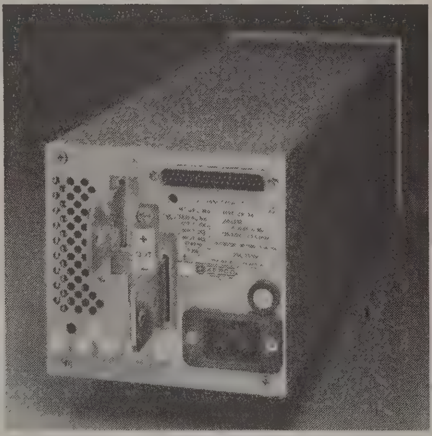
HSP™ 90-277V a-c
130-420V d-c

The Kepco HSP Series is a group of seven, kilowatt-size power supplies with outputs from 3.3 Volts to 48 Volts. They feature current-sharing for parallel operation and hot swappability for redundancy applications. Kepco's HSP have a universal input (90-277V a-c), and incorporate power factor correction (0.99) to meet IEC 555-2. These modern power supplies operate at 60 KHz in current mode. This provides rapid response to source and load changes and tight stabilization.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

Features:

- **90-277V a-c wide-range input, 130-420V d-c input.**
- **Power factor correction, PF = 0.99** (meets IEC 555-2).
- **Hot swappable.**
- **Current sharing for N + 1 redundancy.**
- **Designed to EN 950 and UL 1950,** under evaluation.
- **EMI filter meets FCC 20780 Level A.**
- **1KW in 5" x 5" x 15.5" plug-in package.**



REAR VIEW

1000 WATT MODELS

SPECIFICATION	OUTPUT VOLTAGE		OVP SETTING	OUTPUT CURRENT			RIPPLE		NOISE	EFFICIENCY
UNIT	VOLTS		VOLTS	AMPS			mV p-p		mV p-p	Percent
	Factory Set	Adjustment Range	Nominal Input 25°C	50°C	60°C	71°C	Source max	SW max	(Spike) 20MHz	100% Load 120/240V a-c
HSP 3.3-230	3.3	2.3-3.6	3.9-4.7	230	173	105	20	20	50	78
HSP 5-200	5	3.5-5.5	5.9-7.2	200	150	95	20	20	50	78
HSP 12-84	12	8.4-13.2	14-17.2	84	63	40	20	25	75	81
HSP 15-66	15	10.5-16.5	17.6-21.4	66	49.5	31.4	20	25	75	82
HSP 24-42	24	16.8-26.4	28.1-34.3	42	31.5	20	20	30	100	84
HSP 28-36	28	19.6-30.8	32.8-40	36	27	17	20	30	100	85
HSP 48-21	48	33.6-60.0	63-77	21	16	10	20	30	100	85

Case Size: 5" x 5" x 15.5" **Net Weight:** 15 lbs.

For complete specifications send for Series HSP Brochure 146-1796 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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KEPCO THE POWER SUPPLIER™

HEAVY DUTY INDUSTRIAL GRADE d-c to d-c CONVERTERS

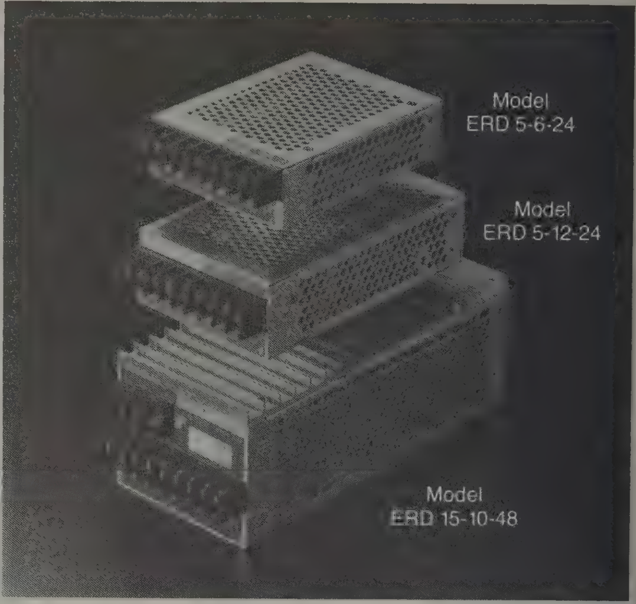
ERD™ SINGLE OUTPUT

24V and 48V d-c input

These are d-c to d-c converters operating at 300KHz. High frequency switching, plus extensive use of custom hybrid microcircuits with surface mount components, allow for small size (the ERD are only 3¾″ wide). The microcircuits afford high reliability by contributing to low parts count. The ERD are true transformer isolated power supplies whose output polarity is independent of the input. Available sizes: 30W, 60W, and 150W.

Features:

- **"Power-OK" LED.**
- **Remote on/off:** Optically isolated logic signal.
- **Remote error sensing:** Compensates for voltage drops between power supply and load.
- **Adjustable voltage** with internal trimmer.
- **Overvoltage protection.**
- **Rectangular current limiting** so you can drive non-linear loads.
- **Built-in EMI filter** meets conducted noise standard of MIL-STD 461B.
- **Safety:** All models recognized by UL, certified by CSA.
- **Produced in** ISO 9001 certified facility.



30 WATT MODELS

24V d-c input MODEL	48V d-c input MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OVP SETTING VOLTS Nom. input, 25 C	OUTPUT CURRENT AMPS 50 C	OUTPUT CURRENT AMPS 60 C	OUTPUT CURRENT AMPS 71 C	SW RIPPLE mV (typ)	NOISE (spike) mV max
ERD 5-6-24	**ERD 5-6-48**	5	4.0 ~ 5.5	6.0 ~ 6.9	6.0	4.2	2.4	<30	<100
ERD 12-2.5-24	**ERD 12-2.5-48**	12	8.4 ~ 13.2	13.7 ~ 15.7	2.5	1.8	1.0	<50	<170
ERD 15-2-24	**ERD 15-2-48**	15	12.0 ~ 16.5	17.0 ~ 19.5	2.0	1.4	0.8	<50	<200
ERD 24-1.3-24	**ERD 24-1.3-48**	24	16.8 ~ 26.4	27.0 ~ 30.5	1.3	0.9	0.5	<50	<290
ERD 48-0.6-24	**ERD 48-0.6-48**	48	32.6 ~ 52.8	55.0 ~ 63.0	0.6	0.4	0.2	<60	<530

Case Size: 3.74″ × 1.38″ × 5.12″ Net Weight: 0.9 lb.

60 WATT MODELS

ERD 5-12-24	**ERD 5-12-48**	5	4.0 ~ 5.5	6.0 ~ 6.9	12.0	8.4	4.8	<30	<100
ERD 12-5-24	**ERD 12-5-48**	12	8.4 ~ 13.2	13.7 ~ 15.7	5.0	3.5	2.0	<50	<170
ERD 15-4-24	**ERD 15-4-48**	15	12.0 ~ 16.5	17.0 ~ 19.5	4.0	2.8	1.6	<50	<200
ERD 24-2.5-24	**ERD 24-2.5-48**	24	16.8 ~ 26.4	27.0 ~ 30.5	2.5	1.8	1.0	<50	<290
ERD 48-1.2-24	**ERD 48-1.2-48**	48	32.6 ~ 52.8	55.0 ~ 63.0	1.2	0.8	0.5	<60	<530

Case Size: 3.74″ × 1.69″ × 6.3″ Net Weight: 1.2 lbs.

150 WATT MODELS

ERD 5-30-24	**ERD 5-30-48**	5	4.0 ~ 5.5	6.0 ~ 6.9	30.0	21.0	12.0	<30	<100
ERD 12-12-24	**ERD 12-12-48**	12	8.4 ~ 13.2	13.7 ~ 15.7	12.0	8.4	4.8	<50	<170
ERD 15-10-24	**ERD 15-10-48**	15	12.0 ~ 16.5	17.0 ~ 19.5	10.0	7.0	4.0	<50	<200
ERD 24-6-24	**ERD 24-6-48**	24	16.8 ~ 26.4	27.0 ~ 30.5	6.0	4.2	2.4	<50	<290
ERD 48-2.8-24	**ERD 48-2.8-48**	48	32.6 ~ 52.8	55.0 ~ 63.0	2.8	2.0	1.1	<60	<530

Case Size: 3.74″ × 3.15″ × 8.66″ Net Weight: 2.6 lbs.

Current ratings are for vertical installation. For use horizontally, derate by 20%. Moving air (5 CFM) is sufficient to avoid derating in horizontal position.

For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

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KEPCO® **THE POWER SUPPLIER**™

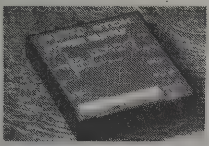
FPD™

This KEPCO product is backed by a firm 1-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

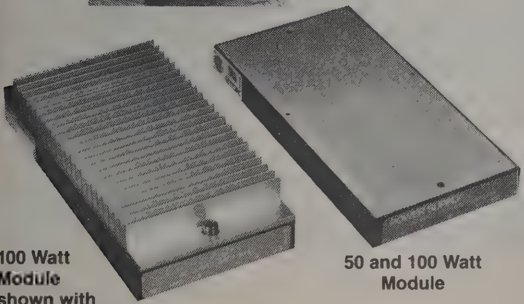
HIGH DENSITY d-c to d-c CONVERTERS

Flatpack d-c to d-c board-mount converters. Ideal for distributed power applications. Aluminum base plate/PCB stuffed with surface-mount devices… even a surface-mount transformer, a 500KHz fixed-frequency forward converter (not resonant mode) and beautiful, unpotted construction. Produced in ISO 9001 certified facility.


5 Watt Module, 20-56V Input

10 Watt Module, 36-72V Input

10 Watt Module, 20-56V Input


100 Watt Module shown with optional finned radiator

50 and 100 Watt Module

FINNED ACCESSORIES **Finned radiators available for 50W & 100W designs.**

The FPD 5W and 10W modules require no added cooling for normal operation. The 50W and 100W modules may require additional heat sinking. The special construction of FPD fastens surface-mount devices to the aluminum base plate so that excellent thermal coupling is obtained. Depending upon your application, FPD modules may be fastened by their base plate surface to a chassis or other cold plate – or a finned radiator may be attached as illustrated.

For normal operation at 100% current, the average base plate surface temperature should be maintained at or below 85°C.

FPD 50W	12V, 24V, 50V, 150V	use FIN-50
FPD 100W	24V, 48V	use FIN-50
FPD 100W	150V	use FIN-100

DIMENSIONS
5W: inches – 2 x 1.57 x 0.3 mm – 50.8 x 39.8 x 8.5
10W: inches – 2 x 2 x 0.3 mm – 50.8 x 50.8 x 8.5
50W: inches – 2.28 x 4.53 x 0.52 mm – 58 x 115 x 13.2
100W: (24V, 48V) inches – 2.28 x 4.53 x 0.52 mm – 58 x 115 x 13.2
100W: (150V) inches – 2.28 x 5.12 x 0.52 mm – 58 x 130 x 13.2

NET WEIGHT **5W:** 1.0 oz, 30 gm **10W:** 1.4 oz, 40 gm
50W: 5.3 oz, 150 gm **100W:** 5.3 oz, 150 gm

FPD MODEL TABLE

SPECIFICATION	OUTPUT VOLTS	OVP SETTING VOLTS	OUTPUT CURRENT AMPS	OVER CURRENT SETTING (2)	NOMINAL INPUT VOLTS
5 WATT MODELS(1), 20-56 VOLT INPUT					
FPD 5-1-48W	5	5.5- 6.9	1.0	1.20-2.0 FB	24-48
FPD 12-0.4-48W	12	13.2-15.7	0.4	0.48-0.8 FB	24-48
FPD 15-0.35-48W	15	16.5-19.0	0.35	0.42-0.7 FB	24-48
FPD 24-0.2-48W	24	26.4-31.5	0.2	0.24-0.4 FB	24-48
10-WATT MODELS(1), 20-56 VOLT INPUT					
FPD 5-2-48W	5	5.5- 6.9	2.0	2.4-4.0 FB	24-48
FPD 12-0.8-48W	12	13.2-15.7	0.8	1.0-1.6 FB	24-48
FPD 15-0.65-48W	15	16.5-19.0	0.65	0.8-1.3 FB	24-48
FPD 24-0.4-48W	24	26.4-31.5	0.4	0.5-0.8 FB	24-48
10 WATT MODELS(1), 36-72 VOLT INPUT					
SINGLE OUTPUT					
FPD 5-2-60W	5	5.4-7.0	2.0	3.0-5.2 SQ	48-60
FPD 12-0.8-60W	12	12.6-16.0	0.8	1.5-2.5 SQ	48-60
FPD 15-0.65-60W	15	15.75-19.0	0.65	1.25-2.4 SQ	48-60
DUAL OUTPUT					
FPD2X12-60W	+ 12, − 12	± 13.2-18.0	±0.4	1.2-2.5 SQ	48-60
FPD 2X15-60W	+ 15, − 15	± 16.5-21.0	±0.32	1.1-2.4 SQ	48-60
50 WATT MODELS					
FPD 5-10-12	5	5.5- 6.9	10.0	10.3-13.5A SQ	12
FPD 12-4.2-12	12	13.2-15.7	4.2	4.3- 5.7A SQ	12
FPD 15-3.4-12	15	17.0-19.0	3.4	3.5- 4.5A SQ	12
FPD 24-2.1-12	24	27.0-30.5	2.1	2.2- 2.9A SQ	12
50 WATT MODELS					
FPD 15-10-24	5	5.5- 6.9	10.0	10.3-13.5A SQ	24
FPD 12-4.2-24	12	13.7-15.7	4.2	4.3- 5.7A SQ	24
FPD 15-3.4-24	15	17.0-19.0	3.4	3.5- 4.5A SQ	24
FPD 24-2.1-24	24	27.0-30.5	2.1	2.2- 2.9A SQ	24
50 WATT MODELS					
FPD 5-10-48	5	5.5- 6.9	10.0	10.3-13.5A SQ	48
FPD 12-4.2-48	12	13.7-15.7	4.2	4.3- 5.7A SQ	48
FPD 15-3.4-48	15	17.0-19.0	3.4	3.5- 4.5A SQ	48
FPD 24-2.1-48	24	27.0-30.5	2.1	2.2- 2.9A SQ	48
50 WATT MODELS					
FPD 5-10-150	5	5.5- 6.9	10.0	10.3-13.5A SQ	150
FPD 12-4.2-150	12	13.7-15.7	4.2	4.3- 5.7A SQ	150
FPD 15-3.4-150	15	17.0-19.0	3.4	3.5- 4.5A SQ	150
FPD 24-2.1-150	24	27.0-30.5	2.1	2.2- 2.9A SQ	150
100 WATT MODELS					
FPD 5-20-24	5	5.5- 6.9	20.0	20.6-27A SQ	24
FPD 12-8.3-24	12	13.7-15.7	8.3	8.5-11.2A SQ	24
FPD 15-6.6-24	15	17.0-19.0	6.6	6.8- 8.9A SQ	24
FPD 24-4.2-24	24	27.0-30.5	4.2	4.3- 5.7A SQ	24
100 WATT MODELS					
FPD 5-20-48	5	5.5- 6.9	20.0	20.6-27A SQ	48
FPD 12-8.3-48	12	13.7-15.7	8.3	8.5-11.2A SQ	48
FPD 15-6.6-48	15	17.0-19.0	6.6	6.8- 8.9A SQ	48
FPD 24-4.2-48	24	27.0-30.5	4.2	4.3- 5.7A SQ	48
100 WATT MODELS					
FPD 5-20-150	5	5.5- 6.9	20.0	20.6-27A SQ	150
FPD 12-8.3-150	12	13.7-15.7	8.3	8.5-11.2A SQ	150
FPD 15-6.6-150	15	17.0-19.0	6.6	6.8- 8.9A SQ	150
FPD 24-4.2-150	24	27.0-30.5	4.2	4.3- 5.7A SQ	150

(1) W = wide range input (2) FB = fold back/winker type current limit, SQ = square-type current limit

For complete specifications send for FPD Brochure 146-1766 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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KEPCO THE POWER SUPPLIER™

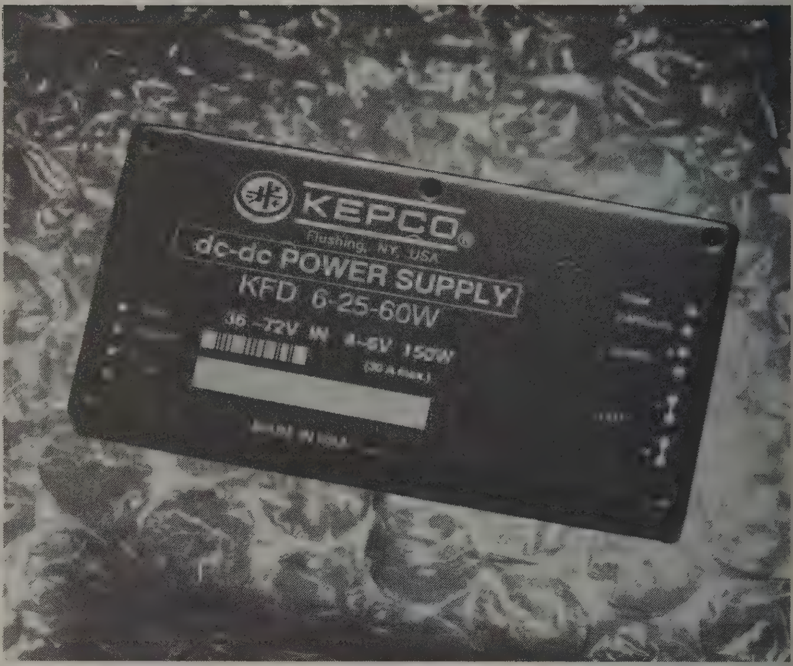
HIGH DENSITY d-c to d-c CONVERTERS

KFD™

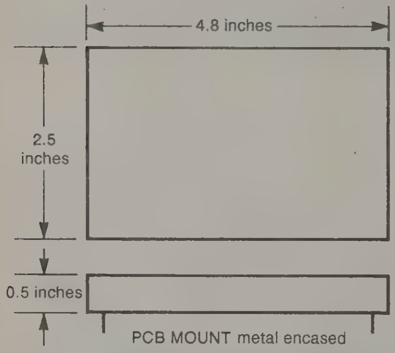
KFD are high density dc-dc converters delivering 100~150 watts. Three outputs are offered: 5~6V, 15V, and 24V from either an 18-36V input or a 36-72V input. KFD are designed for PCB mounting and feature a 5-sided shielded metal enclosure. KFD are ideal for distributed power applications, telecommunications and computer-based instruments.

A built-in paralleling connection allows multiple KFD modules to current-share for redundancy (N+1) configurations.

Features:
- **Paralleling terminals** for redundant operation.
- **Remote on/off logic control.**
- **High efficiency (typ 80%).**
- **Overvoltage Clamp.**
- **Remote sense.**
- **Current Limit (CC type).**
- **Full input to output isolation.**



Model KFD 6-25-60W



Optional fins available

This KEPCO product is backed by a firm **1-YEAR WARRANTY**

18-36V D-C INPUT

MODEL	OUTPUT	OVP SETTING	OUTPUT	OC SETTING	POWER	INPUT VOLTAGE RANGE
	VOLTS	VOLTS	AMPS	AMPS	WATTS	VOLTS
KFD 6-25-28W	4.75-6.00V	7.0-8.0	25	30	150	18-36
KFD 15-10-28W	13.5-16.5V	17.0-19.5	10	13	150	18-36
KFD 24-4.2-28W	21.6-26.4V	27.0-30.5	4.2	8	100	18-36

36-72V D-C INPUT

MODEL	OUTPUT	OVP SETTING	OUTPUT	OC SETTING	POWER	INPUT VOLTAGE RANGE
	VOLTS	VOLTS	AMPS	AMPS	WATTS	VOLTS
KFD 6-25-60W	4.75-6.00V	7.0-8.0	25	30	150	36-72
KFD 15-10-60W	13.5-16.5V	17.0-19.5	10	13	150	36-72
KFD 24-6.25-60W	21.6-26.4V	27.0-30.5	6.25	8	150	36-72

For complete specifications send for Series KFD Brochure 146-1801 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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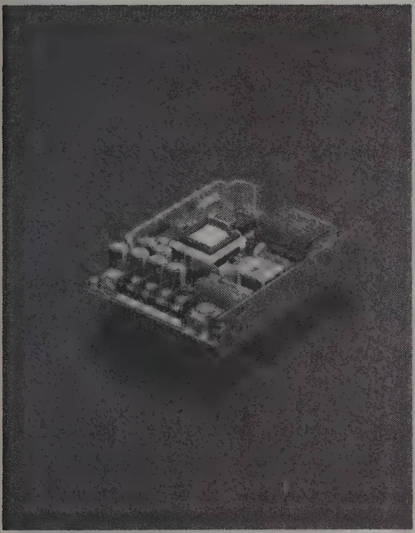
KEPCO. **THE POWER SUPPLIER™**

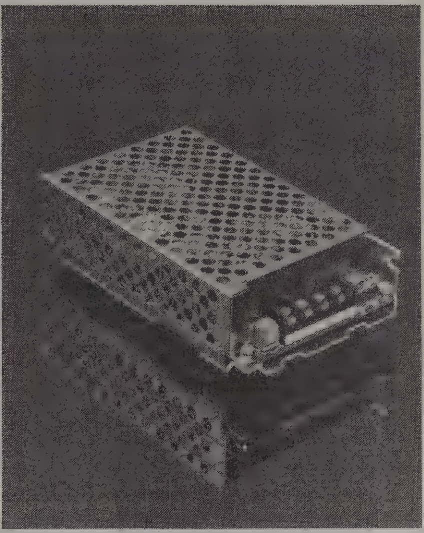
OEM a-c to d-c SLIM SWITCHING MODULES

Very compact switching power supplies featuring surface mount construction, 1-inch thin.

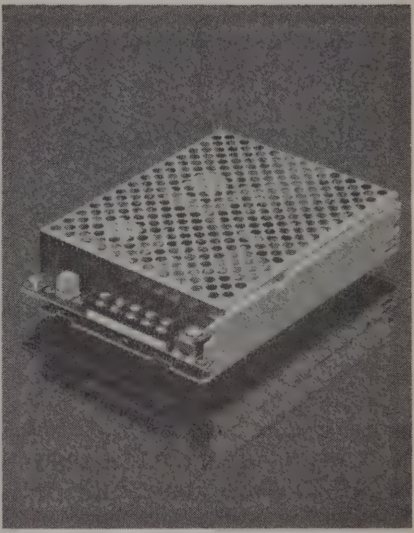
NORTH AMERICAN SERIES FAK™ 85-132V a-c input



15W Model FAK 5-3K
(optional enclosure CA-21)



25W Model FAK 5-5K
(shown with optional enclosure CA-22)



50W Model FAK 5-10K
(shown with optional enclosure CA-23)

These modern single output switchers employ advanced surface mount technology to achieve small size and very low profile, to fit where space is at a premium. They are designed to the standards of UL and CSA. Input is 85~132V a-c; outputs are 5V, 12V, 15V, and 24V d-c. The 15 and 25 Watt models employ flyback topology; the 50 Watt models are forward converters.

Features:

- **Power-OK LED:** green.
- **a-c input 85-132V; d-c input 110-170V.**
- **FET-based high frequency operation** (up to 250 KHz) for high efficiency.
- **Soft-start circuit:** Limits a-c turn-on surge.
- **Adjustable voltage:** Internal trimmer accessible through the case allows manual adjustment of the voltage setting.
- **Holding time:** 30 milliseconds typically, 20 milliseconds minimum.
- **Built-in EMI filter** attenuates conducted noise below the requirements of FCC 20780, for Class B computing devices. Optional perforated metal covers attenuate radiated noise and provide protection.
- **Safety:** UL recognized. CSA certified.
- **Optional Steel Enclosures:** CA 21, CA 22, CA 23.
- **Produced in** ISO 9001 certified facility.

This KEPCO product is backed by a firm 1-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS, 0-50°C	SW RIPPLE mV		NOISE (spike) mV max
				typ	max	
15 WATT MODELS						
FAK 5-3K	5	4.5- 5.5	0-3.0	30	60	<120
FAK 12-1.3K	12	10.8-13.2	0-1.3	30	70	<190
FAK15-1K	15	13.5-16.5	0-1.0	30	70	<220
FAK 24-0.7K	24	21.6-26.4	0-0.7	30	80	<310
Open frame — Size: 0.79″ x 2.76″ x 3.74″ Net weight: 0.44 lb. With cover CA 21 (optional) — Case size: 0.9″ x 2.76″ x 3.74″ Net weight: 0.55 lb.						
25 WATT MODELS						
FAK 5-5K	5	4.5- 5.5	0-5.0	30	70	<120
FAK 12-2.1K	12	10.8-13.2	0-2.1	30	70	<190
FAK 15-1.7K	15	13.5-16.5	0-1.7	30	70	<220
FAK 24-1.1K	24	21.6-26.4	0-1.1	30	80	<310
Open frame — Size: 0.98″ x 2.76″ x 4.53″ Net weight: 0.49 lb. With cover CA 22 (optional) — Case size: 1.12″ x 2.76″ x 4.53″ Net weight: 0.66 lb.						
50 WATT MODELS						
FAK 5-10K	5	4.5- 5.5	0-10.0	25	50	<120
FAK 12-4.2K	12	10.8-13.2	0-4.2	25	50	<190
FAK 15-3.4K	15	13.5-16.5	0-3.4	25	50	<220
FAK 24-2.1K	24	21.6-26.4	0-2.1	25	60	<310
Open frame — Size: 0.98″ x 3.74″ x 5.12″ Net weight: 0.66 lb. With cover CA 23 (optional) — Case size: 1.12″ x 3.74″ x 5.12″ Net weight: 0.88 lb.						

For complete specifications send for FAK Brochure 146-1715 or Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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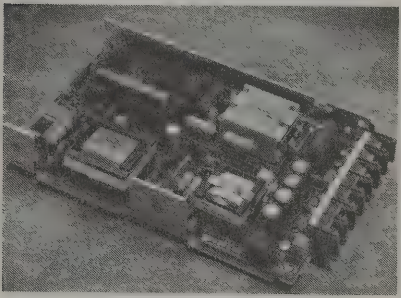
KEPCO® **THE POWER SUPPLIER™**

OEM a-c to d-c SLIM SWITCHING MODULES

Very compact switching power supplies featuring surface mount construction, 1-inch thin.

INTERNATIONAL SERIES FAW™

Wide Range 85-264V a-c input



50W Model FAW 12-4.2K

These modern single output switchers employ advanced surface mount technology to achieve small size and very low profile, to fit where space is at a premium. They are designed to the standards of UL, CSA and TÜV Rheinland. Input is 85~264V a-c; outputs are 5V, 12V, 15V, and 24V d-c. The 100 and 150 Watt groups feature 28V and 48V output models. The 15 and 25 Watt models employ flyback topology; the 50, 100 and 150 Watt models are forward converters.

Features:

- **Power-OK LED:** green.
- **Power-OK logic:** open collector.
- **a-c input:** 85-264V a-c; **d-c input:** 105-370V d-c.
- **Operating frequency:** 120-130KHz.
- **Soft-start circuit:** limits a-c turn on surge.
- **Adjustable voltage:** internal trimmer.
- **Holding time:** output is sustained by internally stored energy for 20ms typical 15ms minimum.
- **Built in EMI filter:** attenuates the conducted noise below the requirements of both FCC 20780 and VDE 0871 for Class B computing devices. Optional perforated metal covers attenuate radiated noise and provide protection.
- **Safety:** All models recognized by UL 478 (4,5); UL 1950. Certified by CSA 1402 level 3. Approved by TÜV Rheinland IEC 380 & 950, VDE 0806, EN 60 950. Also certified to meet the MIL STD 810D environment.
- **Connections:** input and output screw terminal barrier strip.
- **Remote error sensing:** the 50W, 100W & 150W FAW provide separate remote error sense terminals: 0.25V drop/wire.
- **Optional Steel Enclosures:** CA 24, CA 25, CA 26, CA 27 and CA 28.
- **Produced in** ISO 9001 certified facility.

15 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS. 0-50°C	SW RIPPLE mV typ	SW RIPPLE mV max	NOISE (spike) mV max
FAW 5-3K	5	4.5- 5.5	0-3.0	15	30	<120
FAW 12-1.3K	12	10.8-13.2	0-1.3	10	30	<190
FAW 15-1K	15	13.5-16.5	0-1.0	10	30	<220
FAW 24-0.7K	24	21.6-26.4	0-0.7	20	50	<310

Size: Open - 0.98 x 3.74 x 3.94 in. Enclosed (CA 24) - 1.18 x 3.74 x 3.94 in. Net wt. 9.52 oz, 270 gm
25 x 95 x 100 mm 30 x 95 x 100 mm

25 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS. 0-50°C	SW RIPPLE mV typ	SW RIPPLE mV max	NOISE (spike) mV max
FAW 5-5K	5	4.5- 5.5	0-5.0	31	62	<120
FAW 12-2.1K	12	10.8-13.2	0-2.1	32	65	<190
FAW 15-1.7K	15	13.5-16.5	0-1.7	42	85	<220
FAW 24-1.1K	24	21.6-26.4	0-1.1	57	115	<310

Size: Open - 0.98 x 3.74 x 4.92 in. Enclosed (CA 25) - 1.18 x 3.74 x 4.92 in. Net wt. 10.6 oz, 300 gm
25 x 95 x 125 mm 30 x 95 x 125 mm

50 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS. 0-50°C	SW RIPPLE mV typ	SW RIPPLE mV max	NOISE (spike) mV max
FAW 5-10K	5	4.5- 5.5	0-10.0	30	60	<120
FAW 12-4.2K	12	10.8-13.2	0-4.2	35	70	<190
FAW 15-3.4K	15	13.5-16.5	0-3.4	45	90	<220
FAW 24-2.1K	24	21.6-26.4	0-2.1	50	100	<310

Size: Open - 0.98 x 3.74 x 6.50 in. Enclosed (CA 26) - 1.22 x 3.74 x 6.50 in. Net wt. 15.9 oz, 400 gm
25 x 95 x 165 mm 31 x 95 x 165 mm

100 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS. 0-50°C	SW RIPPLE mV typ	SW RIPPLE mV max	NOISE (spike) mV max
FAW 5-20K	5	4.5- 5.5	0-20	30	60	<120
FAW 12-8.3K	12	10.8-13.2	0-8.3	35	70	<190
FAW 15-6.6K	15	13.5-16.5	0-6.6	45	90	<220
FAW 24-4.2K	24	21.6-26.5	0-4.2	50	100	<310
FAW 28-3.5K	28	25.2-30.8	0-3.5	60	120	<330
FAW 48-2K	48	43.2-52.8	0-2	80	160	<530

Size: Open - 1.38 x 3.74 x 7.87 in. Enclosed (CA 27) - 1.57 x 3.74 x 7.87 in. Net wt. 2.5 lbs, 1200 gm
35 x 95 x 200 mm 40 x 95 x 200 mm

150 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPS. 0-50°C	SW RIPPLE mV typ	SW RIPPLE mV max	NOISE (spike) mV max
FAW 5-30K	5	4.5- 5.5	0-30	30	60	<120
FAW 12-12K	12	10.8-13.2	0-12	35	70	<190
FAW 15-10K	15	13.5-16.5	0-10	45	90	<220
FAW 24-6K	24	21.6-26.4	0-6	50	100	<310
FAW 28-5K	28	25.2-30.8	0-5	60	120	<330
FAW 48-2.8K	48	43.2-52.8	0-2.8	80	160	<530

Size: Open - 2.01 x 3.74 x 7.87 in. Enclosed (CA 28) - 2.17 x 3.74 x 7.87 in. Net wt. 3.3 lbs, 1500 gm
51 x 95 x 200 mm 55 x 95 x 200 mm

This KEPCO product is backed by a firm 1-YEAR WARRANTY

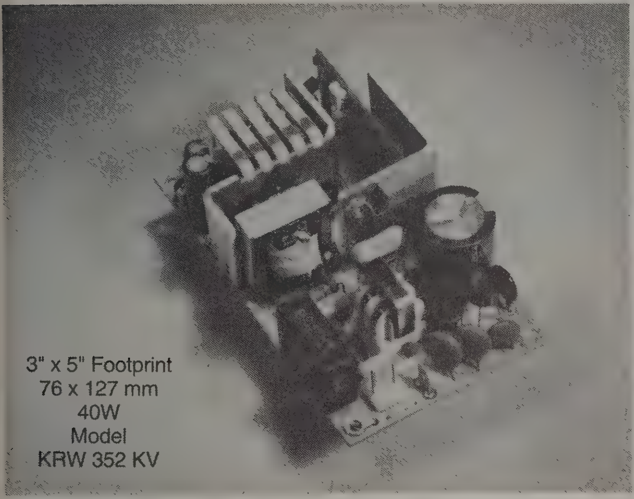
CSA CERTIFIED

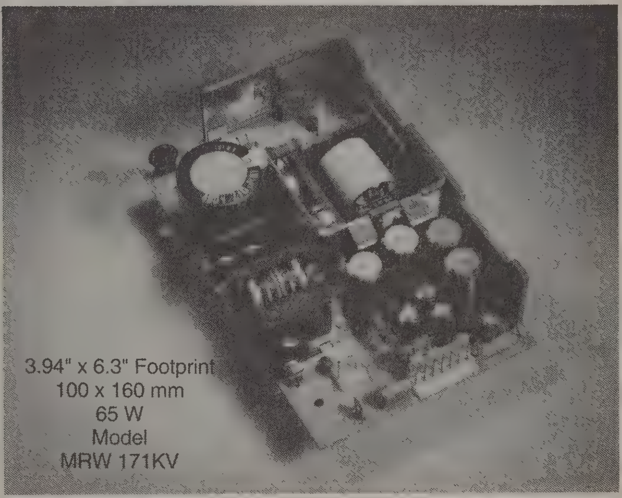
For complete specifications send for FAW Brochure 146-1714 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

10 KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, NY 11352 USA • (718) 461-7000 • FAX: (718) 767-1102 • Easylink (TWX): 710-582-2631

KEPCO **THE POWER SUPPLIER™**

TRIPLE OUTPUT CARD-STYLE POWER SUPPLIES


3" x 5" Footprint
76 x 127 mm
40W
Model
KRW 352 KV


3.94" x 6.3" Footprint
100 x 160 mm
65 W
Model
MRW 171KV

KRW/MRW™

90-264V a-c
130-370V d-c

Series MRW and KRW are triple output card-style power supplies producing 35-65 Watts. Produced in ISO-9001-certified facilities, they're fully approved by TUV/UL/CSA to the IEC 950 specification and are fitted with Class B EMI filters. A wide-range a-c input accepts any voltage from 90-264V a-c. Optional enclosures are available.

Features:

- **90-264V a-c wide-range input, 130-370V d-c input.**
- **Built-in FCC 20780 Class B EMI filter.**
- **Approved by TUV/UL/CSA to IEC 950.**
- **Optional enclosures.**
- **Produced in ISO 9001 certified facility.**

1 This KEPCO product is backed by a firm 1-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED TUV APPROVED

KRW MODEL TABLE **3" X 5" FOOTPRINT**

MODEL	POWER	OUTPUT #1		OUTPUT #2		OUTPUT #3	
	Watts	Volts	Amps	Volts	Amps	Volts	Amps
KRW 350KV	40	+5	0.5-3.0 (typ) (4.0 max)	+12	0.3-2.0 (typ) (3.0 max)	-12	0.01 (typ) (0.3 max)
KRW 351KV	40	+5	0.5-30(typ) (4.0 max)	+15	0.3-1.6 (typ) (2.0 max)	-15	0-0.1(typ) (0.3 max)
KRW 352KV	40	+3.3	0.5-3.0 (typ) (4.0 max)	+12	0.3-2.0 (typ) (3.0 max)	-12	0-0.1(typ) (0.3 max)

Dimensions: 1.25"H x 3"W x 5"D **Net Weight:** 8.47 oz.

MRW MODEL TABLE **4" X 6" FOOTPRINT**

MODEL	POWER	OUTPUT #1		OUTPUT #2		OUTPUT #3	
	Watts	Volts	Amps	Volts	Amps	Volts	Amps
MRW 150KV	35	+5	1.0-2.2(typ) (4.0 max)	+12	0.6-1.8(typ) (2.5 max)	-12	0-0.1 (typ) (0.3 max)
MRW 151KV	35	+5	1.0-2.2 (typ) (4.0 max)	+15	0.6-1.4 (typ) (2.0 max)	-15	0-0.1 (typ) (0.3 max)
MRW 160KV	50	+5	1.0-5.0(typ) (6.0 max)	+12	0.5-2.0 (typ) (2.5 max)	-12	0-0.1 (typ) (0.5 max)
MRW 161KV	50	+5	1.0-5.0 (typ) (6.0 max)	+15	0.5-1.5 (typ) (2.0 max)	-15	0-0.1 (typ) (0.4 max)
MRW 170KV	65	+5	0.8-5.0 (typ) (7.0 max)	+12	0.3-1.7 (typ) (2.5 max)	-12	0.3-1.7(typ) (2.5 max)
MRW 171KV	65	+5	0.8-5.0 (typ) (7.0 max)	+15	0.3-1.3 (typ) (2.0 max)	-15	0.3-1.3(typ) (2.0 max)

Dimensions: MRW 150KV/151KV - 1.14"H x 3.94"W x 6.3"D
MRW 160KV/161KV - 1.5"H x 3.94"W x 6.3"D
MRW 170 KV/171KV - 1.38"H x 3.94"W x 6.3"D

Net Weight: MRW 150KV/151KV - 12.35 oz.
MRW 160KV/161KV - 17.65 oz.
MRW 170KV/171KV - 15.87 oz.

For complete specifications send for Series MRW/KRW Brochure 146-1810 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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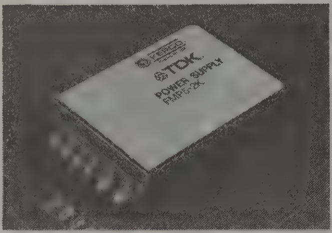
KEPCO® **THE POWER SUPPLIER™**

OEM a-c to d-c SLIM SWITCHING MODULES

FMP™

115V a-c input
110-170V d-c input

SINGLE OUTPUT LOW PROFILE PLASTIC ENCASED SWITCHING POWER SUPPLIES



10W model shown
Model FMP 5-2K

These are plastic encased 3- and 10-Watt single output a-c to d-c flyback voltage stabilizers, producing 5V, 12V, 15V, or 24V.

Features:

- **± 10% voltage adjustment.**
- **Voltage limited** by zener diode across output.
- **Rectangular current limiting** so you can drive nonlinear loads.
- **Low profile:** Only ¾″ thick.
  Produced in ISO 9001 certified facility.

3 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT, AMPS, AT 50°C Max	SW RIPPLE mV	NOISE (SPIKE) Max mV
FMP 5-0.6K	5	4.5-5.5	0.6	<50	<100
FMP 12-0.25K	12	10.8-13.2	0.25	<80	<150
FMP 15-0.2K	15	13.5-16.5	0.2	<80	<150
FMP 24-0.13K	24	21.6-26.4	0.13	<100	<150

Case size: 2.17″ x 0.75″ x 1.97″ Net weight: 0.15 lb. **Cased only.**

10 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT, AMPS, AT 50°C Max	SW RIPPLE mV	NOISE (SPIKE) Max mV
FMP 5-2K	5	4.5-5.5	2.0	<50	<100
FMP 12-0.85K	12	10.8-13.2	0.85	<80	<150
FMP 15-0.7K	15	13.5-16.5	0.70	<80	<150
FMP 24-0.45K	24	21.6-26.4	0.45	<100	<150

Case size: 2.17″ x 0.75″ x 3.16″ Net weight: 0.2 lb. **Cased only.**

FCP™

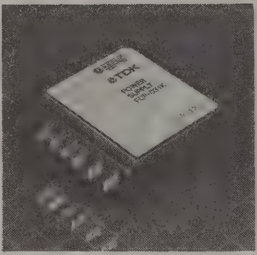
115V a-c input
110-170V d-c input

DUAL OUTPUT LOW PROFILE PLASTIC ENCASED SWITCHING POWER SUPPLIES

These are plastic encased 3- and 10-Watt flyback a-c to d-c switchers producing a dual output (± 12V or ± 15V).

Features:

- **Principal (*plus*) output adjustable ± 10%;** auxiliary (*minus*) tracks it with an accuracy of ± 2% using a 3-terminal (linear) regulator.
- **Rectangular current limiting on both outputs.**
- **Low profile:** Only ¾″ thick.
- **Produced in** ISO 9001 certified facility.



3W model shown
Model FCP 031K

3 WATT MODELS

MODEL	OUTPUT VOLTS (Output #1)	OUTPUT VOLTS (Output #2)	ADJUSTMENT RANGE (1)	OUTPUT CURRENT, AMPS, AT 50°C (Output #1) Max	OUTPUT CURRENT, AMPS, AT 50°C (Output #2) Max	SW RIPPLE mV	NOISE (SPIKE) Max mV
FCP 031K	+12	−12	10.8-13.2	0.12	0.12	<80	<150
FCP 032K	+15	−15	13.5-16.5	0.1	0.1	<80	<150

Case size: 2.17″ x 0.75″ x 1.96″ Net weight: 0.15 lb. **Cased only.**

10 WATT MODELS

MODEL	OUTPUT VOLTS (Output #1)	OUTPUT VOLTS (Output #2)	ADJUSTMENT RANGE (1)	OUTPUT CURRENT, AMPS, AT 50°C (Output #1) Max	OUTPUT CURRENT, AMPS, AT 50°C (Output #2) Max	SW RIPPLE mV	NOISE (SPIKE) Max mV
FCP 101K	+12	−12	10.8-13.2	0.4	0.4	<80	<150
FCP 102K	+15	−15	13.5-16.5	0.32	0.32	<80	<150

Case size: 2.17″ x 0.75″ x 3.16″ Net weight: 0.18 lb. **Cased only.**

(1)Output #2 tracks Output #1 setting, ± 2%.

ECM™

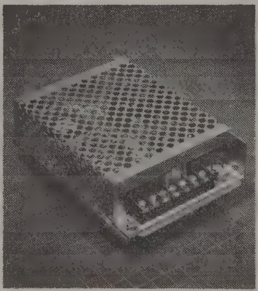
115V a-c input
110-170V d-c input

TRIPLE OUTPUT L-CHASSIS SWITCHING POWER SUPPLIES

These are triple output, 16 Watt metal enclosed switching power supplies featuring simplicity and high reliability.

Features:

- **Adjustable voltage:** (+5V) set by internal trimmer.
- **Auxiliary outputs:** (± 12V or ± 15V) use 3-terminal stabilizer.
- **Metal enclosure** reduces the radiated noise and provides protection.
- **Produced in** ISO 9001 certified facility.



16 WATT MODELS

MODEL	OUTPUT VOLTS (Output #1)	OUTPUT VOLTS (Output #2)	OUTPUT VOLTS (Output #3)	OUTPUT CURRENT, AMPS, AT 50°C (Output #1) Max	OUTPUT CURRENT, AMPS, AT 50°C (Output #2) Max	OUTPUT CURRENT, AMPS, AT 50°C (Output #3) Max	SW RIPPLE mV	NOISE (SPIKE) Max mV
ECM 021K-CB	+5	+12	−12	2	0.3	0.2	<120(1)	2% E_O +50mV
ECM 022K-CB	+5	+15	−15	2	0.3	0.2	<120(1)	

Case size: 3.6″ x 1.28″ x 4.72″ Net weight: 0.8 lb. **Cased only.**

(1) Outputs 2 & 3: <60mV.

ALL MODELS:

- **Holding time:** 30 milliseconds typically, 20 milliseconds minimum.
- **Built-in EMI filter** attenuates conducted noise below the requirements of FCC 20780 for Class B computing devices.
- **Safety:** All models recognized by UL, certified by CSA.

This KEPCO product is backed by a firm **1-YEAR WARRANTY**

UL RECOGNIZED CSA CERTIFIED

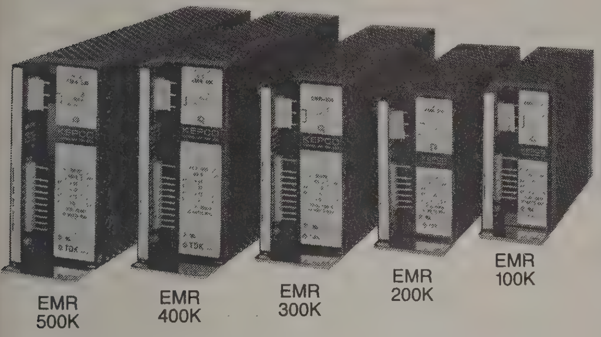
For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

KEPCO® **THE POWER SUPPLIER™**

OEM a-c to d-c SWITCHING MODULES

EMR™ THREE AND FOUR OUTPUT

115/230V a-c input



These fully enclosed multi-output power supplies are intended for industrial grade applications when low cost open frame units just won't do. Their built-in EMI filter meets FCC Class B, conducted EMI specifications. Molex input-output connectors allow easy installation. Connector cable kits available. Produced in ISO 9001 certified facility.

EMR 100K 22W

OUTPUT	VOLTS	AMPS	SW RIPPLE mV typ
Output #1	+5V	1.0 to 3.0	<50
Output #2	+12V	0.0 to 0.3	<50
Output #3	−12V	0.0 to 0.3	<50

Case size: 1.8″ x 3.9″ x 6.4″ Net weight: 1.3 lbs.

EMR 200K 42W

Output #1	+5V	1.0 to 3.0	<50
Output #2	+12V	0.4 to 2.0	<50
Output #3	−12V	0.0 to 0.3	<50

Case size: 2.0″ x 3.9″ x 7.8″ Net weight: 1.8 lbs.

EMR 300K 54W

Output #1	+5V	2.0 to 6.0	<50
Output #2	+12V	0.2 to 1.0	<50
Output #3	−12V	0.2 to 1.0	<50

Case size: 2.1″ x 4.5″ x 8.8″ Net weight: 2.2 lbs.

EMR 400K 53W

Output #1	+5V	2.0 to 4.0	<50
Output #2	+12V	0.1 to 0.5	<50
Output #3	−12V	0.0 to 0.3	<50
Output #4	+24	0.2 to 1.0	<50

Case size: 2.1″ x 5.1″ x 8.8″ Net weight: 2.4 lbs.

EMR 500K 80W

Output #1	+5V	2.0 to 5.0	<50
Output #2	+12V	0.4 to 2.3	<50
Output #3	−12V	0.0 to 0.3	<50
Output #4	+24V	0.2 to 1.0	<50

Case size: 2.1″ x 5.1″ x 10.0″ Net weight: 3.1 lbs.

For complete specifications send for
Series EMR Brochure 146-1507 or
Kepco Power Supply Catalog 146-1811.

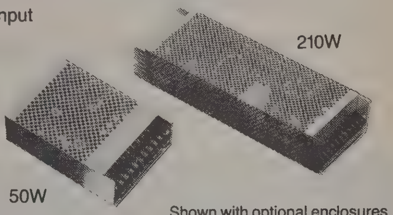
This KEPCO product is backed by a firm 1-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

EFX™ FOUR OUTPUT

115/230V a-c input

Four convenient sizes: 50 Watts, 100 Watts, 150 Watts and 210 Watts. Each available in a variety of popular volt-ampere combinations. Built-in EMI filter attenuates conducted EMI to the limit of FCC Class A. Produced in ISO 9001 certified facility.



Shown with optional enclosures

Note: Figures in parenthesis ( ) are for 15V aux. output

50 WATT MODELS

MODEL	AMPERES OUTPUT CURRENT AT 50°C +5 VOLTS	−5 VOLTS	+12(15) VOLTS	+12 VOLTS	−12(15) VOLTS	+24 VOLTS	SW RIPPLE mV typ
EFX 050T-1	6.0 Typ. 7.2 Max.	—	1.0 Typ. 1.5 Max.	—	1.0 Typ. 1.5 Max.	0.2 Typ. 0.3 Max.	<50
EFX 050T-2	6.0 Typ. 7.2 Max.	—	(1.0 Typ.) (1.2 Max.)	—	(1.0 Typ.) (1.2 Max.)	0.2 Typ. 0.3 Max.	<50
EFX 050T-3	6.0 Typ. 7.2 Max.	0.8 Typ. 1.2 Max.	1.0 Typ. 1.5 Max.	—	1.0 Typ. 1.5 Max.	—	<50
EFX 050T-4	6.0 Typ. 7.2 Max.	0.8 Typ. 1.2 Max.	(1.0 Typ.) (1.2 Max.)	—	(1.0 Typ.) (1.2 Max.)	—	<50

Size: Open 1.97″ x 4.96″ x 7.20″ Enclosed (CA 11) 2.00″ x 5.00″ x 7.20″ Net wt.: 2.0 lbs.

100 WATT MODELS

EFX 100T-1	8.0 Typ. 9.6 Max.	—	2.0 Typ. 3.0 Max.	—	2.0 Typ. 3.0 Max.	0.5 Typ. 0.75 Max.	<50
EFX 100T-2	8.0 Typ. 9.6 Max.	—	(1.6 Typ.) (2.4 Max.)	—	(1.6 Typ.) (2.4 Max.)	0.5 Typ. 0.75 Max.	<50
EFX 100T-3	8.0 Typ. 9.6 Max.	1.5 Typ. 2.25 Max.	2.0 Typ. 3.0 Max.	—	2.0 Typ. 3.0 Max.	—	<50
EFX 100T-4	8.0 Typ. 9.6 Max.	1.5 Typ. 2.25 Max.	(1.6 Typ.) (2.4 Max.)	—	(1.6 Typ.) (2.4 Max.)	—	<50

Size: Open 1.97″ x 4.96″ x 9.41″ Enclosed (CA 12) 2.00″ x 5.00″ x 9.41″ Net wt.: 2.7 lbs.

150 WATT MODELS

EFX 150T-1	15.0 Typ. 18.0 Max.	—	2.5 Typ. 3.75 Max.	—	2.5 Typ. 3.75 Max.	1.0 Typ. 1.5 Max.	<50
EFX 150T-2	15.0 Typ. 18.0 Max.	—	(2.0 Typ.) (3.0 Max.)	—	(2.0 Typ.) (3.0 Max.)	1.0 Typ. 1.5 Max.	<50
EFX 150T-3	15.0 Typ. 18.0 max.	2.0 Typ. 3.0 Max.	2.5 Typ. 3.75 Max.	—	2.5 Typ. 3.75 Max.	—	<50
EFX 150T-4	15.0 Typ. 18.0 Max.	2.0 Typ. 3.0 max.	(2.0 Typ.) (3.0 Max.)	—	(2.0 Typ.) (3.0 Max.)	—	<50

Size: Open 2.48″ x 4.96″ x 13.35″ Enclosed (CA 13) 2.52″ x 5.00″ x 13.40″ Net wt.: 3.8 lbs.

210 WATT MODELS

EFX 210T-1	20.0 Max.	—	4.0 Max.	—	4.0 Max.	1.0 Max.	<50
EFX 210T-2	20.0 Max.	—	(3.0 Max.)	—	(3.0 Max.)	1.0 Max.	<50
EFX 210T-3	20.0 Max.	2.0 Max.	4.0 Max.	—	4.0 Max.	—	<50
EFX 210T-4	20.0 Max.	2.0 Max.	(3.0 Max.)	—	(3.0 Max.)	—	<50

Size: Open 2.48″ x 4.96″ x 14.96″ Enclosed (CA 14) 2.52″ x 5.00″ x 15.00″ Net wt.: 4.8 lbs.

For complete specifications send for
Series EFX Brochure 146-1469 or
Kepco Power Supply Catalog 146-1811.

This KEPCO product is backed by a firm 1-YEAR WARRANTY

UL RECOGNIZED CSA CERTIFIED

Data and specifications subject to change without notice.

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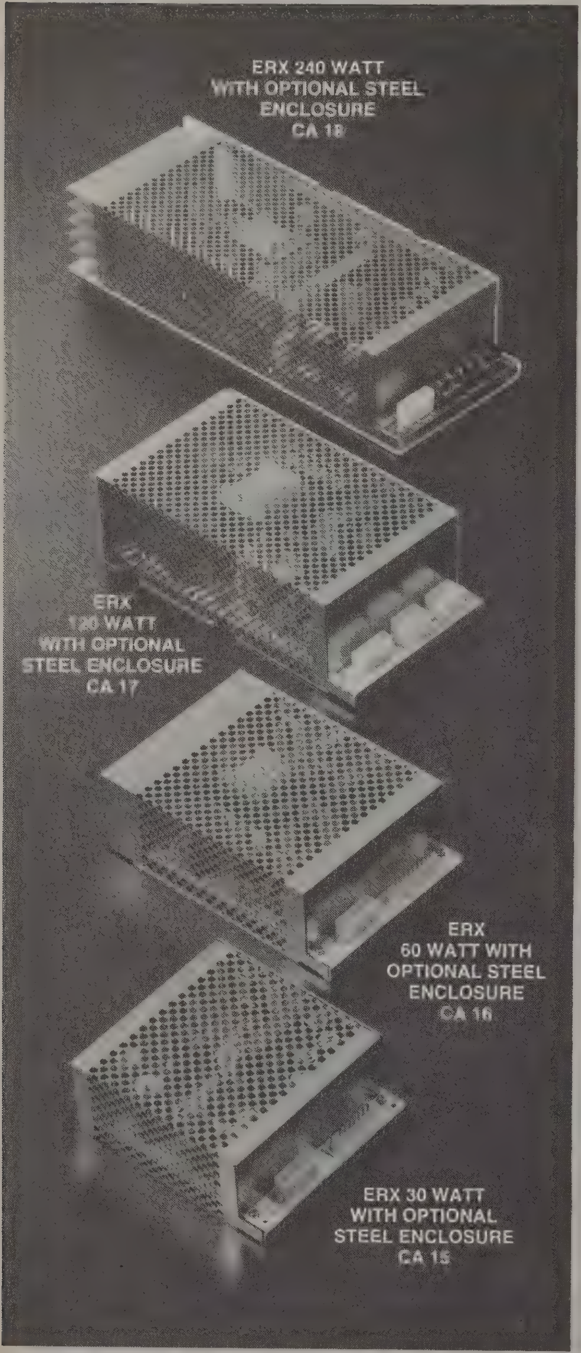
KEPCO. **THE POWER SUPPLIER™**

OEM a-c to d-c SWITCHING MODULES

ERX™ 115/230V a-c input

WORLD POWER™ SINGLE OUTPUT

For the demanding requirements of OEM instrument makers, these are affordable low cost switching power supplies built on an open frame L-chassis, with optional perforated metal enclosures. Input and output is via Molex pin headers for easy installation (except for the 240 Watt models which use a barrier strip for their high current output). The built-in EMI filter meets the conducted EMI attenuation limits of FCC Class B. The use of custom hybrid microcircuits reduces parts count and contributes to high reliability. Connector cable kits available.
Produced in ISO 9001 certified facility.


ERX 240 WATT WITH OPTIONAL STEEL ENCLOSURE CA 18
ERX 120 WATT WITH OPTIONAL STEEL ENCLOSURE CA 17
ERX 60 WATT WITH OPTIONAL STEEL ENCLOSURE CA 16
ERX 30 WATT WITH OPTIONAL STEEL ENCLOSURE CA 15

240 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPERES*				SW RIPPLE mV (typ)	NOISE (Spike) mV max
			40°C	50°C	60°C	70°C		
ERX 5-48	5	4.0- 5.5	48.0	38.4	28.8	19.2	<50	<150
ERX 12-20	12	8.4-13.2	20.0	16.0	12.0	8.0	<50	<300
ERX 15-16	15	10.5-16.5	16.0	12.8	9.6	6.4	<50	<300
ERX 24-10	24	16.8-26.4	10.0	8.0	6.0	4.0	<50	<400

Cased/Uncased size: 2.76″ x 4.84″ x 12.91″ Net weight: 5.5 lbs.

120 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPERES*				SW RIPPLE mV (typ)	NOISE (Spike) mV max
			40°C	50°C	60°C	70°C		
ERX 5-24	5	4.0- 5.5	24.0	19.2	14.4	9.6	<40	<150
ERX 12-10	12	8.4-13.2	10.0	8.0	6.0	4.0	<40	<300
ERX 15-8	15	10.5-16.5	8.0	6.4	4.8	3.2	<40	<300
ERX 24-5	24	16.8-26.4	5.0	4.0	3.0	2.0	<40	<400

Cased/Uncased size: 2.76″ x 4.84″ x 8.90″ Net weight: 3.1 lbs.

60 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPERES*				SW RIPPLE mV (typ)	NOISE (Spike) mV max
			40°C	50°C	60°C	70°C		
ERX 5-12	5	4.0- 5.5	12.0	9.6	7.2	4.8	<30	<150
ERX 12-5	12	8.4-13.2	5.0	4.0	3.0	2.0	<40	<300
ERX 15-4	15	10.5-16.5	4.0	3.2	2.4	1.6	<40	<300
ERX 24-2.5	24	16.8-26.4	2.5	2.0	1.5	1.0	<40	<400

Cased/Uncased size: 2.36″ x 4.84″ x 7.09″ Net weight: 1.5 lbs.

30 WATT MODELS

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT AMPERES*				SW RIPPLE mV (typ)	NOISE (Spike) mV max
			40°C	50°C	60°C	70°C		
ERX 5-6	5	4.5- 5.5	6.0	4.8	3.6	2.4	<40	<150
ERX 12-2.5	12	10.8-13.2	2.5	2.0	1.5	1.0	<40	<300
ERX 15-2	15	13.5-16.5	2.0	1.6	1.2	0.8	<40	<300
ERX 24-1.3	24	21.6-26.4	1.3	1.0	0.8	0.5	<40	<400

Cased/Uncased size: 2.17″ x 4.84″ x 5.51″ Net weight: 1.5 lbs.

*These ratings are for vertical installation without optional cover.
For horizontal mounting, enclosed, derate by 10%.

UL RECOGNIZED CSA CERTIFIED TÜV APPROVED

This KEPCO product is backed by a firm 1-YEAR WARRANTY

For complete specifications send for ERX Brochure 146-1641 or Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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KEPCO® THE POWER SUPPLIER™

KEPCO CUSTOM SYSTEM POWER ASSEMBLIES

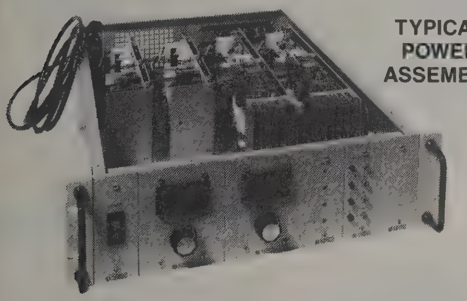
You design them... Kepco builds them for you.

These are combinations of Kepco power supplies and accessories, custom-designed by you and your Kepco sales engineer, expertly wired, ready for your rack — at surprisingly low cost.

Our expert engineers will work with you to layout a custom assembly to your specifications choosing from power modules that span 3 Watts to 1500 Watts, 2 Volts to 48 Volts — a-c and d-c inputs.

Call your Kepco Sales Engineer to help you meet your Custom Power Assembly needs.

Consult factory for special requirements.



TYPICAL POWER ASSEMBLY

CURRENT SENSING RESISTORS

Model	Resistance	Current display
KT 1915	1.0Ω	0-199.9mA
KT 1387	0.1Ω	0-1.999A
KT 2713	0.01Ω	0-19.99A
KT 2714	0.001Ω	0-40.0A
KT 2780	0.001Ω	0-100.0A
KT 2796	0.001Ω	0-500.0A

ACCESSORY POWER SUPPLY TO ENERGIZE DVMs

Model	Description
DMS 2X9	Mounts internally, powers 2 DVMs

POWER FAIL DETECTOR

Model
PFD 01

CHASSIS SLIDES*

Model	Size
CS-01 (pr.)	20″ deep
CS-02 (pr.)	22″ deep
CS-03 (pr.)	24″ deep

**For other chassis slides, please consult factory.*

REDUNDANT COMBINATION CIRCUIT BOARD

Model	
RDN-1	1 Pair of Power Supplies
RDN-2	2 Pair of Power Supplies
RDN-3	3 Pair of Power Supplies

For complete specifications send for
Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

RACK ADAPTERS

Model	H	W	D
RA 42	5 1/4"	19"	21"
RA 43*	7"	19"	21"
RA 44	5 1/4"	19"	16"
RA 45*	7"	19"	16"
RA 46	5 1/4"	19"	24"
RA 47*	8 3/4"	19"	24"
RA 48	5 1/4"	19"	15"

*Supplied with either Vented Front Filler Panel FFP-A or Non-vented Front Filler Panel FFP-B.

FRONT PANEL COMPONENTS

Model	Description
MSP 1-1	Ckt. Breaker, Single Pole, 7.5 Amp., & Pilot
MSP 2-1	Ckt. Breaker, Single Pole, 15 Amp., & Pilot
MSP 3-1	4 Test Points (2 pr.)
MSP 4-1	8 Test Points (4 pr.)
MSP 5-1	4 LEDs
MSP 6-1	8 LEDs
MSP 7-1	2 Adj. Trimmers
MSP 8-1	4 Adj. Trimmers
MSP 9-2	Digital Voltmeter (DVM)
MSP 10-2	DVM with 2-Pos. Switch
MSP 11-2	DVM with 4-Pos. Switch
MSP 12-2	DVM with 8-Pos. Switch
MSP 13-2	DVM & Adj. Trimmer
MSP 14-2	DVM, Adj. Trimmer, 1 LED, 1 Pr. Test Pts., & 2-Pos. Switch
MSP 17-1	4 Toggle Switches for Remote On/Off (RAX, RBX, ERD)
MSP 18-1	8 Toggle Switches for Remote On/Off (RAX, RBX, ERD)
MSP 19-1	12 Test Pts. (6 pr.)
MSP 20-1	6 LEDs
MSP 21-1	6 Adj. Trimmers
MSP 22-1	Ckt. Breaker, Single Pole, 25 Amp., & Pilot
MSP 23-2	Ckt. Breaker, Double Pole, 25 Amp., & Pilot
MSP 24-3	4 LEDs, 4 Adj. Trimmers, & 8 Test Pts. (4 pr.)
MSP 25-3	5 LEDs, 5 Adj. Trimmers, & 10 Test Pts. (5 pr.)
MSP 26-3	6 LEDs, 6 Adj. Trimmers, & 12 Test Pts. (6 pr.)
MSP 27-3	7 LEDs, 7 Adj. Trimmers, & 14 Test Pts. (7 pr.)
MSP 33-1	Ckt. Breaker, Single Pole, 20 Amp., & Pilot
MSP 34-1	Ckt. Breaker, Single Pole, 30 Amp. & Pilot
MSP 35-2	Ckt. Breaker, Double Pole, 15 Amp & Pilot
MSP 36-2	Ckt. Breaker, Double Pole, 20 Amp & Pilot
MSP 37-2	Ckt. Breaker, Double Pole, 30 Amp & Pilot
MSP 38-2	Ckt. Breaker, Three Pole & Pilot (Consult factory for rating)

FRONT FILLER PANELS (BLANK)

FFP 1	1/8	**FFP 3**	3/8	**FFP 5**	5/8	**FFP 7**	7/8
FFP 2	1/4	**FFP 4**	1/2	**FFP 6**	3/4	**FFP 8**	Full

REAR PANEL COMPONENTS

Model	Description
RCP 1-1	1 a-c Inlet, 1 a-c Outlet, 15 Amp
RCP 2-1	1 a-c Inlet, 15 Amp
RCP 2-4	Fan, 1 a-c Inlet, 1 a-c Outlet, 15 Amp
RCP 3-4	3 Barrier Strips (45 Terminals, 20 Amps/Terminal)
RCP 4-4	4 Barrier Strips (36 Terminals, 20 Amps/ Terminal), Two 150 Amp Connector Studs
RCP 5-2	Vent Panel
RCP 5-3	Vent Panel
RCP 6-1	a-c or d-c Inlet, 30 Amp. Barrier Strip, with Strain Relief Clamp & Cover
RCP 7-4	a-c Inlet, 30 Amp. Barrier Strip, with Strain Relief Clamp, Fan, & Cover
RCP 8-4	1 Barrier Strip (15 Terminals, 20 Amps/Terminal)
RCP 9-4	2 Barrier Strips (30 Terminals, 20 Amps/Terminal)
RCP 10-2	3 wire a-c Input with Mating Connector(1)
RCP 11-2	115V 1ϕ 3 wire a-c Input with Mating Connector & 20 Amp Line cord
RCP 12-2	115V 1ϕ 3 wire a-c Input with Mating Connector & 30 Amp Line Cord
RCP 13-2	7 wire a-c Input with Mating Connector(1)
RCP 14-4	Fan, 115V 1ϕ (230V a-c optional), 3 wire a-c Input with Mating Connector)
RCP 15-4	Fan, 115V 1ϕ 3 wire a-c Input with Mating Connector & 20 Amp Line Cord
RCP 16-4	Fan, 115V 1ϕ 3 wire a-c Input with Mating Connector 30 Amp Line Cord
RCP 17-4	Fan, 115V 1ϕ 7 wire a-c Input with Mating Connector & Plug(1)
RCP 18-4	Two 600 Amp Terminals with two 7-Terminal Barrier Strips, 20 Amps/ Terminal

(1) Consult factory for line cord requirement

REAR FILLER PANELS (BLANK)

RFP 1	1/8	**RFP 3**	3/8	**RFP 5**	5/8	**RFP 7**	7/8
RFP 2	1/4	**RFP 4**	1/2	**RFP 6**	3/4	**RFP 8**	Full

EMI FILTERS

Model	Volts	Amps	Model	Volts	Amps
FLA 250-1	115/230V a-c	1.2	**FLD 24-5**	24V d-c	5.0
FLA 250-4	115/230V a-c	4.0	**FLD 48-3**	48V d-c	3.0
FLA 250-20	115/230V a-c	20.0	**FLD 48-6**	48V d-c	6.0

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KEPCO® THE POWER SUPPLIER™

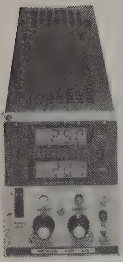
POWER SUPPLIES for LABORATORY, BENCH & SYSTEMS

ATE™ LINEAR PROGRAMMABLE POWER SUPPLIES FOR AUTOMATIC TEST EQUIPMENT SYSTEMS.

FEATURING:

- Full external control over both voltage and current with automatic crossover; separate voltmeter and ammeter for continuous output monitoring. Local control through 10-turn rheostats on front panel, remote through fixed gain power amplifier scaling from an input of 10 Volts to rated voltage.
- Digital control. ATE power supplies can be controlled by any of Kepco's systems programmers including the MATE-verified TLD 488-16.
- Options: Digital or analog meters
- User selectable slow or fast mode of operation; slow mode is ideal for delivering constant voltage; in fast mode, the ATE can follow rapidly changing load voltages to deliver constant current, or follow high speed voltage or current programming.
- Two built-in, uncommitted amplifiers for scaling, summing, or other manipulation of programming signals. Both voltage and current control channels have full zeroing and calibration facilities for compatibility with Kepco's digital interfaces.
- Programmable/ tracking overvoltage protection.
- For optional digital meters, substitute suffix "DM" in the model number, eg. ATE 6-5 DM.

QUARTER-RACK



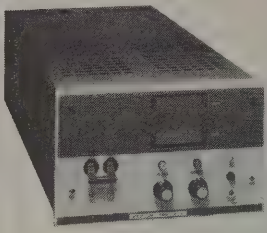
50 WATT MODELS

MODEL	VOLTS	AMPS
ATE 6-5M	0-6	0-5
ATE 15-3M	0-15	0-3
ATE 25-2M	0-25	0-2
ATE 36-1.5M	0-36	0-1.5
ATE 55-1M	0-55	0-1
ATE 75-0.7M	0-75	0-0.7
ATE 100-0.5M	0-100	0-0.5
ATE 150-0.3M	0-150	0-0.3

100 WATT MODELS

MODEL	VOLTS	AMPS
ATE 6-10M	0-6	0-10
ATE 15-6M	0-15	0-6
ATE 25-4M	0-25	0-4
ATE 36-3M	0-36	0-3
ATE 55-2M	0-55	0-2
ATE 75-1.5M	0-75	0-1.5
ATE 100-1M	0-100	0-1
ATE 150-0.7M	0-150	0-0.7

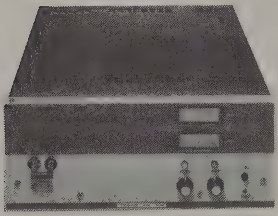
HALF-RACK



250 WATT MODELS

MODEL	VOLTS	AMPS
ATE 6-25M	0-6	0-25
ATE 15-15M	0-15	0-15
ATE 25-10M	0-25	0-10
ATE 36-8M	0-36	0-8
ATE 55-5M	0-55	0-5
ATE 75-3M	0-75	0-3
ATE 100-2.5M	0-100	0-2.5
ATE 150-1.5M	0-150	0-1.5
ATE 325-0.8M	0-325	0-0.8

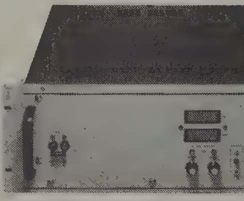
THREE-QUARTER RACK



500 WATT MODELS

MODEL	VOLTS	AMPS
ATE 6-50M	0-6	0-50
ATE 15-25M	0-15	0-25
ATE 25-20M	0-25	0-20
ATE 36-15M	0-36	0-15
ATE 55-10M	0-55	0-10
ATE 75-8M	0-75	0-8
ATE 100-5M	0-100	0-5
ATE 150-3.5M	0-150	0-3.5

FULL-RACK



1000 WATT MODELS

MODEL	VOLTS	AMPS
ATE 6-100M	0-6	0-100
ATE 15-50M	0-15	0-50
ATE 25-40M	0-25	0-40
ATE 36-30M	0-36	0-30
ATE 55-20M	0-55	0-20
ATE 75-15M	0-75	0-15
ATE 100-10M	0-100	0-10
ATE 150-7M	0-150	0-7

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE		OUTPUT EFFECTS CURRENT MODE		OFFSETS(3)	
		Typ.	Max	Typ.	Max.	ΔE_{io}	ΔI_{io}
SOURCE VOLTAGE (min.–max.) (1)		<0.0005% E_0 max.	0.001% E_0 max.	<0.002% I_0 max.	0.005% I_0 max.	<1 μV	<1 nA
LOAD (no load–full load)		<0.001% E_0 max.	0.002% E_0 max.	<0.5 mA (2)	1 mA(2)	–	–
TIME 8-hour (drift):		<0.005% E_0 max.	0.01% E_0 max.	<0.01% I_0 max.	0.02% I_0 max.	<20 μV	<1 nA
TEMPERATURE, per °C		<0.005% E_0 max.	0.01% E_0 max.	<0.01% I_0 max.	0.02% I_0 max.	<20 μV	<2 nA
RIPPLE and NOISE	rms	<0.1 mV	0.3 mV	<0.01% I_0 max.	0.03% I_0 max.	–	–
(Slow Mode)	p-p	<1 mV	3 mV	<0.1% I_0 max.	0.3% I_0 max.	–	–
RIPPLE and NOISE	rms	<1 mV	3 mV	<0.01% I_0 max.	0.03% I_0 max.	–	–
(Fast Mode)	p-p	<10 mV	30 mV	<0.1% I_0 max.	0.3% I_0 max.	–	–

(1)105-125/210-250V a-c.

(2)In slow mode, the leakage current through the output capacitor adds approximately 0-6 mA to the current mode load effect.

(3)Uncommitted amplifier offsets.

DYNAMIC SPECIFICATIONS

OUTPUT VOLTAGE RATING		6V	15V	25V	36V	55V	75V	100V	150V	325V
BANDWIDTH (−3db)(1) KHz	Min.	16	10.6	8	6.4	4	3.5	2.5	1.7	0.94
PROGRAMMING TIME CONSTANT (μsec)(1)	Max.	10	15	20	25	40	45	65	95	170
VOLTAGE RECOVERY	For step load change between 10% and 100% I_0 maximum < 50 μsec typ., <100 μsec max. to recover within 10 mV									

(1) In fast mode, operating into a resistive load.

DIMENSIONS:	NET WEIGHT:
50 Watt (Quarter-Rack): $5\frac{7}{32}$"H x $4\frac{5}{32}$"W x $17\frac{1}{8}$"D(1)	14 lbs.
100 Watt (Quarter-Rack): $5\frac{7}{32}$"H x $4\frac{5}{32}$"W x $17\frac{1}{8}$"D(1)	17 lbs.
250 Watt (Half-Rack): $5\frac{7}{32}$"H x $8\frac{11}{32}$"W x $17\frac{9}{64}$"D(1)	35 lbs.
500 Watt (Three Quarter-Rack): $5\frac{7}{32}$"H x $12\frac{17}{32}$"W x $17\frac{9}{64}$"D(1)	43 lbs.
1000 Watt (Full-Rack):(2) $6\frac{31}{32}$"H x $16\frac{1}{2}$"W x $20\frac{1}{64}$"D(1)	87 lbs.

(1)Add $2\frac{1}{2}$" for connector protrusion.

(2)The full rack model is supplied with brackets for direct mounting in a standard 19-inch rack.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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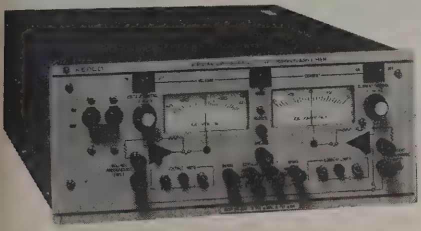
KEPCO. **THE POWER SUPPLIER™**

BIPOLAR POWER SUPPLIES for LABORATORY & SYSTEMS

BOP™ 4-QUADRANT VOLTAGE/CURRENT STABILIZERS



These are four-quadrant bipolar power supplies that can be controlled (programmed) linearly from positive to negative output. They may be programmed as a voltage source with current limiting, or as a current source with voltage limiting. Their wide bandwidth encompasses nearly all of the audio spectrum for use as a powerful amplifier, or as a driver of complex waveforms for ATE operations. The BOPs are able to sink power when driving dynamic loads. IEEE-488 programming is possible with the optional internal BIT cards (see below), or with one of the Kepco programmers.

BOP are high speed power operational amplifiers that can be used to provide dynamically agile voltage for test and simulation. They are *not* general purpose power supplies. By the nature of bipolar high speed power, they do not have any energy-storage, noise discriminating output capacitors. As a consequence, they will work best into mainly resistive loads. A provision is made to slow down operation as a current source to enable BOP to drive inductive loads. If your load is capacitive, (>0.1 microfarad), please consult the factory for the necessary precautions.

MODEL	d-c OUTPUT RANGE E_0 max.	I_0 max.	CLOSED LOOP GAIN VOLTAGE CHANNEL G_V (V/V)	CURRENT CHANNEL G_I (A/V)	OUTPUT IMPEDANCE VOLTAGE MODE SERIES R	SERIES L	CURRENT MODE SHUNT R	SHUNT C
100 WATT	Size: 5 7/32"H x 12 17/32"W x 17 [illegible]"D	Net weight: 38 lbs.						
BOP 20-5M	± 20V	± 5A	2.0	0.5	80 μΩ	20μH	40 kΩ	0.05μF
BOP 50-2M	± 50V	± 2A	5.0	0.2	0.5 mΩ	100μH	50 kΩ	0 05μF
BOP 100-1M	± 100V	± 1A	10.0	0.1	2.0 mΩ	200μH	100 kΩ	0.05μF
200 WATT	Size: 5 7/32"H x 12 17/32"W x 17 [illegible]"D	Net weight: 41 lbs.						
BOP 20-10M	± 20V	± 10A	2.0	1.0	40 μΩ	50μH	20 kΩ	0.1μF
BOP 36-6M	± 36V	± 6A	3.6	0.6	120 μΩ	50μH	36 kΩ	0.1μF
BOP 50-4M	± 50V	± 4A	5.0	0.4	0.25 mΩ	100μH	50 kΩ	0.05μF
BOP 72-3M	± 72V	± 3A	7.2	0.3	0.48 mΩ	200μH	72 kΩ	0.05μF
BOP 100-2M	± 100V	± 2A	10.0	0.2	1.0 mΩ	200μH	100 kΩ	0.05μF
BOP 200-1M(1)	± 200V	± 1A	20.0	0.1	4.0 mΩ	1.2 mH	200 kΩ	0.03μF
400 WATT	Size: 5 7/32"H x 16 [illegible]"W x 20 [illegible]"D	Net weight: 68 lbs.						
BOP 20-20M	± 20V	± 20A	2.0	2.0	20 μΩ	50μH	20 kΩ	0.2μF
BOP 36-12M	± 36V	± 12A	3.6	1.2	60 μΩ	50μH	36 kΩ	0.2μF
BOP 50-8M	± 50V	± 8A	5.0	0.8	125 μΩ	100μH	50 kΩ	0.15μF
BOP 72-6M	± 72V	± 6A	7.2	0.6	240 μΩ	200μH	72 kΩ	0.1μF
BOP 100-4M	± 100V	± 4A	10.0	0.4	500 μΩ	200μH	100 kΩ	0.1μF

(1)Same size and weight as 400 Watt models.

For optional digital meters substitute the letter D for the suffix M eg. BOP 50-8D

DYNAMIC SPECIFICATIONS

MODEL	BANDWIDTH (d-c to f_{-3dB}) KHz (minimum) Mode V	I	RISE & FALL TIME 10%-90% μsec (maximum) Mode V	I	LARGE SIGNAL FREQUENCY (min) RESPONSE, KHz Mode V	I	SLEWING RATE (minimum) Mode V	I	RECOVERY STEP LOAD μsec (maximum) Mode V	I
100 WATT	3⁄4 RACK USE RA 37									
BOP 20-5M	18	12	20	30	17	13	5V/μsec	0.15A/μsec	25	10
BOP 50-2M	18	12	20	30	17	13	5V/μsec	0.15A/μsec	25	10
BOP 100-1M	18	11	17	22	18	11	11V/μsec	70mA/μsec	40	25
200 WATT	3⁄4 RACK USE RA 38									
BOP 20-10M	18	6	20	60	17	7	2V/μsec	0.4A/μsec	80	20
BOP 36-6M	16	13	20	27	15	14	3V/μsec	0.5A/μsec	50	35
BOP 50-4M	23	14	14	25	15	11	4.5V/μsec	0.25A/μsec	40	30
BOP 72-3M	20	15	18	26	17	12	10V/μsec	0.15A/μsec	30	30
BOP 100-2M	22	15	18	26	17	12	10V/μsec	0.15A/μsec	30	30
BOP 200-1M	4.0	2.5	110	150	4	2.5	5V/μsec	15mA/μsec	150	120
400 WATT	FULL RACK REMOVABLE MOUNTING EARS									
BOP 20-20M	9.5	10	35	35	8	10	1V/μsec	1.25A/μsec	100	75
BOP 36-12M	20	10	16	30	19	10	4V/μsec	0.75A/μsec	50	30
BOP 50-8M	24	10	14	35	24	11	7.5V/μsec	0.5A/μsec	40	30
BOP 72-6M	19	9.5	18	40	20	11	9V/μsec	0.4A/μsec	50	20
BOP 100-4M	18	14	22	30	16	10	10V/μsec	0.25A/μsec	40	30

STATIC SPECIFICATIONS

This KEPCO product is backed by a firm 5-YEAR WARRANTY

INFLUENCE QUANTITY		OUTPUT EFFECTS(2) VOLTAGE MODE TYP	MAX	CURRENT MODE TYP	MAX	PREAMPLIFIER OFFSETS ΔE_{io}	ΔI_{io}	REFERENCE ±10V
SOURCE (min-max)(1)		<0.0005%	0.001%	<0.002%	0.005%	<5μV	<1nA	<0.0005%
LOAD (NL-FL):		<0.001%	0.002%	<0.5mA	1mA	—	—	<0.0005%
TIME (8-hour drift):		<0.005%	0.01%	<0.01%	0.02%	<20μV	<1nA	<0.005%
TEMP., per °C:		<0.005%	0.01%	<0.01%	0.02%	<20μV	<1nA	<0.005%
RIPPLE and NOISE:(3)	rms	<1mV	3mV	<0.01%	0.03%	—	—	—
	p-p(4)	<10mV	30mV	<0.1%	0.3%	—	—	—

(1) 105-125/210-250V a-c.

(2) Output effects, expressed as a percentage, are referred to the maximum rated output voltage or current.

(3) Measured with the common terminal grounded so that the common mode current does not flow through the load.

(4) Peak-to-peak ripple is measured over a 20 Hz to 10MHz bandwidth.

BIT™

OPTIONAL INTERFACE BOARD

Mounts inside BOP.

SUFFIX(1)	MODEL(2)	DATE FORMAT	RESOLUTION Principal Channel	Limit Channel	INPUT
-488-B	BIT 488-B	ASCII/Hex	12 Bit (binary)	8 Bit (binary)	For IEEE-488 (GPIB) bus
-488-D	BIT 488-D	ASCII/Decimal	3-Digit (BCD)	2-Digit (BCD)	For IEEE-488 (GPIB) bus
-TMA-27	BIT TMA-27	2-Wire Serial	12 Bit (binary)	12 Bit (binary)	For Kepco control bus
-4882	BIT 488-2	GPIB	12 Bit (binary)	12 Bit (binary)	Talk-Listen IEEE-488-2

MODEL TABLE

(1) Add to model No. of the BOP to specify a factory installed interface

(2) Use this designation when ordering separately to field installation.

For complete specifications send for Series BOP Brochure 146-1704 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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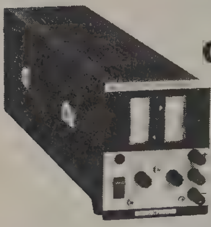
KEPCO. **THE POWER SUPPLIER™**

POWER SUPPLIES for LABORATORY & SYSTEMS

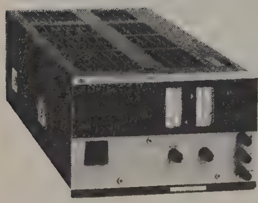
JQE™ 115/230V a-c input

GENERAL PURPOSE VOLTAGE STABILIZERS

Systems-type, voltage stabilizers with current limiting, programmable from the IEEE bus using Kepco digital interfaces. JQE's voltage control channel has an I-C front end for maximum stability and minimum offset. The rated power is delivered under the realistic thermal environs of a system's cabinet with no derating. The 10-turn voltage control is standard. For units requiring overvoltage protection and/or high speed programming, see the ATE group.

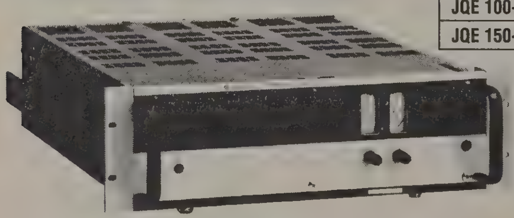


QUARTER RACK 100 WATT



HALF RACK 250/500 WATT

FULL-RACK 1000 WATT



100 WATT MODELS

MODEL	d-c OUTPUT RANGE VOLTS	d-c OUTPUT RANGE AMPS	OUTPUT IMPEDANCE VOLTAGE MODE SERIES R	OUTPUT IMPEDANCE VOLTAGE MODE SERIES L	OUTPUT IMPEDANCE CURRENT MODE SHUNT R	OUTPUT IMPEDANCE CURRENT MODE SHUNT C	MAX INPUT AMPS AT 125V a-c
JQE 6-10M	0-6	0-10	30 μΩ	1μH	50KΩ	3KμF	2.0
JQE 15-6M	0-15	0-6	125 μΩ	1μH	84KΩ	1KμF	2.1
JQE 25-4M	0-25	0-4	300 μΩ	1μH	125KΩ	700 μF	2.2
JQE 36-3M	0-36	0-3	600 μΩ	1μH	165KΩ	400 μF	2.2
JQE 55-2M	0-55	0-2	1.4mΩ	1μH	250KΩ	220 μF	2.3
JQE 75-1.5M	0-75	0-1.5	2.5mΩ	1μH	330KΩ	160 μF	2.3
JQE 100-1M	0-100	0-1	5 mΩ	2μH	500KΩ	110 μF	2.1

250 WATT MODELS

MODEL	VOLTS	AMPS	SERIES R	SERIES L	SHUNT R	SHUNT C	MAX INPUT AMPS AT 125V a-c
JQE 6-22M	0-6	0-22	14 μΩ	0.5μH	23 KΩ	5.8KμF	4.2
JQE 15-12M	0-15	0-12	63 μΩ	0.5μH	42 KΩ	2.7KμF	4.0
JQE 25-10M	0-25	0-10	125 μΩ	0.5μH	50 KΩ	2.4KμF	5.3
JQE 36-8M	0-36	0-8	225 μΩ	0.5μH	62.5KΩ	1.4KμF	6.0
JQE 55-5M	0-55	0-5	550 μΩ	1 μH	100 KΩ	850 μF	5.0
JQE 75-3M	0-75	0-3	1.25mΩ	1 μH	165 KΩ	850 μF	4.0
JQE 100-2.5M	0-100	0-2.5	2 mΩ	1 μH	200 KΩ	600 μF	4.5
JQE 150-1.5M	0-150	0-1.5	5 mΩ	2 μH	330 KΩ	440 μF	4.6

500 WATT MODELS

MODEL	VOLTS	AMPS	SERIES R	SERIES L	SHUNT R	SHUNT C	MAX INPUT AMPS AT 125V a-c
JQE 6-45M	0-6	0-45	7 μΩ	0.5μH	11 KΩ	8 KμF	9.0
JQE 15-25M	0-15	0-25	30 μΩ	0.5μH	20 KΩ	4.5KμF	8.4
JQE 25-20M	0-25	0-20	63 μΩ	0.5μH	25 KΩ	4.3KμF	10.5
JQE 36-15M	0-36	0-15	120 μΩ	0.5μH	33 KΩ	3.6KμF	9.5
JQE 55-10M	0-55	0-10	275 μΩ	1 μH	50 KΩ	2.1KμF	9.0
JQE 75-8M	0-75	0-8	469 μΩ	1 μH	62.5KΩ	1.2KμF	10.0
JQE 100-5M	0-100	0-5	1.25mΩ	1 μH	100 KΩ	600 μF	8.4
JQE 150-3.5M	0-150	0-3.5	2.2 mΩ	2 μH	140 KΩ	440 μF	8.7

1000 WATT MODELS

MODEL	VOLTS	AMPS	SERIES R	SERIES L	SHUNT R	SHUNT C	MAX INPUT AMPS AT 125V a-c
JQE 6-90M	0-6	0-90	3.5 μΩ	0.5μH	3.5KΩ	17.6KμF	15.7
JQE 15-50M	0-15	0-50	15 μΩ	0.5μH	10 KΩ	12 KμF	16.6
JQE 25-40M	0-25	0-40	31 μΩ	0.5μH	12.5KΩ	14 KμF	21.0
JQE 36-30M	0-36	0-30	60 μΩ	0.5μH	16 KΩ	11 KμF	19.0
JQE 55-20M	0-55	0-20	138 μΩ	1 μH	25 KΩ	7,3KμF	18.0
JQE 75-15M	0-75	0-15	250 μΩ	1 μH	33 KΩ	4.2KμF	18.0
JQE 100-10M	0-100	0-10	0.62mΩ	1 μH	50 KΩ	2.2KμF	17.0
JQE 150-7M	0-150	0-7	1.1 mΩ	2 μH	72 KΩ	1 KμF	18.0

DIMENSIONS:

Quarter-Rack Models: $5\tfrac{7}{32}$"H x $4\tfrac{5}{32}$"W x $17\tfrac{3}{16}$"D(1); Net Weight: 17 lbs.

Half-Rack Models: $5\tfrac{7}{32}$"H x $8\tfrac{11}{32}$"W x $17\tfrac{3}{8}$"D
Net Weight: 250W — 35 lbs; 500W — 46 lbs.

Rack Mount RA 24

Full-Rack Models: $5\tfrac{7}{32}$"H x $16\tfrac{1}{2}$"W(2) x $17\tfrac{1}{64}$"D(1); Net Weight: 95 lbs.

(1)behind panel (2)with supplied "ears" standard 19" panel width

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE(1)	AMPLIFIER OFFSETS VOLTAGE ΔE_{io}	AMPLIFIER OFFSETS CURRENT ΔI_{io}	REFERENCE 6.2V ± 5%
SOURCE: 105-125/210-250V a-c		<0.0005%	<0.005%	<10 μV	<2 nA	0.0001%
LOAD: No load-full load		<0.005% or 0.2 mV(2)	<0.01%	<200 μV	<5 nA	—
TIME: 8-hours (drift)		<0.01% or 1 mV(2)	<0.02%	<20 μV	<2 nA	0.005%
TEMPERATURE: Per °C		<0.01%(3)	<0.02%(3)	<20 μV	<5 nA	0.005%
RIPPLE and NOISE:(4)	rms	<0.2 mV	<0.02% of I_o max.	—	—	—
	p-p(5)	<1.0 mV	<0.1% of I_o max.	—		—

(1)External current sensing, using the *voltage* amplifier. Effects are measured for a 1-volt current sensing voltage drop.

(2)Whichever is greater.

(3)Typical temperature effect coefficients are: 0.005% per °C voltage mode; 0.01% per °C externally sensed current mode.

(4)One terminal grounded or connected so that the common-mode current does not flow through the load or (in current-mode) through a sensing resistor.

(5)20 Hz to 10 MHz.

For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, NY 11352 USA • (718) 461-7000 • FAX: (718) 767-1102 • Easylink (TWX): 710-582-2631

KEPCO. **THE POWER SUPPLIER™**

POWER SUPPLIES for LABORATORY & SYSTEMS
HIGH VOLTAGE MODELS

APH™

115/230V
a-c input

AUTOMATIC CROSSOVER CONVENTIONALLY FILTERED

KEPCO
VOLTAGE
CURRENT
POWER
ON
OFF

High voltage laboratory power supplies offering continuously adjustable or remotely programmable voltage and current in an automatic crossover configuration. APH 500M and APH 1000M can be digitally controlled by one of Kepco's SN-Series programmers. For control of the 2000V model please consult the factory.

20 WATT MODELS

MODEL	VOLTS	AMPS
APH 500M	0-500	0-0.04
APH 1000M	0-1000	0-0.02
APH 2000M	0-2000	0-0.01

DIMENSIONS: 5 7/32"H x 12 17/32"W x 12 7/8"D
NET WEIGHT: 20 lbs.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE (1)	OUTPUT EFFECTS CURRENT MODE (Internal Sensing)
SOURCE: 105-125/210-250V a-c		<0.001%	<0.005% of I_0 max
LOAD (No load—full load):		<0.005%	<0.01% of I_0 max.
TIME: 8-hour (drift)		<0.01%	<0.01% of I_0 max.
TEMPERATURE: Per °C		<0.01%	<0.01% of I_0 max.
RIPPLE and NOISE	rms	<2 mV	<40 μA
	p-p	<10 mV	<200 μA

(1) Specifications are expressed as a *percent-of-setting* for the output range 10% to 100%. Below 10% output, the specification limit is the rated percentage of the 10% output setting.

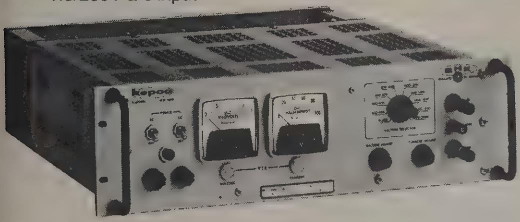
Rack Mount RA 24 or RA 37

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

BHK™

200 WATT AUTOMATIC CROSSOVER, CONVENTIONAL AND HIGH SPEED

115/230V a-c input



Models BHK 500-0.4M and BHK 1000-0.2M are programmable from the IEEE-488 bus using one of the stand-alone Kepco digital interfaces. For control of the 2000V model please consult the factory. The BHK are arranged in an automatic crossover configuration for control of both voltage and current. Provision is made for disconnecting the output capacitor for high speed programming.

200 WATT MODELS

MODEL	VOLTS	AMPS
BHK 500-0.4M	0-500	0-0.4
BHK 1000-0.2M	0-1000	0-0.2
BHK 2000-0.1M	0-2000	0-0.1

CONTROL/PROGRAMMING:
Output voltage is controlled from the panel by a combination of a 10-position decade switch and a 10-turn vernier control. This arrangement provides 0.005% resolution yet does not inhibit the ability to sweep program a BHK linearly through its entire range. External control can be exercised by a resistance (1000 ohms per volt) or by a control voltage, delivering 0 to +1 milliampere into the summing junction with respect to the plus (+) output/sense terminal. External signals can be substituted for, or summed with, the internal reference for additional control. BHK can be strapped for either conventional speed operation or for fast programming. In fast mode the output can be controlled at 0.5V per microsecond.

DIMENSIONS: 5 7/32"H x 19"W x 15 5/16"D (behind panel) **NET WEIGHT:** 38 lbs.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE (Internal Sensing)
SOURCE: 105–125/210–250V a-c		<0.005%	<100 μA
LOAD: No load—full load		<0.01%	<100 μA
TIME: 8 hours (drift)		<0.01%	<0.01% of I_0 max
TEMPERATURE: Per °C		<0.01%	<0.05% of I_0 max
RIPPLE and NOISE: (Slow Mode)	rms	<1 mV	<100 μA
	p-p	<10 mV	<1 mA
RIPPLE AND NOISE: (Fast Mode)	rms	<50 mV	<500 μA
	p-p	<500 mV	<5 mA

CAUTION!

NOTE: BHK Power Managers should be mounted in a 19" rack or rack-style cabinet. They are not fully enclosed for bench type use. Dangerous voltages are exposed at the rear of the unit.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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KEPCO® **THE POWER SUPPLIER™**

BIPOLAR POWER SUPPLIES for LABORATORY & SYSTEMS

HIGH VOLTAGE MODELS

FOUR-QUADRANT VOLTAGE/CURRENT STABILIZERS

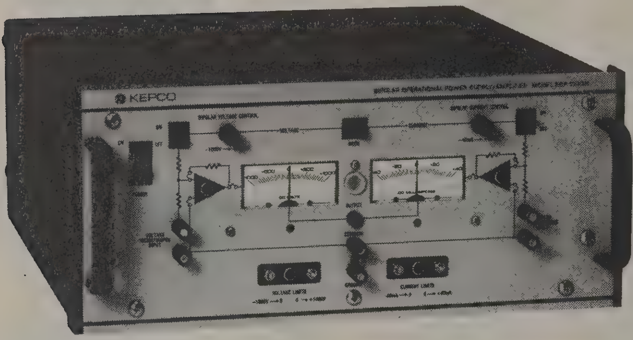
BOP-HV™

These high voltage power supplies share the bipolar and source/sink capabilities of the lower voltage BOP. Their outputs can be made to vary smoothly and linearly through their entire rated plus and minus ranges, passing linearly through zero. They can source as well as sink 100% of their current rating at any voltage setting. BOP-HV models are bounded in all four quadrants by four fully adjustable, programmable boundary limits, and are digitally programmable with any of the Kepco SN series systems programmers.

40 WATT MODELS

MODEL	d-c OUTPUT RANGE E_0 max	d-c OUTPUT RANGE I_0 max	CLOSED LOOP GAIN VOLTAGE CHANNEL G_V (V/V)	CLOSED LOOP GAIN CURRENT CHANNEL G_I (mA/V)	OUTPUT IMPEDANCE VOLTAGE MODE SERIES R	OUTPUT IMPEDANCE VOLTAGE MODE SERIES L	OUTPUT IMPEDANCE CURRENT MODE SHUNT R	OUTPUT IMPEDANCE CURRENT MODE SHUNT C
BOP 500M	± 500V	± 80 mA	50	8.0	0.05 Ω	10 mH	100 MΩ	0.02 μF
BOP 1000M	± 1000V	± 40 mA	100	4.0	0.2 Ω	10 mH	400 MΩ	0.01 μF

Size: $6\frac{31}{32}$"H x 16½"W x $17\frac{5}{64}$"D *19" with rack mount flanges supplied. **Net Weight:** 65 lbs.



DYNAMIC SPECIFICATIONS

PARAMETER	MODE SWITCH	BOP 500M	BOP 1000M
BANDWIDTH (d-c to f_{-3dB})	Voltage	2 kHz	1 kHz
	Current	1.3 kHz	0.64 kHz
RISE & FALL TIME 10%-90% μsec (maximum)	Voltage	165	330
	Current	275	550
LARGE SIGNAL FREQUENCY RESPONSE	Voltage	2 kHz	0.5 kHz
	Current	2 kHz	0.5 kHz
SLEWING RATE	Voltage	6V / μsec	3V / μsec
	Current	1 mA / μsec	0.13 mA / μsec
TRANSIENT RECOVERY (Step Load Change)	Voltage	100 μsec	100 μsec
	Current	125 μsec	250 μsec

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS(1) VOLTAGE MODE	OUTPUT EFFECTS(1) CURRENT MODE	PREAMPLIFIER OFFSETS ΔE_{IO}	PREAMPLIFIER OFFSETS ΔI_{IO}	REFERENCES
SOURCE: 105-125/210-250V a-c		<0.0005%	<0.0005%(2)	<5μV	<1nA	<0.0005%
LOAD (No load-full load)		<0.0005%	<0.005%	—	—	<0.0005%
TIME 8-hour (drift)		<0.01%	<0.01%	<20μV	<1nA	<0.005%
TEMPERATURE (Per °C)		<0.01%	<0.01%	<20μV	<1nA	<0.005%
RIPPLE and NOISE(3)	rms	<10mV	<25μA(5)	—	—	<10μV
	p-p BOP 500M	<100mV(4)	<25μA(5)	—	—	<100μV
	p-p BOP 1000M	<200mV(4)	<200μA(5)	—	—	<100μV

(1) Specifications are expressed as a *percent-of-setting* for the output range 10% to 100%. Below 10% output, specification limit is the rated percentage of the 10% output setting.

(2) Or 0.2μA, whichever is greater.

(3) Measured with the common terminal grounded so that the common mode current does not flow through the load.

(4) Peak-to-peak ripple is measured over a 20Hz to 10MHz bandwidth.

(5) For frequency components in the bandwidth of the current stabilizer. Beyond cutoff, noise will appear as a voltage component equal to the rated voltage mode noise.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

For complete specifications send for BOP Series Brochure 146-1704 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

KEPCO® **THE POWER SUPPLIER™**

OEM MODULES

PRM™ FERRORESONANT VOLTAGE STABILIZERS

Rack mounting panels available, consult factory.

Fixed output, heavy duty stabilizers for exceptional longevity under rugged conditions. PRM's offer high efficiency (50-75%) and excellent source isolation.

NOTE: The models listed are for operation on 115V a-c 60 Hz mains only (tolerance ±3 Hz). For 50 Hz operation add suffix-50 and derate output current by 20%.

DIMENSIONS:

Size A Models: (1) 6¹³⁄₁₆H x 4¾W x 10²⁷⁄₃₂D.
Net weight: 20 lbs.
Size AA Models: (1) 6¹³⁄₁₆H x 4¾W x 10²⁹⁄₃₂D.
Net weight: 24 lbs.
Size B Models: 3¹³⁄₃₂H x 5W x 13⅞D.
Net weight: 17 lbs.
Size C Models: (1) 6¹³⁄₁₆H x 4¾W x 15⅛D.
Net weight: 30 lbs. (2)
Size D Models: 3¹³⁄₃₂H x 5W x 10⅞D.
Net weight: 11 lbs.

(1) Dimension, Models A and C are uncased.
(2) Dual Output: 38 lbs 450 Watt Series: 40 lbs

Enclosures available for Sizes A, AA and C

180 WATT MODELS
Size A Fixed Output

MODEL	VOLTS	AMPS
PRM 12-15	12.0	0-15
PRM 24-8	24.0	0-8
PRM 28-7	28.0	0-7
PRM 120-1.5	120.0	0-1.5

280 WATT MODELS
Size AA Fixed Output

MODEL	VOLTS	AMPS
PRM 8.5-30	8.5	0-30
PRM 12-23	12.0	0-23
PRM 15-18	15.0	0-18
PRM 24-12	24.0	0-12
PRM 28-10	28.0	0-10
PRM 48-6	48.0	0-6
PRM 120-2.4	120.0	0-2.4

300 WATT MODELS
Size C Dual Output

MODEL	VOLTS	AMPS
PRM 2x12-12	12.0	0-12
PRM 2x15-10	15.0	0-10
PRM 2x24-6	24.0	0-6
PRM 2x60-2.5	60.0	0-2.5

Two independent outputs identically rated.

INFLUENCE QUANTITY	OUTPUT EFFECT
SOURCE VOLTAGE: 100-130V a-c	± 1% E_0 max. (1) ± 1.5% E_0 max. (2)
LOAD CHANGE: 100% to 50% 100% to 25%	< + 10% E_0 max (3) < + 20% E_0 max. (3)
TIME: 8-hour (drift)	< 1% E_0 max.
TEMPERATURE: Per °C	< 0.05% E_0 max.
RIPPLE and NOISE: rms	2 mV to 300 mV (3)

(1) At full load. (2) At no load. (3) Depends on model.

450 WATT MODELS
Size C Fixed Output

MODEL	VOLTS	AMPS
PRM 12-35	12.0	0-35
PRM 24-20	24.0	0-20
PRM 28-17	28.0	0-17
PRM 48-10	48.0	0-10

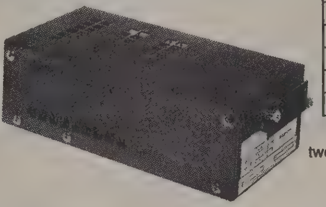
60 WATT MODELS
Size D Selectable Output

MODEL	VOLTS	AMPS
PRM 5-10	5.0	0-10.0
PRM 8-7	8.0	0-7.0
PRM 12-5	12.0	0-5.0
PRM 15-4	15.0	0-4.0
PRM 21-2.9	21.0	0-2.9
PRM 26-2.3	26.0	0-2.3
PRM 36-1.7	36.0	0-1.7
PRM 240-0.25	240.0	0-0.25

The nominal output is listed. Taps for two settings higher and two settings lower.

120 WATT MODELS
Size B Fixed Output

MODEL	VOLTS	AMPS
PRM 12-10	12.0	0-10
PRM 24-5	24.0	0-5
PRM 120-1	120.0	0-1



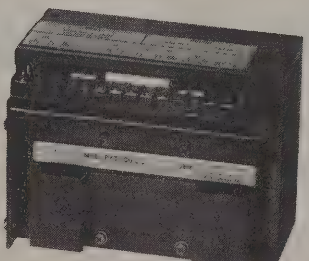
UL RECOGNIZED

This KEPCO product is backed by a firm 5-YEAR WARRANTY

LINEAR PROGRAMMABLE VOLTAGE / CURRENT STABILIZERS

PAT™

These operationally programmable power modules offer a single high-gain control channel for voltage or current stabilization, backed up by an adjustable overcurrent limiter. Programmable from IEEE-488 bus using a Kepco digital interface.



DIMENSIONS:
4⅞"H × 6⅜"W × 3¹¹⁄₃₂"D
NET WEIGHT: 6 lbs.

20 WATT MODELS

MODEL	VOLTS	AMPS
PAT 7-2	0-7	0-2
PAT 15-1.5	0-15	0-1.5
PAT 21-1	0-21	0-1
PAT 40-0.5	0-40	0-0.5
PAT 72-0.3	0-72	0-0.3
PAT 100-0.2	0-100	0-0.2

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE(1)
SOURCE: 105-125.210-250V a-c		<0.0005%	<0.005%
LOAD: No Load – full load		<0.005%	<0.01%
TIME: 8-hours (drift)		<0.01%	<0.02%
TEMPERATURE: Per °C		<0.01%	<0.02%
RIPPLE and NOISE:	rms	<0.1 mV	<0.02% of I_0 max
	p-p	<0.5 mV	<0.1% of I_0 max

(1) External current sensing, using the *voltage* amplifier. Effects are measured for a 1-volt current sensing voltage drop.

PTR™

DIMENSIONS:
3¹⁷⁄₆₄"H x
5"W x
13²⁷⁄₃₂"D
(including barrier-strip).
NET WEIGHT:
11 lbs.

Programmable voltage/current stabilizer with automatic crossover and optional overvoltage protection, conventional speed design. Programmable from IEEE-488 bus using a Kepco digital interface.

50 WATT MODELS

MODEL	VOLTS	AMPS
PTR 7-5.5	0-7	0-5.5
PTR 15-3.3	0-15	0-3.3
PTR 21-2.5	0-21	0-2.5
PTR 40-1.4	0-40	0-1.4
PTR 72-0.8	0-72	0-0.8
PTR 100-0.6	0-100	0-0.6

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE INTERNAL	EXTERNAL(1)
SOURCE: 105-125/210-250V a-c		<0.001%	<0.005%	<0.005%
LOAD: No load — full load		<0.005%	<3.0 mA	<0.01%
TIME: 8-hours (drift)		<0.01%	<0.05%	<0.02%
TEMPERATURE: Per °C		<0.01%	<0.05%	<0.02%
RIPPLE and NOISE:	rms	<0.1 mV	<0.5 mA	<0.5 mA
	p-p	<2.0 mV	<2.0 mA	<2.0 mA

(1) External current sensing and feedback to the voltage amplifier.

For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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KEPCO® THE POWER SUPPLIER™

BENCH OR RACK MOUNT TYPE POWER SUPPLIES

These keyboard-controlled Power Managers provide 75 Watts of well-behaved d-c power in four ranges from 0-12.5V to 0-125V. *Conventional control knobs are not to be found!*

DPS™

DPS is controlled by a convenient front panel keypad that commands a built-in microprocessor to set voltage, current limit, range, OVP, displays and over-current protection.
Remote talk-listen control is exercised via a simple RS 232C connection that may be addressed in BASIC or most common languages.
Keypad SLEW controls permit continuous adjustment of the voltage up and down for fine adjustment while the output is enabled.
Separate large-character LED displays are provided for both voltage and current.

Features:

- **Automatic low-range relay** allows higher current at low voltage.
- **Digital keypad** offers easy and precise setup.
- **Keypad SLEW control** for simple incrementing.
- **Three (volatile) memory locations** store configurations.
- **Programmed active pulldown circuit** for fast SLEW from full voltage to zero.
- **Serial interface RS 232C** can drive up to 31 instruments.
- **Full voltage and current readback through RS 232C.**

Model DPS 25-3M

DPS MODEL TABLE

	d-c OUTPUT HIGH RANGE		d-c OUTPUT LOW RANGE		RESOLUTION	
MODEL	VOLTS	AMPERES	VOLTS	AMPERES	VOLTAGE	CURRENT
DPS 12.5-6M	0-12.5	0-6	0-6	0-8	0.05V	0.04A
DPS 25-3M	0-25	0-3	0-9	0-5	0.1V	0.02A
DPS 40-2M	0-40	0-2	0-15	0-3	0.2V	0.02A
DPS 125-0.5M	0-125	0-0.5	0-60	0-1	0.5V	0.002A

INTERFACE TABLE

CONNECTORS	CONTROL IN	PC/AT 9-PIN D FEMALE
	CONTROL OUT	PC/AT 9-PIN D MALE
Levels	—	RS232C standard
Isolation	—	Optically isolated
Handshake	Signal	Nil
Baud rate	DIP switch select	1200, 2400, 4800, 9600
Word length	—	8 bits
Parity	—	None
Stop bit	—	1
Protocol	KOIB	One std RS232C links up to 31 devices

DPS STATIC SPECIFICATIONS

INFLUENCE QTY	CONDITION	OUTPUT EFFECTS VOLTAGE MODE
SOURCE	MIN-MAX	± 0.02%+3mV
LOAD	No Load-Full Load	± 0.02% +3mV
TIME	0.5-8.5 hours	0.1%
TEMPERATURE	per °C	0.1%
RIPPLE & NOISE	rms	5mV
(BW = 20MHz)	p-p	50mV

GENERAL

Operating temperature	—	0-40° C
Storage temperature	—	-40 to +75° C
Relative humidity	—	0-95% non condensing
Shock	—	5g 3 axes
Vibration	—	2g 10-55Hz 3-axes

This KEPCO product is backed by a firm 5-YEAR WARRANTY

For rack mounting in a standard 19" rack, use RA-56

For complete specifications send for Series DPS Brochure 146-1784 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

KEPCO. **THE POWER SUPPLIER™**

DIGITAL POWER SUPPLIES FOR THE BENCH

MBT™

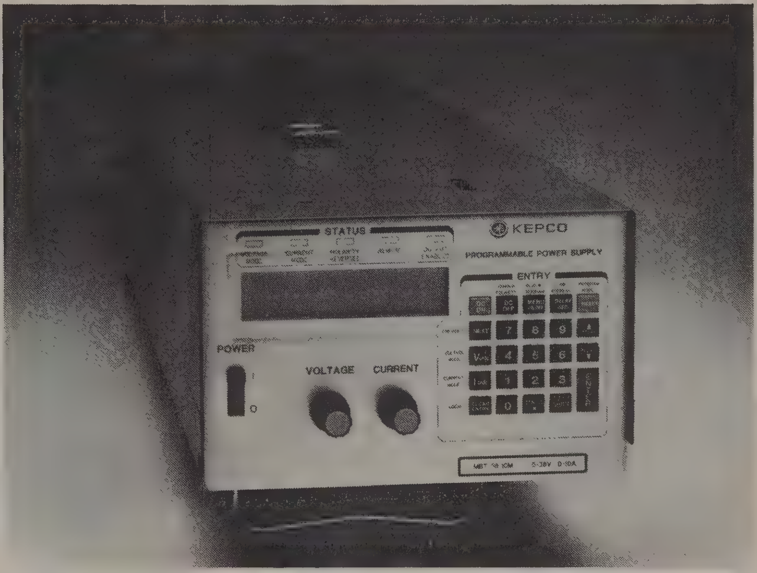
Series MBT offers the control features needed for today's automatic test supplies as well as the versatility required of a benchtop instrument. They use fully linear series-pass stabilizers for low output noise and good stability. Control is by a panel mounted keyboard or rotary optical encoders for the traditional "feel" of control knobs. Remote input includes the IEEE-1118 2-wire serial bus for long range control. Option "G" adds an internal single board computer to support IEEE-488-2 (SCPI and CIIL) and RS 232C buses. MBT may be used to transmit commands to associated power supplies in the MAT and MST families. Optional relays are available for output isolation and polarity reversal.

Features:

- **Full control** over both voltage and current with automatic crossover 12 bits resolution each.
- **Control inputs:** panel keypad, control knobs or from one of three built-in communication buses.
- **Full talk-listen capability** via GPIB (IEEE 488-2) Kepco serial bus (IEEE-1118) or RS 232C.
- **Panel LCD screen** for menu-driven command structure and read back.
- **Calibration and self test routines built-in.**
- **Optional enable and polarity reversal relay.**
- **Tracking overvoltage protection** with SCR crowbar trigger.
- **No derating** any output setting, any load.
- **Selectable 115V a-c/230V a-c mains.**

For rack mounting in a standard 19" rack, use RA-37

This KEPCO product is backed by a firm 5-YEAR WARRANTY



360 WATT MODELS

MODEL	VOLTS	AMPS	POWER(Watts)
MBT 6-32M	0-6	0-32	192
MBT 15-20M	0-15	0-20	300
MBT 25-14M	0-25	0-14	350
MBT 36-10M	0-36	0-10	360
MBT 55-7M	0-55	0-7	385
MBT 75-5M	0-75	0-5	375
MBT 100-3.6M	0-100	0-3.6	360
MBT 150-2.4M	0-150	0-2.4	360

½ Rack Size: 5 7/32" x 8 11/32" x 15"

NOTE: Add suffix "G" for IEEE-488-2 and RS 232C communications
NOTE: Add suffix "R" for optional relays

STATIC SPECIFICATIONS

SPECIFICATION	CONDITION	RATING/DESCRIPTION
Source Effect	Voltage	0.001% $E_{o\max}$
	Current	0.005% $I_{o\max}$
Load Effect	Voltage	0.002% $E_{o\max}$
	Current	3 mA
Time (8 Hour Drift)	Voltage	0.01% $E_{o\max}$
	Current	0.02% $I_{o\max}$
Temperature Coefficient °C	Voltage	0.01% $E_{o\max}$
	Current	0.02% $I_{o\max}$
Ripple & Noise rms/p-p	Voltage	0.001%/0.01% $E_{o\max}$ or 0.3mV/3mV (1)
	Current	0.03%/0.3% $I_{o\max}$

(1) Whichever is greater

For complete specifications send for
Series MBT Brochure 146-1812 or
Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

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KEPCO® **THE POWER SUPPLIER™**

LABORATORY/BENCH & RACK MOUNT POWER SUPPLIES

PRR™

Ferroresonant stabilized 1000W designs producing fixed voltages.

1000 WATT MODELS

MODEL	VOLTS	AMPS
PRR 12-77M	12.0	0-77
PRR 24-42M	24.0	0-42
PRR 28-36M	28.0	0-36
PRR 48-22M	48.0	0-22

DIMENSIONS:
6 31/32"H x 19"W x 12 5/64"D behind panel.
NET WEIGHT: 63 LBS.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

STATIC SPECIFICATIONS

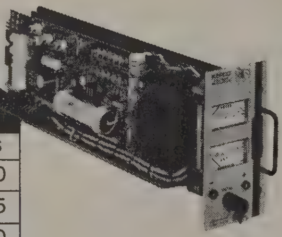
INFLUENCE QUANTITY		OUTPUT EFFECTS TYP.	OUTPUT EFFECTS MAX.
SOURCE: 105-125/210-250V a-c, 60 Hz		± 0.5%	± 1.0%
LOAD: No load - full load		(1)	
TIME: 8-hour (drift)		<1%	
TEMPERATURE: Per °C		<0.05%	
RIPPLE and NOISE:	RMS	—	50MV
	P-P	—	—

(1) 100%-50% load change - voltage increase 3 - 6%; 100%-25% load change - voltage increase 5 - 10%

PLUG-IN POWER SUPPLIES

PCX-MAT™

Voltage stabilizers, current limited. Programmable from IEEE-488 bus using a Kepco digital interface.



20 WATT MODELS

MODEL	VOLTS	AMPS
PCX 7-2MAT	0-7	0-2.0
PCX 15-1.5MAT	0-15	0-1.5
PCX 21-1MAT	0-21	0-1.0
PCX 40-0.5MAT	0-40	0-0.5
PCX 72-0.3MAT	0-72	0-0.3
PCX 100-0.2MAT	0-100	0-0.2

DIMENSIONS:
5 7/32" x 2 25/32" x 14 15/16" (behind panel).
NET WEIGHT: 8 LBS.

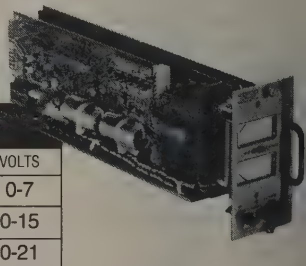
STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE
SOURCE: 105-125/210-250V a-c		<0.0005%	<0.005%
LOAD: No load - full load		<0.005%	<0.01%
TIME: 8-hour (drift)		<0.01%	<0.02%
TEMPERATURE: Per °C		<0.01%	<0.02%
RIPPLE and NOISE:	rms	<0.1 mV	<0.02% of I_0 max.
	P-P	<3 mV	<0.2% of I_0 max.

NOTE: Use optional cases CA-3, CA-4 or CA-5 for bench use, or plug-in style rack adapters RA-22-6A or RA-32. Consult factory for details of the mounting options.

CC™

Current stabilizer. Programmable from IEEE-488 bus using a Kepco digital interface.



20 WATT MODELS

MODEL	AMPS	VOLTS
CC 7-2M	0-2.0	0-7
CC 15-1.5M	0-1.5	0-15
CC 21-1M	01.0	0-21
CC 40-0.5M	0-0.5	0-40
CC 72-0.3M	0-0.3	0-72
CC 100-0.2M	0-0.2	0-100

DIMENSIONS:
5 7/32" x 2 25/32" x 14 15/16" (behind panel).
NET WEIGHT: 8 LBS.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS CURRENT MODE
SOURCE: 105-125/210-250V a-c		<0.0005%
LOAD: No load - full load		<0.005%
TIME: 8-hour (drift)		<0.02%
TEMPERATURE: Per °C		<0.01%
RIPPLE and NOISE:	rms	<0.02% of selected scale
	P-P	<0.1% of selected scale

NOTE: Use optional cases CA-3, CA-4 or CA-5 for bench use, or plug-in style rack adapters RA-22-6A or RA-32. Consult factory for details of the mounting options.

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KEPCO® THE POWER SUPPLIER™

BENCH TYPE AND RACK MOUNTABLE POWER SUPPLIES

MSK™ SINGLE OUTPUT

Model
MSK 10-10M

Powerful linear power supplies with unique "preview" feature

This new series gives you a selection of five models, offering 100 Watts of clean, stable benchtop power. The Kepco Series MSK features front panel 10-turn precision controls for voltage and current, with automatic crossover between modes. A pair of LED mode indicators (green for voltage mode, amber for current), two 3½ digit meters and heavy duty output binding posts for easy connection to your breadboards, are also on the front panel.

The preview switch (d-c on-off) allows you to pre-set voltage and current with the digital meters displaying the set values. At "d-c off", no voltage is applied to the output terminals and no load current needs to be drawn to set the current control. At "d-c on", the set voltage is applied to the output terminals. The appropriate mode indicator is lit, and the meters indicate *actual* voltage and current.

Series MSK power supplies use fully dissipative, high gain linear (series pass) stabilizer circuits, for low noise output, good stability, and accurate resettability. A built-in quiet, low-speed fan ensures good cooling in the crowded environment of your laboratory.

100 WATT MODELS

MODEL	d-c OUTPUT RANGE Volts	d-c OUTPUT RANGE Amps	POWER Watts
MSK 10-10M	0-10	0-10	0-100
MSK 20-5M	0-20	0-5	0-100
MSK 40-2.5M	0-40	0-2.5	0-100
MSK 60-2M	0-60	0-2	0-120
MSK 125-1M	0-125	0-1	0-125

DIMENSIONS: 5¾"*H x 8⅛"W x 13⁵⁄₃₂"D *including feet

NET WEIGHT: MSK 10-10M, 20-5M, 40-2.5M, 60-2M . . . 19 lbs. MSK 125-1M . . . 22 lbs.

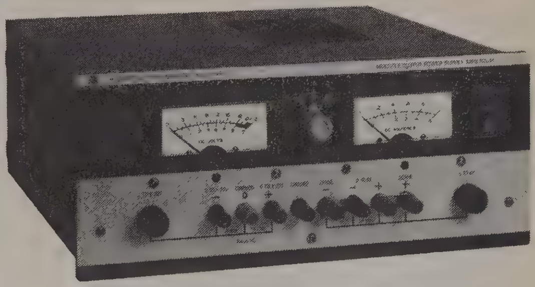
STATIC SPECIFICATIONS

INFLUENCE QUANTITY		VOLTAGE MODE	CURRENT MODE
SOURCE 105-125/210-250V a-c		0.01%	0.01%
LOAD No load – full load		0.01%	0.05%
TIME 8-hour (drift)		0.01%	0.02%
TEMPERATURE Per °C		0.01%	0.02%
RIPPLE and NOISE	rms	0.5mV	0.02%
	p-p	3.0mV	0.01%

Note: Percentage values are referenced to the maximum rated voltage or current of the unit.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

MPS 620M™ MULTIPLE OUTPUT



This power supply has been specifically designed to meet the needs of the IC/microprocessor experimenter.

The MPS 620M is actually two linear (series pass) power supplies in one: The first has a single 0-6V, 0-5A output for digital work; the second has two *tracked* outputs, 0 to +20V and 0 to −20V, both rated at 0-1Amp. The two power supplies are completely isolated from each other, sharing only the front panel meters and the chassis.

The 0-6V output is continuously adjustable with a 10-turn control on the front panel, and is backed up by a current limiter and overvoltage crowbar. The crowbar is set by a locking-type screwdriver adjustment. The fixed rectangular current limit circuit is set to approximately 110% of maximum current. The dual 0 to ±20V outputs are continuously adjustable by a single 10-turn front panel control, and tracking is better than ±1% +10mV. The outputs can be used in series to provide 0-40V, but since they share a common (center) terminal, they cannot be used in parallel. Both outputs are equipped with adjustable current limits.

70 WATT MODEL

OUTPUT	VOLTS	AMPS
Output #1	0 to 6	0-5
Output #2	0 to +20	0-1
Output #3	0 to −20	0-1

Outputs 2 and 3 are tracked.
Output 1 is protected by an overvoltage crowbar.

DIMENSIONS: 5⁷⁄₃₂"H x 12¹⁷⁄₃₂"W x 12⅞"D **NET WEIGHT:** 29 lbs.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS 0 to 6V Output	OUTPUT EFFECTS 0 to ±20V Output
SOURCE 105-125/210-250V a-c		0.01%	0.01%
LOAD No load – full load		0.01%	0.05%
TIME 8 hour (drift)		0.01%	0.01%
TEMPERATURE Per °C		0.01%	0.01%
RIPPLE and NOISE	rms	0.1 mV	0.1 mV
	p-p	1.0 mV	1.0 mV

For complete specifications send for Series MSK Brochure 146-1659 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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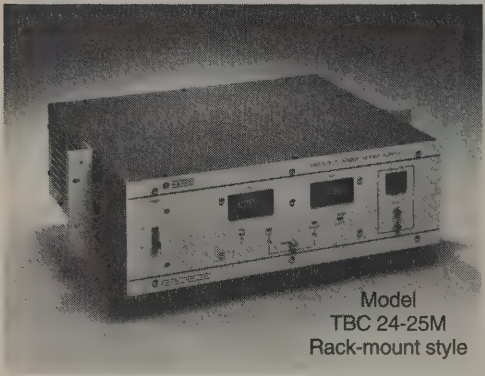
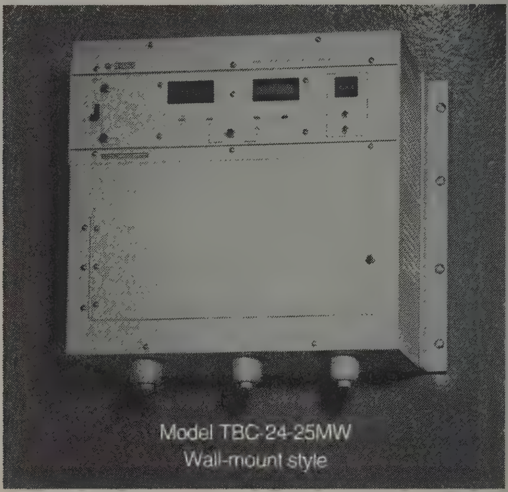
KEPCO® THE POWER SUPPLIER™

TELECOMMUNICATIONS BATTERY CHARGERS AND BURN-IN POWER SUPPLIES

SINGLE PHASE • 12A TO 120A • 300 TO 3000 WATTS

TBC™


Model
TBC 24-25M
Rack-mount style


Model TBC-24-25MW
Wall-mount style

Kepco's TBC are designed for float-equalize service to maintain battery arrays such as are found in many telecommunication installations. The TBC are fully filtered and stabilized battery eliminators that also find application as burn-in power supplies. The float and equalize settings are fully independent adjustments whose settings are made by screwdriver access through small sliding doors in the front panel. The digital voltmeter allows precise adjustment. A digital ammeter displays the charging current or output current.

If the current drops to zero – either because the ac mains power to the TBC is lost, the front panel circuit breaker is turned off or the voltage setting is adjusted below the battery's voltage, a "charging stopped" LED is illuminated and a flag signal is provided.

Equalize mode can be selected either with a front panel push button – or a remote contact closure. This sets the voltage to the equalize level (adjustable). A timer is activated that will reset back to float mode after a period of time (0.1 to 99.9 hrs) that can be set from the front panel with a thumbwheel selector. A flag signal is produced when the TBC is in equalize mode.

Kepco's TBC employ high frequency switching technology (100-150 KHz forward converters) for high efficiency, small size and light weight. The output is filtered so that residual voice band noise (on battery) is below 22dB rnC.

This KEPCO product is backed by a firm
5-YEAR WARRANTY

For complete specifications send for Kepco Power Supply Catalog 146-1811.
Data and specifications subject to change without notice.

TBC MODEL TABLE

MODEL	OUTPUT VOLTS NOMINAL RANGE		OUTPUT CURRENTS	SIZE(2)	INPUT VOLTS	INPUT AMPS	EFFICIENCY
TBC 12-20M	12V	11.5-15V	0-20A	A	115/230	4.6A(1)	77%
TBC 12-50M	12V	11.5-15V	0-50A	A	115/230	12.5A(1)	80%
TBC 12-120M	12V	11.5-15V	0-120A	A	230	16A	82%
TBC 24-25M	24V	23-30V	0-25A	A	115/230	12A(1)	85%
TBC 24-60M	24V	23-30V	0-60A	A	230	16A	83%
TBC 24-120M	24V	23-30V	0-120A	B	230	32A	82%
TBC 48-12M	48V	47-60V	0-12A	A	115/230	12A(1)	85%
TBC 48-30M	48V	47-60V	0-30A	A	230	16A	84%
TBC 48-60M	48V	47-60V	0-60A	B	230	32A	83%

(1) Input current with input selector set to 115V a-c
(2) Size A — 5¼H x 19W x 13½D inches, 133 x 483 x 343 mm
Size B — 8¾H x 19W x 15D inches, 222 x 483 x 351 mm
Wall — 15H x 19W x 8¾D inches, 381 x 483 x 222 mm

Add suffix "W" for Wall-mount style.

TBC STATIC SPECIFICATIONS

SPECIFICATION	CONDITION		TYP	MAX
Source Effect	Min-Max		0.8%	1.5%
Load Effect	10%-100%		0.8%	1.5%
Temperature Effect	0-50°C		1.0%	1.5%
Combined Effect	(source, load, temp)		1.2%	3.0%
Time Effect	(1/2-8 hrs)		0.1%	0.8%
Output Noise	Voice band on battery		—	<22dB rnC
	Wide band 50 MHz	12V	—	100 mV p-p
		24V	—	100 mV p-p
		48V	—	100 mV p-p
Load Recovery	Excursion 50-100%		—	<4%
	Recovery within ± 1%		—	<1 msec.

KEPCO® **THE POWER SUPPLIER**™

DIGITALLY CONTROLLED POWER SUPPLIES

Three 360 Watt MAT modules shown in RA 50 Housing

TMA/MAT™

Kepco's MAT are digital systems power supplies offering 360W, 720W and 1080 Watts of linearly-stabilized power for low noise high precision applications. Control is by a 2-wire serial bus conforming to IEEE-1118 which can control up to 27 MAT modules over a 900' span. MAT will also interface with Kepco's MBT power supply and can be intermixed with the 200 Watt MST units. IEEE-488 control can be implemented using either a stand-alone IEEE-488 to IEEE-1118 converter (Kepco TMA 488-27)or using either an MBT's IEEE-488 interface (or its keyboard) or the MST's IEEE-488 interface. In all instances, a full talk-listen interchange is implemented. The Kepco model TMA PC-27 is a plug-in card for PC's that will directly drive the IEEE-1118 bus for control of up to 27 MAT modules.

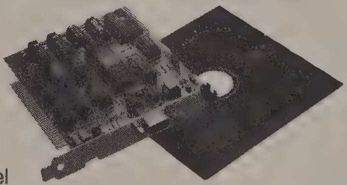
Features:

- **Full talk-listen control.**
- **360 and 720 Watt models** plug-in to enable installation and replacement from the front.
- **Isolation and polarity reversal relays built-in.**
- **Linear design** for low noise fast response.
- **12 bit resolution voltage and current.**
- **LCD metering**, voltage and current.
- **Available, to order without the digital control and without relays** for remote analog control by resistance.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

Use a PC to directly control Kepco's type MAT Power Supplies -without IEEE-488.

TMA PC-27 PLUG-IN CARD FOR YOUR PC



Software emulator of Kepco's model TMA 488-27. Where TMA 488-27 converts an IEEE-488 bus into the bit-bus to talk with Kepco's MAT, MBT and MST power modules, the new model, TMA PC-27, communicates directly from your PC to the MAT power modules. TMA PC-27 comprises a board that will fit into your PC or PC-AT or compatible computer. With the provided software, it allows your computer to emulate the whole TMA function. Your PC will communicate directly with up to 27 MAT power supplies providing all control and communication functions without requiring an IEEE-488 (GPIB) card.

360 WATT MODULES – 1/3 RACK

Single output. Nominally 360 Watts.
Mount in RA 50 and RA 51.

Model	Volts	Amps	Power
MAT 6-32	0-6	0-32	192
MAT 15-20	0-15	0-20	300
MAT 25-14	0-25	0-14	350
MAT 36-10	0-36	0-10	360
MAT 55-7	0-55	0-7	385
MAT 75-5	0-75	0-5	375
MAT 100-3.6	0-100	0-3.6	360
MAT 150-2.4	0-150	0-2.4	360

720 WATT MODULES – 2/3 RACK

Single output. Nominally 720 Watts. Mount in RA 51

Model	Volts	Amps	Power
MAT 6-64	0-6	0-64	384
MAT 15-40	0-15	0-40	600
MAT 25-28	0-25	0-28	700
MAT 36-20	0-36	0-20	720
MAT 55-14	0-55	0-14	770
MAT 75-10	0-75	0-10	750
MAT 100-7.2	0-100	0-7.2	720
MAT 150-4.8	0-150	0-4.8	720

1080 WATT MODULES – FULL RACK

Single output. Nominally 1080 Watts.
Mount directly into 19″ rack. Panel: 5 1/4″ Depth: 25″

Model	Volts	Amps	Power
MAT 6-100	0-6	0-100	600
MAT 15-60	0-15	0-60	900
MAT 25-42	0-25	0-42	1050
MAT 36-30	0-36	0-30	1080
MAT 55-20	0-55	0-20	1100
MAT 75-15	0-75	0-15	1125
MAT 100-10	0-100	0-10	1000
MAT 150-7	0-150	0-7	1050

For complete specifications send for Series TMA/MAT Brochure 146-1706 or Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

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KEPCO® **THE POWER SUPPLIER™**

200W DIGITALLY PROGRAMMABLE PLUG-IN POWER SUPPLIES

MST™

Kepco's MST employ switching technology for high efficiency and high power density combined with linear stabilization techniques for accuracy and resolution. The switching front end is an advanced current mode controller with power factor correction. A power factor of better than 0.998 ensures that the MST meets IEC 555-2. A wide range a-c input accepts any mains voltage from 90 to 264V a-c.

MST are packaged in a 7" high 1/9th rack-width plug-in module that mounts in a special housing called RA-55. MST modules plug-in from the front and may be unplugged and removed without shutting down the entire power system. N+1 redundancy is provided with forced current sharing when like modules are mounted together and wired in parallel.

Each unit is totally self-contained with its own power factor controlled input and cooling system. Individual models may therefore be operated independently on the bench. (Cable kits available).

Features:
- **200W, 1/9 rack plug-in design.**
- **Power factor correction.**
- **Wide range a-c input.**
- **Programmable** SCPI & CIIL, 2-wire bus, IEEE-1118, VXI, IEEE-488-2, RS232C.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

KEPCO
POWER SUPPLY
VOLTS
AMPS
POWER
MST 36-5M 0-36V 0-5A

Model MST 36-5M

200 WATT MODELS

SPECIFICATION	OUTPUT	OUTPUT CURRENT			RIPPLE		NOISE	EFFICIENCY
Unit	VOLTAGE	Amps			mV p-p		mV p-p	Percent
Condition	Adjustment Range	45°C	55°C	65°C	Source max	SW max	(Spike) 20MHz	100% Load Any Input
MST 6-20M	0-6	20	15	9.5	2.5	5	50	51%
MST 15-12M	0-15	12	9	5.7	5	10	100	64%
MST 25-8M	0-25	8	6	3.8	5	10	100	69%
MST 36-5M	0-36	5	3.75	2.8	5	10	100	70%
MST 55-3.5M	0-55	3.5	2.6	1.7	5	10	100	71%
MST 75-2.5M	0-75	2.5	1.9	1.2	7.5	15	150	72%
MST 100-2M	0-100	2	1.5	1	7.5	15	150	74%
MST 150-1.2M	0-150	1.2	0.9	0.6	7.5	20	200	73%

Dimensions: 7" x 1¾" x 20" **Net Weight:** 7.5 lbs.

For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

KEPCO® DIGITAL PROGRAMMING INTERFACES

This KEPCO product is backed by a firm 5-YEAR WARRANTY

SNR 488™

CARD-CAGE STYLE DIGITAL PROGRAMMERS FOR MULTIPLE UNIT SYSTEMS

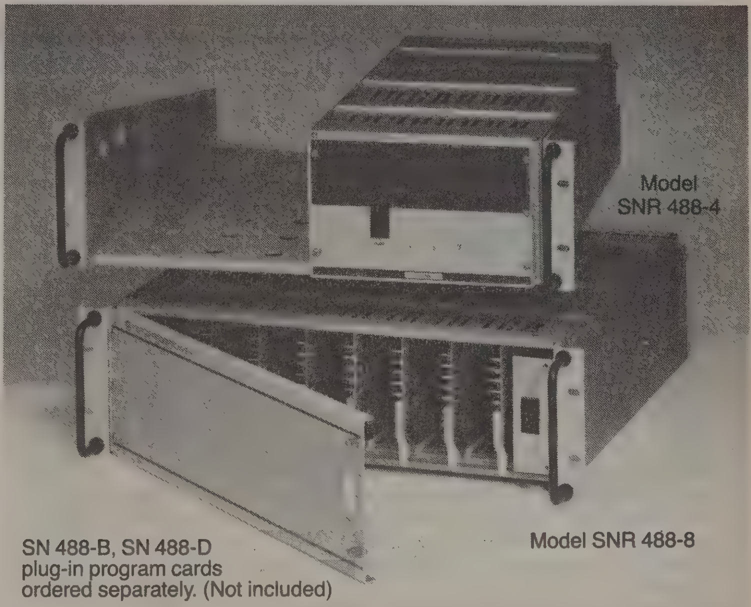
The SNR 488 system provides a card cage for plugging in dual channel program cards SN 488-B and/or SN 488-D.

Other provisions include:

IEEE-488 connector
Address select switch
Handshake card
Manual keyboard input connector
Local bus distribution to the card sockets

Each program card controls one Power Supply, and is isolated from the others in the card cage.

Two models of the SNR 488 card cages are available:
SNR 488-4 with space for four program cards, plus space for two ¼-rack or one ½-rack Power Supplies.
SNR 488-8 with space for eight program cards.



Model SNR 488-8

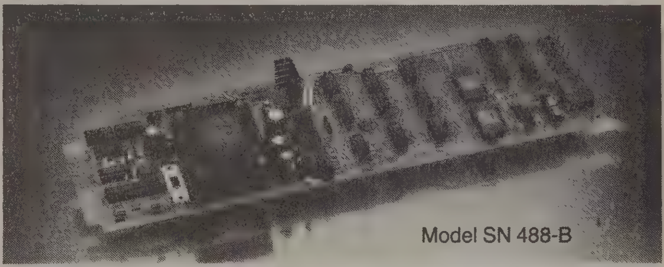
SN 488-B, SN 488-D plug-in program cards ordered separately. (Not included)

SNR 488 GENERAL SPECIFICATIONS

	SNR 488-4	SNR 488-8
a-c voltage	105-125/210-250, 50-440 Hz.	
Power	≈ 6VA	
Dimensions (behind panel)	(inches) $5\frac{7}{32}$H × 19W × $17\frac{13}{16}$D (mm) 132.6H × 482.6W × 452.4D	
Weight (packed for shipment)	17 lbs. 7.7 Kg.	23 lbs. 10.5Kg.
Color	Two-tone black & gray Fed. Std. 26440	Gray Fed. Std. 26440
Mounting	19″ rack (mounting "ears" supplied)	

SN 488-B plug-in program cards for SNR 488-4 and SNR 488-8, in 12 bit binary format.

SN 488-D plug-in program cards for SNR 488-4 and SNR 488-8, in 3 digit BCD.



Model SN 488-B

SN cards can control two functions of any power supply in the following groups: ATE, BOP,(1) BOP-HV, JQE,(2) PTR, PAT, CC,(3) PCX-MAT,(2) BHK,(4) OPS IX,(4) and NTC.

RESOLUTION: 3 digit BCD (decimal) is 1 part in 999 (0.1%). 12 bit binary (hexadecimal) is 1 part in 4095 (0.024%).

DATA FORM: N = C AAA BBB (9 ASCII encoded characters). To "talk" to a power supply you should transmit a nine character set of the form:

N = C AAA BBB

N is the address of the particular program card to which you wish to "talk" (there are eight possible addresses from 0 to 7).

"=" is the ASCII character that separates the card address from data.

C is control character: 0, 1, 2,..., F (see Truth Table in Manual).

AAA is data as a percent of full scale (Channel A)

BBB is data as a percent of full scale (Channel B)

Note: The maximum output of the binary models is FFF (Hex). The maximum output of the BCD models is 999. In both instances "maximum" corresponds to an analog programming voltage of ± 10V or ± 1V (depending on the range and polarity selected).

SN 488-B & SN 488-D GENERAL SPECIFICATIONS

SPECIFICATIONS		MODEL SN 488-B	SN 488-D
INPUT DATA FORMAT		Hexidecimal	Decimal
RESOLUTION		12 Bit Binary	3 Digit BCD
OUTPUT VOLTAGE	High Range	± 10V	
	Low Range	± 1V	
OUTPUT CURRENT		± 2 mA max.	
OUTPUT IMPEDANCE		<0.05 ohms	
LINEARITY ERROR 0 to +70°C		± 1/2 LSB	
TEMPERATURE COEFFICIENT	Full Scale	± 35 PPM/°C max.	
	Zero High Range	± 20μV/°C max.	
	Zero Low Range	± 10μV/°C max.	
LOGIC INPUT		TTL Compatible	
DATA TRANSFER FORMAT (ASCII CODED)		BYTE Serial BIT Parallel	
INTERFACE FUNCTIONS IMPLEMENTED		AH1, L1	
A-C INPUT	Voltage	105-125V/210-250V	
	Frequency	50-440 Hz	
	Power	≈ 7 VA	

(1) Instead of using built-in interface — when part of multiple unit installation
(2) Voltage channel only (3) Current channel only (4) 500V and 1000V models only

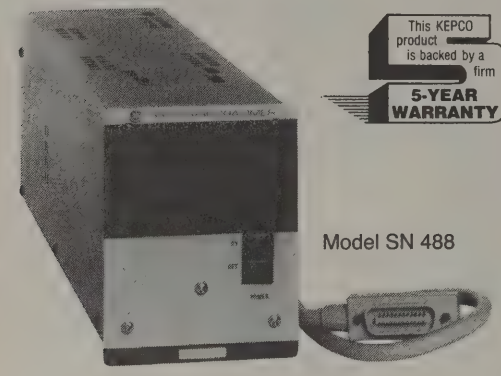
For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

KEPCO®

STAND ALONE DIGITAL INTERFACES FOR SINGLE OR MULTIPLE CHANNEL OPERATION

SN 488™ For use with buses using IEEE format (byte serial, bit parallel) data transfer

SN 500™ For use with buses using bit parallel data transfer



This KEPCO product is backed by a firm **5-YEAR WARRANTY**

Model SN 488

These digital programmers are designed for use with all Kepco operationally-programmable power supplies (high speed and conventionally filtered) and/or voltage-controlled instruments. They enable you to interface your d-c power supplies with the logic bus of a computer-controlled system.

SN 488 and SN 500 are both available in decimal format (3-digit BCD), or in hexadecimal format (12-bit binary). A single channel instrument can be converted in the field to a dual channel model by plugging in auxiliary boards SN 603 or SN 612.

IEEE-488 STANDARD: The SN 488 implements the AH1 acceptor handshake and L1 listener plus listener-only functions of the IEEE-488 protocol.

PARALLEL INPUT: The SN 500 uses data buses having bit-parallel data transfer. Sixteen bits control one channel: two additional bits add a second full channel.

ISOLATION: The SN Series programmers incorporate optical isolation (up to 1000 Volts d-c), so they may be used to control floating power supplies.

CHANNELS: The SN 488 and SN 500 offer a choice of single or dual channel operation. Each channel is completely isolated from the other so that they can be used to drive independent instruments or two functions of the same instruments. SN cards can control two functions of any power supply in the following groups: ATE, BOP,(1) BOP-HV, JQE,(2) PTR, PAT, CC,(3) PCX-MAT,(2) BHK,(4) OPS IX,(4) and NTC.

POLARITY: The SN 488 and SN 500 provide a means of controlling positive or negative polarity. This feature is useful when the programmer controls a bipolar power supply such as the Kepco Series BOP.

RANGE: The SN 488 and SN 500 provide a means of controlling range over a 10:1 ratio. This is accomplished by a programmable attenuator. The "high" range provides a 0 to ±10V analog output; the "low" range provides a 0 to ±1V analog output. This multiplies small output resolution by 10:1.

RESOLUTION: 3-digit BCD (decimal) is 1 part of 999 (0.1%). 12 bit binary (hexadecimal) is 1 part in 4095 (0.024%).

(1) Instead of using built-in interface-when part of multiple unit installation
(2) Voltage channel only
(3) Current channel only
(4) 500V and 1000V models only

SN 488 & SN 500 MODEL TABLE

MODEL	NO. CHANNELS	DATA FORMAT	RESOLUTION
SN 488-121, SN 500-121	one	hexadecimal	12 bit binary
SN 488-122, SN 500-122	two (isolated)	hexadecimal	12 bit binary
SN 488-031, SN 500-031	one	decimal	3 digit BCD
SN 488-032, SN 500-032	two (isolated)	decimal	3 digit BCD
Field installable add-on channel:			
SN 612	1 added channel	hexadecimal	12 bit binary
SN 603	1 added channel	decimal	3 bit BCD
Interconnect devices for use with IEEE-488 bus.			
MODEL	TYPE		LENGTH
SNQ 488-1	Cable, printed circuit edge to IEEE- 488		1 meter
SNQ 488-2	Cable, printed circuit edge to IEEE- 488		2 meter
PC-488	Plug printed circuit edge to IEEE-488		—

Note: The SNQ cables have an IEEE-488 connector at one end and a printed circuit edge connector at the other end. Model SNQ 488-2 is supplied with each type SN 488 single/dual channel programmer (one cable services both channels). If the PC 488 adapter plug is used, a separate IEEE-488 cable should be ordered.

The SN 500 is supplied with a connector, PC 12, which may be field wired to the parallel data source.

SN 488 & SN 500 GENERAL SPECIFICATIONS

SPECIFICATIONS		MODELS SN 488- & SN 500- 121	122	031	032
NUMBER OF CHANNELS		1	2	1	2
INPUT DATA FORMAT		Hexadecimal		Decimal	
RESOLUTION		12 Bit Binary		3 Digit BCD	
OUTPUT VOLTAGE	High Range	±10V			
	Low Range	± 1V			
OUTPUT CURRENT		±2 mA max.			
OUTPUT IMPEDANCE		<0.05 ohms			
LINEARITY ERROR 0 to +70°C		±1/2 LSB			
TEMPERATURE COEFFICIENT	Full Scale	±35 PPM/°C max.			
	Zero High Range	±20μV/°C max.			
	Zero Low Range	±10μV/°C max.			
LOGIC INPUT		TTL Compatible			
DATA TRANSFER FORMAT, SN 488 (ASCII CODED)		Byte serial, Bit parallel			
INTERFACE FUNCTIONS IMPLEMENTED, SN 488		AH1, L1			
DATA TRANSFER FORMAT, SN 500		Bit parallel			
A-C INPUT	Voltage	105-125V/210-250V			
	Frequency	50-440 Hz			
	Power	≈ 12 VA			
DIMENSIONS (behind panel)		(inches) $5\frac{7}{32}$H × $4\frac{5}{32}$W × $17\frac{3}{16}$D (mm) 132.6H × 105.6W × 436.6D			
WEIGHT (packed for shipment)		10 lbs., 4.6 Kg.			
COLOR		Two tone black & light gray, Fed Std. 26440			
MOUNTING ¼ rack size		Use Rack Adapter RA 24, RA 32, or RA 37 for mixing with Power Supplies.			

For complete specifications send for Kepco Power Supply Catalog 146-1811. Data and specifications subject to change without notice.

K.G.S. electronics, inc.

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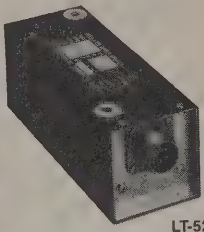
KGS ELECTRONICS DC POWER SUPPLIES
MODEL LT-SERIES SPECIFICATIONS

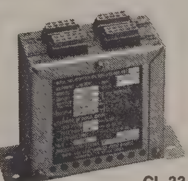
LT-55


LT-52A

Input Voltage:	28 VDC nominal, 20 to 40 VDC
Output Voltage:	Adjustable with external rheostat or potentiometer and most models have DC voltage control.
Regulation:	2% for line, 2% for load and 2% temperature.
Output Ripple:	50 mVpp max.
Altitude:	55,000 ft.
Protection: (Overvoltage)	Output voltage is limited to approximately 125% of rating even though remote control rheostat opens or shorts, or internal failure occurs.
Temperature:	−55°C to +71°C (sufficient cooling required at +71°C ambient)
Protection: (Overload)	Input and output current limit when overload exceeds approximately 125% or rating.

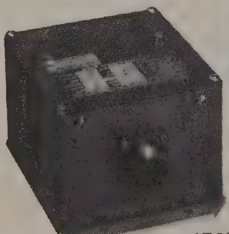
MODEL	OUTPUT (TOTAL)				INPUT CURR. at 28 VDC, at Full Load	EFFICIENCY % Typical at Full Load	SIZE (INCH) W×L×H	WEIGHT (LBS.)
	VOLT DC	AMPS	WATTS	RIPPLE				
LT-45	0 to 28	2.5	70	25 mVpp	3.0 A	83	2.03×5.03×1.63	.60
LT-45(D)	0 to 28	3.6	100	25 mVpp	4.3 A	83	2.33×5.03×1.63	.62
LT-48	0 to 5	7.5	38	25 mVpp	1.7 A	75	2.03×5.03×1.63	.60
LT-245	0 to 28	3.6	100	25 mVpp	4.3 A	83	4.0×5.0×1.65	1.20
LT-246(C)	12	12	144	50 mVpp	6.2 A	84	4.0×5.0×1.65	1.20
LT-248	5 & 0–5	7.5 & 7.5	75	25 mVpp	3.4 A	75	4.0×5.0×1.65	1.20
LT-50	0 to 5	7.5	40	8 mVpp	1.7 A	75	2.3×6.9×2.0	1.2
LT-52A, 53	0 to 5	10	50	25 mVpp	2.5 A	75	3.43×5.8×2.3	1.5
LT-55(A)(D)	0 to 5	15	75	25 mVpp	3.6 A	75	3.43×5.1×2.6	1.2
LT-57(F)	13.75	10	138	50 mVpp	5.6 A	81	3.4×5.1×2.6	1.3
LT-70, 73	0 to 12	5.8	70	25 mVpp	3.2 A	78	2.3×5.8×2.3	1.5
LT-71, 71A	14	8	112	50 mVpp	4.7 A	80	2.4×6.9×2.2	1.5
LT-100, 103	0 to 28	3.6	100	25 mVpp	4.2 A	84	2.3×5.8×2.3	1.5
LT-352	0 to 5 (Three)	28	150	25 mVpp	7.5 A	73	6.7×6.5×2.35	3.6
LT-370	0 to 12 (Three)	17	200	25 mVpp	9.2 A	78	6.7×6.5×2.35	3.6

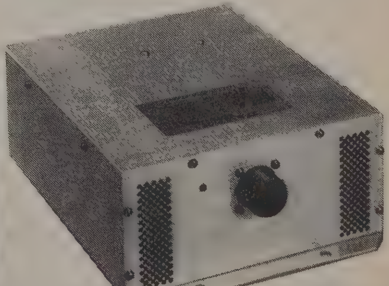
BATTERY CHARGERS, CURRENT LIMITERS, REGULATED & UNREGULATED DC CONVERTERS FOR AIRBORNE APPLICATIONS


CL-33

Input:	28 VDC & 14 VDC
Output:	Fixed DC Voltage
Altitude:	50,000 ft.
Temperature:	−55°C to +71°C
Environmental:	Per RTCA DO-160C Env.

MODEL	Vin	Vout	AMPS	WATTS	INPUT CURRENT	EFFIC.	SIZE	WT. (LBS.)
BC-14	28	14±1	5.0±1	70	3.1 A	80	2.3 x 5.8 x 2.3	1.5
BC-28	28	28±2	2.5±.5	70	3.0 A	85	2.3 x 5.8 x 2.3	1.5
CL-33	28	32 ind. outputs	200 mADC 250 mADC	60	2.5 A	85	1.56 x 4 x 3.05	0.57
RB125	11-14	28	5	140	14-11A	87	2.3 x 2.3 x 5.75	1.5
UC14-28	14	28	10	280	23 A	90	4.5 x 2.8 x 8.25	3.4
UC28-14	28	14	16	220	8.8 A	90	4.5 x 2.8 x 8.25	3.4
RG40	28	14	30	420	17.0	80	6.2 x 9.5 x 3.4	3.5


LT-23


SRP-500

AC TO DC AIRBORNE AND MILITARY POWER SUPPLIES

Input:	115 VAC 400Hz Single Phase *115/208 VAC 60-400Hz 4 Wire WYE
Output:	Adjustable DC Output.
Output Ripple:	500 MvTyp., 2 Vpp Max. @ 800 Hz
Altitude:	50,000 ft.
Temperature:	−55°C to +70°C
Environmental:	per RTCA DO-160C Env.

MODEL	Vin	FREQ	Vout	AMPS	INPUT CURRENT	EFFIC.	SIZE	WT. (LBS.)
LT-23	115	400 Hz	.5–5	0–10 A	.70 A	63%	4.0×4.0×3.0	3.2
LT-25	115	400 Hz	1–28	0–10 A	2.9 A	84%	4.0×4.0×7.0	6.0
LT-258	115	400 Hz	.5–5/1–28	10 A/15 A	2.3 A	75%	4.0×4.0×7.0	6.0
* SRP500-14	120 3PH	60–400 Hz	14.0	36A	2A/Phase	75%	7.75×3.6×10.7	7.0

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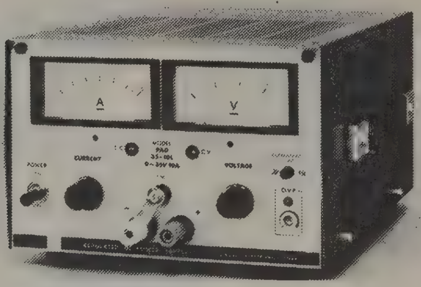
DC POWER SUPPLIES FOR LAB SYSEMS & BENCH USE GP-IB

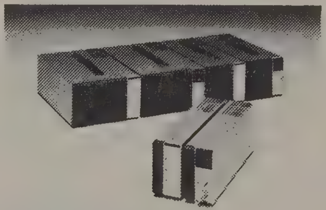


GENERAL-PURPOSE DC POWER SUPPLIES

Linear output PAD-L Series DC CV/CC power supplies combine high reliability with excellent line and load regulation. They're ideal for variable power sources in R&D, manufacturing burn-in and systems use.

- ☐ Low noise, linear output
- ☐ 0.005% line and load regulation
- ☐ IEEE-488, analog or resistive programmable
- ☐ Input choke circuitry for high efficiency and reduced line distortion
- ☐ Excellent temperature coefficient
- ☐ Options include preset voltage selector (manual or scan), soft start, and digital readouts

MODEL	DESCRIPTION
PAD 16-XXXL	0-16V @ 0-10, 18, 30, 50, 100, 200 or 500A
PAD 35-XXXL	0-35V @ 0-5, 10, 20, 30, 50, 100, 200 or 300A
PAD 55-XXXL	0-55V @ 0-3, 6, 10, 20, 35, 60, or 120A
PAD 70-XXL	0-70V @ 0-2.5, 5, 8, or 15A
PAD 110-XXL	0-110V @ 0-1.5, 3, 5, 10, 20 30, or 60A
PAD 160-XL	0-160 @ 0-1, 2, 3.5, or 7A
PAD 250-XXL	0-250V @ 0-2.5, 4.5, 8,or 15 amps
PAD 500-2L	0-500V @ 0-2A
PAD 600-1.5L	0-600V @ 0-1.5A

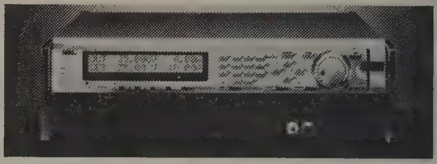


BURN - IN DC SWITCHERS

Light weight, high efficiency PAK-A Series DC CV/CC switching supplies have digital meters and are analog or resistive programmable.

- ☐ Constant voltage and constant current
- ☐ Compact package size
- ☐ IEEE-488, analog or resistive programmable

MODEL	DESCRIPTION
PAK 6-XXXA	0-6V @ 0-60, 120, or 160A
PAK 10-XXXA	0-10V @ 0-35, 70, or 100A
PAK 20-XXA	0-20V @ 0-18, 36, or 50A
PAK 20-XXA	0-35V @ 0-10, 20, or 30A
PAK 60-XXA	0-60V @ 0-6, 12, or 18A



PROGRAMMABLE DC POWER SUPPLIES

PAX Series programmable DC CV/CC power supplies feature fast rise times, low noise, and tight regulation.

- ☐ Fast response time — <50 µsec
- ☐ Program complex waveforms using the sequence mode
- ☐ Low Noise — <3mV P-P
- ☐ Optional plug-in GPIB or RS-232C interface cards for full control, plus read back of measured output readings

MODEL	DESCRIPTION
PAX 16-XX	0-16V @ 0-20, 40, or 60A
PAX 35-XX	0-35V @ 0-10, 20, or 30A

BIPOLAR POWER SUPPLIES

PBX Series programmable four quadrant power supplies can sequence multiple commands to output complex waveforms and can be used as programmable amplifiers.

- ☐ True four quadrant power supply
- ☐ Fast rise and fall times — <50µsec
- ☐ Low noise — <10mV P-P
- ☐ Optional plug-in GPIB or RS-232C interface cards for full control, plus read back of measured output readings

MODEL	DESCRIPTION
PBX 20-XX	0-±20V @ 0-±5, 10, or 20A
PBX 40-XX	0-±40V @ 0-±2.5, 5, or 10A

BENCH AND DUAL-TRACKING DC POWER SUPPLIES

PAB Series bench supplies are compact, economical units with excellent resolution, dual controls, and an output on/off switch.

With analog meters . . .

MODEL	DESCRIPTION
PAB 8-5	0-8V @ 0-5A
PAB 18-X.X	0-18V @ 0-1, 1.8, 3, or 5.5A
PAB 32-X.X	0-32V @ 0-0.5, 1.2, 2, or 3A
PAB 70-1	0-70V @ 0-1A
PAB 160-0.4	0-260V @ 0-0.4A
PAB 350-0.2	0-350V @ 0-0.2A

With digital meters . . .

MODEL	DESCRIPTION
PAB 18-X.XA	0-18V @ 0-1, or 1.8A
PAB 32-XA	0-32V @ 0-1.2, or 2A
PAB 70-1A	0-70V @ 0-1A
PAB 110-0.6A	0-260V @ 0-0.6A
PAB 250-0.25A	0-250V @ 0-0.25A
PAB 350-0.1A	0-350V @ 0-0.1A

PAB DU/TR Series provides independent ± output or dual tracking.

- ☐ Dual and triple output versions
- ☐ Linear output
- ☐ High reliability

MODEL	DESCRIPTION
PAB 18-2.5DU	Dual output; 0-±18V @ 0-+2.5A
PAB 32-1.5DU	Dual output; 0-±32V @ 0-+1.5A
PAB 25-1TR	Triple output; 0-±25V @ 0-+1A; 0-6VB, 0-5A

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KIKUSUI

KIKUSUI INTERNATIONAL CORP.

AC POWER SUPPLIES & DC ELECTRONIC LOADS FOR LAB SYSTEMS & BENCH USE.

ELECTRONIC AC POWER SOURCES

PCR-L Series single-phase or 3 phase sources deliver both AC and DC output with DC offset and FFT data output. All functions can be programmed and measured via the remote controller and optional GPIB or RS-232C interfaces.

- ☐ AC, DC, or AC/DC output capability
- ☐ Dual-range output voltage — 1-150VAC (0-212VDC) and 0-300VAC (0-424VDC)
- ☐ FFT data output
- ☐ Sequence mode generates complex waveforms
- ☐ Simulates brown outs, surges and spikes
- ☐ Peak current is four times RMS
- ☐ Programmable output impedance

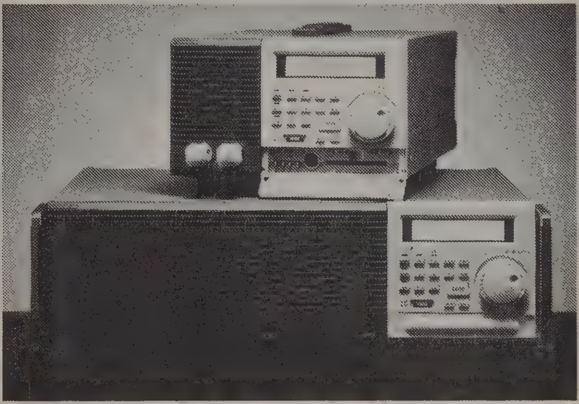
MODEL	DESCRIPTION
PCR 500L	0-150/0-300VAC; 500VA 0-212/0-424VDC; 250W
PCR 1000L	0-150/0-300VAC; 1000VA 0-212/0-424VDC; 500W
PCR 2000L	0-150/0-300VAC; 2000VA 0-212/0-424VDC; 1000W
PCR 4000L	0-150/0-300VAC; 4000VA 0-212/0-424VDC; 2000W
PCR 6000L	0-150/0-300VAC; 6000VA 0-212/0-424VDC; 3000W

PROGRAMMABLE LINEAR AC POWER SOURCES

PCR Series electronic sources accurately simulate power interruptions, power outages, voltage spikes, brownouts and surges.

- ☐ Linear, fully isolated output
- ☐ Single- or 3-phase operation
- ☐ Frequency from 5Hz to 500Hz
- ☐ Choice of control options and plug-in talk/listen GPIB interface card

MODEL	DESCRIPTION
PCR 500	0-140/0-280VAC; 500VA
PCR 1000	0-140/0-280VAC; 1000VA
PCR 2000	0-140/0-280VAC; 200VA
PCR 4000	0-140/0-280VAC; 400VA



HIGH PERFORMANCE SYSTEM OR BENCH ELECTRONIC DC LOADS

PLZ-3W Series is the closest thing yet to a real-world load. These high-speed electronic loads provide a wide operating voltage range (0.3-120VDC) and slew rates up to 4 A/µsec.

- ☐ Four operating modes — constant current, resistance, voltage and power
- ☐ Sequence mode acts as a 10-bit arbitrary waveform generator
- ☐ All functions can be programmed and measured values read back from the front panel or optional plug-in GPIB or RS-232C interfaces

MODEL	DESCRIPTION
PLZ 153W	1.5-120v, 0-30A, 150W
PLZ 303W	1.5-120v, 0-60A, 300W
PLZ 603W	1.5-120v, 0-120A, 600W
PLZ 1003W	1.5-120v, 0-200A, 1000W

Economical bench-top PLZ Series DC electronic loads for power' supply, battery and capacitor discharge testing.

- ☐ Digital meters
- ☐ Remote analog or resistive programmable
- ☐ Choices include the only full power to 0V load on the market (PLZ 152WA)

MODEL	DESCRIPTION
PLZ 72W	4-110V, 0-12A, 70W
PLZ 152W	4-110V, 0-30A, 150W
PLZ 152WA	0-110V, 0-30A, 150-W

Low-cost PLZ-WU Series burn-in or system DC electronic loads are remote analog or resistive programmable. (No meters.)

- ☐ Ideal for burn-in applications

MODEL	DESCRIPTION
PLZ 50WU	2-60V, 0-10A, 50W
PLZ 150WU	2-60V, 0-10A, 150W
PLZ 300WU	2-60V, 0-10A, 300W

For manufacturer's sales offices, see yellow pages. Also see our ads under Oscilloscopes and Hi-Pot Testers. GP-IB

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200 TO 1500 W

WORLD'S MOST FLEXIBLE MODULAR POWER SUPPLIES

Series 4/Omega

FEATURES

- Up to 4 Watts / in³
- Up to 10 Outputs
- Isolated & Floating Outputs
- EMI Filter Meets VDE/FCC, Class B
- Meets UL, CSA, BS, IEC & EN Specs
- Wide Range User-Adjustable Outputs
- No Pre-Loading
- Low Leakage Current
- Field-Selectable 115/230VAC

AVAILABLE OPTIONS

- Power Factor Correction Per IEC555-2
- 48VDC Input
- Input Power Fail Signal
- Global & Individual Inhibits
- Auto Current Sharing on All Outputs
- Output Good Signals
- 300VDC Back-up Input
- Side Mount I/O Connections
- In-Line I/O Connections

How to Configure Your Own Series 4/Omega Power Supply

If you cannot find a standard Series 4 Omega that fills your requirements, Configure one yourself. Here's how to do it:

Step 1) List your Voltage & Current requirements (as all the outputs are floating, polarity can be ignored).

For Example:

	Volts	Amps	Watts
Output#1	5V	25A	125
Output#2	5V	10A	50
Output#3	12V	2A	24
Output#4	12V	4A	48
Output#5	28V	5A	140
		Total Power	387W

Step 2) Combine the individual output powers to determine the total output power and select the converter to suit your requirements.

Converters

200W	
400W	X
600W (PFC)	
1500W (PFC), 1000W Main	

(In above example a 400 watt converter is required).

Step 3) Refer to the table below and select the modules required.

Module	Volts	Amps	Type	Slots
A	2-6V	60A	Std	2
B	2-6V	25A	Std	1
C	5-15V	12A	Std	1
D	12-28V	7A	Std	1
E	5-15V(×2)	6A max*	Dual	1
F	5-15V	24A	Std	2
G	12-28V	15A	Std	2
H	12-28V(×2)	3.5A max*	Dual	1
J	25-60V	10A	Std	2
L	4.5-5.5V	100A	Std	2⑥

*Total Current

Step 4) Select case style from catalog drawings:

Side Mounted Terminals	No suffix	
In-Line Terminals	"U" suffix	×

Step 5) Put Modules in descending current rating (with voltage setpoint preceding module code letter)

Example: 400U 5B 5C 28D 12/12E

Step 6) Contact the Factory for Catalog number allocation, options, or assistance.

STANDARD MODELS (Partial Listing)

200-1500 Watt, User-Configurable, Single/Multiple Output
Series 4/Omega, Wide Adjustment Range, Switchmode Supplies

Catalog No.	Max. Power Watts	Full Output Ratings @ 50°C Ambient				Case Size H×W×L (Inches)
		Nominal Volts/Amps (Adjustment Range)				
		Output #1	Output #2	Output #3	Output #4	
Single Output		**Adjust**				
4A 1F A2 A	200W	24V/7A (12-28V)				2.5×5.0×5.6
4B 1C A1 A	360W	5V/60A (2-6V)				2.5×5.0×11
4B 1C A2 A						2.5×5.0×8.4
4B 1C B1 A	400W	5V/74A (2-6V)				2.5×5.0×11
4B 1C B2 A						2.5×5.0×9.3
4B 1F A1 A	400W	24V/15A (12-28V)				2.5×5.0×11
4B 1F A2 A						2.5×5.0×8.4
4C 1C A1 E	600W (W/PFC)	5V/120A (2-6V)				2.5×5×12.7
4C 1C A2 E						2.5×5.0×12
4D 1C A3 E	600W (W/PFC)*	5V/120A (2-6V)				5×5×9.5
4E 1C A1 E	1000W (W/PFC)*	5V/200A (4.5-6V)				3.15×8×11
4E 1D A1 E	1000W (W/PFC)*	12V/83A (11.5-16V)				3.15×8×11
4E 1F A1 E	1000W (W/PFC)*	24V/41A (23-30V)				3.15×8×11
4E 1H A1 E	1000W (W/PFC)*	48V/21A (45-60V)				3.15×8×11
Dual Output		**Adjust**	**Adjust**			
4A 2F A2 A	200W	24V/7A (12-28V)	24V/7A (12-28V)			2.5×5.0×6.5
4B 2F A1 A	400W	24V/15A (12-28V)	24V/15A (12-28V)			2.5×5.0×11
4B 2F A2 A						2.5×5.0×10.2
4C 2F A1 E	600W (W/PFC)	24V/15A (12-28V)	24V/15A (12-28V)			2.5×5.0×12.7
4C 2F A2 E						2.5×5.0×12
4D 2F A3 E	600W (W/PFC)*	24V/15A (12-28V)	24V/15A (12-28V)			5×5×9.5
Triple Output		**Adjust**	**Adjust**	**Adjust**		
4A 3A A2 A	200W	5V/25A (2-6V)	12V/3A (5-15V)	12V/3A (5-15V)		2.5×5.0×6.5
4B 3A A1 A	400W	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)		2.5×5.0×11
4B 3A A2 A						2.5×5.0×10.2
4C 3A A1 E	600W (W/PFC)	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)		2.5×5.0×12.7
4C 3A A2 E						2.5×5.0×12
4D 3A A3 E	750W (W/PFC)*	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)		5×5×9.5
4F 3A A1 E	1500W (W/PFC)*	5V/200A (4.5-6V)	12V/24A (5-15V)	12V/24A (5-15V)		5×8×11
Quad Output		**Adjust**	**Adjust**	**Adjust**	**Adjust**	
4B 4B A1 A	400W	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)	24V/7A (12-28V)	2.5×5.0×11
4B 4B A2 A						2.5×5.0×11.1
4B 4A A1 A	400W	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)	5V/12A (2-6V)	2.5×5.0×11
4B 4A A2 A						2.5×5.0×11.1
4B 4E A1 A	400W	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)	12V/12A (5-15V)	2.5×5.0×11
4B 4E A2 A						2.5×5.0×11.1
4B 4A B1 A	400W	12V/24A (5-15V)	12V/12A (5-15V)	5V/12A (2-6V)	5V/12A (2-6V)	2.5×5.0×11
4B 4A B2 A						2.5×5.0×11.1
4B 4B B1 A	400W	24V/15A (12-28V)	12V/12A (5-15V)	12V/12A (5-15V)	5V/12A (2-6V)	2.5×5.0×11
4B 4B B2 A						2.5×5.0×11.1
4C 4B A2 E	600W (W/PFC)	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)	24V/15A (12-28V)	2.5×5.0×13.8
4F 4A A1 E	1500W (W/PFC)*	5V/200A (4.5-6V)	5V/60A (2-6V)	12V/12A (5-15V)	12V/12A (5-15V)	5×8×11
4F 4B A1 E	1500W (W/PFC)*	5V/200A (4.5-6V)	12V/24A (5-15V)	24V/15A (12-28V)	12V/12A (5-15V)	5×8×11

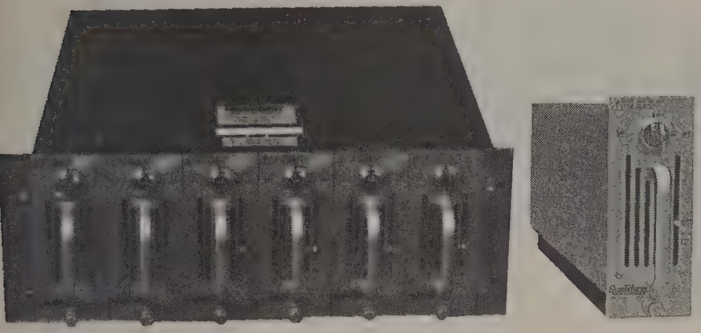
*Preliminary Specifications.

LAMBDA Qualidyne Inc.

3055 Del Sol Blvd. San Diego, CA 92154
(619) 575-1100 • FAX: (619) 575-7185

200 TO 3600 W HOT PLUG-IN POWER SUPPLIES AND POWER SYSTEMS

SERIES 4/OMEGA, PLUG-IN SUPPLIES/SYSTEMS



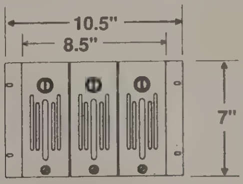
FEATURES

- Hot Plug-In/Replacement Supplies
- AC, PFC Inputs
- Zero System Down Time
- Fault Tolerant N+1 Power
- Independent DC Fan-Cooled Supplies
- Rack Mountable Enclosures
- 1 to 6 Supplies per Enclosure
- 400 to 3600 Watts per System
- 200 to 600 Watts per System
- User-Configurable System
- Meets UL, CSA, EN, BABT: BS6301 (Some Models)
- Out-Of-Tolerance Indicators and Status Signals
- Meets VDE & UL EMI, Class A
- User-Configurable Backplane with Mating Connectors
- 1 to 10 DC Outputs per Supply
- 2V to 56VDC Outputs

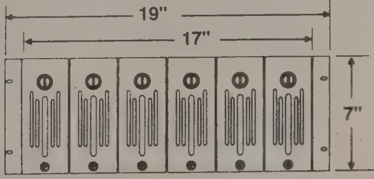
OPTIONS

- Customized Configurations
- Automatic Current Sharing with Power Supply Fail Signal
- Internal Isolation Diodes
- Custom Cabling

Up to 1800 Watts, MPS-4 (1/2 Rack)
1 to 3, Series 4 Plug-In Supplies Per System



Up to 3600 Watts, MPS-4 (Full Rack)
1 to 6, Series 4 Plug-In Supplies Per System



NOTE: Contact factory for specifications & availability.

SERIES 4/OMEGA POWER SUPPLIES

INPUT SPECIFICATIONS

AC Input Voltage Ranges	90-132/180-264VAC, externally selectable. (85-264VAC with PFC)
Input Frequency (AC Units)	47-63 Hz
In-Rush Current	13A
Hold-Up Time	20 msec, min.

OUTPUT SPECIFICATIONS

Output Polarity	All units are floating
Line Regulation	0.1% max.
Load Regulation	0.1% for 0 to 100% load change with remote sense
Transient Response	10% max. for 50% load change; recovery to <1% in 300 μsec
Minimum Load	No minimum load required
PARD, All Channels	1% measured over 50 MHz bandwidth
Temperature Coefficient	0.02%/°C max.
Current Limit	120% of rated current
Overvoltage Protection	125% of nominal output voltage; latching, individual adjustments
Reverse Voltage Protection	To 100% rated current, when fan is operating
Remote Sense	Remote sense will compensate for up to 0.5V of total load cable drop

GENERAL SPECIFICATIONS

Efficiency, Typical	75%
Turn-On Delay (Soft Start)	1 sec after input voltage applied
Dielectric Withstand	2200VDC, input-to-output
Leakage Current, Line-to-Chassis	0.56mA max. @ 264VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range	0-70°C
Derating, 50-70°C	Linearly to 50% at 70°C
Storage Temperature Range	−40 to +85°C
Cooling	Internal fan
Humidity	5-95% non-condensing
EMI/RFI, Conducted	VDE 0871 Level B, FCC 20780, Part 15-J Level B
Vibration & Shock, Operating	5-500 Hz; 0.03" to 0.25G, 5G half sine 15 msec, bottom
Vibration & Shock, Non-Operating	5-500 Hz; 0.15" to 1.0G, 10G half sine 15 msec, 3-axes

PHYSICAL SPECIFICATIONS

AC Input Connections	Terminal strip with (7 ea.) 6-32 screw terminals
DC Output Connections	M6 screw terminals on main channel; M4 screw terminals for auxiliary outputs; M3 screw terminals for sense connections

SAFETY

Safety Specifications	When correctly installed in a system the Series 4 will meet the requirements of UL 1950, CSA22.2 No. 220 or No. 950, BS7002, BS6301, IEC950, EN60950

IMPORTANT NOTES

Please consult factory if requirements are not met by models listed here. Specifications are subject to change without notice.

Approvals may be pending on some models; check with factory for status.

LAMBDA Qualidyne Inc. λ

ISO 9001
REGISTERED

3055 Del Sol Blvd. San Diego, CA 92154
(619) 575-1100 • FAX: (619) 575-7185

250 TO 650 W

SINGLE & MULTI-OUTPUT, LOW PROFILE, LOW COST SWITCHMODE POWER SUPPLIES

SERIES 2
2A: 250 WATTS, 2″×4.5″×9″
2B: 400 WATTS, 2.5″×5″×10″
2C: 500 WATTS, 2.5″×5″×11.5″
2D: 650 WATTS, 2.5″×5″×14″

FEATURES

- 1 to 4 Outputs
- Isolated & Floating Outputs
- EMI Filter (FCC/VDE)
- DC Ball-Bearing Fan Cooled
- OVP on All Outputs
- Approved to UL, CSA, VDE, EN Specs
- Input Power Fail Signal—Std
- Field-Selectable 115/230VAC—2B
- Three-Year Warranty

FEATURES

- Auto AC Line Select—Std on 2A, 2C, 2D
- Inhibit, Logic Low—Std on 2C/2D
- Margining Main-Std on 2C/2D
- Wide Range Adjustable Outputs (or factory set)

250 TO 650 STANDARD MODELS (Partial Listing)

Series/Watts	Output #1 (Main)*	Output #2	Output #3	Output #4**
2A/250W	5V/30A	12-15V/10A	12-15V/3A	5V/3A
	5V/30A	12-15V/10A	12-15V/3A	12-24V/2A
2B/400W	5V/50A	12-15V/15A	12-24V/3.5A	2-6V/6A
	5V/50A	12V/15A	12V/6A	5V/6A
2C/500W	5V/70A	12-15V/15A	12-24V/3.5A	12-15V/6A
	5V/70A	12V/15A	12V/6A	5V/6A
	5V/70A	12-15V/15A	12-24V/3.5A	2-6V/6A
2D/650W	5V/100A	12-15V/20A†	12-24V/5A	2-6V/10A
	5V/100A	12-15V/20A†	12-24V/5A	12-15V/10A
	5V/100A	12V/20A†	12V/10A	5V/10A

*Available as Single Output Supply
**5th Output available on 2D (5V/0.75A)
†30A peak
Note: Outputs are adjustable within indicated ranges or ± 10% if no range is shown.

INPUT SPECIFICATIONS

AC Input Voltage Ranges	90-132/180-264VAC, strappable 2B automatic line select (2A, 2C, 2D)
Input Frequency (AC Units)	47-63 Hz
In-Rush Current	30A
Hold-Up Time	20 msec, typical

OUTPUT SPECIFICATIONS

Output Polarity	All units are floating
Line Regulation	0.2% max.
Load Regulation	0.8% for 0 to 100% load change with remote sense
Transient Response	3% max. for 25% load change; recovery to <1% in 300 µsec
Overshoot, Turn-On	1% max.
PARD, All Channels	1% measured over 30 MHz bandwidth
Temperature Coefficient	0.02%/°C max.
Overload Protection	All outputs protected
Overvoltage Protection	125% of nominal output voltage; latching
Reverse Voltage Protection	To 100% rated current, main; 50% rated current, auxiliaries
Remote Sense	Remote sense will compensat for up to 0.5V of total load cable drop

GENERAL SPECIFICATIONS

Efficiency, Typical	75%
Turn-On Delay (Soft Start)	1 sec after input voltage applied
Dielectric Withstand	2200VDC, input-to-output
Leakage Current, Line-to-Chassis	3.5mA max. @ 264VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range	0-70°C
Derating, 50-70°C	Linearly to 50% at 70°C
Storage Temperature Range	−40 to +85°C
Cooling	Internal fan
Humidity	5-95% non-condensing
EMI/RFI, Conducted	VDE 0871 Level A, FCC 20780 Part 15-J Level A
Vibration & Shock, Operating	5-500 Hz; 0.03″ to 0.25G, 5G half sine 15 msec, bottom
Vibration & Shock, Non-Operating	5-500 Hz; 0.15″ to 1.0G, 10G half sine 15 msec, 3-axes

PHYSICAL SPECIFICATIONS

AC Input Connections	Terminal strip with 6-32 screw terminals
DC Output Connections	¼×20 studs on main channe barrier strip with 6-32 screw terminals for auxiliary outputs 2D/2E have 10-32 studs on CH2 output

SAFETY

Safety Specifications	UL478 or 1950, CSA22.2 No. 232, No. 220, No. 950, EN60950

IMPORTANT NOTES

Please consult factory if requirements are not met by models listed here. Specifications are subject to change without notice.

Approvals may be pending on some models; check with factory for status.

BABT

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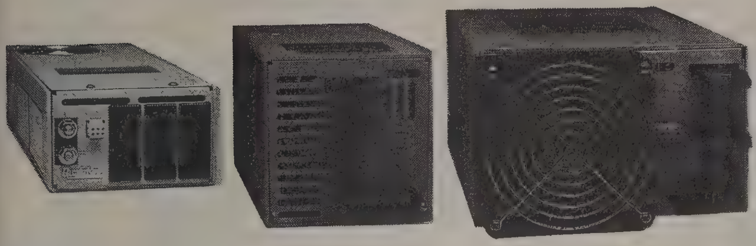
300 TO 3000W

SINGLE OUTPUT SWITCHMODE POWER SUPPLIES & DC-DC CONVERTERS



SERIES 21, 23, 28, 31 & 36
(SEE FRONT PAGES OF THIS VOLUME FOR PRODUCT LINE PHOTOS)

FEATURES

- 2V to 56VDC Outputs
- International Safety Specs
- Wide Adjustment Ranges
- Inhibit
- Input Power Fail Signal
- Three-Year Warranty
- AC (1φ or 3φ) & DC Inputs
- EMI Filter (FCC/VDE)
- DC Ball-Bearing Fan Cooled
- Margining
- Compact Cases

AVAILABLE OPTIONS

- Power Factor Correction Per IEC555-2, <5% Total Harmonic Distortion
- Auto Current Sharing w/Supply Fail Signal (Ideal for N+1 Redundancy)
- Output Power Good Signal
- Output Current Monitor
- Universal Input: 90-264VAC
- Plug-In Configurations
- Rack Mounted/Redundant Power Systems

300-3000W SINGLE OUTPUT MODELS (Partial Listing)

Series 23 3×5×14.25″ **600W** (max.)	Series 21 6.5×5×10″ **750W*** (max.)	Series 28 5×5×11/11.5″ **1000W** (max.)	Series 31 5×8×11/11.5″ **1KW-2KW** (max.)	Series 36 5×8×15.5″ **3000W** (max.)
2V/150A	2V/200A	2V/250A	2-4V/375A	2V/700A
5V/100A	5V/100A	5V/200A	4-6V/300A	5V/600A
12V/50A	12V/50A	12V/84A	7-12V/125A	12V/250A
24V/25A	24V/25A	24V/36A	12-28V/54A	15V/200A
48V/13A	48V/13A	48V/21A	28-56V/17A	24V/125A
2-4V/150A	2-4V/187A	2-4V/250A	2-4V/400A	28V/110A
4-6V/120A	4-6V/150A	4-6V/200A	2-6V/400A	48V/63A
7-12V/50A	7-12V/63A	7-12V/84A	7-12V/167A	—
12-28V/22A	12-28V/27A	12-28V/36A	12-28V/72A	—
28-56V/11A	28-56V/14A	28-56V/18A	28-56V/36A	—

*Derate 21 series to 600W with DC input.

INPUT SPECIFICATIONS

AC Input Voltage Ranges	90-132/180-264VAC, externally selectable; 180-264VAC 1φ or 3φ; universal input 90-264VAC (option)
Input Frequency (AC Units)	47-63 Hz
DC Input Voltage Range	42-56VDC
In-Rush Current, Peak	80A (max).—AC Units
Hold-Up Time	20 msec, typical

OUTPUT SPECIFICATIONS

Output Polarity	Floating
Line Regulation	0.2% max.
Load Regulation	0.8% for 0 to 100% load change with remote sense
Transient Response	3% for 25% load change; recovery to <1% in 300 µsec
Overshoot, Turn-On	1% max.
PARD, All Channels	1% measured over 50 MHz bandwidth
Temperature Coefficient	0.02%/°C max.
Current Limit	120% of rated current
Overvoltage Protection	125% of nominal output voltage; latching
Reverse Voltage Protection	To 100% rated current
Remote Sense	Remote sense will compensate for up to 0.5V of total load cable drop

GENERAL SPECIFICATIONS

Efficiency, Typical	75%
Turn-On Delay (Soft Start)	1 sec after input voltage applied
Dielectric Withstand	2200VDC, input-to-output
Leakage Current, Line-to-Chassis	3.5mA max. @ 264VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range	0-70°C
Derating, 50-70°C	Linearly to 50% at 70°C
Storage Temperature Range	−40 to +85°C
Cooling	Internal fan
Humidity	5-95% non-condensing
EMI/RFI, Conducted	VDE 0871 Level A, FCC 20780, Part 15-J Level A
Vibration & Shock, Operating	5-500 Hz; 0.03″ to 0.25G, 5G half sine 15 msec, bottom
Vibration & Shock, Non-Operating	5-500 Hz; 0.15″ to 1.0G, 10G half sine 15 msec, 3-axes

PHYSICAL SPECIFICATIONS

AC Input Connections	Terminal strip with 6-32 screw terminals
DC Output Connections	¼×20 studs; 5/16×18 studs, or bus bars

SAFETY

Safety Specifications	UL478 or 1950, CSA22.2 No. 234, No. 220, No. 950, EN60950

IMPORTANT NOTES

Please consult factory if requirements are not met by models listed here. Specifications are subject to change without notice.

Approvals may be pending on some models; check with factory for status.

BABT

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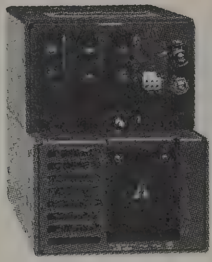
600 TO 2000W

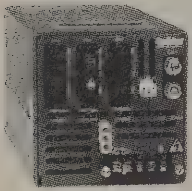
MULTIPLE OUTPUT, MODULAR SWITCHMODE POWER SUPPLIES & DC-DC CONVERTERS

SERIES 21 THRU 36 POWER SUPPLIES

SERIES 23/33
600 WATTS
3″×5″×14.25″
750 WATTS
4″×5″×14.25″

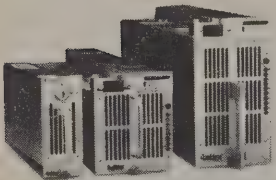


SERIES 21
TO 750 WATTS
6.5″×5″×10″

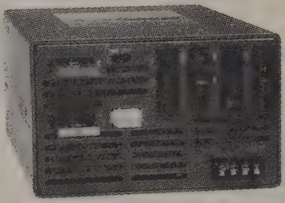


SERIES 28
TO 1000 WATTS
5″×5″×11″/11.5″

SERIES 31
1000/1500 WATTS
5″×8″×11″/11.5″
5″×8″×12.5″ w/PFG

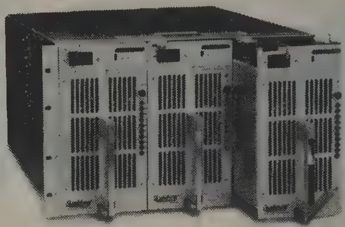


SERIES 4, 28, 31
Plug-In Version*

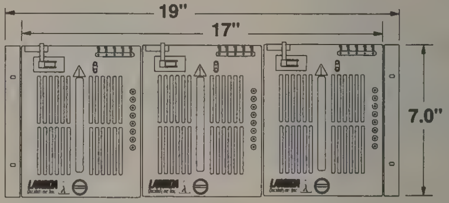


SERIES 36
2000 WATTS
5″×8″×13.75″/15.5″

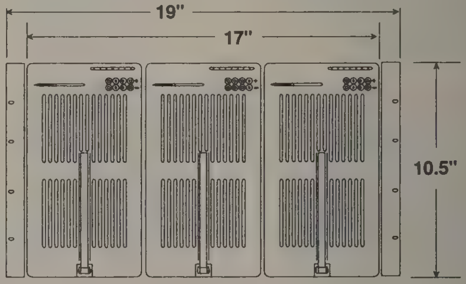
Series 28/31/36 Modular Power Systems Up to 9000Watts



Up to 3000 Watts, MPS-28*
1 to 3, Series 28 Plug-In Supplies Per System



Up to 9000 Watts, MPS-31/36*
1 to 3, Series 31 or 36 Plug-In Supplies Per System



Depth: 20″ max.

*Note: Contact Factory for Specifications & Availability

FEATURES

- 2V to 56VDC Outputs
- Up to 9 Outputs
- International Safety Specs
- Wide Adjustment Ranges
- Inhibit
- Input Power Fail Signal
- Three-Year Warranty
- AC (1φ or 3φ) & DC Inputs
- EMI Filter (FCC/VDE)
- DC Ball-Bearing Fan Cooled
- Margining (Main)
- Compact Cases

AVAILABLE OPTIONS

- Power Factor Correction Per IEC555-2. <5% Total Harmonic Distortion
- Auto Current Sharing w/Supply Fail Signal (Ideal for N+1 Redundancy)
- Output Power Good Signal
- Output Current Monitor (Main)
- Universal Input: 90-264VAC
- Plug-In Configurations
- Rack Mounted/Redundant Power Systems

LAMBDA
Qualidyne Inc. λ

ISO 9001
REGISTERED

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3055 Del Sol Blvd. San Diego, CA 92154
(619) 575-1100 • FAX: (619) 575-7185

600 TO 2000W MULTIPLE OUTPUT, MODULAR SWITCHMODE POWER SUPPLIES & DC-DC CONVERTERS

STANDARD MODELS
(Select Any 3, 4, or 5 Outputs)

Total Power (max.) (Series)	Output #1 (Main)	Output #2	Output #3	Output #4	Output #5
600W (23)	5V/80A	12-15V/10A	12-15V/5A	5V/5A	24V/5A
	5V/80A	12-15V/10A	12-15V/10A	5V/5A	24V/5A
	5V/80A	12-15V/15A	12-15V/10A	5V/5A	24V/5A
750W* (21,33)	5V/100A	12-15V/10A	12-15V/10A	5V/5A	24V/5A
1000W (28)	5V/120A	12-15V/20A	12-15V/10A	5V/5A	24V/5A
1000W (31)	5V/150A	12-15V/20A	12-15V/10A	5V/10A	24V/5A
	5V/150A	12-15V/20A	12-15V/20A	5V/10A	24V/10A
	5V/150A	12-15V/20A	12-15V/10A	5V/20A	24V/10A
1500W (31)	5V/200A	12-15V/20A	12-15V/10A	5V/10A	24V/5A
	5V/200A	12-15V/20A	12-15V/20A	5V/10A	24V/10A
	5V/200A	12-15V/30A	12-15V/10A	5V/20A	—
2000W (36)	5V/300A	12-15V/20A	12-15V/10A	5V/10A	24V/5A
	5V/300A	12-15V/20A	12-15V/20A	5V/10A	24V/10A
	5V/300A	12-15V/40A	12-15V/10A	5V/10A	—

Partial Listing, Consult Factory for Other Volt/Amp Combinations

WIDE ADJUSTMENT RANGE MODELS
(Select Any 3, 4, or 5 Outputs)

Total Power (max.) (Series)	Output #1 (Main)	Output #2	Output #3	Output #4	Output #5
600W (23)	5V/80A	5-15V/15A	5-25V/10A	5-24V/10A	—
	5V/80A	5-24V/10A	5-24/10A	5-24V/10A	—
	5V/100A	5-24V/10A	5-24V/5A	5-24V/5A	—
750W* (21,33)	5V/100A	5-15V/20A	5-15V/20A	5-24V/10A	—
1000W (28)	5V/120A	5-15V/20A	5-15V/20A	5-24V/10A	—
	5V/120A	5-15V/20A	5-24V/5A	5-24V/5A	—
1000W (31)	5V/150A	5-15V/20A	5-15V/20A	5-24V/10A	5-24V/10A
1500W (31)	5V/200A	5-15V/20A	5-15V/20A	5-24V/10A	5-24V/10A
2000W (36)	5V/300A	5-15V/20A	5-15V/20A	5-24V/10A	5-24V/10A
	5V/300A	5-15V/20A	5-24V/10A	5-24V/10A	5-24V/10A

Partial Listing, Contact Factory for Other Volt/Amp Combinations

*Derate 21 series to 600W with DC input.

BABT

SERIES 21 THRU 36 POWER SUPPLIES

INPUT SPECIFICATIONS

AC Input Voltage Ranges	90-132/180-264VAC, externally selectable; 180-264VAC 1φ or 3φ; universal input 90-264VAC (option)
Input Frequency (AC Units)	47-63 Hz
DC Input Voltage Range	42-56VDC
In-Rush Current, Peak	80A (max.)
Hold-Up Time	20 msec, typical

OUTPUT SPECIFICATIONS

Output Polarity	All outputs are floating
Line Regulation	0.2% max.
Load Regulation	0.8% for 0 to 100% load change with remote sense
Transient Response	3% for 25% load change; recovery to <1% in 300 µsec
Overshoot, Turn-On	1% max.
PARD, All Channels	1% measured over 50 MHz bandwidth
Temperature Coefficient	0.02%/°C max.
Current Limit	120% of rated current
Overvoltage Protection	125% of nominal output voltage; latching
Reverse Voltage Protection	To 100% rated current
Remote Sense	Remote sense will compensate for up to 0.5V of total load cable drop

GENERAL SPECIFICATIONS

Efficiency, Typical	75%
Turn-On Delay (Soft Start)	1 sec after input voltage applied
Dielectric Withstand	2200VDC, input-to-output
Leakage Current, Line-to-Chassis	3.5mA max. @ 264VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range	0-70°C
Derating, 50-70°C	Linearly to 50% at 70°C
Storage Temperature Range	−40 to +85°C
Cooling	Internal fan
Humidity	5-95% non-condensing
EMI/RFI, Conducted	VDE 0871 Level A, FCC 20780, Part 15-J Level A
Vibration & Shock, Operating	5-500 Hz; 0.03″ to 0.25G, 5G half sine 15 msec, bottom
Vibration & Shock, Non-Operating	5-500 Hz; 0.15″ to 1.0G, 10G half sine 15 msec, 3-axes

PHYSICAL SPECIFICATIONS

AC Input Connections	Terminal strip with 6-32 screw terminals
DC Output Connections	¼×20 studs; 5/16×18 studs, or bus bars on main outputs; terminal strip with 6-32 screw terminals on each auxiliary module

SAFETY

Safety Specifications	UL478 or 1950, CSA22.2 No. 234, No. 220, No. 950, EN60950

IMPORTANT NOTES

Please consult factory if requirements are not met by models listed here. Specifications are subject to change without notice.

Approvals may be pending on some models; check with factory for status.

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SWITCH MODE POWER SUPPLIES

Ω mega Plus

AC/DC Power Supplies
DC/DC Converters

General

The Omega Plus Series is a family of high density, compact, MIL-Spec switch mode power supplies. These advanced design power supplies accept a wide range of inputs, and are available in multiple output configurations. The Omega Plus Series is ideally suitable for airborne, shipboard, ground mobile, and C^3 applications. The Omega Plus Series of power supplies have been designed and qualified to the most stringent performance and environmental requirements.

Features

Ω MIL-SPEC/ INDUSTRIAL VERSIONS
Ω UNIVERSAL AC/DC INPUT
Ω SINGLE AND MULTIPLE OUTPUTS
Ω HIGH DENSITY - LOW PROFILE
Ω 100 HOUR BURN IN
Ω 3 YEAR WARRANTY
Ω ALTERNATE TEMPERATURE RANGE AVAILABLE

AC/DC Inputs

100 - 126 Vac, 47Hz - 460Hz 1 phase
200 - 252 Vac, 47Hz - 460Hz 1 phase
100 - 126 Vac, 47Hz - 460Hz 3 phase Delta
200 - 252 Vac, 47Hz - 460Hz 3 phase Delta
100 - 126 Vac, 47Hz - 460Hz 3 phase 4 wire Wye
100 - 126 Vac, 47Hz - 460Hz 3 phase 3 wire Wye
120 - 320 Vdc

MODEL	SIZE	VOLUME (CU./IN.)	WATTS (CU./IN.)
25S	2.50 x 3.00 x .80	6.0	3.4
50S	3.00 x 3.50 x .80	8.4	6.0
75S	3.25 x 4.25 x .80	11.0	6.8
75T	3.50 x 4.50 x .80	12.6	6.0
150S	4.50 x 5.75 x .80	20.7	7.3
150T	4.75 x 6.00 x .80	22.8	6.6
300S	6.00 x 6.50 x .80	31.2	10.0
300T	6.00 x 6.50 x .80	31.2	10.0

DC Inputs

14 - 36 Vdc

MODEL	SIZE	VOLUME (CU./IN.)	WATTS (CU./IN.)
25W	2.20 x 2.80 x .80	4.9	5.0
50W	2.50 x 3.50 x .80	7.0	7.2
75W	3.00 x 3.85 x .80	9.2	8.1
150W	3.50 x 4.50 x .80	12.6	12.0
300W	4.25 x 5.50 x .80	18.7	16.0

Typical Configuration Specifications

EFFICIENCY: 75% minimum (single and dual output models) and 70% minimum (multiple output models), measured at nominal input line and full load.

LINE REGULATION: Within 0.1% for input change from low line to high line, at constant load. For single, dual and main outputs 100 mV maximum for auxiliary outputs.

LOAD REGULATION: 0.1% for 0-100% of rated load at nominal input line for single, dual and main outputs. 150 mV for auxiliary outputs with 20% minimum main load.

AUXILIARY OUTPUT CROSS REGULATION: 1.0% maximum deviation when main output load changes from half load to full load.

LOGITEK INC. ™

101 CHRISTOPHER STREET, RONKONKOMA, NY 11779 (516) 467-4200 Fax: 516-467-4090

LOGITEK
RONKONKOMA, N.Y.
CAGE CODE 15420
OMEGA PLUS

PARD (Noise and Ripple): 100 mV P-P at 20 MHz bandwidth for 5V and 12V single, dual and main outputs. 200 mV for all outputs 15V or greater.

ISOLATION VOLTAGE: 1000 Vdc input to output, input to case. 200 Vdc output to case.

INSULATION RESISTANCE: 50 Megohm at 50 Vdc.

TEMPERATURE RANGE: Operating: -55°C to +100°C at 100% load. Temperature measured at base plate, conduction cooled via base plate only. Storage: -55°C to +125°C.

SHORT CIRCUIT PROTECTION: Under any short circuit condition, output voltage drops to less than one volt, with automatic recovery.

INRUSH CURRENT: Limited to 500% of nominal input current.

REMOTE ERROR SENSING: Sensing pins compensates for up to 0.5 volt drop on output leads.

OUTPUT TRACKING: Within 2%.

CURRENT LIMITING: Constant current, limited to 130% of rated output.

OVERVOLTAGE PROTECTION (Single Output): Automatic electronic shut down if voltage exceeds 30% of the nominal output.

INTERFACE: Hook-up via a D-subminiature connector.

QUALITY: We use only MIL qualified components, an inspection system which strictly adheres to MIL-I-45208, and a quality control system which has been surveyed and approved in accordance with MIL-Q-9858A. Also, Logitek's facility is now qualified to MIL-STD-2000.

EMI/RFI CHARACTERISTICS: Tested to MIL-STD-461C using test methods of MIL-STD-462.

ENVIRONMENTAL SPECIFICATIONS: Are to MIL-STD-810C for Shock; Acceleration; Humidity; Altitude; Salt Fog; Sand, Dust and Fungus.

HAMMER SHOCK: Per MIL-STD-901C.

CUSTOM & SPECIAL APPLICATIONS: Logitek's Engineering Department is available to discuss your applications of our power supplies or to custom design to meet your system's requirements.

LOGITEK 101 CHRISTOPHER STREET, RONKONKOMA, NY 11779 (516) 467-4200 Fax: 516-467-4090

UNIVERSAL INPUT SWITCHING POWER SUPPLIES

General Specifications:(1)

- **AC Input:** 90-260 VAC / 47-63 Hz
- **DC Outputs:** Output 1 adjustable 5%
  Output 2 tracks Output 1
- **Temperature Coefficient:** 0.02% / °C, all outputs
- **Humidity:** 0-90%
- **Operating Temprature:** 0° to 50° C
- **Storage Temperature:** –40°C to 80°C
- **Switching Frequency:** 30-40 KHz
- **Dielectric Strength:** 3750 VAC for 1 min.
- **Efficiency:** 70% minimum
- **Input Filter:** Pi or Capacitor Network
- **Isolation:** 500 VDC
- **Isolation Resistance:** 10 Ohms
- **MTBF:** 50,000 Hours
- **Hold-up Time:** 15-20 mSec
- **Safety: UL:** 1012, 478, 1950
  CSA: 22.2, No. 220
  TUV: IEC 950, EN60950
- **EMI:** Meets FCC Class 'B' and VDE 0871 Class B rules using static load.

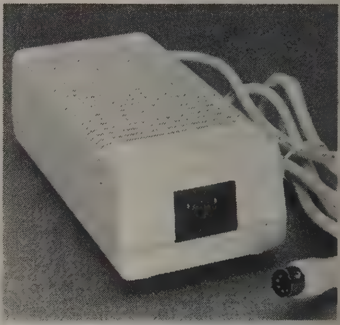
IEC950 FCC

I. DESK TYPE MODELS WITH IEC INPUT CONNECTOR, 15-54 WATTS

ALL MODELS ARE UL/CSA/TUV APPROVED

	MODEL NO.	POWER WATTS	OUTPUT VOLTAGE VDC	LOAD-AMP			RIPPLE mV	REGULATION %		PKG SIZE
				MIN.	RATED	MAX.		LINE	LOAD	
15W	LZUS1501	15	5	0.2	3.0	5.0	50	1	5	S1
	LZUS1504	15	12	0.1	1.2	2.5	100	1	5	
	LZUS1505	15	15	0.1	1.0	1.5	150	1	5	
	LZUS1506	15	18	0.1	0.8	1.5	180	1	5	
	LZUS1507	15	24	0.1	0.62	1.0	240	1	5	
	LZUS1502	15	5	0.2	2.0	3.0	50	1	5	
			12	0.0	0.5	1.0	100	1	5	
	LZUS1503	15	5	0.2	1.8	3.0	50	1	5	
			12	0.0	0.4	1.0	100	1	5	
			–12	0.0	0.1	0.3	150	1	10	
25W	LZUS2501	25	5	0.76	3.8	4.56	50	1	5	S2
	LZUS2502	25	9	0.52	2.6	3.12	90	1	5	
	LZUS2503	25	12	0.4	2.0	2.4	120	1	5	
	LZUS2504	25	13.5	0.36	1.8	2.16	135	1	5	
	LZUS2505	25	15	0.32	1.6	1.92	150	1	5	
	LZUS2506	25	16.7	0.3	1.5	1.8	165	1	5	
	LZUS2507	25	18	0.26	1.3	1.56	180	1	5	
	LZUS2508	25	24	0.2	1.0	1.2	240	1	5	
	LZUS2509	25	5	0.5	2.5	3.0	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
	LZUS2510	25	5	0.5	2.5	3.0	50	1	5	
			–12	0.2	1.0	1.2	120	1	7	
	LZUS2511	25	5	0.4	2.0	2.4	50	1	5	
			24	0.12	0.6	0.72	240	1	7	
	LZUS2512	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
	LZUS2513	25	12	0.2	1.0	1.2	120	1	5	
			24	0.1	0.5	0.6	240	1	7	
	LZUS2514	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
			–12	0.04	0.2	0.24	120	1	10	
	LZUS2515	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
			–5	0.04	0.2	0.24	50	1	10	
	LZUS2516	25	5	0.4	2.0	2.4	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
			–12	0.04	0.2	0.24	120	1	10	
	LZUS2517	25	5	0.4	2.0	2.4	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
			–5	0.04	0.2	0.24	50	1	10	
	LZUS2518	25	5	0.4	2.0	2.4	50	1	5	
			24	0.1	0.5	0.6	240	1	7	
			–12	0.04	0.2	0.24	120	1	10	

MODEL: LZUS2501, 5VDC @ 3.8A, Size S2



MODEL: LZUS5403, 12-18VDC , Size S7

MODEL: LZUS4306, 12VDC @ 3.6A, Size S6

NOTES: (1) Specifications may vary slightly for different models.

LZRelectronics,inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436

UNIVERSAL INPUT SWITCHING POWER SUPPLIES

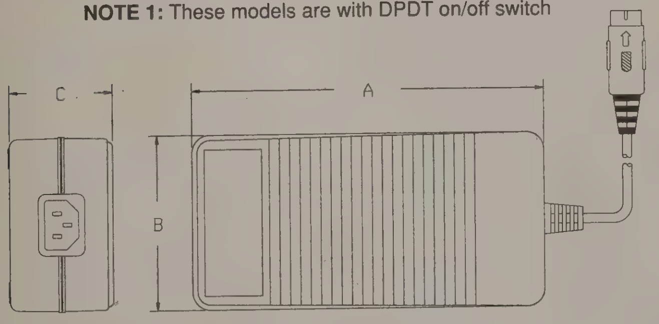
IEC950 FCC

I. DESK TYPE MODELS WITH IEC INPUT CONNECTOR, 15-54 WATTS (cont.)

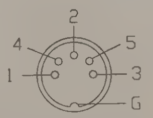
ALL MODELS ARE UL/CSA/TUV APPROVED

	MODEL NO.	POWER WATTS	OUTPUT VOLTAGE VDC	LOAD-AMP			RIPPLE mV	REGULATION %		PKG SIZE
				MIN.	RATED	MAX.		LINE	LOAD	
30W	LZUS05	30	5	0.6	6.0	8.0	100	1	3	S3
	LZUS09	30	9	0.2	3.3	4.0	100	1	3	S3
	LZUS12	30	12	0.3	2.5	3.5	120	1	3	S3
	LZUS3001	30	12	0.3	2.5	2.8	120	1	3	S4
	LZUS15	30	15	0.3	2.0	2.7	150	1	3	S3
	LZUS3002	30	15	0.3	2.0	2.3	150	1	3	S4
	LZUS24	30	24	0.2	1.3	1.7	200	1	3	S3
	LZUS02[1]	30	5	0.5	2.0	—	100	1	3	S3
			12	—	1.5	3.0	120	1	5	
	LZUS3003	30	5	0.6	3.0	3.2	50	1	3	S4
			12	0.3	1.2	1.4	120	1	5	
	LZUS03[1]	30	5	0.5	1.5	—	100	1	3	S3
			12	—	1.5	3.0	120	1	5	
			–12	—	0.3	—	120	1	5	
40W	LZUS4000	40	12	0.3	3.4	3.8	120	1	3	S5
	LZUS4001	40	16.5	0.3	2.3	2.8	150	1	3	
	LZUS4002	40	5	0.6	0.3	3.2	50	1	3	
			12	0.3	1.8	2.0	120	1	5	
			–12	—	0.3	0.5	120	1	5	
43W	LZUS4304	43	5	0.6	6.0	8.0	50	1	3	S6
	LZUS4306	43	12	0.3	3.6	4.5	120	1	3	
	LZUS4305	43	5	0.6	5.0	7.0	50	1	3	
			24	0.2	0.5	1.0	240	1	3	
	LZUS4301	43	5	0.6	3.0	5.0	50	1	3	
			12	0.2	2.0	3.0	120	1	5	
			–12	—	0.3	0.3	120	1	1	
	LZUS4302	43	5	0.6	3.0	5.0	50	1	3	
			12	0.2	2.0	3.0	120	1	5	
			–5	—	0.3	0.3	50	1	1	
	LZUS4303	43	5	0.6	3.0	5.0	50	1	3	
			15	0.2	1.6	2.0	150	1	5	
			–15	—	0.3	0.3	150	1	1	
54W	LZU5403	54	12-18	0.1	Adj.	—	150	1	5	S7
	LZU242	54	24	0.1	2.2	—	200	1	5	S8

NOTE 1: These models are with DPDT on/off switch



SIZE	DIMENSIONS (mm)		
	A	B	C
S1	137	84	64
S2	110	69	37
S3	180	89	61
S4	156	87	48
S5	174	86	51
S6	152	84	53
S7	203	89	58
S8	165	81	56



FRONT VIEW

UNIVERSAL INPUT SWITCHING POWER SUPPLIES

IEC950 FCC

II. OPEN FRAME PC BOARD TYPE, 25-65 WATTS

ALL MODELS ARE UL/CSA/TUV APPROVED

	MODEL NO.	POWER WATTS	OUTPUT VOLTAGE VDC	LOAD-AMP			RIPPLE mV	REGULATION %		PKG SIZE
				MIN.	RATED	MAX.		LINE	LOAD	
25W	LZUPC2501	25	5	0.76	4.0	4.56	50	1	5	PC1
	LZUPC2502	25	9	0.52	2.7	3.12	90	1	5	
	LZUPC2503	25	12	0.4	2.0	2.4	120	1	5	
	LZUPC2504	25	13.5	0.36	2.0	2.16	135	1	5	
	LZUPC2505	25	15	0.32	1.8	1.92	150	1	5	
	LZUPC2506	25	16.7	0.3	1.6	1.8	165	1	5	
	LZUPC2507	25	18	0.26	1.5	1.56	180	1	5	
	LZUPC2508	25	24	0.2	1.1	1.2	240	1	5	
	LZUPC2509	25	5	0.5	2.5	3.0	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
	LZUPC2510	25	5	0.5	2.5	3.0	50	1	5	
			–12	0.2	1.0	1.2	120	1	7	
	LZUPC2511	25	5	0.4	2.0	2.4	50	1	5	
			24	0.12	0.6	0.72	240	1	7	
	LZUPC2512	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
	LZUPC2513	25	12	0.2	1.0	1.2	120	1	5	
			24	0.1	0.5	0.6	240	1	7	
	LZUPC2514	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
			–12	0.04	0.2	0.24	120	1	10	
	LZUPC2515	25	5	0.6	3.0	3.6	50	1	5	
			12	0.1	0.5	0.6	120	1	7	
			–5	0.04	0.2	0.24	50	1	10	
	LZUPC2516	25	5	0.4	2.0	2.4	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
			–12	0.04	0.2	0.24	120	1	10	
	LZUPC2517	25	5	0.4	2.0	2.4	50	1	5	
			12	0.2	1.0	1.2	120	1	7	
			–5	0.04	0.2	0.24	50	1	10	
	LZUPC2518	25	5	0.4	2.0	2.4	50	1	5	
			24	0.1	0.5	0.6	240	1	7	
			–12	0.04	0.2	0.24	120	1	10	
30W	LZUPC3005	30	5	0.2	6.0	8.0	50	1	1	PC2
	LZUPC3006	30	12	0.1	2.5	3.5	100	1	1	
	LZUPC3007	30	15	0.1	2.0	2.5	150	1	1	
	LZUPC3008	30	24	0.1	1.3	2.0	200	1	1	
	LZUPC3001	30	5	0.2	2.5	2.5	50	1	5	
			12	0.0	1.5	3.0	100	1	5	
			–12	0.0	0.3	0.3	150	1	10	
	LZUPC3002	30	5	0.2	2.5	2.5	50	1	5	
			12	0.0	1.5	3.0	100	1	5	
			–5	0.0	0.3	0.3	150	1	10	
	LZUPC3003	30	5	0.2	2.5	2.5	50	1	5	
			15	0.1	1.0	2.0	100	1	5	
			–15	0.1	0.3	0.3	150	1	10	
	LZUPC3004	30	5	0.2	2.0	2.0	50	1	5	
			24	0.1	0.8	1.5	200	1	5	
			–12	0.0	0.3	0.3	100	1	10	

LZRelectronics,inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

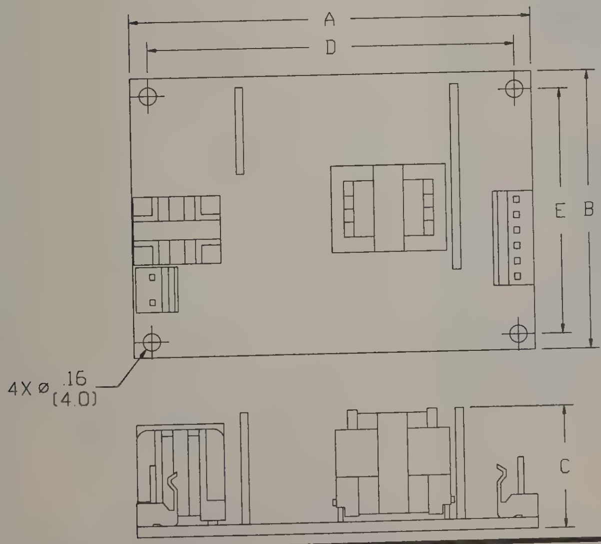
UNIVERSAL INPUT SWITCHING POWER SUPPLIES

IEC950 FCC

II. OPEN FRAME PC BOARD TYPE, 25-65 WATTS (cont.)

ALL MODELS ARE UL/CSA/TUV APPROVED

	MODEL NO.	POWER WATTS	OUTPUT VOLTAGE VDC	LOAD-AMP			RIPPLE mV	REGULATION %		PKG SIZE
				MIN.	RATED	MAX.		LINE	LOAD	
43W	LZUPC4301	43	5	0.6	8.0	8.0	50	1	3	PC3
	LZUPC4302	43	9	0.3	4.7	6.0	100	1	3	
	LZUPC4303	43	12	0.3	3.6	4.5	120	1	3	
	LZUPC4304	43	13.5	0.3	3.2	4.2	150	1	3	
	LZUPC4305	43	15	0.3	2.7	3.5	150	1	3	
	LZUPC4306	43	16.7	0.2	2.6	3.4	160	1	3	
	LZUPC4307	43	18	0.2	2.4	3.0	180	1	3	
	LZUPC4308	43	24	0.2	1.8	2.3	240	1	3	
	LZUPC4309	43	5 12		5.0 1.0		50 120	1 1	3 3	
	LZUPC4310	43	5 24	0.6 0.2	6.0 0.5	8.0 1.0	50 240	1 1	3 3	
	LZUPC4311	43	5 12 –12	0.6 0.2 0.0	3.0 2.0 0.3	5.0 3.0 0.3	50 120 120	1 1 1	3 5 1	
	LZUPC4312	43	5 12 –5	0.6 0.2 0.0	3.0 2.0 0.3	5.0 3.0 0.3	50 120 50	1 1 1	3 5 1	
	LZUPC4313	43	5 15 –15	0.6 0.2 0.0	3.0 1.6 0.3	5.0 2.0 0.3	50 150 150	1 1 1	3 5 1	
50W	LZUPC5001	50	5 12	0.6 —	3.0 3.0	5.0 5.5	50 100	.5 1	1 3	PC4
	LZUPC5002	50	5 12	0.6 —	3.0 3.0	5.0 5.5	50 100	.5 1	1 3	PC5
65W	LZUPC6505	65	5	0.2	13.0	—	50	.5	1	PC6
	LZUPC6512	65	12	0.2	5.5	—	100	.5	1	
	LZUPC6515	65	15	0.2	4.5	—	100	.5	1	
	LZUPC6524	65	24	0.2	2.75	—	100	.5	1	
	LZUPC6501	65	5 12 –12	0.2 — —	6.0 3.0 0.5	— 6.0 —	50 100 100	.5 1 1	1 5 3	
	LZUPC6502	65	5 12 –12 –5	0.2 — — —	5.5 2.5 0.5 0.5	10.0 6.0 1.0 1.0	50 100 100 50	.5 1 1 1	1 5 3 3	



SIZE	DIMENSIONS (mm)				
	A	B	C	D	E
PC1	92	63	25	84	55
PC2	130	70	32	120	60
PC3	127	76	25	116	65
PC4	178	51	48	168	41
PC5	127	76	48	116	65
PC6	152	89	46	122	80

Note: Component layout varies for the different package sizes

LZR *electronics, inc.* 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

AC ADAPTORS FOR NORTH AMERICA AND JAPAN

DC Output, Wall Plug-in and Desk-Top

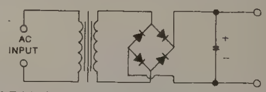
General Specifications

Input Voltage: 120VAC/60 Hz for North American models.
Input Voltage: 100VAC/50 - 60 Hz for Japan models.
Output Tolerance: ±5% at full load.
Operating Temperature: 0° - 40°C.
Storage Temperature: -20°C - 70°C.
Dielectric Strength: 1500VAC for 1 min.
Enclosure: Black Noryl, UL94V-0.
Output Cord: 6 ft, 20 - 24AWG, Black.
Safety: UL Listed per 1310 std. for wall mount units.
UL Listed per 1012 std. for desk top units.
CSA Certified to CSA std. 22.2 #107 or #223.

Options

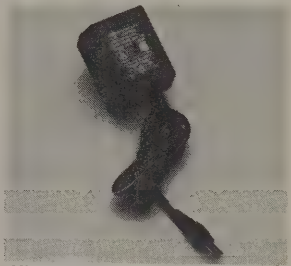
1. Other outputs or custom design per customer specifications are available.
2. UL/CSA approvals for custom designed units.
3. Earth ground PIN on primary and/or secondary. For selected models.

SCHEMATIC DIAGRAM

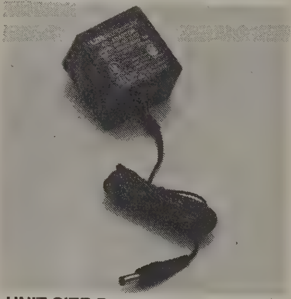


REMARK: STANDARD CAPACITOR = 1000 MFD
HIGHER RATINGS ARE AVAILABLE ON SPECIAL ORDER.

MODEL NO.	OUTPUT (VDC)	CURRENT (MA)	UNIT SIZE	APPROVAL CODE
AD-0310	3.0	100	A	UCJ
AD-0350	3.0	500	A	UCJ
AD-0410	4.5	100	A	UCJ
AD-0450	4.5	500	B	UCJ
AD-041A	4.5	1000	E	UL
AD-0560	5.0	600	E	UC
AD-052A	5.0	2000	K	UL
AD-0610	6.0	100	A	UCJ
AD-0620	6.0	200	A	UCJ
AD-0630M	6.0	300	A	UCJ
AD-0630	6.0	300	B	UCJ
AD-0640	6.0	400	B	UCJ
AD-0650	6.0	500	B	UCJ
AD-0660	6.0	600	B	UCJ
AD-0670	6.0	700	B	UCJ
AD-0680	6.0	800	B	UCJ
AD-0690	6.0	900	C	UCJ
AD-061A	6.0	1000	C	UCJ
AD-0615	6.0	1500	K	UL
AD-062A	6.0	2000	K	UL
AD-0710	7.5	100	A	UCJ
AD-0720	7.5	200	A	UCJ
AD-0730	7.5	300	B	UCJ
AD-0740	7.5	400	B	UCJ
AD-0780	7.5	800	C	UCJ
AD-0790	7.5	900	C	UCJ
AD-071A(1)	7.5	1000	C	UCJ
AD-0715	7.5	1500	K	UL
AD-0830	8.0	300	E	UL
AD-0880	8.0	800	D	UC
AD-0811A	8.0	1100	D	UL
AD-0910(1)	9.0	100	A	UCJ
AD-0920M	9.0	200	A	UCJ
AD-0930(1)	9.0	300	B	UCJ
AD-0940	9.0	400	B	UCJ
AD-0950(1)	9.0	500	B	UCJ
AD-0960	9.0	600	B	UCJ
AD-0970	9.0	700	C	UCJ
AD-0980	9.0	800	C	UCJ
AD-0990	9.0	900	C	UCJ
AD-091A(1)	9.0	1000	C	UCJ
AD-0911	9.0	1100	D	UL
AD-0915	9.0	1500	K	UL
AD-092A	9.0	2A	K	UL
AD-1045	10.5	450	E	UL
AD-1060	10.0	600	D	UC
AD-1095	10.5	950	Desk Top	UC
AD-1015	10.5	1500	K	UL
AD-1210(1)	12.0	100	A	UCJ



UNIT SIZE A



UNIT SIZE B

UNIT SIZE C

UNIT SIZE D

MODEL NO.	OUTPUT (VDC)	CURRENT (MA)	UNIT SIZE	APPROVAL CODE
AD-1220M	12.0	200	B	UCJ
AD-1230(1)	12.0	300	B	UCJ
AD-1240	12.0	400	B	UCJ
AD-1250(1)	12.0	500	B	UCJ
AD-1260	12.0	600	C	UCJ
AD-1270	12.0	700	C	UCJ
AD-1280(1)	12.0	800	C	UCJ
AD-121A(1)	12.0	1000	D	UC
AD-1211	12.0	1100	D	UL
AD-1212	12.0	1200	K	UL
AD-1215A	12.0	1500	K	UC
AD-122A	12.0	2000	Desk	UL
AD-1515	15.0	150	B	UCJ
AD-1520	15.0	200	B	UCJ
AD-1530	15.0	300	B	UCJ
AD-1540(1)	15.0	400	B	UCJ
AD-1550	15.0	500	C	UCJ
AD-1560(1)	15.0	600	C	UCJ
AD-1580	15.0	800	D	UL
AD-1590(1)	15.0	900	D	UC
AD-151A	15.0	1000	K	UC
AD-1610	16.0	100	A	UCJ
AD-1620	16.0	200	B	UCJ
AD-1630	16.0	300	B	UCJ
AD-1645	16.0	450	C	UCJ
AD-1650	16.0	500	C	UCJ
AD-1670	16.0	700	D	UL
AD-1690	16.0	900	D	UL
AD-161A	16.0	1000	K	UL
AD-171A	17.0	1000	K	UL
AD-1815	18.0	150	B	UCJ
AD-1820(1)	18.0	200	B	UCJ
AD-1830	18.0	300	B	UCJ
AD-1840	18.0	400	C	UCJ
AD-1850(1)	18.0	500	C	UCJ
AD-1860	18.0	600	D	UL
AD-1880(1)	18.0	800	D	UC
AD-2010	20.0	100	B	UCJ
AD-2020	20.0	200	B	UCJ
AD-2030	20.0	300	B	UCJ
AD-2040	20.0	400	C	UCJ
AD-2060	20.0	600	D	UL
AD-2070	20.0	700	D	UL
AD-2230	22.0	300	C	UCJ
AD-2240	22.0	400	C	UCJ
AD-2410	24.0	100	B	UCJ
AD-2420	24.0	200	B	UC
AD-2430	24.0	300	C	UCJ
AD-2435(1)	24.0	350	C	UCJ
AD-2450(1)	24.0	500	D	UL
AD-2460	24.0	600	D	UL

NOTES:
(1) Models with suffix (1) are readily available from LZR or distributor stock
(2) For Japanese models add "J" after the Model No.
(3) For unit size and output plug options please refer to page no. D•1827

APPROVAL CODES:
UL LISTED = UL
UL/CSA APPROVAL = UC
UL/CSA/JIS APPROVED = UCJ

LZRelectronics,inc.
8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436
LZR

AC ADAPTERS

AC output, U.S. version, wall plug-in type

INPUT: 120 VAC, 50/60 Hz. ALL MODELS ARE UL LISTED

EI 35 SERIES, SIZE E

MODEL NO.	OUTPUT
A0410	4V AC 100 mA
A0420	4V AC 200 mA
A0430	4V AC 300 mA
A0440	4V AC 400 mA
A0450	4V AC 500 mA
A0460	4V AC 600 mA
A0470	4V AC 700 mA
A0480	4V AC 800 mA
A0490	4V AC 900 mA
A0510	5V AC 100 mA*
A0520	5V AC 200 mA
A0530	5V AC 300 mA
A0540	5V AC 400 mA
A0550	5V AC 500 mA
A0560	5V AC 600 mA
A0570	5V AC 700 mA
A0610	6V AC 100 mA
A0620	6V AC 200 mA
A0630	6V AC 300 mA
A0640	6V AC 400 mA
A0650	6V AC 500 mA
A0660	6V AC 600 mA
A0670	6V AC 700 mA
A0710	7V AC 100 mA
A0720	7V AC 200 mA
A0730	7V AC 300 mA
A0740	7V AC 400 mA
A0750	7V AC 500 mA
A0810	8V AC 100 mA
A0820	8V AC 200 mA
A0830	8V AC 300 mA
A0840	8V AC 400 mA
A0850	8V AC 500 mA
A0910	9V AC 100 mA
A0920	9V AC 200 mA
A0930	9V AC 300 mA
A0940	9V AC 400 mA
A1010	10V AC 100 mA
A1020	10V AC 200 mA
A1030	10V AC 300 mA
A1040	10V AC 400 mA
A1210	12V AC 100 mA*
A1220	12V AC 200 mA
A1230	12V AC 300 mA
A1240	12V AC 400 mA
A1510	15V AC 100 mA
A1520	15V AC 200 mA
A1530	15V AC 300 mA
A1610	16V AC 100 mA
A1620	16V AC 200 mA
A1630	16V AC 300 mA
A1810	18V AC 100 mA
A1820	18V AC 200 mA
A2010	20V AC 100 mA
A2020	20V AC 200 mA
A2210	22V AC 100 mA
A2220	22V AC 200 mA
A2410	24V AC 100 mA
A2420	24V AC 200 mA
A2710	27V AC 100 mA

E1 57 Series, Size K, L

AC output U.S. version wall plug-in or desk top

All models UL listed with optional ground & center-tap.

MODEL NO.	OUTPUT		SIZE
AA0728	7 VAC	2.85 A	K
AA083A	8 VAC	3.0 A	K
AA0874A*	8.7 VAC	4.0 A	L
AA102A*	10 VAC	2.0 A	K
AA122A*	12 VAC	2.0 A	K
AA123A*	12 VAC	3.0 A	K
AA1614*	16.5 VAC	1.45 A	K
AA1816*	18 VAC	1.67 A	K
AA1822	18 VAC	2.2 A	L
AA1984*	19 VAC	0.84 A	K
AA1912*	19 VAC	1.26 A	K
AA2215	22 VAC	1.5 A	L
AA2412*	24 VAC	1.25 A	K
AA2416	24 VAC	1.67 A	L
AA2619	26 VAC	1.9 A	L
AA281A	28 VAC	1.0 A	K

EI 41 SERIES, SIZE F WITH GROUND PIN SIZE G

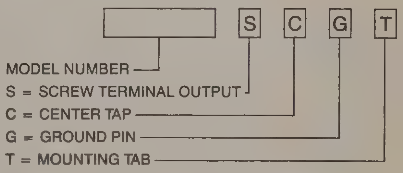
MODEL NO.	OUTPUT
A048041	4V AC 800 mA
A049041	4V AC 900 mA
A041A	4V AC 1 Amp
A056041	5V AC 600 mA
A057041	5V AC 700 mA
A0580	5V AC 800 mA
A0590	5V AC 900 mA
A051A	5V AC 1000 mA
A065041	6V AC 500 mA
A066041	6V AC 600 mA
A067041	6V AC 700 mA
A0680	6V AC 800 mA
A0690	6V AC 900 mA
A061A	6V AC 1000 mA
A0612A	6V AC 1200 mA
A075041	7V AC 500 mA
A0760	7V AC 600 mA
A0770	7V AC 700 mA
A0780	7V AC 800 mA
A0790	7V AC 900 mA
A071A	7V AC 1000 mA
A084041	8V AC 400 mA
A085041	8V AC 500 mA
A0860	8V AC 600 mA
A0870	8V AC 700 mA*
A0880	8V AC 800 mA
A0890	8V AC 900 mA
A081A	8V AC 1000 mA*
A094041	9V AC 400 mA
A0950	9V AC 500 mA
A0960	9V AC 600 mA
A0970	9V AC 700 mA
A0980	9V AC 800 mA
A0990	9V AC 900 mA
A091A	9V AC 1000 mA*
A103041	10V AC 300 mA
A104041	10V AC 400 mA
A1050	10V AC 500 mA*
A1060	10V AC 600 mA
A1070	10V AC 700 mA
A1080	10V AC 800 mA
A1090	10V AC 900 mA
A101A	10V AC 1000 mA
A123041	12V AC 300 mA
A124041	12V AC 400 mA
A1250	12V AC 500 mA*
A1260	12V AC 600 mA
A1270	12V AC 700 mA
A1280	12V AC 800 mA*
A1290	12V AC 900 mA
A121A	12V AC 1000 mA
A152041	15V AC 200 mA
A153041	15V AC 300 mA
A1540	15V AC 400 mA
A1550	15V AC 500 mA
A1560	15V AC 600 mA
A1570	15V AC 700 mA
A1580	15V AC 800 mA
A182041	18V AC 200 mA
A1830	18V AC 300 mA*
A1850	18V AC 500 mA
A1860	18V AC 600 mA
A1880	18V AC 800 mA
A202041	20V AC 200 mA
A2030	20V AC 300 mA
A2040	20V AC 400 mA*
A2050	20V AC 500 mA
A2060	20V AC 600 mA
A222041	22V AC 200 mA
A2230	22V AC 300 mA
A2240	22V AC 400 mA
A2250	22V AC 500 mA
A242041	24V AC 200 mA*
A2430	24V AC 300 mA
A2440	24V AC 400 mA
A2450	24V AC 500 mA
A2720	27V AC 200 mA
A2730	27V AC 300 mA
A2740	27V AC 400 mA

*** CSA Approved**

EI 48 SERIES, SIZE D WITH GROUND PIN, SIZE H

MODEL NO.	OUTPUT
A0614	6V AC 1400 mA
A0615	6V AC 1500 mA
A062A	6V AC 2000 mA
A0625	6V AC 2500 mA
A063A	6V AC 3000 mA
A0712	7V AC 1200 mA
A0714	7V AC 1400 mA
A0715	7V AC 1500 mA*
A072A	7V AC 2000 mA
A0725	7V AC 2500 mA
A0812	8V AC 1200 mA
A0814	8V AC 1400 mA
A0815	8V AC 1500 mA
A0817	8V AC 1700 mA
A082A	8V AC 2000 mA
A0824	8V AC 2400 mA
A0912	9V AC 1200 mA
A0914	9V AC 1400 mA
A0915	9V AC 1500 mA
A0917	9V AC 1700 mA
A092A	9V AC 2000 mA
A1012	10V AC 1200 mA
A1014	10V AC 1400 mA
A1016	10V AC 1600 mA
A1018	10V AC 1800 mA
A1212	12V AC 1200 mA
A1214	12V AC 1400 mA
A1215	12V AC 1500 mA
A1216	12V AC 1600 mA
A1590	15V AC 900 mA
A151A	15V AC 1000 mA
A1512	15V AC 1200 mA
A1650	16V AC 500 mA
A1660	16V AC 600 mA
A1670	16V AC 700 mA
A1680	16V AC 800 mA
A1690	16V AC 900 mA
A161A	16V AC 1000 mA
A1612	16V AC 1200 mA
A1890	18V AC 900 mA
A181A	18V AC 1000 mA
A2070	20V AC 700 mA
A2080	20V AC 800 mA
A2090	20V AC 900 mA
A2260	22V AC 600 mA
A2270	22V AC 700 mA
A2280	22V AC 800 mA
A2290	22V AC 900 mA
A2460	24V AC 600 mA
A2470	24V AC 700 mA
A2480	24V AC 800 mA
A2750	27V AC 500 mA
A2760	27V AC 600 mA
A2770	27V AC 700 mA

OPTION NUMBERING SYSTEM EXCEPT EI-35 SERIES



MODEL NUMBER
S = SCREW TERMINAL OUTPUT
C = CENTER TAP
G = GROUND PIN
T = MOUNTING TAB

Example 1: A101AC: 10VAC at 1A std. enclosure & center tap.

Example 2: A151ASCGT: 15VAC at 1A screw terminal enclosure with center-tap, ground & mounting tab.

NOTES:

1. **See EEM page D•1827 for unit sizes and optional output plugs.**
2. ***CSA Approved with standard enclosure only and no options.**
3. **Most models have a minimum purchase of 500 units. Lead time: 12 wks. A.R.O. non-standard outputs are available upon request.**

LZR *electronics, inc.* 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

DC REGULATED POWER SUPPLIES

General Specifications

Input Voltage: 105V to 129V (117V ± 10%)
Input Frequency: 57 to 63 Hz
Voltage Regulation: over all ±5%
Ripple Voltage: 50mV P-P max. at full load, low line
Dielectric Strength: 1500 Vrms
Overload Protection: Thermal shutdown

Storage Temperature: -20°C to +85°
Operating Temperature: 0°C to +50°C
Humidity: 10% to 90%
Burn-In: 8 hours
Safety: UL 1310, UL 1012, and CSA C22.2 No. 223.
Ground Pin: is optional on most models

DESK TYPE HOUSING: 4.3" x 3.5" x 2.6"

WALL MOUNT HOUSING: 3.3" x 2.2" x 1.9"

Multi-Outputs, U.S. version

Model No.	Outputs		UNIT Size L" x W" x H"	Approval	
	VDC	mA		UL	CSA
AD511222 (1)	+5 +12 -12	1000 200 200	Desk Type 4.7 x 3.5 x 2.6	✓	✓
LZ581211	+5 +12 -12	800 100 100	Wall Mount 3 x 2.5 x 2	✓	✓
LZ581233	+5 +12 -12	850 300 300	Wall Mount 4.2 x 3 x 2.2	✓	
LZ583123	+5 -5 +12	850 300 300	Wall Mount 4.2 x 3 x 2.2	✓	
AD5151222 (1)	+5 +12 -12	1500 200 200	Desk Type 4.7 x 3.5 x 2.6	✓	✓
51152525	+5 +15 -15	1000 250 250	Desk Type 4.7 x 3 x 2.2	✓	✓
AD521222 (1)	+5 +12 -12	2000 200 200	Desk Type 4.7 x 3.5 x 2.6	✓	✓
521255	+5 +12 -12	2000 500 500	Desk Type 7.4 x 4 x 3.5	✓	
55129	+5 +12	500 900	Desk Type 4.7 x 3 x 2.2	✓	
51125	+5 +12	1000 500	Desk Type 4.7 x 3 x 2.2	✓	✓
123030	+12 -12	300 300	Wall Mount 3.3 x 2.2 x 1.9	✓	✓
53122	+5 +12	300 200	Wall Mount 3.5 x 2.7 x 2.2	✓	
AD0820R	+8 -8	200 200	Wall Mount 3.5 x 2.7 x 2.2	✓	

Single Output, U.S. version

Model No.	Output		UNIT Size L" x W" x H"	Approval	
				UL	CSA
AD0520R	5 VDC	0.2A	2.3 X 2 X 1.6 Wall Mount	✓	✓
AD0540R	5 VDC	0.4A	3.0 x 1.9 x 1.8 Wall Mount	✓	✓
AD0560R*	5 VDC	0.6A	3.3 x 2.2 x 1.9 Wall Mount	✓	✓
AD0580R* (1)	5 VDC	0.8A	3.3 x 2.2 x 1.9 Wall Mount	✓	✓
AD051ARD (1)	5 VDC	1.0A	3.8 x 2.6 x 2.0 Desk Type	✓	✓
AD0515RD	5 VDC	1.5A	4.7 x 3 x 2.2 Desk Type	✓	✓
AD052ARD (1)	5 VDC	2.0A	4.7 x 3.5 x 2.6 Desk Type	✓	✓
AD0670R*	6 VDC	0.7A	3.3 x 2.2 x 1.9 Wall Mount	✓	✓
AD0860R*	8 VDC	0.6A	3.3 x 2.2 x 1.9 Wall Mount	✓	✓
AD081AR	8 VDC	1.0A	3.3 x 2.6 x 2.2 Wall Mount	✓	
AD0960R*	9 VDC	0.6A	3.2 x 2.2 x 1.9 Wall Mount	✓	✓
ADO91ARD	9 VDC	1.0A	4.7 x 3.5 x 2.6 Desk Type	✓	✓
AD1250R* (1)	12 VDC	0.5A	3.2 x 2.2 x 1.9 Wall Mount	✓	✓
AD1260RD	12 VDC	0.6A	4.0 x 2.5 x 2 Desk Type	✓	✓
AD1212AR (1)	12 VDC	1.2A	4.7 x 3 x 2.2 Wall Mount	✓	
AD1212ARD* (1)	12 VDC	1.2A	4.7 x 3 x 2.2 Desk Type	✓	✓
AD1540R	15 VDC	0.4A	3.8 x 2.6 x 2.0 Desk Type	✓	✓
AD161AR	16.5 VDC	1.0A	4.7 x 3 x 2.2 Desk Top	✓	✓
AD181AR	18 VDC	1.0A	4.7 x 3 x 2.2 Desk Type	✓	✓
AD2430R*	24 VDC	0.3A	3.3 x 2.2 x 1.9 Wall Mount	✓	✓
AD2450R	24 VDC	0.5A	2.4 x 2.4 x 1.9 Desk Type	✓	✓
AD3210R	32 VDC	0.1A	3.3 x 2.7 x 2.2 Wall Mount	✓	✓
AD4810R	48 VDC	0.1A	4.7 x 3 x 2.2 Desk Mount	✓	✓

* Ground pin optional, add "G" after model No.

NOTES:
(1) Models with suffix (1) are readily available for delivery from LZR or distributor stock.
(2) All models on this page are available with optional output plugs. See page D•1827 for unit sizes and plug types.
(3) Models which are not in stock have a minimum purchase of 500 units. LEAD TIME: 12 wks. A.R.O.
(4) Custom Designs to customer specifications are available upon request.

LZRelectronics,inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

EUROPEAN POWER SUPPLIES

IEC950

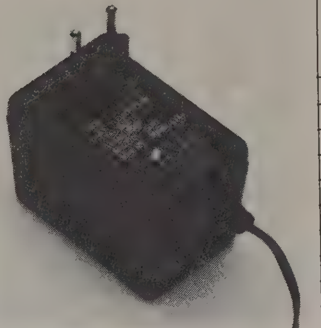
INPUT: 220-230 VAC/50 Hz

ALL MODELS ARE VDE OR TUV APPROVED

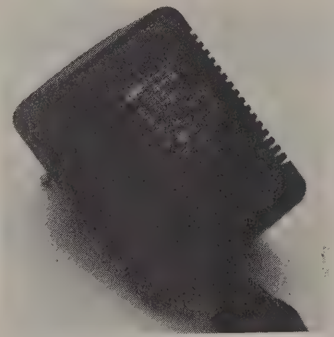
DC OUTPUT

MODEL NO.	OUTPUT VOLTAGE VDC	CURRENT OUTPUT mA	UNIT SIZE
E0330BO	3.0	300	T1
E0360BO	3.0	600	T2
E0410BT	4.5	100	T4
E0430BO	4.5	300	T1
E0460BO	4.5	600	T2
E0610BT	6.0	100	T4
E0630BL	6.0	300	T5
E0650BL	6.0	500	T5
E0660BO	6.0	600	T2
E061ABT	6.0	1000	T6
E0612BO	6.0	1200	T3
E0730BO	7.5	300	T1
E0740BL	7.5	400	T5
E0760BO	7.5	600	T2
E071ABO	7.5	1000	T3
E0910BT	9.0	100	T4
E0930BL	9.0	300	T5
E0950BL(1)	9.0	500	T5
E0960BO	9.0	600	T2
E0980BL	9.0	800	T7
E091ABO(1)	9.0	1000	T3
E091ABL	9.0	1000	T7
AD091ABD7(1)	9.0	1000	DESK
E1220BO	12.0	200	T1
E1230BO	12.0	300	T1
E1230BL	12.0	500	T2
E1250BO(1)	12.0	500	T5
E1250BL	12.0	500	T5
E1280BO(1)	12.0	800	T3
E1280BL	12.0	800	T7
E121ABL	12.0	1A	T8
AD121ABD(1)	12.0	1000	DESK
E131ABDV	13.0	1000	DESK
E1480BT	14.0	800	T6
E1515BO	15.0	150	T1
E1530BL	15.0	300	T5
E1540BO	15.0	400	T2
AD1540BD	15.0	400	DESK
E1560BO(1)	15.0	600	T3
E1560BS	15.0	600	T9
E151ABL	15.0	1A	T8
E1655BT	16.0	550	T6
E1670BT	16.0	700	T6
E1820BO	18.0	200	T1
E1850BO	18.0	500	T3
E1860BT	18.0	600	T6
E1880BDT	18.0	800	DESK
E181ABDT	18.0	1000	DESK
E2010BO	20.0	100	T1
E2030BO	20.0	300	T2
E2240BT	22.0	400	T6
E2410BO	24.0	100	T1
E2425BO	24.0	250	T2
E2440BO	24.0	400	T3

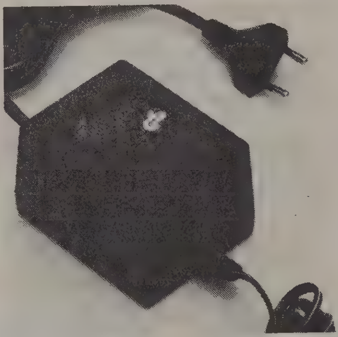
(1) Stock Models



MODEL: E1250BO, 12VDC @ 500mA, Size T2



MODEL: E091ABO, 9VDC @ 1A, Size T3

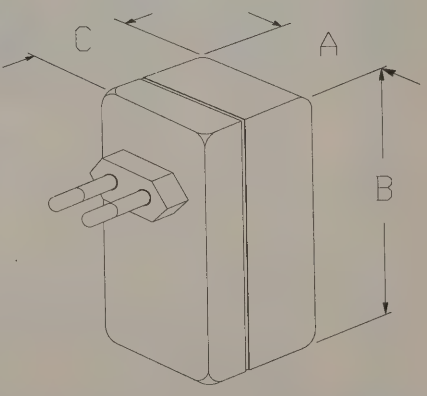


MODEL: E121ABD, 12VDC @ 1A, Size Desk

AC OUTPUT

MODEL NO.	OUTPUT VOLTAGE VDC	CURRENT OUTPUT mA	UNIT SIZE
A0330BO	3.0	300	T1
A0360BO	3.0	600	T2
A0430BO	4.5	300	T1
A0460BO	4.5	600	T2
A0630BO	6.0	300	T1
A0660BO	6.0	600	T2
A0612BO	6.0	1200	T3
A0730BO	7.5	300	T1
A0760BO	7.5	600	T2
A071ABO	7.5	1000	T3
A0930BO	9.0	300	T1
A0950BL	9.0	500	T5
A0960BO	9.0	600	T2
A091ABL	9.0	1000	T7
A093ABDV	9.0	3000	DESK
A094ABT	9.0	4000	DESK
A1230BL	12.0	300	T5
A1250BL	12.0	500	T5
A1280BO	12.0	800	T3
A121ABL	12.0	1000	T7
A1216ABL	12.0	1600	T8
A1530BL	15.0	300	T5
A1540BO	15.0	400	T5
A1560BO	15.0	600	T3
A161ABL	16.0	1000	T8
AA1619AB7	16.0	1.9A	DESK
A1830BO	18.0	300	T1
A1850BO	18.0	500	T3
A1811ABL	18.0	1100	T8
A2030BO	20.0	300	T2
A2040BL	20.0	400	T7
A2425BO	24.0	250	T2
A2440BL	24.0	400	T3
A2460BL	24.0	600	T7
A2412BDV	24.0	1200	DESK

SIZE	DIMENSIONS (mm)		
	A	B	C
T1	50	59.3	41
T2	50	80	54.5
T3	58	90	54.5
T4	43.5	56.5	37
T5	51	60	41.3
T6	55.5	69.5	47.5
T7	56	82	48
T8	65	85	55
T9	58.6	66.5	45.5



LZR *electronics, inc.*

8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436

LZR

EUROPEAN POWER SUPPLIES

Input: 220VAC ±10%, 47-53 Hz
DC Regulated Outputs, 5%

ALL MODELS ARE VDE OR TUV APPROVED

Single Output, Desk Type

MODEL	OUTPUT	SIZE L" x W" x H"
AD051ARBD(1)	5VDC @ 1000 mA	3.4 x 2.7 x 2
AD0515RBD	5VDC @ 1500 mA	3.7 x 3.0 x 2.3
AD1250RBD(1)	12VDC @ 500 mA	3.3 x 2.2 x 2
AD1212RBD(1)	12VDC @ 1200 mA	4.7 x 3 x 2.2

NOTES:
(1) Models with (1) suffix are available from LZR or distributor stock.
(2) Other outputs and custom design power supplies are available upon request.
(3) Other models have a min. purchase of 500 units. Lead time: 12 wks. A.R.O.

Multi-Output, Desk Type

MODEL	OUTPUT	SIZE L" x W" x H"
AD5151222B	5VDC @ 1500 mA 12VDC @ 200 mA -12VDC @ 200 mA	4.7 x 3.5 x 2.6
AD5151222BG(1)	Same as AD5151222B except with ground pin	4.7 x 3.5 x 2.6
AD5251205B	5VDC @ 2500 mA 12VDC @ 50 mA -12VDC @ 50 mA	6.5 x 3.6 x 2.5
AD57125B	5VDC @ 700 mA 12VDC @ 500 mA	4.7 x 3 x 2.4

BRITISH (U.K.) STYLE POWER SUPPLIES

All Models are designed to comply with British Standards BS6301 and BS415

Manufacturing Facility is BABT Approved.

BABT

DC output

U.K. version, wall plug-in
Input: 240VAC/50Hz

MODEL NO.	OUTPUT VDC	OUTPUT mA
AD071AUK	7.5	1000
AD0910UK	9	100
AD0930UK	9	300
AD0950UK	9	500
AD091AUK	9	1000
AD1210UK	12	100
AD1230UK	12	300
AD1250UK	12	500
AD1280UK	12	800
AD121AUK	12	1000
AD1560UK	15	600
AD1820UK	18	200
AD1850UK	18	500
AD1880UK	18	800
AD2435UK	24	350
AD2450UK	24	500

DC regulated OUTPUT 5%

U.K. version.
Input: 240VAC ± 10%/50Hz

MODEL NO.	OUTPUT VDC	OUTPUT mA
AD0550RUK	5	500
AD051ARUK	5	1000
AD0515RUK	5	1500
AD0950RUK	9	500
AD091ARUK	9	1000
AD1250RUK	12	500
AD121ARUK	12	1000
511220UK	+5 +12 −12	1000 200 200

AC output

U.K. version, wall plug-in.
Input: 240VAC/50Hz

MODEL NO.	OUTPUT VAC	OUTPUT mA
AA071AUK	7.5	1000
AA0930UK	9	300
AA0950UK	9	500
AA091AUK	9	1000
AA1230UK	12	300
AA1250UK	12	500
AA121AUK	12	1000
AA1650UK	16	500
AA161AUK	16	1000
AA2475UK	24	750

NOTES:
(1) Other outputs & custom made power supplies are available upon request.
(2) For unit size dimension drawing please contact our sales office.
(3) Most models have a minimum purchase of 500 units. Lead time: 12 wks. A.R.O.

AUSTRALIA STYLE POWER SUPPLIES

All models are designed to comply with SAA standards association of Australia.

DC OUTPUT, Wall plug-in

Input: 240VAC/50Hz

MODEL NO.	OUTPUT VDC	OUTPUT mA	APPROVAL	UNIT SIZE L" × W" × H"
AU0320	3	200	SAA	2.4 × 1.6 × 1.7
AU0450	4.5	500	—	2.3 × 2.0 × 1.6
AU0620	6.0	200	SAA	2.4 × 1.6 × 1.7
AU0630	6.0	300	SAA	2.4 × 1.6 × 1.7
AU0680	6.0	800	SAA	3.15 × 2.2 × 2.2
AU0710	7.5	100	SAA	2.2 × 1.8 × 1.8
AU0750	7.5	500	—	2.3 × 2.0 × 1.6
AU0940	9.0	400	SAA	2.2 × 1.8 × 1.8
AU091A	9.0	1000	—	3.2 × 2.2 × 1.9
AU1020	10.0	200	SAA	2.2 × 1.8 × 1.8
AU1230	12.0	300	SAA	2.2 × 1.8 × 1.8
AU1250	12.0	500	—	2.3 × 2.0 × 1.6
AU1280	12.0	800	—	3.2 × 2.2 × 1.9
AU121A	12.0	1000	—	3.2 × 2.2 × 1.9
AU1440	14.0	400	SAA	3.15 × 2.2 × 2.2
AU1540	15.0	400	—	2.3 × 2.0 × 1.6
AU1560	15.0	600	SAA	3.15 × 2.2 × 2.2
AU1820	18.0	220	SAA	2.2 × 1.8 × 1.8
AU1830	18.0	300	SAA	3.15 × 2.2 × 2.2
AU1850	18.0	500	—	3.2 × 2.2 × 1.9
AU2030	18.0	300	—	2.3 × 2.0 × 1.6
AU2440	24.0	400	—	3.2 × 2.2 × 1.9

AC OUTPUT, Wall plug-in

Input: 240VAC/50Hz

MODEL NO.	OUTPUT VAC	OUTPUT mA	APPROVAL	UNIT SIZE L" × W" × H"
AUA0930	9.0	300	—	2.3 × 2.0 × 1.6
AUA0980	9.0	800	SAA	3.15 × 2.2 × 2.2
AUA091A	9.0	1000	—	3.2 × 2.2 × 1.9
AUA101A	10.0	1000	SAA	3.15 × 2.2 × 2.2
AUA1240	12.0	400	SAA	2.2 × 1.8 × 1.8
AUA121A	12.0	1000	SAA	3.15 × 2.2 × 2.2
AUA1340	13.0	400	SAA	2.2 × 1.8 × 1.8
AUA1380	13.0	800	SAA	3.15 × 2.2 × 2.2
AUA1660	16.5	600	SAA	3.15 × 2.2 × 2.2

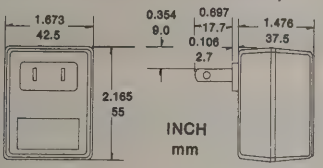
NOTES:
(1) Other outputs & custom made power supplies are available upon request.
(2) For unit size dimension drawing please contact our sales office.
(3) Most models have a minimum purchase of 500 units. Lead time: 12 wks. A.R.O.

LZR*electronics,inc.*
8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436
LZR

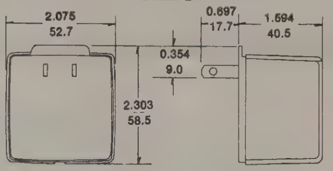
AC ADAPTERS

Enclosure dimensions: unit size inch (mm)

SIZE A


1.673
42.5
0.354
9.0
0.697
17.7
0.106
2.7
1.476
37.5
2.165
55
INCH
mm

SIZE B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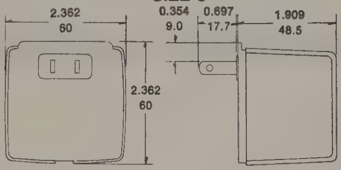
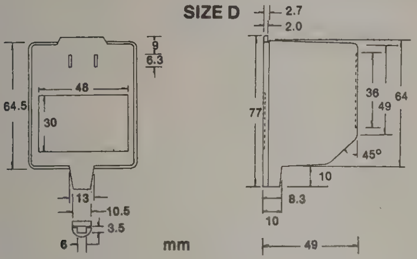
52.7
0.697
17.7
1.594
40.5
0.354
9.0
2.303
58.5

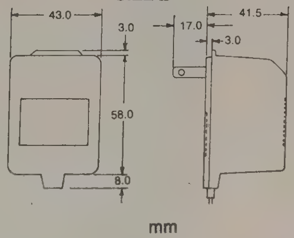
SIZE C


2.362
60
0.354
9.0
0.697
17.7
1.909
48.5
2.362
60

SIZE D


2.7
2.0
9
6.3
48
64.5
30
77
36
49
64
45°
10
8.3
10
13
10.5
3.5
6
49
mm

SIZE E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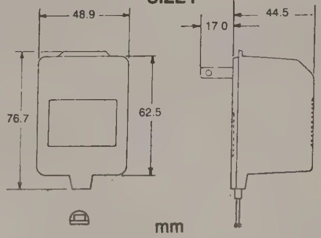
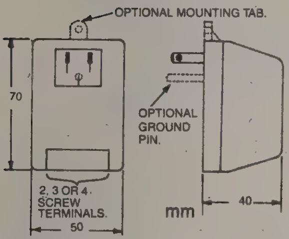
17.0
41.5
3.0
58.0
8.0
mm

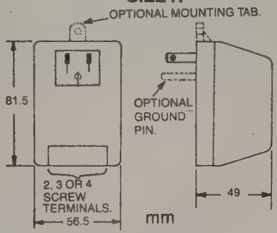
SIZE F


48.9
17 0
44.5
76.7
62.5
mm

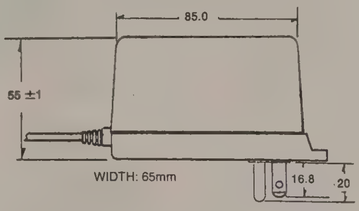
SIZE G


OPTIONAL MOUNTING TAB.
70
OPTIONAL GROUND PIN.
2, 3 OR 4 SCREW TERMINALS.
50
40
mm

SIZE H


OPTIONAL MOUNTING TAB.
81.5
OPTIONAL GROUND PIN.
2, 3 OR 4 SCREW TERMINALS.
56.5
49
mm

SIZE K


85.0
55 ±1
WIDTH: 65mm
16.8
20

SIZE L

WALL MOUNT:

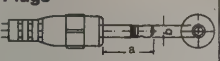
L = 97mm

W = 76mm

H = 62mm

Output plugs

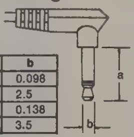
Mini-Plugs



Type	a	b
OP-01	0.453	0.098
	11.5	2.5
OP-02	0.571	0.138
	14.5	3.5

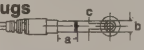
Right Angle Mini-Plugs

MIN: 500 pcs



Type	a	b
OP-03	0.492	0.098
	12.5	2.5
OP-04	0.571	0.138
	14.5	3.5

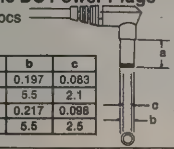
DC Power Plugs



Type	a	b	c
OP-05	0.472	0.197	0.083
	12.0	5.5	2.1
OP-07	0.472	0.217	0.098
	12.0	5.5	2.5

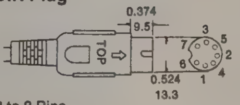
Right Angle DC Power Plugs

MIN: 500 pcs



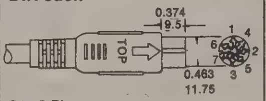
Type	a	b	c
OP-08	0.472	0.197	0.083
	12.0	5.5	2.1
OP-09	0.453	0.217	0.098
	11.5	5.5	2.5

DIN Plug


0.374
9.5
TOP
3
5
7
2
6
4
1
0.524
13.3

3 to 8 Pins
SD30–SD80

DIN Jack


0.374
9.5
TOP
1
4
6
2
7
5
3
0.463
11.75

3 to 8 Pins
SD30J–SD80J

Mating DC power jacks

DJ-001
Panel Mount
Pin Diameter: A = 2.1 mm

DJ-005
PCB Mount
B = 2.5 mm

DJ-009
PCB Mount

3.5ϕ JACKS

SJ-360

SJ-362

SJ-370

FOR DETAILED INFO REFER TO EEM SEC 2100 pages C•1400, C•1401, C•1402, C•1405, C•1406.

3-8 PIN DIN JACKS, PCB MOUNT, SHIELDED/NON-SHIELDED

DJ-014-P5
(5P 180°)

DJ-014-P7
(7P 270°)

DJ-020-3P
(3P 180°)

DJ-022-4P
(4P 210°)

DJ-021-5P
(5P 180°)

DJ-023-6P
(5P 240°)

DJ-024-6P
(6P 240°)

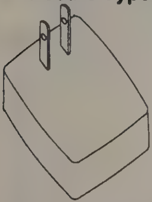
DJ-025-7P
(7P 270°)

DJ-026-8P
(8P 270°)

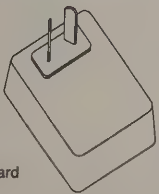
DJ-027-8P
(8P 262°)

For Detailed information on DIN Connectors please refer to EEM Section 2100 Page C•1444

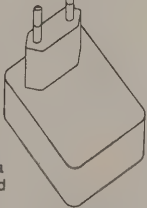
Enclosure Types



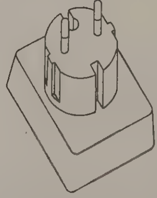
PN-1
U.S.
Standard



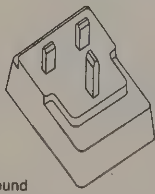
PN-2
Australia
Standard



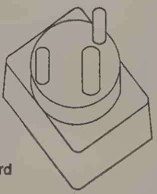
PN-4
VDE
Type



PN-5
VDE
Type
With Ground



PN-6
British
Standard



PN-7
South
Africa
Standard

PX SERIES

10 KW DC POWER SUPPLIES

FAST DELIVERY

Stock to 4 Weeks

FEATURES

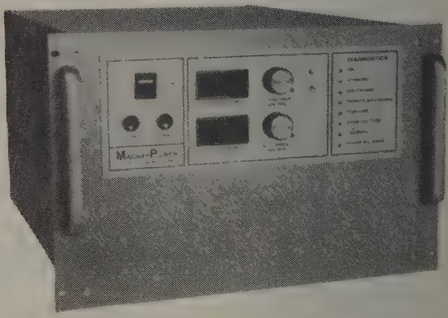
- 13 Models: 16 to 500 Vdc, 20 to 600 Adc
- Series and parallel master/slave operation
- High dielectric withstand: 2500 Vac
- Optional EMI suppression meets VDE 871A
- Digital control lines optically isolated
- Exclusive control loop diagnostics
- Enhanced transient response with Electronic Damping Circuit
- Benchtop or 19" rack mountable
- Power factor corrected for low AC input currents
- OVP shutdown standard, SCR crowbar optional
- Automatic V/I crossover
- Digital meters standard
- Programming resistors isolated from output
- Optional IEEE-488 programming
- Air exhaust in rear of cabinet

MODELS AND RATINGS

MODEL	OUTPUT VOLTAGE Vdc	OUTPUT CURRENT Adc	RIPPLE VOLTAGE mVrms
PX16-600	0-16	0-600	50
PX20-500	0-20	0-500	45
PX32-300	0-32	0-300	30
PX40-250	0-40	0-250	35
PX50-200	0-50	0-200	40
PX80-125	0-80	0-125	50
PX100-100	0-100	0-100	55
PX125-80	0-125	0-80	60
PX160-62	0-160	0-62	70
PX200-50	0-200	0-50	80
PX250-40	0-250	0-40	90
PX375-27	0-375	0-27	100
PX500-20	0-500	0-20	130

APPLICATIONS

AGING RACKS FOR SEMICONDUCTORS
BATTERY CHARGING
CAPACITOR FORMING
CRYOGENIC MAGNETS
CW LASERS
DC MOTORS AND RELAYS
ELECTROPLATING
GENERAL ELECTRONICS



SPECIFICATIONS

Input voltage: 208/240 Vac, 50-60 Hz, 3-phase: standard
440/480 Vac, 50-60 Hz, 3-phase: optional

Regulation line and load combined: 0.10%

Stability: 0.10% for 8 hours after 30 minute warm up

Transient response: 75 ms to recover within 2% of regulated output with 50% to 100% or 100% to 50% load change; 75 ms to recover within 10% of regulated output with 0% to 50% or 50% to 0% load change with Electronic Damping Circuit.

Ambient Temperature: 0 to 50°C

Programming resistors: 1K full scale for output voltage, output current, and over voltage shutdown

Temperature coefficient: 0.04% /°C of maximum output current

Size: 12¼" H x 19" W x 24" D **Weight:** 260 lbs.

Note: Specifications subject to change without notice.

PRICE

All models: $4,795

OPTIONS

SCR crowbar: $195
EMI filter: $295
Electronic Damping (EDC): $695
440/480 Vac input: N/C
Custom input voltage: $295
Custom output voltage: $495
IEEE-488 Interface: $1,795
Other options: consult factory

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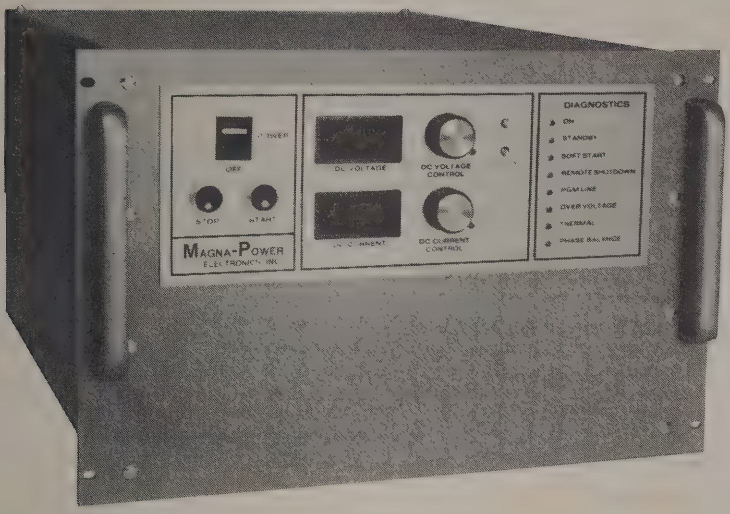
PXA SERIES

20 KW DC POWER SUPPLIES

FAST DELIVERY

Stock to 6 Weeks



MODELS AND RATINGS

MODEL	OUTPUT VOLTAGE Vdc	OUTPUT CURRENT Adc	RIPPLE VOLTAGE mVrms
PXA32-600	0-32	0-600	65
PXA80-250	0-80	0-250	100
PXA125-160	0-125	0-160	125
PXA250-80	0-250	0-80	150
PXA500-40	0-500	0-40	250
PXA600-32	0-600	0-32	300
PXA750-25	0-750	0-25	375

SPECIFICATIONS

Input voltage: 208/240 Vac, 50-60 Hz, 3-phase: standard
440/480 Vac, 50-60 Hz, 3-phase: optional

Regulation line and load combined: 0.10%

Stability: 0.10% for 8 hours after 30 minute warm up

Transient response: 75 ms to recover within 2% of regulated output with 50% to 100% or 100% to 50% load change

Ambient Temperature: 0 to 50°C

Programming resistors: 1K full scale for output voltage, output current, and over voltage shutdown

Temperature coefficient: 0.04% /°C of maximum output current

Size: 15$\frac{3}{4}$" H x 19" W x 24" D

Weight: 420 lbs.

Note: Specifications subject to change without notice.

FEATURES

- 7 Models: 32 to 750 Vdc, 25 to 600 Adc
- Benchtop or 19" rack mountable
- Series and parallel master slave operation
- Programming resistors isolated from output
- Optional EMI suppression meets VDE 871A
- OVP shutdown standard, SCR crowbar optional
- Digital meters standard
- Digital control lines optically isolated
- High dielectric withstand: 2500 Vac
- Automatic V/I crossover
- IEEE-488 compatible
- Air exhaust in rear of cabinet
- Power factor corrected for low AC input currents

APPLICATIONS

AGING RACKS FOR SEMICONDUCTORS
BATTERY CHARGING
CAPACITOR FORMING
CRYOGENIC MAGNETS
CW LASERS
DC MOTORS AND RELAYS
ELECTROPLATING
GENERAL ELECTRONICS

PRICE

All models: $6,995

OPTIONS

SCR crowbar: $195
EMI filter: $295
440/480 Vac input: N/C
Custom input voltage: $295
Custom output voltage: $495
IEEE-488 Interface: $1,795

MAGNA-POWER ELECTRONICS, INC.

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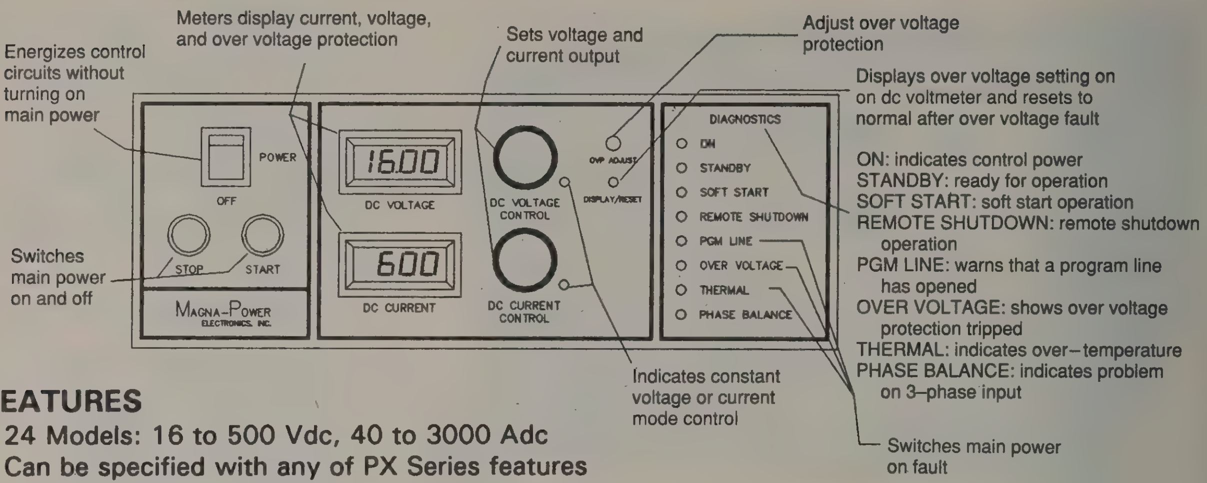
SX SERIES

20 TO 50 KW DC SYSTEMS

MODULAR

Engineered Assemblies



Energizes control circuits without turning on main power

Meters display current, voltage, and over voltage protection

Sets voltage and current output

Adjust over voltage protection

Displays over voltage setting on on dc voltmeter and resets to normal after over voltage fault

Switches main power on and off

ON: indicates control power
STANDBY: ready for operation
SOFT START: soft start operation
REMOTE SHUTDOWN: remote shutdown operation
PGM LINE: warns that a program line has opened
OVER VOLTAGE: shows over voltage protection tripped
THERMAL: indicates over–temperature
PHASE BALANCE: indicates problem on 3–phase input

Indicates constant voltage or current mode control

Switches main power on fault

FEATURES

- 24 Models: 16 to 500 Vdc, 40 to 3000 Adc
- Can be specified with any of PX Series features
- Or'd diagnostic functions for detection of module conditions
- Dedicated master control panel with digital control lines optically isolated
- Modules share currents equally

SX SERIES operate two to five 10 KW modules in master slave configurations for system specific applications. Control functions are merged into one panel for true system integration and control. Standard systems are configured for parallelled output. Non-standard systems can be specified for tracking plus and minus outputs, multiple outputs, and IEEE-488 programming.

SX SERIES are engineered from standardized modules, standardized control panels, and modular cabinets. This means quick delivery, minimum cost, and proven performance!

SIZE AND PRICE MATRIX

POWER	CASE	HEIGHT	WEIGHT	PRICE
20 KW	A	49 ⅛	600	$7,095
30 KW	B	59 ⅝	875	10,595
40 KW	C	68 ⅜	1150	14,195
50 KW	D	84 ⅛	1425	17,695

Note: 1) Specifications subject to change without notice.
2) See PX Series for electrical specifications.
3) All cabinets are 22" W by 28 ⅞"D.
4) Consult factory for options.

STANDARD MODELS AND RATINGS

MODEL	OUTPUT VOLTAGE Vdc	OUTPUT CURRENT Adc	CASE SIZE
SX16-1200	16	1200	A
SX32-600	32	600	A
SX80-250	80	250	A
SX125-160	125	160	A
SX250-80	250	80	A
SX500-40	500	40	A
SX16-1800	16	1800	B
SX32-900	32	900	B
SX80-375	80	375	B
SX125-240	125	240	B
SX250-120	250	120	B
SX500-60	500	60	B
SX16-2400	16	2400	C
SX32-1200	32	1200	C
SX80-500	80	500	C
SX125-320	125	320	C
SX250-160	250	160	C
SX500-80	500	80	C
SX16-3000	16	3000	D
SX32-1500	32	1500	D
SX80-625	80	625	D
SX125-400	125	400	D
SX250-200	250	200	D
SX500-100	500	100	D

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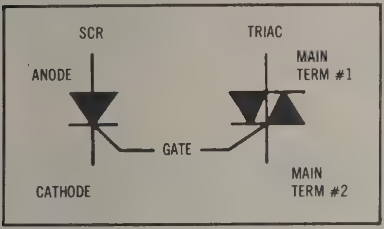
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

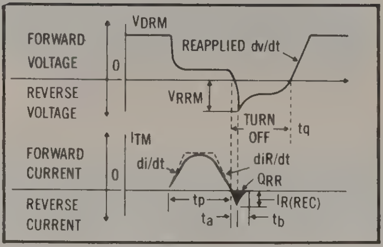


Fig. 1. Concurrent voltage and current waveforms

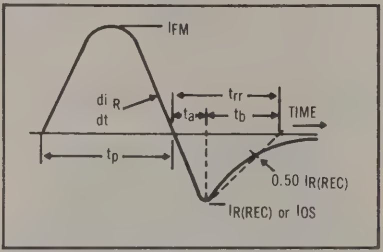


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp*.

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

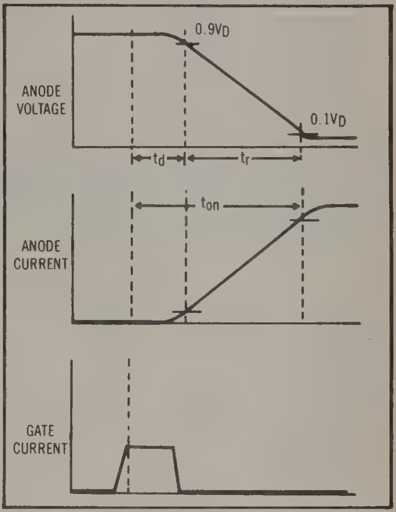


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time*. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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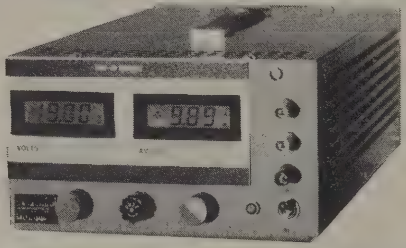
HWD Constant Voltage/Constant Current Supplies

FEATURES

- Digital Ammeter/Voltmeter
- Remotely Programmable
- Remote Sensing
- Series and Parallel Operation
- 1mV Volts Ripple
- .01% Load Regulation
- .01% Line Regulation
- Separate Voltmeter and Ammeter
- Models to 200 Volts
- Half Rack Size or Bench Mounting



APPLICATION

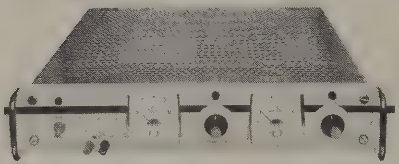
The HWD Series power supplies are designed to be used in the lab bench or for system application. The use of digital meters provides accurate readings of output voltage and current without the need of external DVM'S.

Model Number	Output		Regulation				Price
			Line %		Load %		
	Volts	Amps	CV	CC	CV	CC	
HWD 6-20A	0-6	0-20	0.01	0.1	0.01 or 1 mv	0.5	$ 950.
HWD 10-15A	0-10	0-15	0.01	0.1	0.01 or 1 mv	0.5	950.
HWD 20-10A	0-20	0-10	0.01	0.1	0.01 or 1 mv	0.5	950.
HWD-50-4	0-50	0-4	0.01	0.1	0.01 or 1 mv	0.5	950.
HWD 40-5A	0-40	0-5	0.01	0.1	0.01 or 1 mv	0.5	$ 950.
HWD 60-3A	0-60	0-3	0.01	0.1	0.01 or 1 mv	0.5	950.
HWD 100-2A	0-100	0-2	0.01	0.1	0.01 or 1 mv	0.5	1065.
HWD 200-1A	0-200	0-1	0.01	0.1	0.01 or 1 mv	0.5	1200.

PR Constant Voltage/Current Silicon Supplies

FEATURES

- High Power — Small Size
- Remotely Programmable
- All Silicon Semiconductors
- Mode Lites
- Low Ripple
- .01% Regulation
- Constant Voltage/Constant Current
- Parallel Operation



APPLICATION

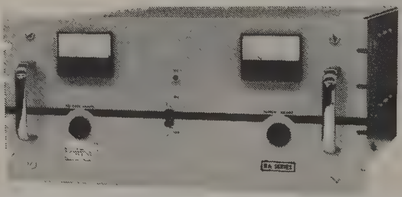
The PR Series find application in the laboratory and in systems where both versatility of operation and a high degree of regulation is required. The voltage to current crossover point may be set anywhere within the limits of zero to full rated output voltage and zero to full rated output current.

Model Number	Output		Regulation				Panel Ht.	Price
			Line %		Load %			
	Volts	Amps	CV	CC	CV	CC		
PR 20-15A	0-20	0-15	0.01	0.01	0.01	0.25	3½"	$1595.
PR 40-10A	0-40	0-10	0.01	0.01	0.01	0.25	3½"	1550.
PR 60-7A	0-60	0-7	0.01	0.01	0.01	0.25	3½"	1650.
PR 125-3.2A	0-125	0-3.2	0.01	0.01	0.01	0.25	3½"	1885.
PR 20-25A	0-20	0-25	0.01	0.01	0.01	0.25	5¼"	1830.
PR 40-20A	0-40	0-20	0.01	0.01	0.01	0.25	5¼"	$1770.
PR 60-14A	0-60	0-14	0.01	0.01	0.01	0.25	5¼"	1890.
PR 125-6.5A	0-125	0-6.5	0.01	0.01	0.01	0.25	5¼"	2060.
PR 125-10A	0-125	0-10	0.01	0.01	0.01	0.25	7"	2835.
PR 250-10A	0-250	0-10	0.01	0.01	0.01	0.25	8¾"	5000.

RA Constant Voltage Silicon Supplies

FEATURES

- High Power — Small Size
- Remotely Programmable
- Low Ripple
- Parallel Operation
- .01% Regulation
- All Silicon Semiconductors



APPLICATION

The RA Series are all silicon, relatively high in power, and tightly regulated. They find application in the laboratory and in systems where both versatility of operation and a high degree of regulation is required. Adjustable solid state current limiting provides load protection.

Model Number	Output		Regulation		Panel Ht.	Price
	Volts	Amps	Line %	Load %		
RA 20-15A	0-20	0-15	0.01	0.01	3½"	$1435.
RA 40-10A	0-40	0-10	0.01	0.01	3½"	1433.
RA 60-7A	0-60	0-7	0.01	0.01	3½"	1433.
RA 125-3.2A	0-125	0-3.2	0.01	0.01	3½"	1460.
RA 20-25A	0-20	0-25	0.01	0.01	5½"	1630.
RA 40-20A	0-40	0-20	0.01	0.01	5½"	1580.
RA 60-14A	0-60	0-14	0.01	0.01	5½"	1650.
RA 125-6.5A	0-125	0-6.5	0.01	0.01	5½"	$1840.
RA 40-30A	0-40	0-30	0.01	0.01	7"	2160.
RA 60-20A	0-60	0-20	0.01	0.01	7"	2280.
RA 125-10A	0-125	0-10	0.01	0.01	7"	2265.
RA 40-50A	0-40	0-50	0.01	0.01	8¾"	3400.
RA 60-30A	0-60	0-30	0.01	0.01	7"	3510.
RA 250-10A	0-250	0-10	0.01	0.01	8¾"	4650.
RA 25-100A	0-25	0-100	0.01	0.01	10½"	4975.

Options include: meters, overvoltage, special input voltages.

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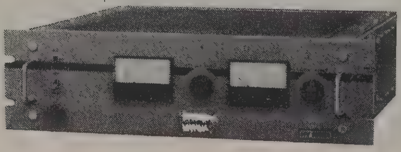
HV Constant High Voltage Supplies

FEATURES

- All Solid State
- Adjustable Current Limit
- < 1 Millivolt Ripple
- 10-Turn Voltage Adjustments
- Remote Programming
- Remote Sensing



APPLICATION

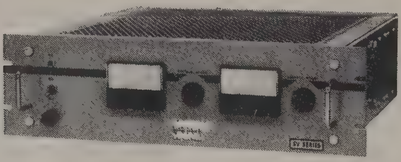
The HV is a versatile series of constant voltage units adjustable from zero to full rated voltage. Adjustable solid state current limiting is a feature. Options provide for either systems or laboratory use. Crossover from constant voltage to current limiting is automatic solid state and noninterrupting. Units may be operated in parallel for increased current capacity.

Model Number	Output		Regulation		Size	Price
	Volts	Amps	Line %	Load %		
HV 350-1	0-350	1	0.005	0.01	3½ × 19 × 16½	$2450.
HV 350-2	0-350	2	0.005	0.01	5¼ × 19 × 16½	2900.
HV 350-3	0-350	3	0.005	0.01	7 × 19 × 16½	3250.
HV 350-5	0-350	5	0.005	0.01	8¾ × 19 × 16½	3700.

SV Constant High Voltage Power Supplies

FEATURES

- All Solid State
- Adjustable Current Limit
- 3 Millivolt Ripple
- 0.01% Regulation
- 10-Turn Voltage Adjustments
- Remote Programming
- Remote Sensing
- Meters



APPLICATION

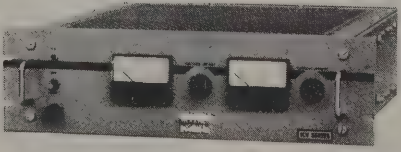
The SV is a versatile series of constant voltage units adjustable from 0 to full rated voltage. Options provide either systems or laboratory use. Crossover from constant voltage to current limiting is automatic solid state and noninterrupting. Units may be operated in parallel for increased current capacity.

Model Number	Output		RMS Ripple	Regulation		Size	Price
	Volts	Amps		Line %	Load %		
SV 600-0.5	0-600	0-0.5	<3mv	0.01	0.01	3½ × 19 × 16½	$2900.
SV 600-1	0-600	0-1	<3mv	0.01	0.01	5¼ × 19 × 16½	3500.
SV 600-2	0-600	0-2	<3mv	0.01	0.01	7 × 19 × 16½	4400.

KV High Voltage Power Supplies

FEATURES

- Output 100 to 1500 VDC
- Voltage Regulated 0.5%
- Current Regulated 0.5%
- Voltmeter and Ammeter
- Ripple 0.5% RMS
- Voltage/Voltage Programmable
- Resistance Programmable



APPLICATION

The KV1000 Series Power Supplies are constant voltage/constant current units with automatic crossover. Models are available with up to 3 ampere current capacity over the full voltage range. Options such as remote voltage and current programming, remote turn on and turn off make the unit a versatile piece of equipment for laboratory or manufacturing operations.

Model Number	Output		Regulation %		Panel Height	Price
	Voltage	Amps	Current	Voltage		
KV 1000-0.5	100-1000	0-0.5	0.5	0.5	5¼″	$2700.
KV 1000-1	100-1000	0-1.0	0.5	0.5	7″	3400.
KV 1000-2	100-1000	0-2.0	0.5	0.5	10½″	5800.
KV 1000-3	100-1000	0-3.0	0.5	0.5	14″	6900.
KV 1500-0.5	100-1500	0-0.5	0.5	0.5	7″	$3095.
KV 1500-1	100-1500	0-1.0	0.5	0.5	10½″	4300.
KV 1500-1.5	100-1500	0-1.5	0.5	0.5	14″	6600.

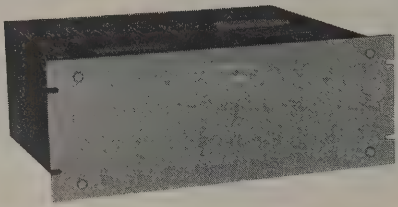
MID-EASTERN INDUSTRIES, INC.

Division of **TECHNOLOGY DYNAMICS, INC.** 100 School Street, Bergenfield, New Jersey 07621 Phone (201) 385-0500
FAX (201) 385-0702

MS High Power System Component Power Supplies

FEATURES

- Most Complete Coverage
  Up to 600 Volts
  Up to 1200 Amperes
- Low Cost
- All Solid State
- Extreme Reliability



APPLICATION

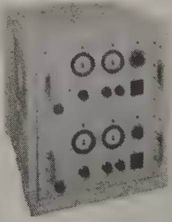
Strictly designed for incorporation into systems, these supplies are considered as components. They are of exceptionally high reliability; yield the highest power at the lowest cost; and provide complete coverage of all possible needs.

Model Number	Height in Inches	Model Number	Height in Inches	Model Number	Height in Inches	Model Number	Height in Inches	Model Number	Height in Inches	Model Number	Height in Inches
MS 9-600	48⅝	MS 20-30	5¼	MS 34-20	5¼	MS 65-10	5¼	MS 128-6	5¼	MS 350-1.5	5¼
MS 9-1200	67⅞	MS 20-45	8¾	MS 34-30	8¾	MS 65-15	8¾	MS 128-10	8¾	MS 350-3	8¾
		MS 20-80	12¼	MS 34-50	12¼	MS 65-25	12¼	MS 128-15	12¼	MS 350-5	12¼
MS 12-40	5¼	MS 20-120	17½	MS 34-75	17½	MS 65-35	17½	MS 128-24	17½	MS 350-7	17½
MS 12-60	8¾	MS 20-180	24	MS 34-125	24	MS 65-50	24	MS 128-35	24	MS 350-10	24
MS 12-100	12¼	MS 20-400	67⅞	MS 34-300	67⅞	MS 65-75	48⅝	MS 128-45	48⅝	MS 350-30	67⅞
MS 12-150	17½					MS 65-150	67⅞	MS 128-90	67⅞	MS 410-1.5	5¼
MS 12-225	24									MS 410-3	8¾
MS 12-400	67⅞									MS 410-5	12¼
		MS 25-25	5¼	MS 38-20	5¼	MS 77-10	5¼	MS 240-.75	3½	MS 410-7	17½
		MS 25-37	8¾	MS 38-30	8¾	MS 77-15	8¾	MS 240-3	5¼	MS 410-10	24
MS 13.5-40	5¼	MS 25-60	12¼	MS 38-50	12¼	MS 77-25	12¼	MS 240-5	8¾	MS 410-30	67⅞
MS 13.5-60	8¾	MS 25-90	17½	MS 38-75	17½	MS 77-35	17½	MS 240-7	12¼	MS 470-2	8¾
MS 13.5-100	12¼	MS 25-140	24	MS 38-125	24	MS 77-50	24	MS 240-10	17½	MS 470-3	12¼
MS 13.5-150	17½	MS 25-200	48⅝	MS 38-300	67⅞	MS 77-75	48⅝	MS 240-15	24	MS 470-5	17½
MS 13.5-225	24	MS 25-400	67⅞			MS 77-150	67⅞	MS 240-40	67⅞	MS 470-7	24
MS 13.5-400	67⅞									MS 470-10	48⅝
		MS 29-25	5¼	MS 46-15	5¼	MS 109-6	5¼	MS 273-.75	3½	MS 470-20	67⅞
MS 17-30	5¼	MS 29-37	8¾	MS 46-22	8¾	MS 109-10	8¾	MS 273-3	5¼	MS 545-2	8¾
MS 17-45	8¾	MS 29-60	12¼	MS-46-40	12¼	MS 109-15	12¼	MS 273-5	8¾	MS 545-3	12¼
MS 17-80	12¼	MS 29-90	17½	MS 46-60	17½	MS 109-24	17½	MS 273-7	12¼	MS 545-5	17½
MS 17-120	17½	MS 29-140	24	MS 46-90	24	MS-109-35	24	MS 273-10	17½	MS 545-7	24
MS 17-180	24	MS 29-200	48⅝	MS 46-120	48⅝	MS 109-45	48⅝	MS 273-15	24	MS 545-10	48⅝
MS 17-400	67⅞	MS 29-400	67⅞	MS 46-240	67⅞	MS 109-90	67⅞	MS 273-40	67⅞	MS 545-20	67⅞

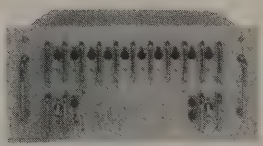
NOTE: The digits of the Model Number indicate the output voltage and current in amps. Example: MS9-600 has an output of 9 volts, current of 600 amps. MS9-1200 has an output of 9 volts at 1200 amps. **Consult factory for prices.**

Custom Power Supplies and Systems

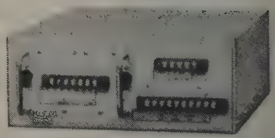
Double redundant regulated DC power distribution system for process industry. Features no break transfer and battery backup.



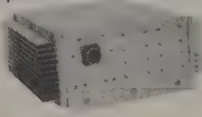
High power, 150-volt, constant current/constant voltage, shipboard-qualified power supply.



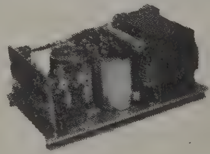
Regulated no-break, redundant 24-volt dc, 15-ampere, 10-channel power distribution system for television studios.



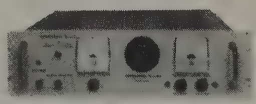
Uninterrruptable power supply, with internal battery charger, used for avionics instrumentation.



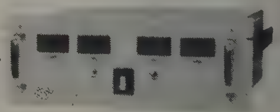
Mil Spec 4 output regulated power supply.



Regulated multi-output power supply for computer.



Automatic constant current battery charger with automatic range selection based on battery temperature and voltage level.



±5V 50A linear regulated power supply for semi-conductor testing and burn-in.

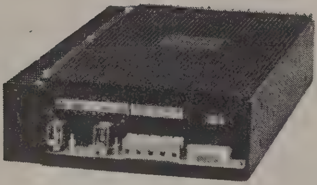
NOTE: Not pictured are these special devices: (a) Power supply for CW lasers; (b) Redundant power systems for military telephone communications systems; (c) Xenon lamp power supplies; (d) True RMS regulated ac power supplies; and (e) High current dc power supply for automotive production line testing.

MID-EASTERN INDUSTRIES, INC.

Division of **TECHNOLOGY DYNAMICS, INC.** 100 School Street, Bergenfield, New Jersey 07621 Phone (201) 385-0500
FAX (201) 385-0702

SM High Current Switching Power Supplies

FEATURES
- Soft Start—Solid State
- Overvoltage Protection
- Current Limit
- Remote Shut Down
- Over Temperature Protection
- 47-400 Hz AC Input
- Convection Cooled
- Fully Enclosed
- −0° to +70°C Ambient
- Lightweight
- Input Line Filter

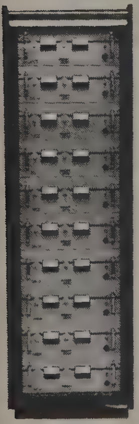


SPECIFICATIONS
- Line Regulation 0.1%
- Load Regulation 0.1%
- Ripple and Noise 2% pp
- Efficiency 75% Typical
- Temperature Coefficient .02%/°C
- Stability 0.1%/8 hours
- Hold Up Time 16.5 MSec Minimum

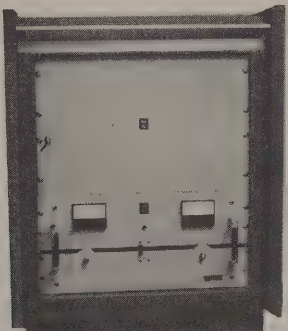
* Prices shown for 100 pcs.

Model No.	Volts	Amps @40°C	Price*	Model No.	Volts	Amps @40°C	Price*
300W							
SM 5-300	5	60	$399.	SM 24-300	24	12.5	$460.
SM 6-300	6	50	399.	SM 28-300	28	10.7	460.
SM 12-300	12	25	399.	SM 48-300	48	6.3	460.
SM 15-300	15	20	399.	SM 125-300	125	2.4	460.
600W							
SM 5-600	5	120	675.	SM 24-600	24	25	725.
SM 6-600	6	100	675.	SM 28-600	28	21.4	725.
SM 12-600	12	50	675.	SM 48-600	48	12.5	725.
SM 15-600	15	40	675.	SM 125-600	125	4.8	725.
1000W							
SM 5-1000	5	200	900.	SM 24-1000	24	41.7	990.
SM 6-1000	6	165	900.	SM 28-1000	28	35.7	990.
SM 12-1000	12	83	900.	SM 48-1000	48	20.8	990.
SM 15-1000	15	67	900.	SM 125-1000	125	8	990.

Custom Power Supplies and Systems

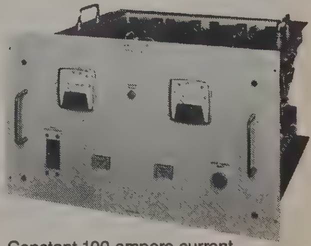


48-volt, 240-ampere redundant power supply for process industry.

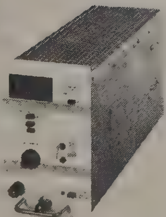


24-volt, 50 ampere distributed power system for process industry.

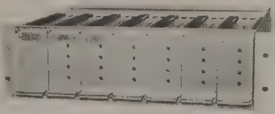
Tracking power supply: ± 15-volt, 75-ampere.



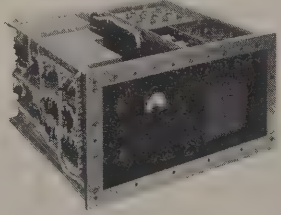
Constant 100 ampere current power supply for Xenon lamp application.



Constant current power supply. 3 ranges: 0-2ma, 0-20ma, 0-200ma. Maximum output voltage 1200 volts.



24-channel, individually adjustable, constant current distributed power source.



Multi-output Mil Spec power supply.

± 13-volt, 40-ampere power supply for telecommunications industry. Designed for redundant operation.

eem

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

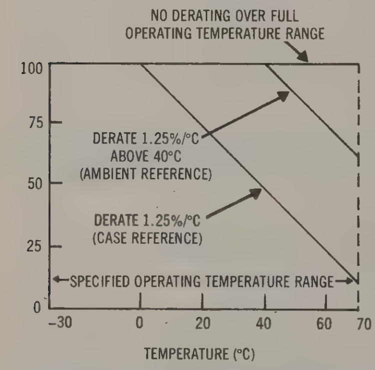


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

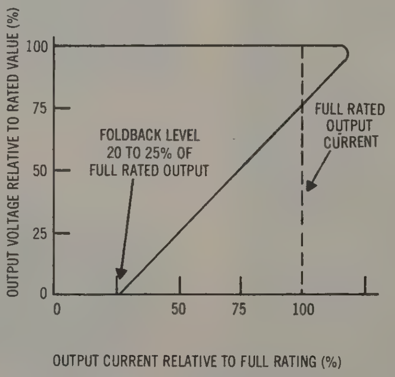


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

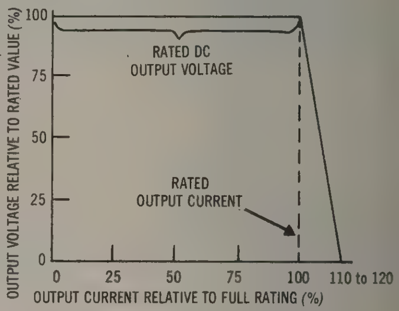


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

1 to 2000 Watts

YOUR CHOICE OF POWER TECHNOLOGIES

Hybrid • Part Hybrid • Discrete
Standard • Semi-custom • Custom

Whether your requirements call for one of our many standard parts, a standard part with a minor modification, an assembly of standard parts, or a completely new custom design — Modular Devices Inc is ready to assist you.

Modular Devices Inc (MDI) designs and manufactures a wide range of standard and custom power supplies for aerospace, military and industrial use. MDI has a complete thick film hybrid capacity on site, which permits us to produce unique power electronic functions for our customers quickly and efficiently. MDI can also meet challenging radiation and aerospace requirements. With its high technology power supply capability and custom hybrid facility, MDI is uniquely positioned to apply the best and most appropriate packaging technology to your diverse and challenging requirements.

MDI offers the optimum technology for each application.

Full Hybrid Power Supplies using thick film, chip and wire/surface mount components within hermetic hybrid enclosures allows ultimate power density. Low tooling and set up costs and availability of unique hybrid enclosures make power hybrid technology economical for small production runs. Careful computer aided thermal analysis and proven thermal management techniques assure high reliability. MDI's hybrid power supply technology incorporates the latest advances in high frequency techniques, power hybrid and miniature magnetic components. MDI's product capacity includes:

- Standard, off the shelf DC to DC converters to 80 watts, operating frequencies to 400 kHz, power densities to 40 W/in^3
- Custom variations of standard DC to DC converters to 120 watts
- Custom DC–AC static inverters to 10 watts
- Design and construction to "S" level, "B" level and other requirements
- Wide temperature range

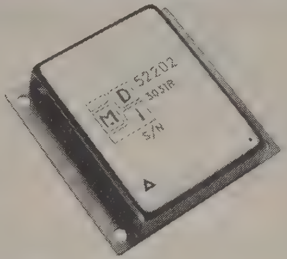
Hybrids combined with discrete components allow great volumetric efficiency as compared to all discrete designs. MDI's packaging technology incorporates the latest advances in NC milled and dip brazed enclosures, FLEX PRINT wiring and surface mount technology. This product capability provides:

- Higher packaging densities than all discrete designs
- Lower cost and quicker delivery than all hybrid designs
- Best suited for aerospace/high reliability, high density requirements at power levels from 50 watts to 1 KVA

Discrete Power Electronics encompasses a wide spectrum of power supply products as well as areas such as servo and power amplifiers, motor drives and controls. MDI's power supply technology incorporates the latest advances in high frequency switch mode power FET techniques. MDI's product capability includes:

- AC to DC power supplies to 5 KVA with single and multiple outputs with power densities to 4 W/in^3
- DC to DC converters to 2 KVA, operating frequencies to 450 kHz, power densities to 10 W/in^3
- DC to AC static inverters to 2 KVA, inputs 12 VDC to 400 VDC, output from 50 Hz to 1600 Hz
- Design and construction to NHB-5300, MIL-E-16400, NAVMAT P-4855A, WS 6536E, MIL-STD-2000 and other aerospace and military specifications

MODEL 3031R
DC-DC 80W
full hybrid
"The mouse that roared!"



MODEL 2536
DC-DC 75W, part hybrid
This unit is in terrific shape!

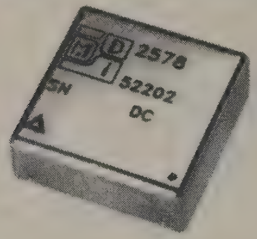
MODEL 2549
AC-DC 600W, all discrete
We call this unit "Arnold"

MODULAR DEVICES INC

BROOKHAVEN R&D PLAZA • ONE RONED ROAD • SHIRLEY, NEW YORK 11967
TEL 516-345-3100 • FAX 516-345-3106

5 Watt HYBRID

DC-DC CONVERTERS



Features

- Completely self contained Thick Film Hybrid DC-DC Converter
- For MIL-STD-704/1275 applications
- T²L inhibit function
- Fully isolated design
- Single, dual or triple outputs
- Current limiting, power on soft start
- 200 kHz operation for low ripple and fast response time
- No external capacitors required
- High reliability screening available, specify "M" (e.g. "2578M-S05")
- Full hermetic package
- Radiation hardened available
- Internal EMI filter

Specifications

INPUT: 28VDC nominal
  Range: 16 to 50 VDC continuous.
  Survives 80 V transients/MIL-STD-704
  Current: 200 mA typical at full load
OUTPUT: Voltage & Current (see chart)
REGULATION: (see chart)
RIPPLE: 30 mV peak-to-peak, typical
PROTECTION: Short circuit protection by current limit.
ISOLATION:
  Input to case: 500 VDC
  Input to output: 500 VDC
ENVIRONMENT:
  Operating temperature:
    - 55°C ambient to +85°C case
  Linearity derates to zero at 115°C
  Storage temperature: -55°C to +150°C
  Case rise 30°C typical at full load
  Shock: 50G
  Acceleration: 500G
  Vibration: 30G
MECHANICAL:
  Dimensions: 1.08" x 1.08" x 0.380"
  Terminals: PC board mount
  Case: Kovar header, tin plate cover
  Weight: 0.5 ounces

We can modify these units to meet your custom converter requirements.

SERIES 2578

SINGLE OUTPUT CONVERTERS		2578-S03.3 (5W)			2578-S05 (5W)			2578-S05.2 (5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	—	+3.2	+3.3	+3.4	+4.9	+5.0	+5.1	-5.1	-5.2	-5.3
Output current	V_{in}= 16 to 50 VDC	—	—	1 A	—	—	1 A	—	—	961 mA
Efficiency	P_{in}= max rated load	70%	73%	—	74%	77%	—	74%	77%	—
Line regulation	P_{in}= max rated load V_{in}= 16 to 50 VDC	—	7 mV	20 mV	—	7 mV	20 mV	—	7 mV	20 mV
Load regulation	P_{out}= 0 to 5 watts	—	5 mV	20 mV	—	5 mV	20 mV	—	5 mV	20 mV
Output ripple	Full load BW 2 MHz mV_{pp}	—	30	50	—	30	50	—	30	50

SINGLE OUTPUT CONVERTERS		2578-S12 (5W)			2578-S15 (5W)			2578-S28 (5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	—	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1	+27.8	+28.0	+28.2
Output current	V_{in}= 16 to 50 VDC	—	—	416 mA	—	—	333 mA	—	—	178 mA
Efficiency	P_{in}= max rated load	74%	77%	—	75%	78%	—	75%	78%	—
Line regulation	P_{in}= max rated load V_{in}= 16 to 50 VDC	—	25 mV	50 mV	—	30 mV	60 mV	—	30 mV	60 mV
Load regulation	P_{out}= 0 to 5 watts	—	5 mV	20 mV	—	5 mV	20 mV	—	5 mV	20 mV
Output ripple	Full load BW 2 MHz mV_{pp}	—	30	50	—	30	50	—	30	50

DUAL OUTPUT CONVERTERS		2578-D05 (5W)			2578-D12 (5W)			2578-D15 (5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output current	V_{in}= 16 to 50 VDC	35 mA	--	500 mA	15 mA	—	208 mA	12 mA	—	166 mA
Efficiency	P_{in}= max rated load	74%	77%	—	74%	77%	—	74%	77%	—
Line regulation	P_{in}= max rated load V_{in}= 16 to 50 VDC	—	5 mV	2 V	—	2 V	5 mV	—	5 mV	2 V
Load regulation	P_{out}= 0 to 5 watts	—	5 mV	20 mV	—	5 mV	20 mV	—	5 mV	20 mV
Output ripple	Full load BW 2 MHz mV_{pp}	—	30	50	—	30	50	—	30	50

TRIPLE OUTPUT CONVERTERS			2578-T12 (4W)			2578-T15 (4W)		
PARAMETER	CONDITION		MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	$+I_{out} = -I_{out}$	MAIN	+4.9	+5	+5.1	+4.9	+5	+5.1
		DUAL	+11.5	+12.0	+12.5	+14.5	+15.0	+15.5
		DUAL	-11.5	-12.0	-12.5	-14.5	-15.0	-15.5
Output current	V_{in}= 16 to 50 VDC	MAIN	100mA	—	500mA	100mA	—	500mA
		DUAL	—	—	±50mA	—	—	±40mA
Efficiency	P_{in}= max rated load		68%	70%	—	68%	70%	—
Line regulation	P_{in}= max rated load	MAIN	—	0.1%	0.2%	—	0.1%	0.4%
	V_{in}= 16 to 50 VDC	DUAL	—	0.25%	0.4%	—	0.25%	0.4%
Load regulation	P_{out}= 0 to 4 watts	MAIN	—	0.2%	0.4%	—	0.2%	0.4%
		DUAL	—	0.25%	0.4%	—	0.25%	0.4%
Output ripple	Full load BW 2 MHz	MAIN	—	—	80	—	—	80
	mV_{pp}	DUAL	—	—	30	—	—	30

MODULAR DEVICES INC

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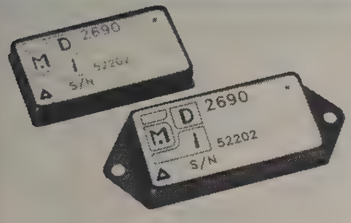
4-6.5 Watt HYBRID

RAD HARD DC-DC CONVERTERS

FULL FEATURE SERIES 2690R



ADD "F" FOR OPTIONAL FLANGE

Features

- Specifically designed for redundant or individual space applications
- Completely self contained Thick Film Hybrid DC-DC Converter
- No external filter caps required
- Fully isolated design
- For MIL–STD 704/1275 applications
- T^2L inhibit function
- Power on soft start
- 200 kHz operation for low ripple and fast response time
- RAD hard, 10^5 total dose
- Built-in EMI input filter meets MIL–STD 461C requirements CE01, CE03, CE07, CS01 and CS02
- Short circuit and overvoltage protection with externally selectable wiring option which yields latching/non-latching option
- Non-latching reset interval is externally programmable by choosing a capacitor to select the time constant.
- Capability of external synch for switching frequencies
- Built-in test capability with T^2L interface
- "S" level configuration available

Specifications

INPUT: 28VDC nominal
Range: 16 VDC to 50 VDC continuous
Survives 80 V transients
OUTPUT: Voltage & Current (see chart)
REGULATION: (see chart)
RIPPLE: 50 mV peak-to-peak, typical
ISOLATION:
Input to case: 500 VDC
Input to output: 500 VDC
ENVIRONMENT:
Full power from - 55°C to +85°C T_{case}
Linearly derates to zero from 85°C to 115°C
Storage temperature: -55°C to +150°C
Shock: 50G
Acceleration: 500G
Vibration: 30G
WEIGHT: 35 grams
DIMENSIONS: 2.12" x 1.12" x 0.375" (without flange)

OPTIONS:		
	2690	non-screened
	2690M	non-RAD High Rel
	2690E	125°C military
	2690L	50K RAD
	2690R	100K RAD
	2690S	space grade

SINGLE OUTPUT DEVICES

PARAMETER	CONDITION	2690R-S03.3 (6.5W) MIN	TYP	MAX	2690R-S05 (6.5W) MIN	TYP	MAX	2690R-S05.2 (6.5W) MIN	TYP	MAX
Output Voltage	—	+3.2	+3.3	+3.4	+4.9	+5.0	+5.1	-5.1	-5.2	-5.3
Output Current	V_{in} = 16–50 VDC	—	—	1.97 A	—	—	1.3 A	—	—	1.25 A
Efficiency	P_{out} = Max Rated Load	65%	69%	—	72%	75%	—	72%	75%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	7 mV	20 mV	—	7 mV	20 mV	—	10 mV	20 mV
Load Regulation	P_{out} = 0–6.5 W	—	5 mV	20 mV	—	5 mV	20 mV	—	10 mV	20 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	50	—	30	50	—	30	65

SINGLE OUTPUT DEVICES

PARAMETER	CONDITION	2690R-S12 (6.5W) MIN	TYP	MAX	2690R-S15 (6.5W) MIN	TYP	MAX	2690R-S28 (6.5W) MIN	TYP	MAX
Output Voltage	—	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1	+27.8	+28.0	+28.2
Output Current	V_{in} = 16–50 VDC	—	—	541 mA	—	—	433 mA	—	—	232 mA
Efficiency	P_{out} = Max Rated Load	80%	82%	—	81%	83%	—	82%	84%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	10 mV	20 mV	—	10 mV	20 mV	—	10 mV	20 mV
Load Regulation	P_{out} = 0–6.5 W	—	10 mV	20 mV	—	10 mV	20 mV	—	10 mV	20 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	65	—	30	65	—	30	65

DUAL OUTPUT DEVICES

PARAMETER	CONDITION	2690R-D05 (5W) MIN	TYP	MAX	2690R-D12 (6.5W) MIN	TYP	MAX	2690R-D15 (6.5W) MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output Current*	V_{in} = 16–50 VDC	35 mA	—	500 mA	40 mA	—	270 mA	32 mA	—	217 mA
Efficiency	P_{out} = Max Rated Load	72%	75%	—	81%	84%	—	82%	85%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	10 mV	25 mV	—	10 mV	25 mV	—	10 mV	25 mV
Load Regulation†	P_{out} = .5–5 or .65–6.5W	—	20 mV	50 mV	—	20 mV	50 mV	—	20 mV	50 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	50	85	—	50	85	—	50	85

Notes: * Up to 90% full power available from either output if rated output power is not exceeded; † Balanced load conditions.

TRIPLE OUTPUT DEVICES

PARAMETER	CONDITION	2690R-T05 (4W) MIN	TYP	MAX	2690R-T12 (4W) MIN	TYP	MAX	2690R-T15 (4W) MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	+4.9 +4.9 -4.9	+5.0 +5.0 -5.0	+5.1 +5.1 -5.1	+4.9 +11.9 -11.9	+5.0 +12.0 -12.0	+5.1 +12.1 -12.1	+4.9 +14.9 -14.9	+5.0 +15.0 -15.0	+5.1 +15.1 -15.1
Output Current	V_{in} = 16–50 VDC	60mA —	— —	350 mA ±150mA	60 mA —	— —	500 mA ±105 mA	60 mA —	— —	500 mA ±83 mA
Efficiency	P_{out} = Max Rated Load	70%	72%	—	68%	70%	—	68%	70%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	— —	0.1% 0.25%	0.2% 0.4%	— —	0.1% 0.25%	0.2% 0.4%	— —	0.1% 0.25%	0.2% 0.4%
Load Regulation	P_{out} = .4–4 W	— —	0.2% 0.25%	0.4% 0.5%	— —	0.2% 0.25%	0.4% 0.4%	— —	0.2% 0.25%	0.4% 0.4%
Output Ripple	Full Load BW 2 MHz mV_{P-P}	— —	— —	80 50	— —	— —	80 30	— —	— —	80 30

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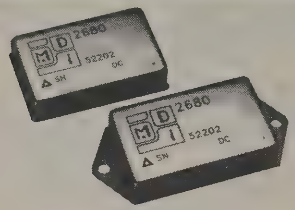
20-30 Watt HYBRID

RAD HARD DC-DC CONVERTERS

FULL FEATURE SERIES 2680R



ADD "F" FOR OPTIONAL FLANGE

Features

- Specifically designed for redundant or individual space applications
- Completely self contained Thick Film Hybrid DC-DC Converter
- No external filter caps required
- Fully isolated design
- For MIL–STD 704/1275 applications
- T²L inhibit function
- Power on soft start
- 200 kHz operation for low ripple and fast response time
- RAD hard, 10^5 total dose
- Built-in EMI input filter meets MIL–STD 461C requirements CE01, CE03, CE07, CS01 and CS02
- Short circuit and overvoltage protection with externally selectable wiring option which yields latching/non-latching option
- Non-latching reset interval is externally programmable by choosing a capacitor to select the time constant.
- Capability of external synch for switching frequencies
- Built-in test capability with T²L interface
- "S" level configuration available

Specifications

INPUT: 28VDC nominal
Range: 16 VDC to 50 VDC continuous
Survives 80 V transients
OUTPUT: Voltage & Current (see chart)
REGULATION: (see chart)
RIPPLE: 50 mV peak-to-peak, typical
ISOLATION:
Input to case: 500 VDC
Input to output: 500 VDC
ENVIRONMENT:
Full power from - 55°C to +85°C T_{case}
Linearly derates to zero from 85°C to 115°C
Storage temperature: -55°C to +150°C
Shock: 50G
Acceleration: 500G
Vibration: 30G
WEIGHT: 50 grams
DIMENSIONS: 2.15" x 1.34" x 0.495"
(without flange)

OPTIONS:	2680	non-screened
	2680M	non-RAD High Rel
	2680E	125°C military
	2680L	50K RAD
	2680R	100K RAD
	2680S	space grade

SINGLE OUTPUT DEVICES

		2680R-S03.3 (30W)			2680R-S05 (30W)			2680R-S05.2 (30W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	—	+3.2	+3.3	+3.4	+4.9	+5.0	+5.1	-5.1	-5.2	-5.3
Output Current	V_{in} = 16–50 VDC	—	—	6.06 A	—	—	6 A	—	—	5.76 A
Efficiency	P_{out} = Max Rated Load	65%	69%	—	72%	75%	—	72%	75%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	7 mV	20 mV	—	7 mV	20 mV	—	10 mV	20 mV
Load Regulation	P_{out} = 0–30 W	—	5 mV	20 mV	—	5 mV	20 mV	—	10 mV	20 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	50	—	30	50	—	30	65

SINGLE OUTPUT DEVICES

		2680R-S12 (30W)			2680R-S15 (30W)			2680R-S28 (30W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	—	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1	+27.8	+28.0	+28.2
Output Current	V_{in} = 16–50 VDC	—	—	2.5 A	—	—	2 A	—	—	1.07 A
Efficiency	P_{out} = Max Rated Load	80%	82%	—	81%	83%	—	82%	84%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	10 mV	20 mV	—	10 mV	20 mV	—	10 mV	20 mV
Load Regulation	P_{out} = 0–30 W	—	10 mV	20 mV	—	10 mV	20 mV	—	10 mV	20 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	65	—	30	65	—	30	65

DUAL OUTPUT DEVICES

		2680R-D05 (20W)			2680R-D12 (30W)			2680R-D15 (30W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output Current*	V_{in} = 16–50 VDC	150 mA	—	2 A	95 mA	—	1.25 A	76 mA	—	1 A
Efficiency	P_{out} = Max Rated Load	72%	75%	—	81%	84%	—	82%	85%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	—	10 mV	25 mV	—	10 mV	25 mV	—	10 mV	25 mV
Load Regulation†	P_{out} = 2–20 or 3–30 W	—	20 mV	50 mV	—	20 mV	50 mV	—	20 mV	50 mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	50	85	—	50	85	—	50	85

Notes: * Up to 90% full power available from either output if rated output power is not exceeded; † Balanced load conditions.

TRIPLE OUTPUT DEVICES

		2680R-T05 (17.5W)			2680R-T12 (17.5W)			2680R-T15 (17.5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	+4.9 +4.9 -4.9	+5.0 +5.0 -5.0	+5.1% +5.1% -5.1%	+4.9 +11.9 -11.9	+5.0 +12.0 -12.0	+5.1 +12.1 -12.1	+4.9 +14.9 -14.9	+5.0 +15.0 -15.0	+5.1 +15.1 -15.1
Output Current	V_{in} = 16–50 VDC	90 mA 40 mA	— —	3 A ±250 mA	5 mA ±12 mA	— —	2 A ±312 mA	5 mA ±15 mA	— —	2 A ±250 mA
Efficiency	P_{out} = Max Rated Load	70%	72%	—	74%	76%	—	74%	76%	—
Line Regulation	P_{out} = Max Rated Load V_{in} = 16–50 VDC	— —	0.1% 0.25%	0.2% 0.4%	— —	0.1% 0.25%	0.2% 0.4%	— —	0.1% 0.25%	0.2% 0.4%
Load Regulation	P_{out} = 1.5–15 W	— —	0.2% 0.25%	0.4% 0.5%	— —	0.2% 0.25%	0.4% 0.4%	— —	0.2% 0.25%	0.4% 0.4%
Output Ripple	Full Load BW 2 MHz mV_{P-P}	— —	— —	80 50	— —	— —	80 30	— —	— —	80 30

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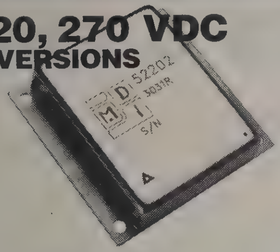
40-80 Watt HYBRID

RAD HARD DC-DC CONVERTERS

SERIES 3031R, 3041R, 3051R

28, 120, 270 VDC
INPUT VERSIONS



Features

- Specifically designed for redundant or individual space applications
- Completely self contained Thick Film Hybrid DC-DC Converter
- No external filter caps required
- Fully isolated design
- T^2L inhibit function
- Power on soft start
- 200 kHz operation for low ripple and fast response time
- RAD hard, 10^5 total dose
- Built-in EMI input filter meets MIL–STD 461C requirements CE01, CE03, CE07, CS01 and CS02
- Short circuit and overvoltage protection with externally selectable wiring option which yields latching/non-latching option
- Non-latching reset interval is externally programmable by choosing a capacitor to select the time constant.
- Capability of external synch for switching frequencies
- Built-in test capability with T^2L interface
- "S" level configuration available

Specifications

INPUT:

Model	$V_{in\ nom}$	Voltage range
3031	28 VDC	16~50 VDC
3041	270 VDC	200~335 VDC
3051	120 VDC	86~158 VDC

OUTPUT: Voltage & Current (see chart)
REGULATION: (see chart)
RIPPLE: 50 mV peak-to-peak, typical
ISOLATION:
  Input to case: 500 VDC
  Input to output: 500 VDC
ENVIRONMENT:
  Full power from - 55°C to +85°C T_{case}
  Linearly derates to zero from 85°C to 115°C
  Storage temperature: -55°C to +150°C
  Shock: 50G
  Acceleration: 500G
  Vibration: 30G
WEIGHT: 125 grams
DIMENSIONS: 2.6" x 2.7" x 0.495"

OPTIONS:	non-screened
Model #-M	non-RAD High Rel
Model #-E	125°C military
Model #-L	50K RAD
Model #-R	100K RAD
Model #-S	space grade

SINGLE OUTPUT DEVICES

		3031R,3041R,3051R-S03.3			3031R,3041R,3051R-S05			3031R,3041R,3051R-S05.2		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	—	+3.2	+3.3	+3.4	+4.9	+5.0	+5.1	-5.1	-5.2	-5.3
Output Current	$V_{in\ min}$ — $V_{in\ max}$	—	—	15A	—	—	15A	—	—	15A
Efficiency	P_{out} = Max Rated Load	65%	69%	—	72%	75%	—	72%	75%	—
Line Regulation	P_{out} = Max Rated Load $V_{in\ min}$ — $V_{in\ max}$	—	7mV	20mV	—	7mV	20mV	—	10mV	20mV
Load Regulation	P_{out} = 10% to Full Load	—	5mV	20mV	—	5mV	20mV	—	10mV	20mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	50	—	30	50	—	30	65

SINGLE OUTPUT DEVICES

		3031R,3041R,3051R-S12			3031R,3041R,3051R-S15			3031R,3041R,3051R-S28		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	—	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1	+27.8	+28.0	+28.2
Output Current	$V_{in\ min}$ — $V_{in\ max}$	—	—	6.25A	—	—	5A	—	—	2.5A
Efficiency	P_{out} = Max Rated Load	80%	82%	—	81%	83%	—	82%	84%	—
Line Regulation	P_{out} = Max Rated Load $V_{in\ min}$ — $V_{in\ max}$	—	10mV	20mV	—	10mV	20mV	—	10mV	20mV
Load Regulation	P_{out} = 10% to Full Load	—	10mV	20mV	—	10mV	20mV	—	10mV	20mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	30	65	—	30	65	—	30	65

DUAL OUTPUT DEVICES

		3031R,3041R,3051R-D05			3031R,3041R,3051R-D12			3031R,3041R,3051R-D15		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output Current*	$V_{in\ min}$ — $V_{in\ max}$	266mA	—	7.5A	158mA	—	3.1A	127mA	—	2.5A
Efficiency	P_{out} = Max Rated Load	72%	75%	—	81%	84%	—	82%	85%	—
Line Regulation	P_{out} = Max Rated Load $V_{in\ min}$ — $V_{in\ max}$	—	10mV	25mV	—	10mV	25mV	—	10mV	25mV
Load Regulation†	P_{out} = 10% to Full Load	—	20mV	50mV	—	20mV	50mV	—	20mV	50mV
Output Ripple	Full Load BW 2 MHz mV_{P-P}	—	50	85	—	50	85	—	50	85

Notes: * Up to 90% full power available from either output if total rated power is not exceeded; † Balanced load conditions.

TRIPLE OUTPUT DEVICES

			3031R,3041R,3051R-T12			3031R,3041R,3051R-T15		
PARAMETER	CONDITION		MIN	TYP	MAX	MIN	TYP	MAX
Output Voltage	$+I_{out} = -I_{out}$	MAIN	+4.9	+5.0	+5.1	+4.9	+5.0	+5.1
		DUAL	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1
		DUAL	-11.9	-12.0	-12.1	-14.9	-15.0	-15.1
Output Current	$V_{in\ min}$ — $V_{in\ max}$	MAIN	90mA	—	5A	90mA	—	5A
		DUAL	40mA	—	±750mA	32mA	—	±750mA
Efficiency	P_{out} = Max Rated Load		74%	76%	—	74%	76%	—
Line Regulation	P_{out} = Max Rated Load $V_{in\ min}$ — $V_{in\ max}$	MAIN	—	0.1%	0.2%	—	0.1%	0.2%
		DUAL	—	0.25%	0.4%	—	0.25%	0.4%
Load Regulation	P_{out} = 10% to Full Load	MAIN	—	0.2%	0.4%	—	0.2%	0.4%
		DUAL	—	0.25%	0.4%	—	0.25%	0.4%
Output Ripple	Full Load BW 2 MHz mV_{P-P}	MAIN	—	—	80	—	—	80
		DUAL	—	—	30	—	—	30

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10 & 20 Watt

DC-DC REGULATED CONVERTERS

SERIES 2639 & 2649

Features

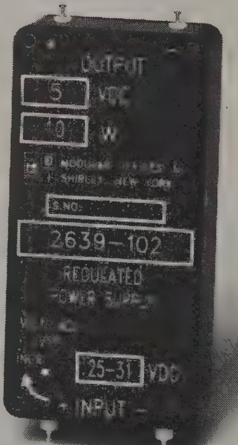
- Available in single & dual output
- 1.56 watts/cubic inch (#2639)
- 2.78 watts/cubic inch (#2649)
- Silicon rubber encapsulation
- Environmentally rugged for military application
- Operates down to zero load

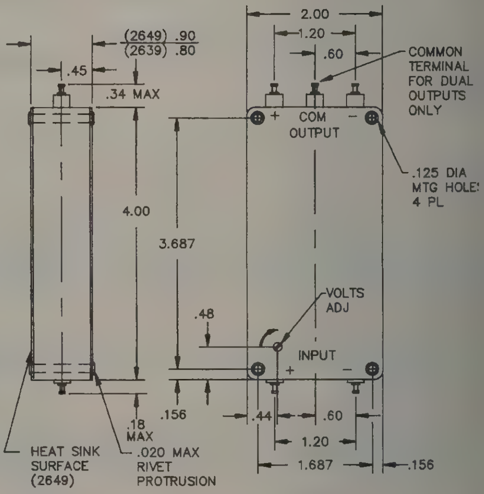
Specifications

INPUT:
  28VDC nominal
  Range: 22 to 40 VDC cont.
  50VDC for 1 second maximum
  Reverse polarity protected to 50VDC
  Current (#2639):
    530 mA typical at full load
  Current (#2649):
    1020 mA typical at full load
OUTPUT:
  Voltage and Current (see chart)
  Voltage Adjustment: ±10% at full load
MINIMUM LOAD: zero
REGULATION: (see chart)
RIPPLE: (see chart)
  Frequency: 150KHz ± 20%
PROTECTION: Short circuit protection by current limit.
ISOLATION:
  Input to case: 500 VDC
  Input to output: 1000 VDC
ENVIRONMENT:
  Operating temperature:
    - 55°C ambient to +100°C case
  Storage temperature:
    - 55°C to +150°C
  Case rise 30°C typical at full load
  Meets or exceeds MIL-E-5400
EMI: add “E” to model number to specify an imbedded MIL-STD-461 EMI filter that meets CE01, CE03, CE07, CS01 and CS02 requirements
MECHANICAL:
  Dimensions (#2639): 4" x 2" x 0.8"
  Dimensions (#2649): 4" x 2" x 0.9"
  Terminals: turret solder type
  Case: extruded aluminum with black anodized finish
  Encapsulation: RTV silicon rubber
  Weight (#2639): 9.6 ounces
  Weight (#2649); 11 ounces

Series Specifications

Model Number 2639- 2649-	Output Voltage VDC nominal	OutputCurrent mA max.		Output Ripple $V_{p\text{-}p}$ max.	REGULATION, VDC		
		2639	2649		Line V_{in} 22~40 VDC max.	10~100% max.	-55°~100°C typ.
101	2	3750	7500	.040	.008	.150	.075
102	5	2000	4000	.030	.008	.100	.075
103	7.5	1300	2600	.045	.012	.100	.112
104	10	1000	2000	.040	.015	.100	.150
126	12	830	1660	.035	.020	.12	.18
105	15	670	1330	.045	.022	.15	.225
106	30	330	670	.060	.030	.25	.450
107	50	200	400	.050	.050	.5	.750
108	75	130	260	.075	.075	.75	1.13
109	100	100	200	.100	1.0	1.0	1.5
110	150	67	130	.150	1.5	1.5	2.25
111	300	33	67	.30	3.0	3.0	4.50
120	±12	±416	±830	.035	.15	.12	.18
121	±15	±333	±666	.030	.22	.15	.225
122	±25	±200	±400	.050	.30	.25	.38
123	±50	±100	±200	.100	.50	.50	.75
124	±100	±50	±100	.100	1.0	1.00	1.5


OUTPUT
5 VDC
10 W
S.NO.
2639-102
REGULATED POWER SUPPLY
25-31 VDC
INPUT


(2649) .90
(2639) .80
.45
.34 MAX
4.00
3.687
.48
.18 MAX
.156
HEAT SINK SURFACE (2649)
.020 MAX RIVET PROTRUSION
2.00
1.20
.60
COMMON TERMINAL FOR DUAL OUTPUTS ONLY
+ COM −
OUTPUT
.125 DIA MTG HOLE: 4 PL
VOLTS ADJ
INPUT
+ −
.44
.60
1.20
1.687
.156

NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE ±.020.
2. FLUSH MOUNT FOR 20 WATT VERSIONS.

We can meet your custom converter requirements.

MODULAR DEVICES INC

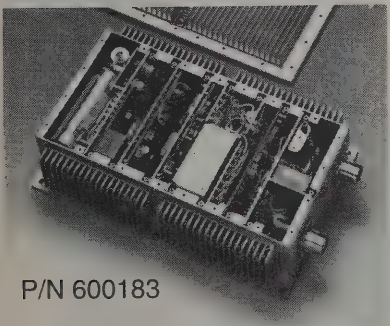
BROOKHAVEN R&D PLAZA • ONE RONED ROAD • SHIRLEY, NEW YORK 11967
TEL 516-345-3100 • FAX 516-345-3106

Plasma
DISPLAY POWER SUPPLIES

Series Specifications

P/N	INPUT VOLTAGE	OUTPUT VOLTAGES / OUTPUT CURRENTS								DIMENSIONS EXCLUDING CONNECTOR LxWxH (inches)	REMARKS
		+5V	-5V	+12V	-12V	+13V	+55V	+70V	135V / OTHER		
600057	115V; 50/60 Hz	10A*	—	400MA	60MA	—	1A	—	+133V; 900MA*	10.5 x 9.5 x 2.0	Commercial flange mount.
600046	115V; 50/60 Hz	8A*	—	250MA	250MA	—	270MA	—	+133V; 300MA*	10.0 x 6.0 x 2.0	Hi-reliability shipbrd MIL-STD-1399 POWER.
600187	115V; 50/60 Hz	—	—	—	—	—	200MA	—	+133V; 120MA*	7.0 x 4.0 x 1.5	Low-cost commercial.
600183	115V; 50/60 Hz	10A	500MA	—	—	250MA	—	250MA	115-135V; 200MA*	11.2 x 7.18 x 3.8	Drip-proof, multi-svc environment, remote programming.
600036	115/230V; 50/60 Hz	10A*	—	1A	—	—	1A	—	+136V; 900MA	12.0 x 9.0 x 2.5	Shipbrd application MIL-STD-1399 POWER.
600031	115/230V; 50/60 Hz	4A*	—	500MA	—	—	150MA	—	+133V; 100MA*	8.5 x 1.91 x 4.6	EMI feed through terminal outputs.
600045	115/230V; 50/60 Hz	4A*	—	500MA	—	—	150MA	—	+133V; 100MA*	8.5 x 1.62 x 4.0	Multiple side adjustments.
600185	8-18 VDC	—	—	—	—	—	—	—	+95V 210MA	6.5 x 3.35 x 0.63	Low-cost, low-profile board level, commercial.
600189	115V; 47-500 Hz	10A*	—	400MA	60MA	—	1A	—	+136V; 900MA*	9.5 x 9.0 x 2.0	Military.
600184	28 VDC	10A	500MA	—	—	250MA	—	250MA	115-135V; 200MA*	11.2 x 7.18 x 3.8	Drip-proof, multi-svc environment, remote programming.
600186	115/230 VAC or 200 VDC	—	—	150MA	—	—	—	—	+95V; 200MA*	6.5 x 3.66 x 0.35	Low-cost, low profile board level, commercial.

(*) *Denotes adjustable*



P/N 600183

Options:

- ☐ Radiation hardened
- ☐ Military environment required
- ☐ MIL STD 461 RFI/EMI
- ☐ MIL STD 2000
- ☐ Short circuit protection
- ☐ Overvoltage protection
- ☐ Inhibit function
- ☐ BIT
- ☐ Remote sensing
- ☐ Sync capability
- ☐ Reverse polarity protection
- ☐ Hold-up
- ☐ Input/Output connectorization

We can meet your custom requirements.

MODULAR DEVICES INC

BROOKHAVEN R&D PLAZA • ONE RONED ROAD • SHIRLEY, NEW YORK 11967
TEL 516-345-3100 • FAX 516-345-3106

2 Watt High-Volt

DC-DC ADJUSTABLE CONVERTERS

SERIES 2682

Features

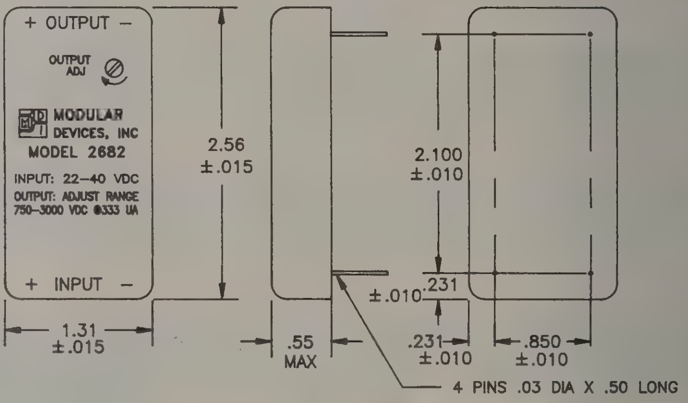
- Miniature package designed for board mounting
- Excellent line and load regulation
- Adjustable over a 4:1 range
- Encapsulated for environmental resistance
- Either output may be grounded (please specify)

Specifications

INPUT:
28VDC nominal
Range: 20 to 40 VDC
Survives 80 V transients
OUTPUT:
Voltage and Current (see chart)
REGULATION: (see chart)
RIPPLE: 1% p-p typ. (see chart)
ISOLATION:
Input to case: 1000 VDC
Input to output: 4000 VDC
ENVIRONMENT:
Operating Temperature
Full Power: -55°C to +85°C
Storage: -55°C to +150°C
Shock: 50g
Acceleration: 500g
MECHANICAL:
Dimensions: 2.56" x 1.31" x 0.55"
Terminals: 0.03" x 0.5"
Case: aluminum
Weight: 55 grams

SPECIFICATIONS

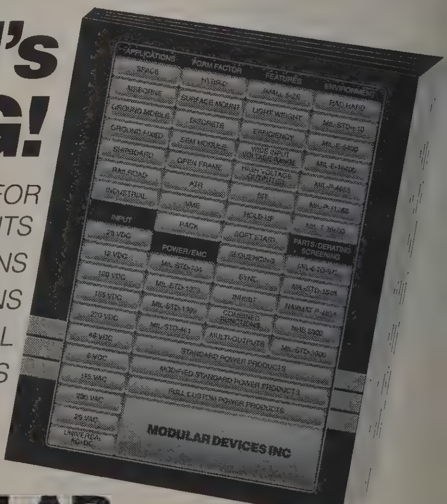
MODEL NUMBER 2682	OUTPUT VOLTAGE DC	OUTPUT CURRENT MAX.	OUTPUT RIPPLE V_{P-P} MAX.	REGULATION LINE	REGULATION LOAD
102	500	4.00	4.0	0.3%	0.3%
103	750	2.66	5.0	0.3%	0.3%
104	1000	2.00	7.5	0.3%	0.3%
105	1500	1.33	10.0	0.3%	0.3%
106	2000	1.00	15.0	0.3%	0.3%
107	3000	0.66	20.0	0.3%	0.3%


+ OUTPUT –
OUTPUT ADJ
MODULAR DEVICES, INC
MODEL 2682
INPUT: 22–40 VDC
OUTPUT: ADJUST RANGE 750–3000 VDC @333 UA
+ INPUT –
2.56 ±.015
1.31 ±.015
.55 MAX
2.100 ±.010
±.010 .231
.231 ±.010
.850 ±.010
4 PINS .03 DIA X .50 LONG

Call or write for MDI's NEW CATALOG!

- DC-DC CONVERTERS & POWER SUPPLIES DESIGNED FOR THE MOST DEMANDING REQUIREMENTS
- MILITARY, SPACE OR INDUSTRIAL APPLICATIONS
- HIGH REL HYBRID AND DISCRETE VERSIONS
- RADIATION HARDENED OPTIONAL
- THOUSANDS OF STANDARD, MODIFIED & CUSTOM UNITS

We can meet your custom converter requirements.


APPLICATIONS
FORM FACTOR
FEATURES
ENVIRONMENT
INPUT
POWER/EMC
PARTS/DERATING SCREENING
STANDARD POWER PRODUCTS
MODIFIED STANDARD POWER PRODUCTS
FULL CUSTOM POWER PRODUCTS
MODULAR DEVICES INC

MODULAR DEVICES INC

BROOKHAVEN R&D PLAZA • ONE RONED ROAD • SHIRLEY, NEW YORK 11967
TEL 1-800-333-POWR • FAX 516-345-3106

MODUPOWER by SEMTECH
652 Mitchell Rd., Newbury Park, CA 91320
Phone: 805-498-2111 Fax: 805-498-3804

FILTERED DC/DC CONVERTERS

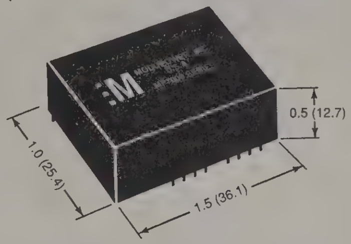
DO YOU NEED 3.3 VOLTS AND A WIDE-RANGE-INPUT DC/DC CONVERTER, TOO?

The MP7101 converts 5V to 3.3V: the MP7008 converts 7-35V to 3.3V

THE MP7101 5V TO 3.3V CONVERTER/REGULATOR IS HASSLE-FREE. This non-isolated converter requires no external filters and does not generate EMI or spikes. It includes short-circuit protection and thermal shutdown.

Vout: 3.3V ± 5%
Load Regulation: 0.3%
Iout: 1A continuous

Vin Range: 4.5V to 10V
Output Noise: 0.1mV(rms)
T(operating): -25°C/+85°C



MP7xxx and MP7101 Dimensions

These modules are a high-efficiency means of providing a regulated output from raw DC or DC/DC conversion. They are non-isolated, and have pulse-by-pulse current limiting and thermal shutdown. A logic-level ON/OFF control is also provided.

The MP7xxx series accepts 7-35V, and gives fixed and adjustable outputs

Part #	Vin Range V	Vout NOM. V	Iq mA	Eff min %	Ripple +Noise mVpp
MP7001	7-35	5.00	15	82	50
MP7003	14-35	12.00	15	88	100
MP7004	17-35	15.00	20	92	100
MP7008	7-35	3.3	20	80	50
MP7009	7-35	ADJ*	20	80	100

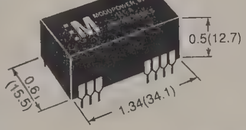
All Devices: Current Limit = 3.2A; I (standby) = 0.5mA; Input Ripple = 200mV;
*ADJ range is 1.33V to 30V; Vout is within approximately ± 5%.

DO YOU NEED AN ISOLATED DC/DC CONVERTER?

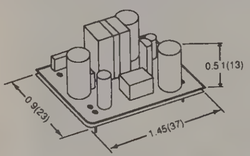
MP9xxx SERIES CONVERTERS NEED NO FILTERS AND PRODUCE NO NOISE. They mount on PC boards and have very low height requirements. The MP90xx, 91xx, 92xx, and 93xx are particularly low-cost modules. The MP90xx and 92xx use a 24-pin dual-in-line package, while the MP91xx is unpotted.

MP9xxx Series Converters are Fully Isolated, Allowing Inverted-Output Operation

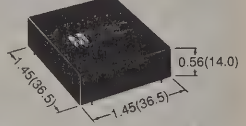
Series	PWR typ W	Isolation V
MP90xx	2	500
MP91xx	1.8	2000
MP92xx	2	2000
MP93xx	2	2000
MP94xx	4-6	500
MP96xx	20	500



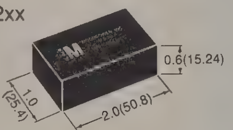
MP90xx & MP92xx



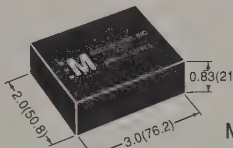
MP91xx



MP93xx



MP94xx



MP96xx

All Devices: Load regulation = ± 0.5%; T (oper) = 0°C/70°C (MP96xx is -20°C/+105°C);
MP94xx case is metal: all others are non-metallic; Short-circuit protected; Input and output filters (C, LC, or Pi)

Part #	Vin V	Vout V	Iout mA
MP9001	5	5	220
MP9002	5	9	200
MP9003	5	12	160
MP9004	5	15	100
MP9006	5	24	60
MP9011	12	5	220
MP9012	12	9	200
MP9013	12	12	160
MP9014	12	15	100
MP9016	12	24	60
MP9053	5	±12	±60
MP9054	5	±15	±40
MP9063	12	±12	±60
MP9064	12	±15	±40
MP9102	5	9	200
MP9112	9.4-16	9	200
MP9141	36-72	5	400
MP9201	5	5	220
MP9202	5	9	200
MP9203	5	12	160
MP9204	5	15	100
MP9206	5	24	60
MP9211	12	5	220
MP9212	12	9	200
MP9213	12	12	160
MP9214	12	15	100
MP9216	12	24	60
MP9301	5	5	300
MP9302	5	9	200
MP9303	5	12	140
MP9304	5	15	100
MP9306	5	24	80
MP9311	9.4-18	5	300
MP9312	9.4-18	9	200
MP9313	9.4-18	12	140
MP9314	9.4-18	15	100
MP9316	9.4-18	24	80
MP9321	20-30	5	300
MP9322	20-30	9	200
MP9323	20-30	12	140
MP9324	20-30	15	100
MP9326	20-30	24	80
MP9341	36-72	5	300
MP9343	36-72	12	200
MP9344	36-72	15	200
MP9394	36-72	±15	±50
MP9401	5	5	800
MP9403	5	12	500
MP9404	5	15	300
MP9406	5	24	250
MP9411	12	5	800
MP9413	12	12	500
MP9414	12	15	300
MP9416	12	24	250
MP9431	24	5	800
MP9433	24	12	500
MP9434	24	15	300
MP9436	24	24	250
MP9441	36-72	5	800
MP9443	36-72	12	500
MP9444	36-72	15	400
MP9453	5	±12	±200
MP9454	5	±15	±150
MP9456	5	±24	±120
MP9463	12	±12	±200
MP9464	12	±15	±150
MP9466	12	±24	±120
MP9483	24	±12	±200
MP9484	24	±15	±150
MP9486	24	±24	±120
MP9493	36-72	±12	±250
MP9494	36-72	±15	±150
MP9611	9-18	5	4000
MP9613	9-18	12	1600
MP9614	9-18	15	1300
MP9616	9-18	24	800
MP9631	18-36	5	4000
MP9633	18-36	12	1600
MP9634	18-36	15	1300
MP9636	18-36	24	800
MP9641	36-72	5	4000
MP9643	36-72	12	1600
MP9644	36-72	15	1300
MP9646	36-72	24	800
MP9661	9-18	±5	±2000
MP9663	9-18	±12	±800
MP9664	9-18	±15	±850
MP9666	9-18	±24	±400
MP9681	18-36	±5	±2000
MP9683	18-36	±12	±800
MP9684	18-36	±15	±650
MP9686	18-36	±24	±400
MP9691	36-72	±5	±2000
MP9693	36-72	±12	±800
MP9694	36-72	±15	±650

MPC/ DIVISION OF CONSULTING SYSTEMS

538 MAIN STREET
DANVILLE, NH 03819
603-642-5913
FAX 603-642-5913 1-800-238-8360

MODULAR POWER CONVERTERS

AC
AC
MODULAR POWER CONVERTERS
MODEL NO.
MPC15D100
DANVILLE, N.H.
MADE IN U.S.A.
−
COM
+

FEATURES

- EXCELLENT REGULATION
- HIGH QUALITY QC/QA TO YOUR PROGRAM
- ENCAPSULATED MODULES
- ENVIRONMENT RESISTANT
- COST EFFECTIVE
- DELIVERY FROM STOCK
- OPTIONS AVAILABLE

	SUFFIX	PRICE ADDER
220 Vac Input	E	$5.00
240 Vac Input	K	5.00
100 Vac Input	J	5.00
2.0″ Input Pin Configuration	A	None
Chassis mounting with right angle barrier strip *	RCM	10.00
Chassis mounting with straight barrier strip	SCM	10.00
Chassis mounting with top mount barrier strip	TCM	20.00

* This option is recommended only for mounting on non-conductive surfaces.

SELECTION GUIDE

	SINGLE OUTPUT UNITS				DUAL OUTPUT UNITS						TRIPLE
MODEL (E Vdc) 1(mA) Case	MPC5S250 5 250 A	MPC5S500 5 500 A	MPC5S1000 5 1000 B	MPC5S2000 5 2000 C	MPC15D100 15 100 A	MPC12D100 12 100 A	MPC15D200 15 200 B	MPC12D200 12 200 B	MPC15D300 15 300 C	MPC12D300 12 300 C	MPC5S500 /15D100 C
				UNIT PRICES ($) F.O.B. DANVILLE, NH 03819 USA							
1-4	42.00	47.00	55.00	69.00	48.00	50.00	56.00	60.00	65.00	67.00	85.00
5-9	39.00	45.00	53.00	65.00	45.00	48.00	54.00	56.00	62.00	63.00	80.00
10-99	35.00	40.00	46.00	57.00	41.00	42.00	47.00	50.00	54.00	56.00	71.00
100-499	32.00	36.00	42.00	51.00	37.00	39.00	43.00	45.00	49.00	50.00	63.00
500-999	29.00	32.00	37.00	45.00	34.00	34.00	39.00	40.00	44.00	45.00	56.00
1000 & UP	27.00	30.00	35.00	42.00	32.00	32.00	37.00	37.00	42.00	42.00	52.00

ELECTRICAL SPECIFICATIONS

TYPICAL AT 25°C UNLESS OTHERWISE SPECIFIED

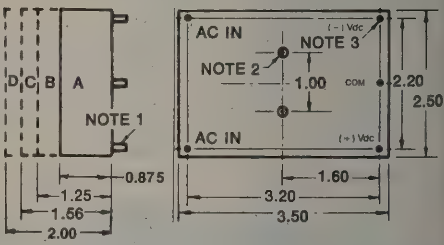
INPUT	
VOLTAGE	105 to 125 Vac
FREQUENCY	50 to 440 Hz
OUTPUT	
FIXED VOLTAGE (Vdc)	1% Max.
LINE REGULATION	0.05%
LOAD REGULATION (5 Vdc Models)	0.2%
LOAD REGULATION (Dual Models)	0.05%
RIPPLE & NOISE (PARD)	1mV RMS Max.
OVERVOLTAGE PROTECTION on 5Vdc Models Only	Set for 6.5 Vdc
SHORT CIRCUIT PROTECTED	Continuous
ENVIRONMENT	
OPERATING	−25°C to +71°C
STORAGE	−25°C to +85°C
TEMPERATURE COEFFICIENT	0.02%/°C
WARM-UP DRIFT	0.25% after 15 minutes

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

MPC designs power converters, including DC to DC converters to exact requirements when they differ from standard specifications.

Please send MPC your specifications for a fast response.

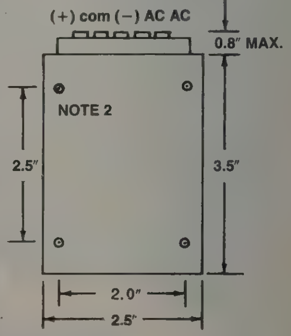
MECHANICAL SPECIFICATIONS



SINGLE AND DUAL

NOTES:
1. Gold Plated 0.040 Dia 0.20 Lg Min
2. Mounting Inserts 4-40 0.10 Lg Min
3. Single Output Models No Connection
4. All Dimensions in Inches

TOP VIEW (SCM)
BOTTOM VIEW (RCM)



CHASSIS MOUNTING WITH TERMINAL BARRIER STRIP

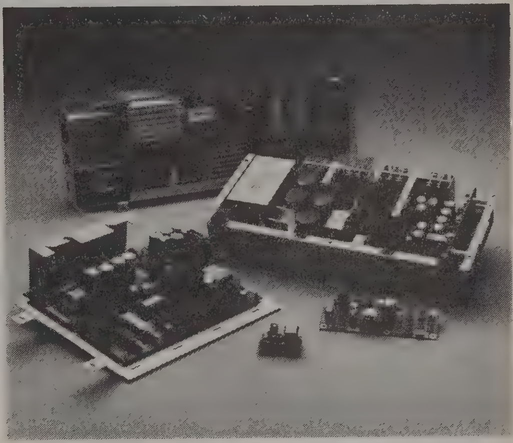
MultiPower, Inc.

YOUR POWER SUPPLY PARTNER

A Spectrum Electronics Corporation

Custom Switching Power Supplies
3 Watts Single Output To 2000 Watts And Over 20 Outputs

TYPICAL POWER ASSEMBLIES



FEATURES:

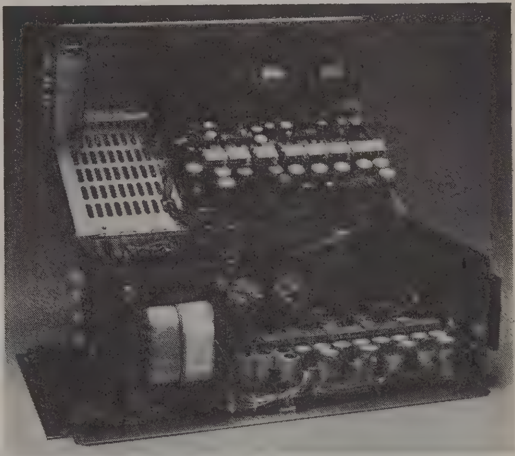
- POWER FACTOR CORRECTION
- BATTERY BACK-UP
- INTERGRATED HV/ LV DESIGNS
- CUSTOM PACKAGING
- SURFACE MOUNT APPLICATIONS

APPLICATIONS

- MEDICAL
- TEST AND MEASUREMENT
- FLAT—SCREEN TECHNOLOGY
- COMMUNICATIONS
- SPECIALTY COMPUTER
- INDUSTRIAL AND ROBOTICS

MultiPower, Inc.'s Switching Power Supplies Are Custom Engineered For OEM's:

- DESIGNS ACCOMMODATING A WIDE RANGE OF VOLTAGE AND WATTAGE REQUIREMENTS
- SHORTENED LEAD TIMES FROM QUOTES TO PROTOTYPES
- MAGNETIC DESIGN AND MANUFACTURING IN-HOUSE
- COMPLY WITH DOMESTIC AND INTERNATIONAL EMI/RFI REGULATIONS AND MIL-STD
- LOW LEAKAGE SWITCHING SUPPLIES DO NOT REQUIRE HEAVY ISOLATION
- SAFETY AND REGULATORY CERTIFICATION STAFF IN-HOUSE UL / CSA / TUV / IEC / FCC
- QUICK TURN QUOTES AND PROTOTYPES



REPRESENTATIVE PRODUCTS DESIGNED AND MANUFACTURED BY MPI

MODEL	REGULATED WATTS	REGULATED OUTPUTS	TYPE	APPLICATION	FEATURES
MP29-6	29	6	DC-DC	E-L SCREEN	MINIATURIZED
MP151-7	150	7	12 VDC/OFF-LINE	DATA LOGGING	AC MAINS GR 12 VDC INPUT
MP350-1	350	5	OFF-LINE	TEST AND MEASUREMENT	EXTENSIVE FUNCTIONAL MONITORING
MP589-6	589	6	OFF-LINE	LINE PRINTER	HIGH POWER: AUTO RANGE SELECT
MP1350-21	1350	21	OFF-LINE	MEDICAL	21 LOW RIPPLE ISOLATED SUPPLIES

ALL PRODUCTS ARE CERTIFIED TO APPROPRIATE DOMESTIC AND INTERNATIONAL REGULATORY STANDARDS.

OUR OBJECTIVE AT MULTIPOWER IS TO SERVE AS AN EXTENSION OF YOUR ENGINEERING GROUP THROUGH A CLOSE WORKING RELATIONSHIP—FROM PRODUCT SPECIFICATION THROUGH PRODUCTION.

CALL US FOR CONSULTATION. LET US SEND YOU OUR POWER SUPPLY SPECIFICATION FORM TO ASSIST IN DESIGNING YOUR OPTIMUM POWER SUPPLY.

3005 S.W. 154th TERRACE, BEAVERTON, OREGON 97006 • (503) 646-4700 • FAX (503) 643-4889

Multi Products International

250 Lackawanna Ave., West Paterson, New Jersey 07424
(201) 890-1344 • Telex 219289 • FAX 201-890-1677

Adapters

Multi Products International has been designing and manufacturing adapters for many years and today has one of the finest and most complete lines in the industry. Our expertise has led to the development of many innovations for custom use that have now become standards. Typical applications are for use with computer peripheral equipment, modems, medical electronics, office equipment, home appliances and other items which require a low voltage external power source.

Our adapters are designed to and/or listed by UL-CSA-VDE-CEE as required. Outputs are 3-24V AC or DC up to 40 VA. A large inventory is always on hand. In addition to the listed items, we can design and manufacture to meet your exact requirements.

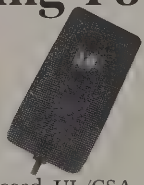
WALL PLUG-IN

NUMBER	OUTPUT		CASE
	VOLTAGE	MILLIAMPS	
W35D*-E500-2/1 (5/1)	6.0	500	35
W41D-E900-2/1 (5/1)	6.0	900	41
W41D-E1200-2/1 (5/1)	6.0	1200	41
W41D-G800-2/1 (5/1)	7.5	800	41
W35D-H300-2/1 (5/1)	9.0	300	35
W41D-H600-2/1 (5/1)	9.0	600	41
W48D-H1000-2/1 (5/1)	9.0	1000	48
W41D-J500-2/1 (5/1)	12.0	500	41
W48D-J1000-2/1 (5/1)	12.0	1000	48
W57D-J1300-2/1 (5/1)	12.0	1300	57
W35D-L200-2/1 (5/1)	15.0	200	35
W41D-L400-2/1 (5/1)	15.0	400	41
W48D-L900-2/1 (5/1)	15.0	900	48
W57D-L1200-2/1 (5/1)	15.0	1200	57
W48D-Q500-2/1 (5/1)	24.0	500	48
W57D-Q900-2/1 (5/1)	24.0	900	57
W41A*-O8800-2/1 (5/1)	8.0	800	41
W41A-G1000-2/1 (5/1)	8.0	1000	41
W41A-O9600-2/1 (5/1)	9.0	600	41
W41A-J700-2/1 (5/1)	12.0	700	41
W57A-M1750-A6/1	16.5CT	1750	57
W41A-N500-2/1 (5/1)	18.0	500	41
W57A-N2220-A6/1	18.0CT	2220	57
W48A-Q700-2/1 (5/1)	24.0	700	48
TABLE TOP			
T57A-L1168-A6/1	15.0CT	1168	57
T57A-M1750-A6/1	16.5CT	1750	57
T57A-N1900-A6/1	18.0CT	1900	57
T57A-N2200-A6/1	18.0CT	2200	57

	AC/AC (mm)			AC/DC (mm)		
CASE	W	L	H	W	L	H
W35	45.0	45.0	40.0	40.0	57.0	36.0
W41	50.6	50.6	43.0	50.6	60.0	39.0
W48	60.0	58.0	47.7	61.5	66.1	47.0
W57	69.0	67.0	53.8	69.5	81.5	54.0
T57	68.2	85.2	55.4	68.2	85.2	55.4

* "A", "D" following case size designates AC or DC output

External Switching Power



When size & weight are critical, use our external switching power supplies. Available in table top configurations—up to 40 Watts. Configurations include single, double and triple outputs of +5, +/-12 and +/-15 VDC. All of these units are made to meet or exceed UL/CSA and VDE standards, providing higher capabilities in small, off the board packages. Custom design switching power supplies are also available in a variety of low profile and output ratings.

Regulated Single Output Power Supplies

Multi Products manufactures a large variety of regulated single output power supplies. Our power supplies are designed to and/or listed by UL-CSA-VDE-TUV as required. This allows the end user the convenience of incorporating our supplies into the final product, thus avoiding the costly and complicated agency approval process.

Below is a partial list of our single output models and general specifications. Call for options & sizes.

TABLE TOP

CATALOG NO.	SINGLE OUTPUT		
	VOLTAGE (DC)	MILLIAMPS	LxWxH (mm's)
T48R-05750-G/1	+5	750	81x55x49
T48R-05900-G/1	+5	900	81x55x49
T66R-052300-G/1	+5	2300	150x80x72
T66R-053000-G/1	+5	3000	150x80x72
T60R-H1500-G/1	+9	1500	120x78x65
T60R-J1200-G/1	+12	1200	120x78x65
T66R-N833-G/1	+18	833	150x80x72
T66R-Q625-G/1	+24	625	150x80x72
T48R-T100-G/1	+48	100	81x55x49
T66R-T315-G/1	+48	315	150x80x72

Regulated Triple Output Power Supplies

Multi Products International has become a major supplier of triple output supplies over the last several years. All of our triple output supplies meet or exceed the specifications of applicable safety agencies.

In addition to the products shown, MPI engineers will design custom supplies to meet specific requirements.

WALL PLUG-IN

CATALOG NO.	INPUT	OUTPUT 1		OUTPUT 2		OUTPUT 3	
		VDC	mA	VDC	mA	VDC	mA
WA5121000/1	120V RMS ± 10% 60HZ	+5	1000	+12	150	-12	150
WA5151000/1		+5	1000	+15	120	-15	120
WA512750/1		+5	750	+12	200	-12	200
WA515750/1		+5	750	+15	160	-15	160
WA512500/1		+5	500	+12	250	-12	250
WA515500/1		+5	500	+15	200	-15	200
TABLE TOP							
*T5121500/1	120V RMS ± 10% 60HZ	+5	1500	+12	100	-12	100
T5121000/1		+5	1000	+12	310	-12	310
T5151000/1		+5	1000	+15	250	-15	250
T512750/1		+5	750	+12	360	-12	360
T515750/1		+5	750	+15	290	-15	290
T512600/1		+5	600	+12	235	-12	235
T512500/1		+5	500	+12	415	-12	415
T515500/1		+5	500	+15	330	-15	330

*Not UL/CSA Listed

Partial Listings Only Appear On This Page. European Power Supplies and Adapters Also Available. Contact Factory.

INTERNATIONAL

Multi Products International
P.O. Box 737 • 250 Lackawanna Avenue
West Paterson, NJ 07424
(201) 890-1344
FAX (201) 890-1677

Modular Power Subsystem
S6000 SERIES

- ***Up to six DC Supplies in a single 5-1/4 inch inch chassis.***
- ***Configureable with AC supplies and electronic load modules***
- ***Constant Power operating envelope.***
- ***High efficiency design reduces size, weight and waste heat.***
- ***Controllable via IEEE-488.2, MATE/CIIL, SCPI or VXIbus Programmer.***

S6000 POWER SUBSYSTEM
POWER
TALK
LISTEN
REMOTE
OUTPUT

The S6000 Series programmable power supplies are designed for use in Automatic Test Equipment (ATE) requiring a wide variety of programmable sources in a minimum of rack space. The S6000 combines high density packaging with comprehensive selftest and control capability.

More Power and Outputs

Up to six single output (400W) or (200W) DC modules can be installed into a single 5-1/4 inch chassis. Because these modules may be paralleled, a maximum of 2,400 watts is available per chassis. Six additional slave chassis may be controlled from a single control chassis.

Constant Power Design

The DC power modules are "constant power" designs, meaning they can deliver current up to their maximum power rating at any point within their operating envelope. No longer is it necessary to select separate power supplies for high voltage and low voltage requirements. This benefits the overall station design because fewer modules are needed to cover a wider range of UUT requirements.

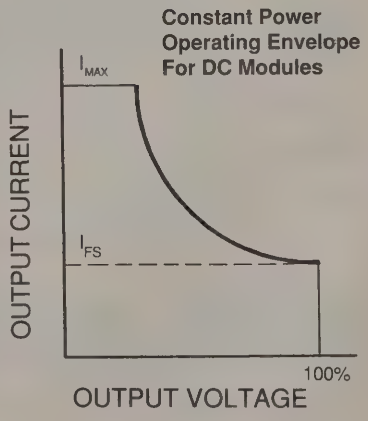
Greater Efficiency

Greater than 80% operating efficiency is achieved using an advanced power conversion design. This means less waste heat, reduced size and weight and improved station reliability due to lower operating temperatures. And if a failure does occur, the internal selftest firmware isolates faults to the module level for ease of maintenance and repair.

DC Module Selection

No. of Outputs	Power per Output	Voltage Range	1 (Max)	1 (FS)
LOW VOLTAGE MODULES				
Single Single	200W 400W	0 to 10 VDC 0 to 10 VDC	30A 60A	20A 40A
MEDIUM VOLTAGE MODULES				
Single Single	200W 400W	0 to 60 VDC 0 to 60 VDC	8A 16A	3.5A 7.0A
HIGH VOLTAGE MODULES				
Single Single	200W 400W	0 to 400 VDC 0 to 400 VDC	3A 4A	0.55A 1.1A
AC MODULE SELECTION				
Single	400VA	0 to 140 VAC 0 to 280 VAC	20A (PK) 10A (PK)	3.3A (RMS) 1.6A (RMS)
LOADS SELECTION				
Single	300W	– 0 to 120 VDC 0 to 400 VDC	– – –	60A 6A 0.6A

Operating Envelope



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Power Supplies

AC to DC Open Frame Switching Power Supplies

Watts	Model	V1	V2	V3	V4	EMI		Safety			Size
		V/A	V/A	V/A	V/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
20W	BPS-203-2	+5V 2A		+12V 0.7A	-12V 0.2A	*		*	*		100x60x30mm 3.9"x2.4"x1.2"
30W	BPS-303-1	+5V 3A	+12V 1A	-12V 0.3A		*		*	*	*	130x70x33mm 5.1"x2.8"x1.3"
40W	BPS-402-1	+5V 3A	+12V 2A			*	*	△	△	*	127x76x33mm 5.0"x3.0"x1.3"
40W	BPS-402-1L	+5V 3A	+12V 2A			*	*	△	△	*	178x51x33mm 7.0"x2.0"x1.3"
40W	BPS-403-1	+5V 3A	+12V 2.0A	-12V 0.2A		*	*	△	△	*	127x76x33mm 5.0"x3.0"x1.3"
45W *1	BPS-454-1	+5V 1A	+12V 0.2A	-12V 0.2A	+24V 2.5A	*	*	*	*	*	185x60x35mm 7.3"x2.4"x1.4"
65W	BPS-653-1	+5V 6A	+12V 2.3A	-12V 0.2A		*		*	*	*	127x76x40mm 5.0"x3.0"x1.6"

Small Size PC and Standard PC Power Supplies

Watts	Model	V1	V2	V3	V4	EMI		Safety			Size
		V/A	V/A	V/A	V/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
60W	BPS-604	+5V 6A	+12V 2.2A	-12V 0.2A	-15V 0.1A	*	*	*	*	*	160x90x40mm 6.3"x3.5"x1.6"
100W	BPS-1004	+5V 10A	+12V 4A	-12V 0.3A	-5V 0.3A	*	*	*	*	*	180x105x55mm 7.1"x4.1"x2.2"
200W	BPS-2004-1	+5V 20A	-5V 0.5A	+12V 8A	-12V 0.5A	*	*	△	△	△	For Tower Case 211x149x150mm 8.3"x5.9"x5.9"
250W	BPS-2504-1	+5V 25A	-5V 0.5A	+12V 9.5A	-12V 0.5A	*	*	*	*	*	
300W	BPS-3004-1	+5V 30A	-5V 0.5A	+12V 15A	-12V 0.5A	*	*	*	*	*	
200W	BPS-2004-2	+5V 20A	-5V 0.5A	+12V 8A	-12V 0.5A	*	*	△	△	△	For Tower Case For Baby Case 165x150x150mm 6.5"x5.9"x5.9"
250W	BPS-2504-2	+5V 25A	-5V 0.5A	+12V 9.5A	-12V 0.5A	*	*	*	*	*	
300W	BPS-3004-2	+5V 30A	-5V 0.5A	+12V 15A	-12V 0.5A	*	*	*	*	*	
200W	BPS-2004-2A	+5V 20A	-5V 0.5A	+12V 8A	-12V 0.5A	*	*	△	△	△	For Tower Case 165x150x150mm 6.5"x5.9"x5.9"
250W	BPS-2504-2A	+5V 25A	-5V 0.5A	+12V 9.5A	-12V 0.5A	*	*	*	*	*	
300W	BPS-3004-2A	+5V 30A	-5V 0.5A	+12V 15A	-12V 0.5A	*	*	*	*	*	
150W	BPS-1504-4	+5V 15A	-5V 0.5A	+12V 5.5A	-12V 0.5A	*	*	△	△	△	For Slim Case 150x140x86mm 5.9"x5.5"x3.4"
200W	BPS-2004-4	+5V 20A	-5V 0.5A	+12V 8A	-12V 0.5A	*	*	△	△	△	
250W	BPS-2504-4	+5V 25A	-5V 0.5A	+12V 9.5A	-12V 0.5A	*	*	*	*	*	
300W	BPS-3004-4	+5V 30A	-5V 0.5A	+12V 15A	-12V 0.5A	*	*	*	*	*	

DC - DC Converters

	Model	Input	Output			Size (L x W x H)
Car Adaptor	BDD-401	11.5V-16V	12V or 15V			110x40x20mm 4.3"x1.6"x0.8"
Car Adaptor with Charger	BDD-401-24C	11.5V-16V	12V or 15V			85x52x20mm 3.3"x2.1"x0.8"
Multiple Outputs DC-DC	BDD-183	8.5V-16.5V	+5V 3A	+12V 0.1A	-23V 0.1A	Per Customer's Specs.
	BDD-185	8.5V-16.5V	+5V 3A	+12V 0.1A	+35V 0.1A	Maximum Size: 80x45x98mm 3.1"x1.8"x0.7"

Remarks: "*" Meet Safety Regulations, "△" Approved, "*1" Specially Designed for Fax Machines

AC-DC Switching Power Adaptor (Wall Mount)

Watts	Model	Output	EMI		Safety			Size
		V/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
10W	BPA-101-5	+5V/1.8A	*		*	*	*	68x49x42mm 2.7"x1.9"x1.7"
	BPA-101-12	+12V/0.83A	*		*	*	*	
20W	BPA-201-12	+12V/1.7A	*		*	*	*	68x49x42mm 2.7"x1.9"x1.7"
48W	BPA-481-12	+12V/4.0A			*	*	*	85x68x56mm 3.3"x2.7"x2.2"

Range +5V to +24V

AC - DC Single Output Switching Power Adaptor

New

Watts	Model	Output	EMI		Safety			Size
		V/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
30W	BPA-301-12	+12V/2.5A	*	*	△	△	△	108x62x38mm 4.3"x2.4"x1.5"
	BPA-301-15	+15V/2.0A	*	*	△	△	△	
	BPA-301-18	+18V/1.7A	*	*	△	△	△	
	BPA-301-24	+24V/1.25A	*	*	△	△	△	
35W	BPA-351-12	+12V/2.9A	*	*	△	△	△	140x60x40mm 5.5"x2.4"x1.6"
	BPA-351-15	+15V/2.3A	*	*	△	△	△	
	BPA-351-18	+18V/1.9A	*	*	△	△	△	
	BPA-351-24	+24V/1.4A	*	*	△	△	△	
50W	BPA-501-12	+12V/4.1A	*	*	△	△	△	166x70x45mm 6.5"x2.8"x1.8"
	BPA-501-15	+15V/3.3A	*	*	△	△	△	
	BPA-501-18	+18V/2.7A	*	*	△	△	△	
	BPA-501-24	+24V/2.1A	*	*	△	△	△	

AC - DC Dual Output Switching Power Adaptor

Watts	Model	Output		EMI		Safety			Size
		V1/A	V2/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
30W	BPA-302-1	+5V/2.5A	+12V/1.5A	*	*	△	△	△	108x62x38mm 4.3"x2.4"x1.5"
35W	BPA-352-1	+5V/3.0A	+12V/1.7A	*	*	△	△	△	140x60x40mm 5.5"x2.4"x1.6"
50W	BPA-502-1	+5V/4.0A	+12V/2.5A	*	*	△	△	△	166x70x45mm 6.5"x2.8"x1.8"

AC - DC Triple Output Switching Power Adaptor

Watts	Model	Output			EMI		Safety			Size
		V1/A	V2/A	V3/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
30W	BPA-303-1	+5V/2.5A	+12V/1.4A	-12V/0.1A	*	*	△	△	△	108x62x38mm 4.3"x2.4"x1.5"
35W	BPA-353-1	+5V/3.0A	+12V/1.5A	-12V/0.2A	*	*	△	△	△	140x60x40mm 5.5"x2.4"x1.6"
50W	BPA-503-1	+5V/4.0A	+12V/2.0A	-12V/0.5A	*	*	△	△	△	166x70x45mm 6.5"x2.8"x1.8"

AC - DC Single Output Switching Power Adaptor with Charger

Watts	Model	Output	EMI		Safety			Size
		V/A	FCC	FTZ	UL	CSA	TUV	(L x W x H)
30W	BPA-351-12C	+12V/2.9A	*	*	△	△	△	140x60x40mm 5.5"x2.4"x1.6"
50W	BPA-501-12C	+12V/4.1A	*	*	*	*	*	166x70x45mm 6.5"x2.8"x1.8"

Range 12V to 24V

AC - DC Dual Outputs Switching Power Adaptor (V2 for Charging Battery)

New

Watts	Model	Output		EMI		Safety			Size
		V1/A	V2	FCC	FTZ	UL	CSA	TUV	(L x W x H)
35W	BPA-352-1C	+15V/3.0A	10-18V	*	*	*	*	*	140x60x40mm 5.5"2.4"1.6"
50W	BPA-502-1C	+15V/4.0A	10-18V	*	*	*	*	*	166x70x45mm 6.5"x2.8"x1.8"

See our Fans, LCD and Keyboard data in the other volumes of EEM.

Asia - Europe - North America

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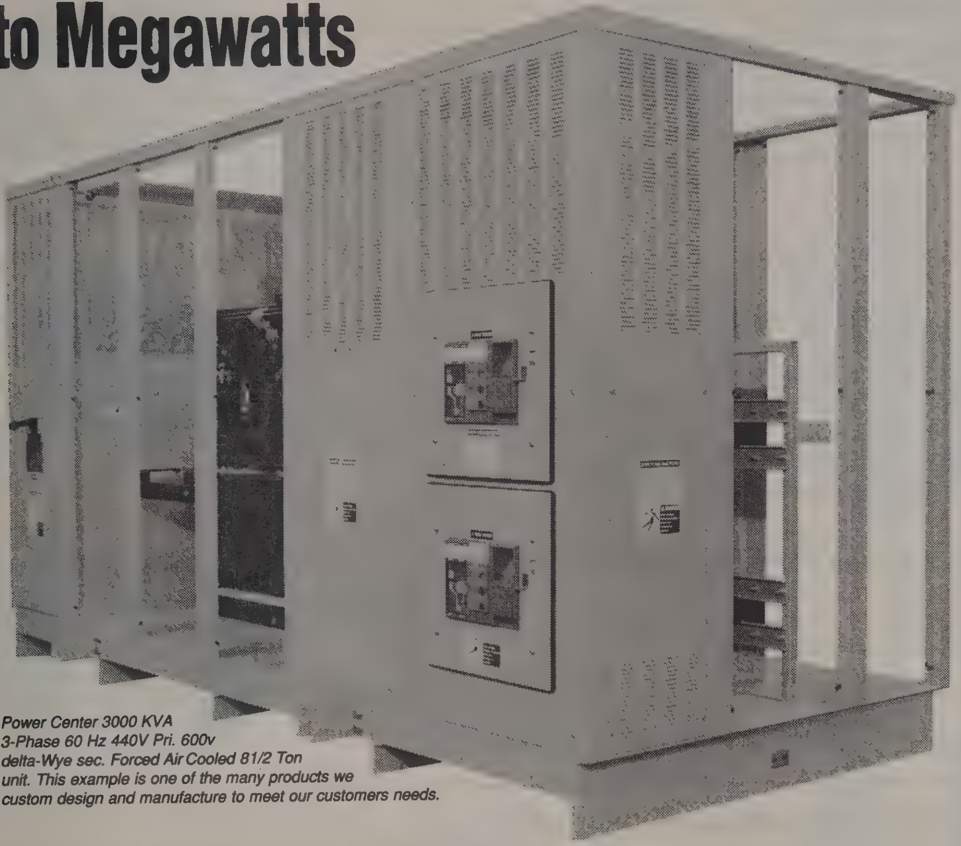

Power Center 3000 KVA 3-Phase 60 Hz 440V Pri. 600v delta-Wye sec. Forced Air Cooled 81/2 Ton unit. This example is one of the many products we custom design and manufacture to meet our customers needs.

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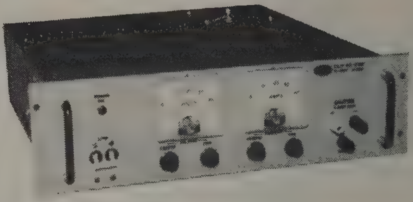
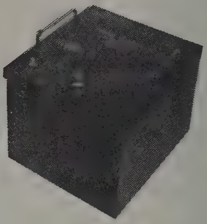
☐ Available in customer specified enclosures.



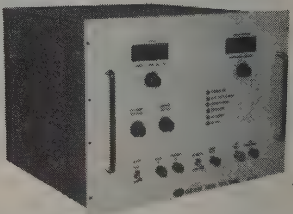
Power Packs–P Series

☐ Output voltage range from 3KV to 100KV.
☐ Output current range from 1mA to 20mA.
☐ Single phase input at customer specified input voltage.
☐ Fixed output polarity or floating pos-neg output.
☐ Oil filled, epoxy filled, or other insulating medium available.
☐ Mounting by ¼-20 mounting studs at bottom of each unit.
☐ Surge limiting resistors.
☐ Estimated life exceeds 30,000 hours at rated voltage and current.
☐ Custom requested features and specifications available.



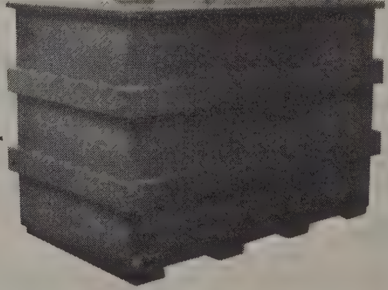
Unregulated High Voltage Power Supplies–DS Series

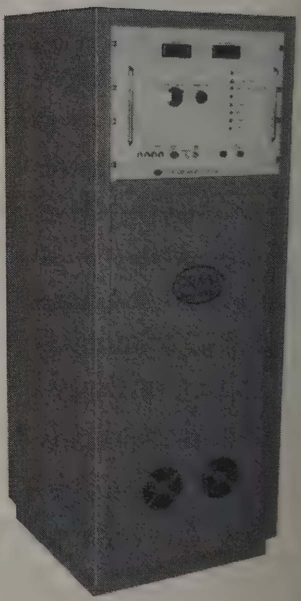
☐ Output voltage range from 1KV to 500KV.
☐ Output current range from 1mA to 50A.
☐ Adjustable overload and overvoltage trip point.
☐ Standard ripple is 2% rms of rated voltage. Ripple reduction of $^1/_{10}$ or $^1/_{100}$ is available as an option.
☐ Standard enclosure is in a rack mount chassis or customer specified.



Regulated High Voltage Power Supplies–DSR Series

☐ Output voltage from 1KV to 500KV.
☐ Output current range from 1 milliampere to 50 amperes.
☐ Regulated power supply with voltage regulation or current regulation or automatic crossover regulation between voltage and current; regulation 1%
☐ Standard is 2% rms of rated voltage. Ripple reduction of $^1/_{10}$ or $^1/_{100}$ available as an option.
☐ Standard enclosure is in a rack mount chassis or customer specified.





Tube Regulated High Voltage Power Supplies–DTR Series

☐ Output voltage from 1KV to 500KV; reversible polarity available as an option.
☐ Output current range from 1 milliampere to 50 amperes.
☐ Standard regulation is ±0.05% for line and load with option for regulation of ±0.01% or ±0.001% for line and load.
☐ Standard ripple is 0.05% with option for ripple of 0.01% or 0.001%
☐ Stability is 0.02% short term and 0.05% per 8 hour period, better stability available.
☐ Standard enclosure is in a rack mount chassis or customer specified.

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P.O. BOX 1176, KLEMP ROAD, DAYTON, TX 77535-1176
Telephone: (409) 258-5553 FAX: (409) 258-5555

Switching Power Supplies–DSF Series

☐ Output power level to 10KW; output voltage to 200KV with higher voltage available, please consult factory.
☐ Precise regulation with automatic crossover between voltage and current regulation.
☐ Standard regulation is ±0.05% for line and load, better regulation available.
☐ Ripple is 0.01% rms (0.1% above 100KV).
☐ Reversible polarity models available.
☐ Remote programming capability.
☐ High efficiency at maximum power output.
☐ Standard enclosure is in a rack mount chassis or customer specified.

ORAM HIGH VOLTAGE

TEST INSTRUMENTS

Liquid Dielectric Testers

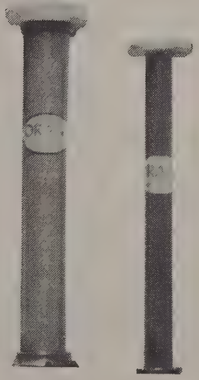
☐ Voltage Range from 50KV to 90KV.
☐ Memory meter to record breakdown voltage.
☐ Automatic motorized rise rate with manual dwell at any voltage.
☐ Accurately test for breakdown voltage of insulation oils in accordance with ASTM specifications.
☐ Customized units Features.

Non-Destructive AC/DC Hipot and Insulation Tester

☐ Selectable AC (15KV) or DC (40KV) output with function indicator.
☐ Audible failure signal.
☐ Continuously adjustable overload sensitivity control from 50µA to 5mA for non-destructive testing.
☐ Gravity operated output shorting solenoid.
☐ Enclosed in either bench top or 19″ rack mount.
☐ Customized units Features.

Resistive Voltage Divider

☐ High input impedance precision resistive divider network.
☐ Wide range of rated voltage, corona free.
☐ Accuracy of 0.5%, 0.25% or 0.1% available.
☐ Portable compact construction with BNC connectors.
☐ Custom division ratios.
☐ Digital or analog meter readout.



Transformers are available with a wide variety of voltage ratings and sizes to suit most customer needs.

☐ High Voltage—air or oil or epoxy insulation.
☐ High Voltage Isolation—air or oil or epoxy insulation.
☐ Filament—isolation with air or oil or epoxy insulation.
☐ High Voltage Filter Chokes.
☐ Saturable Core Reactors.

Transformers features custom designing with customer specified input and output voltage(s). Operation frequency of 60 hertz or 50 hertz or 50/60 hertz or 400 hertz or customer specified operation frequency are available, specify when inquiring.

DC to DC Converters

A broad range of DC/DC Converter products designed to support your company's Networking Applications.
Features : Low Common Mode Noise, Input Filtering, Regulated & Unregulated and Input/Output Isolation.

PCA Part No.	Standard Pkg and Pin Connection	Optional † Pkg and Pin Connection	V in Volts	V in Tolerance (%, Max.)	V out Volts (± 5%)	I out mA (Max.)	Ripple mV P-P (Max.)	Efficiency % (Typ.)	Isolation Vrms	Regulation	Enable
EPC1000P	A1		4-7.5	N/A	9	250	100	73	500	Precision Reg	No
EPC1002P	A2		4-7.5	N/A	9	250	100	73	500	Precision Reg	Active High
EPC1002PS**	A2		4-7.5	N/A	9	250	100	73	500	Precision Reg	Active High
EPC1005P	A1		7.5-15	N/A	9	250	100	73	500	Precision Reg	No
EPC1006	C1		3.5-7.0	N/A	24.25	20	N/A	65		Precision Reg	No
EPC1007H	E1	E1-G, F2	5	N/A	9	200	100	75	2000	Unregulated	No
EPC1007P	E	E-G, F2, See √	5	N/A	9	200	100	75	500	Unregulated	No
EPC1008H	E1	E1-G, F2	12	N/A	9	200	100	75	2000	Unregulated	No
EPC1008P	E	E-G, F2, See √	12	N/A	9	200	100	75	500	Unregulated	No
EPC1010	D1		10-40	N/A	5	400	N/A	80		Precision Reg	No
EPC1011	D1		10-40	N/A	6	350	N/A	80		Precision Reg	No
EPC1012H	E6		12	10 %	9	200	100	70	2000	Regulated	Active Low
EPC1012P	E6		12	10 %	9	200	100	70	500	Regulated	Active Low
EPC1013H	E1	E1-G, F2	12	10 %	9	200	100	70	2000	Regulated	No
EPC1013P	E	E-G, F2, See √	12	10 %	9	200	100	70	500	Regulated	No
EPC1014P	A1		4 - 14	N/A	9	250	100	73	500	Precision Reg	No
EPC1015H	E1	E1-G, F2	5	10 %	9	200	100	70	2000	Regulated	No
EPC1015P	E	E-G, F2, See √	5	10 %	9	200	100	70	500	Regulated	No
EPC1016H	A1	A4	12	10 %	9	200	100	70	2000	Regulated	No
EPC1016P	A1	A4	12	10 %	9	200	100	70	500	Regulated	No
EPC1017H	A1	A4	5	10 %	9	250	100	70	2000	Regulated	No
EPC1017P	A1	A4	5	10 %	9	250	100	70	500	Regulated	No
EPC1018H	E5	E1, E1-G, F2	5	N/A	9	200	100	75	2000	Unregulated	No
EPC1018P	E5	E, E-G, F2, See √	5	N/A	9	200	100	75	500	Unregulated	No
EPC1019H	E2		12	10 %	9	200	100	70	2000	Regulated	Active High
EPC1019P	E2		12	10 %	9	200	100	70	500	Regulated	Active High
EPC1020H	E3	A3	5	10 %	9	250	100	70	2000	Regulated	Active High
EPC1020P	E3	A3	5	10 %	9	250	100	70	500	Regulated	Active High
EPC1021	C1		4-6	N/A	20	50	N/A	70		Precision Reg	No
EPC1025H	E1	E1-G, F2	12	10 %	5	330	100	62	2000	Regulated	No
EPC1025P	E	E-G, F2, See √	12	10 %	5	330	100	62	500	Regulated	No
EPC1026P	F1		5	N/A	5.2	450	100	80	500	Unregulated	No
EPC1027H	G1		12	10 %	9	200	100	70	2000	Regulated	No
EPC1027P	G1		12	10 %	9	200	100	70	500	Regulated	No
EPC1029C	A7		5	5%	See ◊1	See ◊1	100	70	2500	Unregulated	No
EPC1037H	A5	E6	15.75	± 1.25 V	See ◊2	See ◊2	100	70	2000	Regulated	No
EPC1037P	A5	E7-G	15.75	± 1.25 V	See ◊2	See ◊2	100	70	500	Regulated	No
EPC1038P	E7	E7-G	5	10 %	12	165	50	70	500	Regulated	Active Low
EPC1041P	A8		65-70	N/A	±5	60	100	82	500	Unregulated	No
EPC1046H	A6		15.75	± 1.25 V	See ◊3	See ◊3	See ◊3	70	2000	Regulated	No
EPC1053	L		7.5-16	N/A	9	250	100	70*	500	Precision Reg.	No
EPC1054H	E8		5	10 %	9	225	100	70	2000	Regulated	Active Low
EPC1054P	E8	E7	5	10 %	9	225	100	70	500	Regulated	Active Low
EPC1055H	E1	E1-G, F2	5	10 %	15	135	100	70	2000	Regulated	No
EPC1055P	E	E-G, F2, See √	5	10 %	15	135	100	70	500	Regulated	No
EPC1057H	A1		4-14	N/A	7	250	100	73	2000	Precision Reg.	No
EPC1057P	A1		4-14	N/A	7	250	100	73	500	Precision Reg.	No
EPC1058H	E9	E5-G	16	10 %	5	330	100	62	2500	Regulated	No
EPC1058P	E9	E5-G	16	10 %	5	330	100	62	500	Regulated	No
EPC1059P	A9		65-70	N/A	28	60	100	82	500	Unregulated	No
EPC1061P	F3		5	N/A	±7	25	100	70	500	Unregulated	No
EPC1063H	E1	E1-G, F2	5	N/A	12	200	100	75	2000	Unregulated	No
EPC1063P	E	E-G, F2, See √	5	N/A	12	200	100	75	500	Unregulated	No

◊1. ±12V : 30mA Total; +12V : 60mA

◊2. ± 12V: 12mA each ; +5V : 150mA

◊3. +5V : 180mA -5V : 12mA Ripple: 35mV Ripple: 10mV

* At 12V Nominal Input Voltage

** For Soft Start (Inrush Current Controlled)

√ Additional Packages : E1, E1-G, E4, E4-G,

† Add Suffix Letter and Number to PCA P/N for Optional Package and Pin Connections Only

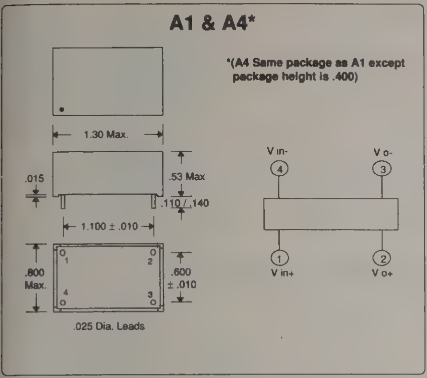
(Optional Sample P/N = EPC1007PE1-G)

16799 Schoenborn St. North Hills, CA 91343 PCA ELECTRONICS INC.. Phone: (818) 892-0761 Fax: (818) 894-5791

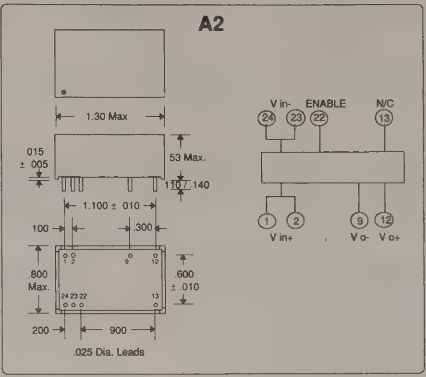
DC/DC Converters

A1 & A4*

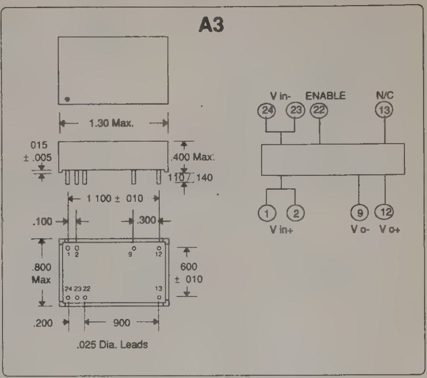
*(A4 Same package as A1 except package height is .400)


1.30 Max.
.015
.53 Max
.110 / .140
1.100 ± .010
.800 Max.
.600 ± .010
.025 Dia. Leads
V in-
V o-
V in+
V o+
1
2
3
4

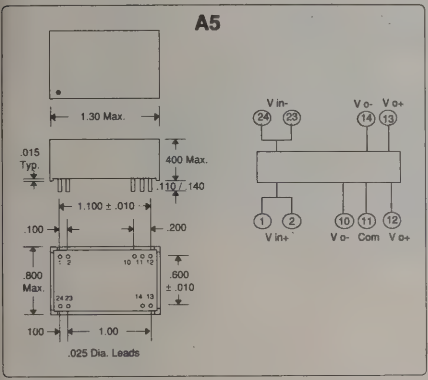
A2


1.30 Max
015 ± 005
53 Max.
110 / 140
1.100 ± 010
100
300
.800 Max.
.600 ± .010
200
900
.025 Dia. Leads
V in-
ENABLE
N/C
V in+
V o-
V o+
24
23
22
13
1
2
9
12

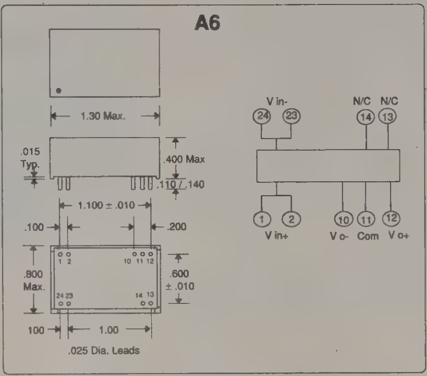
A3


1.30 Max.
015 ± .005
.400 Max.
110 / 140
1 100 ± 010
.100
.300
800 Max
600 ± 010
.200
900
.025 Dia. Leads
V in-
ENABLE
N/C
V in+
V o-
V o+
24
23
22
13
1
2
9
12

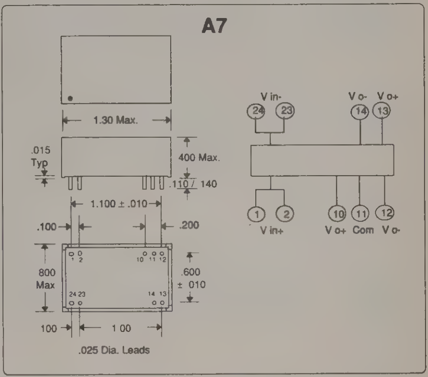
A5


1.30 Max.
.015 Typ.
400 Max.
.110 / 140
1.100 ± .010
.100
.200
.800 Max.
.600 ± .010
100
1.00
.025 Dia. Leads
V in-
V o-
V o+
V in+
V o-
Com
V o+
24
23
14
13
1
2
10
11
12

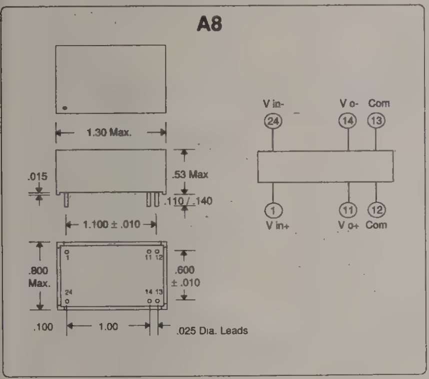
A6


1.30 Max.
.015 Typ.
.400 Max
.110 / .140
1.100 ± .010
.100
.200
.800 Max.
.600 ± .010
100
1.00
.025 Dia. Leads
V in-
N/C
N/C
V in+
V o-
Com
V o+
24
23
14
13
1
2
10
11
12

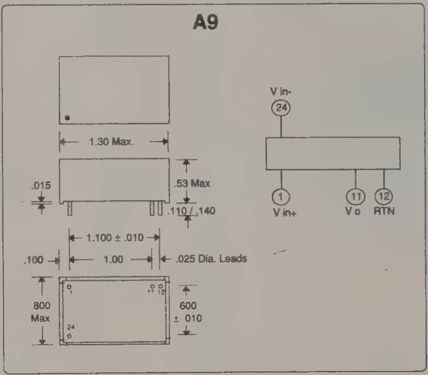
A7


1.30 Max.
.015 Typ
400 Max.
.110 / 140
1.100 ± .010
.100
.200
800 Max
.600 ± 010
100
1 00
.025 Dia. Leads
V in-
V o-
V o+
V in+
V o+
Com
V o-
24
23
14
13
1
2
10
11
12

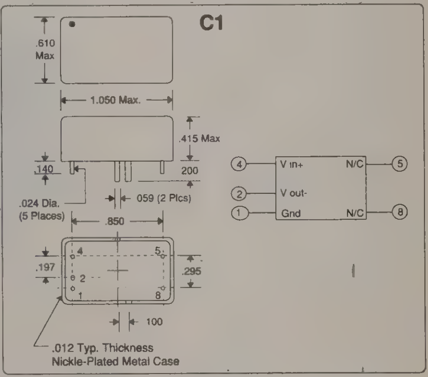
A8


1.30 Max.
.015
.53 Max
.110 / .140
1.100 ± .010
.800 Max.
.600 ± .010
.100
1.00
.025 Dia. Leads
V in-
V o-
Com
V in+
V o+
Com
24
14
13
1
11
12

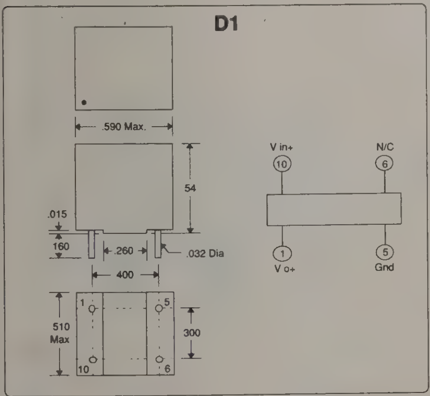
A9


1.30 Max.
.015
.53 Max
.110 / .140
1.100 ± .010
.100
1.00
.025 Dia. Leads
800 Max
600 ± 010
V in-
V in+
V o
RTN
24
1
11
12

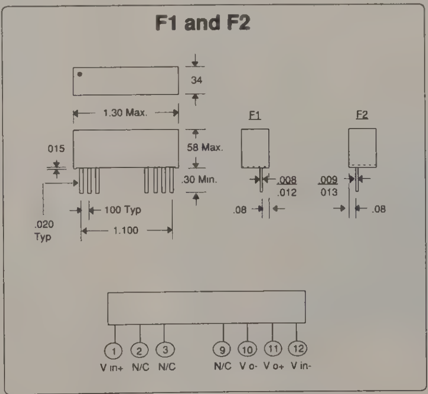
C1


.610 Max
1.050 Max.
.415 Max
.140
200
.024 Dia. (5 Places)
059 (2 Plcs)
.850
.197
.295
100
.012 Typ. Thickness Nickle-Plated Metal Case
V in+
V out-
Gnd
N/C
N/C
4
2
1
5
8

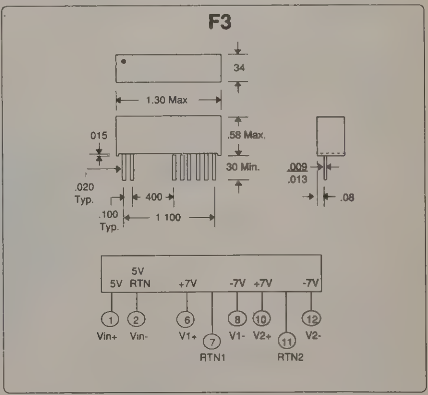
D1


.590 Max.
54
.015
160
.260
.032 Dia
400
510 Max
300
V in+
N/C
V o+
Gnd
10
6
1
5

F1 and F2


34
1.30 Max.
015
58 Max.
.30 Min.
100 Typ
1.100
.020 Typ
F1
F2
.008
.012
.009
013
.08
.08
V in+
N/C
N/C
N/C
V o-
V o+
V in-
1
2
3
9
10
11
12

F3


34
1.30 Max
015
.58 Max.
30 Min.
.020 Typ.
400
.100 Typ.
1 100
.009
.013
.08
5V
5V RTN
+7V
-7V
+7V
-7V
Vin+
Vin-
V1+
RTN1
V1-
V2+
RTN2
V2-
1
2
6
7
8
10
11
12

4/7/93

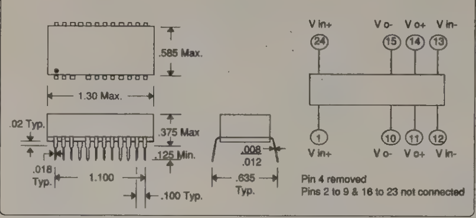
Unless Otherwise Noted
Dimensions in Inches
Tolerances:
Fractional = ± 1/32
.XX = ± .030 .XXX = ± .010

PCA ELECTRONICS INC.

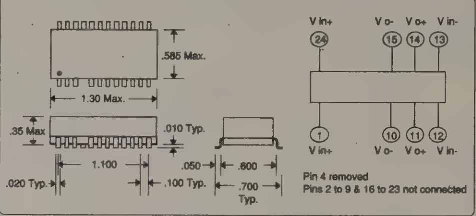
16799 SCHOENBORN ST.
NORTH HILLS, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791

DC/DC Converters

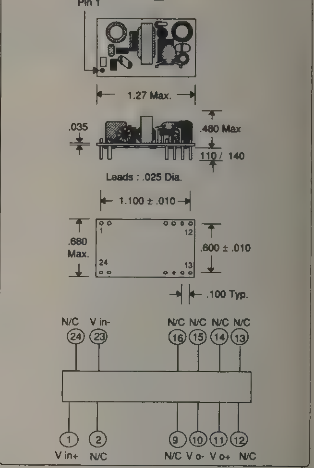
E


.585 Max.
1.30 Max.
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.100 Typ.
.008
.012
.635 Typ.
V in+ 24
V o- 15
V o+ 14
V in- 13
1 V in+
10 V o-
11 V o+
12 V in-
Pin 4 removed
Pins 2 to 9 & 16 to 23 not connected

E-G

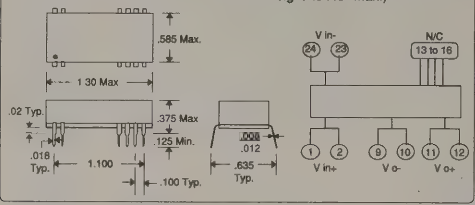

.585 Max.
1.30 Max.
.35 Max
.010 Typ.
1.100
.020 Typ.
.050
.100 Typ.
.600
.700 Typ.
V in+ 24
V o- 15
V o+ 14
V in- 13
1 V in+
10 V o-
11 V o+
12 V in-
Pin 4 removed
Pins 2 to 9 & 16 to 23 not connected

L


White Dot Pin 1
1.27 Max.
.035
.480 Max
.110 / .140
Leads : .025 Dia.
1.100 ± .010
.680 Max.
.600 ± .010
.100 Typ.
N/C 24
V in- 23
N/C 16
N/C 15
N/C 14
N/C 13
1 V in+
2 N/C
9 N/C
10 V o-
11 V o+
12 N/C

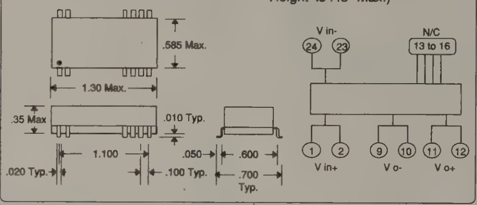
E1 and E9*

* (Same Package Except Package Height is .43" Max.)

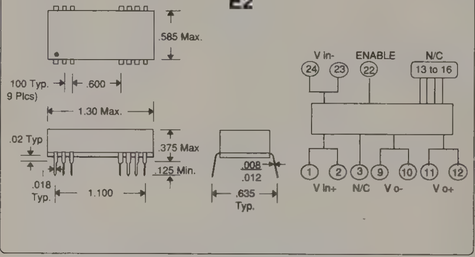

.585 Max.
1.30 Max
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.100 Typ.
.008
.012
.635 Typ.
V in- 24 23
N/C 13 to 16
1 2 V in+
9 10 V o-
11 12 V o+

E1-G and E5G*

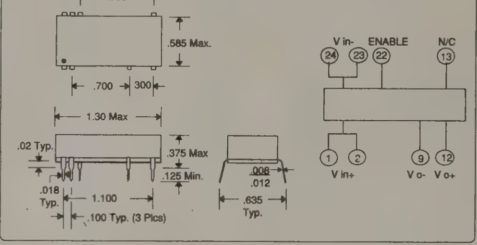
* (Same Package Except Package Height is .43" Max.)


.585 Max.
1.30 Max.
.35 Max
.010 Typ.
1.100
.020 Typ.
.050
.100 Typ.
.600
.700 Typ.
V in- 24 23
N/C 13 to 16
1 2 V in+
9 10 V o-
11 12 V o+

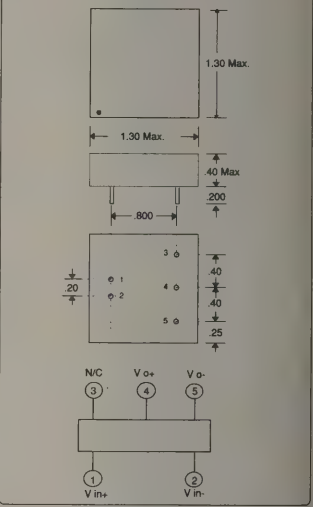
E2


.585 Max.
100 Typ. (9 Plcs)
.600
1.30 Max.
.02 Typ
.375 Max
.125 Min.
.018 Typ.
1.100
.008
.012
.635 Typ.
V in- 24 23
ENABLE 22
N/C 13 to 16
1 2 V in+
3 N/C
9 10 V o-
11 12 V o+

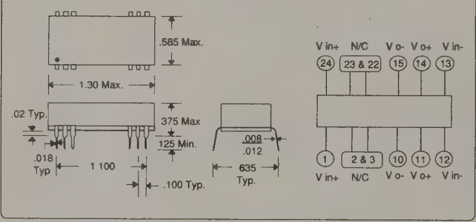
E3


.900
.585 Max.
.700
300
1.30 Max
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.100 Typ. (3 Plcs)
.008
.012
.635 Typ.
V in- 24 23
ENABLE 22
N/C 13
1 2 V in+
9 V o-
12 V o+

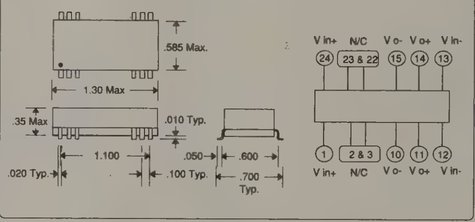
G1


1.30 Max.
1.30 Max.
.40 Max
.200
.800
.20
.40
.40
.25
1 2 3 4 5
N/C 3
V o+ 4
V o- 5
1 V in+
2 V in-

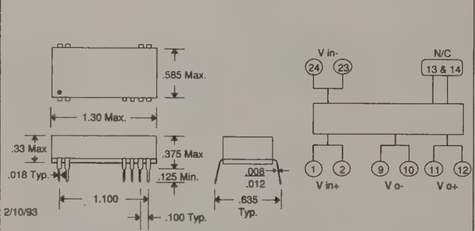
E4


.585 Max.
1.30 Max.
.02 Typ.
.375 Max
.125 Min.
.018 Typ
1.100
.100 Typ.
.008
.012
.635 Typ.
V in+ 24
N/C 23 & 22
V o- 15
V o+ 14
V in- 13
1 V in+
2 & 3 N/C
10 V o-
11 V o+
12 V in-

E4-G

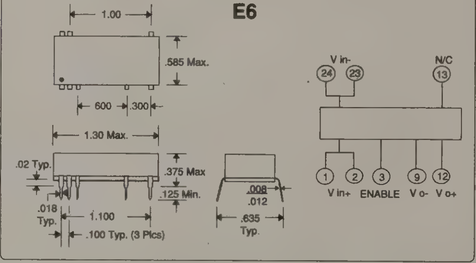

.585 Max.
1.30 Max.
.35 Max
.010 Typ.
1.100
.020 Typ.
.050
.100 Typ.
.600
.700 Typ.
V in+ 24
N/C 23 & 22
V o- 15
V o+ 14
V in- 13
1 V in+
2 & 3 N/C
10 V o-
11 V o+
12 V in-

E5

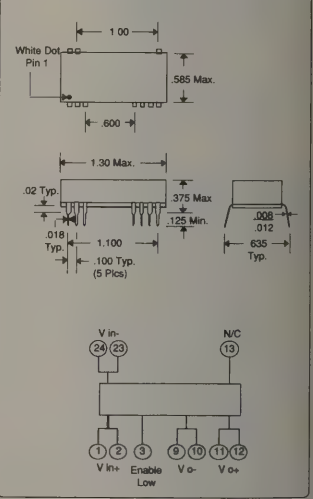

.585 Max.
1.30 Max.
.33 Max
.018 Typ.
.375 Max
.125 Min.
1.100
.100 Typ.
.008
.012
.635 Typ.
V in- 24 23
N/C 13 & 14
1 2 V in+
9 10 V o-
11 12 V o+

2/10/93

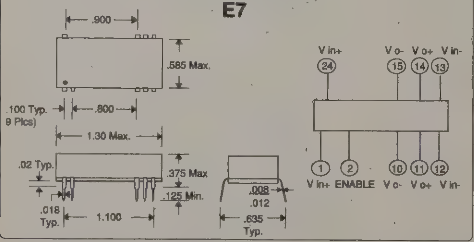
E6


1.00
.585 Max.
600
.300
1.30 Max.
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.100 Typ. (3 Plcs)
.008
.012
.635 Typ.
V in- 24 23
N/C 13
1 2 V in+
3 ENABLE
9 V o-
12 V o+

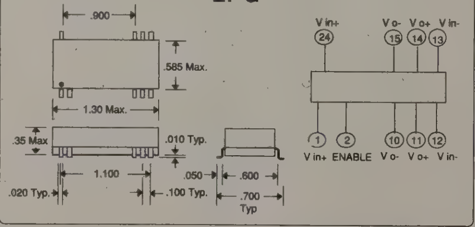
E8


White Dot Pin 1
1.00
.585 Max.
.600
1.30 Max.
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.100 Typ. (5 Plcs)
.008
.012
.635 Typ.
V in- 24 23
N/C 13
1 2 V in+
3 Enable Low
9 10 V o-
11 12 V o+

E7


.900
.585 Max.
.100 Typ. (9 Plcs)
.800
1.30 Max.
.02 Typ.
.375 Max
.125 Min.
.018 Typ.
1.100
.008
.012
.635 Typ.
V in+ 24
V o- 15
V o+ 14
V in- 13
1 V in+
2 ENABLE
10 V o-
11 V o+
12 V in-

E7-G


.900
.585 Max.
1.30 Max.
.35 Max
.010 Typ.
1.100
.020 Typ.
.050
.100 Typ.
.600
.700 Typ
V in+ 24
V o- 15
V o+ 14
V in- 13
1 V in+
2 ENABLE
10 V o-
11 V o+
12 V in-

4/7/93

Unless Otherwise Noted
Dimensions in Inches
Tolerances:
Fractional = ± 1/32
.XX = ± .030 .XXX = ± .010

PCA ELECTRONICS INC.

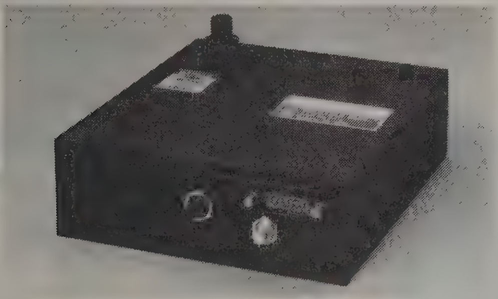
16799 SCHOENBORN ST.
NORTH HILLS, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791

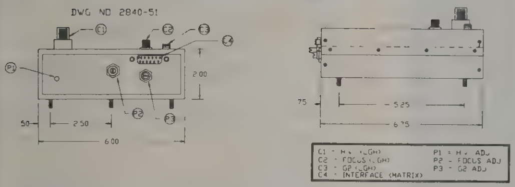
Penn-Tran Corporation

Designers and Manufacturers of CRT Deflection Components

A Spectrum Electronics Corporation

30 Watt High Voltage Power Supply For Military and Airborne Applications MIL HVS 2825




DWG NO 2840-51
C1
C2
C3
C4
P1
P2
P3
2.00
.50
2.50
6.00
.75
5.25
6.75
C1 - HV (LGH)
C2 - FOCUS (LGH)
C3 - G2 (LGH)
C4 - INTERFACE (MATRIX)
P1 = HV ADJ
P2 - FOCUS ADJ
P3 - G2 ADJ

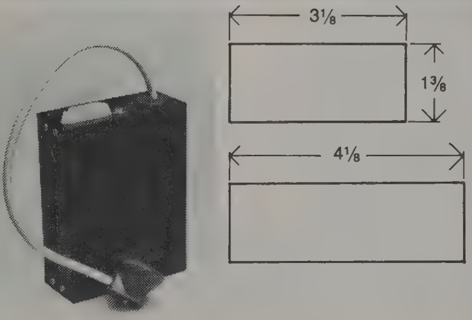
Performance Specifications

Input	28VDC ± 2 Volts
Anode Voltage	25KV (less than ± 1%)
Anode Current	0-1.2 MA
Ripple (P-P)	7.5 Volts (P-P) @ 1.2 MA
Temperature Coefficient	100 PPM/°C
Line Regulation	.05%
Focus Voltage	5-8 KV
G2 Voltage	200-1000 VDC
G1 Voltage	−150 VDC
Operation Temperature	−55° to 70°C

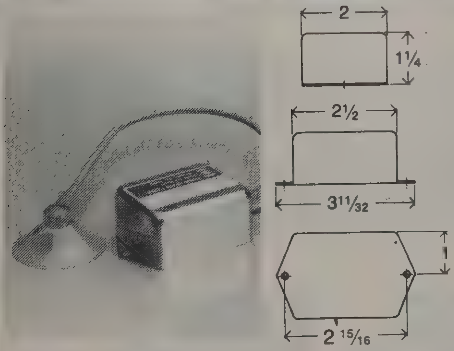
High Voltage Power Supplies

Engineers know us for quality and innovation in the design and manufacture of deflection components for CRT Displays and television cameras. High Voltage Power Supplies are part of the new Penn-Tran's team of deflection components, exactingly designed, manufactured and backed by our 45 years as a pioneer in the field.

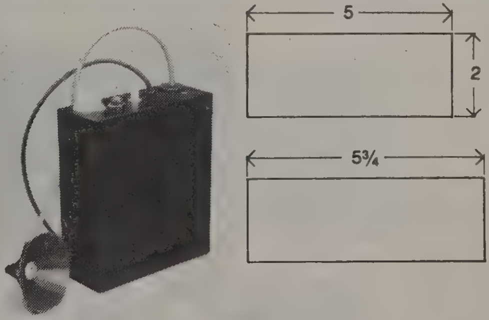
These power supplies are suitable for multiple customer-specified applications, or we will design a prototype to suit your application. UL listed file.



10 Watt -	B+	HV(KV)	SEC	SEC	SEC
HVS 2610	26	10	400	−100	
HVS 2617	26	17	1000	−110	


2
1¼
2½
3 11/32
1
2 15/16

3 Watt -	B+	HV(KV)	SEC	SEC
HVS 1509	15	9.0	400	−100
HVS 1512	15	12.0	400	−100



30 Watt –	B+	HV(KV)	SEC(KV)	SEC	SEC
HVS 2825	28	25	(5.0-8.0)	(200-1000)	−150
HVS 3625	36	25	(5.5-8.5)	(200-700)	−200

Penn-Tran Corporation Route 144 North, P.O. Box 1321, Wingate, PA 16880
814-355-1521 Fax 814-355-1524

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We are a leading, international supplier to major **Telecommunications, Scientific, Medical** (UL-544), **and Computer** peripheral equipment manufacturers. We design and manufacture a wide range of commercial and high grade industrial power supplies. Our extensive product line includes:

- ☐ **SWITCHING, LINEAR and ferroresonant power supplies**
- ☐ **AC to DC and DC to AC converters**
- ☐ **Power levels from 10 watts to over 2,000 watts**
- ☐ **High frequency/high power density resonant converters (>500 kHz)**
- ☐ **High frequency saturable reactor post-regulators**
- ☐ **Battery backup/battery chargers**
- ☐ **Parallelable devices for N+1 redundancy**
- ☐ ***Low distortion ringers for Telecommunications, Linear and H.F. 8 to 100 Watts***

All our power products meet applicable UL, CSA, VDE, TUV and BABT requirements and comply with FCC class A or B.

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Phone: (201) 236-0156 • Fax: (201) 236-0224

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AC-DC LINEAR MODULES . . Series LAC/TLAC Regulated, Isolated ***Single, Dual and Triple, Wide Input Range up to 10 Watts***	D•1860-61
AC-DC SWITCHERS . . . Series SW, Regulated, Isolated, Industrial ***Low Profile .5″ ht., up to 15 Watts***	D•1862-63
AC-DC SWITCHERS . . . Series 5AC, Regulated, Isolated ***Single and Dual, Lowest Profile 0.5″ ht., up to 5 Watts***	D•1864
AC-DC SWITCHERS . . . Series 10 AC, Regulated, Isolated ***Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 10 Watts***	D•1865
AC-DC SWITCHERS . . . Series 30 AC, Regulated, Isolated ***Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 30 Watts***	D•1866
AC-DC SWITCHERS . . . Series 50 AC, Regulated, Isolated ***Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 55 Watts***	D•1867
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AC-DC SWITCHERS . . . OFB 5, 13 Fully Enclosed, Jumper Selectable ***Multiple Outputs, up to 130 Watts***	D•1870-71
AC-DC SWITCHERS . . . OFJ 10, 20 PCB or L-bracket Design, Jumper Selectable ***Multiple Outputs, up to 200 Watts***	D•1872-73

DC-DC CONVERTERS *(See Section #4025)*

	D•2137
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SURFACE MOUNT DC-DC CONVERTERS . . . Series SMV ***.440″ ht., up to 500V DC output/.540″ ht., up to 1000V DC output***	D•2144-45
DC-DC CONVERTERS . . . Series AT/DT ***Single and Dual, .200″ ht. up to .75 Watts***	D•2146-47
DC-DC CONVERTERS . . . Series B ***Single and Dual, .7″ × 1.12″ × .3″ ht., up to 2.5 Watts***	D•2148-49
DC-DC CONVERTERS . . . Series C ***Single and Dual, 1.12″ × 1.24″ × .3″ ht., up to 4 Watts***	D•2150-51
DC-DC CONVERTERS . . . Series E ***Single 1.24″ × 1.43 × .4″ ht.-Dual 1.12″ × 2 ″ × .4″ ht., up to 7 Watts***	D•2152-53
DC-DC CONVERTERS . . . Series FR, Regulated ***Single and Dual .5″ × 1″ × .3″ ht. up to 1 Watt***	D•2154
DC-DC CONVERTERS . . . Series GR, Regulated ***Single and Dual 1.125″ × 2.25″ × .350″ ht. up to 3.5 Watts***	D•2155
MILITARY DC-DC CONVERTERS . . . Series M ***Single and Dual, up to 1.25 Watts***	D•2156-57
MILITARY DC-DC CONVERTERS . . . Series MR, ***Wide Input Voltage, Single and Dual Outputs, up to 2½ Watts***	D•2158-59
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DC-DC CONVERTERS . . . Series PLR, Regulated ***Single and Dual Outputs, Wide Input Range up to 5 Watts, .300″ max. ht.***	D•2162-63
DC-DC CONVERTERS . . . Series IR, Regulated, Isolated ***Single and Dual Outputs, Wide Input Range 5 to 60 Volts, up to 10 Watts***	D•2164-65
DC-DC CONVERTERS . . . Series JR, Regulated, Isolated ***Single and Dual Outputs, Wide Input Range 18 to 60 Volts, up to 15 Watts***	D•2166-67
DC-DC CONVERTERS . . . Series KR, Regulated, Isolated ***Single and Dual Outputs, Wide Input Range 18 to 60 Volts, up to 20 Watts***	D•2168-69
DC-DC CONVERTERS . . . Series NR, Regulated ***Single, Dual and New Triple Outputs, Wide Input Range 18 to 72 Volts, up to 30 Watts***	D•2170-71
DC-DC CONVERTERS . . . Series LV, Regulated, Isolated ***Wide Input 36-80 VDC, up to 10 Watts***	D•2172-73
DC-DC CONVERTERS . . . Series HV, Regulated, Isolated ***Wide Input 70-170 VDC, up to 15 Watts***	D•2174-75

HIGH POWER DC-DC CONVERTERS *(See Section #4025)*

	D•2137
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PA**–Wide Input 18-36V DC, Regulated, ***17 Standard*** **Dual** ***and Single Models***	D•2176-77
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PB**–Wide Input 36-72V DC, Regulated, ***17 Standard*** **Dual** ***and Single Models***	D•2178-79
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PC**–Wide Input 100-180V DC, Regulated, ***17 Standard*** **Dual** ***and Single Models***	D•2180-81
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PD**–Wide Input 200-380V DC, Regulated, ***17 Standard*** **Dual** ***and Single Models***	D•2182-83
APPLICATION NOTES MECHANICAL CONFIGURATIONS	D•2184-85

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Delivery:
Stock to one week

FAX: 914-699-5565

PICO Electronics, Inc.

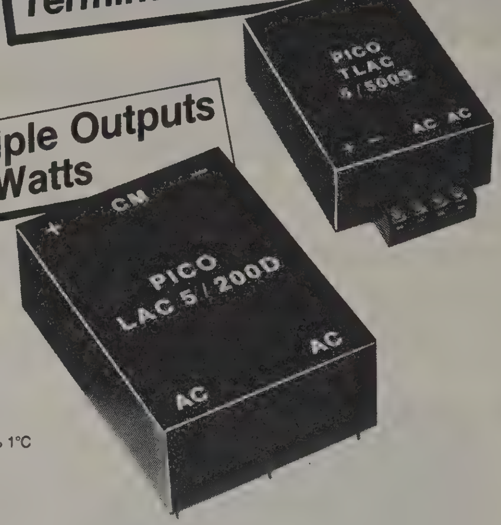
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

SERIES LAC-TLAC

Hi Reliability Isolated Regulated AC-DC Linear Modules

TLAC Standard Terminal Strip Modules

Single, Dual & Triple Outputs Up to 10 Watts



TYPICAL CHARACTERISTICS:
Test conditions: 25°C ambient
Input voltage: 105-125 VAC
Input frequency: 50 to 440 Hz
Line/load regulation: Consult chart
Output voltage tolerance: ±1.0%
Operating temperature: −25°C to +70°C
Output voltage temperature coefficient: 0.02% 1°C
Storage temperature: −55°C to +85°C
Typical isolation: 100 megohms
Short circuit protection: Continuous

Series LAC-TLAC AC-DC Linear Modules

FEATURES:
- Terminal strips available-TLAC
- Low output ripple = 1 to 2 MV RMS
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Excellent voltage regulation
- Excellent load regulation
- Up to 9 watts output power at 70°C ambient
- Typical isolation 100 megohms
- Single, dual and triple outputs
- No heat sink required
- No output capacitor required

This series of linear AC to DC Power Supplies are available in 46 different models. All single, dual and triple output models offer excellent line and load regulation, while maintaining the output voltage ripple at a minimum. Continuous short-circuit protection and isolation are also standard on all models. The convenience of PC mounting, with mounting inserts, allows the use of this encapsulated unit in harsh environments, and the TLAC models offer a terminal strip for easy electrical connection.

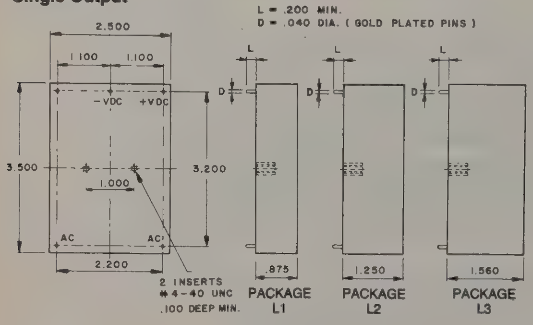
SERIES LAC-TLAC SINGLE OUTPUT

** PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	OUT VOLT TOLERANCE (±%)*	V LD. REG. LOAD	LINE REGULATION	OUTPUT VOLTAGE RIPPLE @ FULL LOAD MV RMS	PACKAGE NUMBER		HEIGHT INCHES	L PKG PRICE 1-24	T** PACKAGE 1-24
LAC 5/500S	5	500	2.5	1.0	0.2	0.05	1	L1	T1	.875	69.00	83.00
LAC 5/1000S	5	1000	5	1.0	0.2	0.05	1	L2	T2	1.250	85.00	99.00
LAC 5/2000S	5	2000	10	1.0	0.2	0.05	1	L3	T3	1.560	99.00	113.00
LAC 12/120S	12	120	1.44	1.0	0.1	0.10	1	L1	T1	.875	69.00	83.00
LAC 12/200S	12	200	2.4	1.0	0.1	0.10	1	L2	T2	1.250	85.00	99.00
LAC 12/500S	12	500	6.0	1.0	0.1	0.10	1	L3	T3	1.560	99.00	113.00
LAC 15/120S	15	120	1.8	1.0	0.1	0.10	1	L1	T1	.875	69.00	83.00
LAC 15/200S	15	200	3.0	1.0	0.1	0.10	1	L2	T2	1.250	85.00	99.00
LAC 15/500S	15	500	7.5	1.0	0.1	0.10	1	L3	T3	1.560	99.00	113.00
LAC 24/100S	24	100	2.4	1.0	0.1	0.10	1	L1	T1	.875	69.00	83.00
LAC 24/300S	24	300	7.2	1.0	0.1	0.10	1	L3	T3	1.560	99.00	113.00

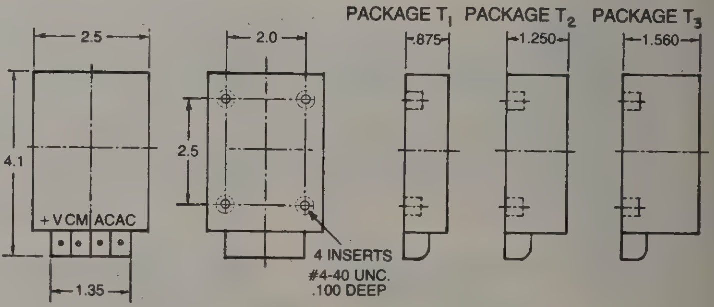
*Consult factory for special voltage requirements

** For terminal strip model add "T" to front of part number.

Series LAC Single Output



Series TLAC Single Output



Delivery— stock to one week

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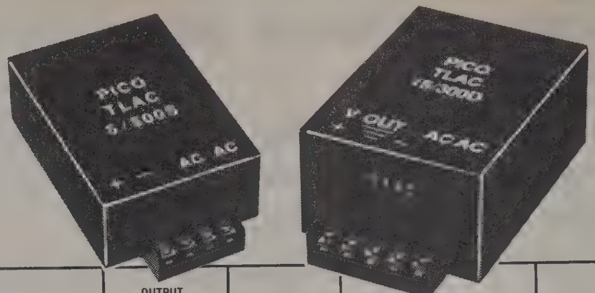
SERIES LAC-TLAC

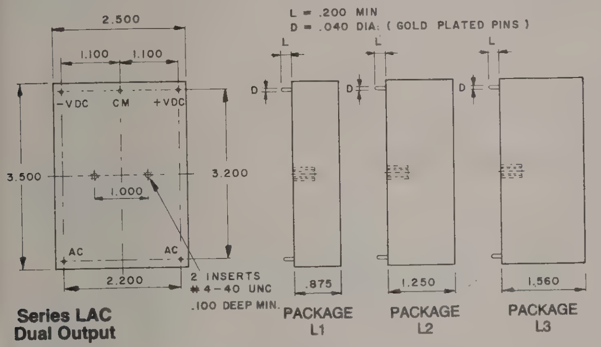
TLAC Standard Terminal Strip Models


PICO
TLAC
5/300D
+ − AC AC
PICO
TLAC
15/300D
V OUT
AC AC

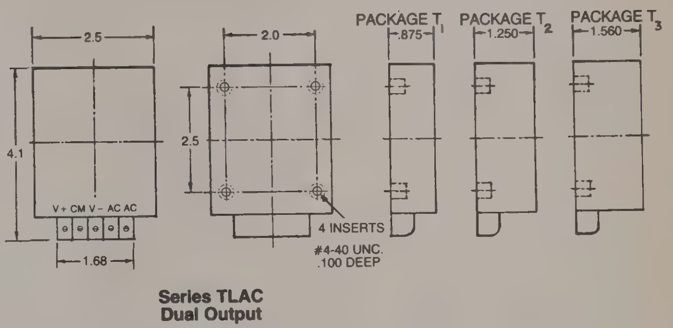
SERIES LAC-TLAC DUAL OUTPUT

** PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	OUT VOLT TOLERANCE (±%)*	V LD. REG. LOAD	LINE REGULATION	OUTPUT VOLTAGE RIPPLE @ FULL LOAD MV RMS	PACKAGE NUMBER		HEIGHT INCHES	L PKG PRICE 1-24	T ** PACKAGE 1-24
LAC 5/200D	5	200	1.0	1%	0 1%	.05%	1	L2	T2	1 250	95 00	109.00
LAC 5/300D	5	300	1.5	1%	0.1%	.05%	1	L3	T3	1 560	110.00	124 00
LAC 12/100D	12	100	1.2	1%	0.1%	.02%	1	L1	T1	.875	95.00	109.00
LAC 12/300D	12	300	3.6	1%	0.1%	.02%	1	L3	T3	1 560	110 00	124.00
LAC 15/100D	15	100	1 5	1%	0.1%	.02%	1	L1	T1	.875	95 00	109.00
LAC 15/300D	15	300	4.5	1%	0.1%	.02%	1	L3	T3	1 560	110 00	124 00
LAC 24/100D	24	100	2.4	1%	0.2%	0.1%	1	L2	T2	1.250	95 00	109.00
LAC 24/200D	24	200	4 8	1%	0.2%	0.1%	1	L3	T3	1.560	110.00	124.00

* Consult factory for special voltage requirements ** For terminal strip model add "T" to front of part number.


2.500
1.100
1.100
L = .200 MIN
D = .040 DIA. (GOLD PLATED PINS)
L
D
−VDC
CM
+VDC
3.500
3.200
1.000
AC
AC
2.200
2 INSERTS
# 4-40 UNC
.100 DEEP MIN.
.875
1.250
1.560
PACKAGE L1
PACKAGE L2
PACKAGE L3

Series LAC Dual Output


2.5
4.1
V+ CM V− AC AC
1.68
2.0
2.5
4 INSERTS
#4-40 UNC.
.100 DEEP
PACKAGE T1
.875
PACKAGE T2
1.250
PACKAGE T3
1.560

Series TLAC Dual Output

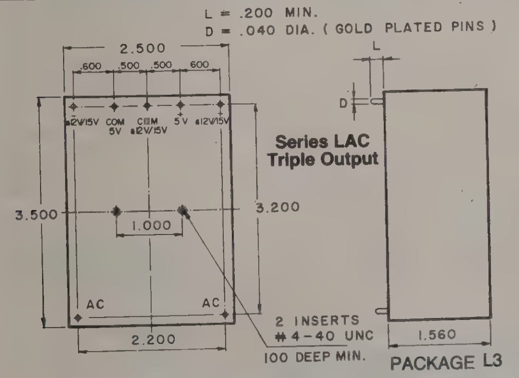
SERIES LAC-TLAC TRIPLE OUTPUT

** PICO PART NUMBER	MAIN OUTPUT VOLTAGE: OUTPUT VOLTAGE DC OUTPUT	MAX LOAD CURRENT mA OUTPUT	MAX OUTPUT POWER (watts) OUTPUT	V LD.REG. LOAD %	OUTPUT VOLTAGE RIPPLE @ FULL LOAD MV RMS	AUXILIARY OUTPUT VOLTAGE: OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	VOLT. LOAD REG. LOAD %	OUTPUT VOLTAGE RIPPLE @ FULL LOAD MV RMS	PACKAGE NUMBER		HEIGHT INCHES	L PKG PRICE 1-24	T ** PRICE 1-24
LAC 512A	5	250	1.25	0.2	1.0	12	120	1.44	0.1	1.0	L3	T3	1.56	115.00	129.00
LAC 512 B	5	500	2.5	0 2	1 0	12	120	1.44	0.1	1.0	L3	T3	1.56	130.00	144.00
LAC 515A	5	250	1.25	0 2	1.0	15	100	1.50	0 1	1.0	L3	T3	1.56	115.00	129.00
LAC 515B	5	500	2.5	0.2	1.0	15	100	1.50	0.1	1.0	L3	T3	1.56	130 00	144.00

Common Characteristics
Main Output Voltage Tolerance ±0.5%*
Main Line Regulation ±0.2%

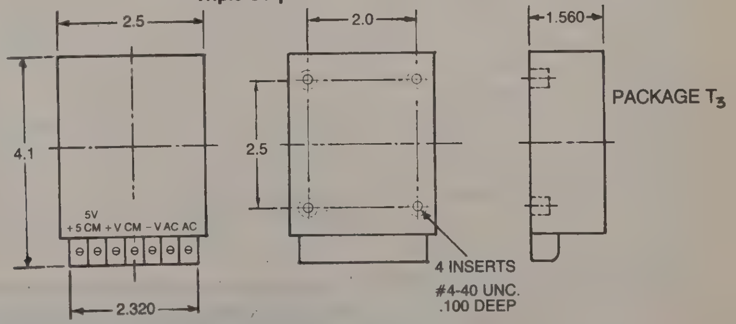
Common Characteristics
Auxiliary Output Voltage Tolerance ±0.5%*
Auxiliary Line Regulation ±0.2%

* Measurements taken at 115VAC-60Hz
** For terminal strip model add "T" to front of part number.


L = .200 MIN.
D = .040 DIA. (GOLD PLATED PINS)
2.500
.600
.500
.500
.600
±12V/15V
COM 5V
COM ±12V/15V
5V
±12V/15V
3.500
3.200
1.000
AC
AC
2.200
2 INSERTS
# 4-40 UNC
100 DEEP MIN.
L
D
1.560
PACKAGE L3

Series LAC Triple Output

Series TLAC Triple Output


2.5
4.1
5V
+5 CM +V CM −V AC AC
2.320
2.0
2.5
4 INSERTS
#4-40 UNC.
.100 DEEP
1.560
PACKAGE T3

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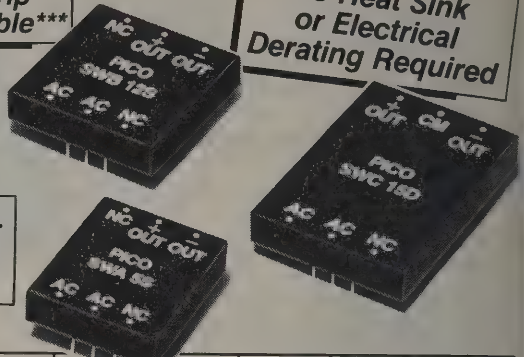
Series SW-Single Output-AC-DC Switching Power Supplies

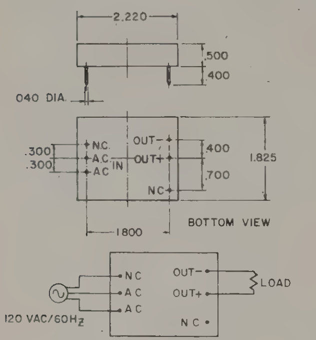
Hi Reliability
Industrial Grade
Input Voltage (90-130VAC, 47-440Hz)
Isolated 1200 VRMS
Fully Regulated—up to 15 Watts
Short Circuit Protected

*TSW Standard Terminal Strip Models Available****

No Heat Sink or Electrical Derating Required

NO EXTERNAL CAPACITORS REQUIRED


NC OUT OUT
PICO SWB 12S
AC AC NC
OUT CM OUT
PICO SWC 15D
AC AC NC
NC OUT OUT
PICO SWA 5S
AC AC NC


2.220
.500
.400
.040 DIA.
.300
.300
NC
AC
AC
IN
OUT−
OUT+
NC
.400
.700
1.825
BOTTOM VIEW
1.800
NC
AC
AC
OUT−
OUT+
NC
LOAD
120 VAC/60Hz

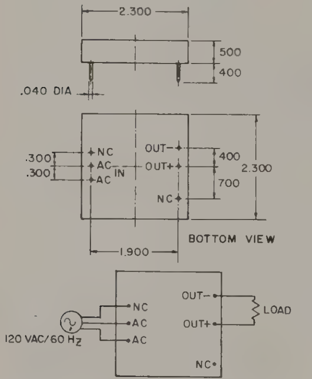
Series SWA-Single Output-5 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	** LOAD REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWA5S	5	1000	5	68	2	2	1	150	79 00
SWA12S	12	415	5	68	2	2	1	100	79 00
SWA15S	15	330	5	70	2	2	1	100	79 00

*Measurements taken at 115VAC @ 60 Hz.

** 10% minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2.300
.500
.400
.040 DIA.
.300
.300
NC
AC
AC
IN
OUT−
OUT+
NC
.400
.700
2.300
BOTTOM VIEW
1.900
NC
AC
AC
OUT−
OUT+
NC
LOAD
120 VAC/60 Hz

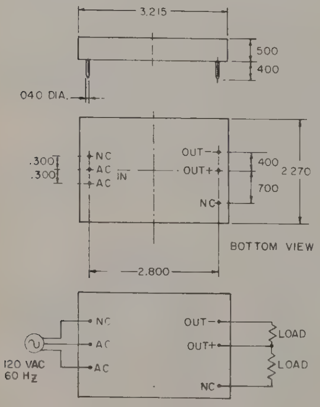
Series SWB-Single Output-10 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	** LOAD REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWB5S	5	1600	8	67	2	2	1	150	89 00
SWB12S	12	830	10	73	2	2	1	100	89 00
SWB15S	15	660	10	75	2	2	1	100	89 00

*Measurements taken at 115VAC @ 60 Hz.

** 10% Minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


3.215
.500
.400
.040 DIA.
.300
.300
NC
AC
AC
IN
OUT−
OUT+
NC
.400
.700
2.270
BOTTOM VIEW
2.800
NC
AC
AC
OUT−
OUT+
NC
LOAD
LOAD
120 VAC 60 Hz

Series SWC-Single Output-15 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	** LOAD REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWC5S	5	2000	10	67	2	2	1	150	99 00
SWC12S	12	1250	15	73	2	2	1	100	99 00
SWC15S	15	1000	15	74	2	2	1	100	99 00

*Measurements taken at 115VAC @ 60 Hz.

** 10% minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

Delivery—
stock to one week

*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Series SW-Dual Output-AC-DC Switching Power Supplies

.5″ Height

FEATURES:
- Excellent line regulation ±1% (90–130 VAC)
- Excellent load regulation, from 25% to 100%, ±2%
- Continuous short circuit protection
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Isolation: 100 megohms at 1200 VRMS
- Wide input 90–130 VAC, 47 to 440 Hz

This series of switching AC-DC power supplies are available in 18 different models. All single and dual outputs are isolated and offer excellent line and load regulation. These units have continuous short circuit protection, require no output capacitors and will operate from −25°C to +70°C ambient, with no heat sink or electrical derating required. The hi-reliability SW Series, up to 15 Watts, is the design choice for your stringent industrial applications.

TSW Standard Terminal Strip Models Available***

TYPICAL CHARACTERISTICS:
Test conditions: 25°C ambient
Input voltage: 90–130 VAC, 47 to 440 Hz
Converter frequency: 200 – 800 KHz
Operating temperature: −20°C to +70°C ambient
Storage temperature: −55°C to +105°C
Output voltage temperature coefficient: 0.02%/°C
Isolation: 1200 VRMS

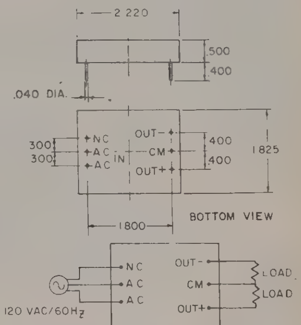
Series SWA-Dual Output-5 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA) per output	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	** LOAD REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWA5D	±5	500	2.5	68	2	2	1	150	92.00
SWA12D	±12	200	2.5	68	2	2	1	100	92.00
SWA15D	±15	165	2.5	70	2	2	1	100	92.00

*Measurements taken at 115VAC @ 60 Hz.

** 10% Minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2 220
.500
.400
.040 DIA.
300
300
NC
AC
AC
IN
OUT−
CM
OUT+
400
400
1 825
1 800
BOTTOM VIEW
NC
AC
AC
OUT−
CM
OUT+
LOAD
LOAD
120 VAC/60Hz

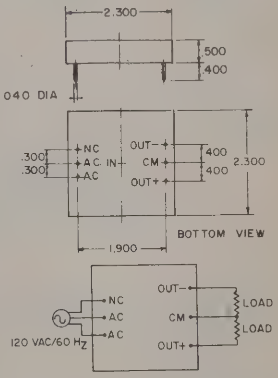
Series SWB-Dual Output-10 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA) per output	MAX. OUTPUT POWER (watts) per output	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	LOAD ** REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWB5D	±5	800	4	68	2	2	1	150	102.00
SWB12D	±12	415	5	75	2	2	1	100	102.00
SWB15D	±15	335	5	76	2	2	1	100	102.00

*Measurements taken at 115VAC @ 60 Hz.

** 10% minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2.300
.500
.400
.040 DIA
.300
.300
NC
AC
AC
IN
OUT−
CM
OUT+
400
400
2.300
1.900
BOTTOM VIEW
NC
AC
AC
OUT−
CM
OUT+
LOAD
LOAD
120 VAC/60 Hz

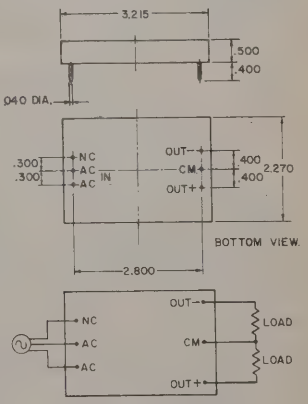
Series SWC-Dual Output-15 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA) per output	MAX. OUTPUT POWER (watts) per output	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (±%)	** LOAD REGULATION 25% - 100% LOAD (±%) *	LINE * REGULATION @ FULL LOAD (±%)	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
SWC5D	±5	1000	5	69	2	2	1	150	112.00
SWC12D	±12	625	7.5	75	2	2	1	100	112.00
SWC15D	±15	500	7.5	76	2	2	1	100	112.00

*Measurements taken at 115VAC @ 60 Hz.

** 10% minimum load required at all times

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


3.215
.500
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.300
.300
NC
AC
AC
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OUT−
CM
OUT+
.400
.400
2.270
2.800
BOTTOM VIEW
NC
AC
AC
OUT−
CM
OUT+
LOAD
LOAD

*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747***

Delivery—stock to one week

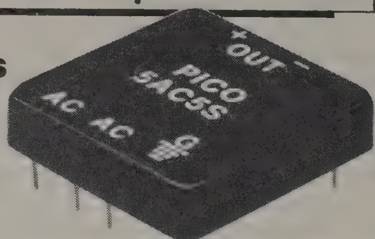
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES 5AC

Hi Reliability Hi Efficiency/Isolated Single and Dual Outputs Regulated 5 Watt AC-DC Switchers

Lowest Profile! 0.5"ht. up to 5 Watts



TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Input voltage: 90-130VAC (47-440Hz)
Line/load Regulation: See specifications below
Converter frequency: 25-35 KHz typ.
Operating temperature: –25°C to +70°C ambient
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: –55°C to +125°C
Isolation: 1200V RMS
Short circuit protection: Continuous

OPTIONS AVAILABLE

- *Expanded operating temp (–55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (–55°C to +125°C)*
- *Hi Temp, burn in*

No Heat Sink or Electrical Derating Required

Low Capacity Option

All units can be manufactured with isolation capacity of 50pF. Contact factory.

5 Watt AC-DC Switchers

FEATURES:

- Low profile 0.500"
- Low weight
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent voltage regulation
- Excellent load regulation
- Up to 5 watts output power at 70°C ambient
- Low output ripple
- Isolation 1200V RMS
- Single and dual outputs
- No heat sink required
- Miniature size
- No output capacitor required
- Shielding

This series of low profile, 5 Watt AC to DC switchers come in 7 different models. These units offer high efficiency and precise regulation throughout the operating temperature range of –25°C to +70°C ambient, with no heat sink or electrical derating required. The 5 AC series keeps a maximum *0.500"* height while still offering you 1200 volts RMS isolation in a rugged encapsulated case. The convenience of PC mounting and the availability of three outputs should aid your circuit design.

SERIES 5AC SINGLE OUTPUT/INPUT VOLTAGE 90-130VAC (47-440Hz) (OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE RANGE	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1-24
5AC5S	5	1000	5	72	50	0.5	0.5	0.2	189.00
5AC12S	12	417	5	75	50	0.5	0.5	0.2	189.00
5AC15S	15	333	5	75	50	0.5	0.5	0.2	189.00
5AC24S	24	208	5	76	50	0.5	0.5	0.2	189.00

*Readings taken at 115VAC-60Hz   † = 10% minimum load required

**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

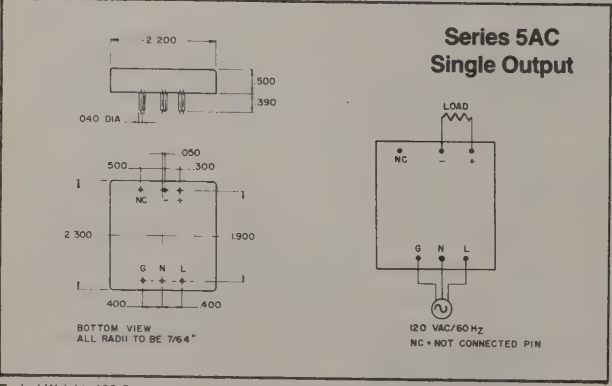
SERIES 5AC DUAL OUTPUT/INPUT VOLTAGE 90-130VAC (47-440Hz) (OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE RANGE	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1-24
5AC5D	±5	500	2.5	72	50	0.5	0.5	0.2	214.00
5AC12D	±12	209	2.5	75	50	0.5	0.5	0.2	214.00
5AC15D	±15	167	2.5	75	50	0.5	0.5	0.2	214.00

*Readings taken at 115VAC-60Hz   † = 10% minimum load required

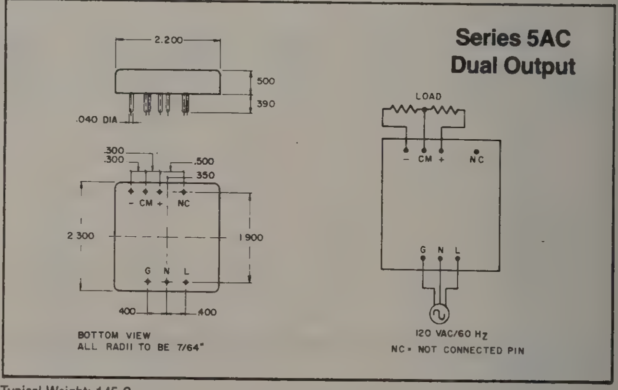
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

Series 5AC Single Output



Typical Weight: 130 Grams

Series 5AC Dual Output



Typical Weight: 145 Grams

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

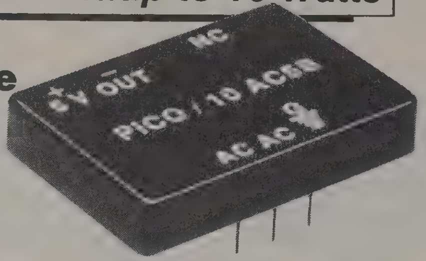
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES 10AC

Hi Reliability
Hi Efficiency/Isolated
Single, Dual and Triple Outputs
Regulated
10 Watt AC-DC Switchers

Lowest Profile!
0.5"ht.up to 10 Watts



10 Watt AC-DC Switchers

FEATURES:

- Low Profile *0.500"*
- Low weight
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent voltage regulation
- Excellent load regulation
- Up to 10 watts output power at 70°C ambient
- Low output ripple
- Isolation 1200V RMS
- Single, Dual, Triple Outputs
- No heat sink required
- Miniature size
- No output capacitor required
- Shielding

No Heat Sink or Electrical Derating Required

This series of low profile, 10 Watt AC to DC switchers come in 11 different models. These units offer high efficiency and precise regulation throughout the operating temperature range of -25°C to + 70°C ambient, with no heat sink or electrical derating required. The 10AC series keeps a maximum 0.500" height while still offering you 1200 volts RMS isolation in a rugged encapsulated case. The convenience of PC mounting and the availability of three outputs should aid your circuit design.

OPTIONS AVAILABLE PER MIL-STD-883

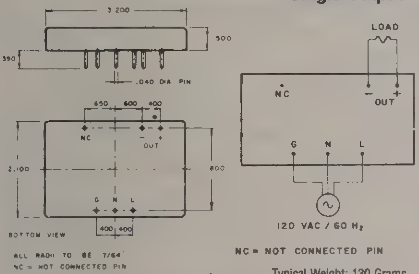
- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, burn in*

Low Capacity Option

All units can be manufactured with isolation capacity of 50pF. Contact factory.

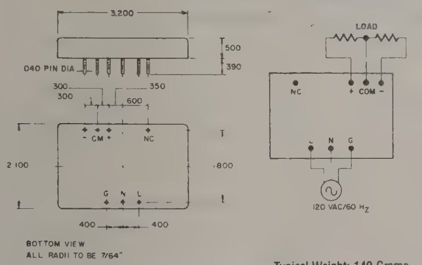
TYPICAL CHARACTERISTICS:
Test conditions: 25°C ambient
Input voltage: 90-130VAC (47-440Hz)
Line/load Regulation: See specifications below
Converter frequency: 25-35 KHz typ.
Operating temperature: −25°C to +70°C ambient
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Isolation: 1200V RMS
Short circuit protection: Continuous

Series 10AC
Single Output



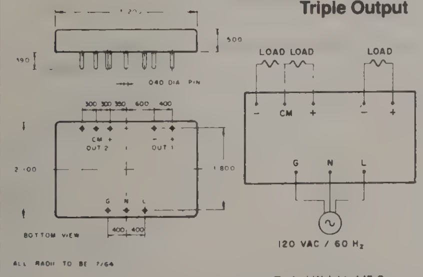
Typical Weight: 130 Grams

Series 10AC
Dual Output



Typical Weight: 140 Grams

Series 10AC
Triple Output



Typical Weight: 145 Grams

SERIES 10AC SINGLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440 Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
10AC5S	5	2000	10	75	50	0.5	0.5	0.2	199.00
10AC12S	12	833	10	77	50	0.5	0.5	0.2	199.00
10AC15S	15	666	10	79	50	0.5	0.5	0.2	199.00
10AC24S	24	416	10	80	50	0.5	0.5	0.2	199.00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

SERIES 10AC DUAL OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
10AC5D	±5	1000	5	75	50	0.5	0.5	0.2	224.00
10AC12D	±12	417	5	77	50	0.5	0.5	0.2	224.00
10AC15D	±15	333	5	80	50	0.5	0.5	0.2	224.00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

SERIES 10AC TRIPLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440Hz**)

	MAIN OUTPUT VOLTAGE					AUXILIARY OUTPUT VOLTAGE						
PICO PART NUMBER	OUTPUT VOLTAGE DC VDC	MAX LOAD CURRENT mA OUTPUT	MAX OUTPUT POWER (watts) OUTPUT	V LD.REG. 25-100% LOAD (±%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	VOLT. LOAD REG. 25-100% LOAD † (±%)*	OUTPUT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	EFF. @ FULL LOAD TYPICAL (%)	PRICE 1–24
10AC5T12	5	1400	7	0.5	50	±12	125	1.5	5	50	77	249.00
10AC5T15	5	1400	7	0.5	50	±15	100	1.5	5	50	77	249.00
10AC12T5	12	583	7	0.5	50	±5	300	1.5	5	50	77	249.00
10AC15T5	15	466	7	0.5	50	±5	300	1.5	5	50	79	249.00
	Common Characteristics Main Output Voltage Tolerance ±0.5%* Main Line Regulation ±0.2%					Common Characteristics Auxiliary Output Voltage Tolerance ± 5%* Auxiliary Line Regulation ±0.2%					*Measurements taken at 115VAC-60Hz	

† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747***

Delivery—
stock to one week

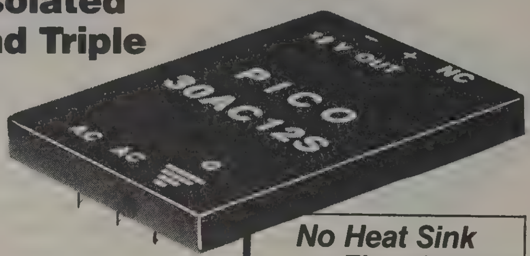
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES 30AC

Hi Reliability
Hi Efficiency/Isolated
Single, Dual and Triple Outputs
Regulated
30 Watt AC-DC Switchers

Lowest Profile!
0.5″ ht. up to 30 Watts



12 V OUT
NC
PICO
30AC12S
AC
AC

No Heat Sink or Electrical Derating Required

Low Capacity Option

All units can be manufactured with isolation capacity of 70pF. Contact factory.

TYPICAL CHARACTERISTICS

Test conditions: 25°C ambient
Input voltage: 90-130VAC (47-440Hz)
Line/load regulation: See specifications below
Converter frequency: 25-35 KHz typ.
Operating temperature: −25°C to +70°C ambient
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Isolation: 1200V RMS
Short circuit protection: Continuous

30 Watt AC-DC Switchers

FEATURES:

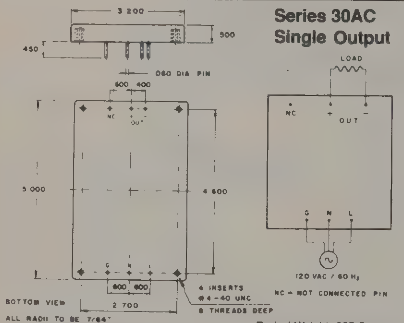
- Low Profile *0.500″*
- Low weight
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent voltage regulation
- Excellent load regulation
- Up to 30 watts output power at 70°C ambient
- Low output ripple
- Isolation 1200V RMS
- Single, Dual and Triple Outputs
- No heat sink required
- Miniature size
- No output capacitor required
- Shielding

OPTIONS AVAILABLE PER MIL-STD-883

- *Expanded operating temp. (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, burn in*

This series of low profile, 25-30 Watt AC to DC switchers come in 11 different models. These units offer high efficiency and precise regulation throughout the operating temperature range of -25°C to + 70°C ambient, with no heat sink or electrical derating required. The 30AC series keeps a maximum 0.500" height while still offering you 1200 volts RMS isolation in a rugged encapsulated case. The convenience of PC mounting and the availability of three outputs should aid your circuit design.

Series 30AC Single Output



3 200
500
450
080 DIA PIN
600 400
NC
OUT
5 000
4 600
G N L
600 600
2 700
BOTTOM VIEW
4 INSERTS #4-40 UNC 8 THREADS DEEP
ALL RADII TO BE 7/64"
NC = NOT CONNECTED PIN
LOAD
NC + − OUT
G N L
120 VAC / 60 Hz
NC = NOT CONNECTED PIN

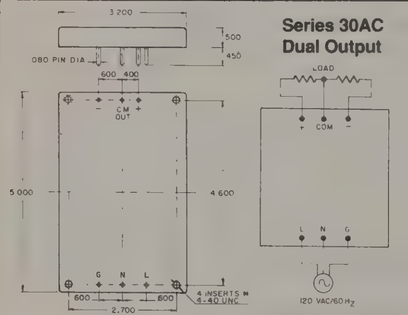
Typical Weight: 325 Grams

SERIES 30AC SINGLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
30AC5S	5	5000	25	75	50	0.5	0.5	0.2	299.00
30AC12S	12	2500	30	81	50	0.5	0.5	0.2	299.00
30AC15S	15	2000	30	82	50	0 5	0.5	0.2	299 00
30AC24S	24	1250	30	83	50	0.5	0.5	0.2	299 00
30AC28S	28	1070	30	83	50	0 5	0 5	0 2	299 00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

Series 30AC Dual Output



3 200
500
450
080 PIN DIA
600 400
CM OUT
5 000
4 600
G N L
600 600
2.700
4 INSERTS # 4-40 UNC
BOTTOM VIEW
ALL RADII TO BE 7/64"
LOAD
COM
L N G
120 VAC/60 Hz

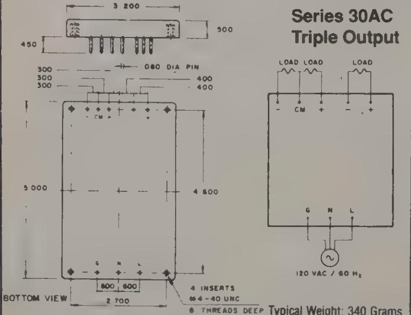
Typical Weight: 330 Grams

SERIES 30AC DUAL OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
30AC5D	±5	2500	12 5	76	50	0 5	0 5	0 2	334 00
30AC12D	+12	1250	15	78	50	0 5	0 5	0 2	334 00
30AC15D	±15	1000	15	80	50	0 5	0 5	0 2	334 00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

Series 30AC Triple Output



3 200
500
450
080 DIA PIN
300 300 300
400 400
CM
5 000
4 600
600 600
2 700
BOTTOM VIEW
4 INSERTS #4-40 UNC 6 THREADS DEEP
ALL RADII TO BE 7/64"
LOAD LOAD LOAD
CM
G N L
120 VAC / 60 Hz

Typical Weight: 340 Grams

SERIES 30AC TRIPLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz)
(OPTIONAL 170-240VAC, 47-440Hz**)

	MAIN OUTPUT VOLTAGE					AUXILIARY OUTPUT VOLTAGE						
PICO PART NUMBER	OUTPUT VOLTAGE DC VDC	MAX LOAD CURRENT mA OUTPUT	MAX OUTPUT POWER (watts) OUTPUT	V LD.REG. 25-100% LOAD (±%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	VOLT. LOAD REG. 25-100% LOAD † (±%)*	OUTPUT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	EFF. @ FULL LOAD TYPICAL (%)	PRICE 1–24
30AC5T12	5	4000	20	0.5	50	±12	208	2.5	5	50	78	369.00
30AC5T15	5	4000	20	0.5	50	±15	166	2.5	5	50	78	369 00
30AC12T5	12	2080	25	0.5	50	±5	500	2.5	5	50	80	369.00
30AC15T5	15	1660	25	0.5	50	±5	500	2.5	5	50	80	369 00

Common Characteristics
Main Output Voltge Tolerance ±0.5%*
Main Line Rgulation ±0.2%

Common Characteristics
Auxiliary Output Voltge Tolerance ±5%*
Auxiliary Line Rgulation ±0.2%

*Measurements taken at 115VAC-60Hz

† = 10% minimum load required
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

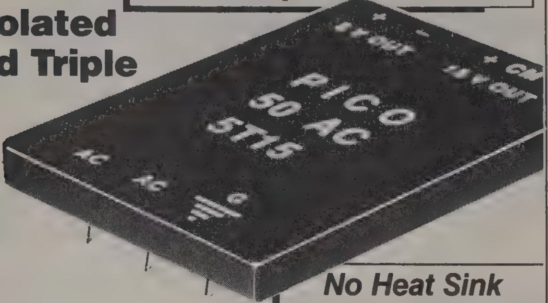
Delivery—
stock to one week

PICO Electronics, Inc.
For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES 50AC

Hi Reliability
Hi Efficiency/Isolated
Single, Dual and Triple Outputs
Regulated
55 Watt AC-DC Switchers

Lowest Profile!
0.5″ht. up to 55 Watts



+ 5 V OUT
-
+ CM
-15 V OUT
PICO
50 AC
5T15
AC
AC
G

No Heat Sink or Electrical Derating Required

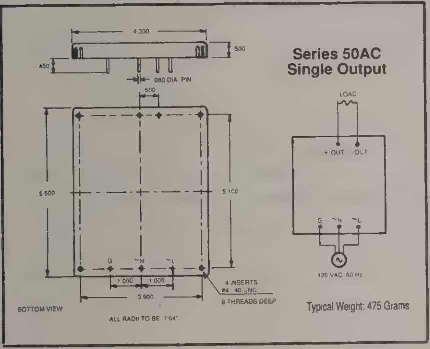
TYPICAL CHARACTERISTICS:
Test conditions: 25°C ambient
Input voltage: 90-130VAC (47-440Hz)
Line/load regulation: See specifications below
Converter frequency: 40-60 KHz typ.
Operating temperature: −25°C to +70°C ambient
Output voltage temperature coefficient: 0.02%C
Storage temperature: −55°C to +125°C
Isolation: 1200V RMS
Short circuit protection: Continuous

OPTIONS AVAILABLE PER MIL-STD-883
- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, burn in*

55 Watt AC-DC Switchers

FEATURES:
- Low Profile *0.500″*
- Low weight
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent voltage regulation
- Excellent load regulation
- Up to 55 watts output power at 70°C ambient
- Low output ripple
- Isolation 1200V RMS
- Single, Dual and Triple Outputs
- No heat sink required
- Miniature size
- No output capacitor required
- Shielding

This series of low profile, 45-55 Watt AC to DC switchers come in 11 different models. These units offer high efficiency and precise regulation throughout the operating temperature range of -25°C to +70°C ambient, with no heat sink or electrical derating required. The 50AC series keeps a maximum 0.500" height while still offering you 1200 volts RMS isolation in a rugged encapsulated case. The convenience of PC mounting and the availability of three outputs should aid your circuit design.



4 300
500
450
080 DIA. PIN
600
5 600
5 100
G
~N
~L
1 000
1 000
3 900
4 INSERTS
#4 40 UNC
8 THREADS DEEP
BOTTOM VIEW
ALL RADII TO BE 7/64"
LOAD
+ OUT
OUT
120 VAC 60 Hz

Series 50AC
Single Output

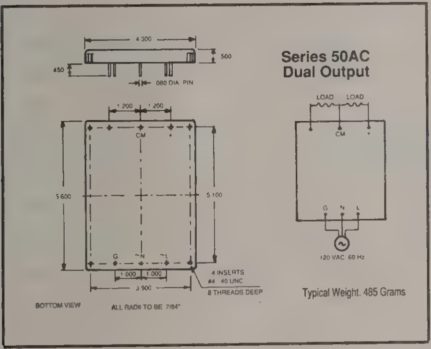
Typical Weight: 475 Grams

SERIES 50AC SINGLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz) (OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
50AC5S	5	9000	45	75	50	1.0	0.75	0.2	359.00
50AC12S	12	4583	55	80	50	0.5	0.30	0.2	359.00
50AC15S	15	3667	55	83	50	0.5	0.30	0.2	359.00
50AC24S	24	2292	55	86	50	0.5	0.30	0.2	359.00
50AC28S	28	1964	55	86	50	0.5	0.30	0.2	359.00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required

**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.



4 300
500
450
080 DIA. PIN
1 200
1 200
CM
5 600
5 100
G
N
L
1 000
1 000
3 900
4 INSERTS
#4 40 UNC
8 THREADS DEEP
BOTTOM VIEW
ALL RADII TO BE 7/64"
LOAD
LOAD
CM
120 VAC 60 Hz

Series 50AC
Dual Output

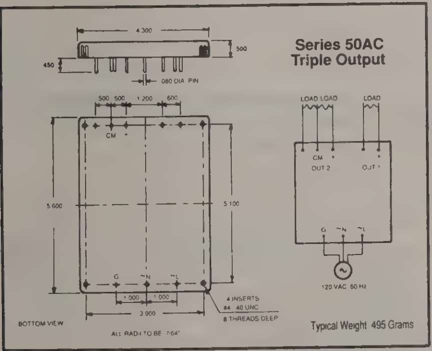
Typical Weight. 485 Grams

SERIES 50AC DUAL OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz) (OPTIONAL 170-240VAC, 47-440Hz**)

PICO PART NUMBER	OUTPUT VOLTAGE VDC	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%-100% LOAD † (±%)*	LINE REGULATION (±%)*	PRICE 1–24
50AC5D	±5	4500	22.5	75	50	1.0	0.75	0.2	377.00
50AC12D	±12	2291	27.5	80	50	0.5	0.30	0.2	377.00
50AC15D	±15	1833	27.5	83	50	0.5	0.30	0.2	377.00

*Readings taken at 115VAC-60Hz
† = 10% minimum load required

**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.



4 300
500
450
080 DIA. PIN
500
500
1 200
600
CM
5 600
5 100
G
N
L
1 000
1 000
3 900
4 INSERTS
#4 40 UNC
8 THREADS DEEP
BOTTOM VIEW
ALL RADII TO BE 7/64"
LOAD LOAD
LOAD
CM
OUT 2
OUT 1
120 VAC 60 Hz

Series 50AC
Triple Output

Typical Weight 495 Grams

SERIES 50AC TRIPLE OUTPUT
INPUT VOLTAGE 90-130VAC (47-440Hz) (OPTIONAL 170-240VAC, 47-440Hz**)

	MAIN OUTPUT VOLTAGE					AUXILIARY OUTPUT VOLTAGE						
PICO PART NUMBER	OUTPUT VOLTAGE DC VDC	MAX LOAD CURRENT mA OUTPUT	MAX OUTPUT POWER (watts) OUTPUT	V LD.REG. 25-100% LOAD (±%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	VOLT. LOAD REG. 25-100% LOAD † (±%)*	OUTPUT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p*	EFF. @ FULL LOAD TYPICAL (%)	PRICE 1–24
50AC5T12	5	8000	40	0.75	50	±12	208	2.5	1.0	50	75	395.00
50AC5T15	5	8000	40	0.75	50	±15	167	2.5	1.0	50	75	395.00
50AC12T5	12	3750	45	0.25	50	±5	500	2.5	1.0	50	77	395.00
50AC15T5	15	3000	45	0.25	50	±5	500	2.5	1.0	50	79	395.00
	Common Characteristics Main Output Voltge Tolerance ±0.5%* Main Line Rgulation ±0.2%					Common Characteristics Auxiliary Output Voltge Tolerance ±0.5%* Auxiliary Line Rgulation ±0.2%					*Measurements taken at 115VAC-60Hz	

† = 10% minimum load required

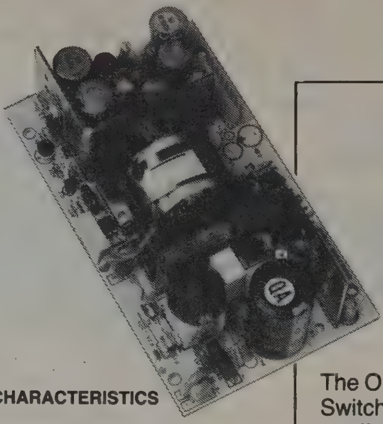
**All units available with 170-240VAC Input. Add H, prefix to part number-$40 per unit cost added.

Delivery— stock to one week

PICO Electronics, Inc. *Call Toll Free 800-228-9747*
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES OFU

30-40-65 Watt
Universal Input (85-264 VAC)
No Jumper Required
Agency Approved
Isolated
Short Circuit Protection



Open Frame PCB AC-DC Switchers

FEATURES:
- 85 to 264 VAC input
- 47 to 440 Hz
- UL-CSA-TUV certified
- Compact size
- Meets FCC/VDE-EMI requirements
- Hi-Reliability
- Over voltage protection
- Over current protection
- 100% hi-temperature testing
- Single-Dual-Triple outputs

The OFU Series of Open Frame AC-DC Switching Power Supplies are designed to offer the best of today's technical advancements. Standard features include small size, universal input, agency approvals, plus 100% burn-in. For a high reliable, low cost answer to your circuit requirements, let PICO simplify your power needs for computer designs or industrial applications.

TYPICAL CHARACTERISTICS:

Meets conduction limits: FCC 20780 Level B, VDE 0871 Level A

Meets or exceeds:

UL 1950

CSA 1402C

EN 60950/IEC 950

Efficiency: 65% min. @ full load

Hold-up time: 16 msec typical

Line regulation: ±0.5% max. @ full load

Inrush current: 30 Amps @ 115 VAC
60 Amps @ 230 VAC

Isolation: 3750 VAC—input to output
1250 VAC—input to ground

ELECTRICAL CHARACTERISTICS ALL MODELS:

Input voltage: 85 to 264 VAC

Input frequency: 47 to 440 Hz

Input current:	OFU 30	OFU 40	OFU 65
115 VAC	0.65A	0.85A	1.0A
230 VAC	0.35A	0.45A	0.6A

Over voltage: 5.6 to 6.6V threshold on 5V output models

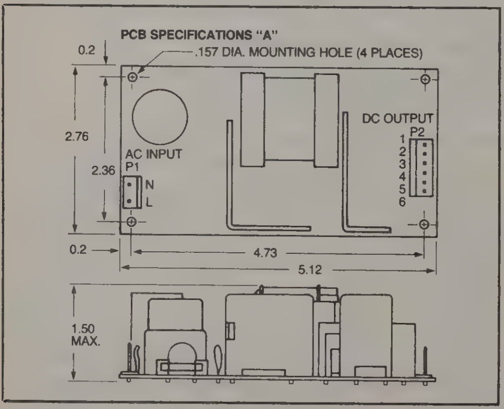
Over current: All outputs short circuit protected

Ripple/noise: 1% p-p max. on all models

Temp. coefficient: ±0.04%/°C

OFU3-30 Watt, 85-264 VAC Input

		OUTPUT 1				OUTPUT 2				OUTPUT 3					
MODEL NUMBER	MAX. TOTAL POWER	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	MECH. DRAWING	PRICE 1-24
OFU3-1S	25W	+5VDC	0.3A	5A	1%	–	–	–	–	–	–	–	–	A	52.80
OFU3-2S	30W	+12VDC	0.2A	2.5A	1%	–	–	–	–	–	–	–	–	A	52.80
OFU3-3S	30W	+15VDC	0.1A	2A	1%	–	–	–	–	–	–	–	–	A	52.80
OFU3-4S	30W	+24VDC	0.1A	1.3A	1%	–	–	–	–	–	–	–	–	A	52.80
OFU3-5D	30W	+5VDC	0.3A	3A	3%	+12VDC	0.3A	1.5A	5%	–	–	–	–	A	54.00
OFU3-6D	30W	+5VDC	0.3A	3A	3%	+15VDC	0.2A	1.5A	5%	–	–	–	–	A	54.00
OFU3-7D	30W	+5VDC	0.3A	3A	3%	+24VDC	0.1A	1A	5%	–	–	–	–	A	54.00
OFU3-8M	30W	+5VDC	0.3A	3A	3%	+12VDC	0.3A	1.5A	5%	-5VDC	0.05A	0.2A	10%	A	56.20
OFU3-9M	30W	+5VDC	0.3A	3A	3%	+12VDC	0.3A	1.5A	5%	-12VDC	0.05A	0.2A	10%	A	56.20
OFU3-10M	30W	+5VDC	0.3A	3A	3%	+15VDC	0.2A	1.5A	5%	-15VDC	0.05A	0.2A	10%	A	56.20
OFU3-11M	30W	+5VDC	0.3A	3A	3%	+15VDC	0.2A	1.5A	5%	-12VDC	0.05A	0.2A	10%	A	56.20



NOTES:
1. Dimensions shown in inch.
2. Tolerance 0.02 maximum.
3. Weight: 9.9 oz. (280 grams) approx.

CONNECTOR DATA

Input connector mates with Molex housing 09-50-3031 and Molex 2878 series crimp terminal.

Output connector mates with Molex housing 09-50-3061 and Molex 2878 series crimp terminal.

PIN CHART PCB "A"

MODEL NUMBER	DC OUTPUT CONNECTOR					
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN #6
OFU3-1S/2S/3S/4S	OUTPUT #1	OUTPUT #1	OUTPUT #1	RETURN	RETURN	RETURN
OFU3-5D/6D/7D	OUTPUT #1	OUTPUT #1	COMMON	COMMON	N.C.	OUTPUT #2
OFU3-8M/9M/10M/11M	OUTPUT #1	OUTPUT #1	COMMON	COMMON	OUTPUT #3	OUTPUT #2

Delivery—
stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

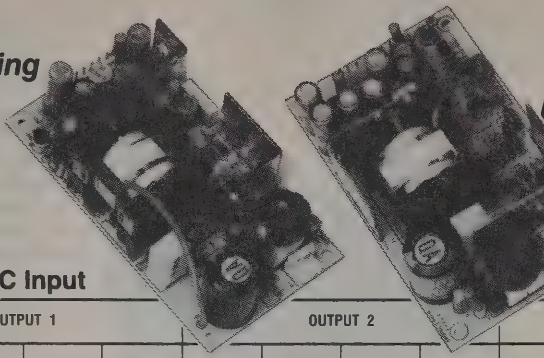
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

35 MODELS

0°C to +50°C Operating Temperature

Single-Dual Multiple Outputs Available

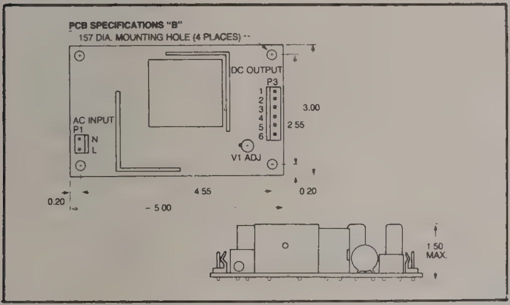
Standard 100% Hi Temp Testing



Universal Input Voltage
No Jumper Required
Multiple Outputs

OFU4-40 Watt, 85-264 VAC Input

MODEL NUMBER	MAX. TOTAL POWER	OUTPUT 1 V OUTPUT	OUTPUT 1 I MINIMUM	OUTPUT 1 I MAXIMUM	OUTPUT 1 TOLERANCE	OUTPUT 2 V OUTPUT	OUTPUT 2 I MINIMUM	OUTPUT 2 I MAXIMUM	OUTPUT 2 TOLERANCE	OUTPUT 3 V OUTPUT	OUTPUT 3 I MINIMUM	OUTPUT 3 I MAXIMUM	OUTPUT 3 TOLERANCE	MECH. DRAWING	PRICE 1-24
OFU4-1S	30W	+5VDC	0.5A	6A	1%	–	–	–	–	–	–	–	–	B	61.20
OFU4-2S	40W	+12VDC	0.2A	3.5A	1%	–	–	–	–	–	–	–	–	B	61.20
OFU4-3S	40W	+15VDC	0.2A	3A	1%	–	–	–	–	–	–	–	–	B	61.20
OFU4-4S	40W	+24VDC	0.1A	2A	1%	–	–	–	–	–	–	–	–	B	61.20
OFU4-5D	40W	+5VDC	0.5A	3A	3%	+12VDC	0.2A	2A	5%	–	–	–	–	B	61.20
OFU4-6D	40W	+5VDC	0.5A	3A	3%	+15VDC	0.2A	2A	5%	–	–	–	–	B	61.20
OFU4-7D	40W	+5VDC	0.5A	3A	3%	+24VDC	0.1A	1A	5%	–	–	–	–	B	61.20
OFU4-8M	40W	+5VDC	0.5A	3A	3%	+12VDC	0.2A	2A	5%	-5VDC	0.05A	0.3A	10%	B	61.20
OFU4-9M	40W	+5VDC	0.5A	3A	3%	+12VDC	0.2A	2A	5%	-12VDC	0.05A	0.3A	10%	B	61.20
OFU4-10M	40W	+5VDC	0.5A	3A	3%	+15VDC	0.2A	2A	5%	-15VDC	0.05A	0.3A	10%	B	61.20
OFU4-11M	40W	+5VDC	0.5A	3A	3%	+15VDC	0.2A	2A	5%	-12VDC	0.05A	0.3A	10%	B	61.20
OFU4-12M	40W	+5VDC	0.5A	3A	3%	+24VDC	0.1A	1A	5%	-12VDC	0.05A	0.3A	10%	B	61.60



NOTES: 1. Dimensions shown in inch.
2. Tolerance 0.02 maximum.
3. Weight: 10.6 oz. (300 grams) approx.

CONNECTOR DATA

Input connector mates with Molex housing 09-50-3031 and Molex 2878 series crimp terminal.

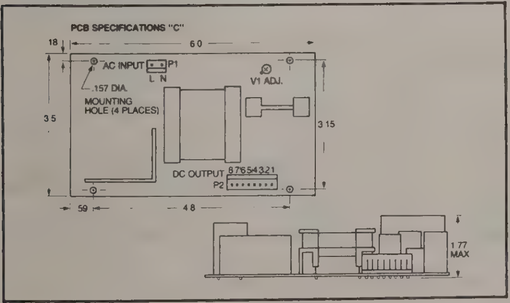
Output connector mates with Molex housing 09-50-3061 and Molex 2878 series crimp terminal.

PIN CHART PCB "B"

MODEL NUMBER	DC OUTPUT CONNECTOR PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN #6
OFU4-1S/2S/3S/4S	OUTPUT #1	OUTPUT #1	OUTPUT #1	RETURN	RETURN	RETURN
OFU4-5D/6D/7D	OUTPUT #2	OUTPUT #1	OUTPUT #1	COMMON	COMMON	N.C.
OFU4-8M/9M/10M/11M /12M	OUTPUT #2	OUTPUT #1	OUTPUT #1	COMMON	COMMON	OUTPUT #3

OFU6-65 Watt, 85-264 VAC Input

MODEL NUMBER	MAX. TOTAL POWER	OUTPUT 1 V OUTPUT	OUTPUT 1 I MINIMUM	OUTPUT 1 I MAXIMUM	OUTPUT 1 TOLERANCE	OUTPUT 2 V OUTPUT	OUTPUT 2 I MINIMUM	OUTPUT 2 I MAXIMUM	OUTPUT 2 TOLERANCE	OUTPUT 3 V OUTPUT	OUTPUT 3 I MINIMUM	OUTPUT 3 I MAXIMUM	OUTPUT 3 TOLERANCE	MECH. DRAWING	PRICE 1-24
OFU6-1S	50W	+5VDC	1A	10A	1%	–	–	–	–	–	–	–	–	C	68.20
OFU6-2S	65W	+12VDC	0.5A	5.5A	1%	–	–	–	–	–	–	–	–	C	68.20
OFU6-3S	65W	+15VDC	0.4A	4.5A	1%	–	–	–	–	–	–	–	–	C	68.20
OFU6-4S	65W	+24VDC	0.3A	3A	1%	–	–	–	–	–	–	–	–	C	68.20
OFU6-5D	65W	+5VDC	1A	6A	3%	+12VDC	0.5A	3A	5%	–	–	–	–	C	69.40
OFU6-6D	65W	+5VDC	1A	6A	3%	+15VDC	0.4A	3A	5%	–	–	–	–	C	69.40
OFU6-7D	65W	+5VDC	1A	6A	3%	+24VDC	0.3A	2A	5%	–	–	–	–	C	69.40
OFU6-8M	65W	+5VDC	1A	6A	3%	+12VDC	0.5A	3A	5%	-5VDC	0.1A	0.5A	10%	C	71.60
OFU6-9M	65W	+5VDC	1A	6A	3%	+12VDC	0.5A	3A	5%	-12VDC	0.1A	0.5A	10%	C	71.60
OFU6-10M	65W	+5VDC	1A	6A	3%	+15VDC	0.4A	3A	5%	-15VDC	0.1A	0.5A	10%	C	71.60
OFU6-11M	65W	+5VDC	1A	6A	3%	+15VDC	0.4A	3A	5%	-12VDC	0.1A	0.5A	10%	C	71.60
OFU6-12M	65W	+5VDC	1A	6A	3%	+24VDC	0.3A	2A	5%	-12VDC	0.1A	0.5A	10%	C	71.60



NOTES: 1. Dimensions shown in inch.
2. Tolerance 0.02 maximum.
3. Weight: 13.4 oz. (380 grams) approx.

CONNECTOR DATA

Input connector mates with Molex housing 09-50-3031 and Molex 2878 series crimp terminal.

Output connector mates with Molex housing 09-50-3081 and Molex 2878 series crimp terminal.

PIN CHART PCB "C"

MODEL NUMBER	DC OUTPUT CONNECTOR PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN #6	PIN #7	PIN #8
OFU6-1S/2S/3S/4S	OUTPUT #1	OUTPUT #1	OUTPUT #1	OUTPUT #1	RETURN	RETURN	RETURN	RETURN
OFU6-5D/6D/7D	OUTPUT #1	OUTPUT #1	COMMON	COMMON	OUTPUT #2	OUTPUT #2	N.C.	N.C.
OFU6-8M/9M/10M/12M	OUTPUT #1	OUTPUT #1	COMMON	COMMON	OUTPUT #2	OUTPUT #2	OUTPUT #3	N.C.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

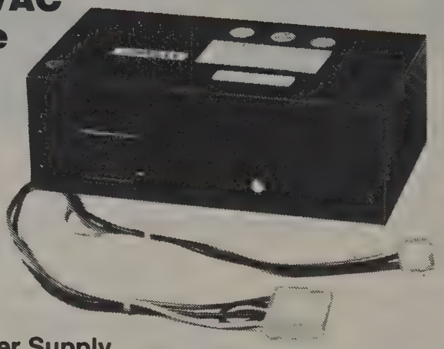
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES OFB

50-130 Watt
Fully Enclosed
90-130 VAC or 180-260 VAC
Input-Jumper Selectable
Short Circuit Protection
Isolated Outputs

Fully Enclosed AC-DC Switchers

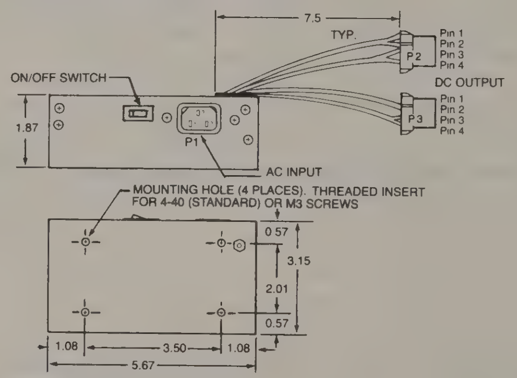


FEATURES:
- 90-130 VAC or 180-260 VAC input
- Meets FCC/VDE, EMI requirements
- 100% burn-in testing
- Meets or exceeds UL-CSA requirements
- Hi Reliability
- Over current protection
- Low noise less than 1% p-p
- Single-dual-triple and quad outputs

OFB 5-50 Watt AC-DC Switching Power Supply

		OUTPUT 1				OUTPUT 2				OUTPUT 3					
MODEL NUMBER	MAX. TOTAL POWER	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	MECH. DRAWING	PRICE 1-24
OFB5-1S	50W	+5VDC	2A	10A	1%	–	–	–	–	–	–	–	–	D	74 80
OFB5-2S	50W	+12VDC	0 8A	4 2A	1%	-	-	–	–	–	–	–	–	D	74 80
OFB5-3S	50W	+15VDC	0 6A	3 5A	1%	–	–	–	–	–	–	–	-	D	74 80
OFB5-4S	50W	+24VDC	0 4A	2 2A	1%	–	–	–	–	–	–	–	-	D	74 80
OFB5-5D	50W	+5VDC	0 5A	2A	3%	+12VDC	0 5A	3 5A	5%	–	–	-	–	D	77 00
OFB5-6M	50W	+5VDC	1A	6A	3%	+12VDC	0 4A	2A	5%	-5VDC	0 1A	0 5A	10%	D	80 40
OFB5-7M	50W	+5VDC	1A	6A	3%	+12VDC	0 4A	2A	5%	-12VDC	0 1A	0 5A	10%	D	80 40
OFB5-8M	50W	+5VDC	1A	6A	3%	+15VDC	0 4A	2A	5%	-15VDC	0 1A	0 5A	10%	D	80 40

MECHANICAL SPECIFICATIONS "D"



NOTES:
1. Dimensions shown in inch.
2. Tolerance 0.02 maximum.
3. Weight: 21.9 oz. (620 grams) approx.

CONNECTOR DATA

Output connectors mate with AMP P/N 1-480426-0 pin housing assembly or P/N 1-350211-1 pin header assembly.

PIN CHART OFB5 "D"

MODEL NUMBER	CONNECTOR NO. P1			P2				P3			
	PIN 1	PIN 2	PIN 3	PIN 1	PIN 2	PIN 3	PIN 4	PIN 1	PIN 2	Pin 3	Pin 4
OFB5-1S	AC Live	Ground	AC Neutral	Return	Return	+5V	+5V	N/A	N/A	N/A	N/A
OFB5-2S	AC Live	Ground	AC Neutral	Return	Return	+12V	+12V	N/A	N/A	N/A	N/A
OFB5-3S	AC Live	Ground	AC Neutral	Return	Return	+15V	+15V	N/A	N/A	N/A	N/A
OFB5-4S	AC Live	Ground	AC Neutral	Return	Return	+24V	+24V	N/A	N/A	N/A	N/A
OFB5-5D	AC Live	Ground	AC Neutral	+12V	Common	Common	+5V	+12V	Common	Common	+5V
OFB5-6M	AC Live	Ground	AC Neutral	+12V	-5V	Common	+5V	+12V	N.C.	Common	+5V
OFB5-7M	AC Live	Ground	AC Neutral	+12V	-12V	Common	+5V	+12V	N C.	Common	+5V
OFB5-8M	AC Live	Ground	AC Neutral	+15V	-15V	Common	+5V	+15V	N C	Common	+5V

Delivery—
stock to one week

For immediate engineering assistance or to place an order— Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwv.. Mt. Vernon. N.Y. 10552 • • FAX 914-699-5565

For manufacturers' sales offices, see yellow pages

The OFB Series of fully enclosed AC-DC Switching Power Supplies are designed to offer the best of todays technical advancements. Standard features include small size, jumper selectable input voltage, meeting agency requirements and 100% burn-in, for a high reliable, low cost answer to your circuit requirements. One to four standard outputs ease your distribution problems for computer designs or industrial applications.

TYPICAL CHARACTERISTICS:

Input voltage: 90-130 VAC or 180-260 VAC jumper selectable

Input frequency: 47 to 440 Hz

Input current:	OFB 5	OFB 13
115 VAC	0.9 A	2.8 A
230 VAC	0.5 A	1.5 A

Ripple and noise: 1% p-p max.

Short circuit protection: All outputs

Over voltage protection: Output one all models

Temp. coefficient: ±0.04%/°C

Efficiency: 65% min. @ full load

Line regulation: ±0.5% max. @ full load

Isolation: Input to output 3000 VAC
Input to ground 1500 VAC

Operating temp: 0°C to +50°C

Storage temp: −20°C to +85°C

Hold-up time: 20 msec typical

EMI requirements: Meets requirements FCC 20780 Level B, VDE 0871 Level A

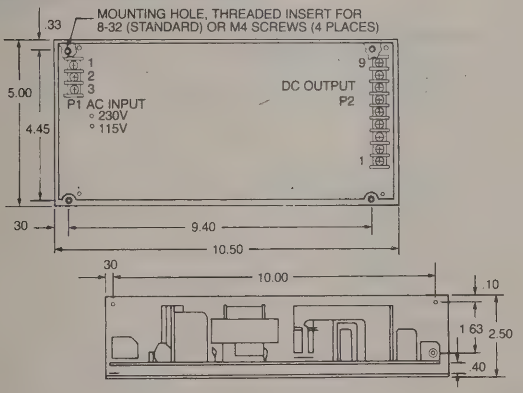
Safety requirements: Model OFB 5 certified,
UL-1950,
CSA-1402C,
EN 609050/IEC 950.

Model OFB 13 meets requirements of
UL-1950,
CSA 1402C,
IEC 950.

OFB 13-130 Watt AC-DC Switching Power Supply

		OUTPUT 1				OUTPUT 2				OUTPUT 3				OUTPUT 4					
MODEL NUMBER	MAX. TOTAL POWER	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	MECH. DRAWING	PRICE 1-24
OFB13-1D	130W	+5VDC	3A	15A	3%	+12VDC	1A	5A	5%	–	–	–	–	–	–	–	–	E	129.80
OFB13-2T	130W	+5VDC	3A	15A	3%	+12VDC	1A	5A	5%	-12VDC	0A	0 8A	5%	–	–	–	–	E	132.40
OFB13-3M	130W	+5VDC	3A	15A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	-5VDC	0	0 8A	5%	E	137.60
OFB13-4M	130W	+5VDC	3A	15A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+12VDC	0 5A	1 5A	6%	E	137 60
OFB13-5M	130W	+5VDC	3A	15A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+15VDC	1A	4A	10%	E	137.60
OFB13-6M	130W	+5VDC	3A	15A	3%	+12VDC	0.8A	4A	5%	-15VDC	0A	0.8A	5%	+15VDC	0 5A	1 5A	6%	E	137.60
OFB13-7M	130W	+5VDC	3A	15A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+24VDC	1A	4A	10%	E	137.60

MECHANICAL SPECIFICATIONS "E"



NOTES:

1. Dimensions shown in inch.
2. Tolerance 0.02 maximum.
3. Weight: 3.5 lbs. approx. for enclosed unit.

CONNECTOR DATA

Input connector type is Beau Inc. P/N 72-5-03C.

Output connector type is Beau Inc. P/N 72-5-09C.

Screws are 6-32 on 0.375 inch centers.

PIN CHART OFB13 "E"

MODEL NUMBER	CONNECTOR NO. P1			P2						
	PIN 1	PIN 2	PIN 3	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5,6,7	PIN 8,9	Pin 10
OFB13-1D	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5V	N.C.	Common	+5V	N.C.
OFB13-2T	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	N.C.	-12V	Common	+5V	N.C
OFB13-3M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5.V	-12V	Common	+5V	N.C.
OFB13-4M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V (6A)	N.C.	-12V	Common	+5V	+12V (4A)
OFB13-5M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	N.C.	-12V	Common	+5V	+24V
OFB13-6M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V (6A)	-5V	-12V	Common	+5V	+12V (4A)
OFB13-7M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5V	-12V	Common	+5V	+24V

*Power failure detect.

Delivery—
stock to one week

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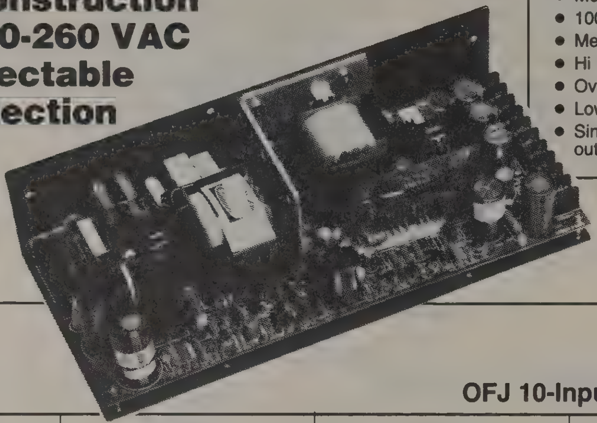
SERIES OFJ

AC-DC Switchers

100-200 Watt
PCB-L-Bracket Construction
90-130 VAC or 180-260 VAC
Input-Jumper Selectable
Short Circuit Protection
Isolated Outputs

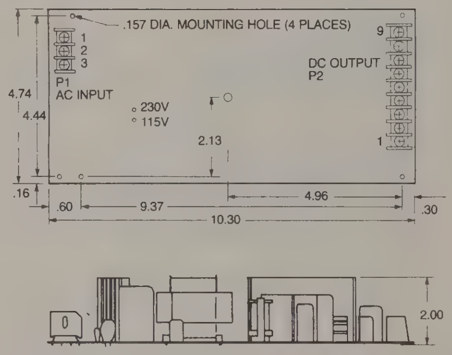
FEATURES:
- 90-130 VAC or 180-260 VAC input
- Meets FCC/VDE, EMI requirements
- 100% burn-in testing
- Meets or exceeds UL-CSA-IEC requirements
- Hi Reliability
- Over current protection
- Low noise less than 1% p-p
- Single-dual-triple quad and 2 models with *five* outputs



OFJ 10-Input 90-130 VAC or 180-260 VAC

		OUTPUT 1				OUTPUT 2				OUTPUT 3				OUTPUT 4					
MODEL NUMBER	MAX. TOTAL POWER	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	MECH. DRAWING	PRICE 1-24
OFJ10-1D	100W	+5VDC	2A	10A	3%	+12VDC	1A	5A	5%	–	–	-	-	–	–	–	–	F	104 60
OFJ10-2M	100W	+5VDC	2A	10A	3%	+12VDC	1A	5A	5%	-12VDC	0A	0 8A	5%	–	–	–	–	F	106 80
OFJ10-3M	100W	+5VDC	2A	10A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	-5VDC	0A	0 8A	5%	F	109.00
OFJ10-4M	100W	+5VDC	2A	10A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+12VDC	0 5A	1.5A	6%	F	109 00
OFJ10-5M	100W	+5VDC	2A	10A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+15VDC	1A	3A	8%	F	109 00
OFJ10-6M	100W	+5VDC	2A	10A	3%	+12VDC	0.8A	4A	5%	-15VDC	0A	0.8A	5%	+15VDC	0 5A	1 5A	8%	F	109 00
OFJ10-7M	100W	+5VDC	2A	10A	3%	+12VDC	0.8A	4A	5%	-12VDC	0A	0.8A	5%	+24VDC	1A	3A	8%	F	109 00

MECHANICAL SPECIFICATIONS "F"



NOTES:
1. Dimensions shown in inch.
2. Tolerance 0.02 maximum
3. Weight: 2.05 lbs. (930 grams) approx.

CONNECTOR DATA

Input connector type is Beau Inc. P/N 72-5-03C.

Output connector type is Beau Inc. P/N 72-5-09C.

Screws are 6-32 on 0.375 inch centers.

PIN CHART OFJ10 "F"

MODEL NUMBER	CONNECTOR NO. P1			P2					
	PIN 1	PIN 2	PIN 3	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5.6.7	PIN 8.9
OFJ10-1D	AC Live	AC Ground	AC Neutral	P.F.D.*	N.C.	+12V	N.C.	Common	+5V
OFJ10-2M	AC Live	AC Ground	AC Neutral	P.F.D.*	-12V	+12V	N.C.	Common	+5V
OFJ10-3M	AC Live	AC Ground	AC Neutral	P.F.D.*	-12V	+12V	-5V	Common	+5V
OFJ10-4M	AC Live	AC Ground	AC Neutral	P.F.D.*	-12V	+12V (4A)	+12V (1.5A)	Common	+5V
OFJ10-5M	AC Live	AC Ground	AC Neutral	P.F.D.*	-12V	+12V	+15V	Common	+5V
OFJ10-6M	AC Live	AC Ground	AC Neutral	P.F.D.*	+15V	+12V	+15V	Common	+5V
OFJ107M	AC Live	AC Ground	AC Neutral	P.F.D.*	-12V	+12V	+24V	Common	+5V

*Power failure detect

Delivery—
stock to one week

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PICO Electronics, Inc.

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The OFJ Series of AC-DC Switching Power Supplies are designed to offer the best of todays technical advancements.
These models are available in 100 and 200 watts. Standard features include jumper selectable input voltage, meeting agency requirements and 100% burn-in, for a high reliable, low cost answer to your circuit requirements. 14 models with up to 5 standard outputs provide solutions for power distribution problems.

TYPICAL CHARACTERISTICS:

Input voltage: 90–130 VAC or 180–260 VAC jumper selectable

Input frequency: 47 to 440 Hz

Input current:	OFJ 10	OFJ 20
115 VAC	2.2 A	4.2 A
230 VAC	1.2 A	2.4 A

Ripple and noise: 1% p-p max.

Short circuit protection: All outputs

Over voltage protection: Output one all models

Temp. coefficient: ±0.04%/°C

Efficiency: 65% min. @ full load

Line regulation: ±0.5% max. @ full load

Isolation: Input to output 3750 VAC
Input to ground 1750 VAC

Operating temp: 0°C to +50°C

Storage temp: −20°C to +85°C

Hold-up time: 20 msec typical

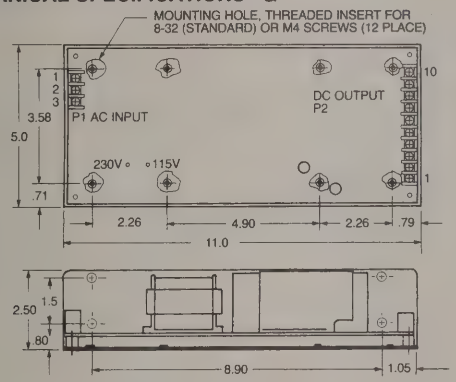
EMI requirements: Meets requirements FCC 20780 Level B, VDE 0871 Level A

Safety requirements: Meets or exceeds UL-1950, CSA-1402C, IEC 950

OFJ 20-Input 90-130 VAC or 180-260 VAC

		OUTPUT 1				OUTPUT 2				OUTPUT 3				OUTPUT 4				OUTPUT 5					
MODEL NUMBER	MAX. TOTAL POWER	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	V OUTPUT	I MINIMUM	I MAXIMUM	TOLERANCE	MECH. DRAWING	PRICE 1-24
OFJ20-1M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-5VDC	0A	1A	5%	–	–	–	–	–	–	–	–	G	162.80
OFJ20-2M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-12VDC	0A	1A	5%	–	–	–	–	–	–	–	–	G	162.80
OFJ20-3M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-5VDC	0A	1A	5%	-12VDC	0A	1A	5%	–	–	–	–	G	167.20
OFJ20-4M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-12VDC	0A	1A	5%	+12VDC	0A	4A	5%	–	–	–	–	G	167.20
OFJ20-5M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-12VDC	0A	1A	5%	+24VDC	0A	3A	8%	–	–	–	–	G	167.20
OFJ20-6M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-5VDC	0A	1A	5%	-12VDC	0A	1A	5%	+12VDC	0 6A	4A	5%	G	171.60
OFJ20-7M	200W	+5VDC	4A	20A	3%	+12VDC	1A	6A	5%	-5VDC	0A	1A	5%	-12VDC	0A	1A	5%	+24VDC	0.3A	3A	8%	G	171.60

MECHANICAL SPECIFICATIONS "G"



NOTES:
1. Dimensions shown in inch.
2. Tolerance 0.02 maximum
3. Weight: 3.5 lbs. (1.6 Kgs) approx. for L-bracket form.

CONNECTOR DATA

Input connector type is Beau Inc. P/N 72-5-03C.

Output connector type is Beau Inc. P/N 72-5-10C.

Screws are 6-32 on 0.375 inch centers.

PIN CHART OFJ20 "G"

MODEL NUMBER	CONNECTOR NO. P1			P2						
	PIN 1	PIN 2	PIN 3	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5,6,7	PIN 8,9	PIN 10
OFJ20-1M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5V	N.C.	Common	+5V	N.C.
OFJ20-2M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	N.C.	-12V	Common	+5V	N.C.
OFJ20-3M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5V	-12V	Common	+5V	N.C.
OFJ20-4M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V (6A)	N.C.	-12V	Common	+5V	+12V (4A)
OFJ20-5M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	N.C.	-12V	Common	+5V	+24V
OFJ20-6M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V (6A	-5V	-12V	Common	+5V	+12V (4A)
OFJ207M	AC Ground	AC Neutral	AC Live	P.F.D.*	+12V	-5V	-12V	Common	+5V	+24V

*Power failure detect

Delivery—
stock to one week

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PILLAR INDUSTRIES

MANUFACTURER OF

STANDARD/CUSTOM AC/AC OR AC/DC ADAPTORS

- **UL, CSA Approved Power Supplies**
- **VDE Approved European Power Supplies**
- **JIS Approved Japanese Power Supplies**
- **British (U.K.) Style Power Supplies**
- **Switching Power Supplies**
- **Full Range Power Supplies**
- **Linear Power Supplies**
- **Battery Chargers**

GENERAL SPECIFICATIONS

- Input Rating:

120 VAC	60Hz	UL/CSA	North America.
220 VAC	50Hz	VDE/TUV	Europe.
100 VAC	50/60Hz	JIS	Japan.
240 VAC	50Hz	BSI/SAA	U.K/Australia/S. Africa.

- Tolerance of Output Voltage: ±0.5V at rated load.
- Dielectric Withstand Voltage: UL/CSA JIS 1500 VAC/One Minute.
  VDE BSI TUV SAA 4000 VAC/One Minute.
- Humidity: 95%
- Storage Temperature: -40°C to +70°C.
- Operation Temperature: -10°C to +40°C.
- Output Cord: 6 feet, AWG 24 or heavier.
- MTBF.: 30000 hours at 25°C, full load.
- Q A STD: MIL-STD-105D
- Customer Design Are Available On Request To Meet Exact Specification.

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DUARTE, CA 91010
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PILLAR INDUSTRIES Manufacturer of AC ADAPTORS

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- **VDE Approved European Power Supplies**
- **JIS Approved Japanese Power Supplies**
- **British (U.K.) Style Power Supplies**

STANDARD AC/DC ADAPTORS JIS UL ■ CSA APPROVED

MODEL	INPUT	OUTPUT	UL	CSA	JIS
AD-0690	120V 15W	6VDC 900mA	✓	✓	✓
AD-061A	120V 15W	6VDC 1 A	✓	✓	✓
AD-0780	120V 15W	7.5VDC 800mA	✓	✓	✓
AD-0790	120V 15W	7.5VDC 900mA	✓	✓	✓
AD-071A	120V 15W	7.5VDC 1 A	✓	✓	✓
AD-0980	120V 15W	9VDC 800mA	✓	✓	✓
AD-0990	120V 15W	9VDC 900mA	✓	✓	✓
AD-091A	120V 15W	9VDC 1 A	✓	✓	✓
AD-1260	120V 15W	12VDC 600mA	✓	✓	✓
AD-1270	120V 15W	12VDC 700mA	✓	✓	✓
AD-1280	120V 15W	12VDC 800mA	✓	✓	✓
AD-1280	120V 15W	12.6VDC 800mA	✓	✓	
AD-1550	120V 15W	15VDC 500mA	✓	✓	✓
AD-1560	120V 15W	15VDC 600mA	✓	✓	✓
AD-1645	120V 15W	16VDC 450mA	✓	✓	✓
AD-1650	120V 15W	16VDC 500mA	✓	✓	✓
AD-1655	120V 15W	16VDC 550mA	✓	✓	✓
AD-1835	120V 15W	18VDC 350mA	✓	✓	✓
AD-1840	120V 15W	18VDC 400mA	✓	✓	✓
AD-1850	120V 15W	18VDC 500mA	✓	✓	✓
AD-2035	120V 15W	20VDC 350mA	✓	✓	✓
AD-2040	120V 15W	20VDC 400mA	✓	✓	✓
AD-2045	120V 15W	20VDC 450mA	✓	✓	✓
AD-2230	120V 15W	22VDC 300mA	✓	✓	✓
AD-2235	120V 15W	22VDC 350mA	✓	✓	✓
AD-2240	120V 15W	22VDC 400mA	✓	✓	✓
AD-2430	120V 15W	24VDC 300mA	✓	✓	✓
AD-2435	120V 15W	24VDC 350mA	✓	✓	✓
AD-1370	120V 15W	13VDC 700mA	✓		✓
AD-0660L	120V 15W	6VDC 600mA	✓		✓
AD-0670L	120V 15W	6VDC 700mA	✓		✓
AD-0680L	120V 15W	6VDC 800mA	✓		✓
AD-0760L	120V 15W	7.5VDC 600mA	✓		✓
AD-0770L	120V 15W	7.5VDC 700mA	✓		✓
AD-0960L	120V 15W	9VDC 600mA	✓	✓	✓
AD-1540L	120V 15W	15VDC 400mA	✓	✓	✓
AD-1845	120V 15W	18VDC 450mA	✓	✓	✓
AD-2030L	120V 15W	20VDC 300mA	✓	✓	✓
AD-2425L	120V 15W	24VDC 250mA	✓	✓	✓
AD-0970	120V 15W	9VDC 700mA	✓		✓
AD-052A	120V 20W	5VDC 2 A	✓		✓
AD-062A	120V 22W	6VDC 2 A	✓		✓
AD-091A2	120V 18W	9VDC 1.2 A	✓		✓
AD-091A5	120V 22W	9VDC 1.5 A	✓		✓
AD-1290	120V 18W	12VDC 900mA	✓		✓
AD-121A	120V 22W	12VDC 1 A	✓		✓
AD-121A2	120V 22W	12VDC 1.2 A	✓	✓	✓
AD-1570	120V 18W	15VDC 700mA	✓		✓
AD-1580	120V 22W	15VDC 800mA	✓		✓
AD-1590	120V 22W	15VDC 900mA	✓		✓
AD-1660	120V 18W	16VDC 600mA	✓		✓
AD-1670	120V 18W	16VDC 700mA	✓		✓
AD-1680	120V 22W	16VDC 800mA	✓		✓
AD-1860	120V 18W	18VDC 600mA	✓		✓
AD-1870	120V 22W	18VDC 700mA	✓		✓
AD-1880	120V 22W	18VDC 800mA	✓		✓
AD-2050	120V 18W	20VDC 500mA	✓		✓
AD-2060	120V 22W	20VDC 600mA	✓		✓
AD-2070	120V 22W	20VDC 700mA	✓		✓
AD-2250	120V 18W	22VDC 500mA	✓		✓
AD-2260	120V 22W	22VDC 600mA	✓		✓
AD-2450	120V 22W	24VDC 500mA	✓		✓
AD-2460	120V 22W	24VDC 600mA	✓		✓
AA-1540L	120V 15W	15VAC 400mA	✓		
AA-1550	120V 15W	15VAC 500mA	✓		
AA-1645	120V 15W	16VAC 450mA	✓		
AA-1650	120V 15W	16VAC 500mA	✓		
AA-1835	120V 15W	18VAC 350mA	✓		
AA-1840	120V 15W	18VAC 400mA	✓		
AA-1845	120V 15W	18VAC 450mA	✓		
AA-2030L	120V 15W	20VAC 300mA	✓		
AA-2035	120V 15W	20VAC 350mA	✓		
AA-2040	120V 15W	20VAC 400mA	✓		
AA-2230	120V 15W	22VAC 300mA	✓		
AA-2235	120V 15W	22VAC 350mA	✓		
AA-2425L	120V 15W	24VAC 250mA	✓		
AA-1960	120V 15W	19VAC 600mA	✓	✓	
AA-081A	120V 15W	8VAC 1 A	✓	✓	
AA-091A	120V 15W	9VAC 1 A	✓	✓	
AA-1283	120V 15W	12VAC 830mA	✓	✓	
AA-1850	120V 15W	18VAC 500mA	✓		
AA-2417	120V 15W	24VAC 170mA	✓	✓	
AA-061A	120V 15W	6VAC 1 A	✓		
AA-071A	120V 15W	7.5VAC. 1 A	✓		
AA-091A	120V 15W	9VAC 1 A	✓	✓	
AA-1280	120V 15W	12VAC 800mA	✓	✓	
AA-1370	120V 15W	13VAC 700mA	✓		
AA-1560	120V 15W	15VAC 600mA	✓		
AA-1655	120V 15W	16VAC 550mA	✓		
AA-2045	120V 15W	20VAC 450mA	✓		
AA-2240	120V 15W	22VAC 400mA	✓		
AA-2435	120V 15W	24VAC 350mA	✓		
AA-0670L	120V 15W	6VAC 700mA	✓		
AA-0680L	120V 15W	6VAC 800mA	✓		
AA-0690L	120V 15W	6VAC 900mA	✓		
AA-0760L	120V 15W	7.5VAC 600mA	✓		
AA-0770L	120V 15W	7 5VAC 700mA	✓		
AA-0780	120V 15W	7.5VAC 800mA	✓		
AA-0790	120V 15W	7.5VAC 900mA	✓		
AA-0960L	120V 15W	9VAC 600mA	✓		
AA-0970	120V 15W	9VAC 700mA	✓		
AA-0980	120V 15W	9VAC 800mA	✓		
AA-0990	120V 15W	9VAC 900mA	✓		
AA-1260	120V 15W	12VAC 600mA	✓		
AA-1270	120V 15W	12VAC 700mA	✓		
AD-5129-1	120V 24W	5VDC 1200mA +12VDC 200mA -12VDC 200mA	✓	✓	
AD-5129-3	120V 24W	5VDC 1000mA +12VDC 300mA -12VDC 100mA	✓		
AD-5129-5	120V 24W	5VDC 1500mA +12VDC 150mA -12VDC 50mA	✓		
AD-0903	120V 3W	9VDC 30mA		✓	✓
AD-0905	120V 3W	9VDC 50mA		✓	✓
AD-0910	120V 3W	9VDC 100mA	✓	✓	✓
AD-0920M	120V 5W	9VDC 200mA	✓	✓	✓
AD-0930M	120V 5W	9VDC 300mA	✓	✓	✓
AD-1205	120V 3W	12VDC 50mA	✓	✓	✓
AD-1210	120V 3W	12VDC 100mA	✓	✓	✓
AD-1215	120V 5W	12VDC 150mA	✓	✓	✓
AD-1220M	120V 5W	12VDC 200mA	✓	✓	✓
AD-1605	120V 3W	16VDC 50mA		✓	✓
AD-1610	120V 5W	16VDC 100mA	✓	✓	✓
AD-1015	120V 5W	10VDC 150mA	✓	✓	✓
AD-1225M	120V 5W	12VDC 250mA	✓	✓	✓
AD-0910RT	120V 3.5W	9VDC 100mA	✓		✓
AD-0920RT	120V 5W	9VDC 200mA	✓		✓
AD-0310	120V 3W	3VDC 100mA	✓	✓	✓
AD-0320	120V 3W	3VDC 200mA	✓	✓	✓
AD-0330	120V 3W	3VDC 300mA	✓	✓	✓
AD-0340	120V 3W	3VDC 400mA	✓	✓	✓
AD-0350	120V 4W	3VDC 500mA	✓	✓	✓
AD-0410	120V 3W	4.5VDC 100mA	✓	✓	✓
AD-0420	120V 3W	4.5VDC 200mA	✓	✓	✓
AD-0430	120V 4W	4.5VDC 300mA	✓	✓	✓
AD-0440	120V 5W	4.5VDC 400mA	✓	✓	✓
AD-0603	120V 3W	6VDC 30mA		✓	✓
AD-0610	120V 3W	6VDC 100mA	✓	✓	✓
AD-0620	120V 3W	6VDC 200mA	✓	✓	✓
AD-0630M	120V 5W	6VDC 300mA	✓	✓	✓
AD-0710	120V 3W	7.5VDC 100mA	✓	✓	✓
AD-0720	120V 4W	7.5VDC 200mA	✓	✓	✓
AA-0310	120V 3W	3VAC 100mA	✓	✓	
AA-0320	120V 3W	3VAC 200mA	✓	✓	
AA-0330	120V 3W	3VAC 300mA	✓	✓	
AA-0340	120V 3W	3VAC 400mA	✓	✓	
AA-0350	120V 4W	3VAC 500mA	✓	✓	
AA-0410	120V 3W	4.5VAC 100mA	✓	✓	
AA-0420	120V 3W	4.5VAC 200mA	✓	✓	
AA-0430	120V 4W	4.5VAC 300mA	✓	✓	
AA-0440	120V 5W	4.5VAC 400mA	✓	✓	
AA-0603	120V 3W	6VAC 30mA		✓	
AA-0610	120V 3W	6VAC 100mA	✓	✓	
AA-0620	120V 3W	6VAC 200mA	✓	✓	
AA-0630M	120V 5W	6VAC 300mA	✓	✓	
AA-0710	120V 3W	7.5VAC 100mA	✓	✓	
AA-0720	120V 4W	7.5VAC 200mA	✓	✓	
AA-0903	120V 3W	9VAC 30mA		✓	
AA-0905	120V 3W	9VAC 50mA		✓	
AA-0910	120V 3W	9VAC 100mA	✓	✓	
AA-0920M	120V 5W	9VAC 200mA	✓	✓	
AA-0930M	120V 5W	9VAC 300mA	✓	✓	
AA-1015	120V 5W	10VAC 150mA	✓	✓	
AA-1205	120V 3W	12VAC 50mA	✓	✓	
AA-1210	120V 3W	12VAC 100mA	✓	✓	
AA-1215	120V 5W	12VAC 150mA	✓	✓	
AA-1220M	120V 5W	12VAC 200mA	✓	✓	
AA-1605	120V 3W	16VAC 50mA		✓	
AA-1610	120V 5W	16VAC 100mA	✓	✓	
AA-1225M	120V 5W	12VAC 250mA	✓		
AD-2S50	120V 9W	6VDC/12VDC 500mA	✓		✓
AD-6S20/50	120V 9W	3/4.5/6/7.5/9/12VDC 200mA/500mA	✓	✓	✓
AD-6S50	120V 9W	3/4 5/6,7 5/9/12VDC 500mA	✓	✓	✓
AD-6S20/50N	120V 9W	3/4.5/6/7.5/9/12VDC 200mA/500mA	✓		✓
AD-6S10/30N	120V 9W	3/4.5/6/7.5/9/12VDC 100mA/300mA	✓		✓
AD-6S30N	120V 9W	3/4.5/6/7.5/9/12VDC 300mA	✓		✓
AA-0760	120V 9W	7.5VAC 600mA	✓		
AA-0940	120V 9W	9VAC 400mA	✓		
AA-1530	120V 9W	15VAC 300mA	✓		
AA-1245	120V 9W	12VAC 450mA	✓		
AA-042A	120V 15W	4.5VAC 2 A	✓	✓	
AA-061A5	120V 15W	6VAC 1.5 A	✓	✓	
AA-071A5	120V 16W	7.5VAC 1.5 A	✓	✓	
AA-091A	120V 15W	9VAC 1 A	✓	✓	
AA-1283	120V 15W	12VAC 830mA	✓	✓	
AA-121A	120V 18W	12VAC 1 A	✓	✓	
AA-1370	120V 15W	13VAC 700mA	✓	✓	
AA-1670	120V 16W	16VAC 700mA	✓	✓	
AA-1860	120V 16W	18VAC 600mA	✓	✓	
AA-2055	120V 16W	20VAC 550mA	✓	✓	
AA-2445	120V 16W	24VAC 450mA	✓	✓	
AA-0680	120V 9W	6VAC 800mA	✓	✓	
AA-0950	120V 9W	9VAC 500mA	✓	✓	
AA-0960	120V 9W	9VAC 600mA	✓	✓	
AA-1235	120V 9W	12VAC 350mA	✓	✓	
AA-1240	120V 9W	12VAC 400mA	✓	✓	
AA-1250	120V 9W	12VAC 500mA	✓	✓	
AA-1260	120V 9W	12VAC 600mA	✓	✓	
AA-1525	120V 9W	15VAC 250mA	✓	✓	
AA-1535	120V 9W	15VAC 350mA	✓	✓	
AA-1540	120V 9W	15VAC 400mA	✓	✓	
AA-1625	120V 9W	16VAC 250mA	✓	✓	
AA-1630	120V 9W	16VAC 300mA	✓	✓	
AA-1635	120V 9W	16VAC 350mA	✓	✓	
AA-1825	120V 9W	18VAC 250mA	✓	✓	
AA-1830	120V 9W	18VAC 300mA	✓	✓	
AA-2020	120V 9W	20VAC 200mA	✓	✓	
AA-2025	120V 9W	20VAC 250mA		✓	
AA-2030	120V 9W	20VAC 300mA	✓	✓	
AA-2420	120V 9W	24VAC 200mA	✓	✓	
AA-2425	120V 9W	24VAC 250mA	✓	✓	
AD-0450	120V 5W	4.5VDC 500mA	✓	✓	✓
AD-0630	120V 5W	6VDC 300mA	✓	✓	✓
AD-0640	120V 6W	6VDC 400mA	✓	✓	✓
AD-0650	120V 8W	6VDC 500mA	✓	✓	✓
AD-0730	120V 5W	7.5VDC 300mA	✓	✓	✓
AD-0740	120V 7W	7.5VDC 400mA	✓	✓	✓
AD-0920	120V 5W	9VDC 200mA	✓	✓	✓
AD-0930	120V 6W	9VDC 300mA	✓	✓	✓
AD-0940	120V 7W	9VDC 400mA	✓	✓	✓
AD-1220	120V 6W	12VDC 200mA	✓	✓	✓
AD-1230	120V 7W	12VDC 300mA	✓	✓	✓
AD-1515	120V 5W	15VDC 150mA	✓	✓	✓
AD-1516	120V 5W	15VDC 160mA	✓	✓	✓
AD-1520	120V 7W	15VDC 200mA	✓	✓	✓
AD-1525	120V 8W	15VDC 250mA	✓	✓	✓
AD-1615	120V 5W	16VDC 150mA	✓	✓	✓
AD-1620	120V 7W	16VDC 200mA	✓	✓	✓
AD-1815	120V 7W	18VDC 150mA	✓	✓	✓
AD-1820	120V 7W	18VDC 200mA	✓	✓	✓
AD-2010	120V 5W	20VDC 100mA	✓	✓	✓
AD-2015	120V 7W	20VDC 150mA	✓	✓	✓
AD-2410	120V 5W	24VDC 100mA	✓	✓	✓
AD-2415	120V 7W	24VDC 150mA	✓	✓	✓
AD-0660	120V 9W	4.5 OR 6VDC 600mA	✓	✓	✓
AD-0670	120V 9W	6VDC 700mA	✓	✓	✓
AD-0680	120V 9W	6VDC 800mA	✓	✓	✓
AD-0950	120V 9W	9VDC 500mA	✓	✓	✓
AD-0960	120V 9W	9VDC 600mA	✓	✓	✓
AD-1235	120V 9W	12VDC 350mA	✓	✓	✓
AD-1240	120V 9W	12VDC 400mA	✓	✓	✓
AD-1250	120V 9W	12VDC 500mA	✓	✓	✓
AD-1525	120V 9W	15VDC 250mA	✓	✓	✓
AD-1530	120V 9W	15VDC 300mA	✓	✓	✓
AD-1540	120V 9W	15VDC 400mA	✓	✓	✓
AD-1625	120V 9W	16VDC 250mA	✓	✓	✓
AD-1630	120V 9W	16VDC 300mA	✓	✓	✓
AD-1635	120V 9W	16VDC 350mA	✓	✓	✓
AD-1825	120V 9W	18VDC 250mA	✓	✓	✓
AD-1830	120V 9W	18VDC 300mA	✓	✓	✓
AD-2020	120V 9W	20VDC 200mA	✓	✓	✓
AD-2025	120V 9W	20VDC 250mA		✓	✓
AD-2030	120V 9W	20VDC 300mA	✓	✓	✓
AD-2420	120V 9W	24VDC 200mA	✓	✓	✓
AD-2425	120V 9W	24VDC 250mA	✓	✓	✓
AD-0760	120V 9W	7.5VDC 600mA	✓		✓
AD-1245	120V 9W	12VDC 450mA	✓		✓
AD-1535	120V 9W	15VDC 350mA	✓	✓	✓
AA-1230	120V 7W	12VAC 300mA	✓	✓	
AA-1820	120V 7W	18VAC 200mA	✓		
AA-630	120V 5W	6VAC 300mA	✓		
AA-650	120V 8W	6VAC 500mA	✓		
AA-0450	120V 7W	4.8VAC 500mA	✓		
AA-0660	120V 7W	6VAC 600mA	✓		
AA-0930	120V 5W	9VAC 300mA	✓		
AA-1620	120V 7W	16VAC 200mA	✓		
AA-1150	120V 10W	11VAC 500mA	✓		
AA-1045-0210	120V 10W	10.7/2 4VAC 450/100mA	✓		
AA-0660	120V 9W	6VAC 600mA	✓	✓	
AA-0670	120V 9W	6VAC 700mA	✓	✓	
AD-05126	110V 0.225W	5VDC 600mA +12VDC 250mA -12VDC 250mA	✓	✓	
AD-122A	120V	12VDC 2 A	✓		
AD-121A6	120V	12V 1.6A	✓	✓	
AD-0950R	117V 10VA	9VDC 500mA		✓	
AD-1240R	117V 10VA	12VDC 400mA		✓	
AD-1073DT	120V 15W	10.5VDC 730mA	✓	✓	
AD-091A5	120V 24W	11VDC 1.53A	✓		
AD-1095DT	120V 18W	10.6VDC 950mA	✓	✓	

PILLAR INDUSTRIES/1780 EVERGREEN STREET/DUARTE, CA 91010/TEL: 818-358-1337/FAX: 818-358-0398

PILLAR INDUSTRIES Manufacturer of AC ADAPTORS

220V AC 50HZ EUROPEAN CONTINENTAL TYPE AC ADAPTOR/TUV OR VDE APPROVED

MODEL	INPUT	OUTPUT	TUV	VDE
AD-51274B	220V 10.8W	5VDC 700mA	✓	
		12VDC 500mA		
AD-5129	220V 24.5W	5VDC 1 A	✓	
		+12VDC 200mA		
		-12VDC 200mA		
AD-051A5R	220V 18.75W	5VDC 1.5 A	✓	
AD-0330B	220V 4.4W	3VDC 300mA	✓	✓
AD-0350B	220V 5.5W	3VDC 500mA	✓	
AD-0430B	220V 4.4W	4.5VDC 300mA	✓	✓
AD-0630B	220V 4.4W	6VDC 300mA	✓	✓
AD-0730B	220V 5.5W	7.5VDC 300mA	✓	✓
AD-0930B	220V 6.6W	9VDC 300mA	✓	✓
AD-1220B	220V 5W	12VDC 200mA	✓	✓
AD-1515B	220V 5W	15VDC 150mA	✓	
AD-1815B	220V 5.5W	18VDC 150mA	✓	✓
AD-2010B	220V 4.4W	20VDC 100mA	✓	✓
AD-2410B	220V 5W	24VDC 100mA	✓	✓
AD-1516B	220V 5W	15VDC 160mA		✓
AD-0820B	220V	8.4VDC 220mA	✓	
AD-0450B	220V 7.8W	4.5VDC 500mA	✓	
AD-0650B	220V 7.7W	6VDC 500mA	✓	
AD-0750B	220V 8.8W	7.5VDC 500mA	✓	
AD-0950B	220V 9.9W	9VDC 500mA	✓	
AD-1310B	220V	13VDC 100mA	✓	
AD-1230B	220V 7.3W	12VDC 300mA	✓	
AD-1525B	220V 7W	15VDC 250mA	✓	
AD-1820B	220V 7.7W	18VDC 200mA	✓	
AD-2015B	220V 6.6W	20VDC 150mA	✓	
AD-2415B	220V 7W	24VDC 150mA	✓	
AA-0330B	220V 3.3W	3VAC 300mA	✓	

MODEL	INPUT	OUTPUT	TUV	VDE
AA-0350B	220V 4.4W	3VAC 500mA	✓	
AA-0430B	220V 3.3W	4.5VAC 300mA	✓	
AA-0630B	220V 3.3W	6VAC 300mA	✓	
AA-0730B	220V 4.4W	7.5VAC 300mA	✓	
AA-0930B	220V 4.4W	9VAC 300mA	✓	
AA-1220B	220V 4.4W	12VAC 200mA	✓	
AA-1515B	220V 4.4W	15VAC 150mA	✓	
AA-1815B	220V 4.4W	18VAC 150mA	✓	
AA-2010B	220V 4.4W	20VAC 100mA	✓	
AA-2410B	220V 3.96W	24VAC 100mA	✓	
AD-0360B	220V 5.5W	3VDC 600mA	✓	✓
AD-0460B	220V 6.6W	4.5VDC 600mA	✓	✓
AD-0660B	220V 7.7W	6VDC 600mA	✓	✓
AD-0760B	220V 8.8W	7.5VDC 600mA	✓	✓
AD-0960B	220V 9.9W	9VDC 600mA	✓	✓
AD-1250B	220V 9.9W	12VDC 500mA	✓	✓
AD-1540B	220V 9.9W	15VDC 400mA	✓	✓
AD-1830B	220V 8.8W	18VDC 300mA	✓	✓
AD-2030B	220V 9.9W	20VDC 300mA	✓	✓
AD-2425B	220V 9.9W	24VDC 250mA	✓	✓
AA-0360B	220V 5.5W	3VAC 600mA	✓	✓
AA-0460B	220V 6.6W	4.5VAC 600mA	✓	✓
AA-0660B	220V 7.7W	6VAC 600mA	✓	✓
AA-0760B	220V 8.8W	7.5VAC 600mA	✓	✓
AA-0960B	220V 9.9W	9VAC 600mA	✓	✓
AA-1250B	220V 9.9W	12VAC 500mA	✓	✓
AA-1540B	220V 9.9W	15VAC 400mA	✓	✓
AA-1830B	220V 8.8W	18VAC 300mA	✓	✓
AA-2030B	220V 9.9W	20VAC 300mA	✓	✓
AA-2425B	220V 9.9W	24VAC 250mA	✓	✓
AD-071AB	220V 14.3W	7.5VDC 1000mA	✓	✓

MODEL	INPUT	OUTPUT	TUV	VDE
AD-091AB	220V 15.5W	9VDC 1000mA	✓	✓
AD-1280B	220V 17.6W	12VDC 800mA	✓	✓
AD-1560B	220V 15.4W	15VDC 600mA	✓	✓
AD-1850B	220V 15.4W	18VDC 500mA	✓	✓
AD-2030B	220V 11W	20VDC 300mA	✓	✓
AD-2440B	220V 14.3W	24VDC 400mA	✓	✓
AD-061A2B	220V 13.2W	6VDC 1.2 A	✓	✓
AD-122AB	220V	12VDC 2 A	✓	
AA-061A2B	220V 11W	6VAC 1.2 A	✓	✓
AA-071AB	220V 11W	7.5VAC 1 A	✓	✓
AA-091AB	220V 13.2W	9VAC 1 A	✓	✓
AA-1280B	220V 14.3W	12VAC 800mA	✓	✓
AA-1560B	220V 13.2W	15VAC 600mA	✓	✓
AA-1850B	220V 12.2W	18VAC 500mA	✓	✓
AA-2030B	220V 8.8W	20VAC 300mA	✓	✓
AA-2440B	220V 13.2W	24VAC 400mA	✓	✓

DC REGULATED 5% U.S. VERSION

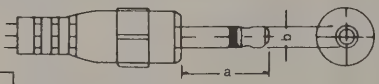
MODEL	INPUT	OUTPUT	UL	CSA
AD-0330R	120V 6W	3VDC 300mA	✓	✓
AD-0520R	120V 6W	5VDC 200mA	✓	✓
AD-0530R	120V 11W	12VDC 200mA		
		5.2VDC 300mA	✓	
AD-0950R	120V 10WA	9VDC 500mA		✓
AD-1260R	120V 10WA	12VDC 400mA		✓

BATTERY CHARGER

MODEL	INPUT	OUTPUT	UL	CSA
BC-2408A	120V 3.5A	24VDC 8 Amp	✓	✓
BC-2760R	120V	7.5VDC 600mA	✓	

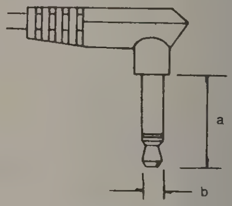
OUTPUT PLUG TYPES

OP-01/OP-02



TYPE	a	b
OP-01	0.453 11.5	0.098 2.5
OP-02	0.571 14.5	0.138 3.5

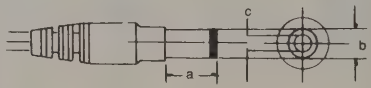
OP-03/OP-04



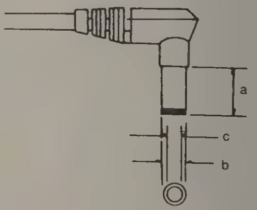
TYPE	a	b
OP-03	0.492 12.5	0.098 2.5
OP-04	0.571 14.5	0.138 3.5

OP-05/OP-06/OP-07-1/OP-07-2

TYPE	a	b	c
OP-05	0.472 12.0	0.197 5.0	0.079 2.0
OP-06	0.472 12.0	0.197 5 0	0.098 2.5
OP-07-1	0.472 12.0	0.217 5.5	0 098 2.5
OP-07-2	12.0	5.5	2.1

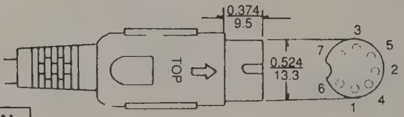


OP-08/OP-09



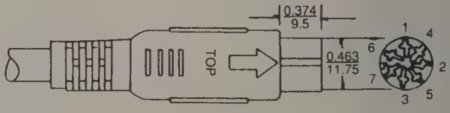
TYPE	a	b	c
OP-08	0.472 12.0	0.197 5.0	0.083 2.1
OP-09	0.453 11.5	0.217 5.5	0.098 2.5

OP-10/OP-11



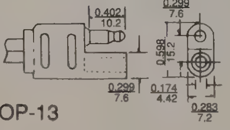
TYPE	PRESENT PIN						
	1	2	3	4	5	6	7
OP-10	✓	✓	✓	✓	✓		
OP-11	✓	✓	✓				

OP-12



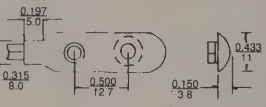
TYPE	PRESENT PIN						
	1	2	3	4	5	6	7
OP-12	✓	✓	✓	✓	✓		

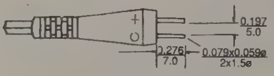
OP-13/OP-14/OP-15



OP-13

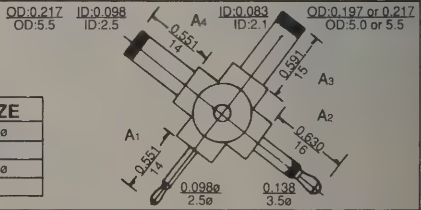
OP-14





OP-15

OP-16/OP-17



TYPE	A3 PLUGSIZE
OP-16	0.197ø x 0.083ø 5.0ø x 2.1ø
OP-17	0.217ø x 0.083ø 5.5ø x 2.1ø

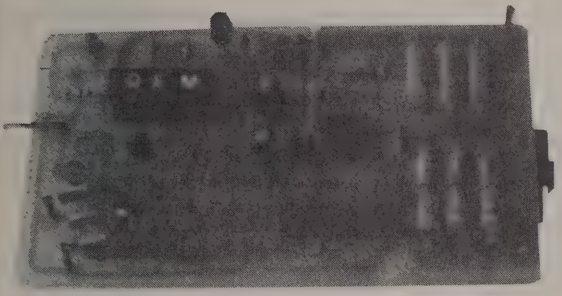
PILLAR INDUSTRIES/1780 EVERGREEN STREET/DUARTE, CA 91010/TEL: 818-358-1337/FAX: 818-358-0398

PILLAR INDUSTRIES Manufacturer of AC ADAPTORS

30 WATT AC/DC DESKTOP POWER SUPPLIES HAVE 90 TO 260VAC INPUT RANGE

Single, dual, and triple outputs are available. The most common outputs are 5, + or -12VDC, and + or -15VDC. Any combination of outputs may be used, provided that the total output does not exceed 30 watts.
All outputs have short circuit protection with automatic recovery. An AC input cord and a DC output cable is supplied with each unit. Size: 5.1 x 2.75 x 1.25 inches.

BATTERY CHARGERS FOR TELECOM EQUIPMENT



Battery Charger for most popular telephones including Motorola, NEC, OKI, and UNIDEN. Batteries are completely discharged, then fully recharged within 1 hour, via use of the unique current charge curve.

BATTERY CHARGERS FOR HAND TOOLS

A broad line of battery chargers are available for battery operated hand tools. All feature our unique rapid charging capability. Phone or Fax your requirements to us for a quote.

BATTERY CHARGERS FOR AUTOMOTIVE & ELECTRIC CARS

BATTERY CHARGER
15 AMP
12 VDC

Battery Chargers for the lead-acid batteries used in Electric Cars. Rated at 12VDC @ 15A. Will completely charge two 12VDC batteries within 4 hours.

DC MOTOR SPEED CONTROLLERS

For:
12VDC @ 10A
12VDC @ 20A
12VDC @ 30A
12VDC @ 40A

TEST EQUIPMENT FOR AC/AC & AC/DC ADAPTORS

ADAPTOR TESTER, provides maximum load of 3A, tests input and output power, no load and full load voltages, and ripple. Performs HI-POT tests and provides printed output of all test data.

PILLAR INDUSTRIES
1780 EVERGREEN STREET/DUARTE, CA 91010
TEL: 818-358-1337/FAX: 818-358-0398

eem

MINIGLOSSARY
ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

Pioneer Magnetics

Your best choice in high power switching supplies

It's the broadest line in the industry. From 500 to 3000 watts, single or multiple output. AC/DC or DC/DC. All the standard features and options you'll ever need or want. You can optimize your design with the International Line supplies, designed to meet tough noise and safety specs for worldwide applications. Pioneer power supplies are setting industry standards for reliability, performance and affordability.

- More than 400,000 units in the field.
- Over 250,000 hours MTBF.
- Conservatively rated for full performance at maximum output.
- Internal EMI filtering.

The International Line–

First choice for precise DC output power.

- >.99 active power factor correction.
- Meets FCC and VDE level A conducted noise (150 kHz to 30 MHz) and level B radiated noise specs.
- Meets SELV level of IEC/VDE, UL and CSA safety standards (standard models approved).
- Certifications provided upon request with volume orders.
- Full output rating at 50°C ambient.
- 85% efficiency.
- Completely isolated output.
- OV, overload and reverse voltage protection.
- Soft start; no turn-on or turn-off overshoot.
- Self-contained forced-air cooling.
- No minimum load required; each channel independently regulated.

Specifications

AC Input

90-264 VRMS,
47-63 Hz, Single or Three Phase. Line dips to 70-140 VRMS.

DC Input

38-63 V continuous (70 VDC short term).

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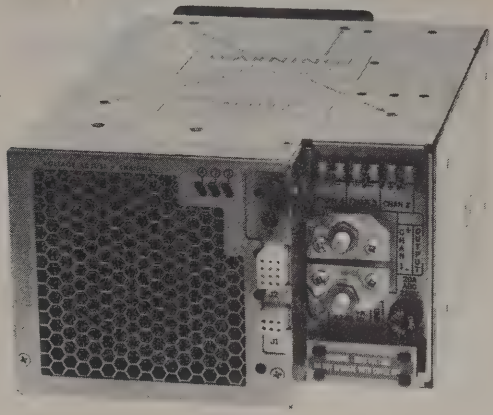

Dynamic Regulation:

International Line Units: Output Transient Response: 2% deviation (100mV deviation for units under 5V) with recovery to 1/2% in less than 500 μsec for a 25% load step, 1A/μsec slew rate.

P-P Ripple and Noise: 1% of nominal output at full load current, 20 Hz to 20 MHz bandwidth for 5V to 48V outputs. 50 mV for outputs less than 5V.

Static Regulation:

- Line: ±0.25% over full line range.
- Load: ±0.25% over no load to full load.
- Voltage Stability: ±0.1% after 30 min. warm-up for a 24-hr. period.
- Temperature Coefficient: ±0.02%/°C from 0°C to 50°C.

Over-Temperature Protection:

Supply is automatically latched off in the event of an over-temperature condition.

Standard Options:

- Power fail signal.
- Logic on/off.
- Crowbar.
- Remote programming/margining.
- Local margin check.
- Output tolerance status.
- Output power good signal.
- OV secondary channels.

Special Options

- Single channel battery backup.
- Single wire current sharing.
- Load sharing for power or redundancy.
- Tailored EMI filtering for system requirements.
- "Hot-Pluggable" versions of all products with "OR"-ing diodes for Fault Tolerant Redundant and N+1 applications.
- Power Shelf – 19" or 24" rack to hold "Hot-Pluggable" Power Supplies.
  Custom options can be designed to your exact requirements.

NEW!

High-Power Switchers Provide >.99 Power Factor Correction.

MEETS PROPOSED IEC 555-2.

If you're seriously interested in Power Factor Correction, you owe it to yourself to investigate Pioneer's new high-power switchers that use a patented resistor emulation PFC technique. It has made available a full range of single and multiple output switchers able to provide up to 42% more output power – 1KW from any standard 120 VAC, 15 A wall outlet and comply with UL's 12 A limitation.

Check these outstanding features:

- Meets UL 1012 and UL 1950, CSA 1402C and CSA 22.2 Standard No. 234 and 350, EN 60950, DIN VDE 0805/90, IEC 950.
- Meets VDE and FCC EMI specifications.
- Standard 5" x 8" package, 23 lbs. max.
- Insensitive to input voltage and frequency variations – 90-264 VAC, DC and 43-120 Hz.
- Eliminates input switching or strapping.
- Wide range of output power – 500 to 2500 W.
- No minimum load.
- 0 to 50°C operation at full load.
- Overvoltage/overcurrent/overtemperature protection.
- Soft start.
- Remote sense.
- No turn-on or turn-off overshoot.
- Completely isolated outputs.
- Self-contained forced-air cooling.

SINGLE OUTPUT SUPPLIES WITH >.99 PF

*3ø input with >.94PF

	AC/DC					
Model	PM2943A	PM2945A	PM2946A	PM2541A	PM2549	PM2514*
	–	PM3225A	PM3246	–	–	–
Max. Total Output Pwr. (Watts)	625	850	1000	1500	2000	3000
Output Voltage (VDC)		Output Current (Amps)				
2	125	170	200	325	–	700
3	125	170	200	300	–	700
5	125	170	200	300	400	600
12	52	71	85	120	–	250
15	42	57	70	100	–	200
18	–	–	–	85	–	–
24	26	35	40	60	–	120
28	22	30	36	55	–	105
36	–	–	–	–	–	80
48	13	18	20	32	–	60
Chassis Size (A, B, C)	5x8x15 in.	5x8x15 in. 5x8x11 in.	5x8x12.5 in.	5x8x15 in.		
Maximum Weight	20 lbs.			25 lbs.		

MULTI-OUTPUT SUPPLIES WITH >.99 PF

		AC/DC					
Model		–	PM2993A	–	PM2995A		
Max. Total Output Pwr. (Watts)		PM3272A	PM3273A	PM3274A	PM3275A	PM3386	PM3487
		500	625	750	850	1000	1400
Main Channel	DCV Avail.	5					
	Max. W @ 5A	400	500	600	750	750	1000
	Max. A @ 5A	80	100	120	150	150	200
Secondary Channels	DCV Avail.	2; 3, 5, 12, 15, 24, 28				Ch2-3: 2-28	Ch2-3: 2-28
	Max. A	15	15	15	15	15	20
	DCV Avail.	30, 48				Ch4-5: 2-28	Ch4-5: 2-28
	Max. A	7.5	7.5	7.5	7.5	7.5	7.5
Chassis Size (A,B,C)		5 x 8 x 12.75 in. (PM2993A-97A series 5 x 8 x 15 in.)				5x5x11	5x8x11
Maximum Wt.		20 lbs. (PM2993A-97A series 23 lbs.)			12 lbs.	12 lbs.	25 lbs.

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Selection Guide –

Other "World Class" Choices

Pioneer Magnetics

Number one in high power switching supplies.

800-233-1745

Single Output Supplies

	AC/DC							DC/DC		
Model	PM2922A	PM2923A	PM2924A	PM2925A	PM2926A	PM2501B	PM2512A	PM3024	PM3025	PM3026
Max. Total Output Pwr. (Watts)	500	625	750	850	1000	1500	2000	750	850	1000
Output Voltage (VDC)	Output Current (Amps)							Output Current (Amps)		
2	–	–	–	–	–	325	400	200	–	–
3	150	175	200	–	–	300	400	200	–	–
5	100	125	150	170	200	300	400	150	170	200
12	42	52	60	71	85	120	180	60	71	85
15	33	42	50	57	70	100	150	50	57	70
18	–	–	–	–	–	85	–	–		
24	21	26	33	35	40	60	100	33	35	40
28	18	22	27	30	36	55	80	27	30	36
36	–	–	–	–	–	–	65	–	–	–
48	10	13	16	18	20	32	50	16	18	20
Chassis Size (A,B,C)	5 x 8 x 11 in.						5 x 8 x 15 in.	5 x 8 x 11 in.		
Maximum Weight	16 lbs.						25 lbs.	20 lbs.		

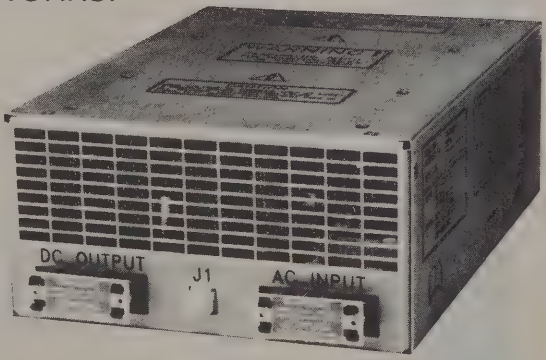
Multiple Output Supplies

		AC/DC							DC/DC		
Model		PM2972A	PM2973A	PM2974A	PM2975A	PM2976A	PM2977A	PM3178A	PM3074A	PM3075	PM3076
Max. Total Output Pwr. (Watts)		500	625	750	850	1000	1250	1500	750	850	1000
Main Channel	DCV Avail.	2,3,5,12,15,24.28,48						5	2,3,5,12.24.28,48		
	Max. W @ 5V	400	500	600	750	750	900	1500	600	750	750
	Max. A @ 5V	80	100	120	150	150	180	300	120	150	150
Secondary Channels, Max. Output Current in Amperes	DCV Avail.	2,3,5,12,15,24,28,30						2-24	2,3,5,12,24,28,30		
	Low Curr.	6	6	6	6	6	6		6	6	6
	Std.	12	12	12	12	12	12	20	12	12	12
	High Curr.	15	15	15	15	15	15	-	15	15	15
	DCV Avail.	30,48						-	30,48		
	Low Curr.	3	3	3	3	3	3	-	3	3	3
	Std.	6	6	6	6	6	6		6	6	6
	High Curr.	7.5	7.5	7.5	7.5	7.5	7.5	-	7.5	7.5	7.5
Chassis Size (A,B,C)		5 x 8 x 11 in.		5 x 8 x 12.75 in.				5 x 8 x 11	5 x 8 x 12.75 in		
Maximum Weight		16 lbs.		20 lbs.				22 lbs.	20 lbs.		

PFC Bulk Power Converters.

PROVIDES 375-390 VDC or 48 VDC TO CONVENTIONAL DC/DC CONVERTER OR DISTRIBUTED DC BUS NETWORKS. MEETS PROPOSED IEC 555-2.

- Meets UL, CSA and IEC safety standards.
- Meets VDE and FCC EMI specifications.
- >.99 active power factor correction.
- Eliminates input switches or jumpers.
- 90-264 VAC or DC and 43-120 Hz @ 20 A max.
- Single Output: 380VDC: 1680 W from 96-150 VAC input; 2100W & 3100 W available for 180-264 VAC input.
  48 VDC: 1500W from 96-150VAC input, 2100 W from 180-264 VAC input.
- 380 VDC: 4" x 8" x 11" package.
- 48 VDC: 5" x 8" x 11" package.
- Overvoltage/overcurrent/overtemperature protection.
- 0 to 50°C operation at full load.
- Input and output fuses.
- Brownout to 75 VAC.
- Holdup performance improved up to 200%.
- Self-contained forced-air cooling.



Non-Isolated

	AC/DC	
Model	PM2958	PM2959
Max. Total Output Pwr. (Watts)	2100 W	3100 W
Output (VDC)	380 VDC	
4 x 8 x 11 in.		
10 lbs.		

Isolated

PM3529
2100W
48VDC
5 x 8 x 11 in.
10 lbs.

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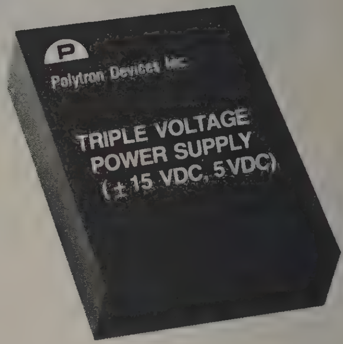
LINEAR ENCAPSULATED POWER MODULES

See section 4050 pages D•2292-2296 for DC/DC converters.

FEATURES:

- REGULATION LINE & LOAD 0.2% to 0.02%
- P.C. CARD OR CHASSIS MOUNTING
- SHORT CIRCUIT PROTECTION
- SINGLE, DUAL, TRIPLE OUTPUTS

FROM STOCK



SPECIFICATIONS: ①

- **INPUT VOLTAGE AND FREQUENCY:** 105 to 125Vac–50 to 440Hz
- **VOLTAGE OUTPUT TOLERANCE:** Factory set at ±1% (fixed)
- **TEMPERATURE COEFFICIENT:** 0.02% / °C typical
- **INPUT ISOLATION:** 50 Mohms
- **OPERATING TEMPERATURE:** –25°C to +71°C
- **STORAGE TEMPERATURE:** –25°C to 85°C

	OUTPUT VOLT. (VDC)	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE ② STYLE ③	MODEL NUMBER	PRICE 1-9 QTY.
			LINE	LOAD				
SINGLE VOLTAGE UNITS	5V	200mA	0.2%	.2%	1.0mV RMS	G	P34-5SM	36.00
		500mA	0.2%	.2%	0.5mV RMS	A, 1AT	P37	30.00
		500mA	0.02%	0.05%	0.5mV RMS	A, 1AT	P37-1	41.00
		1000mA	0.2%	0.2%	1.0mV RMS	B, 1BT	P38	50.00
		1000mA	0.02%	0.05%	1.0mV RMS	B, 1BT	P38-1	63.00
		1000mA	0.02%	0.05%	0.5mV RMS	C, 1CT	P38/1.56	66.00
		2000mA	0.02%	0.1%	1.0mV RMS	C, 1CT	P39	76.00
		3000mA	0.02%	0.15%	1.0mV RMS	D, 1DT	P39-3	95.00
	10V	120mA	0.1%	0.1%	1.0mV RMS	E	P33-10SM	50.00
		150mA	0.1%	0.1%	1.0mV RMS	A, 1AT	P33-10S	28.00
		250mA	0.1%	0.1%	1.0mV RMS	B, 1BT	P34-10S	40.00
		500mA	0.02%	0.05%	0.5mV RMS	C, 1CT	P37-10S	54.00
	12V	100mA	0.1%	0.1%	1.0mV RMS	E	P33-12SM	50.00
		120mA	0.02%	0.1%	1.0mV RMS	A, 1AT	P33-12S	28.00
		200mA	0.1%	0.1%	1.0mV RMS	B, 1BT	P34-12S	39.00
		500mA	0.02%	0.1%	0.5mV RMS	C, 1CT	P37-12S	54.00
		1000mA	0.1%	0.1%	1.0mV RMS	D, 1DT	P38-12S	69.00
	15V	80mA	0.1%	0.1%	1.0mV RMS	E	P33-15SM	50.00
		120mA	0.02%	0.1%	1.0mV RMS	A, 1AT	P33-15S	26.00
		200mA	0.1%	0.1%	1.0mV RMS	B, 1BT	P34-15S	38.00
		300mA	0.1%	0.1%	1.0mV RMS	C, 1CT	P35-15S	55.00
		500mA	0.02%	0.1%	0.5mV RMS	C, 1CT	P37-15S	59.00
		800mA	0.02%	0.1%	1.0mV RMS	D, 1DT	P38-15S	69.00
	18V	50mA	0.1%	0.1%	1.0mV RMS	E	P32-18SM	50.00
		50mA	0.02%	0.05%	1.0mV RMS	A, 1AT	P32-18S	31.00
		100mA	0.02%	0.05%	1.0mV RMS	A, 1AT	P33-18S	34.00
	24V	50mA	0.1%	0.1%	1.0mV RMS	E	P32-24SM	50.00
		100mA	0.1%	0.1%	1.0mV RMS	A, 1AT	P33-24S	31.00
		300mA	0.1%	0.1%	1.0mV RMS	C, 1CT	P35-24S	57.00
	48V	50mA	0.2%	0.2%	2.0mV RMS	B, 1BT	P32-48S	42.00
		100mA	0.2%	0.2%	2.0mV RMS	B, 1BT	P33-48S	54.00
		200mA	0.2%	0.2%	2.0mV RMS	C, 1CT	P34-48S	76.00

① 115 VAC, 50 to 400 Hz. @ 25°C

② CASE STYLES ENDING WITH THE LETTER "T" (CHASSIS MOUNTED UNITS WITH TERMINAL BARRIER STRIP) ARE DESIGNATED BY THE SUFFIX "T". CASE STYLES A,B,C,D,G AND E (PC CARD MOUNTING) DO NOT REQUIRE SUFFIXING.

③ **MOST COMPETITORS' PINOUTS AVAILABLE—CONTACT FACTORY**

POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 **FAX: (201) 345-1264**

LINEAR POWER MODULES (Continued)

	OUTPUT VOLT. (VDC)	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE ② STYLE	MODEL NUMBER	PRICE 1-9 QTY.
			LINE	LOAD				
DUAL VOLTAGE	± 5V	± 50mA	0.02%	0.02%	1.0mV RMS	A, 2AT	P32-5	31.00
		± 100mA	0.1%	0.1%	1.0mV RMS	A, 2AT	P33-5	43.00
		± 200mA	0.1%	0.1%	1.0mV RMS	B, 2BT	P34-5	52.00
		± 300mA	0.02%	0.05%	0.5mV RMS	C, 2CT	P35-5	58.00
		± 500mA	0.02%	0.05%	0.5mV RMS	C, 2CT	P37-5	66.00
		± 1000mA	0.1%	0.1%	1.0mV RMS	D, 2DT	P38-5	86.00
	± 8V	± 500mA	0.1%	0.1%	1.0mV RMS	D, 2DT	P37-8	71.00
	± 10V	± 100mA	0.02%	.05%	0.5mV RMS	A, 2AT	P33-10	40.00
	± 12V	± 25mA	0.1%	0.1%	2mV RMS	G	P31-12M	36.00
		± 25mA	0.02%	0.05%	0.5mV RMS	A, 2AT	P31-12	23.00
		± 50mA	0.02%	0.05%	0.5mV RMS	A, 2AT	P32-12	29.50
		± 100mA	0.1%	0.1%	1.0mV RMS	A, 2AT	P33-12	40.00
		± 200mA	0.1%	0.1%	1.0mV RMS	B, 2BT	P34-12	59.00
		± 300mA	0.1%	0.1%	1.0mV RMS	C, 2CT	P35-12	69.00
		± 500mA	0.1%	0.1%	1.0mV RMS	D, 2DT	P37-12	85.00
	± 15V	± 25mA	0.1%	0.1%	2mV RMS	G	P31-M	36.00
		± 25mA	0.2%	0.2%	1.0mV RMS	A, 2AT	P31	23.00
		± 25mA	0.02%	0.02%	0.5mV RMS	A, 2AT	P31-1	26.00
		± 50mA	0.2%	0.2%	1.0mV RMS	A, 2AT	P32	28.00
		± 50mA	0.02%	0.02%	0.5mV RMS	A, 2AT	P32-1	37.00
		± 100mA	0.2%	0.2%	1.0mV RMS	A, 2AT	P33	38.00
		± 100mA	0.02%	0.02%	1.0mV RMS	A, 2AT	P33-1	42.00
		± 200mA	0.2%	0.2%	1.0mV RMS	B, 2BT	P34	57.00
		± 200mA	0.02%	0.05%	1.0mV RMS	B, 2BT	P34-1	68.00
		± 350mA	0.2%	0.2%	1.0mV RMS	C, 2CT	P35	68.00
		± 350mA	0.02%	0.05%	1.0mV RMS	C,2CT	P35-1	78.00
		± 500mA	0.1%	0.1%	1.0mV RMS	D,2DT	P37-15	86.00
	± 18V	± 50mA	0.1%	0.1%	1.0mV RMS	A, 2AT	P32-18	32.00
		± 100mA	0.1%	0.1%	1.0mV RMS	B, 2BT	P33-18	45.00
	± 24V	± 50mA	0.1%	0.1%	1.0mV RMS	B, 2BT	P32-24	46.00
		± 100mA	0.1%	0.2%	1.0mV RMS	B, 2BT	P33-24	69.00
		± 200mA	0.1%	0.2%	1.0mV RMS	C, 2CT	P34-24	92.00
TRIPLE VOLTAGE	5V/ ± 12V	250/ ± 60mA	.02%	0.1%	1.0mV RMS	C, 3CT	P51-12	52.00
		250/ ± 120mA	.02%	0.1%	1.0mV RMS	C, 3CT	P52-12	66.00
		500/ ± 120mA	.02%	0.1%	1.0mV RMS	C, 3CT	P53-12	72.00
		300/± 180 mA	.02%	0.1%	1.0mV RMS	C, 3CT	P53-12L	72.00
		1000/ ± 150mA	.02%	0.1%	1.0mV RMS	D, 3DT	P53-1280	94.00
	5V/ ± 15V	250/ ± 50mA	.02%	0.1%	1.0mV RMS	C, 3CT	P51-15	51.00
		250/ ± 100mA	.02%	0.1%	1.0mV RMS	C, 3CT	P52-15	61.00
		300/ ± 150mA	.02%	0.1%	1.0mV RMS	C, 3CT	P53-15L	71.00
		500/ ± 100mA	0.02%	0.1%	1.0mV RMS	C, 3CT	P53-15	69.00
		1000/ ± 150mA	0.02%	0.1%	1.0mV RMS	D, 3DT	P53-1580	99.00

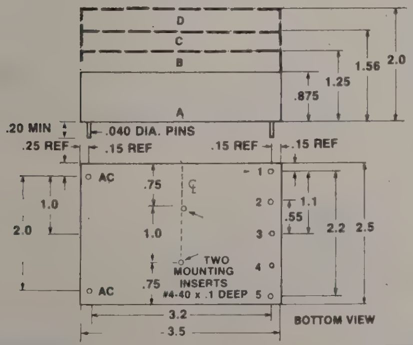
② CASE STYLES ENDING WITH THE LETTER "T" (CHASSIS MOUNTED UNITS WITH TERMINAL BARRIER STRIP) ARE DESIGNATED BY THE SUFFIX "T". CASE STYLES A,B,C,D,G AND E (P.C. CARD MOUNTING) DO NOT REQUIRE SUFFIXING

	SINGLE AND DUAL UNITS	TRIPLE OUTPUT UNITS
1	– VDC*	COM (5)
2	NO PIN	+ 5 Vdc
3	COM *	– 12/– 15
4	NO PIN	COM (12/15)
5	+ VDC	+ 12/ + 15

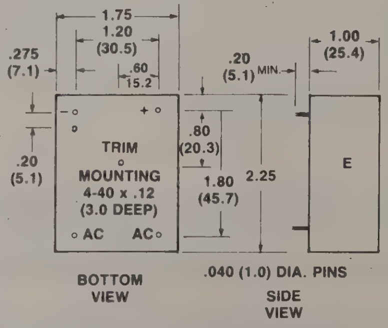
* – VDC Internally connected to COM for single output units. All dimensions are in inches.

OPTIONS AVAILABLE	SUFFIX	PRICE ADDER
220VAC	X	5.00
240VAC	XE	5.00
100VAC	Q	10.00
115/220	AX	15.00
Alternate Pin-Out	22	NONE
Chassis mounting with terminal barrier strip (case styles ending with letter ("T")	T	10.00

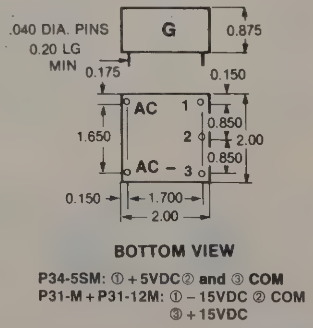
CASES A,B,C,D


D
C
B
A
1.56
2.0
1.25
.875
.20 MIN
.040 DIA. PINS
.25 REF
.15 REF
.15 REF
.15 REF
AC
.75
1.0
2.0
1.0
1
2
3
4
5
1.1
.55
2.2
2.5
TWO MOUNTING INSERTS #4-40 x .1 DEEP
.75
AC
3.2
3.5
BOTTOM VIEW

CASE E


1.75
1.20
(30.5)
.60
15.2
.275
(7.1)
.20
(5.1) MIN.
1.00
(25.4)
–
+
TRIM
MOUNTING 4-40 x .12 (3.0 DEEP)
AC
AC
.80
(20.3)
1.80
(45.7)
2.25
.20
(5.1)
E
BOTTOM VIEW
.040 (1.0) DIA. PINS
SIDE VIEW

CASE G


.040 DIA. PINS
0.20 LG MIN
G
0.875
0.175
0.150
AC
1
1.650
2
0.850
2.00
0.850
AC
–
3
0.150
1.700
2.00
BOTTOM VIEW

P34-5SM: ① + 5VDC② and ③ COM
P31-M + P31-12M: ① – 15VDC ② COM ③ + 15VDC

LINEAR ENCAPSULATED POWER MODULES

50VDC TO 250VDC

See section 4050 pages D•2292-2296 for DC/DC converters.

FEATURES:

- SHORT CIRCUIT PROTECTION
- HIGHLY REGULATED FLOATING OUTPUT
- P.C. CARD OR CHASSIS MOUNTING
- DOMESTIC AND/OR EUROPEAN LINE VOLTAGE

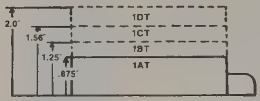
SPECIFICATIONS:

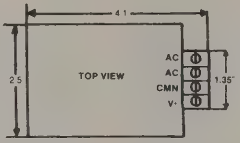
All electrical specifications are at 25°C and nominal input voltage unless otherwise noted.

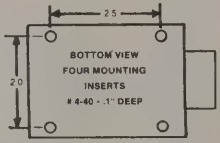
- **INPUT VOLTAGE AND FREQUENCY**
  115VAC nominal (105 to 125VAC)—50 to 60Hz
  Other optional input voltages are available.
  Use designated suffix to order these units:
  220VAC nominal (200 to 240VAC) suffix X
  240VAC nominal (220 to 260VAC) suffix XE
  100VAC nominal (90 to 110VAC) suffix Q
  115/220VAC nominal (105 to 125VAC or 200 to 240VAC) suffix AX
- **VOLTAGE OUTPUT TOLERANCE**
  Factory set at ± 1% (fixed)
- **TEMPERATUE COEFFICIENT**
  0.02%/°C typical
- **INPUT ISOLATION RESISTANCE**
  100 Mohms
- **ISOLATION VOLTAGE**
  2500VDC
- **OPERATING TEMPERATURE**
  −25°C to +71°C
- **STORAGE TEMPERATURE**
  −55°C to +105°C

P
REGULATED
POWER SUPPLY

CHASSIS MOUNTED UNITS CASES 1AT, 1BT, 1CT, 1DT


2.0"
1.56"
1.25"
.875"
1DT
1CT
1BT
1AT


4 1
2 5
TOP VIEW
AC
AC
CMN
V+
1.35"

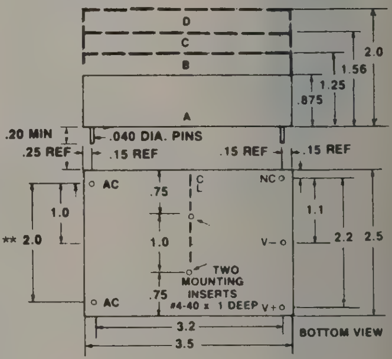

2 5
2 0
BOTTOM VIEW
FOUR MOUNTING
INSERTS
# 4-40 × .1" DEEP

OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	REGULATION		RIPPLE & NOISE mV (RMS)	CASE STYLE*		MODEL #	PRICE 1-9
		LINE %	LOAD %		P.C. Mount	Chassis Mount		
50	50	0.05	0.20	1.0	A	1AT	P32-50S	40.00
	100	0.05	0.20	2.0	B	1BT	P33-50S	52.00
	200	0.05	0.20	2.0	C	1CT	P34-50S	73.00
	300	0.20	0.20	3.0	D	1DT	P35-50S	79.00
75	35	0.05	0.20	2.0	A	1AT	P32-75S	43.00
	70	0.05	0.20	2.0	B	1BT	P33-75S	55.00
	150	0.05	0.20	2.0	C	1CT	P34-75S	76.00
	200	0.10	0.20	3.0	D	1DT	P35-75S	82.00
100	25	0.05	0.20	2.0	A	1AT	P32-100S	43.00
	50	0.05	0.20	2.0	B	1BT	P33-100S	55.00
	100	0.05	0.20	3.0	C	1CT	P34-100S	76.00
	150	0.10	0.20	3.0	D	1DT	P35-100S	82.00
150	17	0.05	0.20	2.0	A	1AT	P32-150S	43.00
	35	0.05	0.20	3.0	B	1BT	P33-150S	55.00
	70	0.05	0.20	3.0	C	1CT	P34-150S	76.00
	100	0.10	0.20	3.0	D	1DT	P35-150S	82.00
180	15	0.05	0.20	3.0	A	1AT	P32-180S	44.00
	30	0.05	0.20	3.0	B	1BT	P33-180S	56.00
	55	0.05	0.20	3.0	C	1CT	P34-180S	77.00
	80	0.10	0.20	3.0	D	1DT	P35-180S	83.00
200	12	0.05	0.20	3.0	A	1AT	P32-200S	44.00
	25	0.05	0.20	3.0	B	1BT	P33-200S	56.00
	50	0.05	0.20	3.0	C	1CT	P34-200S	77.00
	75	0.10	0.20	3.0	D	1DT	P35-200S	83.00
250	10	0.05	0.20	3.0	A	1AT	P32-250S	45.00
	20	0.05	0.20	3.0	B	1BT	P33-250S	57.00
	40	0.05	0.20	3.0	C	1CT	P34-250S	78.00
	60	0.10	0.20	3.0	D	1DT	P35-250S	85.00

*To order chassis mounted units use suffix "T" after model number (add $10 to price)
To order P.C. mounted units no suffix is required after model number.

P.C. MOUNTED UNITS CASES A, B, C, D

**Available in 2.2" pin spacing
Use suffix 22
after Model #


D
C
B
A
2.0
1.56
1.25
.875
.20 MIN
.040 DIA. PINS
.25 REF
.15 REF
.15 REF
.15 REF
AC
NC
C L
.75
1.0
1.0
** 2.0
1.1
2.2
2.5
V−
TWO MOUNTING INSERTS #4-40 x 1 DEEP
.75
AC
V+
3.2
3.5
BOTTOM VIEW

POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 **FAX: (201) 345-1264**

eem

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

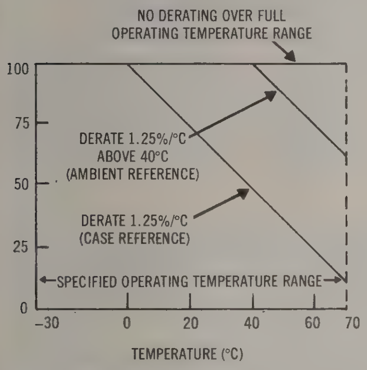


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

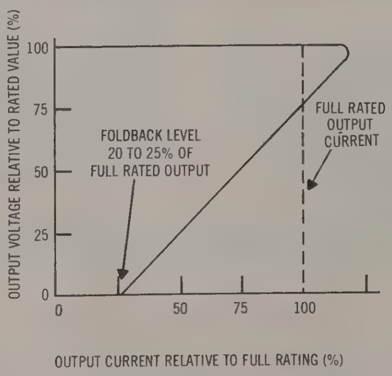


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

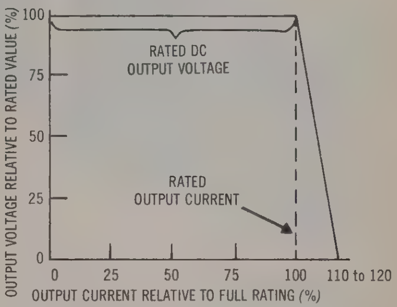


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

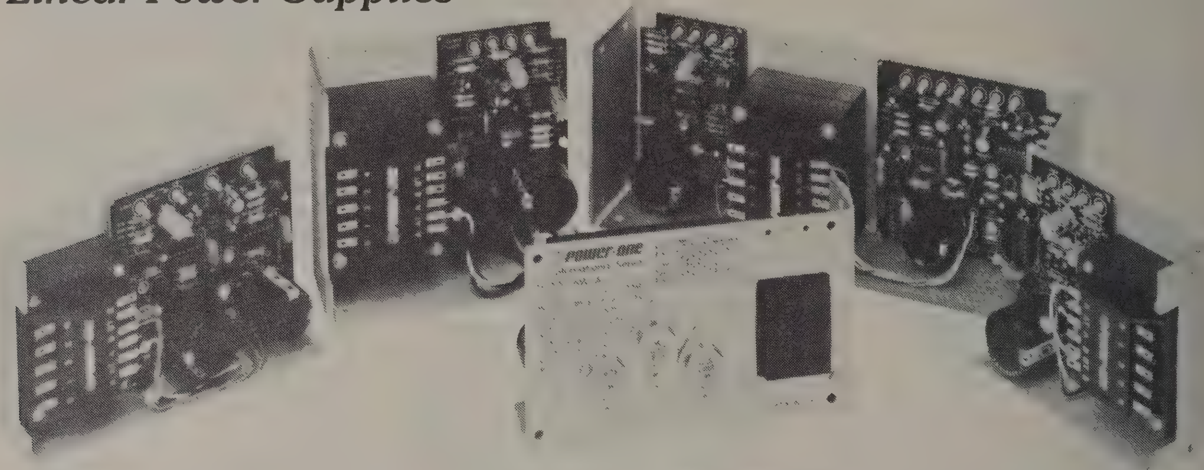
"Innovators in Power Supply Technology"

POWER-ONE D.C. POWER SUPPLIES

POWER-ONE, INC.
740 Calle Plano • Camarillo, CA 93012-8583 • Phone: 805/987-8741 • FAX: 805/388-0476
Call Toll Free: 800/678-9445

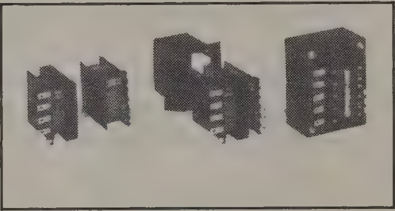
International Series

Linear Power Supplies



FEATURES

- VDE TRANSFORMER CONSTRUCTION
- WORLDWIDE AC INPUT CAPABILITIES 100/120/220/230/240 VAC
- MEETS DOMESTIC AND FOREIGN SAFETY STANDARDS - UL, CSA, IEC, VDE, BPO, ECMA, CEE
- INDUSTRY STANDARD PACKAGES



INTERNATIONAL TRANSFORMER CONSTRUCTION

Power-One's patented International Series transformers feature separate, fully enclosed, primary and secondary coils. Meets safety requirements of VDE, UL, CSA, BPO, IEC, CEE, and ECMA.

DESCRIPTION

POWER-ONE's new International Series is the first and only high reliability D.C. power supply series designed for products sold throughout the world's major electronics markets.

The International Series can be used anywhere, for almost any application. It meets the most important safety requirements of UL, CSA, IEC, VDE, BPO, ECMA, and CEE. Also, each unit provides the AC input ranges needed for worldwide operation: 100, 120, 220, 230, and 240 volts, 47 to 63 Hz. This multi-range input capability reduces customer inventory and service requirements since only one standard off-the-shelf power supply is needed, regardless of the product's final destination. These are exclusive features of the International Series, and are not available on any competitive standard model.

In an effort to meet the world's toughest safety regulations, POWER-ONE achieved a technological breakthrough in power transformer design. Our new patented winding process features separate, fully enclosed primary and secondary windings. This unique construction complies with the most respected regulatory safety agency specifications, worldwide.

The end result is that product acceptance throughout the world is greatly simplified for domestic and foreign equipment manufacturers. The International Series power supplies comply with the major body of regulatory safety agencies responsible for product safety in virtually all of the major world markets. Its compatibility with world safety standards, combined with dramatically increased flexibility, results in far greater potential for international acceptance of your products.

MEETS SAFETY AGENCY REQUIREMENTS THROUGHOUT THE WORLD

Why compliance is so important!

For years electronic equipment manufacturers have found that safety requirements for most of the world's electronics markets are significantly different than those established in the USA by Underwriters Laboratories (UL). Also, there is little consistency in the requirements among the world's regulatory safety agencies. This has created almost impossible compliance problems for designers who are developing products for worldwide distribution.

Recognizing this dilemma, POWER-ONE initiated an extensive R&D program aimed at producing the first D.C. power supply line that truly meets the world's toughest safety requirements. The innovative new International Series—the solution to the difficult problem of gaining worldwide acceptance for your products.

SAFETY AGENCIES WORLDWIDE

The following regulatory agency specifications have gained industry-wide acceptance as the most important to comply with when designing products for the world's major electronics markets. The International Series meets or exceeds the leakage current, creepage distance, and dielectric withstand test requirements of these safety agency specifications:

UL1950, EN60950, CSA1402

INTERNATIONAL SERIES DESIGN STANDARDS:

Leakage Current, Line to Ground: 0.05mA Max.

Safety Spacings, Live Parts to Dead Metal: 9.0 mm

Dielectric Withstand Voltage,
Input to Ground: 3750 VAC
Input to Outputs: 3750 VAC
Outputs to Ground: 500 VDC

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International Series
Linear Power Supplies

MEETS INTERNATIONAL SAFETY REQUIREMENTS THROUGHOUT THE WORLD

SPECIFICATIONS

AC Input:	100/120/220/240 VAC +10% −13%. 47-63 Hz. Tolerance for 230 VAC operation is +15%, −10%. Derate output current 10% for 50 Hz operation.
DC Output:	See Voltage/Current Rating Chart. Adjustment range ±5% minimum.
Line Regulation:	±.05% for a 10% line change.
Load Regulation:	±.05% for a 50% load change.
Output Ripple:	5V through 15V models: 5.0 mV PK-PK maximum; 24V and 28V models: 0.2% PK-PK maximum.
Transient Response:	50µ seconds for a 50% load change.
Short Circuit and Overload Protection:	Automatic current limit/foldback.
Overvoltage Protection:	Provided on 5V outputs where indicated. Set at 6.2V ±0.4V. Other outputs use optional overvoltage protectors OVP-12 and OVP-24.

Stability:	±0.3% for 24 hours after warm-up.
Temperature Rating:	0°C to 50°C full-rated, derated linearly to 40% at 70°C.
Temperature Coefficient:	.01%/°C typical, .03%/°C maximum.
Efficiency: (typical)	5V outputs: 45% 12V and 15V outputs: 55% 24V and 28V outputs: 60%
Vibration:	Per MIL-STD-810C, Method 514, Procedure X
Shock:	Per MIL-STD-810C, Method 516, Procedure V
EMI/RFI:	These linear power supplies have inherently low conducted and radiated noise levels. For most system applications they will meet the requirements of FCC Docket 20780 for Class A equipment and VDE 0871 for Class A equipment without additional noise filtering.

VOLTAGE/CURRENT RATING CHARTS

SINGLE OUTPUT MODELS

Model	Voltage/ Current	Case Size	Price (1–24)
5 VOLTS			
HA5-1.5/OVP-A*	5V @ 1.5A	B	$ 29.21
HB5-3/OVP-A*	5V @ 3A	B	34.43
HC5-6/OVP-A*	5V @ 6A	C	57.42
HN5-9/OVP-A*	5V @ 9A	N	78.32
HD5-12/OVP-A*	5V @ 12A	D	88.77
HE5-18/OVP-A*	5V @ 18A	E	125.35
F5-25/OVP-A*	5V @ 25A	F	161.92
G5-35/OVP-A*	5V @ 35A	F	203.72
CP197-A*	5V @ 50A	F	229.95
12 VOLTS			
HA15-0.9-A	12V @ 0.9A	B	$ 29.21
HB12-1.7-A	12V @ 1.7A	B	34.43
HC12-3.4-A	12V @ 3.4A	C	52.20
HN12-5.1-A	12V @ 5.1A	N	73.10
HD12-6.8-A	12V @ 6.8A	D	83.55
HE12-10.2-A	12V @ 10.2A	E	114.90
F15-15-A	12V @ 16A	F	161.92
15 VOLTS			
HA15-0.9-A	15V @ 0.9A	B	$ 29.21
HB15-1.5-A	15V @ 1.5A	B	34.43
HC15-3-A	15V @ 3A	C	52.20
HN15-4.5-A	15V @ 4.5A	N	73.10
HD15-6-A	15V @ 6A	D	83.55
HE15-9-A	15V @ 9A	E	114.90
F15-15-A	15V @ 15A	F	161.92
24 VOLTS			
HA24-0.5-A	24V @ 0.5A	B	$ 29.21
HB24-1.2-A	24V @ 1.2A	B	34.43
HC24-2.4-A	24V @ 2.4A	C	52.20
HN24-3.6-A	24V @ 3.6A	N	73.10
HD24-4.8-A	24V @ 4.8A	D	83.55
HE24-7.2-A	24V @ 7.2A	E	114.90
F24-12-A	24V @ 12A	F	161.92
28 VOLTS			
HA24-0.5-A	28V @ 0.5A	B	$ 29.21
HB28-1-A	28V @ 1A	B	34.43
HC28-2-A	28V @ 2A	C	52.20
HN28-3-A	28V @ 3A	N	73.10
HD28-4-A	28V @ 4A	D	83.55
HE28-6-A	28V @ 6A	E	114.90
F24-12-A	28V @ 10A	F	161.92
48 VOLTS			
HB48-0.5-A	48V @ 0.5A	B	$ 36.52
HC48-1-A	48V @ 1A	C	57.42
HD48-3-A	48V @ 3A	D	88.77
HE48-4-A	48V @ 4A	E	125.35
180/200 VOLTS			
HB200-0.12-A	175-210V @ 0.12A	B	$ 46.97
250 VOLTS			
HB250-0.1-A	250V @ 0.1A	B	$ 45.93

*INCLUDES OVERVOLTAGE PROTECTION.

DUAL OUTPUT MODELS

Model	Output #1	Output #2	Case Size	Price (1–24)
±5 VOLTS				
HAA5-1.5/OVP-A	5V @ 1.5A*	−5V @1.5A*	AA	$ 52.20
HBB5-3/OVP-A	5V @ 3A*	−5V @3A*	BB	76.23
HCC5-6/OVP-A	5V @ 6A*	−5V @ 6A*	CC	101.31
±12 TO 15 VOLTS				
HAD12-0.4-A	12V @ 0.4A	−12V @ 0.4A	B	$ 38.61
HAD15-0.4-A	15V @ 0.4A	−15V @ 0.4A	B	38.61
HAA15-0.8-A	12V @ 1A OR 15V @ 0.8A	−12V @ 1A OR −15V @ 0.8A OR −5V @ 0.4A	AA	44.88
HBB15-1.5-A	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	BB	$ 57.42
HCC15-3-A	12V @ 3.4A OR 15V @ 3A	−12V @ 3.4A OR −15V @ 3A	CC	91.91
HDD15-5-A	12V TO 15V@ 5A	(−)12V TO 15V@5A	E	135.80
5 VOLTS AND 9 TO 15 VOLTS (Isolated Outputs)				
HAA512-A	5V @ 2A*	9 TO 15V @ 0.5A	AA	$ 52.20
HBB512-A	5V @ 3A*	12 TO 15V @ 1.25A	BB	62.65
HCC512-A	5V @ 6A*	9 TO 15V @ 2.5A	CC	99.22
±18 TO 24 VOLTS				
HAA24-0.6-A	18-20V @ 0.4A OR 24V @ 0.6A	(−)18-20V @ 0.4A OR −24V @ 0.6A	AA	$ 44.88
HBB24-1.2-A	18-20V @ 0.9A OR 24V @ 1.2A	(−)18-20V @ 0.9A OR −24V @ 1.2A	BB	57.42
HCC24-2.4-A	18-20V @ 1.8A OR 24V @ 2.4A	(−)18-20V @ 1.8A OR −24V @ 2.4A	CC	91.91

TRIPLE OUTPUT MODELS

Model	Output #1	Output #2	Output #3	Case Size	Price (1–24)
HTAA-16W-A	5V @ 2A*	9 TO 15V @ 0.4A	(−)9 TO 15V @0.4A OR −5V @ 0.4A	AA	$ 57.42
HBAA-40W-A	5V @ 3A*	12V @ 1A OR 15V @ 0.8A	−12V @1A OR −15V @ 0.8A OR −5V @ 0.4A	BAA	79.37
HCAA-60W-A	5V @ 6A*	12 TO 15V @ 1A	(−)12 TO 15V @ 1A OR −5V @ 0.4A	D	94.00
HCBB-75W-A	5V @ 6A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	CBB	104.45
CP131-A	5V @ 8A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	131	125.35
HDBB-105W-A	5V @ 12A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	DBB	141.02
HDCC-150W-A	5V @ 12A*	12V @ 3.4A OR 15V @ 3A	−12V @ 3.4A OR −15V @ 3A	DCC	161.92

HIGH PEAK CURRENT MODELS

Model	Output #1	Output #2	Output #3	Output #4	Output #5	Case Size	Price (1–24)
CP205-A	5V @ 1A*	−5V @ 0.5A*	24V @ 1.5A/ 1.7A PK			BAA	$ 94.00
CP510-A	5V @ 6A*	12V @ 2.5A/ 7.5A PK				CP510-A	83.55
CP323-A	5V @ 2A*					N	83.55
CP498-A	5V @ 6A*	12V @ 5A/ 10A PK	−12V @ 0.5A OR −5V @ 0.25A			131	135.80
CP379-A	5V @ 6A*	−5V @ 1.2A OR −12V @ 1.2A	24V @ 3.5A/ 8A PK			131	135.80
CP503-A	5V @ 6A*	12V @ 1.2A	−12V @ 0.8A	24V @ 2.5A/ 4APK		131	135.80

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International Series - Map Series

55 Watts to 130 Watts

FEATURES

- AUTOMATIC SELECTING AC INPUT: 90-132/175-264 VAC, 47-63 HZ
- ALL OUTPUTS FULLY REGULATED
- MEETS DOMESTIC AND INTERNATIONAL SAFETY: 3750 VAC ISOLATION • VDE SAFETY SPACINGS
- UNIVERSAL TERMINAL BLOCK CONNECTORS
- UNIVERSAL MOUNTING SYSTEM
- HIGH POWER DENSITY, UP TO 2.2 WATTS/CUBIC INCH
- MOSFET SWITCHING TECHNOLOGY
- RUGGED WRAP-AROUND CHASSIS
- 105°C RATED STORAGE CAPACITORS
- 75% TYPICAL EFFICIENCY
- PLATINUM BARRIER SCHOTTKY RECTIFIERS
- CONVECTION COOLED
- THERMAL SHUTDOWN WITH WARNING
- UL RECOGNIZED, CSA CERTIFIED
- MEETS DOMESTIC AND INTERNATIONAL EMI: FCC 47CFR, PART 15, LEVEL B • VDE 0871 LEVEL B
- INTERNAL INPUT LINE FILTER
- POWER-FAIL WARNING SIGNAL
- FULL LOAD BURN-IN AND THERMAL CYCLING
- 2 YEAR WARRANTY

Single Output MAP Series Products

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	Power	
						Continuous	Peak
MAP40 -1005	5V	8A/11Apk	ADJUSTABLE NOTE A	0.2%	2%	40	55
MAP55 -1012	12V or 15V	5A/5.8Apk 4A/4.7Apk	ADJUSTABLE NOTE B	0.2%	1%	60	70
MAP55 -1024	24V or 28V	2.5A/3Apk 2.2A/2.5Apk	ADJUSTABLE NOTE C	0.2%	1%	60	70
MAP80 -1005	5V	16A/20Apk	ADJUSTABLE NOTE A	0.2%	1%	80	100
MAP80 -1012	12V or 15V	7.5A/9.2Apk 6A/7.3Apk	ADJUSTABLE NOTE B	0.2%	1%	90	110
MAP80 -1024	24V or 28V	3.8A/4.6Apk 3.2A/3.9Apk	ADJUSTABLE NOTE C	0.2%	1%	91	110

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	Power	
						Continuous	Peak
MAP130 -1005	5V	26A/30Apk	ADJUSTABLE NOTE A	0.2%	1%	130	TBD
MAP130 -1012	12V or 15V	12A/13.8Apk 10A/11Apk	ADJUSTABLE NOTE B	0.2%	1%	144	165
MAP130 -1024	24V or 28V	6.25A/6.8Apk 5.4A/5.9Apk	ADJUSTABLE NOTE C	0.2%	1%	150	165

NOTES

A. Voltage level adjustable from 4.75V to 5.50V. Factory set to ±1% of nominal.
B. Voltage level adjustable from 11V to 16V. Factory set to 12V ±0.2V.
C. Voltage level adjustable from 23V to 29V. Factory set to 24V ±0.2V.
D. Voltage level adjustable from 10V to 16V. Factory set to 12V ±0.2V.

Multiple Output MAP Series Products

MAP55 Series 55 Watts Continuous, 65 Watts Peak Price:$110.00 (1-9)

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION
MAP55 -4000	+5V	6A	ADJUSTABLE NOTE A	0.2%	2%
	+12V	3A/4A PK	±4% NOTE C	0.2%	2%
	-12V	0.5A	±4% NOTE C	0.5%	2%
	-5V	0.5A	±4% NOTE C	0.5%	2%
MAP55 -4001	+5V	6A	ADJUSTABLE NOTE A	0.2%	2%
	+24V	1.5A/2.5Apk	±4% NOTE C	0.2%	2%
	+12V	0.5A	±4% NOTE C	0.5%	2%
	-12V	0.5A	±4% NOTE C	0.5%	2%
MAP55 -4002	+5V	6A	ADJUSTABLE NOTE A	0.2%	2%
	+12V	3A/4A PK	±4% NOTE C	0.2%	2%
	+12V	0.5A	±4% NOTE C	0.5%	2%
	-12V	0.5A	±4% NOTE C	0.5%	2%
MAP55 -4003	+5V	6A	ADJUSTABLE NOTE A	0.2%	2%
	+15V	2.5A/3.5Apk	±4% NOTE C	0.2%	2%
	-5V	0.5A	±4% NOTE C	0.5%	2%
	-15V	0.5A	±4% NOTE C	0.5%	2%

MAP80 Series 80 Watts Continuous, 90 Watts Peak Price:$135.00 (1-9)

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION
MAP80 -4000	+5V	14A	ADJUSTABLE NOTE A	0.2%	1%
	+12V	4A/6A PK	ADJUSTABLE NOTE B	0.2%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
	-5V	1A	±4% NOTE C	0.5%	2%
MAP80 -4001	+5V	14A	ADJUSTABLE NOTE A	0.2%	1%
	+24V	2A/3.5Apk	ADJUSTABLE NOTE B	0.2%	2%
	+12V	1A	±4% NOTE C	0.5%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
MAP80 -4002	+5V	14A	ADJUSTABLE NOTE A	0.2%	1%
	+12V	4A/6A PK	ADJUSTABLE NOTE B	0.2%	2%
	+12V	1A	±4% NOTE C	0.5%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
MAP80 -4003	+5V	14A	ADJUSTABLE NOTE A	0.2%	1%
	+15V	3.5A/5A PK	ADJUSTABLE NOTE B	0.2%	1%
	-5V	1A	±4% NOTE C	0.5%	2%
	-15V	1A	±4% NOTE C	0.5%	2%

NOTES: A. Voltage level adjustable from 4.75V to 5.50V. Factory set to at 5.0 to 5.2V.
B. Fully regulated output, voltage adjustable ±4% minimum. Factory set to ±1% of nominal.
C. Fully regulated output, voltage fixed.

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International Series - Map Series

Multiple Output Switch-Mode Models

VOLTAGE/CURRENT RATING CHARTS (cont.)

MAP130 Series 130 Watts Continuous, 165 W Peak Price: $210.00 (1-9)

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION
MAP130 -4000	+5V	20A	ADJUSTABLE NOTE A	0.2%	1%
	+12V	5A/10A PK	ADJUSTABLE NOTE B	0.2%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
	-5V	1A	±4% NOTE C	0.5%	2%
MAP130 -4001	+5V	20A	ADJUSTABLE NOTE A	0.2%	1%
	+24V	3.5A/5A PK	ADJUSTABLE NOTE B	0.2%	2%
	+12V	1A	±4% NOTE C	0.5%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
MAP130 -4002	+5V	20A	ADJUSTABLE NOTE A	0.2%	1%
	+12V	5A/10A PK	ADJUSTABLE NOTE B	0.2%	2%
	+12V	1A	±4% NOTE C	0.5%	2%
	-12V	1A	±4% NOTE C	0.5%	2%
MAP130 -4003	+5V	20A	ADJUSTABLE NOTE A	0.2%	1%
	+15V	4A/8A PK	ADJUSTABLE NOTE B	0.2%	2%
	-5V	1A	±4% NOTE C	0.5%	2%
	-15V	1A	±4% NOTE C	0.5%	2%

NOTES: A. Voltage level adjustable from 4.75V to 5.50V. Factory set to at 5.0 to 5.2V.
B. Fully regulated output, voltage adjustable ±4% minimum. Factory set to ±1% of nominal.
C. Fully regulated output, voltage fixed.

ELECTRICAL SPECIFICATIONS

AC Input: Automatic selecting dual range: 90-132 VAC or 175-264 VAC. 47-63 HZ single phase. NOTE: AC input range selection is fully automatic. No manual switchover is required.

DC Outputs: See Voltage/Current Rating Charts.

Output Power: See Voltage/Current Rating Charts.

Peak Output Power: See Voltage/Current Rating Charts. Peak power capability is recommended for short term operation only. Contact POWER-ONE for technical assistance on specific applications.

Brown-Out Protection: Regulation is maintained down to 90/175 VAC, at full rated load, with no compromise in performance.

Hold-Up Time: 20 msec minimum at full rated load and nominal AC input voltage. Hold-up time increases to 40 msec at 50% load.

Power-Fail Warning Signal: TTL compatible signal goes low before the main +5V output drops 5%, at full rated load. Minimum warning time: MAP80: 5 msec MAP130: 2.5 msec Warning time increases at reduced load levels.

Efficiency: Measured at full rated load and nominal AC input voltage. 75% ±5% depending on how the load is distributed among the outputs.

Regulation Characteristics: See Voltage/Current Rating Charts for individual model ratings.

Measurement method: LINE: Measured over a 90-132 VAC or 175-264 VAC line change. LOAD: Measured over a 20% to 100% load change.

Initial Setting Tolerance: Measured at 50% of full rated load on all outputs.

Minimum Load: Minimum output models require the following main +5V output minimum loads in order to maintain regulation:

MAP130 series: 3A
MAP80 series: 1A
MAP55 series: 0.5A

Note: Minimum load requirements increase at higher than 50*C.

Remote Sensing: Provided on MAP130 multiple output models on the main +5Voutput and on MAP130 single output models.

Output Noise and Ripple: 0.3% RMS, 1% PK-PK maximum on main +5V output.

Transient Response: Main +5V output: 500 µsec typical for a 50-100% load change and recovery to within 1% of initial voltage set point. Maximum excursion: 4% from initial voltage set point.

Overload Protection: Fully protected against output overload and short circuit. Automatic recovery upon removal of overload condition. Delayed-foldback current limiting characteristics assure reliable turn-on into reactive and non-linear loads. Provided on MAP130 series models.

Overvoltage Protection: Provided on the main +5V output. Set at 6.2V ±0.6V.

Overtemperature Protection: Initiates shutdown in the event of an overtemperature condition. Automatic reset. Power-Fail Warning Signal is initiated prior to shutdown. Provided on MAP130 series models.

Power-Up Initialization Period: Typical 0.3 sec turn-on delay assures orderly ramp-up and stabilization of all output voltages during power-up.

Input Protection: AC input line fuse provided.

Internally located.

Inrush Current: Internally limited by thermistor.

Temperature Rating: OPERATING: 0°C to +50°C at full rated output power. Consult factory for operating information between +50°C to +70°C. STORAGE: -55°C to +85°C.

Temperature Coefficient: ±0.03%/°C typical, ±0.05%/°C maximum over entire operating temperature range of 0°C to +70°C.

Cooling: Convection cooling is adequate where non-restricted air flow is available. When operating in a confined area, forced air cooling is recommended.

Vibration: Per MIL-STD-810D, Method 514.3, Category 1, Procedure I.

Shock: Per MIL-STD-810D, Method 514.3, Procedure III.

SAFETY SPECIFICATIONS

The International Series meets the safety requirements of the world's most respected regulatory safety agencies. All models exceed the following safety standards:

Leakage Current: Line to Ground (max.): 500 µA

Safety Spacings: 8.0 mm minimum between primary and secondary circuitry. 4.0 mm minimum between primary and grounded circuitry.

Dielectric Withstand Voltage (min.): Input to Ground: 3750 VRMS; Input to Outputs: 3750 VRMS; Outputs to Ground: 700 VDC. Consult POWER-ONE for testing methods.

UL RECOGNIZED: UL File Number E55974

CSA CERTIFIED: CSA File Number LR38879

TUV Essen Certified: TUV certified to meet the requirements of VDE 0805, VDE 0806, IEC 380, IEC 950, and EN60950.

EMI SPECIFICATIONS

All International Series models are equipped with internal line filtering which allows compliance to the conducted emisson limits of FCC 47CFR, Part 15, Level B; and VDE 0871 Level B.

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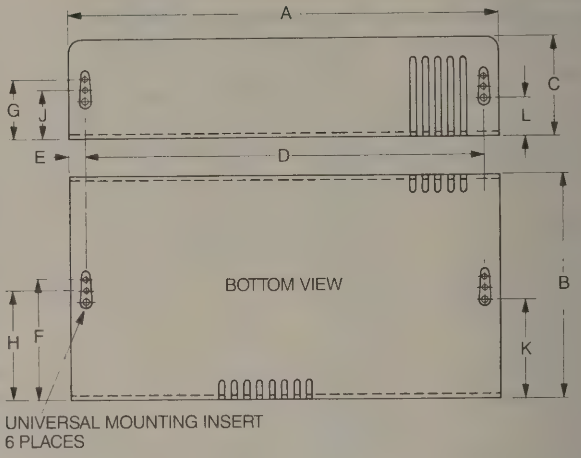
INTERNATIONAL SERIES D.C. POWER SUPPLIES—MAP SERIES

MAP55 SERIES

OVERALL SIZE: 6.00" x 3.27" x 1.60"
WEIGHT: 1.21 LB., 0.549 KG.

DIM	INCH	MM
A	6 000	152 400
B	3 270	83 058
C	1 600	40 640
D	5 500	139 700
E	0 250	6 350

MOUNTING APPLICATION								
6-32 THREAD HOLE "A"			M4 THREAD HOLE "B"			.170$^{+.003}_{-.000}$ DIA THRU HOLE "C"		
Dim.	In.	mm	Dim.	In.	mm	Dim.	In.	mm
F	1.900	48 260	H	1.672	42.469	K	1.370	34.798
G	1.065	27.051	J	0.837	21.260	L	0.535	13.589

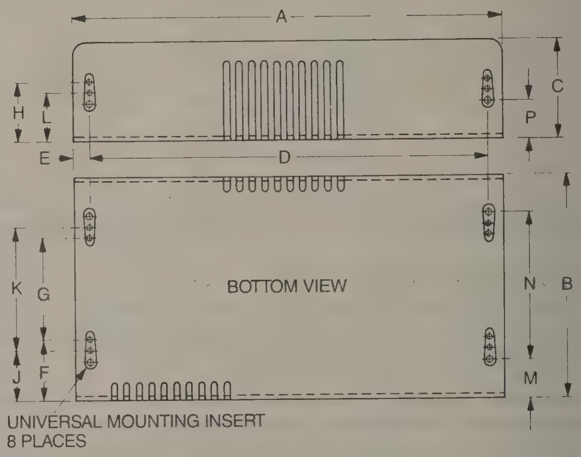

A
C
G
J
L
E
D
B
BOTTOM VIEW
H
F
K
UNIVERSAL MOUNTING INSERT
6 PLACES

MAP80 SERIES

OVERALL SIZE: 7.20" x 4.20" x 1.80"
WEIGHT: 1.70 LB., 0.771 KG.

DIM	INCH	MM
A	7 200	182 880
B	4 200	106 680
C	1 800	45 720
D	6 700	170 180
E	0 250	6 350

MOUNTING APPLICATION								
6-32 THREAD HOLE "A"			M4 THREAD HOLE "B"			.170$^{+.003}_{-.000}$ DIA THRU HOLE "C"		
Dim.	In.	mm	Dim.	In.	mm	Dim.	In.	mm
F	1.015	25.781	J	0.787	19.9898	M	0.485	12.319
G	2.170	55.118	K	2.626	66 7004	N	3.230	82.042
H	1.040	26.416	L	0.812	20.6248	P	0.510	12.954


A
C
H
L
P
E
D
K
G
BOTTOM VIEW
N
B
J
F
M
UNIVERSAL MOUNTING INSERT
8 PLACES

MAP130 SERIES

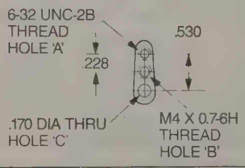
OVERALL SIZE: 8.50" x 4.50" x 2.00"
WEIGHT: 2.54 LB., 1.134 KG.

DIM	INCH	MM
A	8 500	215 900
B	4 500	114 300
C	2 000	50 800
D	8 000	203 200
E	0 250	6 350

MOUNTING APPLICATION								
6-32 THREAD HOLE "A"			M4 THREAD HOLE "B"			.170$^{+.003}_{-.000}$ DIA THRU HOLE "C"		
Dim.	In.	mm	Dim.	In.	mm	Dim.	In.	mm
F	1.265	32.131	J	1.037	26.3398	M	0.735	18.669
G	1.970	50.038	K	2.426	61.6204	N	3.030	76.962
H	1.265	32.131	L	1.037	26.3398	P	0.735	18.669

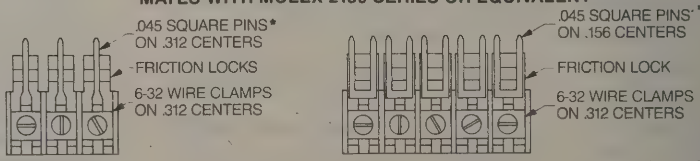
UNIVERSAL MOUNTING INSERT

TYPICAL ALL MODELS


6-32 UNC-2B
THREAD
HOLE 'A'
.228
.530
.170 DIA THRU
HOLE 'C'
M4 X 0.7-6H
THREAD
HOLE 'B'

UNIVERSAL TERMINAL BLOCK CONNECTORS

AC INPUT (TYPICAL ALL MODELS) DC OUTPUT (MAP55 SHOWN FOR REFERENCE)
*MATES WITH MOLEX 2139 SERIES OR EQUIVALENT


.045 SQUARE PINS*
ON .312 CENTERS
FRICTION LOCKS
6-32 WIRE CLAMPS
ON .312 CENTERS
.045 SQUARE PINS*
ON .156 CENTERS
FRICTION LOCK
6-32 WIRE CLAMPS
ON .312 CENTERS

CONSULT FACTORY FOR BOARD - ONLY CONFIGURATIONS

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SPL SERIES; 40-250 WATT SWITCHING POWER SUPPLIES

SINGLE AND MULTIPLE OUTPUT MODELS, WITH WORLDWIDE CAPABILITIES

FEATURES:

- ■ WORLDWIDE AC INPUT: 90-132/180-264 VAC
- ■ PCC AND VDE CLASS A EMI
- ■ TWO YEAR WARRANTY
- ■ UL/CSA/TUV APPROVALS

VOLTAGE/CURRENT RATING CHARTS

SINGLE OUTPUT

Model	Voltage	Current	Line Regulation	Load Regulation	Price (1-9)
5 Volts					
SPL40-1005	5V	8A	±0.2%	±1%	$ 99.28
SPL53-1005	5V	16A	±0.2%	±1%	$125.40
SPL130-1005	5V	26A	±0.1%	±1%	$177.65
SPL250-1005	5V	50A	±0.1%	±1%	$282.15
12-15 Volts					
SPL40-1012	12-15V	3.3A/2.7A	±0.2%	±1%	$ 99.28
SPL53-1012	12-15V	6.7A/5.3A	±0.2%	±1%	$125.40
SPL130-1012	12-15V	11A/9A	±0.1%	±1%	$177.65
SPL250-1012	12-15V	21A/17A	±0.1%	±1%	$282.15
24-28 Volts					
SPL40-1024	24-28V	1.6A/1.4A	±0.2%	±1%	$ 99.28
SPL53-1024	24-28V	3.3A/2.8A	±0.2%	±1%	$125.40
SPL130-1024	24-28V	5.5A/4.5A	±0.1%	±1%	$177.65
SPL250-1024	24-28V	10A/9A	±0.1%	±1%	$282.15

MULTIPLE OUTPUT

SPL40 SERIES PRICE: $109.00 (1-9)
40 WATTS CONTINUOUS

Model	Voltage	Current	Initial Setting Tolerance	Line Regulation	Load Regulation	Cross Regulation
SPL40 -4000	+5V	5A	Adjustable Note A	±0.1%	±1%	N/A
	+12V	0.5A	±4% Note B	±0.1%	±1%	N/A
	−12V	0.5A	±4% Note B	±0.1%	±1%	N/A
	−5V	0.5A	±4% Note B	±0.1%	±1%	N/A

SPL50 SERIES PRICE: $61.00 (1-9)
50 WATTS CONTINUOUS, 60 WATTS PEAK

Model	Voltage	Current	Initial Setting Tolerance	Line Regulation	Load Regulation	Cross Regulation
SPL50 -3200	+5V	6A	Adjustable Note A	±0.1%	±1%	N/A
	+12V	2A/ 4A PK	±5% Note C	±0.3%	±3%	±5%
	−12V	0.5A	±5% Note C	±0.3%	±5%	±10%

SPL53 SERIES PRICE: $130.00 (1-9)
80 WATTS

Model	Voltage	Current	Initial Setting Tolerance	Line Regulation	Load Regulation	Cross Regulation
SPL53 -4000	+5V Note G	8A	Adjustable Note A	±0.1%	±1%	N/A
	+12V Note G	2.5A/ 5A PK	Adjustable Note D	±0.1%	±1%	N/A
	−12V	0.6A	±4% Note B	±0.1%	±1%	N/A
	−5V	0.6A	±4% Note B	±0.1%	±1%	N/A
SPL53 -4101	+5V	8A	Adjustable Note A	±0.1%	±1%	N/A
	+12V	1.2A	±4% Note B	±0.1%	±1%	N/A
	−12V	0.6A	±4% Note B	±0.1%	±1%	N/A
	+24V	1.5A/ 3A PK	±5% Note C	±0.3%	±5%	±5%
SPL53 -4102	+5V	8A	Adjustable Note A	±0.1%	±1%	N/A
	+12V	1.2A	±4% Note B	±0.1%	±1%	N/A
	+12V	2.5A/ 5A PK	±5% Note C	±0.3%	±5%	±5%
	−12V	0.6A	±4% Note B	±0.1%	±1%	N/A
SPL53 -3200	+5V	8A	Adjustable Note A	±0.1%	±1%	N/A
	+12V	4A/ 6A PK	±5% Note C	±0.3%	±5%	±5%
	+24V	1.5A/ 2.5A PK	±5% Note C	±0.3%	±5%	±5%

SWA125 SERIES PRICE: $156.00 (1-9)
125 WATTS

Model	Voltage	Current		Initial Setting Tolerance	Line Regulation	Load Regulation	Cross Regulation
		Max.	Min.				
SWA125 -4000R	+5V	15A	4A	Adjustable Note A	±0.5%	±1%	N/A
	+12V	4A/ 8A PK	.005A	Adjustable Note D	±0.5%	±1%	N/A
	−12V	1.5A	.005A	±4% Note B	±0.1%	±1%	N/A
	−5V	1.5A	.005A	±4% Note B	±0.1%	±1%	N/A

NOTES

A. Voltage level adjustable from 4.75V to OVP trip point.
B. Fully regulated output, voltage fixed (3 terminal regulator).
C. Quasi-regulated output.
D. Fully regulated output, voltage adjustable ±5% minimum.
E. The sum of the main +5V and AUX 1 load currents must not exceed 30A.
F. The sum of the main +5V and AUX 1 load currents must not exceed the main +5V current rating.
G. Maximum load is 10A or 120W.
H. The sum of the main +5V and AUX 1 load currents must not exceed 50A.

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NRG Series

350 to 550 Watt Modular Power Supplies

The **NRG MID POWER SERIES** is a modular power solution utilizing standard off the shelf power modules configured to customer requirements. Products are available from 350 to 550 watts. This flexible power system is delivered completely configured, burned-in, and tested.

FEATURES

- FULLY MODULAR DESIGN
- AUTOSELECT AC INPUT
- UP TO SEVEN OUTPUTS
- WIDE SELECTION OF VOLTAGES/ CURRENTS
- FCC/VDE CATEGORY B EMI/RFI
- VME COMPATIBLE SIGNALS
- UL1950/EN60950 CERTIFICATIONS
- CURRENT SHARE/CURRENT MONITOR
- CUSTOM INTERFACE SIGNALS
- UL1950 & IEC950 CERTIFICATIONS
- FULLY REGULATED OUTPUTS
- HIGH POWER AUXILIARY OUTPUTS
- ADJUSTABLE AUXILIARY OUTPUTS
- POWER FAIL SIGNAL
- INDUSTRY STANDARD MOUNTING
- FULLY ISOLATED OUTPUTS

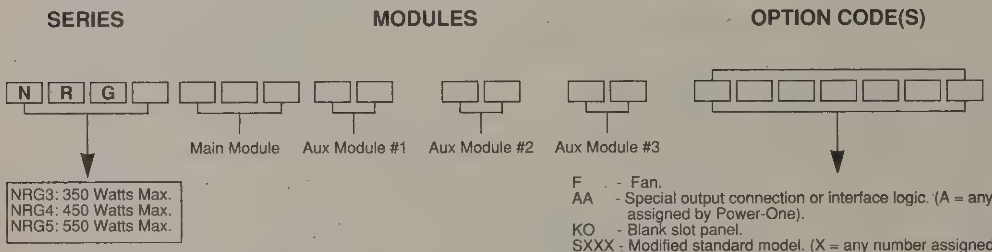
OPTIONS

- FAN AND COVER
- IEEE587 CATEGORY A AND CATEGORY B
- IEC601/UL544 CERTIFICATION
- CUSTOM INTERCONNECT CONFIGURATIONS

SELECTION AND CONFIGURATION

1. Choose a chassis based on the required wattage.
2. Choose the output modules. a minimum and maximum of one main module must be specified.
3. For standard products, auxiliary modules are configured in a descending power rating. Auxiliary module #1 should have the highest power rating.
4. Decide on the options. Standard options are listed on the next page. Please consult the factory for special requirements such as logic option boards.
5. Isolated outputs are provided on standard products. Consult factory for other interconnect options.
6. Use VC connector option when ordering any combination that includes dual output modules.
7. When using a C9 module, Aux. #1 and #2 can only be C9 or K0. A C9 cannot be used in the Aux. #3 position.

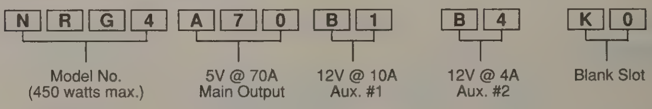
CONSULT THE FACTORY FOR ADDITIONAL CONFIGURATION INFORMATION.

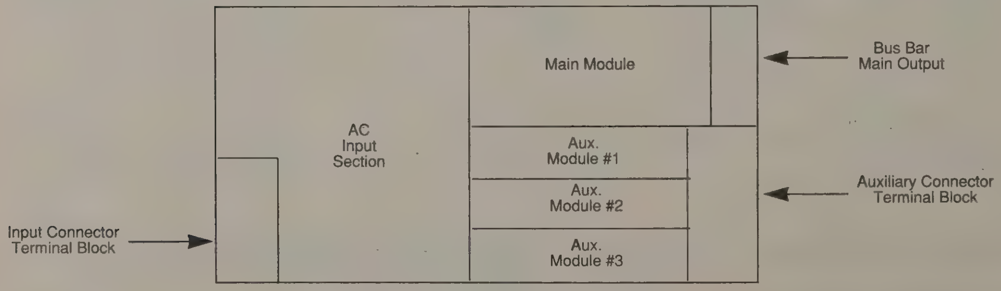

SERIES
MODULES
OPTION CODE(S)
N R G
Main Module
Aux Module #1
Aux Module #2
Aux Module #3
NRG3: 350 Watts Max.
NRG4: 450 Watts Max.
NRG5: 550 Watts Max.

F - Fan.
AA - Special output connection or interface logic. (A = any alpha letter assigned by Power-One).
KO - Blank slot panel.
SXXX - Modified standard model. (X = any number assigned by Power-One). Needs safety resubmittal.
ZXXX - Modified standard model. (X = any number assigned by Power-One). Does not need safety resubmittal.

Model NRG4A70B184KO

Example:	Outputs Selected:	5V	@	70A
		12V	@	10A
		12V	@	4A


N R G 4
A 7 0
B 1
B 4
K 0
Model No.
(450 watts max.)
5V @ 70A
Main Output
12V @ 10A
Aux. #1
12V @ 4A
Aux. #2
Blank Slot


Main Module
Bus Bar
Main Output
AC
Input
Section
Aux.
Module #1
Aux.
Module #2
Aux.
Module #3
Auxiliary Connector
Terminal Block
Input Connector
Terminal Block

Physical location of Modules in the Chassis
Top View

OVERALL SIZE

WITHOUT FAN
10.5" X 5" X 2.5"

WITH FAN
12" X 5" X 2.5"

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NRG Series

350 to 550 Watt Modular Power Supplies

DC OUTPUT MODULE SELECTOR GUIDE

NOMINAL VOLTAGE (V_o) VDC	MAXIMUM CURRENT (I_o) ADC	OUTPUT POWER (P_o) W @ 50°C	PART NUMBER	LOCATION
SINGLE OUTPUT MODULES				
2*	35	70	F35	Main
2*	70	140	F70	Main
3.3*	35	115	H35	Main
3.3*	70	231	H70	Main
5	4	20	A4	Aux.
5	8	40	A8	Aux.
5	35	175	A35	Main
5	50	250	A50	Main
5	70	350	A70	Main
5-12	5	25-60	V5	Aux.
12	4	48	B4	Aux.
12	10	120	B1	Aux.
12*	30	360	B30	Main
12-24	3	36-72	W3	Aux.
15	4	60	C4	Aux.
15	9	135	C9	Aux.
24	4	96	D4	Aux.
24	7	168	D7	Aux.
24*	15	360	D15	Main
DUAL OUTPUT MODULES; fully isolated, outputs can be referenced independently as + or -				
5/5	1/1	10	A2	Aux.
12/12	1/1	24	B2	Aux.
15/15	1/1	30	C2	Aux.
5/5*	4/4	40	M2	Aux.
12/12*	4/4	96	N2	Auz.
15/15*	4/4	120	P2	Aux.
24/24*	2/2	96	Q2	Aux.

* Advanced product release, consult factory for availability

GENERAL SPECIFICATIONS

All measurements @ 25°C unless otherwise noted.

PARAMETER	CONDITIONS	MIN.	NOM.	MAX.	UNITS
Efficiency	Full load, 85-264VAC		70		%
Vibration-Operating	5-32 Hz and 32-5 Hz, Sine Wave 32-2000 Hz and 2000-32 Hz, Sine Wave			.02 1.0	in(DA) g(PK)
Vibration-Non Operating	10 to 350 Hz, 6.15 g(RMS) 350 to 2000 Hz, 6.15 g(RMS)			.04 .007	g^2/Hz g^2/Hz
Shock-Operating	10±3 mSec, 3 axes, Half Sine			20	g(PK)
Shock-Non Operating	10±3 mSec, 3 axes, Half Sine			40	g(PK)
Drop Test	In shipping container, all 6 faces, 3 edges, one corner		30		Inches
Operating Temperature	Derate linearly to 50% of Po from 50 to 70°C ambient.	0		50 70	°C
Storage Temperature		-30		85	°C
Altitude	Operating Non-Operating			10,000 40,000	Feet Feet
Relative Humidity	Non-condensing	0		90	%
External Cooling Air Velocity	Measured 1/4" above and @ the middle of the chassis	NRG3 NRG4 NRG5	300 400 factory supplied fan		LFM LFM

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International High Power Series

500 to 2500 Watt Multiple Output Modular Power Systems

FEATURES

- FULLY MODULAR CONSTRUCTION
- UP TO 21 FULLY REGULATED OUTPUTS...2V THRU 48V
- WORLDWIDE AC INPUT: 90-132/180-264 VAC, 47-440 HZ, FIELD SELECTABLE
- 100% SWITCH-MODE OUTPUTS
- MOSFET SWITCHING TECHNOLOGY
- CURRENT-MODE CONTROL
- PARALLELABLE OUTPUTS WITH CURRENT SHARING
- AUTORANGING ON PFC PRODUCTS
- MEETS FCC AND VDE EMI LIMITS
- UL RECOGNIZED, CSA CERTIFIED
- UPS BATTERY BACKUP OPTION
- 48 VDC INPUT OPTION
- 300 VDC INPUT OPTION
- HIGH RELIABILITY HYBRID CONTROLLERS
- BALL BEARING DC FAN
- EXTENSIVE SYSTEM INTERFACE FEATURES
- .99 PFC AVAILABLE

DESCRIPTION

The International Series High Power products are modular power systems using separate switch-mode DC Output Modules to provide the voltage and current ratings required by each specific application.

The system is based on a 300 VDC System Power Bus derived from either the AC utility line, a user supplied 300 VDC source, or our optional battery backup UPS module. This 300 VDC bus provides the bulk DC required by each output module for conversion to its specified output voltage and current ratings.

This independent modular approach provides complete isolation between the outputs, as well as all other system elements. Also, the switching circuitry of each output module is clocked and synchronized by the Sync & Bias Supply section to reduce electrical interference between the outputs.

SELECTION AND CONFIGURATION

The modularity of the International Series High Power products allows the user to specify a power system configured from a wide selection of standard off-the-shelf plug in modules. The power system is delivered completely assembled, burned in, and tested. A part number comprised of a series designation, module listing, and options can be configured as follows:

1. **Choose a chassis based on required wattage and/or power factor.**
2. **Select the module(s).**
3. **Decide on the option(s).**

INTERNATIONAL SERIES HIGH POWER PRODUCT OVERVIEW

CHASSIS	# OF OUTPUTS	OUTPUT POWER	AC INPUT RANGE	.99 PFC	BATTERY PACK UP OPTION	CHASSIS SIZE
SPM2	6	500 WATTS	85-264	NO	NO	5"X3"X11"
SPM3	9	1000 WATTS	85-264	NO	NO	5"X5.5"X11"
SPM5	15	1500 WATTS	85-264	NO	YES	5"X8"X11"
SPM7	21	1500 WATTS	85-264	NO	YES	5"X13"X13"
HPM5	15	2000 WATTS	180-264	NO	YES	5"X8"X11"
HPM7	21	2500 WATTS	180-264	NO	YES	5"X13"X13"
SPF4	12	1300 WATTS	85-264	YES	YES	5"X8"X11"
SPF6	18	1300 WATTS	85-264	YES	YES	5"X13"X13"
HPF4	12	2000 WATTS	180-264	YES	YES	5"X8"X11"
HPF6	18	2000 WATTS	180-264	YES	YES	5"X13"X13"

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International High Power Series

500 to 2500 Watt Modular Power Supplies

MODULE SELECTOR GUIDE

SINGLE OUTPUT MODULE

NOMINAL VOLTAGE	NOMINAL CURRENT (AMPS) 50°C	60°C	70°C	OUTPUT POWER (WATTS)	MODULE PART NUMBER	SYSTEM SLOTS USED	NOISE & RIPPLE (MV PK-PK) 20MHZ BANDWIDTH TYPICAL	MAXIMUM
2	35	26	18	70	F1	1	20	50
2	60	45	30	120	F6	1	30	50
2	150	113	75	300	F2	2	30	50
2	250	188	125	500	F4	2	30	50
3.3	35	26	18	115	H1	1	30	50
5	35	26	18	175	A1	1	30	50
5	60	45	30	300	A6	1	30	50
5	80	60	40	400	A8	1	30	50
5	150	113	75	750	A2	2	30	50
5	220/250[1]	165/188[1]	110/125[1]	1100/1250[1]	A4	2	30	50
8	65	49	33	520	AJ	2	53	80
10	20	15	10	200	AW	1	66	100
10	40	30	20	400	BE	1	40	60
10	65	49	33	650	AQ	2	66	100
12	20	15	10	240	B1	1	80	120
12	40	30	20	480	B6	1	40	60
12	65	49	33	780	B2	2	80	120
14 to 24[3]	10	8	5	240	W1	1	160	240
15	16	12	8	240	C1	1	100	150
15	52	39	26	780	C2	2	100	150
24	10	8	5	240	D1	1	160	240
24	15	11	8	360	D6	1	160	240
24	32	24	16	768	D2	2	160	240
28	9	7	4	252	E1	1	249	280
28	27	20	14	756	E2	2	249	280
36	21	16	11	756	J2	2	100	200
48	5	4	3	240	G1	1	400	480
48	12.5	9.3	6.2	600	G4	1	40	60
48	16	12	8	768	G2	2	135	200

DUAL OUTPUT MODULES

NOMINAL VOLTAGE	50°C	60°C	70°C	OUTPUT POWER (WATTS)	MODULE PART NUMBER	SYSTEM SLOTS USED	TYPICAL	MAXIMUM
±12	10/4	7.5/3	5/2	168	M4	1	120	240
±12	10/10	7.5/7.5	5/5	240	B4	1	120	240
±15	8/8	6/6	4/4	240	C4	1	150	300
±24	5/5	3.8/3.8	2.5/2.5	240	D4	1	80	120

TRIPLE OUTPUT MODULES

NOMINAL VOLTAGE	50°C	60°C	70°C	OUTPUT POWER (WATTS)	MODULE PART NUMBER	SYSTEM SLOTS USED	TYPICAL	MAXIMUM
5/12/12[2]	10/10/10	7.5/7.5/7.5	5/5/5	290	M6	1	30/80/80	50/120/120
12/12/12[2]	10/10/10	7.5/7.5/7.5	5/5/5	360	N6	1	80/80/80	120/120/120
24/12/12[2]	5/10/10	3.8/7.5/7.5	2.5/5/5	360	P6	1	160/80/80	240/120/120
5/24/24[2]	10/5/5	7.5/3.8/3.8	5/2.5/2.5	290	R6	1	30/160/160	50/240/240
5/12/24	10/10/5	7.5/7.5/3.8	5/5/2.5	290	U6	1	30/80/160	50/120/240
5/2.2/12	10/10/10	7.5/7.5/7.5	5/5/5	192	W6	1	30/20/80	50/50/120
5/15/15[2]	10/8/8	7.5/6/6	5/4/4	290	V6	1	30/100/100	50/150/150

48V INPUT/UPS MODULES - Do not use with SPM2/SPM3

NOMINAL INPUT VOLTAGE	BUILT-IN BATTERY CHARGER	BATTERY CHARGE CURRENT	MAXIMUM DC OUTPUT BACK-UP CAPABILITY	MODULE PART NUMBER	SYSTEM SLOTS USED
48	YES	4.4A	1000W	CONSULT FACTORY	2
48	NO	N/A	1000W	M5	2

NOTES: 1. Rated for configuration in slots #3/#1
2. Like output voltages can be current shared. Consult factory.
3. Adjustable output

POWER SUPPLY CONCEPTS, INC.

MILITARY AND INDUSTRIAL POWER SUPPLIES

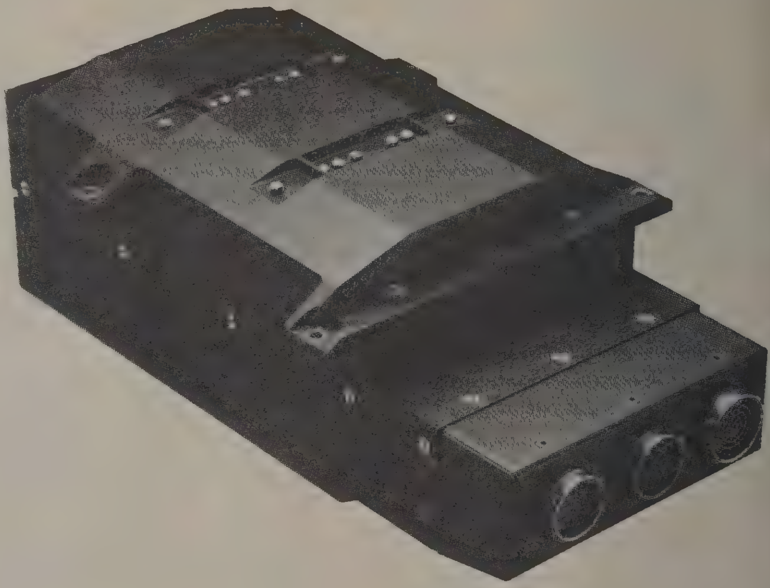
Military Power Supplies

Combat Proven in Operation Desert Storm

Switchmode / Linear Supplies

Single and Multiple Outputs

Complete Power Supply Systems



Custom and Standard (Library >500)

☆

"Government Approved Source"

☆

2 YEAR WARRANTY

☆

THOUSANDS BUILT LESS THAN 0.1% RETURNED

- 10 Watts to 5KW
- 1 Volt to 10 Kilovolts
- AC-DC ○ DC-DC ○ DC-AC
- AC Regulators
- Radiation Hardening
- Tempest Proofing

ENTIRELY BUILT in the USA

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PSC

POWER SUPPLY CONCEPTS, INC.

MILITARY AND INDUSTRIAL POWER SUPPLIES

Industrial Power Supplies

Specialists in ...

- ***Low to Medium Volume Production***
- ***Competitive Prices***

Switchmode - Linear

Single - Multiple - Programmable

Complete Power Supply Systems

Card - Enclosed - Encapsulated

Custom and Standard
(Library >500)

☆

"Low to No" NRE
on Custom Supplies

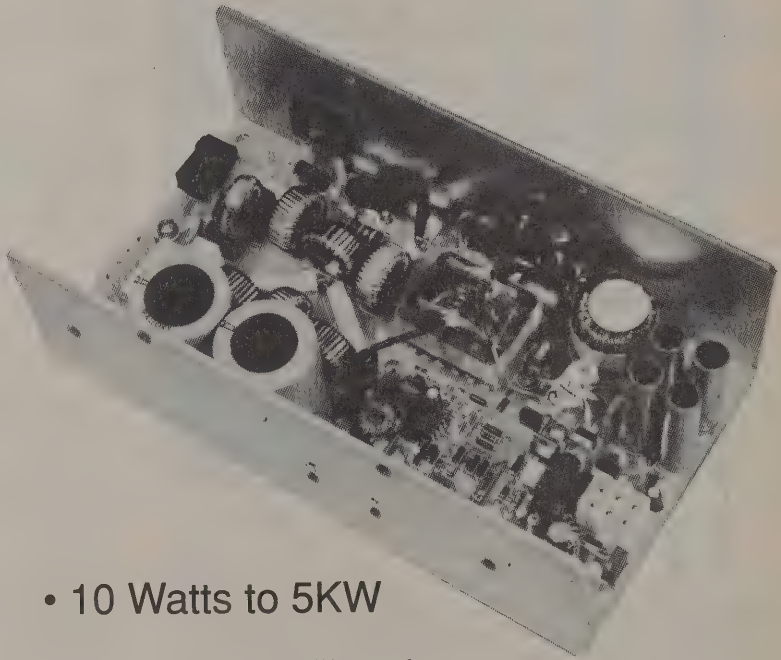
☆

2 YEAR WARRANTY

☆

BUILT
to the same
STANDARDS
as our
MILITARY SUPPLIES

ENTIRELY
BUILT
in the
USA



- 10 Watts to 5KW
- 1 Volt to 10 Kilovolts
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- AC Regulators
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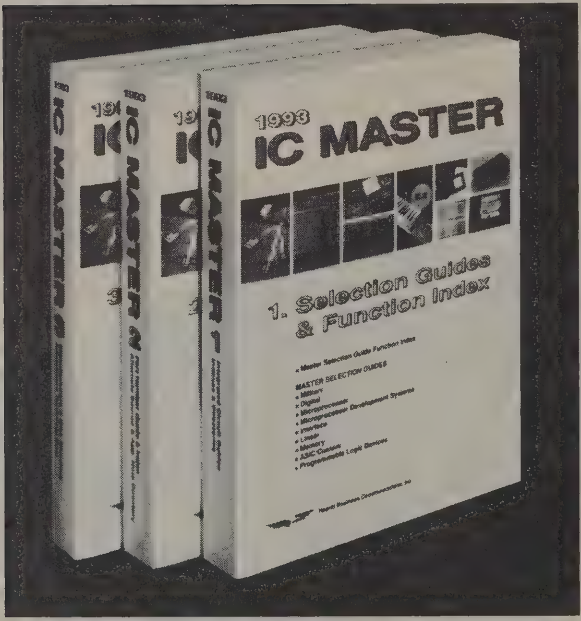
SUPER TIME SAVER!



Do you work with ICs? Do you have trouble finding the IC you need? Are you sick and tired of sifting through dozens of manufacturers' data books? Do you have trouble comparing one set of specs to another? Are you sick and tired of wasting time?

Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

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IC MASTER
Published annually in February,

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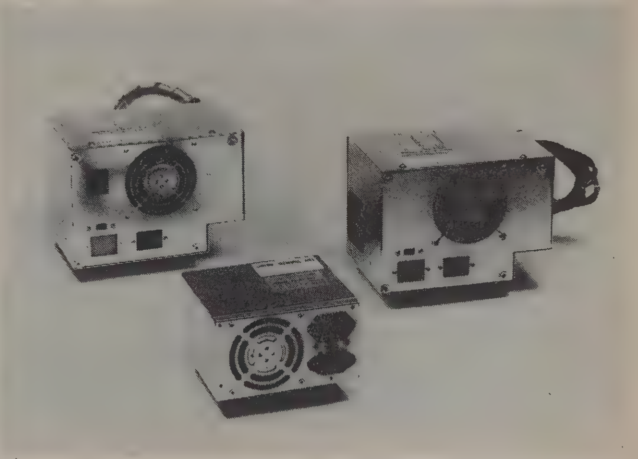
PS-STANDARD/"BABY" AT SERIES

FEATURES

- UL recognized, CSA certified, and TUV approved
- EMI/RFI within limits of VDE 0871/6.78 and FCC Part 15, subpart J
- Operates on 115 or 230 VAC
- OVP on +5 VDC output
- Full ONE YEAR WARRANTY
- 200-325 Watts
- Custom options available
- Tight regulation on all outputs available
- Automatic current limit
- Short circuit protection
- MTBF greater than 50,000 hours



SPECIFICATIONS

COMMERCIAL GRADE

PS-AT-200E (BABY AT)

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5V	10A	20A	22.5A
+12V	1A	6A	8A
−12V	0A	0.5A	1A
− 5V	0A	0.5A	1A

PS-AT-300E (BABY AT)

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5V	7A	20A	25A
+12V	2.5A	10A	14A
−12V	0A	1A	1.5A
−5V	0A	1A	1.5A

INDUSTRIAL GRADE

PS-AT-200 (BABY AT)

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5V	2A	20.0A	22.5A
+12V	1A	6.0A	8.0A
−12V	0A	0.5A	1.0A
− 5V	0A	0.5A	1.0A

PS-AT-190

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5 VDC	2.0A	19A	20A
+12 VDC	1.5A	7.0A	8.0A
−12 VDC	0	0.5A	1.0A
−5 VDC	0	0.5A	1.0A

PS-AT-270

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5 VDC	3.0A	30A	33A
+12 VDC	2.0A	8.0A	10A
−12 VDC	0	0.5A	1.0A
−5 VDC	0	0.5A	1.0A

PS-AT-325

DC OUTPUT VOLTAGE	RATED LOADS MIN.	TYP.	MAX.
+5 VDC	3.0A	40A	42A
+12 VDC	2A	10A	11A
−12 VDC	0	0.5A	1.0A
−5 VDC	0	0.5A	1.0A

BATTERY BACK-UP OPTION

The "Standand" PS-AT Series is now available with a battery back-up module to give you uninterruptible power source capabilities. Operation in the back-up mode is a function of the ampere hours rating of the external (customer supplied) batteries. Add suffix BU to model number.

FEATURES

- No outage at switch over
- 85% efficiency
- Battery charging circuit available
- Low battery voltage signal
- Automatic switch-off for low batteries
- Automatic switch-over from batteries when AC returns

MODIFIED STANDARDS, AND CUSTOM DESIGNS AVAILABLE

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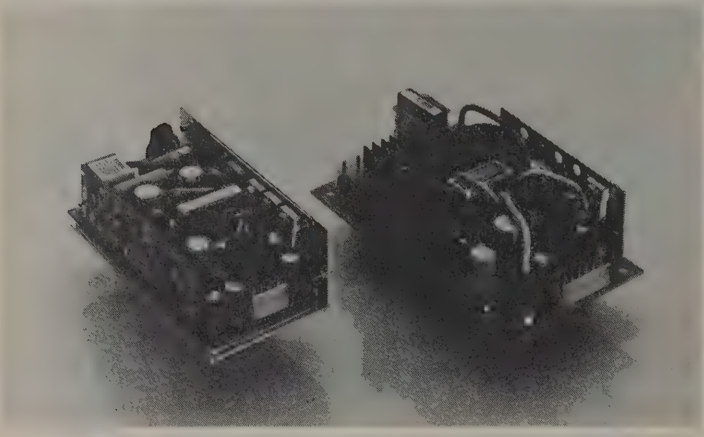
PVI UNIVERSAL AUTOMATIC AC INPUT SERIES

SINGLE AND MULTIPLE OUTPUTS



FEATURES

- Automatically Accommodates Universal AC Sources
- Designed and Tested to Worldwide EMI/RFI Regulations. Meets VDE and FCC Level "B" Emissions
- Compact Size
- Overload Protection
- Overvoltage Protection
- Many Options Available
- MTBF Greater than 100K Hours
- UL Recognized, CSA Certified, TUV Licensed
- High Peak Currents for Starting Loads

SPECIFICATIONS

PARAMETER	CONDITIONS	LIMITS
AC INPUT	No load to full load	90-260 VAC (115 or 230 VAC nominal) Auto input range without any external changes
AC INPUT FREQUENCY	No load to full load	47-63 Hz (consult factory for 440 Hz operation)
INPUT SURGE CURRENT	Peak (cold start)	15A (115 VAC) 30A (230 VAC)
DC OUTPUT		See Model Selection Chart
DC OUTPUT ADJUSTMENT	+5VDC output	+4.5V to OVP trip point
HOLD-UP TIME	Nominal input voltage and max output power	20 ms
LINE REGULATION	Within specified AC limits	±0.5% typical
LOAD REGULATION	20% to 100% load change	±1.0% main output ±3.0% for auxiliary output without post regulator ±1.0% for auxiliary output with post regulator

PARAMETER	CONDITIONS	LIMITS
RIPPLE AND NOISE	Max load	50mV Pk-Pk max 5V output 1% max any other output
TRANSIENT RESPONSE	50% load change	2% max deviation, returns to initial condition in 1 ms max
AMBIENT OPERATING TEMPERATURE	Continuous duty, full rating Derate linearly to 50% of full rating at +71°C	0° to 50°C 0% to 70% (fan cooled) 50° to 71°C
STORAGE TEMPERATURE	Non operating	−20°C to +80°C
OVERVOLTAGE PROTECTION	+5V output only	+6.2V ± 0.4V
SHORT CIRCUIT PROTECTION	Will withstand a continuous short without damage; will automatically return to regulation upon removal of short.	
OVERLOAD PROTECTION	Maximum rated current cannot be drawn from all outputs at the same time. The overload protection feature will reduce all output voltages to a safe dissipation level when the total output power exceeds 125% of maximum rated power.	
NO LOAD OPERATION	No damage to power supply will occur when operating at no load.	

POWER SWITCH CORP.

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PVI UNIVERSAL AUTOMATIC AC INPUT SERIES

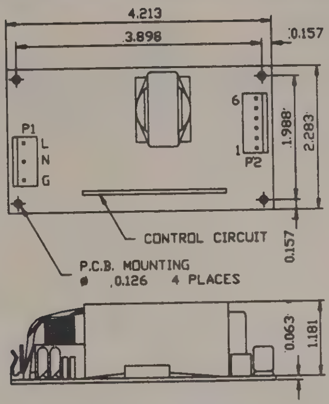
SINGLE AND MULTIPLE OUTPUTS

VOLTAGE/CURRENT RATING CHART

PVI-10 SERIES

10 Watt maximum output power convection cooled.

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE,	PEAK	AUX 2	AUX 3
PVI-10-10	+5 @ 2.0	—	—	—	
PVI-10-11	+12 @ 1.0	—	—	—	
PVI-10-12	+15 @ 0.7	—	—	—	
PVI-10-13	+24 @ 0.5	—	—	—	
PVI-10-20	+5 @ 1.7	5 @ 0.3	1.0	—	—
PVI-10-21	+5 @ 1.0	12 @ 0.5	1.0	—	—
PVI-10-22	+5 @ 1.0	15 @ 0.4	1.0	—	—
PVI-10-23	+5 @ 1.0	24 @ 0.2	1.0	—	—

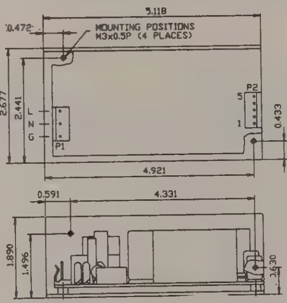

4.213
3.898
0.157
6
1
P2
1.988
2.283
P1
L
N
G
CONTROL CIRCUIT
0.157
P.C.B. MOUNTING
ø 0.126 4 PLACES
0.063
1.181

PVI-10 SERIES

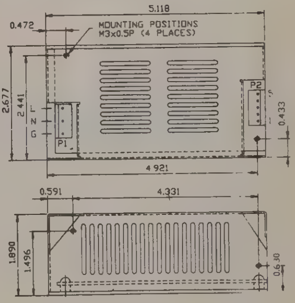
PVI-21 SERIES

20 Watt maximum output power convection cooled.

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE,	PEAK	AUX 2	AUX 3
PVI-21-20	+5 @ 3.0	5 @ 1.0	1.0	—	—
PVI-21-21	+5 @ 3.0	12 @ 0.5	1.0	—	—
PVI-21-22	+5 @ 3.0	15 @ 0.5	1.0	—	—
PVI-21-23	+5 @ 2.0	24 @ 0.5	1.0	—	—
PVI-21-30	+5 @ 2.0	+12 @ 0.5	1.0	12 @ 0.5	—
PVI-21-31	+5 @ 2.0	+12 @ 0.5	1.0	5 @ 1.0	—
PVI-21-32	+5 @ 2.0	+24 @ 0.2	1.0	12 @ 0.5	—
PVI-21-33	+5 @ 2.0	+15 @ 0.5	1.0	15 @ 0.5	—
PVI-21-34	+5 @ 2.0	+24 @ 0.2	1.0	5 @ 1.0	—


5.118
0.472
MOUNTING POSITIONS
M3x0.5P (4 PLACES)
2.677
2.441
L
N
G
P1
P2
5
1
0.433
4.921
0.591
4.331
1.890
1.496
0.630

PVI-21 SERIES

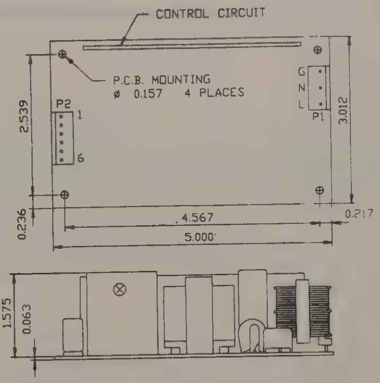

5.118
0.472
MOUNTING POSITIONS
M3x0.5P (4 PLACES)
2.677
2.441
L
N
G
P1
P2
0.433
4.921
0.591
4.331
1.890
1.496
0.630

PVI-21 SERIES (BOX)

PVI-30 SERIES

40 Watts maximum output power convection cooled.

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE,	PEAK	AUX 2	AUX 3
PVI-30-10	+5 @ 8.0	—		—	—
PVI-30-11	+12 @ 3.3	—		—	—
PVI-30-12	+15 @ 2.6	—		—	—
PVI-30-13	+24 @ 1.6	—		—	—
PVI-30-20	+5 @ 3.0	−5 @ 2.5	4.0	—	—
PVI-30-21	+5 @ 3.0	+12 @ 2.5	4.0	—	—
PVI-30-23	+5 @ 3.0	+24 @ 1.5	2.0	—	—
PVI-30-30	+5 @ 3.0	+12 @ 2.5	4.0	12 @ 1.0	—
PVI-30-33	+5 @ 3.0	+24 @ 1.5	2.0	12 @ 1.0	—
PVI-30-34	+5 @ 3.0	+15 @ 2.0	3.0	15 @ 1.0	—
PVI-30-21TA	+5 @ 3.0	+12 @ 3.0	5.5	—	


CONTROL CIRCUIT
P.C.B. MOUNTING
ø 0.157 4 PLACES
G
N
L
P1
P2
1
6
2.539
3.012
0.236
4.567
5.000
0.217
1.575
0.063

PVI-30 SERIES

POWER SWITCH CORP.

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PVI UNIVERSAL AUTOMATIC AC INPUT SERIES

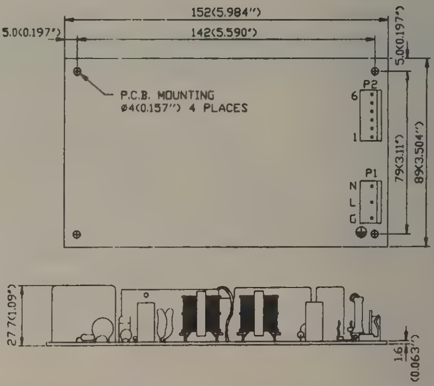
SINGLE AND MULTIPLE OUTPUTS

VOLTAGE/CURRENT RATING CHART

PVI-33 SERIES

Low Profile 30 Watt

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE, PEAK	AUXILIARY 2
PVI-33-10	+5 @ 6.5	—	—
PVI-33-11	+12 @ 2.7	—	—
PVI-33-12	+15 @ 2.0	—	—
PVI-33-13	+24 @ 1.5	—	—
PVI-33-20	+5 @ 5.5	5 @ 1.0 1.0	—
PVI-33-21	+5 @ 4.0	12 @ 1.0 1.0	—
PVI-33-23	+5 @ 4.0	24 @ 0.5 1.0	—
PVI-33-30	+5 @ 3.0	+12 @ 1.0 1.5	12 @ 0.5
PVI-33-31	+5 @ 3.0	+12 @ 1.2 1.5	5 @ 0.5
PVI-33-32	+5 @ 3.0	+24 @ 1.5 2.0	12 @ 1.0
PVI-33-33	+5 @ 3.0	+15 @ 2.0 3.0	15 @ 1.0

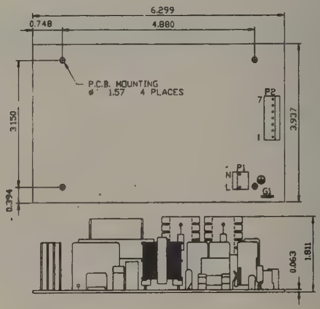

152(5.984")
5.0(0.197")
142(5.590")
5.0(0.197")
P.C.B. MOUNTING
Ø4(0.157") 4 PLACES
P2
6
1
P1
N
L
G
79(3.11")
89(3.504")
27.7(1.09")
1.6
(0.063")

PVI-33 SERIES

PVI-40 SERIES

40 Watt maximum output power convection cooled.

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE, PEAK	AUX 2	AUX 3
PVI-40-30	+5 @ 3.0	+12 @ 1.5 2.0	12 @ 0.5	—
PVI-40-31	+5 @ 3.0	+12 @ 1.5 2.0	5 @ 1.0	—
PVI-40-32	+5 @ 3.0	+24 @ 0.8 1.5	12 @ 0.5	—
PVI-40-33	+5 @ 3.0	+15 @ 1.4 2.0	15 @ 0.4	—
PVI-40-40	+5 @ 3.0	+12 @ 1.2 2.0	12 @ 0.5	−12 @ 0.5
PVI-40-41	+5 @ 3.0	+12 @ 1.2 2.0	12 @ 0.5	−5 @ 1.0
PVI-40-42	+5 @ 3.0	+24 @ 0.5 1.5	12 @ 0.5	−12 @ 0.5
PVI-40-43	+5 @ 3.0	+15 @ 1.0 2.0	15 @ 0.5	−12 @ 0.5

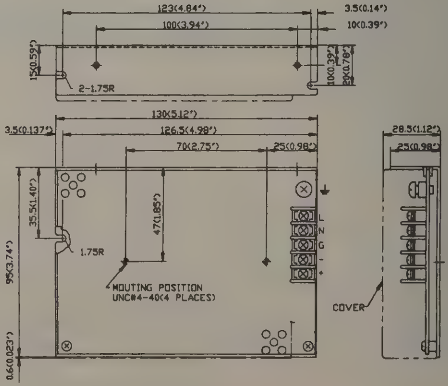

6.299
0.748
4.880
P.C.B. MOUNTING
ø 1.57 4 PLACES
P2
7
1
3150
3.937
P1
N
L
G1
0.394
0.063
1.811

PVI-40 SERIES

PVI-50 SERIES

Low Profile 50 Watt

MODEL NUMBER	MAIN OUTPUT AVE, PEAK
PVI-50-10	+5 @ 10.0 10.0
PVI-50-11	+12 @ 4.0 4.5
PVI-50-12	+15 @ 3.0 3.5
PVI-50-13	+24 @ 2.0 2.2


123(4.84")
100(3.94")
3.5(0.14")
10(0.39")
15(0.59")
2-1.75R
10(0.39")
20(0.78")
130(5.12")
3.5(0.137")
126.5(4.98")
70(2.75")
25(0.98")
28.5(1.12")
25(0.98")
35.5(1.40")
47(1.85")
1.75R
L
N
G
-
+
95(3.74")
MOUTING POSITION
UNC#4-40(4 PLACES)
COVER
0.6(0.023")

PVI-50 SERIES (BOX)

POWER SWITCH CORP.

17 Vreeland Street, Lodi, New Jersey 07644
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PVI UNIVERSAL AUTOMATIC AC INPUT SERIES

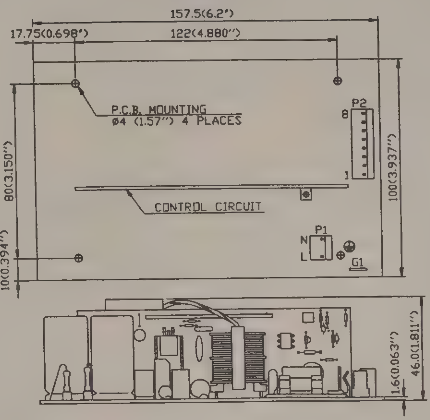
SINGLE AND MULTIPLE OUTPUTS

VOLTAGE/CURRENT RATING CHART

PVI-80 SERIES

80 watts max output power with 12 cfm forced air cooling

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE	PEAK	AUXILIARY 2
PVI-80-21	+5 @ 6.0	+12 @ 6.0	13.0	
PVI-80-30	+5 @ 8.0	+12 @ 2.0	4.0	−12 @ 2.0
PVI-80-32	+5 @ 8.0	+24 @ 1.5	3.0	−12 @ 1.0
PVI-80-33	+5 @ 8.0	+12 @ 2.0	4.0	+24 @ 1.5
PVI-80-34	+5 @ 8.0	+15 @ 1.5	3.0	−15 @ 1.5

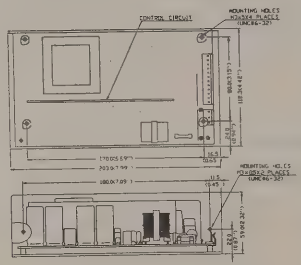

157.5(6.2")
17.75(0.698")
122(4.880")
P.C.B. MOUNTING
Ø4 (1.57") 4 PLACES
P2
8
1
80(3.150")
100(3.937")
CONTROL CIRCUIT
P1
N
L
G1
10(0.394")
1.6(0.063")
46.0(1.811")

PVI-80 SERIES

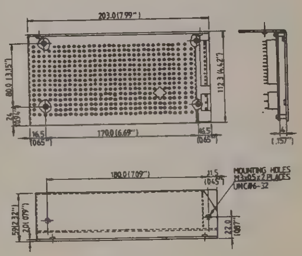
PVI-90 SERIES

90 Watt max convection cooled 110 watts with 12 cfm forced air cooling

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE	PEAK	AUX 2	AUX 3
PVI-90-30	+5 @ 10.0	+12 @ 3.0	4.0	−12 @ 1.5	—
PVI-90-32	+5 @ 10.0	+24 @ 1.5	3.0	−12 @ 1.5	—
PVI-90-33	+5 @ 10.0	+24 @ 1.5	3.0	+12 @ 1.5	—
PVI-90-34	+5 @ 10.0	+15 @ 2.0	4.0	−15 @ 1.6	—
PVI-90-40	+5 @ 10.0	+12 @ 2.0	3.0	−12 @ 1.5	−5 @ 1.5
PVI-90-42	+5 @ 10.0	+24 @ -1.5	3.0	+12 @ 1.5	−12 @ 1.0
PVI-90-43	+5 @ 10.0	+15 @ 2.5	4.0	−15 @ -1.5	−5 @ 1.5
PVI-90-44	+5 @ 10.0	+12 @ 3.0	4.0	+12 @ 1.5	−12 @ 1.0


CONTROL CIRCUIT
MOUNTING HOLES

PVI-90 SERIES

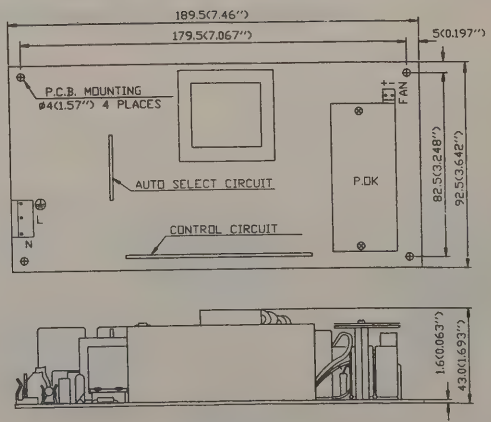

203.0(7.99")
170.0(6.69")
180.0(7.09")
MOUNTING HOLES

PVI-90 SERIES (BOX)

PVI-110 SERIES

110 watts max output power with 12 cfm forced air cooling

MODEL NUMBER	MAIN OUTPUT	AUXILIARY 1 AVE	PEAK	AUXILIARY 2
PVI-110-31T	+5 @ 14.0	+12 @ 3.0	3.0	−12 @ 0.5
PVI-110-30	+5 @ 10.0	+12 @ 3.0	4.0	−12 @ 1.5
PVI-110-32	+5 @ 10.0	+24 @ 1.5	3.0	−12 @ 1.5
PVI-110-33	+5 @ 10.0	+24 @ 1.5	3.0	+12 @ 1.5
PVI-110-34	+5 @ 10.0	+15 @ 2.0	4.0	−15 @ 1.5


189.5(7.46")
179.5(7.067")
5(0.197")
P.C.B. MOUNTING
Ø4(1.57") 4 PLACES
FAN
AUTO SELECT CIRCUIT
P.OK
82.5(3.248")
92.5(3.642")
L
N
CONTROL CIRCUIT
1.6(0.063")
43.0(1.693")

PVI-110 SERIES

POWER SWITCH CORP.

17 Vreeland Street, Lodi, New Jersey 07644
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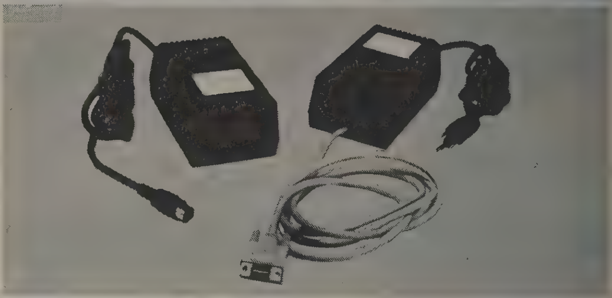
PES AC-DC AUTOMATIC DESKTOP SERIES

AC INPUT



FEATURES:

- Automatically accommodates universal AC sources.
- Designed to meet universal safety standards.
- Designed and tested to world wide EMI/RFI regulations. Meets VDE and FCC Part 15 level "B".
- Overload protection.
- Overvoltage protection.
- Custom outputs available.
- Compact size.

20, 40 AND 60 WATT CONFIGURATIONS

PARAMETER	CONDITIONS	LIMITS
AC INPUT	No load to full load	90-260VAC Typical, 85-265VAC available
AC INPUT FREQUENCY	No load to full load	47–440 Hz
INPUT SURGE CURRENT	Peak (cold start)	20A for PES-20 & PES-30 25A for PES-60
DC OUTPUT		See Voltage/Current Rating Chart
DC OUTPUT ADJUSTMENT		Main output internal adjustable from 4.5V till OVP trip point
HOLD-UP TIME	Nominal input voltage and max output power.	20m Sec. at 120VAC FULL LOAD
LINE REGULATION	Within specified AC limits	Main output 0.1% Aux. output 1.5%
LOAD REGULATION	20% to 100% load change	5% at cable connector ends.
DIELECTRIC WITHSTANDING		3,750VAC-Outpout/Input. 1,500VAC-Input/GND 500VAC-Output/GND
RIPPLE AND NOISE	Max load	Typical 1% peak-peak
AMBIENT OPERATING TEMPERATURE		0°C to 40°C
STORAGE TEMPERATURE	Non operating	–20°C to +85°C
OVERVOLTAGE PROTECTION		124%±8% on Main output
SHORT CIRCUIT PROTECTION	The Overload Protection feature protects against Short Circuit	
OVERLOAD PROTECTION	The overload protection will reduce all output voltage to safe dissipation level when the average power rating exceeds 125–150% of max power	
NO LOAD OPERATION	ALLOWED	

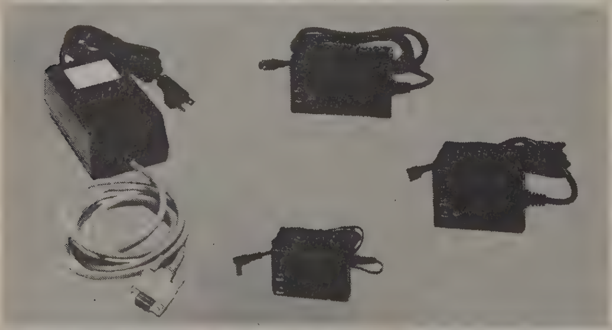
PER WALLMOUNT AND DESKTOP SERIES

AC-DC REGULATED

2 TO 24 WATT CONFIGURATIONS

FEATURES:

- 120 VAC or 220 VAC input
- Designed to meet universal safety standards.
- Regulated outputs typically 1.5%
- Overload protection. • Short circuit protection.
- Custom outputs available. • 100% burn-in before shipment.
- 0° to 50°C operation. • Fully one year warranty.



SPECIFICATIONS:

PARAMETER	CONDITIONS	LIMITS
AC INPUT	No load to full load	Nominal 120VAC or 220VAC options.
AC INPUT FREQUENCY	No load to full load	50 Hz or 60 Hz
DC OUTPUT		See Voltage/Current Rating Chart
DC OUTPUT ADJUSTMENT		No Adjustable
DIELECTRIC WITHSTANDING		VDE option 3,750VAC RMS. UL option 1,500VAC RMS
AMBIENT OPERATING TEMPERATURE		0°C to 40°C
STORAGE TEMPERATURE	Non operating	–20°C to +85°C
SHORT CIRCUIT PROTECTION		Protected by Post Regulators used.
OVERLOAD PROTECTION		Protected by Post Regulators used.

POWER SWITCH CORP.

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PEA WALLMOUNT AND DESKTOP SERIES

AC-DC UNREGULATED
2.5 TO 35 WATT CONFIGURATIONS

FEATURES:

- 120 VAC or 220 VAC input.
- Designed to meet universal safety standards.
- Custom outputs available.
- 100% burn-in before shipment.
- 0°C to 50°C operation.
- Full one year warranty.

SPECIFICATIONS:

PARAMETER	CONDITIONS	LIMITS
AC INPUT	No load to full load	Nominal 120VAC or 220VAC Option.
AC INPUT FREQUENCY	No load to full load	50 Hz. or 60 Hz. option.
DC OUTPUT		See Voltage/Current Rating Chart
DC OUTPUT ADJUSTMENT		No Adjustable
DIELECTRIC WITHSTANDING	VDE option 3.750VAC RMS. UL option 1,500VAC RMS	
AMBIENT OPERATING TEMPERATURE		0°C to 40°C
STORAGE TEMPERATURE	Non operating	–20°C to +85°C
SHORT CIRCUIT PROTECTION		No protection.
OVERLOAD PROTECTION	Thermal fuse overload protection in the primary installed for 220VAC input. Option for 120VAC input.	

PET WALLMOUNT AND DESKTOP SERIES

AC-AC
4 TO 50 VA CONFIGURATIONS

FEATURES:

- 120 VAC or 220 VAC input.
- Designed to meet universal safety standards.
- Custom outputs available.
- Thermal overload protection available.
- Full one year warranty.

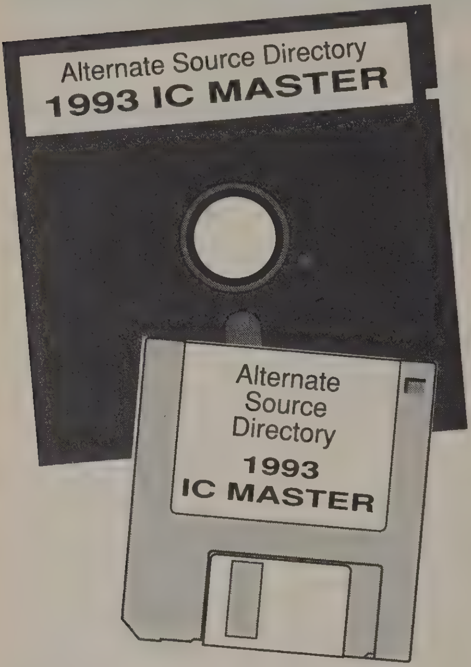
SPECIFICATIONS:

PARAMETER	CONDITIONS	LIMITS
AC INPUT	No load to full load	Nominal 120VAC or 220VAC Option
AC INPUT FREQUENCY	No load to full load	50 Hz. or 60 Hz. option
AC OUTPUT		See Voltage/Current Rating Chart
DIELECTRIC WITHSTANDING	VDE option: 3,750VAC RMS UL option: 1,500VAC RMS	
AMBIENT OPERATING TEMPERATURE		0°C to 40°C
STORAGE TEMPERATURE	Non operating	–20°C to +85°C
SHORT CIRCUIT PROTECTION		No protection
OVERLOAD PROTECTION	Thermal fuse overload protection in the primary installed for 220VAC input. For 120VAC input is option.	

Hearst Engineering Software

ICMASD

Alternate Source Directory



The all new 1993 ICMASD-IC Alternate Source Directory on Disk is identical to the Alternate Source Directory Section contained in Volume Two of the printed version of the 1993 IC Master. All you need is an IBM XT/AT or 100% compatible personal computer with hard drive.

ICMASD is the most comprehensive and reliable guide available to all ICs known to have a realistic replacement or alternative. The 1993 version contains over 106,000 listings to help you find the functional equivalents for both current and discontinued parts.

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ICMASD is organized in a similar fashion to the printed version in the IC MASTER. The database is arranged by manufacturer, showing the manufacturer's original basic part number. All known replacements for that part are listed in alphanumeric order.

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ICMASD is very user friendly. There are no tricky commands to learn. The software is completely menu driven. ICMASD comes complete with documentation that is brief and to the point. It can be ordered on five 51/4" double-sided, double-density disks OR on one 51/4" high-density disk OR on one 31/2" high-density disk.

Published annually in March

FAST AND CONVENIENT

ICMASD includes a complete Manufacturers & Distributors Directory listing the addresses and phone numbers of every manufacturer in the IC industry. With this complete directory any manufacturer or distributor is just a phone call away.

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3400 SERIES
1800W & 2000W
3½" H • < 30#

4500 SERIES
2500W
5¼" H • < 45#

Three Phase

Single Output

4600 SERIES
2500W & 5000W
5¼" H • < 55#

4700 SERIES
7500 & 10000W
10½" H • < 110#

Dual Output

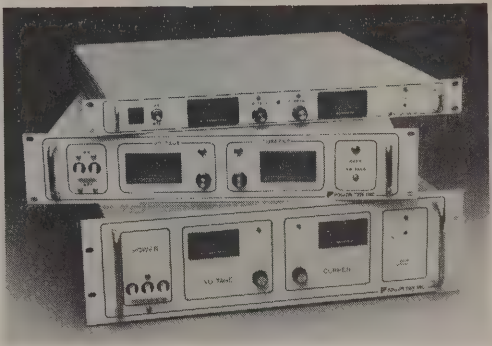
5600 SERIES*
5000W TOTAL
5¼" H • < 55#

5700 SERIES*
7500W TOTAL
10½" H • < 110#

5800 SERIES*
10000 TOTAL
10½" H • < 110#

Plus other V-A Combinations

* Mix or Match



Single Phase Prime Power

MODEL	Output DC		Output Ripple RMS
	Volts	Amps	
3300-7.575	0 - 7.5	75	30 mV
3300-7.5125	0 - 7.5	125	30 mV
3400-7.5250	0 - 7.5	250	30 mV
4500-7.5300	0 - 7.5	300	10 mV
3300-1060	0 - 10	60	30 mV
3300-10100	0 - 10	100	30 mV
3400-10200	0 - 10	200	30 mV
4500-10250	0 - 10	250	10 mV
3300-2030	0 - 20	30	30 mV
3300-2050	0 - 20	50	30 mV
3400-20100	0 - 20	100	30 mV
4500-20125	0 - 20	125	10 mV
4500-3080	0 - 30	80	30 mV
3300-4015	0 - 40	15	30 mV
3300-4025	0 - 40	25	30 mV
3400-4050	0 - 40	50	30 mV
4500-4060	0 - 40	60	10 mV
3300-6010	0 - 60	10	30 mV
3300-6016	0 - 60	16	30 mV
3400-6030	0 - 60	30	30 mV
4500-6040	0 - 60	40	20 mV
3300-8006	0 - 80	6	50 mV
3300-8012	0 - 80	12	50 mV
4500-8030	0 - 80	30	20 mV
3300-10010	0 - 100	10	50 mV
4500-10025	0 - 100	25	50 mV
4500-15016	0 - 150	16	75 mV
4500-25010	0 - 250	10	100 mV
3400-3006	0 - 300	6	100 mV
4500-3008	0 - 300	8	100 mV
4500-4505	0 - 450	5	150 mV
3400-6003	0 - 600	3	200 mV
4500-6004	0 - 600	4	200 mV

Three Phase Prime Power

MODEL	Output DC		Output Ripple RMS
	Volts	Amps	
4600-7.5300	0 - 7.5	300	10 mV
4600-10250	0 - 10	250	10 mV
4600-10375	0 - 10	375	10 mV
4600-10500	0 - 10	500	10 mV
4700-10750	0 - 10	750	30 mV
4700-101000	0 - 10	1000	30 mV
4600-20125	0 - 20	125	10 mV
4600-20185	0 - 20	185	10 mV
4600-20250	0 - 20	250	10 mV
4700-20375	0 - 20	375	30 mV
4700-20500	0 - 20	500	30 mV
4600-3080	0 - 30	80	10 mV
4600-30120	0 - 30	120	10 mV
4600-30160	0 - 30	160	10 mV
4700-30240	0 - 30	240	10 mV
4700-30320	0 - 30	320	10 mV
4600-4060	0 - 40	60	10 mV
4600-4090	0 - 40	90	10 mV
4600-40125	0 - 40	125	10 mV
4700-40185	0 - 40	185	30 mV
4700-40250	0 - 40	250	30 mV
4600-6040	0 - 60	40	20 mV
4600-6060	0 - 60	60	20 mV

Three Phase Prime Power (Continued)

MODEL	Output DC		Output Ripple RMS
	Volts	Amps	
4600-6080	0 - 60	80	20 mV
4700-60125	0 - 60	125	30 mV
4700-60160	0 - 60	160	30 mV
4600-8030	0 - 80	30	20 mV
4600-8045	0 - 80	45	20 mV
4600-8060	0 - 80	60	20 mV
4600-10025	0 - 100	25	50 mV
4600-10037	0 - 100	37	50 mV
4600-10050	0 - 100	50	50 mV
4600-15016	0 - 150	16	75 mV
4600-15024	0 - 150	24	75 mV
4600-15033	0 - 150	33	75 mV
4600-25010	0 - 250	10	100 mV
4600-25015	0 - 250	15	100 mV
4600-25020	0 - 250	20	100 mV
4700-25030	0 - 250	30	100 mV
4700-25040	0 - 250	40	100 mV
4600-3008	0 - 300	8	100 mV
4600-30012	0 - 300	12	100 mV
4600-30016	0 - 300	16	100 mV
4700-30024	0 - 300	24	100 mV
4700-30032	0 - 300	32	100 mV
4600-4505	0 - 450	5	150 mV
4600-4507	0 - 450	7	150 mV
4600-45010	0 - 450	10	150 mV
4700-45016	0 - 450	16	150 mV
4700-45022	0 - 450	22	150 mV
4600-6004	0 - 600	4	200 mV
4600-6006	0 - 600	6	200 mV
4600-6008	0 - 600	8	200 mV
4700-60012	0 - 600	12	200 mV
4700-60016	0 - 600	16	200 mV

Dual Output (Mix or Match)

	PS1			PS2		
Series	DC Output		Output Ripple RMS	DC Output		Output Ripple RMS
	Volts (0 to)	Amps (0 to)		Volts (0 to)	Amps (0 to)	
5600 Height: 5 1/4" Weight: < 55 lbs. 5,000W Total	10	250	10mV	10	250	10mV
	15	160	10mV	15	160	10mV
	20	125	10mV	20	125	10mV
	30	80	10mV	30	80	10mV
	40	60	10mV	40	60	10mV
	60	40	10mV	60	40	10mV
	80	30	10mV	80	30	10mV
5700 Height: 10 1/2" Weight: < 110 lbs. 7,500W Total	10	375	10mV	10	375	10mV
	15	240	10mV	15	240	10mV
	20	185	10mV	20	185	10mV
	30	120	10mV	30	120	10mV
	40	90	10mV	40	90	10mV
	60	60	10mv	60	60	10mv
5800 Height: 10 1/2" Weight: < 110 lbs. 10,000W Total	10	500	10mV	10	500	10mV
	15	320	10mV	15	320	10mV
	20	250	10mV	20	250	10mV
	30	160	10mV	30	160	10mV
	40	125	10mV	40	125	10mV
	60	80	10mv	60	80	10mv

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High Efficiency, typically 80 - 85%
High Power Density to
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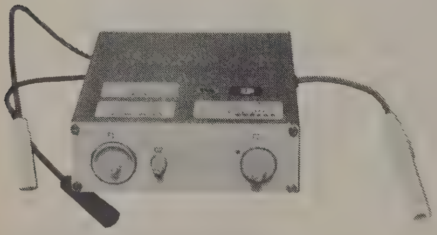
CDF Series Color Dual Focus Commercial HVPS



FEATURES:

- 20kV to 29kV @ 1.2mA, multiple outputs
- Dual focus outputs (independently adjustable)
- DF input permits modulation of Focus #2
- Low cost
- Overvoltage & overcurrent safety circuits
- Customer-specified options available
- Remote on/off
- Beam current sense (optional)
- High quality, MTBF > 65,000 hrs.
- Low ripple, tightly regulated
- UL & CSA recognized models

Series CDF is designed to power the latest bi-potential color CRT's. Attributes include fixed outputs for anode, G1 and B+ (to power your external amplifier), as well as adjustable focus #1, focus #2 and G2 outputs. An AC-coupled DF input (DC restored) enables modulation of focus #2. Overvoltage and overcurrent protection, beam current sense, remote on/off and optional remote G2 adjustment are also featured in this sophisticated, highly reliable, yet low cost high voltage power supply.

ELECTRICAL SPECS (Typical):

- **Anode** : 27kV ±3% @ up to 1.2mA; Ripple: <3Vp-p
- **Focus #1**: 5.9kV to 9.2kV @ ±5uA
- **Focus #2**: 5.9kV to 9.2kV @ ±5uA
- **G2**: 200V to 850V @ ±5uA
- **G1**: -200V @ up to 2mA
- **Amp B+**: +400V @ up to 3mA (optional)
- **DF Input**: Up to 1kV (DC restored)
- Input: ±32V ±5% (options available)
- Regulation
  Line: .04%
  Load: .04%
  Dynamic Load: 60V peak @ 1.2mA
- Remote on/off - TTL compatible
- Beam current sense (optional)

MECHANICAL SPECS:

Size: 8.0" x 5.75" x 1.9"
Weight: Approx. 4.5 lbs.

ENVIRONMENTAL SPECS:

Operating Temp: 0 to +60°C case
Storage Temp: -35°C to +90°C
Operating Altitude: 0 to 10,000 ft.
Humidity: 0 to 95% non-condensing

Rantec reserves the right to change specifications at any time without prior notice. It is Rantec's policy to improve products as new techniques and components become available.

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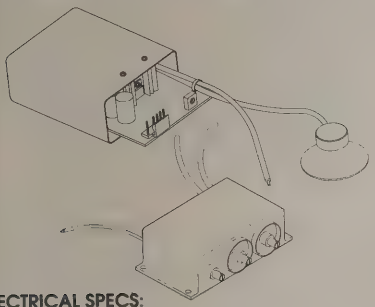
CLC Series Color Low Cost Commercial HVPS



FEATURES:
- 20kV to 29kV @ 1.2 mA, multiple outputs
- Super low cost
- Modular design for installation ease
- Low ripple, tightly regulated
- Overvoltage & overcurrent safety circuitsv
- Single and dual focus options
- Customer-specified options available
- REmote on/off
- Beam current sense
- UL & CSA recognized models

Series CLC offers maximum versatility with compact modules to be mounted separately, minimizing interference while permitting accessability to voltage adjustments. One module houses the fixed anode, focus, G1 and Amp B+ outputs, while the second module interfaces to provide adjustments for the Focus and G2 outputs and the DF input. All this and super low cost too! Available in a dual focus configuration as well! (Pictured.)

ELECTRICAL SPECS:

Voltage Module
- **Anode**: Fixed output specified from 20kV to 29kV ±3% @ up to 1.2mA; Ripple: <3Vp-p
- **Focus**: Fixed output specified from 30% to 60% of anode voltage @ up to 250uA
- **G1**: -200V @ up to 2mA
- **Amp B+**: +400V @ up to 3mA, 6mA peak
- Input: +24V ±5% (options available)
- Remote on/off - TTL compatible
- Beam current sense

Potentiometer Module:
- **Focus**: 19% to 31% of anode @±15uA (options available)
- **G2**: 100V to 1kV @ ±15uA
- **DF Input**: AC-coupled, up to 1kV (DC restored)

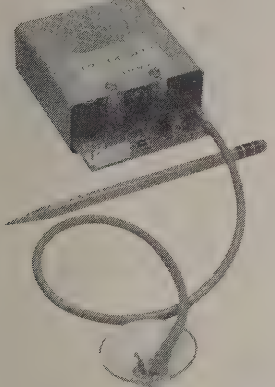
MECHANICAL SPECS:

Approximate Size:
Voltage Module : 5.9" x 3.4" x 1.8"
Potentiometer Module: 4.0" x 3.0" x 1.5"

ENVIRONMENTAL SPECS:

Operating Temp: 0 to +60°C case
Storage Temp: -35°C to +90°C
Operating Altitude: 0 to 10,000 ft.
Humidity: 0 to 95% non-condensing

SLC Series Super Low Cost Commercial HVPS



FEATURES:
- 2kV to 25kV, multiple outputs
- Up to 10 watts total output power
- Lowest cost unit available
- Highly reliable/MTBF >350,000 hrs.
- Overvoltage safety circuitry (DHHS compliant)
- Low ripple, tightly regulated
- UL recognized models
- Extremely compact
- Customer-specified options available

Series SLC is a sophisticated, light-weight, compact unit ideally suited for use in high resolution monochrome CRT displays. This cost-effective alternative to high-end flybacks is aggressively priced for high volume programs.

ELECTRICAL SPECS:
- **Anode**: Fixed output specified from 2kV to 25kV ±3% @ up to 10 watts maximum total all outputs; Ripple: <3Vp-p
- **Aux #1**: Specified -1kV to +1kV ±10% @ up to 1mA
- **Aux #2**: Specified -1kV to +1kV ±10% @ up to 1mA
- Input: +24V ±5% (options available)
- Regulation
  Line: .3%
  Load: .1%
  Dynamic Load: 10V/100uA

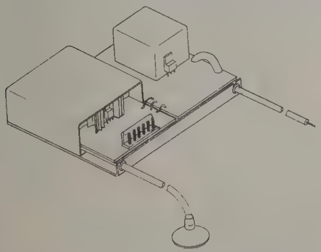
MECHANICAL SPECS:

Size: 4.1" x 3.12" x 1.46"
Weight: Approx. .5 lbs.

ENVIRONMENTAL SPECS:

Operating Temp: 0 to +60° case
Storage Temp: -35°C to +70°C
Operating Altitude: 0 to 10,000 ft.
Humidity: 0 to 95% non-condensing

DAC Series Dynamic Amplifier Commercial HVPS



FEATURES:
- 10kV to 20kV anode plus G2 & G1 @ up to 10 watts
- Focus output 2kV to 5kV @ up to 500uA
- Internal dynamic focus amplifier
- Local and remote focus adjustments
- Optional increased bandwidth
- Low cost
- Remote on/off
- UL recognized models
- Customer-specified options available

Series DAC combines anode, focus, G2 and G1 outputs with an internal dynamic focus amplifier in a low cost, compact design. Ideal for film recording or other highly sensitive applications, the tightly regulated DAC exhibits low ripple and noise, enabling generation of extremely stable, crisp images.

ELECTRICAL SPECS:
- **Anode**: Fixed output specified from 10kV to 20kV ±3% @ up to 10 watts maximum total for anode, G2 & G1 outputs
- **Focus**: Specified from 2kV to 5kV adjustable ±15% @ up to 500uA
- **DF Amplifier**: 0 to 10V input, 0 to 500V output, DC to 100kHz
- **G2**: Specified -1kV to +1kV ±10% @ up to 1mA
- **G1**: Specified -1kV to +1kV ±10% @ up to 1mA
- Input: +24V ±5% (options available)
- Regulation
  Line: .3%
  Load: .1%
  Dynamic Load: 8V/100uA

MECHANICAL SPECS:

Size: 6.5" x 5.5" x 1.45"
Weight: Approx. 1.5 lbs.

ENVIRONMENTAL SPECS:

Operating Temp: 0 to +65°C case
Storage Temp: -35°C to +70°C
Operating Altitude: 0 to 10,000 ft.
Humidity: 0 to 95% non-condensing

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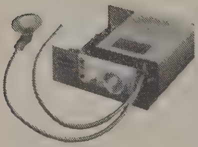
CDC Series Color Display Commercial HVPS



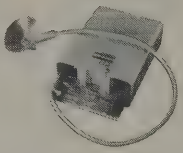
FEATURES:
- 18kV to 30kV @ 1.2mA, multiple outputs
- Extremely low cost
- UL & CSA recognized, TUV Certifiable
- Overvoltage safety circuit (DHHS compliant)
- High quality, MTBF >68,000 hrs.
- Low ripple, tightly regulated
- Other options available

ELECTRICAL SPECS:
- **Anode**: 25kV adjustable ±1kV @ 0-1.2mA
- **Focus**: 5.5kV to 8.5kV @ ±15uA (alternate ranges available)
- **G2:** 0-825V or 200-1kV @ ±5uA
- **G1:** -200V ±10% @ 1mA
- **Amp B+ output:** +400V ±10% @ 3mA
- **DF Input:** 500V max/40Hz to 250kHz
- Input: +24V ±5% (options available)
- Remote on/off - TTL compatible
- Optional Anode Monitor and Beam Current Sense

MECHANICAL SPECS:
Size: 6.0" x 5.0" x 1.75" Weight: <1.8 lbs.

ENVIRONMENTAL SPECS:
Operating Temp: 0 to +65°C case Storage Temp: -35°C to +90°C
Operating Altitude: 0 to 10,000 ft. Humidity: 0 to 95% non-condensing

LCC Series Low Cost Commercial HVPS



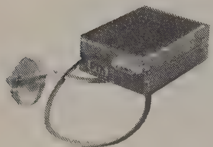
FEATURES:
- 2kV to 20kV at up to 10 watts, multiple outputs
- Extremely low cost
- Designed for high volume production
- UL recognized, CSA, TUV certifiable
- Overvoltage safety circuit (DHHS compliant)
- High quality, MTBF >100,000 hrs.
- Other options available

ELECTRICAL SPECS:
- **Anode**: Fixed output specified from 2kV to 20kV ±3% @ up to 10 watts maximum all outputs
- **Aux #1**: Specified – 1kV to 1kV ±10% @ up to 1mA
- **Aux #2**: Specified – 1kV to 1kV ±10% @ up to 1mA
- Input: +24V ±1.2Vdc (options available)
- Low ripple <5V p-p (C_L = 1500pf)
- Tightly regulated .3% line, .1% load

MECHANICAL SPECS:
Size: 5.10" x 3.12" x 1.4" Weight: <.9 lbs.

ENVIRONMENTAL SPECS:
Operating Temp: 0 to +60°C case Storage Temp: -35°C to +85°C
Operating Altitude: 0 to 10,000 ft. Humidity: 0 to 95% non-condensing

ULC Series Commercial HVPS



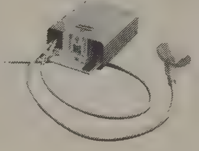
FEATURES:
- 2kV to 20kV at up to 10 watts, multiple outputs
- Low cost
- UL recognized, CSA, TUV Certifiable
- High quality, MTBF >100,000 hrs.
- Low ripple, tightly regulated
- Optional overvoltage protection and remote on/off
- Other options available

ELECTRICAL SPECS:
- **Anode**: Specified from 2kV to 20kV adjustable ±5% @ up to 10 watts maximum total all outputs
- **Aux #1**: Specified -1kV to + 1kV ±10% @ up to 1mA
- **Aux #2**: Specified -1kV to + 1kV ±10% @ up to 1mA
- Input: +24Vdc ±10% (options available)
- Low ripple • Tightly regulated

MECHANICAL SPECS:
Size: 4.13" x 3.16" x 1.37" Weight: <.9 lbs.

ENVIRONMENTAL SPECS:
Operating Temp: 0 to +65°C case Storage Temp: -35°C to +85°C
Operating Altitude: 0 to 10,000 ft. Humidity: 0 to 95% non-condensing

LFC Series Low Cost Commercial HVPS



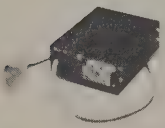
FEATURES:
- 2kV to 20kV at up to 10 watts, multiple outputs
- Extremely low cost
- Designed for high volume production
- UL recognized, CSA, TUV certifiable
- Overvoltage safety circuit (DHHS compliant)
- High quality, MTBF >100,000 hrs.
- Other options available

ELECTRICAL SPECS:
- **Anode**: Fixed output specified from 2kV to 20kV ±3% at up to 10 watts maximum total all outputs
- **Focus:** Specified up to 50% of anode ±10% at up to 50µA
- **Aux #1**: Specified -1kV to + 1kV ±10% @ up to 1mA
- **Aux #2**: Specified -1kV to + 1kV ±10% @ up to 1mA
- Input: +24V ±1.2Vdc • Low ripple • Tightly regulated

MECHANICAL SPECS:
Size: 5.10" x 3.12" x 1.4" Weight: <1 lb.

ENVIRONMENTAL SPECS:
Operating Temp: 0 to +60°C case Storage Temp: -35°C to +85°C
Operating Altitude: 0 to 10,000 ft. Humidity: 0 to 95% non-condensing

ULI Series Ruggedized HVPS



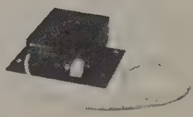
FEATURES:
- 2kV to 20kV at up to 10 watts, multiple outputs
- Low cost
- "Ruggedized" for avionics or industrial applications
- Light weight, only 1 lb.
- Low ripple, tightly regulated
- Optional overvoltage protection and remote on/off
- Other options available

ELECTRICAL SPECS:
- **Anode**: Specified from 2kV to 20kV adjustable ±5% @ up to 10 watts maximum total all outputs
- **Aux #1**: Specified -1kV to + 1kV ±10% @ up to 1mA
- **Aux #2**: Specified -1kV to + 1kV ±10% @ up to 1mA
- Input: +24Vdc ±10% (options available)
- Low ripple • Tightly regulated

MECHANICAL SPECS:
Size: 4.13" x 3.16" x 1.37" Weight: <.9 lbs.

ENVIRONMENTAL SPECS:
Operating Temp: -40°C to +85°C case Storage Temp: -40°C to +95°C
Operating Altitude: 0 to 30,000 ft. Humidity: 0 to 95% non-condensing

DFI Series Dynamic Focus Ruggedized HVPS



FEATURES:
- 2kV to 5.2kV at up to 600µA
- "Ruggedized" for avionics or industrial applications
- Internal dynamic focus amplifier
- 300V p-p modulation
- DC to 200kHz
- Local and remote trim, or fully remote; and on/off
- Other options available

ELECTRICAL SPECS:
- **Focus Voltage**: Specified 2kV to 5.2kV @ up to 600 µA
- Local Adjustment: ±15% • Remote Adjustment: ±3% or ±18% (no local)
- Input: +24Vdc ±10% (options available)
- **Dynamic Focus Amplifier:** Input 0-10V, Output 10-300V
- Low ripple • Tightly regulated

MECHANICAL SPECS:
Size: Power Supply 4.13" x 3.16" x 1.37" Weight: Approx. 1.2 lbs.
Baseplate 4.13" x 5.00" x 0.34"

ENVIRONMENTAL SPECS:
Operating Temp: -40°C to +85°C case Storage Temp: -40°C to +95°C
Operating Altitude: 0 to 30,000 ft. Humidity: 0 to 95% non-condensing

Rantec reserves the right to change specifications at any time without prior notice. It is Rantec's policy to improve products as new techniques and components become available.

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LOS OSOS, CA 93402

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SMI-18-01 Shadow Mask Ruggedized HVPS

FEATURES:

- 18kV @ 600µA, multiple outputs
- Compact size, lightweight
- Sophisticated performance to power hi-res color displays
- "Ruggedized" for use in general aviation pilot displays
- Internal dynamic focus
- Low ripple, tightly regulated
- Other options available

ELECTRICAL SPECS:

- **Anode**: 18kV adjustable ±500V @ 600µA
- **Focus**: Adjustable 25% to 31% of anode @ ±15µA
- **G2:** +400V ±10% @ up to 1mA • **G1**: -100V ±10% @ up to1mA
- **Dynamic Focus**: -600V @ 5V input (TTL) • Input: +28.5V ±4.5V
- Low ripple • Tightly regulated
- Reverse voltage protection

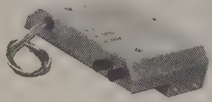
MECHANICAL SPECS:

Size: Approx. 4.96" x 3.15" x 1.23"
Weight: Approx. 1 lb.

ENVIRONMENTAL SPECS:

Operating Temp: -25°C to +70°C case
Operating Altitude: 0 to 55,000 ft.
Storage Temp: -40°C to +90°C
Humidity: 0 to 95% non-condensing

SMI-14-01 Shadow Mask Ruggedized HVPS



FEATURES:

- 14kV @ 1.2mA, multiple outputs
- Extremely compact size, lightweight
- Sophisticated performance to power hi-res color displays
- "Ruggedized" for use in general aviation pilot displays
- Four outputs, including adjustable anode, focus & G2
- Remote on/off

ELECTRICAL SPECS:

- **Anode**: +14.0kV adjustable @ .45mA average, 1.2mA peak
- **Focus:** Adjustable +3.0kV to +4.2kV @ ±15µA
- **G2**: Adjustable +180V to +510V @ ±5µA
- **G1**: Adjustable -130V @ 0-800µA
- Input +15V ±1V @ 2A • Tightly regulated • Low ripple
- Remote on/off – TTL Compatible

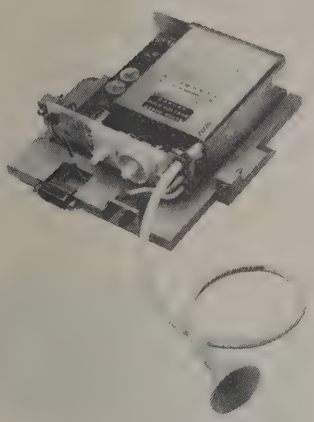
MECHANICAL SPECS:

Size: Approx. 3.62" x 4.83" x 1.26"
Weight: Approx. .75 lb.

ENVIRONMENTAL SPECS:

Operating Temp: -20°C to +75°C case
Operating Altitude: 0 to 55,000 ft.
Storage Temp: -55°C to +85°C
Humidity: 0 to 95% non-condensing

CDI Series Color Display Ruggedized HVPS



FEATURES:

- 18kV to 29kV @ 1.2mA, multiple outputs
- Alternate focus adjustment ranges
- Low ripple, tightly regulated
- Customer-specified options available
- Remote on/off
- Beam current sense, anode monitor
- Overvoltage & overcurrent protection

Series CDI ruggedized high voltage power supply is an extremely cost effective alternative to a "full-MIL" unit. Consider the advantages of a mature, proven design with tens of thousands of units in the field. The CDI has been fully qualified, including operational testing for vibration per MIL-STD-167-1, humidity per MIL-STD-202, and 12 hours of temperature cycling, with non-operational testing for shock per MIL-STD-810C, and altitude to 50,000 feet. The CDI is ideally suited for use in airborne, shipboard or ground applications.

ELECTRICAL SPECS:

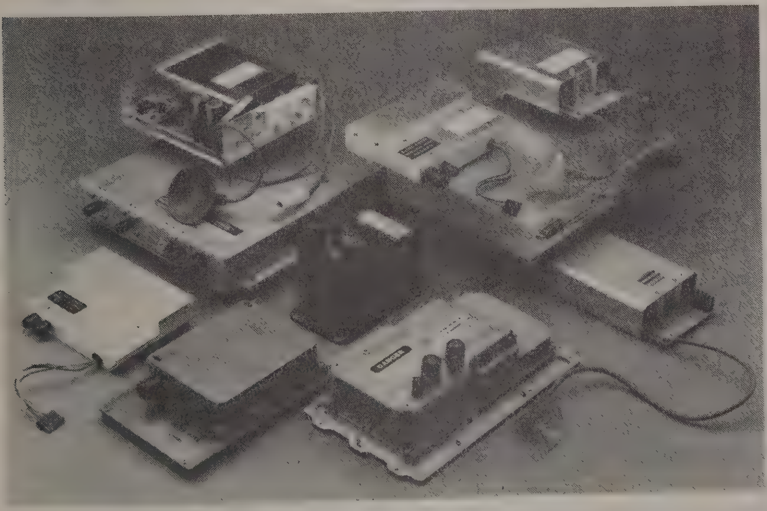
- **Anode**: Specified from 18kV to 29kV ±1kV @up to 1.2mA; Ripple: <3Vp-p
- **Focus**: 5.5kV to 8.5kV @ ±5µA (alternate ranges available)
- **G2**: 200V to 1kV @ ±5µA
- **G1**: -200V ±10% @ up to 2mA
- **Amp B+**: +400V ±10% @ up to 3mA
- **DF Input**: 500V max./40Hz to 250kHz
- Input: +24V ±5% (options available)
- Remote on/off - TTL compatible
- Beam current sense
- Anode monitor

MECHANICAL SPECS:

Size: 6.0" x 5.0" x 1.75"
Weight: Approx. 1.8 lbs.

ENVIRONMENTAL SPECS:

Operating Temp: 15°C to +85°C case
Storage Temp: -55°C to +90°C
Operating Altitude: 0 to 10,000 ft.
Humidity: 0 to 95% non-condensing



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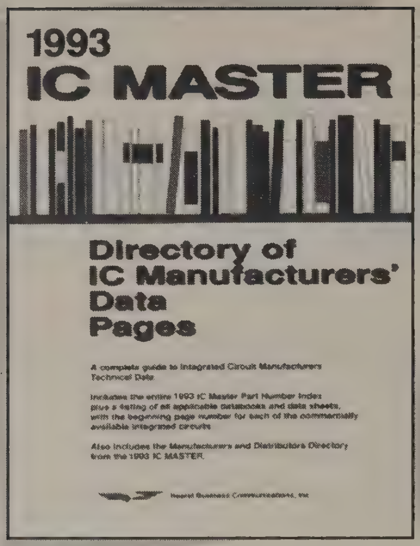

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CONTINUOUS DUTY DC POWER SUPPLIES

MAGNETICALLY REGULATED — GUARANTEED 10 YEARS

- Withstand 220% surges
- Inhrently failsafe
- Immune to EMI/RFI
- CSA and UL approved
- Continuous duty under full load
- Any failure mode drops output
- 13.8 VDC at up to 70° C. ambient
- Impervious to sustained short circuits
- No derating between -30° and 70°C.

MODEL	AMPS	REG. vs. LOAD @ LINE of 117V	REG. vs.LINE @ 105V to 130V LINE	RIPPLE & NOISE (MAX)
PS601MR	6A.	15% for 0- 6Amp	2% @ 6Amp Out	230MV RMS
PS1001MR	10A.	15% for 0-10Amp	2% @ 10Amp Out	230MV RMS
PS1001MRXF	10A.	15% for 0-10Amp	2% @ 10Amp Out	30 MV RMS
PS2513MR	25A.	10% for 0-25Amp	2% @ 25Amp Out	26 MV RMS
PS5013MR	50A.	10% for 0-50Amp	2% @ 50Amp Out	26 MV RMS

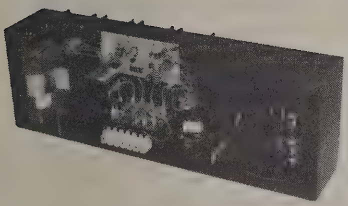
IDEAL FOR FIELD AND ROUGH USE,COMMUNICATIONS,DISPLAYS,ETC.

ELECTRONICALLY REGULATED — GUARANTEED 5 YEARS

- Foldback current limiting
- Automatic reset
- Crowbar circuit
- No turn-on or turn-off transients
- Continuous duty under full load

MODEL	AMPS[1]	OUTPUT VOLTAGE	REG. vs LOAD @ LINE of 117V	REG. vs LINE @ 105V to130VLINE	RIPPLE & NOISE (MAX)
PS400R	4A.	13.8 VDC[2]	.2% for 0-4 Amp	.1%@ 4Amp Out	2 MV RMS
PS600R	6A.	13.8 VDC[2]	.2% for 0-6 Amp	.1%@ 6Amp Out	2 MV RMS
PS1000R	10A.	13.8 VDC[2]	.2% for0-10Amp	.1%@10AmpOut	2 MV RMS
PS2000R	20A.	13.8 VDC[2]	.2% for0-20 Amp	.1%@20AmpOut	2 MV RMS
PS600RMV	6A.	10-15 VDC	.2% for 0-6 Amp	.1%@ 6Amp Out	2 MV RMS
PS2000RMV	20A.	10-15 VDC	.2%for0-20 Amp	.1%@20AmpOut	2 MV RMS

OPEN FRAME ELECTRONIC REGULATED POWER SUPPLIES



MODEL	AMPS[1]	OUTPUT VOLTAGE	REG. vs LOAD @ LINE of 117V	REG. vs LINE @ 105V to130VLINE	RIPPLE & NOISE (MAX)
PS0124OF	1A.	24 VDC	.2% for 0-1 Amp	.2%@ 1Amp Out	2.5 MV RMS
PS01524OF	1.5A.	24 VDC	.2% for 0-1.5 Amp	.2%@1.5Amp Out	2.5 MV RMS
PS0324OF	3A.	24 VDC	.2% for 0-3 Amp	.2%@ 3AmpOut	2.5 MV RMS
PS0524OF	5A.	24 VDC	.2% for 0-5 Amp	.2%@ 5AmpOut	2.5 MV RMS
PS1024OF	10A.	24 VDC	.2% for 0-10 Amp	.2%@ 10Amp Out	2.5 MV RMS
PS1524OF	15A.	24 VDC	.2% for 0-15 Amp	.2%@15AmpOut	2.5 MV RMS

UNIQUE RELCO DESIGN

- Foldback current limiting
- Automatic reset
- Crowbar circuit
- Continuous duty under full load
- Terminal strip Connections
- Quick Disconnect Taps
- Holder mounted Fuse
- 100 - 120 - 220 - 240 Volt Taps
- 50 - 60 Hz.

UNREGULATED — GUARANTEED 5 YEARS

- Continuous duty cycle
- No turn-on or turn-off transients

MODEL	AMPS[1]	OUTPUT VOLTAGE
PS200	2A	12 VDC
PS300	3A	12 VDC

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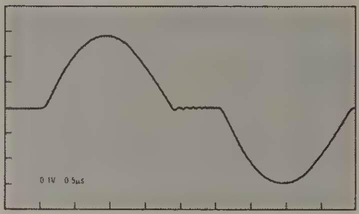
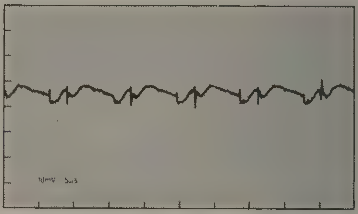
The Future is Now…True Series Resonant Technology Today

Technology and Determination: Resonant Power Technology is an industry leader in the design and manufacture of high technology switching power supplies. In 1985, the founders of RPT began their work towards developing the first commercially available, off-line, series resonant switching power supply. Series resonance provided a smaller, lighter, highly reliable and quieter (both in EMI and output noise & ripple) product that also was able to produce significant surge currents.

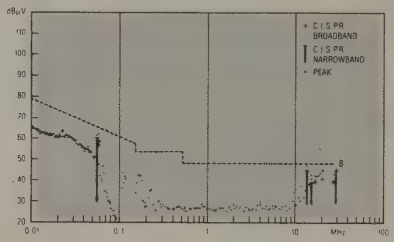


Resonant Circuit Sinusoidal Current Waveform



12 Volt Output Noise Waveform

Radio-Interference Voltages
frequency range: 0.01–30 MHz



RP-130
Series Performance Against
VDE Class B Limits

■ Series resonance offers a number of performance advantages. Switching sinusoidal currents at the zero cross-over point elminates the peak switching stress, typically in the multiple kilowatt region, experienced by pulse width modulated products. Very low switching stress combined with inherent peak current limiting and thermal limiting circuitry results in a power converter whose durability exceeds that indicated by calculated MTBF's in excess of 80,000 hours. RPT's products have been designed using premium quality components derated conservatively thereby enhancing the reliability of its series resonant topology.

■ The sinusoidal current waveform generated by the resonant circuit produces lower RFI/EMI and output noise than conventional square wave converters, due to the substantial reduction in the rate of current change i.e. di/dt. FCC and VDE Class B levels are achieved without use of external filtering on all RPT power supplies. Output ripple levels typcially achieved only by linear power supplies (20 mVolts peak to peak on all outputs) are also a by-product of the series resonant technology.

■ Higher switching frequencies allow the use of smaller passive components resulting in overall size reductions of 2 or 3:1 as compared with conventional switching power supplies. RPT's products typically offer power densities greater than 3.5 Watts/cubic inch.

■ Resonant Power's product line is based upon resonant modules of 130 and 230 Watts offered in single or multiple output versions. A unique characteristic of the resonant converter is its ability to share power equally when placed in a master/slave relationship. RPT has designed and manufactured custom power supplies offering in excess of 600 Watts and 7 outputs utilizing parallel converters. RPT encourages custom designs and offers a broad range of options including power fail detect, power good signal, remote shut down and individual output voltage margining circuits in order to satisfy its customers' individual requirements.

Resonant Power Technology, Inc.

1926 Junction Avenue
San Jose, CA 95131-2102
408-441-0800 • FAX (408) 441-7224

SPECIFICATION TABLE

RPT Model Number	Output 1 Volts DC @ Amperes	Output 2 Volts DC @ Amperes	Output 3 Volts DC @ Amperes	Output 4 Volts DC @ Amperes	Operating Free Air @ 40 C	Temperature Forced Air w/200 LFM	Output Power 190/85 Vac	vs.	Line Voltage 220/110 Vac	AC Power Fail/ DC Power Good Detect Optional	UL544 IEC601 Autoranging Available	Form Factor
RP-140	12-36VDC @ 140W				80W	140W	100W	110W	160W			5.9" x 3.1" x 1.6"
RPM-140	12-36VDC @ 140W				80W	140W	100W	110W	160W		Yes	6.4" x 3.1" x 1.6"
RP-130/3	+12 @ 0-8A	+5 @ 0-12A	-12 @ 0-1A		80W	130W	100W	110W	160W			7.4" x 3.1" x 1.6"
RP-130/4	+12 @ 0-8A	+5 @ 0-12A	12 @ 0-1A	5 @ 0-1A	80W	130W	100W	110W	160W	Power Good only		6.4" x 4.0" x 1.6"
RPM-130/4	+12 @ 0-8A	+5 @ 0-12A	12 @ 0-1A	5 @ 0-1A	80W	130W	100W	110W	160W	Power Good only	Yes	6.8" x 4.0" x 1.6"
RP-230	12-36VDC @ 230W				100W	230W	200W	220W	300W	Yes		6.8" x 4.9" x 2.1"
RP-230/2	+12 @ 0-9A	+5 @ 0-20A			100W	230W	200W	220W	300W	Yes		6.8" x 4.9" x 2.1"
RP-230/3	+12 @ 0-9A	+5 @ 0-20A	12 @ 0-1A		100W	230W	200W	220W	300W	Yes		6.8" x 4.9" x 2.1"
RP-230/4	+12 @ 0-9A	+5 @ 0-20A	12 @ 0-1A	5 @ 0-1A	100W	230W	200W	220W	300W	Yes		6.8" x 4.9" x 2.1"
RPM-200	12-36VDC @ 230W				100W	230W	200W	220W	300W	Yes	Yes	7.25" x 4.9" x 2.1"
RPM-200/2	+12 @ 0-9A	+5 @ 0-20A			100W	230W	200W	220W	300W	Yes	Yes	7.25" x 4.9" x 2.1"
RPM-200/3	+12 @ 0-9A	+5 @ 0-20A	12 @ 0-1A		100W	230W	200W	220W	300W	Yes	Yes	7.25" x 4.9" x 2.1"
RPM-200/4	+12 @ 0-9A	+5 @ 0-20A	12 @ 0-1A	5 @ 0-1A	100W	230W	200W	220W	300W	Yes	Yes	7.25" x 4.9" x 2.1"
RP440/2	+12 @ 0-20A	+5 @ 0-35A			180W	440W	400W	440W	600W			11.5" x 5.0" x 2.1"
RP-440/4	+12 @ 0-10A	+5 @ 0-20A	12 @ 0-10A	5 @ 0-20A	180W	440W	400W	440W	600W			11.5" x 5.0" x 2.1"

INPUT

Input Specifications

Input Voltage Range (Internally Selectable)	95–132 VAC or 190–264 VAC
Input Frequency	47-440 Hz
Input Protection	Internal Fuse
Inrush Current Limit: 80–130 Watts (117 VAC/230 VAC)	20A max/40A max
140–230 Watts (117 VAC/230 VAC)	20A max/40A max
Input EMI Filter:	FCC Class B std VDE Class B opt
Universal Input	Optional
Power Factor Correction	Optional
* UL544 (Leakage Current <100uA) & VDE Class B EMI	Optional
* MIL-STDs: 461C, 704D, 810D	Available on custom units

OUTPUT

Output Specifications

Line/Load Regulation (Outputs 1 & 2)	1% nominal
(Outputs 3 & 4)	3% nominal
Ripple all outputs	20 mV peak-to-peak
Hold-Up Time	30 mSec
Temperature Coefficient	0.05%/degree C
Overload Protection	Fold back with automatic recovery
Thermal Protection	Fold back with automatic recovery
Overvoltage Protection	6.2 ± 0.6 Volts crowbar on the + 5 Vdc Output 14.0 ± 1.0 Volts crowbar on the + 12 Vdc Output*
Power Good Signal	Signal given when:
	+ 5 Vdc 4.6–4.9
	– 5 Vdc – 4.3–4.7 Vdc
	+ 12 Vdc 10.8–11.8 Vdc
	– 12 Vdc – 10.4–11.2 Vdc
AC Power Fail Detect	To customer specification

Environmental Specifications

Operating Temperature Range:	0°C to 70°C
Storage Temperature	– 25°C to 75°C

General Specifications

Transient Response	500 µsec to settle to within 1% of the final value after a 25% load step
Frequency	250 kHz Resonant Frequency
Conversion Method	Series Resonant circuit switching sinusoidal current in zero current mode

Specifications subject to change without notice.

RO ASSOCIATES

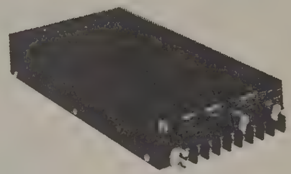
MILITARY/MIL-STD-810

INFORMATION HOTLINE

(408) 744-1450 (800) 443-1450

25 years experience ■
Low profile ■

MIL-STD-810C QUALIFIED



75-150
WATTS

COMMON SPECIFICATIONS

Input
105 to 130/198 to 265 VAC (selectable on barrier block) 47-1000 Hz also 300 VDC ±10%. Brownout protection to 90/180 VAC.

Protection
All outputs are current limited, continuous overload and short circuit proof. Single outputs have self-recovering overvoltage protection. Thermal protection is provided by a thermal relay which opens the power input if the case temperature goes above 80°C. Multiple outputs have self-recovering OVP on the 5V output only.

Operating temperature
−40°C to +80°C case (no derating).

EMI filter
Will meet VDE 0871(A) and FCC spec for conducted emissions using an external filter. Corcom filter 3 SPIA is recommended. For MIL 461A, Captor A4581 is recommended.

Mounting
Mounting on bottom by means of 6, 10-32 tapped inserts.

Storage temperature
−55°C to +85°C

Cooling
Maximum mounting base temperature for full output is 80°C. For no (air or conductive cooling), maximum ambient temperature of 30°C for full power output.

Temperature stability
Better than .02%/°C.

Size
11.12″ × 5.29″ × 1.75″. Single outputs. (28.3 cm × 13.5 cm × 4.3 cm).
10.55″ x 5.29″ × 1.75″. Multiples.

Weight
5.5 lbs.

MTBF
115,000 hours as calculated by MIL-HDBK-217C. (Model 325).

Remote sensing
All models have remote sensing.

FEATURES

- ■ Meets MIL-STD's
- ■ Low profile 1.7″
- ■ Ruggedized design
- ■ 115/230 VAC input without any strapping
- ■ Fully protected
- ■ Full power out at 80°C case temperature
- ■ Brownout protection to below 95 or 190 VAC
- ■ Parallelable (consult factory for procedure)
- ■ Up to 1.6 W per cubic inch
- ■ Soft start limits inrush to 13 amps max.

SINGLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			Load	Line ±10%	
325ST	5VDC	25	5mV	3mV	60mV p-p
325STC	6VDC	20	5mV	3mV	60mV p-p
350ST	12-15VDC	10	10mV	5mV	50mV p-p
351ST	24-28VDC	5	20mV	10mV	100mV p-p

DUAL OUTPUTS

302ST	±15VDC	±3A	10mV	5mV	50mV p-p 10mV rms
303ST	±12VDC	±3A	10mV	5mV	50mV p-p 10mV rms

MULTIPLE OUTPUTS

312ST	(A) 5VDC (B) ±12VDC	10A ±1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
313ST	(A) 5VDC (B) ±15VDC	10A ±1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
314ST	(A) 5VDC (B) 12VDC	10A 2A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
315ST	(A) 5VDC (B) 12VDC	8A 3A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
316ST	(A) 5VDC (B) 12VDC	12A 1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p

MILITARY SPECIFICATIONS

Mil Spec		Method/Procedure	
MIL-STD-810C	Low Pressure	Method 500.1	Proc. I
MIL-STD-810C	High Temp.	Method 501.1	Proc. I, II
MIL-STD-810C	Low Temp.	Method 502.1	Proc. I
MIL-STD-810C	Temp. Shock	Method 503.1	Proc. I
MIL-STD-810C	Temp. Alt.	Method 504.1	Proc. I Class 2 (−20°C operating)
MIL-STD-810C	Humidity	Method 507.1	Proc. I, II
MIL-STD-810C	Fungus	Method 508.1	Proc. I
MIL-STD-810C	Salt Fog		
MIL-STD-810C	Sand & Dust	Method 510.1	Proc. I
MIL-STD-810C	Explosive Atmosphere	Method 511.1	Proc. I
MIL-STD-810C	Vibration	Method 514.2	Proc. VIII Curve W, XI
MIL-STD-810C	Shock	Method 516.2	Proc. I, IV Ground Equip. Fig. 516.2-2
MIL-STD-810C	Temp.-Humidity-Alt.	Method 518.1	Proc. I
MIL-STD-901C	High Shock	Grade A, Class 1	Type A
MIL-STD-461	RFI Conducted		With external filter
MIL-STD-1399	Voltage Transient	Type I	Single Phase
MIL-T-288CC	Random Vibration	Nav. Mat. Pub. P-9492 May, 1979 4.5.3.1.C	

See Our Pages in Section 4025

AC-DC HIGH REL

RO

RO ASSOCIATES

- 25 years experience
- High efficiency

INFORMATION HOTLINE

(800) 443-1450 (408) 744-1450

200 WATT HIGH EFFICIENCY

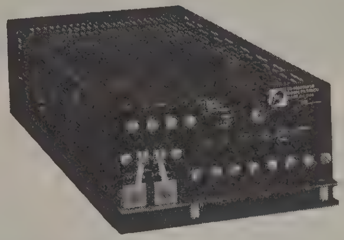
SINGLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
540EU	5V	40A	10mV	±10mV	60mV p-p
550 EU	12V	17A	10mV	±10mV	60mV p-p
555EU	15V	14A	10mV	±10mV	60mV p-p
551EU	24-28V	8A	20mV	±20mV	100mV p-p

MULTIPLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
510EU**	5V	20A	10mV	±10mV	60mV p-p
	+(12-15)VDC	4A@12V-3A@15V	0.5%	±10mV	60mV p-p
	−(12-15)VDC	4A@*12V-3A@15V	0.5%	±10mV	60mV p-p
	−5VDC	0.5A*	400mV	±25mV	60mV p-p
524EU	5V	20A	10mV	+10mV	60mV p-p
	+(12-15)VDC	3A@12V-2.5A@15V	0.5%	±10mV	60mV p-p
	−(12-15)VDC	2A@12V-1.5A@15V	0.5%	±10mV	60mV p-p
	24V	2A3A surge	0.5%	±20mV	100mV p-p
525EU	5V	25A	10mV	±10mV	60mV p-p
	+(12-15)VDC	3A@12V-2.5A@15V	0.5%	±10mV	60mV p-p
	−(12-15)VDC	2A@12V-1.5A@15V	0.5%	±10mV	60mV p-p

*Note: Total current of negative outputs cannot exceed 4 amps for −12V operation (3 amps for −15v)
**Note: The Model 510EU can be ordered with 125VDC input (Model 5510) or with 150VDC input (Model 510).



Input
105 to 130/198 to 265 VAC (selectable on barrier strip) 47 to 1000Hz or 290 to 350VDC input.

FEATURES

- 4 outputs in one package
- Optional power fail signal/logic inhibit available
- AC input transient protection
- High efficiency independently regulated outputs
- Mag amp control for reliability
- No minimum load required

500-840 WATTS LOW PROFILE 3.34″ HIGH

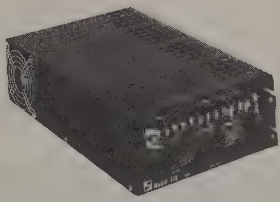
SINGLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
710	5V	100A	10mV	5mV	100mV p-p
712	5V	120A	10mV	5mV	100mV p-p
715	5V	150A	10mV	5mV	100mV p-p
750	12-15V	40A	15mV	10mV	100mV p-p
751	24-28V	20A	20mV	10mV	150mV p-p
754	24-28V	30A	30mV	10mV	150mV p-p
748	48V	16A	200mV	±50mV	240mV p-p

MULTIPLE OUTPUTS*

Model	Volts	Amps	Regulation***		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
713	5V	50A	10mV	±5mV	100mV p-p
	+(12-15)VDC	10A	0.5%	±0.2%	2%
	−(12-15)VDC	10A	0.5%	±0.2%	2%
722	5V	50A	10mV	±0.2%	100mV p-p
	+(12-15)VDC	12A(14A surge)	0.5%	±0.2%	2%
	−(12-15)VDC	8A	0.5%	±0.2%	2%
724	5V	50A	10mV	±5mV	100mV p-p
	+24	4A	10%	±2%	2%
	+(12-15)VDC	6A	0.5%	±0.2%	2%
	−(12-15)VDC	6A	0.5%	±0.2%	2%
725	5V	50A	10mV	±5mV	100mV p-p
	+(12-15)VDC	6A	0.5%	±0.2%	2%
	−(12-15)VDC	6A	0.5%	±0.2%	2%
	−(2-5)VDC	10A	50mV	±10mV	100mV p-p

***MINIMUM 5A load on +5V is required for auxiliary outputs to regulate.



Input
105 to 130/198 to 265 VAC (selectable on barrier block) 47-63Hz also 300 VDC ±10%. Brownout protection to 90/180 VAC. 400Hz option.

FEATURES

- High efficiency secondaries
- Low profile (3.34″ high)
- No parallel transistors
- Soft start
- 1.6 watts per cubic inch
- Brownout protection to below 95 or 190 VAC
- Parallelable (consult factory for procedure)

See Our Pages in Section 4025

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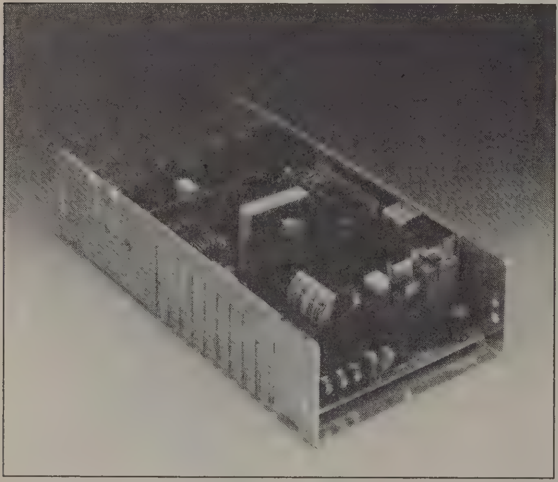
MULTIPLE OUTPUT

FYG Series



FEATURES

- MTBF 500,000+ Hours
- UL, CSA, IEC Safety Approvals
- Wide Range Input
- Over Voltage/Overload Protection

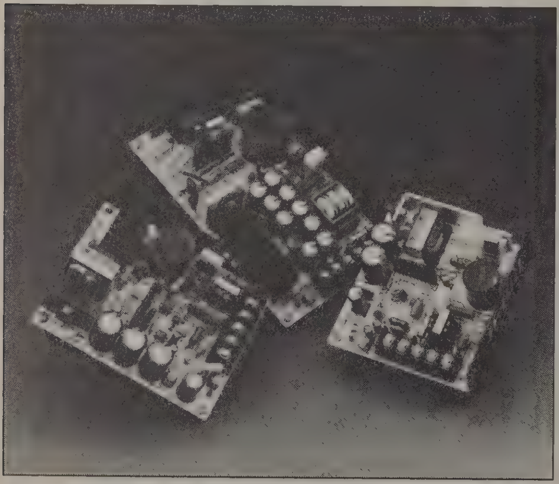
DESCRIPTION

- Compatible with Power One* MAP* 80 and 130 Series
- Quad Output
- Convection Cooled, Open Frame
- High Current 12V and 24V Output
- 80 Watt and 130 Watt Models

*Power One and MAP are trademarks of Power One, Inc.

MULTIPLE OUTPUT

Switching Power Supplies



FEATURES

- MTBF Up to 300,000+ Hours
- UL, CSA, IEC Safety Approvals
- Over Voltage/Overload Protection
- On-Board EMI Filters Meet FCC and VDE Level B

DESCRIPTION

- Convection Cooled, Open Frame
- 2, 3, 4 or 5 Outputs
- Dual Input Voltage
- 19 Models, 15 to 160 Watts
- Full International Specs
- Popular Package Sizes

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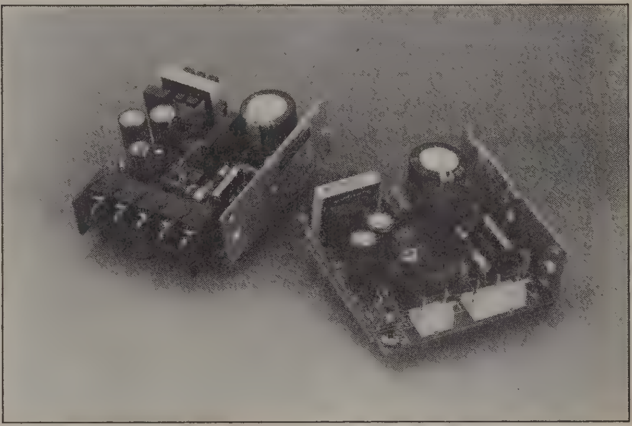
PERFORMANCE, RELIABILITY AND VALUE FOR YOUR POWER SUPPLY NEEDS

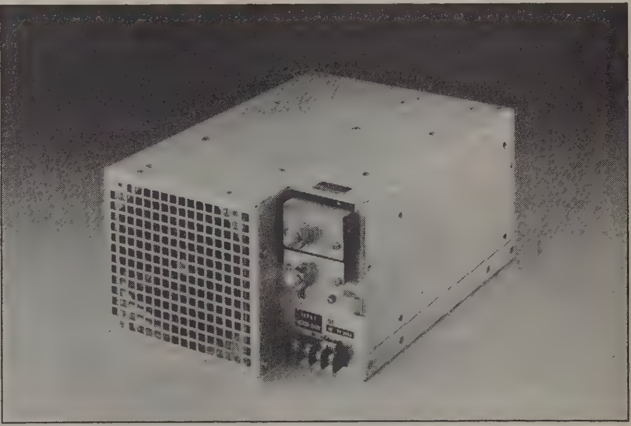
SINGLE OUTPUT

Switching Power Supplies



FEATURES

- MTBF from 85,000 Hours to as High as 457,000 Hours
- Conservative Thermal Design
- Low Component Count
- UL, CSA, IEC Safety Approvals
- Convection or Fan Cooled
- Dual or Wide Range VAC Input
- On-Board EMI Filters



DESCRIPTION

- Fully Enclosed and Open Frame
- Over 100 Models
- From 10 to 2,250 Watts Output
- Full International Specs
- Low Cost Design

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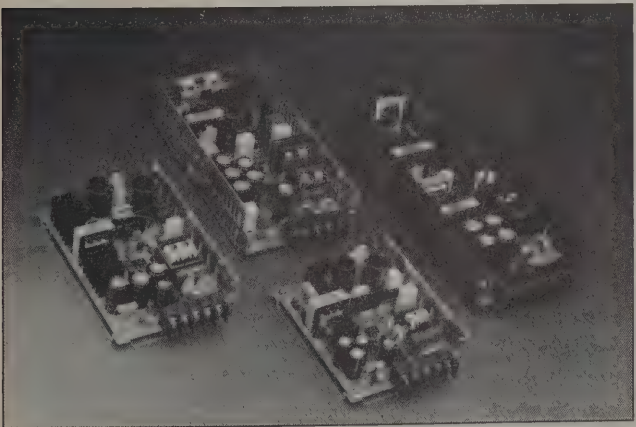

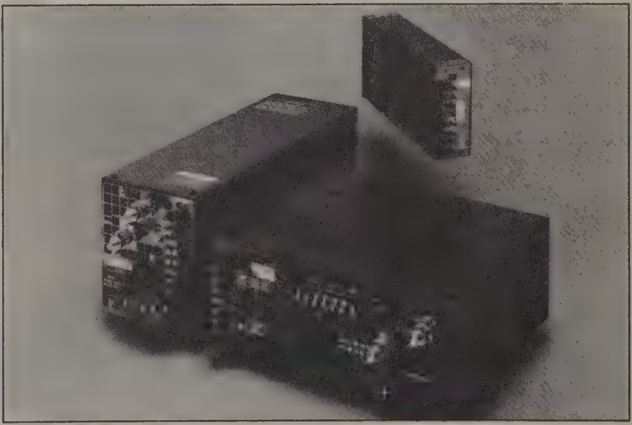

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MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

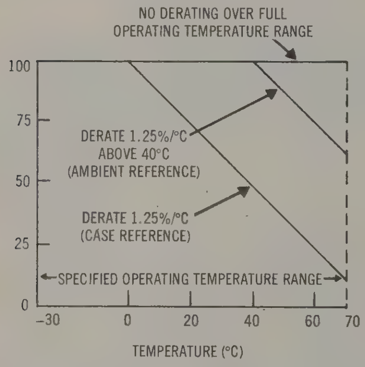

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

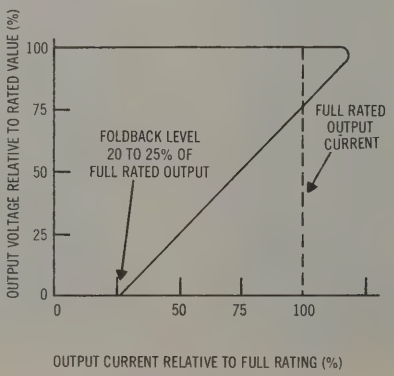

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

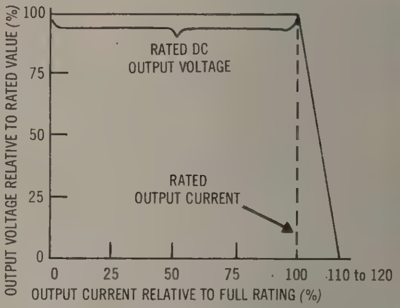

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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Your design deserves Shogyo quality and reliability.
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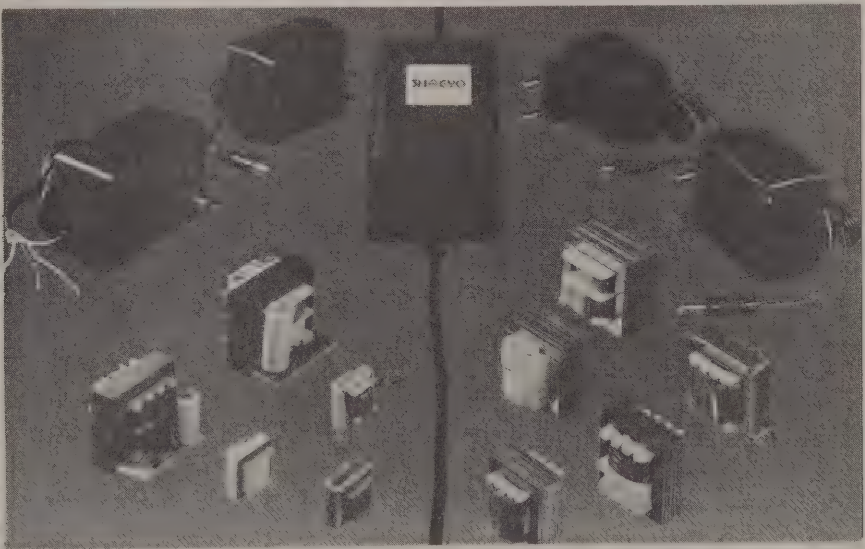
Including a diverse offering of UL/CSA approved:

- Power transformers:
  standard core sizes from EI-28 to EI-86, Nylon 66, PBT or Phinolic bobbin materials, channel frame or PCB mounting, enclosures with or without endbells, and UL recognized AWM, terminal, or pin connections
- Double protection power transformers:
  conform with UL 1411 seven hours construction and abnormal test requirements, 3500V dielectric test voltage
- Line matching transformers:
  70.7 and 25 volt, maximum power levels from 2 to 16 watts, standard core sizes from EI-41 to EI-66, and a secondary impedance of 8 ohms
- Telephone coupling transformers:
  high quality low insertion loss, core sizes from EI-19 to EI-35, frequency response of 300–3500Hz ± 3dBa, and a secondary impedance of 500, 600, or 900 ohms
- Lamp ballast transformers:
  UL 935 listed simple reactance coil type
- Wall-mount, plug-in adapters:
  European or American, 120V, 50/60Hz inputs, outputs from 3VDC to 24VDC, 100mA to 1.7Amp, and 0.3 to 14.4 watts

And featuring:

- PC pin, solder leg mount or lead wire connections
- A complete line of mating cords and terminating plug connectors



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HV POWER SUPPLY SELECTOR

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Power	100-1500V	1-15kV	15-30kV	30-60kV	60-120kV	>120kV	Model	PAGE
LABORATORY SUPPLIES								
10W		S	S				CZE1000R	D•1934
10W-480W		S	S	S	S	S	RHR	D•1929
10W-1.2kW		S	S	S	S	S	SL	D•1925
4kW-12kW		S	S	S			SA4	D•1924
6kW-18kW		S	S	S	S		SR6	D•1923
6kW-24kW		S					CC6	D•1928
3kW-4kW				S			DF3	D•1927
3kW-4kW				S			FF3	D•1927
18kW				S			XR18	D•1928
15kW-60kW						S	CT200	
MODULES								
3-5W	S						MR	D•1932
1.5-5W		S					MM	D•1932
10W		S	S				MP	D•1931
10W		S	S				CZE1000	D•1934
1-30W		S	S				WRM	D•1935
30W		S	S				EPM	D•1933
60W		S	S	S			SMS	D•1931
200W-350W		S	S	S			PTV	D•1930
1W-100kW		S	S	S	S	S	CUSTOM	D•1935

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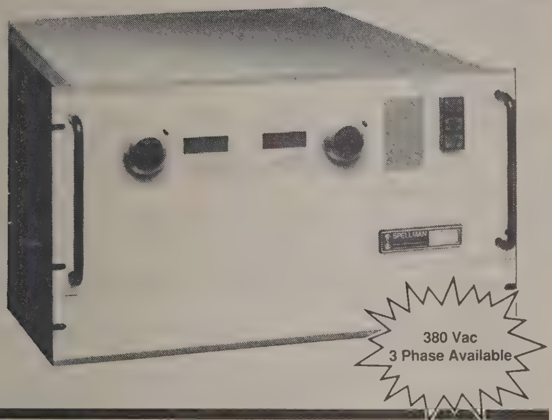
SR6 SERIES

SR6 Series 6kW HV Power Supplies



Features:

- Compact design and light weight
- Low cost per Watt
- Low stored energy
- Low EMI and RFI
- Overvoltage, Overcurrent, Arc, and Short Circuit Protection
- Constant Voltage/Constant Current Operation with Automatic Crossover
- Arc Detect, Arc Quench and Arc Count
- Extensive Local and Remote Operation
- 85% efficiency
- System Status Indicators

The SR6 series incorporates series resonant converter technology with a unique patented control circuit to provide unmatched performance. Special circuitry enables this supply to operate without damage or interruption in rugged environments that frequently pose threats to conventional high voltage power supplies. In addition, the SR6 series protects your load from excessive peak currents by instantaneously limiting the output current when an arcover condition is sensed.

Remote Interface:

- Remote Voltage Control (0 to 10V)
- Remote Current Control (0 to 10V)
- Voltage Test Point (0 to 10V)
- Current Test Point (0 to 10V)
- Remote Power On/Off
- External Interlock
- Inhibit Control of High Voltage Output
- External HV On/Off Control and Indicators

The SR6 series provides extensive remote control capabilities with many standard features not usually found in other supplies. This combination provides the SR6 with flexibility for integration into your applications. Optional circuitry is available to meet your requirements. See Options section.

Specifications:

- Input: 208Vac ±10%, 50 or 60Hz, three phase.
  380Vac, three phase, available.
- Output controls: Voltage and current are continuously adjustable over entire range via 10-turn potentiometers with a lockable counting dials.
- Voltage regulation:
  Load: 0.005% of full voltage for full load change.
  Line: ±0.005% of full voltage over specified input range.
- Current Regulation:
  Load: 0.05% of full current ±100uA for any voltage change.
  Line: ±0.05% of full current over specified input range.
- Ripple: 0.1% P-P.
- Temperature Coefficient: 100ppm/°C. Higher Stability (50ppm/°C) available on special order.
- Stability: 0.01%/hr. after ½ hour warm up, 0.02% per 8 hrs. (typical).
- Metering: Digital voltage and current meters, 1% accuracy.
- Output cable: 10 ft. shielded high voltage cable, removable at rear panel.
- Physical: 10½" H x 19" W x 19" D rack mount for units 1 to 70kV. 10½" H x 19" W x 24" D for units 80 to 120kV.

Options:

AOL	Adjustable Overload Trip
FG	Floating Ground
LR	Low Ripple (0.05% P-P)
CPC	Constant Power Control
APT	Adjustable Power Trip
220	220V AC Single Phase Input w/higher ripple
RMI	Remote Mode Indicators
ROA	Remote Overvoltage Adjust
SL	Mounting Slides
	Filament Power Supply
	12kW & 18 kW Parallel Operation

If you don't see the features or options that your application requires, please contact us with your needs so we may discuss customizing one of our products to match your application.

Maximum Rating		Model Number
kV	mA	
1	6000	SR1*6
2	3000	SR2*6
3	2000	SR3*6
6	1000	SR6*6
10	600	SR10*6
15	400	SR15*6
20	300	SR20*6
30	200	SR30*6
40	150	SR40*6
50	120	SR50*6
60	100	SR60*6
70	86	SR70*6
80	75	SR80*6
100	60	SR100*6
120	50	SR120*6

* Specify "P" for positive, "N" for negative, or "PN" for reversible polarity.
Higher voltage models available on special order.

Parallel Operation:

Parallel Operation options to increase the power and current output capability of the SA4 and SR6 Series HV Power Supplies are available. Each system is comprised of two, three (or more) separate rack mount chassis consisting of the Master and the Slave(s). Signal Cables are connected from the Master to the Slave supplies via 15 pin mini D connectors located on the rear panels and the appropriate HV Interconnect and Ground cables are connected to provide the paralleled outputs.

The modular construction of the Spellman SA4 and SR6 Series permits "mix and match" stacking which make cost efficient output power combinations possible. For example, an SR6 with an SA4 combination provides a 10kW output system.Two SR6's with one SA4 will provide a 16kW output capability in 26.25" of rack space.

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SA4 SERIES

SA4 Series 4kW HV Power Supplies

SPELLMAN
SA4

Features:

- Compact design and light weight
- Low cost per Watt
- Low stored energy
- Low EMI and RFI
- Overvoltage, Overcurrent, Arc, and Short Circuit Protection
- Constant Voltage/Constant Current Operation with Automatic Crossover
- Arc Detect, Arc Quench and Arc Count
- Extensive Local and Remote Operation
- 85% efficiency
- System Status Indicators

The SA4 series incorporates series resonant converter technology with a unique patented control circuit to provide unmatched performance. Special circuitry enables this supply to operate without damage or interruption in rugged environments that frequently pose threats to conventional high voltage power supplies. In addition, the SA4 series protects your load from excessive peak currents by instantaneously limiting the output current when an arcover condition is sensed.

Remote Interface:

- Remote Voltage Control (0 to 10V)
- Remote Current Control (0 to 10V)
- Voltage Test Point (0 to 10V), 0.5% accuracy
- Current Test Point (0 to 10V), 0.5% accuracy
- Remote Power On/Off
- External Interlock
- Inhibit Control of High Voltage Output
- External HV On/Off Control and Indicators

The SA4 series provides extensive remote control capabilities with many standard features not usually found in other supplies. This combination provides the SA4 with flexibility for integration into your applications. Optional circuitry is available to meet your requirements. See Options section.

Specifications:

- Input: 208VAC ±10%, 50 or 60Hz, three phase
- Output controls: Voltage and current are continuously adjustable over entire range via 10-turn potentiometers with lockable counting dials.
- Voltage regulation:
  Load: 0.005% of full voltage for full load change.
  Line: ±0.005% of full voltage over specified input range.
- Current Regulation:
  Load: 0.05% of full current ±100uA for any voltage change.
  Line: ±0.05% of full current over specified input range.
- Ripple: 0.1% rms. Lower ripple available.
- Temperature Coefficient: 100ppm/°C. Higher Stability (50ppm/°C) available on special order.
- Stability: 0.01%/hr. after $\frac{1}{2}$ hour warm up, 0.02% per 8 hrs. (typical).
- Metering: Digital voltage and current meters, 1% accuracy.
- Output cable: 10 ft. shielded high voltage cable, removable at rear panel.
- Physical: 5$\frac{1}{4}$" H x 19" W x 22" D rack mount.

Options:

AOL	Adjustable Overload Trip
FG	Floating Ground
LR	Low Ripple (0.05% rms)
CPC	Constant Power Control
APT	Adjustable Power Trip
220	220V AC Single Phase Input w/higher ripple
RMI	Remote Mode Indicators
ROA	Remote Overvoltage Adjust
SL	Mounting Slides
	Filament Power Supply
	Parallel Operation
	Arc Status, Arc Quench, Arc Count

If you don't see the features or options that your application requires, please contact us with your needs so we may discuss customizing one of our products to match your application.

Maximum Rating kV	mA	Model Number
1	4000	SA1*4
2	2000	SA2*4
3	1330	SA3*4
6	667	SA6*4
10	400	SA10*4
15	267	SA15*4
20	200	SA20*4
30	133	SA30*4
40	100	SA40*4
50	80	SA50*4
60	67	SA60*4
70	59	SA70*4

* Specify "P" for positive, "N" for negative, or "PN" for reversible polarity.
Higher voltage models available on special order.

Parallel Operation:

Parallel Operation options to increase the power and current output capability of the SA4 and SR6 Series HV Power Supplies are available. Each system is comprised of two, three (or more) separate rack mount chassis consisting of the Master and the Slave(s). Signal Cables are connected from the Master to the Slave supplies via 15 pin mini D connectors located on the rear panels and the appropriate HV Interconnect and Ground cables are connected to provide the paralleled outputs.

The modular construction of the Spellman SA4 and SR6 Series permits "mix and match" stacking which make cost efficient output power combinations possible. For example, an SR6 with an SA4 combination provides a 10kW output system.Two SR6's with one SA4 will provide a 16kW output capability in 26.25" of rack space.

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SL SERIES

Compact 10W-1200W HV Power Supplies

Spellman's SL series high voltage power supplies are designed to meet uncompromising performance standards in a minimum of space. These are full featured supplies available in a wide range of outputs with many available options. This makes the SL series ideally suited for satisfying the requirements of applications such as:

- Analytical X-Ray
- CRT Testing
- Electrostatics
- E-Beam Systems
- Capacitor Charging
- Hipot Testing
- General Laboratory
- CW Lasers

Due to the high degree of flexibility built into the design, the SL series can be easily customized for OEM requirements.

Features:

- Very Compact and Light Weight
- Low Stored Energy
- Low EMI and RFI
- Voltage Range from 1 to 130kV
- High Stability
- Constant Voltage / Constant Current Operation with Auto Crossover
- Reversible Polarity Standard up to 6kV
- Overvoltage, Overcurrent, Arc and Short Circuit Protection
- System Status Indicators
- Extensive Analog and Digital Interface
- Designed to Comply with UL/CSA/IEC Standards

A resonant high frequency inverter with proprietary control provides fault free operation in extreme transient and arcing environments together with greater than 85% efficiency.

Specifications:

- Input: 115Vac/220Vac ±10%, 50/60Hz internally selectable.
- Output: Models available from 1kV to 130kV. Each model is available in positive, negative or reversible polarity output.
- Local Controls: Voltage and current are continuously adjustable by ten turn potentiometers with lockable counting dials, on/off circuit breaker/switch, high voltage on switch/indicator and high voltage off switch/indicator.
- Voltage Regulation:
  Load: 0.005% of maximum voltage for full load change.
  Line: ±0.005% of maximum voltage for a ±10% input line change.
- Current Regulation:
  Load: 0.01% of maximum current ±100uA for full voltage change.
  Line: ±0.005% of maximum current for a ±10% input line change.
- Ripple: 0.1% p-p of maximum output, voltage or current regulated.
- Temperature Coefficient: 100ppm/°C voltage or current regulated. Higher stability is available on special order.
- Ambient Temperature: Operating: 0°C to 50°C
  Storage: -40°C to 85°C .
- Stability: 100ppm/hour after a one half hour warm up for both voltage and current regulation.
- Metering: Digital voltage and current meters, 3 1/2 digit ± 1 least significant digit.
- Output Cable: 10 feet of shielded high voltage cable removable at the rear panel.
- Size: 10W and 300W: 1 3/4" H X 19" W X 19" D** rack mount.
  600W & 1200W: 3 1/2" H X 19" W X 19" D** rack mount.
  **Depth becomes 24" for 80-130kV ranges
- Weight: 30-50 lbs depending on model.

Remote Interface:

- Remote Voltage Control: 0-10V = 0-100% ± 0.5% of output.
- Remote Current Control: 0-10V = 0-100% ± 0.5% of output.
- Voltage Test Point: 0-10V = 0-100% ± 0.5% of output.
- Current Test Point: 0-10V = 0-100% ± 0.5% of output.
- Remote H.V. On/Off Control: Contact closure.
- Remote H.V. On/Off Status: +24Vdc at 100mA maximum.
- External Interlock: Contact closure.
- High Voltage Enable: Open collector compatible.

Standard Features:

- 10 second slow start
- Voltage and Current Regulation
- Arc Quench
- Arc Count/Arc Trip

Options:

AOL	Adjustable Overload Trip
FG	Floating Ground (15V Standard)
FGLL	Low Leakage Floating Ground 10nA
LR	Low Ripple, .05% p-p
NSS	No Slow Start
SS(X)	Non-Standard Slow Start
APT	Adjustable Power Trip
CPC	Power Regulation
SL	Mounting Slides
FPS	Filament Power Supply
APM	Analog Panel Meters
RMI	Remote Voltage/Current and/or Power Status
	Remote Power Control (std w/CPC & API)
	Remote Power Test Point (std w/CPC & API)
	Focus Power Supply

Front Panel Status Indicators:

- Voltage Control Mode
- Current Control Mode
- Interlock Open
- Interlock Closed
- High Voltage Inhibit
- Overcurrent
- Overvoltage
- Arc
- Regulation Error
- Overtemperature

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SL Series 10W-1200W HV Power Supplies

* Picture might not depict some models

kV	10Watt mA	10Watt Model	30Watt mA	30Watt Model	60Watt mA	60Watt Model
1	10	SL1PN10	30	SL1PN30	60	SL1PN60
2	5	SL2PN10	15	SL2PN30	30	SL2PN60
3	3.3	SL3PN10	10	SL3PN30	20	SL3PN60
6	1.7	SL6PN10	5	SL6PN30	10	SL6PN60
10	1.0	SL10*10	3	SL10*30	6	SL10*60
15	0.67	SL15*10	2	SL15*30	4	SL15*60
20	0.50	SL20*10	1.5	SL20*30	3	SL20*60
30	0.33	SL30*10	1.0	SL30*30	2	SL30*60
40	0.25	SL40*10	0.75	SL40*30	1.5	SL40*60
50	0.20	SL50*10	0.60	SL50*30	1.2	SL50*60
60	0.17	SL60*10	0.50	SL60*30	1.0	SL60*60
80	0.13	SL80*10	0.38	SL80*30	0.75	SL80*60
100	0.10	SL100*10	0.30	SL100*30	0.60	SL100*60
120	0.10	SL120*10	0.25	SL120*30	0.50	SL120*60
130	0.10	SL130*10	0.25	SL130*30	0.46	SL130*60

kV	150Watt mA	150Watt Model	300Watt mA	300Watt Model	600Watt mA	600Watt Model	1200Watt mA	1200Watt Model
1	150	SL1PN150	300	SL1PN300	600	SL1PN600	1200	SL1PN1200
2	75	SL2PN150	150	SL2PN300	300	SL2PN600	600	SL2PN1200
3	50	SL3PN150	100	SL3PN300	200	SL3PN600	400	SL3PN1200
6	25	SL6PN150	50	SL6PN300	100	SL6PN600	200	SL6PN1200
10	15	SL10*150	30	SL10*300	60	SL10*600	120	SL10*1200
15	10	SL15*150	20	SL15*300	40	SL15*600	80	SL15*1200
20	7.5	SL20*150	15	SL20*300	30	SL20*600	60	SL20*1200
30	5.0	SL30*150	10	SL30*300	20	SL30*600	40	SL30*1200
40	3.75	SL40*150	7.5	SL40*300	15	SL40*600	30	SL40*1200
50	3.00	SL50*150	6.0	SL50*300	12	SL50*600	24	SL50*1200
60	2.50	SL60*150	5.0	SL60*300	10	SL60*600	20	SL60*1200
80	1.90	SL80*150	3.75	SL80*300	7.5	SL80*600	15	SL80*1200
100	1.50	SL100*150	3.00	SL100*300	6.0	SL100*600	12	SL100*1200
120	1.25	SL120*150	2.50	SL120*300	5.0	SL120*600	10	SL120*1200
130	1.15	SL130*150	2.30	SL130*300	4.6	SL130*600	9.2	SL130*1200

* Specify "P" for positive, "N" for negative, or "PN" for reversible polarity.
Higher voltage models available on special order.

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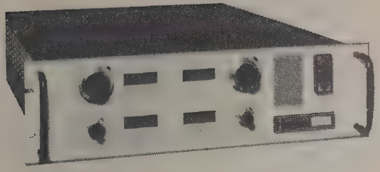
DF3 & FF3 SERIES

DF3 Series 3kW XRD X-Ray Generator



Spellman High Voltage Electronics has again redefined "state of the art" in XRD power supplies. The DF3 offers a unique combination of low cost, high performance and compact size. These features are achieved through Spellman's leadership in high frequency resonant inverter technology.

The DF3 uses a sine wave current source produced by a series resonant circuit to generate dc high voltage at switching frequencies greater than 20kHz. The high efficiency of this unit allows for air cooling in a 5¼" high chassis.

Features:

- Ideal for use with most common XRD X-Ray tubes.
- Compact Size, 5¼" high chassis.
- Greater than 85% efficiency.
- High Stability through precision feedback control circuits.
- Solid encapsulants insure maintenance free operation.
- System fault diagnostics and display including filament errors, overvoltage, over current and tube water flow interlock.
- Automatic ramp of the high voltage and emission current to preset values.
- Continuous adjustment for both high voltage and emission current.
- Fail Safe Interlock.
- Fail Safe X-Ray ON Lamp Circuit.
- Water Flow Control.
- Extensive remote interface capabilities.

Specifications:

- Input Voltage: 187-242 Vac, 50 or 60 Hz, single phase (three phase optional)
- Output Voltage: 0-70kV negative polarity.
- Output Current: 0-80 mA.
- Maximum Output Power: 3kW (4kW optional)
- Output Voltage Regulation:
  Load: 0.005% of rated output for a full load change.
  Line: 0.005% of rated output over specified input range.
- Temperature Coefficient: 50 ppm/°C (20 ppm/°C optional).
- Long Term Stability: 0.01%/8 hours.
- Emission Current Regulation:
  Load: 0.01% of rated output for a 10-60kV change
  Line: 0.005% of rated output over specified input range.
  Temperature Coefficient: 50 ppm/°C.
  Long Term Stability: 0.01%/8 hours.
- Ripple: 0.03% rms below 1kHz
  0.75% rms above 1kHz.
- Filament Voltage: 14 Vac (dc filament optional).
- Filament Current: 5A (up to 12A max available).
- Size: 5¼"(13.26cm) H x 19" (48.26 cm) W x 22" (55.88cm) D.

Metering and Control:

- Front Panel Meters: Digital tube voltage, tube current meters, tube power and filament current meters are provided.
- Front Panel Controls: Potentiometers are provided for tube voltage, tube current, tube power limit and filament current limit. Front panel switches include Control Power On, X-Ray Off and X-Ray On (fail safe).
- Status Indicators: The following status indicators are located on the front panel:

HV Inverter Error
Fil Inverter Error
Interlock Closed
Interlock Open
Overvoltage
Overcurrent
Overpower
HV Regulation Error
Current Regulation Error
kV Minimum Error
Arc Indicator
Filament Current Limit
Open Filament

Additional Features:

- Water Flow Switch: A 24Vdc signal is available on the rear panel to turn on the cooling water to the X-Ray tube. This signal can be enabled either when control power is on or when the high voltage is turned on. (Customer must specify).
- Fail Safe Interlock: A 220Vac or 12-24Vdc signal is available on the rear panel to energize an external X-Ray on lamp. This signal is energized when the high voltage is turned on. High voltage will not enable if this circuit is open.
- Preheat and Ramp: Automatic preheat and ramp control circuits are provided which ramp the kV and mA slowly to set levels. kV ramps in approximately 2 seconds while mA ramps in approximately 10 seconds.
- Output Connector: 75kV, 3 conductor Federal Standard X-Ray connector. -60kV is connected to terminal "C". Terminals "S" and "L" are jumped together. The filament output is connected between terminals "C" and "S". Other configurations are optional.
- Remote Signal Connector: Remote interface is available via a 50 pin mini D connector. Extensive remote programming and monitoring is provided.

FF3 Series 3kW XRF X-Ray Generator

After establishing a leadership position in XRD power supplies, Spellman High Voltage Electronics has brought its expertise to the XRF field. This unit was designed to be used with most end window X-Ray fluorescence tubes. Designed in conjunction with the DF3, the FF3 meets all the specifications of the DF3 with the following exceptions:

Specifications Different from DF3

- Output Voltage: 0-70kV positive polarity.
- Output Current: 0-100 mA.
- Maximum Output Power: 3kW (4kW, 80mA optional).
- Filament Voltage: 14 Vac (dc filament optional).
- Filament Current: 12A ac.
- Optional dual filament power supply available.

Additional Features:

- Output Connector: 75kV, 3 conductor Federal Standard X-Ray connector for the high voltage output. A two position terminal block is provided for the filament output.

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XR18 & CC6 SERIES

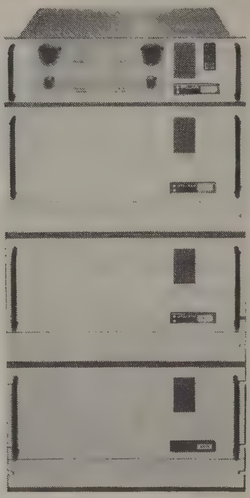
XR18 Series 18kW HV Generator for X-Ray

Features:

- Compact design
- Low stored energy
- 0.1% P-P ripple
- Low EMI and RFI
- Overvoltage, arc, and short circuit protection
- Extensive Local/Remote Operation
- 85% efficiency
- Extensive tube protection features
- Fail Safe X-ray On indicator

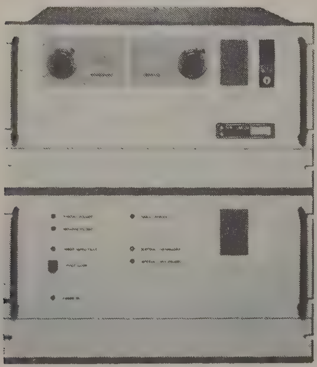
Specifications:

- Input: 208 Vac ±10%, 50 or 60Hz, three phase
- Output: 10-60kV continuously adjustable, negative polarity.
- Output Voltage regulation:
  Load regulation: 0.005% of full voltage for 0 to 100% load change.
  Line regulation: ±0.005% of full voltage over specified input range.
- Output Voltage Ripple: 0.1% P-P (≤360Hz)
- Output Voltage Stability: 0.01%/hr. after 1/2 hour warm up. , 0.02% per 8 hrs. (typical).



- Voltage and Current Temperature Coefficient: 100 ppm / °C Higher Stability (50 ppm / °C) available on special order.
- Emission Current: 0-300mA, continuously adjustable.
- Emission Current Stability: 0.01% per 8 hours after 1/2 hour warm-up.
- Emission Current Regulation: 0.01% ±50 µA for a 50% voltage change.
- Filament Compliance Voltage: 0-20Vac
- Filament Current: 0-18A ac.
- Bias Output Voltage: 0-1kV dc.
- Bias Current: 1mA max.
- Bias Ripple: 0.1% rms.
- Metering: Digital meters for kV, mA, filament current, and bias voltage.
- Controls: AC ON/OFF, Output Voltage, Emission Current, X-Ray ON, X-Ray OFF, Bias Voltage, Filament Limit.
- Output Connector: Federal Standard 75kV X-Ray connector.
- Interface Connector: 50 pin female mini-D.
- Dimensions:
  Three chassis,
  each 10½"H x 19"W x 19"D.
  One chassis, 5¼"H x 19"W x 19"D.
- Weight: 265 lbs total.
- Ambient Temperature:
  Operating: -20°C to 40°C
- Storage: -40°C to 85°C

CC6 Series 6kW Cable Charging System



The Spellman CC6 series is designed for powering long lengths of communications cable and repeaters. A combination high frequency series resonant inverter topology, protective clamps, bleed and crowbar circuits provide fault free operation. The CC6 is ideally suited for testing:

- Power feed cable
- Submarine cable
- Fiber optic cable
- Ship board or land based installations

Because of the flexibility built into the design, the CC6 can easily be customized for OEM requirements.

Features:

- Low stored energy
- Low EMI and RFI
- Redundant externally adjustable overvoltage and overcurrent protection
- True constant current operation
- True cable current sensing
- Reversible polarity via rear panel link
- Output range from 1-6kV
- Power range from 1-6kW
- System status indicators
- Analog/digital interface compatible with RS232
- Safety crowbar automatically engages on power down or during a cable fault
- Internal flyback and reverse transient protection
- 85% efficiency
- Designed to provide stable operation while driving complex cable impedances
- Internal dummy load for calibration and fault system verification
- Designed to meet UL and CSA standards
- Cable charged, dummy load and crowbar indicators

Specifications:

- Input: 220Vac ±10%, 50/60Hz, 1 phase
- Output: Four models available from 1kV to 6kV
- Local Controls: Voltage and current continuously adjustable over entire range via 10 turn potentiometers.
- Voltage Regulation:
  Load: 0.005% of voltage for full load change
  Line: 0.005% of voltage over specified input range
- Current Regulation:
  Load: 0.05% of rated current ±100 µA for any voltage change
  Line: 0.05% of rated current over specified input range
- Output crowbar will automatically engage for any power supply fault.
- Dummy Load: 300 Watts for calibration.
- Temperature Coefficient: 0.01%/°C over the temperature range from -20°C to 40°C. Higher stability available.
- Stability: 0.01%/hour after 1/2 hour warm up. 0.02%/8 hours typical.
- Metering: Digital voltage and current meters. 1% accuracy.
- Output Connector: 90A terminal block

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RHSR, RHR & UHR SERIES

RHSR Series Medium Power HV Power Supplies

Features:

- Exceptionally Good Regulation
- Very Low Ripple
- Remote Programming and Test Points
- Overload and Short Circuit Protected
- Low RFI
- Low Stored Energy

Specifications:

- Input: 105-125Vac, 50-60Hz
- Output: Voltage continuously adjustable over entire range from zero to maximum rated voltage by means of a 10-turn potentiometer
- Load Regulation: 0.001% for FL Change.
- Line Regulation: ±0.001% for a ±10% input change.
- Ripple: 0.001% RMS
- Stability: 0.005%/hr; 0.01%/8hrs
- Metering: Analog voltage and current meters, 2% accuracy.
- Size: All units are 19" W x 16" D. See Chart for height.

Max. Rating			Model Number	Height (In Inches)
kV	mA	W		
5	10	50	RHSR5PN50	5 1/4"
10	6	60	RHSR10PN60	5 1/4"
15	4	60	RHSR15PN60	5 1/4"
20	3	60	RHSR20PN60	5 1/4"
25	2.4	60	RHSR25PN60	5 1/4"
30	2	60	RHSR30PN60	5 1/4"
40	1.5	60	RHSR40*60	8 3/4"
50	1	50	RHSR50*50	8 3/4"
60	1	60	RHSR60*60	8 3/4"

* Specify "P" for positive, "N" for negative or "PN" for reversible polarity

RHR Series Medium Power HV Power Supplies

Features:

- Good Regulation
- Low Ripple
- Overload and Short Circuit Protected
- Low RFI
- Low Stored Energy
- Three Year Warranty

Options are available to adapt the unit to each specific requirement. Options include remote voltage programming, remote voltage and current monitoring, current regulation and external interlock. Contact factory for further details.

Specifications:

- Input: 105-125Vac, 50-60Hz
- Output: Voltage continuously adjustable over entire range from zero to maximum rated voltage by means of a 10-turn potentiometer.
- Load Regulation: 0.01% for FL change.
- Line Regulation: ±0.01% for a ±10% input change.
- Ripple: 0.02% RMS + 2V RMS, Models over 100kV are 0.1% RMS
- Stability: 0.02%+ 2V/hr; 0.05%+ 5V/8hrs
- Metering: Analog voltage and current meters, 2% accuracy.

All units up to 100kV are designed for 19" rack mounting. Units over 100kV consist of a driver chassis, high voltage stack and a rack mountable remote control panel with 15' of cable. See chart for dimensions.

If you don't see the model that your application require we invite you to contact us with your special requirements so we may discuss customizing our products to meet your needs.

SPELLMAN
HIGH VOLTAGE DC SUPPLY

Max. Rating			Model Number	Height (In Inches)
kV	mA	W		
5	2	10	RHR5*10	5 1/4"
5	6	30	RHR5*30	5 1/4"
5	10	50	RHR5*50	5 1/4"
5	20	100	RHR5*100	5 1/4"
5	30	150	RHR5*150	5 1/4"
10	1	10	RHR10*10	5 1/4"
10	3	30	RHR10*30	5 1/4"
10	6	60	RHR10*60	5 1/4"
10	10	100	RHR10*100	5 1/4"
20	0.5	10	RHR20*10	5 1/4"
20	1.5	30	RHR20*30	5 1/4"
20	3.0	60	RHR20*60	5 1/4"
20	6.0	120	RHR20*120	5 1/4"
30	0.33	10	RHR30*10	5 1/4"
30	1	30	RHR30*30	5 1/4"
30	2	60	RHR30*60	5 1/4"
30	4	120	RHR30*120	5 1/4"
30	5	150	RHR30*150	5 1/4"
40	0.75	30	RHR40*30	5 1/4"
40	1.5	60	RHR40*60	5 1/4"
40	3.0	120	RHR40*120	5 1/4"

* Specify "P" for positive, "N" for negative or "PN" for reversible polarity

Max. Rating			Model Number	Height (In Inches)
kV	mA	W		
50	0.25	25	RHR50*25	5 1/4"
50	1.0	50	RHR50*50	5 1/4"
50	3.0	150	RHR50*150	8 3/4"
60	0.5	30	RHR60*30	5 1/4"
60	1.0	60	RHR60*60	5 1/4"
60	2.0	120	RHR60*120	5 1/4"
80	1	80	RHR80*80	8 3/4"
80	3	240	RHR80*240	10 1/2"
80	6	480	RHR80*480	15 3/4"
100	1.0	100	RHR100*100	8 3/4"
100	1.5	150	RHR100*150	8 3/4"
100	2	200	RHR100*200	10 1/2"
100	5	500	RHR100*500	15 3/4"
150	1	150	RHR150*150	34" STACK
150	2	300	RHR150*300	40" STACK
200	0.5	100	RHR200*100	34" STACK
200	1.0	200	RHR200*200	34" STACK
300	0.5	150	RHR300*150	48" STACK
300	1.0	300	RHR300*300	48" STACK
400	0.5	200	RHR400*200	48" STACK
400	1.0	400	RHR400*400	60" STACK

* Specify "P" for positive, "N" for negative or "PN" for reversible polarity

UHR Series Medium Power HV Power Supplies

Features:

- Good Regulation
- 0.1% RMS Ripple
- Overload and Short Circuit Protected
- Low RFI
- Low Stored Energy

Options are available to adapt the unit to each specific requirement. Options include remote voltage programming, remote voltage and current monitoring, current regulation and external interlock. Contact factory for further details on options and custom designed models.

Specifications:

- Input: 105-125Vac, 50-60Hz
- Output: Voltage continuously adjustable over entire range from zero to maximum rated voltage by means of a one-turn potentiometer.
- Load Regulation: 0.05% for FL Change.

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- Line Regulation: ±0.05% for a ±10% input change.
- Ripple: 0.1% RMS
- Stability: 0.05%/hr; 0.1%/8hrs
- Metering: Analog voltage and current meters, 2% accuracy.

All units up to 100kV are designed for 19" rack mounting. Units over 100kV consist of a driver chassis, high voltage stack and a rack mountable remote control panel with 15' of cable. See chart for dimensions.

Max. Rating			Model Number	Height (In Inches)
kV	mA	W		
20	1.5	30	UHR20*30	5 1/4"
20	6.0	120	UHR20*120	5 1/4"
30	1	30	UHR30*30	5 1/4"
30	2	60	UHR30*60	5 1/4"
30	4	120	UHR30*120	5 1/4"
40	0.75	30	UHR40*30	5 1/4"
40	1.5	60	UHR40*60	5 1/4"
40	3.0	120	UHR40*120	5 1/4"
50	0.5	25	UHR50*25	5 1/4"
50	3.0	150	UHR50*150	8 3/4"
60	0.5	30	UHR60*30	5 1/4"
60	1.0	60	UHR60*60	5 1/4"
60	2.0	120	UHR60*120	5 1/4"
80	1	80	UHR80*80	8 3/4"
80	3	240	UHR80*240	10 1/2"
80	6	480	UHR80*480	15 3/4"
100	1	100	UHR100*100	8 3/4"
100	2	200	UHR100*200	10 1/2"
100	5	500	UHR100*500	15 3/4"
150	1.00	150	UHR150*150	34" STACK
200	0.75	150	UHR200*150	34" STACK
300	0.50	150	UHR300*150	48" STACK
400	0.37	150	UHR400*150	48" STACK

* Specify "P" for positive, "N" for negative or "PN" for reversible polarity

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PTV SERIES

200W & 350W Modular HV Power Supplies

The Spellman PTV Series modular high voltage power supplies now deliver up to 350 Watts of continuous power. A quasi-resonant inverter design provides over 85% efficiency with very fast dynamic response and very high peak current capability. The PTVs incorporate extensive standard features in two modules with power output ranges of 200W and 350W in a wide range of output voltages operating to the most exacting specifications. An optional 600 Watt pulse capability is available for applications requiring fast response and high peak power.

Applications:

- Projection Television
- X-ray systems
- E-beam systems
- Capacitor charging systems
- CPT testing

Features:

- Output voltages from 1kV to 60kV at 200W and 350 Watts
- Voltage programming from zero to rated output
- Current programming from zero to rated output
- Output Inhibit control via TTL signal
- Test points for output voltage and current
- Designed to meet UL, CSA and IEC950 specifications
- 1 second slow start
- EMI/RFI input filter
- Overvoltage and Short Circuit protection
- Low stored energy
- Internal 10.24V reference

Signal Input Connector

Nine pin mating connector and pins provided.

Pin	Function
1	10.24V Reference
2	Current Program*
3	Voltage Test Point*
4	Voltage Program*
5	Ground, Common
6	Current Test Point*
7	HV Enable/Inhibit (TTL high to enable)
8	OVP Monitor
9	Program/Test Point Return

* Program and Test Point Scaling:
0 to 10V ±1% = 0 to rated output

Options:

- G2 Zener Regulated Output (1kV, 1mA max)
- Optional Input: 100 Vac ±10%, 50/60 Hz
- Floating Ground (50V max.)
- Bipolar Master/Slave
- Special HV Output Termination
- Special Input Termination
- Inhibit Polarity
- No Slow Start
- Alternate Test Point Scaling
- Custom Designed Modules

Specifications:

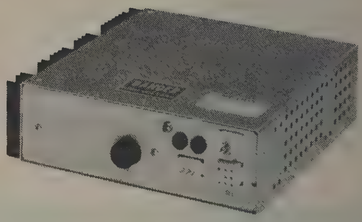
Input:
115 Vac ±10%, 50/60Hz
220 Vac ±10%, 50/60Hz
Specify at time of ordering.

Output:
Models from 1kV to 60kV.
Each model is available in positive or negative polarity outputs.

Voltage Regulation:
Load:
Static: 0.01% of output voltage no load to full load
Dynamic: 1.25% E_{OUT}/mA
Line:
0.01% for a ±10% change in input voltage

Current Regulation:
Load:
0.05% of output current from 0 to rated voltage
Line:
0.05% of rated current over specified input range

Efficiency: 80%



Ripple:
PTV200:
1 - 30kV: 0.05% p-p of output voltage
40 - 60kV: 0.1% p-p of output voltage
PTV350: 0.2% p-p of output voltage

Switching frequency (nominal): 60 kHz

Temperature:
Operating: -20°C to +40°C
Storage: -40°C to +85°C

Voltage Temperature Coefficient: 0.01%/°C

Stability (voltage & current):
0.01%/hr after 1/2 hour warm up
0.02% per 8 hours

Cooling:
200 Watt: convection cooled
350 Watt: fan cooled, rear air intake

Size:
1-40kV: 3 3/16"H x 10 3/4"W x 10"D (81mm x 273mm x 254mm)
50,60kV: 4 3/16"H x 10 7/8"W x 11 13/16"D (106.5mm x 276mm x 351mm)

HV Output Cable:
18" ±1" (457mm) UL listed high voltage cable

Power Input Connector: IEC320

AC Line Voltage Input Cable:
Length: 8 ft (2.4 m)

Output Voltage	200 Watt Model PTV200		350 Watt Model PTV350	
kV	mA	Model Number	mA	Model Number
1	200	PTV1*200	350	PTV1*350
3	70	PTV3*200	117	PTV3*350
5	40	PTV5*200	70	PTV5*350
10	20	PTV10*200	35	PTV10*350
15	14	PTV15*200	23	PTV15*350
20	10	PTV20*200	18	PTV20*350
25	8	PTV25*200	14	PTV25*350
30	7	PTV30*200	12	PTV30*350
40	5	PTV40*200	9	PTV40*350
50	4	PTV50*200	7	PTV50*350
60	3.5	PTV60*200	6	PTV60*350

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MP & SMS SERIES

MP Series 10W High Stability HV Power Supplies

Designed as high performance DC to DC converters with output voltages up to 30kV, the MP Series power supplies combine linear and switched mode techniques minimizing internal dissipation and generated RFI. This gives improved output voltage stability and increased reliability. The high frequency oscillator may be synchronized to other MP modules or to an external source.

Applications:

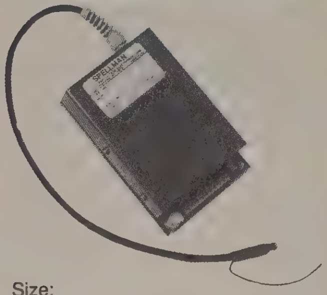
- Photomultiplier tubes
- Scintillators
- Electron guns
- Ion guns
- Nuclear instruments

Features:

- High stability - 0.001% line and load regulation
- Low output ripple - 0.001% p-p
- Remote Voltage Programming
- 10V reference output for external control
- Output current and voltage monitor
- Arc and short circuit protected
- Internal oscillator may be synchronized externally
- Other options available

Specifications:

- Input Voltage: +24Vdc ±2V. Other input voltages available as option.
- Input Current: Less than 1A at full output.
- Output Voltage: Continuously adjustable over entire output range. Positive or negative output polarity.
- Line Regulation: 0.001% for input change of 1V.
- Load Regulation: 0.001% for 100µA to full load change (at maximum voltage).
- Temperature Coefficient: Better than .0025%/°C.
- Stability: <0.007%/hr at constant operating conditions after 1 hour warm up.
- Output Control:
  1) Internal 10-turn potentiometer
  2) External Potentiometer
  3) Remote Voltage Programming, 0 to 10V, accuracy 0.1% full scale
- Output Voltage Monitor: 0 to +10V represents zero to full output ±1%.
- Output Current Monitor: 0 to +10V represents zero to full output ±2%.
- Operating Temperature: 0°C to +50°C
- Storage Temperature: -35°C to +85°C
- Input: 10 pin connector (mating connector supplied)
- Output: 20" shielded cable with flying leads



- Size:
  1-5kV: 5.8"L x 3.86"W x 1.65"H
  10-15kV: 7.44"L x 3.86"W x 1.65"H
  20-30kV: 8.75"L x 3.86"W x 1.65"H

Output Voltage	Max. Current	Ripple (full load)	Model
kV	mA	mV	
0 to 1	10	10mV p-p	MP1*
0 to 1.5	6	10mV p-p	MP1.5*
0 to 2	5	10mV p-p	MP2*
0 to 2.5	4	10mV p-p	MP2.5*
0 to 3	3	10mV p-p	MP3*
0 to 5	2	20mV p-p	MP5*
0 to 10	1	100mV p-p	MP10*
0 to 15	0.60	150mV p-p	MP15*
0 to 20	0.50	200mV p-p	MP20
0 to 30	0.33	300mV p-p	MP30

* Specify "P" for positive polarity or "N" for negative polarity

SMS Series 60W Modular HV Power Supplies

Features:

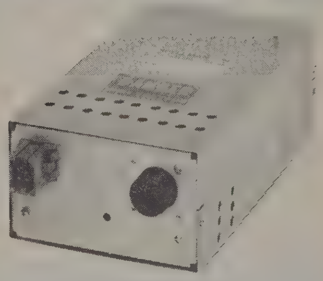
- Output voltages from 1kV to 60kV @ 60 watts
- Voltage programming from zero to rated output
- Current programming from zero to rated output
- Inhibit control of output via TTL signal
- Test points for output current and voltage
- Mode indicators for current and voltage control
- Overvoltage protection
- Overvoltage latch reset
- Designed to meet UL® requirements
- Low stored energy
- Compact package

The SMS series is based on a resonant flyback circuit that provides over 80% efficiency and high pulse current capability. This supply is ideal for applications requiring high peak current from a power supply that operates from a low voltage DC input. With the addition of optional circuitry, the SMS series has capability of delivering constant power down to 25% of the rated output voltage.

Specifications:

- Input: +28Vdc ±10%
- Output: 10 models from 1kV to 60kV. Each model is available in positive or negative polarity outputs.
- Load Regulation:
  Static: 0.01% of output voltage for NL to FL change.
  Dynamic: 10V/100µA max. NL to FL.
- Line Regulation:
  ±0.01% for ±10% input voltage change.
- Ripple:
  1-30kV: 0.05% p-p of output voltage.
  40-60kV: 0.1% p-p of output voltage.
- Physical:
  5" x 9" x 3"
- Input Connector: 9 pin AMP Metri-Mate
- Output Cable: 18" ±1" of UL® approved high voltage wire.
- Voltage Stability: 0.02% per 8 hours
- Voltage Temperature Coefficient: 0.01% per °C

The flexibility of the SMS series' design makes it ideal for customizing to fit OEM and special requirements.



Maximum Rating		Model number
kV	mA	
1	60	SMS1*60
3	20	SMS3*60
5	12	SMS5*60
10	6	SMS10*60
15	4	SMS15*60
20	3	SMS20*60
30	2	SMS30*60
40	1.5	SMS40*60
50	1.2	SMS50*60
60	1.0	SMS60*60

* Specify "P" for positive polarity or "N" for negative polarity

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MM & MR SERIES

MM Series PCB Mount HV Power Supplies

The MM Series high voltage power supplies are low cost, general purpose DC to DC converters, with output voltages up to 15kV, designed for direct PCB mounting. High reliability is designed into a compact and lightweight modular block intended for customer designed products at power levels up to 5 Watts.

The MM Series can be used with an external resistor feedback loop to provide regulated outputs. Application Notes are available from Spellman that show a range of voltage regulated circuits using the MM high voltage power supply.

Applications:

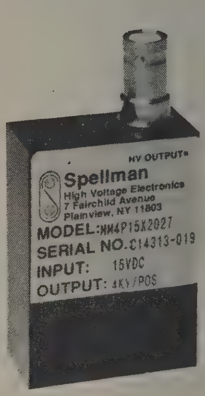
- Photomultiplier Tubes
- Solid State Detectors
- Flow Sensors
- Analytical Instruments
- Spectral Source Lamps
- Ink Jet Printers
- Gas Chromatography

Features:

- Outputs up to 15kV at 1.5W, 3W or 5W
- Low cost
- Compact size
- Arc and short circuit protected
- Positive or Negative Outputs
- Output Voltage Proportional to Input Voltage

Specifications:

- Input Voltage: 9Vdc, 12Vdc, or 24Vdc. Other input voltages available upon special order.
- Output Voltages: Any preset maximum voltage between 500V and 15kV is available. Multiple outputs can also be supplied. Output voltage is proportional to the input voltage over the range 10% to 100%.
- Output Power: 1.5W, 3W or 5W continuous; higher peak power available.
- Output Ripple: Less than 0.1% rms
- Load Regulation: 10% maximum
- Module Efficiency: 55% to 70%
- Isolated Outputs available
- Alternate Input Voltages available (6Vdc to 28Vdc)
- Modules are fully encapsulated in an ABS Box and may be wave soldered.
- Size:
  Up to 3kV: 1.57"L x 1.57"W x 0.79"H
  Over 3kV to 5kV: 1.97"L x 1.97"W x 1.18"H
  Over 5kV to 10kV: 2.95"L x 1.97"W x 1.38"H
  Over 10kV to 15kV: 3.74"L x 2.80"W x1.38"H



MR Series PCB Mount HV Power Supplies

The MR Series high voltage power supplies are low cost, miniature regulated modules with output power capabilities of 3 to 5 Watts.

Output voltages are up to 1500V, with input voltages from 11V to 18V dc. The refined flyback circuitry allows the module to be packaged in a small case size and achieve efficiencies up to 80%.

Typical ripple of less than 8% p-p can be improved by adding extra smoothing.

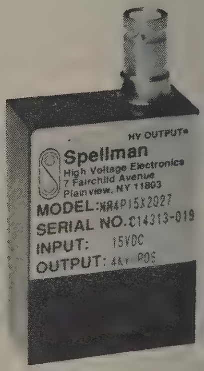
The module is able to run into a short circuit and is ideal for use in capacitor charging applications such as powering flash lamps.

Features:

- Small case size
- Low cost
- PCB Mounting
- Positive or Negative Output
- High Power Density
- Fully Regulated
- Output Current Limited
- Separate Output Control or Fixed Output
- High Efficiency
- Flexible Design can be adapted for special requirements

Specifications:

- Input Voltage: 11Vdc to 18Vdc. Other input voltages available upon special order.
- Output Voltages: Any output voltage up to 1500V. To be selected by customer requirements.
- Output Power: 5 Watts up to 800V.
  3 Watts from 800V to 1500V.
- Line Regulation: 0.1%
- Load Regulation: 0.1% for no load to full load change.
- Ripple at Full Load:
  Below 800V - 15% p-p of output voltage.
  800V to 1500V - 8% p-p of output voltage.
  Note: Improvement can be achieved by adding extra smoothing. A larger case size is required if mounted internally.
- PC Board mounting
- Modules are fully encapsulated in an ABS Box and may be wave soldered.
- Pin diameter is 1.2mm/.047"
- Size:
  Up to 800V: 2.1"L x 1.6"W x 0.51"H
  Over 800V to 1500V: 2.95"L x 1.97"W x 0.51"H



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EPM, LCM & UM SERIES

EPM Series 30W Modular HV Power Supplies

Features:

- Output voltages from 1kV to 30kV @ 30 watts
- Voltage programming from zero to rated output
- Current programming from zero to rated output
- Inhibit control of output via TTL signal
- Test points for output current and voltage
- Overvoltage protection
- Designed to meet UL® requirements
- Compact package
- Low stored energy

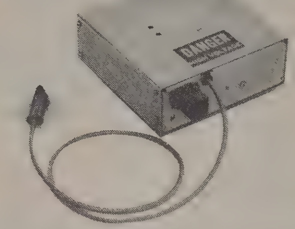
The EPM series utilizes proprietary circuitry enabling these high voltage power supplies to yield full output current from near zero to maximum output voltage. Current regulation is standard on all models and is particularly valuable in applications that require a current source into the load such as:

- Electrophoresis
- Electron Beam
- Ion Sources
- Photomultipliers
- Laboratory Applications

Specifications:

- Input: +24Vdc ±10%
- Output: 8 models from 1kV to 30kV. Each model is available in positive or negative polarity outputs.
- Load Regulation:
  Static: 0.01% of output voltage for NL to FL change.
  Dynamic: 10V / 100µA NL to FL.
- Line Regulation:
  ±0.01% for a ±10% input voltage change.
- Ripple: 0.1% p-p of output voltage.
- Physical: 5.7" x 5.7" x 2"
- Input Connector: 9 pin AMP Metri-Mate
- Output Cable: 18" ±1" of UL® approved high voltage wire.
- Voltage Stability 0.01% per 8 hours
- Voltage Temperature Coefficient: 0.01% per °C
- Voltage Test Point: 10V ± 2% = Max. rated output
- Current Test Point: 10V ± 2% = Max. rated output

Spellman engineers designed the EPM to be very flexible so that it can be easily customized to fit your OEM and special requirements. Please contact Spellman's Sales Department to discuss your application's requirements.



Maximum Rating kV	Maximum Rating mA	Model Number
1	30	EPM1*30
3	10	EPM3*30
5	6	EPM5*30
10	3	EPM10*30
15	2	EPM15*30
20	1.5	EPM20*30
25	1.2	EPM25*30
30	1	EPM30*30

* Specify "P" for positive polarity or "N" for negative polarity

LCM Series CRT HV Power Supplies

Feature:

- Eight standard model from 2kV to 30kV
- Tight dynamic and static regulation
- Proven reliability
- Focus and Grid outputs up to ±1100 volts
- Short circuit and overload protected
- UL® recognized

The LCM series provides a low cost regulated high voltage source for applications such as powering CRT's. This design employs an ultrasonic resonant sinewave oscillator that reduces stored energy and minimizes RFI. All high voltage components are vacuum encapsulated in a high quality silicone elastomer ensuring corona-free operation.

Specifications:

- Input: +24Vdc ±10% @ 800mA maximum at full load.
- Output voltage: See chart
- Load Regulation: 0.5% maximum
- Line Regulation: ±0.1% for a ±10% input change
- Ripple: see chart
- Operating Temperature: 0°C to 50°C.
- Output Cable: 15" ±1" of 40kV UL approved high voltage wire with anode cap.
- Case Dimensions: $4\frac{5}{32}$" L x $1\frac{3}{8}$" H x $3\frac{5}{32}$" W for 2-22kV models. 6" L x $2\frac{1}{8}$" H x $3\frac{3}{4}$" W for 30kV models.

Model	Maximum Rating voltage	Maximum Rating current	Ripple (V p-p)
LCM3.5	2 to 3.5kV	5mA @ 2kV 2.8mA @ 3.5kV	4
LCM5	3.5 to 5kV	2.8mA @ 3.5kV 2mA @ 5kV	4
LCM7.5	5 to 7.5kV	2mA @ 5Kv 1.3mA @ 7.5kV	4
LCM10	7.5 to 10kV	1.3mA @ 7.5kV 1mA @ 10kV	6
LCM14	10 to 14kV	1mA @ 10kV 0.7mA @ 14kV	6
LCM18	14 to 18kV	0.7mA @ 14kV 0.55mA @ 18kV	8
LCM22	18 to 22kV	0.55mA @ 18kV 0.45mA @ 22kV	8
LCM30	22 to 30kV	0.45mA @ 22kV 0.33mA @ 30kV	16

UM Series Unregulated Modular HV Power Supplies

Features:

- Low Cost
- Low Ripple
- Fully Enclosed Shielded Metal Case
- Encapsulated for Full Environmental Protection

The UM series provides compact, economical, unregulated high voltage for CRT's, PMT's, image intensifiers and scintillation counters. Maximum output voltages are from 1kV to 30kV and are proportional to input voltages.

Specifications:

- Input: +24Vdc ±10% for maximum rated output
- Line regulation: Output voltage is approximately proportional to input voltage.
- Load Regulation: Less than 20%, no load to full load at maximum rating.
- Ripple: 0.1% RMS
- Output: Adjustable from zero to maximum rated voltage by adjustment of input.
- Dimensions: Consult factory.

Max. Rating Voltage	Max. Rating Current	Model Number
1kV	1ma	UM1*1000D
1.5kV	1ma	UM1.5*1500D
3kV	500µa	UM3*1500D
6kV	250µa	UM6*1500D
9kV	150µa	UM9*1500D
12kV	100µa	UM12*1500D
15kV	75µa	UM15*1500D
18kV	60µa	UM18*1500D
24kV	50µa	UM24*1500D
30kV	50µa	UM30*1500D

* Specify "P" for Positive polarity or "N" for negative polarity

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NEW! **CZE & MG9 SERIES**

Capillary Electrophoresis HV Power Supplies

Features:

- 30kV output voltage, programmable
- 0-300µA load current, programmable
- Auto polarity reversing upon digital command in <1.5 sec at no load.
- Low stored energy
- Digital ON/OFF control

Description:

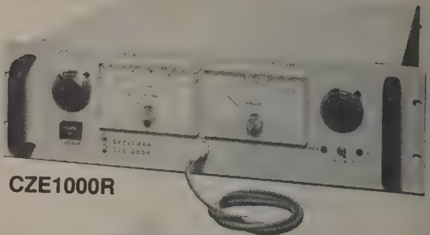
The Spellman CZE2000 and CZE1000R High Voltage power supplies are designed to meet the requirements of the Capillary Zone Electrophoresis application and other applications requiring a hot switched reversible output voltage. The DC output voltage and current are continuously adjustable from 0 to 30kV and 0 to 300µA. Output polarity is reversible on the fly.

Options:

- Rack Mount w/meters and controls (CZE1000R)
- Alternate Input Voltage
- Alternate Test Point Scaling
- Special Connectors

Specifications:

Input Voltage
    CZE1000R: 115Vac ±10%
    CZE2000: 24 Vdc ±10%
Input Current: 1 A max.
Output Voltage: 0 to 30kV programmable
Output Current: 300µA max from 1-30kV
Line regulation:
    0.01% for a 10% input voltage change
Load Regulation:
    0.01% for a no load to full load change
Ripple: 0.1% peak to peak
Voltage Test Point:
    0 to 10V ±1% full scale
Current Test Point:
    0 to 10V ±2% full scale
Remote Enable: 3.4V=ON; <1V=OFF
Output Time Constant w/ no load: 0.3 sec.
Stored energy: 0.45 joules @ 30kV
Size:
    CZE1000R: 5.25"H x 19"W x 17" D
    CZE2000: 3.5"H x 5" W x 10"L


CZE1000R

CZE2000

MG9 Series Magnetron HV Power Supplies

The Spellman MG9 Magnetron HV power supply is a high frequency, high efficiency unit designed specifically to power 6kW magnetrons such as the YJ1600. It contains the filament and optional magnet control supplies necessary to provide optimum drive. This rugged design delivers reliable power to magnetrons used for varied applications including:

- Industrial Cooking
- Powder Drying
- Rubber Vulcanization
- Sintering of Ceramics
- Processing of Radioactive Waste
- Plasma Generation

The MG9 can easily be customized for OEM requirements.

Features:

- Compact design and light weight
- Low stored energy
- Filament Supply with Local Controls
- Over voltage, over current, arc, and short circuit protection
- Constant Voltage/Constant Current Operation with automatic crossover
- Optional ±3A Transconductance Magnet Supply
- System Status Indicators
- Low Ripple
- Low Cost

Specifications:

- Input: 480Vac ±10%, 3 phase, 50/60Hz.
- Output: 0 - 8.0kV at 0 - 1.25A.
- Maximum Output Power: 9.0kW
- Slow Start: 1 second
- Voltage Regulation:
  Load: 0.1% of maximum voltage average for 0-100% output current
  Line: ±0.1% of maximum voltage average for a ±10% line voltage change.
- Current Regulation:
  Load: 0.5% of maximum current average for 0-100% output voltage
  Line: ±0.5% of maximum current average for a ±10% line voltage change.
- Ripple: 10% RMS max. in both voltage and current mode.
- Temperature Range: Operating: 0°C to 40°C; Storage: -40°C to 85°C.
- Metering: Filament RMS Voltmeter. Accuracy is ±2% (measured at primary output terminals).
- Voltage Programming: 10V = 8kV ±1%
- Current Programming: 10V = 1.25A ±1%
- Voltage Monitor: 0-10V = 0-8kV ±1%, Z out = 1K ±1%.

MG9
SPELLMAN

- Current Monitor: 0-10V = 0-1.25A ±1%, Z out = 1K ±1%.
- Filament Supply: The power supply provides a regulated filament drive to the primary of an external filament isolation transformer. (Customer Supplied).
- Size: 19"W X 10.5"H X 17"D.

Magnet Power Supply (optional):

- Typical output: ±3Adc at ±12Vdc. Configured as a transconductance power amplifier with 0-10V input voltage, and -3A to +3A output current. Option includes front panel meter.

Spellman
High Voltage Electronics Corporation
7 Fairchild Avenue Plainview, NY 11803 * (516) 349-8686 * FAX (516) 349-8699 * TWX 510-221-2155

WRM Series, HVD Series & Custom Designs

WRM Well Regulated Modular HV Power Supplies

Specifications:

- Input: +28Vdc ±10%
- Output: Controllable from zero to maximum rating via resistive divider or voltage source (floating or grounded). See chart for output voltage ratings.
- Line regulation: ±0.01% for a ±10% input voltage change
- Load regulation: 0.05% for a full load change
- Ripple:
  1500D/3000D - 0.01% RMS
  6000D - 0.02% RMS
  10KD - 0.03% RMS
  30KD - 0.1% RMS
- Protection: Overload, Arc and Short Circuit.
- Temperature:
  Operating: 0°C to +50°C
  Storage: -30°C to +85°C
- Dimensions: Consult Factory

Max Rating		Model Number
kV	mA	
1.5	1.0	WRM1.5*1500D
1.5	2.0	WRM1.5*3000D
1.5	4.0	WRM1.5*6000D
1.5	6.0	WRM1.5*10KD
1.5	10.0	WRM1.5*15KD
3	0.5	WRM3*1500D
3	1.0	WRM3*3000D
3	2.0	WRM3*6000D
3	3.0	WRM3*10KD
3	10.0	WRM3*30KD
6	0.25	WRM6*1500D
6	0.5	WRM6*3000D
6	1.0	WRM6*6000D
6	1.5	WRM6*10KD
6	5.0	WRM6*30KD

* Specify "P" for positive or "N" for negative polarity

Max Rating		Model Number
kV	mA	
9	0.15	WRM9*1500D
9	0.3	WRM9*3000D
9	0.6	WRM9*6000D
9	1.0	WRM9*10KD
9	3.3	WRM9*30KD
12	0.15	WRM12*1500D
12	0.3	WRM12*3000D
12	0.6	WRM12*6000D
12	0.8	WRM12*10KD
12	2.5	WRM12*30KD
15	0.1	WRM15*1500D
15	0.2	WRM15*3000D
15	0.4	WRM15*6000D
15	0.6	WRM15*10KD
15	2.0	WRM15*30KD

* Specify "P" for positive or "N" for negative polarity

Max Rating		Model Number
kV	mA	
18	0.08	WRM18*1500D
18	0.16	WRM18*3000D
18	0.30	WRM18*6000D
18	0.50	WRM18*10KD
18	1.60	WRM18*30KD
20	0.07	WRM20*1500D
20	0.15	WRM20*3000D
20	0.30	WRM20*6000D
20	0.50	WRM20*10KD
20	1.50	WRM20*30KD
24	0.06	WRM24*1500D
24	0.12	WRM24*3000D
24	0.24	WRM24*6000D
24	0.40	WRM24*10KD
24	1.25	WRM24*30KD
30	0.05	WRM30*1500D
30	0.10	WRM30*3000D
30	0.20	WRM30*6000D
30	0.30	WRM30*10KD
30	1.00	WRM30*30KD

* Specify "P" for positive or "N" for negative polarity

HVD Series Resistive Dividers

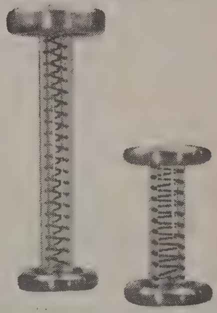
Features:

- High Input Impedance
- 25 ppm Temperature Coefficient
- High Accuracy
- Corona-Free Operation

Spellman's Resistive Voltage Dividers provide laboratory or production facilities with a convenient method of measuring up to 100kVdc or 200kVdc with accuracy better than 0.5%. The Dividers are designed for use with standard high impedance digital and differential voltmeters.

	HVD100	HVD200
Input Voltage	0-100kVdc	0-200kVdc
Input Impedance	1000 Mohms	2000 Mohms
Output Impedance	1 M; 100 kohms	10 kohms
Output Taps	100V, 10V	2V
Accuracy	0.5%: (0.1% opt)[1]	0.5%: (0.25% opt)[2]
Temp. Coefficient	0.01%/8hrs	0.025%/8hrs
Height	17½" (44.5 cm)	33½" (84.5 cm)
Max. Diameter	10" (25.4 cm)	12" (30.5 cm)
Weight	6¾ lbs (3.1 kg)	12 lbs (5.5 kg)
Output Connector	BNC type	BNC type

(1) For accuracy of 0.1% specify HVD100-1
(2) For accuracy of 0.25% specify HVD200-1



Custom Designs

Homologation:

To homologate is to communicate, to concur, to act in harmony, from the Greek *"homologos."* At Spellman, we always blend our thinking with yours. We analyze your system, your needs and your plans. We nurture the technology and the hardware at the beginning - and throughout the product life.

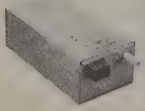
Through such homologation we now create each year more than 40 new power supply sub-systems. These sub-systems accelerate introduction, extend life and improve market share of a wide variety of OEM products. Custom power supplies have been homologized into OEM applications such as, Capillary Zone Electrophoresis, Projection Television and Analytical X-ray.

X-Ray Power Supplies

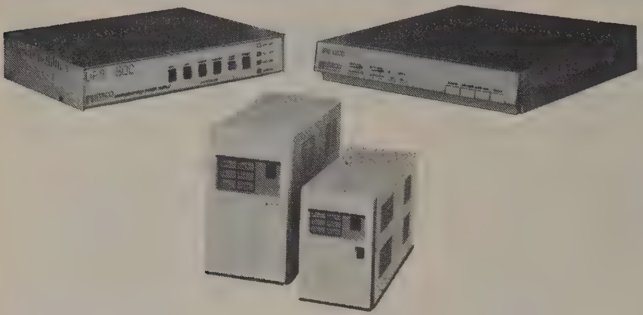
High peak power up to 100kW and continuous power up to 30kW is available using propriety circuitry to improve performance and reliability. Typical applications include CT scanners, radiological equipment, x-ray lithography and industrial x-ray systems. Spellman's HV generators include a floating filament supply, emission control and built in diagnostics.

Capacitor Chargers

Spellman's rack mounted models are available for current operation to permit capacitor charging at a linear rate. Special models can be ordered for high power when the capacitance and repetition rate is high.



STACO ENERGY PRODUCTS CO.

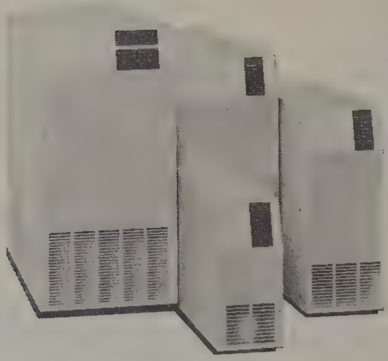


Staco Standby Power System

- Sinewave Output
- Continuos EMI/RFI Filtering
- Fastest Transfer Rate
- Intelligent Communication for Orderly Shut Down
- LED Displays

"SPS" Series are Low Profile Models for single PC protection with Squarewave Output. "S" Series are Tower Models with PWM Sinewave Outputs, 1MS Transfer Rate (S650, S1200) and Network Communication (S650, S1200).

Manufacturers Type	VA	Manufacterers Type	VA
SPS-111-600-5	500	S500	500
SPS-111-601-0	1200	S650	650
S300	300	S1200	1200



Staco True On-Line Power Supplies

- On-Line Protection from Sags, Surges, Spikes, Brownouts and Blackouts.
- Microprocessor Based
- Static Transfer Switch
- Make-Before Break Maintenance

"U" Series are True On-Line, double conversion, regenerated, regulated uninterruptible power supplies. Additional external batteries can be added for extended run times and a Remote Status Panel is available. Standard Run time batteries included in all models.

Manufacturers Type	KVA	Manufacterers Type	KVA
U1001	1	U500X*	5
U300X*	3	U1000X*	10

***X** = Input Voltages (2=208, 3=220, 4=230) Output Voltages (120/208/240)

MINUTE MAN
POWER

Staco Line Conditioners (Single Phase)

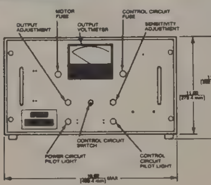
- Word Processor
- Electronic Cash Registers
- POS Terminals
- EDP Systems
- CAD Systems
- Medical Equipment
- Mini Computers
- Computer Graphs
- Telecommunications
- Security Systems

"LCR" Series are small inexpensive voltage regulators which protect everything short of blackout.

"SPP" Series are multi-shielded isolation, tap switching transformer conditioners with zero-current switching technology for optimum performance. These units provide ±4% output voltage regulation, quiet operation EMI filtering, remote emergency power off, bypass switch, circuit breakers, choice of output receptacles and noise attenuation. (140 db common, 60 db normal).

Manufacturers Type	KVA	Input Service	Manufacturers Type	KVA	Input Service
LCR650	.65		SPP208X	8	50A
LCR1200	1.2		SPP210X	10	60A
SPP205X	5	50/30A	SPP215X	15	90A

X = Output Voltage Rating (2=120/240, 3=120/208)



Automatic Voltage Regulators

Precise voltage regulations with no distortion. Single and three phase units from 2.3KVA to 1500KVA with output voltage accurately regulated to ±.75%. For line frequencies 47 through 63Hz. Solid State sensing, voltmeter, pilot light, output level set point. Transient suppressor and isolation transformer are options for power condition and noise suppression.

Manufacturers Type	Input Range	KVA	Weight
AVR12020	95-135	2.3	54
AVR12057	95-135	6.6	87
AVR12114	105-125	13.0	90
AVR12144	95-135	16.6	258
AVR24093	195-255	21.4	253
AVR48148Y	420-500	118	841
AVR48230Y	445-495	180	1250

Rack Mount is available, Individual Three Phase Line Control is available.

STACO ENERGY PRODUCTS CO. • 301 Gaddis Blvd., • Dayton, Ohio 45403 •(513) 253-1191 • FAX (513) 253-1723

STANCOR®

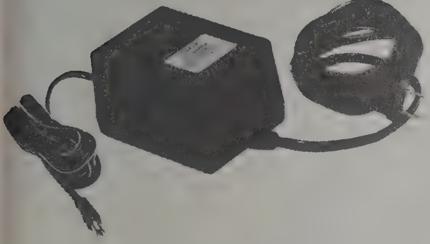
Wall Plug-In Power Sources

WALL PLUG-IN POWER SOURCES—EUROPEAN AND DOMESTIC

DOMESTIC MODELS

Listed

Certified



AC-DC UNREGULATED MODELS 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-3530A	3.0 DC	400	1
STA-3530	3.0 DC	500	1
STA-3540	4.4 DC	400	1
STA-3560B	6.0 DC	100	1
STA-3560	6.0 DC	200	1
STA-3560A	6.0 DC	300	1
STA-4160	6.0 DC	600	2
STA-4160A	6.0 DC	800	2
STA-4860	6.0 DC	1000	3
STA-4860A	6.0 DC	1200	3
STA-5760	6.0 DC	2000	4
STA-3575	7.5 DC	100	1
STA-3575A	7.5 DC	300	1
STA-4875	7.5 DC	1000	3
STA-5775	7.5 DC	1500	4
STA-3590B	9.0 DC	100	1
STA-3590	9.0 DC	200	1
STA-3590A	9.0 DC	300	1
STA-4190A	9.0 DC	500	2
STA-4190F	9.0 DC	700	2
STA-4890	9.0 DC	1000	3
STA-4890A	9.0 DC	1200	3
STA-3512	12.0 DC	50	1
STA-3512C	12.0 DC	100	1
STA-3512B	12.0 DC	200	1
STA-4112B	12.0 DC	300	2
STA-4112	12.0 DC	400	2
STA-4112C	12.0 DC	500	2
STA-4812D	12.0 DC	600	3
STA-4812A	12.0 DC	1000	3
STA-5712	12.0 DC	1200	4
STA-4812	12.5 DC	800	3
STA-5713	13.5 DC	1300	4
STA-5713A	13.5 DC	1700	4
STA-4814	14.5 DC	800	3
STA-4815	15.0 DC	600	3
STA-5715	15.0 DC	1000	4
STA-3518	18.5 DC	80	1

AC-DC REGULATED MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-4130 •	3.0 DC	350	2
STA-4850	5.0 DC	600	9
STA-4190C •	9.0 DC	200	2
STA-4890B	9.0 DC	400	9
STA-4110A	10.0 DC	300	2
STA-300R	12.0 DC	200	2

AC-AC MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-3545B	4.5 AC	300	1
STA-4190B	9.0 AC	300	2
STA-4190D	9.0 AC	500	2
STA-4110	10.0 AC	700	2
STA-3512E •	12.0 AC	100	1
STA-3512F •	12.0 AC	200	1
STA-4112A	12.0 AC	500	2
STA-4812B •	12.0 AC	850	3
STA-4116	16.0 AC	250	2
STA-4118 •	18.0 AC	300	2
STA-4820 •	20.0 AC	700	3
STA-4124	24.0 AC	300	2

- UL listed only/not CSA certified.

•• No agency approvals.

See next page for Model Sizes and Output Terminations.

DESK TOP MODELS

AC-DC UNREGULATED DESK TOP MODELS INPUT 120V, 60 Hz.

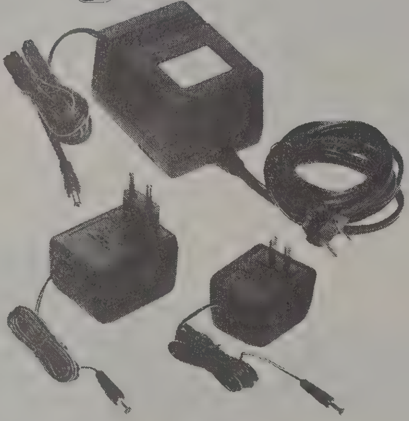
STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-6690	9.0 DC	3000	7
STA-6612	12.0 DC	2000	7
STA-6612A	12.0 DC	2500	7
STA-6612B	12.0 DC	3000	7
STA-5713AC	13.5 DC	1700	4
STA-6013A	13.5 DC	2100	5
STA-6613	13.5 DC	2400	7
STA-6615	15.0 DC	2000	7
STA-6618	18.0 DC	2000	7
STA-6624	24.0 DC	1500	7

AC-AC DESK TOP MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-5760A •	6.0 AC	3300	4
STA-5790	9.0 AC	3400	4

EUROPEAN MODELS

Certified



AC-DC UNREGULATED MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-3924F	4.5 DC	350	6
STAF-1847F	4.8 DC	500	2
STAF-1848F	5.2 DC	1000	3
STAF-0381F	6.0 DC	500	2
STAF-0797F	6.0 DC	1000	3
STAF-2100F	6.2 DC	300	6
STAF-0834F	6.2 DC	350	2
STAF-2243F	7.5 DC	300	2
STAF-2223F	9.0 DC	200	6
STAF-3309F	9.0 DC	300	2
STAF-1058F	9.0 DC	500	2
STAF-0329F	9.0 DC	1000	3
STAF-3382F	12.0 DC	300	2
STAF-2343F	12.0 DC	500	3
STAF-1454F	12.0 DC	1000	4
STAF-1948F	12.0 DC	1200	4
STAF-0460F	12.6 DC	800	3
STAF-1059F	13.5 DC	1300	4
STAF-0354F	14.5 DC	800	3

AC-AC MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-1433F	2.9 AC	320	6
STAF-2099F	3.0 AC	120	6
STAF-0418F	4.5 AC	120	6
STAF-0437F	9.0 AC	130	6
STAF-2098F	24.0 AC	400	3

DESK TOP MODELS

AC-DC UNREGULATED DESKTOP MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-2134F	13.5 DC	1700	5
STAF-3775F	13.5 DC	2100	8
STAF-3777F	13.5 DC	2400	8
STAF-3613F	14.0 DC	1400	5
STAF-1972F	15.0 DC	1000	4

DOMESTIC AND EUROPEAN DIMENSIONS AND SPECIFICATIONS

MODEL SIZE CHART

	L		W		H	
	mm	inches	mm	inches	mm	inches
1	55.0	2.2	42.8	1.7	37.2	1.5
2	63.0	2.5	51.0	2.0	41.0	1.6
3	70.5	2.8	56.0	2.2	47.0	1.9
4	84.5	3.3	64.5	2.5	55.0	2.2
5	95.2	3.7	72.0	2.8	57.0	2.2
6	55.0	2.2	42.8	1.7	35.6	1.4
7	120.0	4.7	80.0	3.1	66.5	2.6
8	120.0	4.7	82.0	3.2	66.5	2.6
9	89.0	3.5	61.0	2.4	48.0	1.9

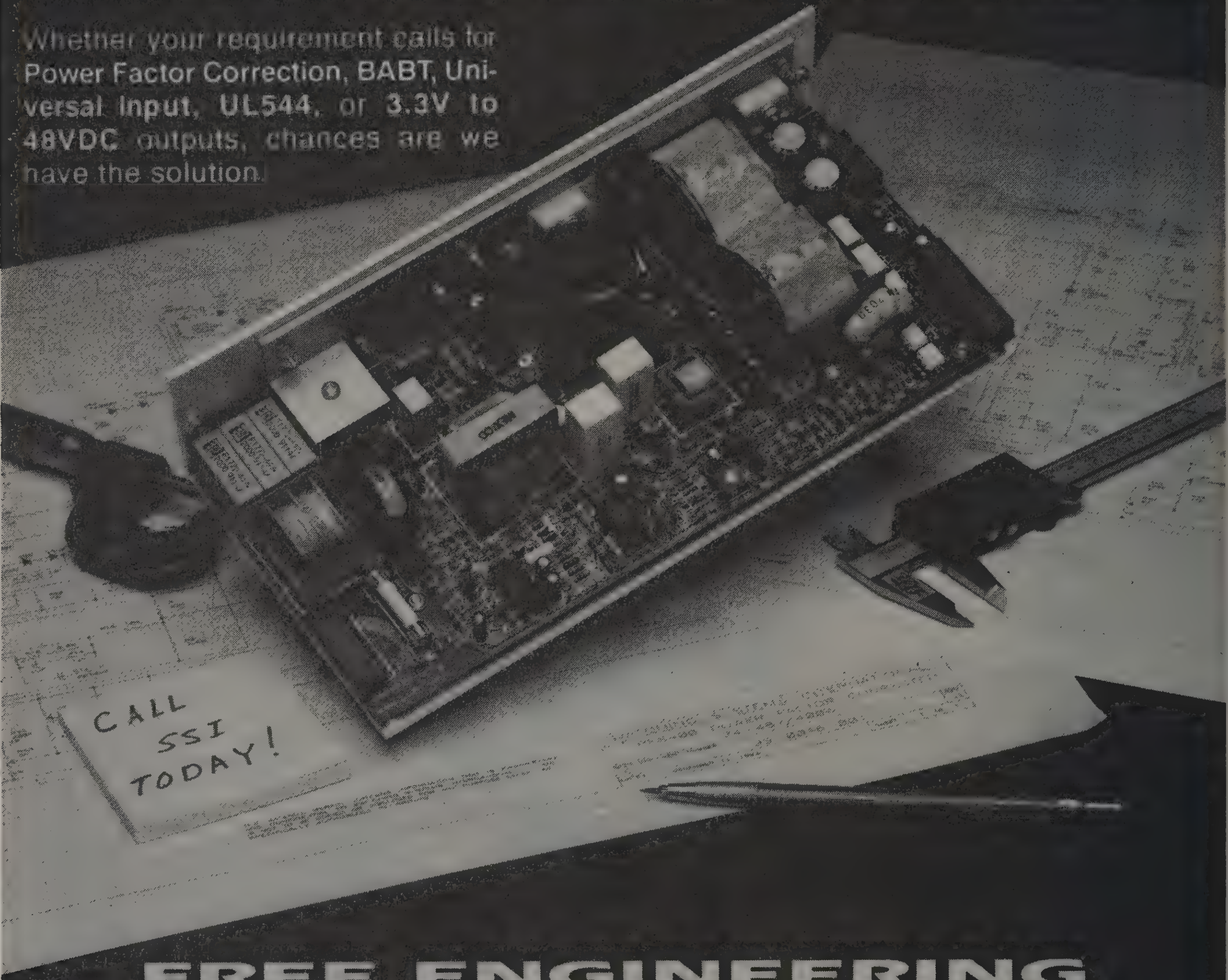
OUTPUT TERMINATIONS

Stancor wall plug-in power sources have output termination compatible with Switchcraft PC-722A or 722A with 6 ft. output cord. Secondary plug size 2.1 x 5.5 mm. Wired Outside-Positive; Inside-Negative for AC-DC models.

CUSTOM POWER REQUIREMENTS

REDEFINED WITH STANDARD SOLUTIONS

Whether your requirement calls for Power Factor Correction, BABT, Universal Input, UL544, or 3.3V to 48VDC outputs, chances are we have the solution.



FREE ENGINEERING

Our maximum versatility continues to make custom made open frame switchers obsolete. Offering over 600 standard products ranging from 100 to 400 watts of output power, we can easily custom tailor our units to your special requirement with no NRE charges.

Medical, data processing, telecommunications, and instrumentation are just a few of the diversified industries which utilize SSI's products.

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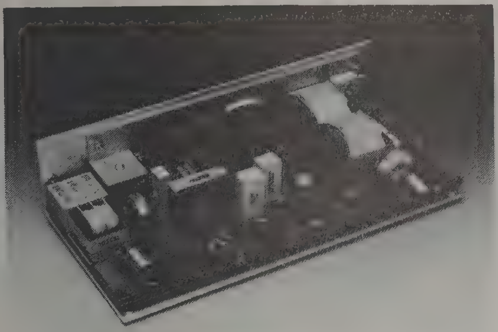
SQM International All Purpose Series



Input: 90-132VAC/180-264VAC, 47-440Hz
Inrush: 15A @ 115V for 1/2 cycle } Cold Start
30A @ 230V for 1/2 cycle } Cold Start

Output: See output voltage table

Line Regulation: 0.2%, all outputs

Load Regulation: 1%, main output
5%, aux. no. 1
1%, aux no.'s 2, 3 and 4

Adjustment Range: ±5%, aux no.'s 2, 3, 4 and main output

Centering: ±3% aux. no. 1

Cross Regulation: 3% aux. no. 1 (change main output from 50% to 100% of max rated load)

Ripple and Noise: 50mV P-P max, main output (10MHz bandwidth)
1% of nominal, aux no. 1 (10MHz bandwidth)
100mV P-P max, aux no.'s 2, 3, and 4 (10MHz bandwidth)

Efficiency: 75% typical

Operating Temp: 0-50°C at full rated load. Derate to 50% of full rated load at 70°C.
Unit requires forced air cooling. Unit is equipped with overtemperature shutdown.

Temp Coefficient: 0.02% per °C

Overvoltage Protection (Main Output): OVP on main output is set between 6-6.5 V. This protection is reset by recycling input power.

Overload Protection: All outputs are protected against overload and short circuit conditions. Recovery is automatic when load is reduced.

Holdover Storage: 16mSEC minimum at full rated load, nominal input voltage

Transient Response: Recovery to within 1% of nominal output voltage within 500μSEC for a 25% load step.

Overshoot: No voltage spikes on turn-on, turn-off, or power fail

Power Fail (Opt): A TTL signal (high or low, customer specified) appears within 5mSEC to warn of input voltage drop below minimum operating level.

Power Valid (Opt): A TTL high signal appears when main output is within TTL operating range.

Universal Input (Opt): 90-264VAC autoranging

Remote Inhibit: (Opt): TTL low or switch closure

SQM OUTPUT VOLTAGE TABLE

MODEL NO.	MAIN OUTPUT(V1) Vnom Imax	AUX #1 (V2) Vnom Imax	AUX #2 (V3) Vnom Imax	AUX #3 (V4) Vnom Imax	AUX # 4* (V5) Vnom Imax	MAX OUTPUT POWER	OUTLINE DIMENSIONS
SQM 150	5V @ 20A	12V @ 5A/7A PK 15V @ 5A/7A PK 24V @ 5A/7A PK	5V @ 3A 12V @ 3A 15V @ 3A 24V @ 3A	5V @ 3A 12V @ 3A 15V @ 3A 24V @ 3A	N/A	150 WATTS (200W PK)	9.5" x 5.0" x 2.5"
SQM 200	5V @ 30A	12V @ 7A/10A PK 15V @ 7A/10A PK 24V @ 7A/10A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	N/A	200 WATTS (250W PK)	10.5" x 5.0" x 2.5"
SQM 205	5V @ 25A	15V @ 7A/10A PK 15V @ 7A/10A PK 24V @ 7A/10A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 3A 12V @ 3A 15V @ 3A 24V @ 3A	5V @ 3A 12V @ 3A 15V @ 3A 24V @ 3A	200 WATTS (250 PK)	9.5" x 5.0" x 2.5"
SQM 225	5V @ 30A	12V @ 8A/12 PK 15V @ 8A/12 PK 24V @ 8A/12 PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @5A 12 V @ 5A 15V @ 5A 24V @ 5A	N/A	225 WATTS (300W PK)	9.5" x 5.0" x 2.5"
SQM 250	5V @ 40A	12v @ 8A/12A PK 15V @ 8A/12A PK 24V @ 8A/12A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	N/A	250 WATTS (300W PK)	12.0" x 5.0" x 2.5"
SQM 350	5V @ 50A	12V @ 8A/16A PK 15V @ 8A/16A PK 24V @ 8A/16A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	N/A	350 WATTS (400W PK)	13.5" x 5.0" x 2.5"
SQM 355	5V @ 30A	12V @ 8A/16A PK 15V @ 8A/16A PK 24V @ 8A/16A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A !5V @ %A 24V @ 5A	350 WATTS (400 PK)	13.5" x 5.0" x 2.5"

SQM ORDERING INFORMATION

S X M XXX - 1 X X X X - X - X

TRIPLE OUTPUT	T
QUAD OUTPUT	Q
FIVE OUTPUT	Q

OUTPUT POWER RATING

150 MODEL	150
200 MODEL	200
205 MODEL	205
225 MODEL	225
250 MODEL	250
350 MODEL	350
355 MODEL	355

MAIN OUTPUT IS 5V ON ALL MODELS

OUTPUT VOLTAGE	AUX #1 DASH NO.	AUX #2 DASH NO.	AUX #3 DASH NO.	AUX #4 DASH NO. *
5V	N/A	1	1	1
12V	2	2	2	2
15V	3	3	3	3
24V	4	4	4	4

OPTIONS

1	POWER FAIL/TTL HIGH
2	POWER FAIL/TTL LOW
3	POWER VALID/TTL HIGH POWER FAIL/TTL LOW
4	POWER FAIL/TTL HIGH WITH COVER
5	POWER FAIL/TTL LOW WITH COVER
6	POWER VALID/TTL HIGH POWER FAIL/TTL LOW WITH COVER
7	COVER ONLY

OPTIONS

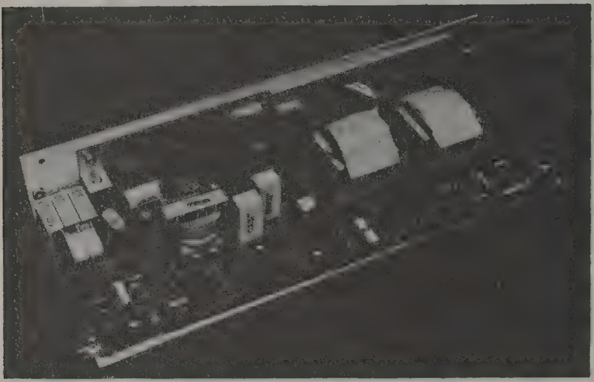
A	AUTORANGER
1	INHIBIT

FOR TRIPLE OUTPUT MODELS SUBSTITUTE A ZERO (0) INDICATING NO. OUTPUT IN THE APPROPRIATE SPACE. *AUX NO. 4 AVAILABLE ON SQM 205 & 355 MODELS ONLY • CONTACT FACTORY FOR INFORMATION ON SPECIALLY MODIFIED UNITS

Switching Systems International
500 Porter Way, Placentia, CA 92670
Tel: (714) 996-0909 • 800-992-7740 • Fax: (714) 996-2753

POWER FACTOR CORRECTION SWITCHERS

PFQ SERIES



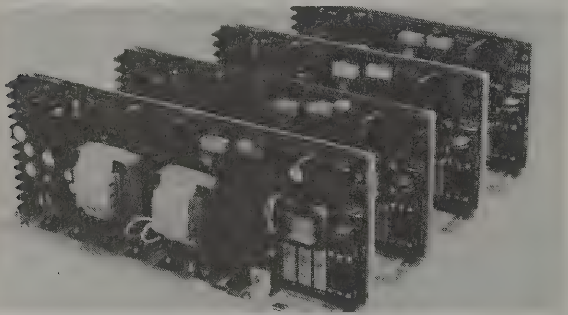
PFQ OUTPUT VOLTAGE TABLE

MODEL NO.	MAIN OUTPUT(V1) Vnom Imax	AUX #1 (V2) Vnom Imax	AUX #2 (V3) Vnom Imax	AUX #3 (V4) Vnom Imax	AUX # 4* (V5) Vnom Imax	MAX OUTPUT POWER	OUTLINE DIMENSIONS
PFQ 350	5V @ 50A	12V @ 8A/16A PK 15V @ 8A/16A PK 24V @ 8A/16A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	N/A	350 WATTS (400W PK)	13.5" x 5.0" x 2.5"
PFQ 355	5V @ 30A	12V @ 8A/16A PK 15V @ 8A/16A PK 24V @ 8A/16A PK	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	5V @ 5A 12V @ 5A 15V @ 5A 24V @ 5A	350 WATTS (400 PK)	13.5" x 5.0" x 2.5"

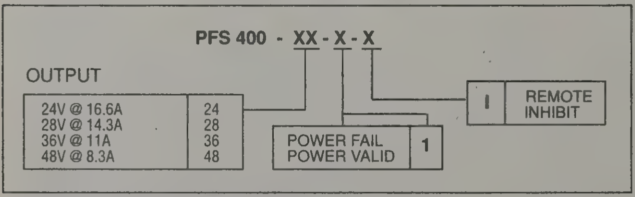
SPECIFICATIONS

Input: Universal, 90-264VAC, 47-63Hz
Inrush: 15A @ 115V for 1/2 cycle
30A @ 230V for 1/2 cycle } Cold Start
Power Factor: >.99 at full load
Harmonic Current Attenuation: Complies with IEC555-2
Output: See output voltage table
Line Regulation: 0.2%, all outputs
Load Regulation: 1%, main output; 5%, aux. no. 1; 1%, aux no.'s 2, 3 and 4
Adjustment Range: ±5%, aux no.'s 2, 3, 4 and main output
Centering: ±3% aux. no. 1
Cross Regulation: 3% aux. no. 1 (change main output from 50% to 100% of max rated load)
Ripple and Noise: 50mV P-P max, main output (10MHz bandwidth)
1% of nominal, aux no. 1 (10MHz bandwidth)
100mV P-P max, aux no.'s 2, 3, and 4 (10MHz bandwidth)
Efficiency: 75% typical
Operating Temp: 0-40°C at full rated load. Derate to 50% of full rated load at 70°C.
Unit requires 50CFM of forced air cooling. Unit is equipped with overtemperature shutdown.
Temp Coefficient: 0.02% per °C
Overvoltage Protection: (Main Output) OVP on main output is set between 6-6.5 V. This protection is reset by recycling input power.
Overload Protection: All outputs are protected against overload and short circuit conditions. Recovery is automatic when load is reduced.
Holdover Storage: 16mSEC minimum at full rated load, nominal input voltage.
Transient Response: Recovery to within 1% of nominal output voltage within 500µSEC for a 25% load step.
Overshoot: No voltage spikes on turn-on, turn-off, or power fail
Power Fail (Opt): A TTL signal (high or low, customer specified) appears within 5mSEC to warn of input voltage drop below minimum operating level.
Power Valid (Opt): A TTL high signal appears when main output is within TTL operating range.
Remote Inhibit (Opt): TTL low or switch closure

PFS400 SERIES



PFS400 ORDERING INFORMATION



Consult factory for output voltages not listed

SPECIFICATIONS

Input: Universal, 90-264VAC, 47-63Hz
Inrush: 15A @ 115V for 1/2 cycle
30A @ 230V for 1/2 cycle } Cold Start
Power Factor: >.99 at full load
Harmonic Current Attenuation: Complies with IEC555-2
Output: See output voltage table
Line Regulation: 0.3%, all outputs
Load Regulation: 2%, main output
Adjustment Range: ±5%
Ripple and Noise: 1% of nominal, P-P max (10MHz bandwidth)
Efficiency: 75% typical
Operating Temp: 0-40°C at full rated load. Derate to 50% of full rated load at 70°C.
Unit requires 25CFM of forced air cooling at full load. Unit is equipped with overtemperature shutdown.
Temp Coefficient: 0.02% per °C
Overvoltage Protection: OVP on output is set at 130% of nominal. This protection is reset by recycling input power.
Overload Protection: All outputs are protected against overload and short circuit conditions. Recovery is automatic when load is reduced
Holdover Storage: 16mSEC minimum at full rated load, nominal input voltage
Transient Response: Recovery to within 1% of nominal output voltage within 500µSEC for a 25% load step.
Overshoot: No voltage spikes on turn-on, turn-off, or power fail
Power Fail (Opt): A TTL signal appears within 5mSEC to warn of input voltage drop below minimum operating level.
Power Valid (Opt): A TTL high signal appears when output is within Operation range.
Remote Inhibit (Opt): TTL low or switch closure
Outline Dimensions: 10.5" x 5.0" x 2.5"

PF501 POWER FACTOR CORRECTION MODULE

The PF501 power factor correction module is designed for use in conjunction with SSI's "SQV" Series and d"SQM" Series switchers.

PF501 accepts an input voltage range of 90-264 VAC and provides 500 watts of output power at 400 VDC with a power factor of better than .99 at full load. PF501 can also be used as a power source for any DC/DC converter requiring 400 VDC as an input.

SPECIFICATIONS

Input: Universal, 90-264VAC, 47-63Hz
Power Factor: Exceeds .99 at full load
Harmonic Current Attenuation: Exceeds requirements of IEC 555-2
Output: 400VDC @ 1.25A (non isolated)
Line Regulation: 2%
Load Regulation: 3%, 10-100% load
Ripple and Noise: 3% P-P max
Overshoot: No overshoot
Operating Temp: 0-40°C at full rated load. Derate to 50% of rated load at 70°C
Outline Dimensions: 6" x 5" x 2.25"

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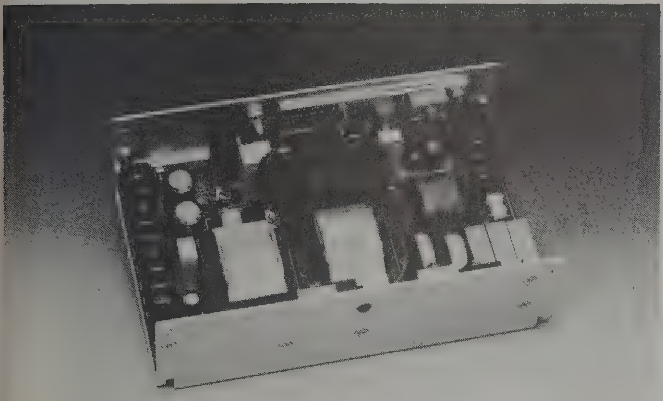
SDS INTERNATIONAL SINGLE/DUAL OUTPUT SERIES



SPECIFICATIONS

Input: Universal, 90-132/180-264VAC, 47-63Hz
Inrush: 15A @ 115V for 1/2 cycle } Cold Start
30A @ 230V for 1/2 cycle } Cold Start
Output: See output voltage table
Line Regulation: 0.2%, all outputs
Load Regulation: 1%
Adjustment Range: ±5%
Ripple and Noise: 1% of nominal
Efficiency: 75% typical
Operating Temp: 0-50° at full rated load. Derate to 50% of full rated load at 70°C.
Unit requires 50CFM of forced air cooling at full rated load.
Unit is equipped with overtemperature shutdown.
Temp Coefficient: 0.02% per °C
Overvoltage Protection: OVP on each output is set at 130% of output. This protection is reset by recycling input power.
Overload Protection: All outputs are protected against overload and short circuit conditions. Recovery is automatic when load is reduced.
Holdover Storage: 16mSEC minimum at full rated load, nominal input voltage
Transient Response: Recovery to within 1% of nominal output voltage within 500µSEC for a 25% load step.
Overshoot: No voltage spikes on turn-on, turn-off, or power fail
Power Fail (Opt): A signal appears within 5mSEC to warn of input voltage drop below minimum operating level.
Outline Dimensions: 8" x 5" x 2.5"
Cover: Optional

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- Single or optional Dual output
- 350 or 400 watts output power
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- Overtemperature shutdown
- Main output voltages from 12 to 48VDC
- Meets requirements of IEC801

SDS ORDERING INFORMATION

SDS XXX - XX - XX - XX

350 WATT MODEL	**350**
400 WATT MODEL	**400**

MAIN OUTPUT (VI) 350W MODEL

12V @ 25A	**12**
24V @ 15A	**24**
28V @ 12.5A	**28**
36V @ 9.7A	**36**
48V @ 7.5A	**48**

MAIN OUTPUT (VI) 400W MODEL

24V @ 16.5A	**24**
28V @ 14A	**28**
36V @ 11A	**36**
48V @ 8.3A	**48**

OPTIONAL AUX (V2) OUTPUT FOR BOTH MODELS

02	2V @ 5A
05	5V @ 5A
12	12V @ 5A
15	15V @ 5A
24	24V @ 5A

OPTIONS

P	POWER FAIL LOW
C	COVER
***F**	FAN/COVER

*FAN/COVER AVAILABLE ON 12V OR 24V OUTPUTS ONLY

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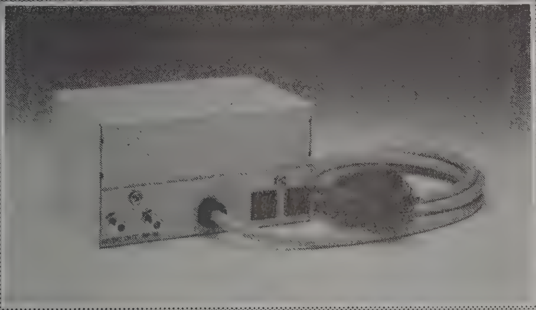
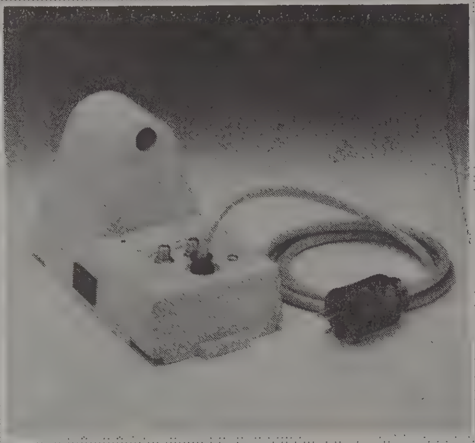
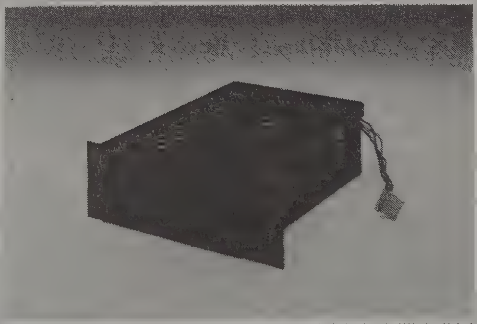




Telecommunications

Industrial Controls



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NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

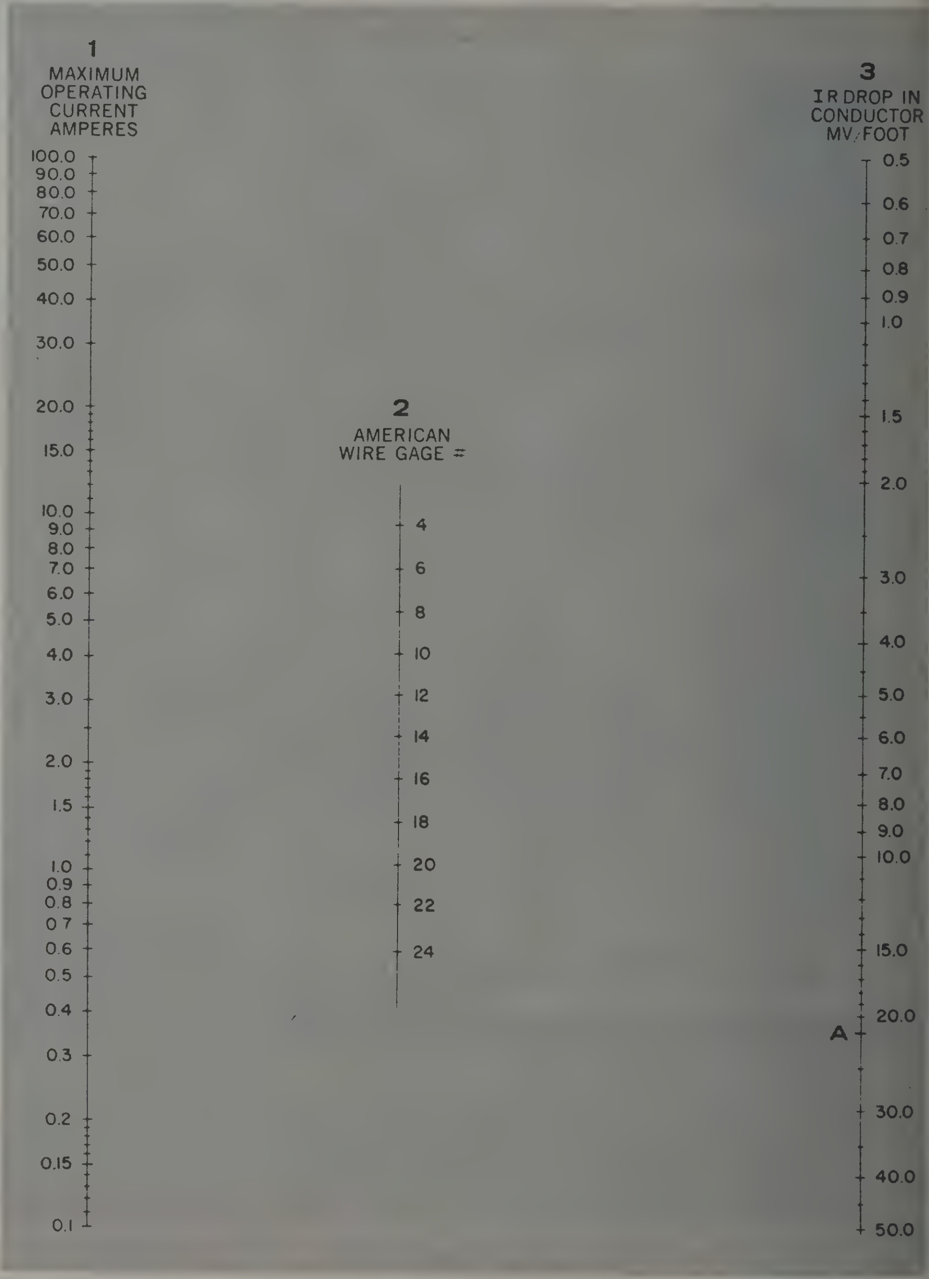
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

* *Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

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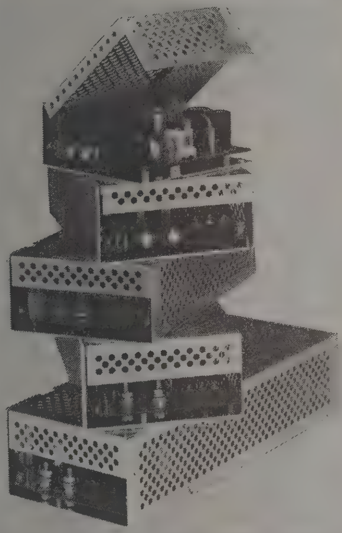
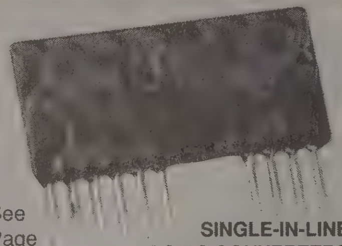


See Page D•1948

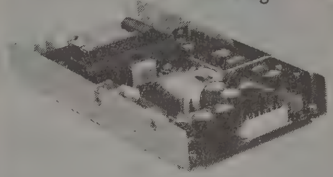
SWITCHING POWER SUPPLIES TO 400W



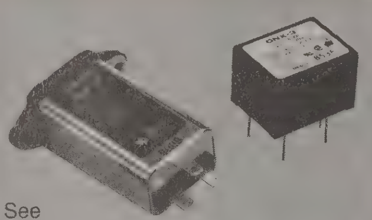
See Page D•1946

SINGLE-IN-LINE DC/DC CONVERTERS

See Page D•1949

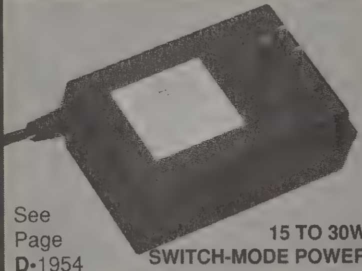


1" HIGH, 85-264VAC, 50W SWITCHING POWER SUPPLIES



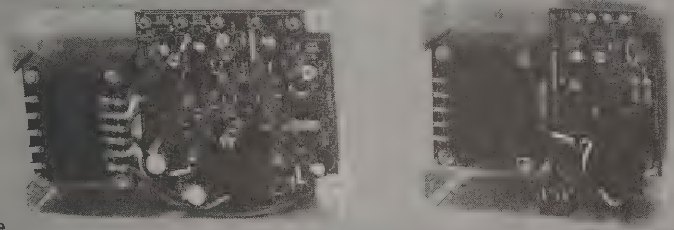
See Page A•1611

EMI/RFI LINE FILTERS



See Page D•1954

15 TO 30W SWITCH-MODE POWER



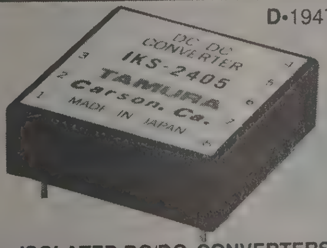
See Page D•1950, D•1951

SINGLE & MULTI-OUTPUT LINEAR POWER SUPPLIES

See Page D•1954

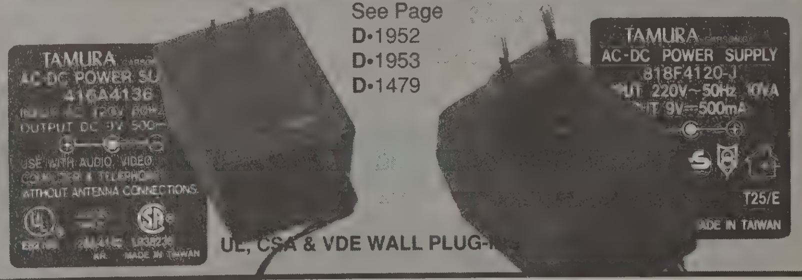
40 TO 60W TABLE TOP POWER SUPPLIES

D•1947


DC DC CONVERTER
IKS-2405
TAMURA
Carson. Co.
MADE IN JAPAN

ISOLATED DC/DC CONVERTERS

See Page D•1952 D•1953 D•1479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TAMURA SINGLE-IN-LINE DC to DC CONVERTERS

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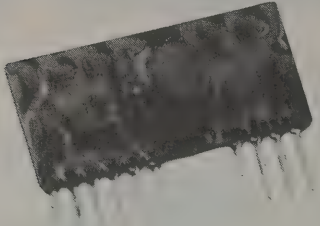
Tamura DC/DC converters provide board level DC power conversion eliminating costly regulator circuitry, additional off-board power supplies and avoid time consuming safety agency certification. Single output SIP models complement the main power supply by providing polarity reversing, voltage boosting, voltage decreasing and direct battery input.

NEW 5W & 10W MODELS



FEATURES

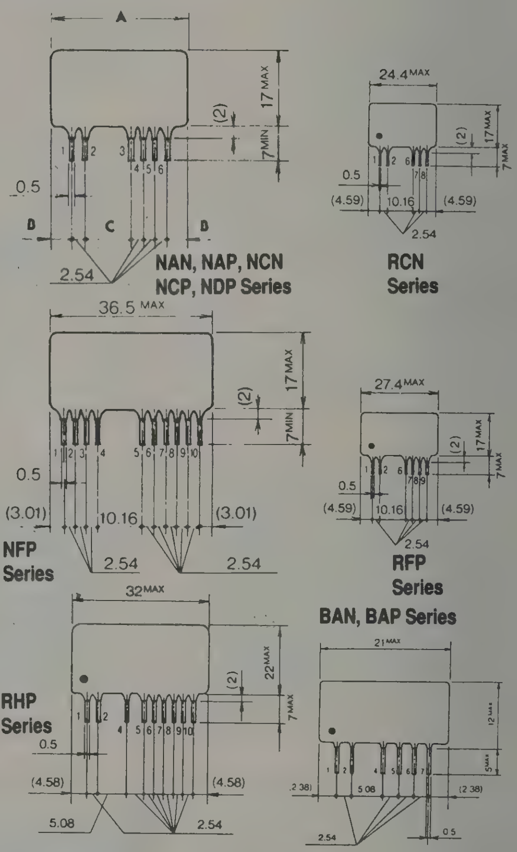
- Input Volt: ±20%; 5VDC, ±10%; 24VDC, ±30%.
- Output Volt: ±1%; Econo/Battery, ±5%.
- Line Reg: 0.8%; Econo, 1.2%; BAN/BAP.
- 5VDC, 2%; 12/15VDC, 1%.
- Load Reg: 1.5%, 30 -100% FL.
- Efficiency: 60% to 72% typ.
- Temp. Coef: ≤0.03%/˚C; 5VDCout Econo, 0.05%/˚C; 12VDCout Econo/Battery, 0.1%/˚C.
- Operating Freq: 50-300kHz, FL to NL.
- Ripple/Noise: 60mV typ, ≤100mV p-p.
- Operating Temp: -10˚C to +70˚C, FL.
- Storage Temp: -30˚C to +85˚C.
- Humidity: 95% RH.
- Case Mat'l: UL94 -V0 epoxy.
- Insul. Resistance: ≥50MΩ at 500VDC.

TAMURA SINGLE-IN-LINE DC/DC CONVERTERS - SIP SERIES

MODEL No.	Vin (VDC)	Vout (VDC)	Iout (ma)	PRICE (qty) 1-9	10-24	25-99	100up
POLARITY REVERSING							
NAN-0505	5	-5	20.0	$12.00	$10.80	$10.20	$9.00
NAN-0512	5	-12	8.5	12.00	10.80	10.30	9.00
NCN-0505	5	-5	60.0	12.80	11.50	10.90	9.60
NCN-0512	5	-12	25.0	12.80	11.50	10.90	9.60
VOLTAGE BOOSTING							
NAP-0512	5	12	8.4	12.00	10.80	10.20	9.00
NAP-0515	5	15	6.7	12.00	10.80	10.20	9.00
NAP-0524	5	24	4.2	12.00	10.80	10.20	9.00
NCP-0512	5	12	25.0	12.80	11.50	10.90	9.60
NCP-0515	5	15	20.0	12.80	11.50	10.90	9.60
NCP-0524	5	24	12.5	12.80	11.50	10.90	9.60
NDP-0512	5	12	42.0	13.70	12.30	11.60	10.30
NDP-0515	5	15	34.0	13.70	12.30	11.60	10.30
NDP-0524	5	24	21.0	13.70	12.30	11.60	10.30
NFP-0512	5	12	84.0	15.30	13.80	13.00	11.50
NFP-0515	5	15	67.0	15.30	13.80	13.00	11.50
NFP-0524	5	24	42.0	15.30	13.80	13.00	11.50
ECONOMY LINE							
RCN-0505	5	-5	60.0	8.20	7.40	7.00	6.20
RCN-0512	5	-12	25.0	8.20	7.40	7.00	6.20
RCN-0515	5	-15	20.0	8.20	7.40	7.00	6.20
RCN-1205	12	-5	60.0	8.20	7.40	7.00	6.20
RCN-1212	12	-12	25.0	8.20	7.40	7.00	6.20
RFP-2405	24	5	200.0	8.40	7.60	7.10	6.30
RHP-2405	24	5	400.0	9.30	8.40	7.90	7.00
BATTERY INPUT							
BAN-0205	1≤3.5	-5	10.00	11.10	10.00	9.40	8.30
BAN-0212	1≤3.5	-12	4.17	11.10	10.00	9.40	8.30
BAN-0215	1≤3.5	-15	3.33	11.10	10.00	9.40	8.30
BAP-0205	1≤3.5	5	10.00	11.10	10.00	9.40	8.30
BAP-0212	1≤3.5	12	4.17	11.10	10.00	9.40	8.30
BAP-0215	1≤3.5	15	3.33	11.10	10.00	9.40	8.30

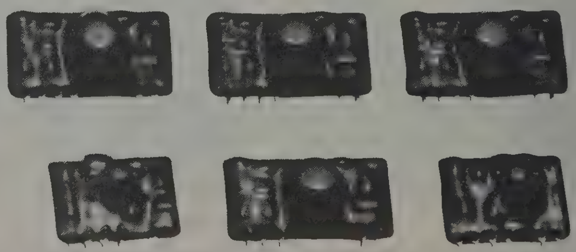
CALL FOR 5W AND 10W MODELS

MECHANICAL DIMENSIONS


A
17 MAX
(2)
7MIN
1 2 3 4 5 6
0.5
D C D
2.54
NAN, NAP, NCN
NCP, NDP Series
24.4 MAX
17 MAX
(2)
7 MAX
1 2 6 7 8
0.5
(4.59) 10.16 (4.59)
2.54
RCN
Series
36.5 MAX
17 MAX
(2)
7MIN
1 2 3 4 5 6 7 8 9 10
0.5
(3.01) 10.16 (3.01)
2.54 2.54
NFP
Series
27.4 MAX
(2)
17 MAX
7 MAX
1 2 6 7 8 9
0.5
(4.59) 10.16 (4.59)
2.54
RFP
Series
32 MAX
22 MAX
(2)
7 MAX
1 2 4 5 6 7 8 9 10
0.5
(4.58) (4.58)
5.08 2.54
RHP
Series
BAN, BAP Series
21 MAX
12 MAX
5 MAX
1 2 4 5 6 7
(2.38) 5.08 (2.38)
2.54 0.5

SINGLE-IN-LINE DIMENSIONS

SERIES PREFIX	DIMENSIONS (mm) A (max)	B	C	WT (gm)
NAN, NAP	20.5	2.63	5.08	2.3
NCN, NCP	24.4	4.58	5.08	2.8
NDP	29.5	4.59	10.16	3.3
NFP	- See Diagram -			4.4
RCN	- See Diagram -			2.5
RFP	- See Diagram -			3.0
RHP	- See Diagram -			4.8
BAN, BAP	- See Diagram -			1.8



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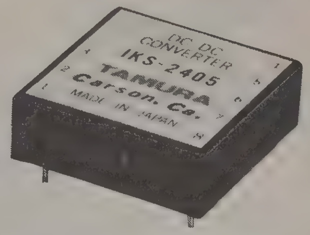
TAMURA ISOLATION TYPE DC/DC CONVERTERS

Tamura's isolation models in a Dual-In-Line package (DIP) have single and dual outputs from 300 to 3,000mW with built-in noise filter inductors and overload protection. For telcom requirements there are 48VDC quad output devices.

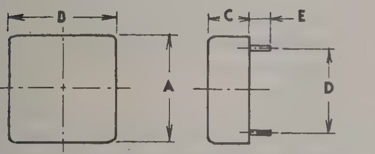
FEATURES

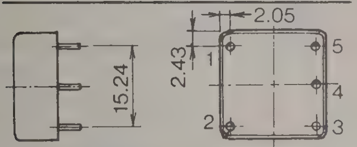
- Input Volt: 5VDC, ±10%; others ±20%.
- 48VDC range, 42 to 60V.
- Output Volt: ±1%, Telcom, ±2%.
- Line Reg: 0.5%; -0505, 0.8%; Telcom, 1%.
- Load Reg: 3.0%; 5VDC out, 6%; Telcom, 8%.
- Efficiency: 60% to 72% typ.
- Temp. Coef: <0.03/°C.
- Overload Protection: 130-200% FL.
- Operating Freq: 50 -300kHz, FL to NL.
- Ripple/Noise: 60mV typ, 100mV p-p max.
- Operating Temp: -10°C to +70°C.
- Storage Temp: -30°C to +85°C.
- Humidity: 95% RH.
- Case Mat'l: UL94V-0 epoxy; 0.3mm alum., 3.0W.

NEW
5W & 10W

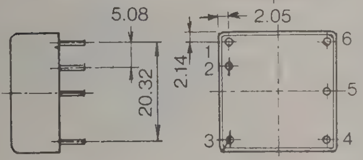


MECHANICAL DIMENSIONS

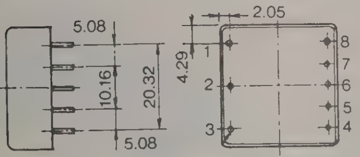




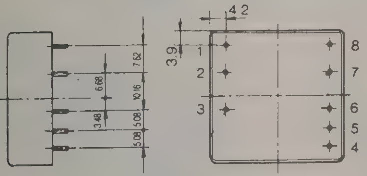
ICS, ICD Series



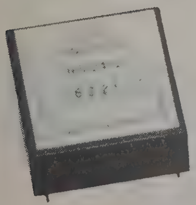
IDS, IDD Series

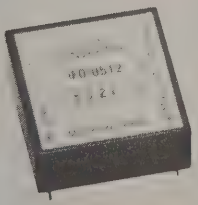


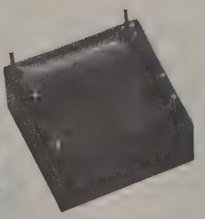
IFS, IFD, IFQ Series



IKS, IKD Series







ISOLATION DC/DC CONVERTERS - DIP SERIES

MODEL No.	Vin (VDC)	Vout (VDC)	Iout (ma)	PRICE (qty)			
				1-9	10-24	25-99	100up
0.3 WATT							
ICS-0505	5	5	60	$16.40	$14.80	$13.90	$12.30
ICS-0512	5	12	25	16.40	14.80	13.90	12.30
ICD-0512	5	±12	12.5	17.70	15.90	15.00	13.30
ICS-1205	12	5	60	16.40	14.80	13.90	12.30
ICS-1212	12	12	25	16.40	14.80	13.90	12.30
ICD-1212	12	±12	12.5	17.70	15.90	15.00	13.30
ICS-2405	24	5	60	16.40	14.80	13.90	12.30
ICS-2412	24	12	25	16.40	14.80	13.90	12.30
ICD-2412	24	±12	12.5	17.70	15.90	15.00	13.30
0.5 WATT							
IDS-0505	5	5	100	19.30	17.40	16.40	14.50
IDS-0512	5	12	42	19.30	17.40	16.40	14.50
IDD-0512	5	±12	21	20.10	18.10	17.10	15.10
IDS-1205	12	5	100	19.30	17.40	16.40	14.50
IDS-1212	12	12	42	19.30	17.40	16.40	14.50
IDD-1212	12	±12	21	20.10	18.10	17.10	15.10
IDS-2405	24	5	100	19.30	17.40	16.40	14.50
IDS-2412	24	12	42	19.30	17.40	16.40	14.50
IDD-2412	24	±12	21	20.10	18.10	17.10	15.10
1.0 WATT							
IFS-0505	5	5	200	23.90	21.50	20.30	17.90
IFS-0512	5	12	84	23.90	21.50	20.30	17.90
IFD-0512	5	±12	42	24.70	22.20	21.00	18.50
IFS-0524	5	24	42	23.90	21.50	20.30	17.90
IFS-1205	12	5	200	23.90	21.50	20.30	17.90
IFS-1212	12	12	84	23.90	21.50	20.30	17.90
IFD-1212	12	±12	42	24.70	22.20	21.00	18.50
IFS-2405	24	5	200	23.90	21.50	20.30	17.90
IFS-2412	24	12	84	23.90	21.50	20.30	17.90
IFD-2412	24	±12	42	24.70	22.20	21.00	18.50
3.0 WATT							
IKS-0505	5	5	600	34.30	30.90	29.20	25.70
IKD-0512	5	±12	125	35.20	31.70	29.90	26.40
IKD-0515	5	±12	100	35.20	31.70	29.90	26.40
IKS-0524	5	24	125	34.30	30.90	29.20	25.70
IKS-1205	12	5	600	34.30	30.90	29.20	25.70
IKS-1212	12	12	250	34.30	30.90	29.20	25.70
IKD-1212	12	±12	125	35.20	31.70	29.90	26.40
IKS-2405	24	5	600	34.30	30.90	29.20	25.70
IKS-2412	24	12	250	34.30	30.90	29.20	25.70
IKD-2412	24	±12	125	35.20	31.70	29.90	26.40
48V - MULTI OUTPUT							
IFQ-48A	48	±5 ±12	33.0 7.1	26.50	23.90	22.50	19.90
IKQ-48A	48	±5 ±12	67.0 14.2	28.50	25.70	24.20	21.40

CALL FOR 5W AND 10W MODELS

ISOLATION SERIES DIMENSIONS

SERIES PREFIX	DIMENSIONS[1] (mm)					
	A	B	C max	D	E min	WT (gm)
ICS/ICD	20.1	20.1	8.5	16.0	4	6.3
IDS/IDD/IDQ	24.6	24.6	10.5	20.5	5	11.5
IFS/IFD/IFQ	26.9	28.9	10.5	22.8	5	14.7
IKS/IKD/IKQ	36.4	36.4	12.0	28.0	4	29.9

Note 1: Pin dia. = 0.75mm.

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TAMURA SINGLE OUTPUT SWITCHING POWER SUPPLIES

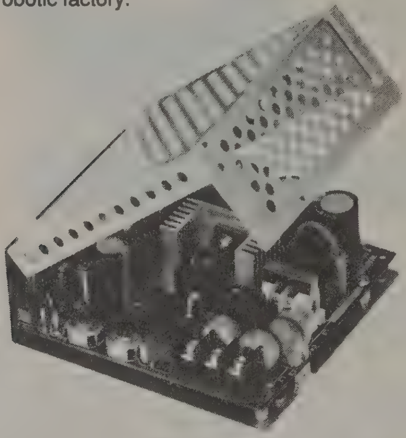
file no. E140527

file no. LR64183

file nos. 2619
2620
2614
2638
2639

EN60 950

Tamura switching power supplies offer sound mechanical construction, excellent thermal management and fault tolerant electronic design resulting in high end-user reliability. Tooled for millions of units, they reflect true vertical manufacturing integration and are produced in a fully robotic factory.

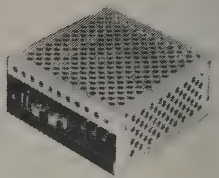


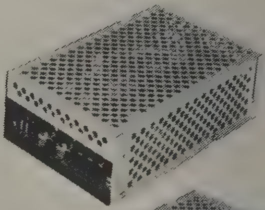
FEATURES

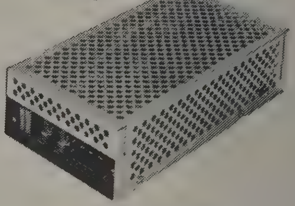
- UL/CSA/VDE File Nos.
- 90-132/180-264VAC.
- EMI Input Filter.
- AC Power Fail Signal.
- 100,000 -150,000 hrs MTBF.
- To 85% Efficiency.
- Turn-On Delay: <100msec.
- Input Surge: <30A, cold start.
- Voltage Adj: 10% of nominal.
- Line/Load Regulation: 0.5%.
- Noise/Ripple: ≤75mV p-p.
- Hold-Up Time: ≥20msec.
- Transient Response: ≤1msec (50-100% load chg).
- Remote/Local Sensing.
- Overload/No-Load Protection.
- OVP: All outputs.
- Stability: 0.1% for 8 hrs.
- Elevated Temp Burn-In/Stress Test.
- Convection Cooled.
- 50°C Rated.
- Storage Temp: -20°C to +85°C.
- Oper. Humdity: 0-95% RH.
- Temp. Coef: ±0.02%/°C max.
- Warranty: Two years.
- Removable Cover/Perm Nut Mtg.-**OPTIONAL**

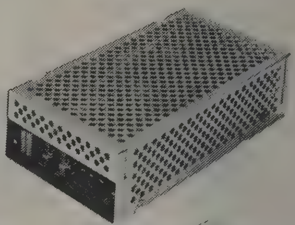
TAMURA 60W to 384W SINGLE OUTPUT SWITCHING POWER SUPPLIES

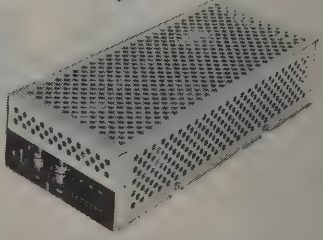
MODEL No.	RATINGS		VDE FILE	CASE SIZE	DIMENSIONS (H"xW"xL")	WT (lbs)	PRICE (qty)		
	VDC	AMPS					1-9	10-24	25-99
60W									
OVS-5E	5V	10A	2619	E	2.0x4.88x4.62	1.32	$96.20	$90.45	$82.75
OVS-12E	12V	5A	2619	E	2.0x4.88x4.62	1.32	96.20	90.45	82.75
OVS-15E	15V	4A	2619	E	2.0x4.88x4.62	1.32	96.20	90.45	82.75
OVS-24E	24V	2.5A	2619	E	2.0x4.88x4.62	1.32	96.20	90.45	82.75
Cover For E Series, Qty. 1 To 99, Add $8.00 Each.									
120W									
OVS-5F	5V	20A	2620	F	2.37x4.88x7.1	2.42	148.55	139.65	127.75
OVS-12F	12V	10A	2620	F	2.37x4.88x7.1	2.42	148.55	139.65	127.75
OVS-15F	15V	8A	2620	F	2.37x4.88x7.1	2.42	148.55	139.65	127.75
OVS-24F	24V	5A	2620	F	2.37x4.88x7.1	2.42	148.55	139.65	127.75
Cover For F Series, Qty. 1 To 99, Add $12.00 Each.									
192W									
OVS-5G	5V	30A	2614	G	2.37x4.88x8.6	2.86	195.05	183.35	167.75
OVS-12G	12V	15A	1614	G	2.37x4.88x8.6	2.86	195.05	183.35	167.75
OVS-15G	15V	12A	2614	G	2.37x4.88x8.6	2.86	195.05	183.35	167.75
OVS-18G	18V	10A	2614	G	2.37x4.88x8.6	2.86	195.05	183.35	167.75
OVS-24G	24V	8A	2614	G	2.37x4.88x8.6	2.86	195.05	183.35	167.75
Cover For G Series, Qty. 1 To 99, Add $15.00 Each.									
288W									
OVS-5H	5V	45A	2639	H	2.6x4.88x10.6	4.62	284.60	267.50	244.75
OVS-12H	12V	22A	2639	H	2.6x4.88x10.6	4.62	284.60	267.50	244.75
OVS-15H	15V	18A	2639	H	2.6x4.88x10.6	4.62	284.60	267.50	244.75
OVS-24H	24V	12A	2639	H	2.6x4.88x10.6	4.62	284.60	267.50	244.75
Cover For H Series, Qty. 1 To 99, Add $18.00 Each.									
384W									
OVS-5J	5V	60A	2638	J	2.75x4.88x12	5.5	341.55	321.05	293.75
OVS-12J	12V	30A	2638	J	2.75x4.88x12	5.5	341.55	321.05	293.75
OVS-15J	15V	25A	2638	J	2.75x4.88x12	5.5	341.55	321.05	293.75
OVS-24J	24V	16A	2638	J	2.75x4.88x12	5.5	341.55	321.05	293.75
Cover For J Series, Qty, 1 To 99, Add $21.00 Each.									


60W


120W


192W


288W


384W

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TAMURA LITE-SWITCHER™ SERIES

50W, 1" High, 85-264VAC, 1-3 Outputs

file nos. E133370
E132244

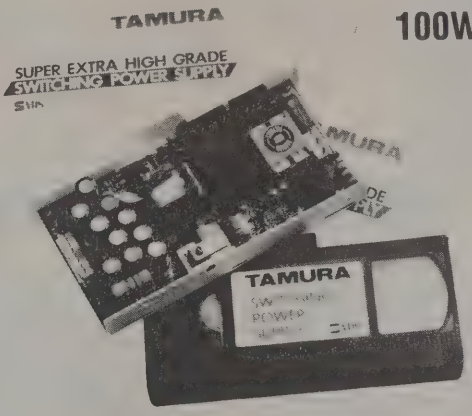
file no. LR44447

file no. 3817

EN60 950

Tamura's Lite-Switcher is smaller than a VHS cassette and weighs only 17 oz., yet delivers a full 50 watts of reliable DC power. You can easily design size and weight out of your products. A wide range universal AC input enables operation anywhere in the world. Certification to the new requirements of IEC, UL and CSA that takes effect in 1992 has been completed. Built-in EMI circuitry insures that FCC and VDE class B emission levels aren't exceeded.

NEW 30W & 100W MODELS



FEATURES

- Input: World Wide 85-264VAC.
- Low Profile: 1" x 3.74" x 7.09".
- EMI: FCC part 15J Class B; VDE 0871 Class B.
- UL 1950.
- CSA 1402C
- VDE (IEC 950).
- Hybrid Integrated Control Ckt (HIC).
- Operating Frequency: 150-200kHz.
- Input Current: 1.3/0.9A @ 120/220VAC.
- Surge: 24A/40A @ 120/220VAC.
- Line Regulation: <1%.
- Load Regulation: <2%, NL to FL.
- Ripple & Noise: 100mV; 48V, 200mV; 24V, FVM (V2, V3) 150mV.
- Voltage Adj: ±5%, FVS; +5% FVM (V1).
- Output Overshoot: None.
- Transient Response: <1msec to 2% of nom. VDC (50-100% load chg).
- Hold Up Time: 20msec typ (100VAC).
- OVP: All FVS; FVM (V1) only.
- Overload Protect: FVS, 120%; FVM, 200%.
- Temp. Coef: ±0.005%/°C; others, ±0.03%/°C.
- Stability: 0.1%; others 0.2%.
- Efficiency: 70% typ (120VAC).
- Convection Cooled.
- Rated Temp: FVS, +60°C; FVM, +50°C.
- Operating Humidity: 30-90% RH.
- Leakage Current: 1.0ma rms.
- Insulation Resistance: ≥100MΩ at 500VDC.
- Vibration: 10-55Hz, 2G (all axis, 1 hr).
- Shock: 20msec, 20G (all axis, 3x ea).
- Weight: FVS, 17 oz; FVM, 24 oz.
- Elevated Temp. Burn-In/Stress Test.
- Warranty: 2 years
- Optional Cover
- Optional Terminal Block

* Speciifications refer to all FVS single output and main FVM output (V1) except as noted.

CALL FOR NEW 30W AND 100W MODELS

SINGLE OUTPUT SWITCHERS WITH UL, CSA and VDE

MODEL No.	RATINGS		POWER (max)	PRICE (qty)		
	VDC	AMPS		1-9	10-24	25-99
FVS-501	5V	10.0A	50.0W	$108.00	$101.50	$92.90
FVS-502	12V	4.2A	50.4W	107.00	100.60	92.00
FVS-503	15V	3.3A	49.5W	107.00	100.60	92.00
FVS-504	24V	2.1A	50.4W	107.00	100.60	92.00
FVS-505	48V	1.1A	52.8W	108.00	101.50	92.90

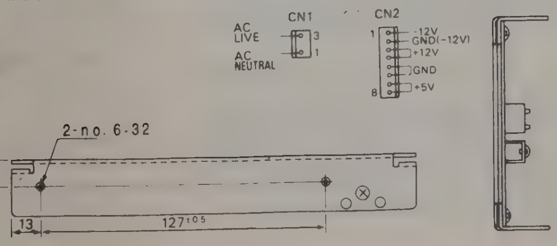
Cover For All Models, Qty. 1 To 99, Add $8.00 Each.

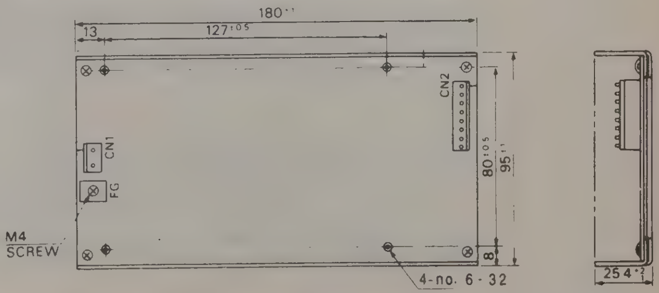
MULTI OUTPUT SWITCHERS WITH UL, CSA and VDE

MODEL No.	OUTPUT RATINGS			LOAD (min)	LOAD (max)[1]	PRICE (qty)		
	No.	VDC	AMPS			1-9	10-24	25-99
FVM-501	V1	+5V	4.0A	1.5A	7.0A	$112.00	$105.30	$96.30
	V2	+12V	1.5A	0A	1.5A			
	V3	-12V	1.0A	0A	1.0A			
FVM-502	V1	+5V	2.5A	1.5A	7.0A	112.00	105.30	96.30
	V2	+15V	1.5A	0A	1.5A			
	V3	-15V	1.0A	0A	1.0A			
FVM-503	V1	+5V	5.4A	1.5A	7.0A	112.00	105.30	96.30
	V2	+12V	1.5A	0A	1.5A			
	V3	-5V	1.0A	0A	1.0A			

Note 1: Maximum power of combined output is 50 watts.
Cover For All Models, Qty. 1 To 99, Add $8.00 Each.

MECHANICAL DIMENSIONS





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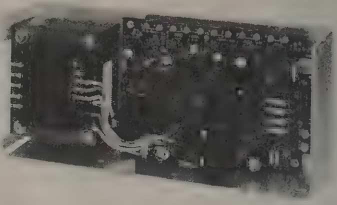
TAMURA DUAL OUTPUT LINEARS - WITH UL, CSA and VDE

AA CASE

CC CASE



131 CASE

UL544 FOR MEDICAL AND DENTAL

TAMURA DUAL OUTPUT LINEARS - WITH UL, CSA and VDE

MODEL No.[1]	POWER-ONE TYPE	VOLTAGE, CURRENT[2,3]		CASE SIZE	DIMENSIONS (L"xW"xH")	WT (lbs)	PRICE (qty)		
		OUTPUT 1	OUTPUT 2				1-9	10-24	25-99
±5 VOLTS									
OLD-5AAV	HAA5-1.5/OVP-A	5V, 1.5A*	-5V, 1.5A*	AA	6.50x4.00x2.07	2	$49.95	$47.45	$45.00
OLD-5BBV	HBB5-3/OVP-A	5V, 3.0A*	-5V, 3.0A*	BB	7.00x4.87x2.95	4	72.95	69.30	58.50
OLD-5CCV	HCC5-6/OVP-A	5V, 6.0A	-5V, 6.0A	CC	9.38x4.87x3.28	7	96.95	92.10	87.50
±12 or 15 VOLTS									
OLD-12B	HAD12-0.4-A	12V, 0.4A*	-12V, 0.4A*	B	4.87x4.00x2.07	2	36.95	35.10	33.50
OLD-15B	HAD15-0.4-A	15V, 0.4A*	-15V, 0.4A*	B	4.87x4.00x2.07	2	36.95	35.10	33.50
±12/15 VOLTS									
OLD-12/15AA	HAA15-0.8-A	12V, 1.0A jumper chg: 15V, 0.8A	-12V, 1.0A -15V, 0.8A or -5V, 0.4A	AA	6.50x4.00x2.07	2	42.95	40.80	38.50
OLD-12/15BB	HBB15-1.5-A	12V, 1.7A jumper chg: 15V, 1.5A	-12V, 1.7A -15V, 1.5A or -5V, 0.7A	BB	7.00x4.87x2.95	4	54.95	52.20	49.50
OLD-12/15CC	HCC15-3-A	12V, 3.4A jumper chg: 15V, 3.0A	-12V, 3.4A -15V, 3.0A	CC	9.38x4.87x3.28	7	87.95	83.55	79.00
±24 or 18 to 20 VOLTS									
OLD-24AA	HAA24-0.6-A	24V, 0.6A* jumper chg: 18≤ 20V, 0.4A	-24V, 0.6A* -18≤ 20V, 0.4A	AA	6.50x4.00x2.07	2	42.95	40.80	38.50
OLD-24BB	HBB24-1.2-A	24V, 1.2A* jumper chg: 18≤ 20, 0.9A	-24V, 1.2A* -18≤ 20V, 0.9A	BB	7.00x4.87x2.95	4	54.95	52.20	49.50
OLD-24CC	HCC24-2.4-A	24V, 2.4A jumper chg: 18≤20V, 1.8A	-24V, 2.4A -18≤ 20V, 1.8A	CC	9.38x4.87x3.28	7	87.95	83.55	79.00
5 & 12 to 15 VOLTS									
OLD-512AA	HAA512-A	5V, 2.0A*	+12≤15V, 0.5A*	AA	6.50x4.00x2.07	2	49.95	47.45	45.00
OLD-512BB	HBB512-A	5V, 3.0A	+12≤ 15V,1.25A	BB	7.00x4.87x2.95	4	59.95	56.95	54.00
OLD-512CC	HCC512-A	5V, 6.0A	+12≤15V, 2.5A	CC	9.38x4.87x3.28	7	94.95	90.20	85.50

TAMURA TRIPLE OUTPUT LINEARS - WITH UL, CSA and VDE

MODEL No.[1]	POWER-ONE TYPE	VOLTAGE, CURRENT[2,3]			CASE SIZE	DIMENSIONS (L"xW"xH")	WT (lbs)	PRICE (qty)		
		OUTPUT 1	OUTPUT 2	OUTPUT 3				1-9	10-24	25-99
5 & ±12 to 15 VOLTS										
OLT-522AA	HTAA-16W-A	5V, 2.0A* jumper chg:	12≤15V, 0.4A*	-(12≤15)V, 0.4A* -5V, 0.4A	AA	6.50x4.00x2.07	2	$54.95	$52.20	$49.50
OLT-522F	CP131-A	5V, 8.0A jumper chg:	12V, 1.7A 15V, 1.5A	-12V, 1.7A -15V, 1.5A - or - -5V, 0.7A	131	11.0x4.87x3.20	9	119.95	113.95	108.00

Note 1: OVP built-in on main 5V output of multiple output units. Use OVP-1 module (up to 34V combined) for other outputs.
Note 2: Other industry standard outputs available on a special, minimum quantity, order.
Note 3: * indicates remote sense not provided.

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TAMURA LINEAR POWER SUPPLIES...THE POWER-ONE ALTERNATIVE

file no. E140527 file no. LR69809 file nos.: 3206 3208 3210 3216 3218 3257 3212 3214 3259 3261 EN60 950

Tamura has set reliability standards through component upgrade design. Critical specs such as temperature, voltage and current have been derated so that, for example, 105˚C instead of 85˚C electrolytic caps are used. The result is the highest available MTBF as calculated by MIL-HDBK-217D at full load, 120VAC and 25˚C.

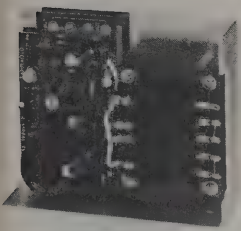
UL544 FOR MEDICAL AND DENTAL

FEATURES

- MTBF to 460,000 Hrs.
- UL Recognized.
- CSA Certified.
- 100/120/220/230/240VAC.
- Remote Sensing.
- 2 Year Warranty.
- 5V OVP Built-in.
- Optional OVP Module.
- Short Circuit Protection.
- Overload Protection.
- Burn-in.
- Voltage Adjust: ± 5%.
- Line/Load Reg: ± 0.05% typ.
- Noise/Ripple: ≤5.0 mV p-p.
- Transient Response: <50 µsec (50% load chg).
- Stability: ± 0.3%.
- 50˚C Rated.
- Temp coef: ± 0.3%/˚ C max.
- Vibration: MIL-STD-810C.
- Shock: MIL-STD-810C.

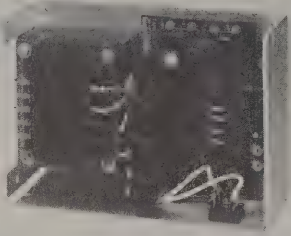
NOW

UL 1950
UL 544
CSA 1402C
VDE 0805
EN60 950

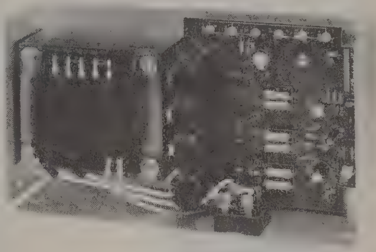


B CASE

C CASE



N CASE



D CASE

TAMURA SINGLE OUTPUT LINEARS - WITH UL, CSA and VDE

MODEL No.[1]	POWER-ONE TYPE	VOLTAGE,[2] CURRENT	CASE SIZE	DIMENSIONS (L"xW"xH")	WT (lbs)	PRICE (qty)		
						1-9	10-24	25-99
5 VOLTS								
OLS-5BV	HB5-3/OVP-A	5V, 3.0A	B	4.87x4.00x2.07	2	$32.95	$31.30	$29.50
OLS-5CV	HC5-6/OVP-A	5V, 6.0A	C	5.62x4.87x2.95	4	54.95	52.20	49.50
OLS-5NV	HN5-9/OVP-A	5V, 9.0A	N	7.00x4.87x3.20	6	74.95	71.20	67.50
OLS-5DV	HD5-12/OVP-A	5V, 12.0A	D	9.00x4.87x3.28	7.5	84.95	80.70	76.50
12 VOLTS								
OLS-12B	HB12-1.7-A	12V, 1.7A	B	4.87x4.00x2.07	2	32.95	31.30	29.50
OLS-12C	HC12-3.4-A	12V, 3.4A	C	5.62x4.87x2.95	4	49.95	47.45	45.00
OLS-12N	HN12-5.1-A	12V, 5.1A	N	7.00x4.87x3.20	6	69.95	66.45	63.00
OLS-12D	HD12-6.8-A	12V, 6.8A	D	9.00x4.87x3.28	7.5	79.95	75.95	72.00
15 VOLTS								
OLS-15B	HB15-1.5-A	15V, 1.5A	B	4.87x4.00x2.07	2	32.95	31.30	29.50
OLS-15C	HC15-3-A	15V, 3.0A	C	5.62x4.87x2.95	4	49.95	47.45	45.00
OLS-15N	HN15-4.5-A	15V, 4.5A	N	7.00x4.87x3.20	6	69.95	66.45	63.00
OLS-15D	HD15-6-A	15V, 6.0A	D	9.00x4.87x3.28	7.5	79.95	75.95	72.00
24 VOLTS								
OLS-24B	HB24-1.2-A	24V, 1.2A	B	4.87x4.00x2.07	2	32.95	31.30	29.50
OLS-24C	HC24-2.4-A	24V, 2.4A	C	5.62x4.87x2.95	4	49.95	47.45	45.00
OLS-24N	HN24-3.6-A	24V, 3.6A	N	7.00x4.87x3.20	6	69.95	66.45	63.00
OLS-24D	HD24-4.8-A	24V, 4.8A	D	9.00x4.87x3.28	7.5	79.95	75.95	72.00
OVP MODULE								
OVP-1	OVP-12	6.4V≤ 34V	OVP	1.58x1.58x0.50	-	7.95	7.55	7.00

Note 1: OVP built-in on 5V output. Use OVP-1 module for other outputs.
Note 2: Industry standard 2V, 28V, 48V, 120V, 200V and 250V outputs available on special order.

Power-One is a registered trademark of Power-One D.C. Power Supplies

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TAMURA VDE WALL PLUG-INS, 220VAC, 50Hz.

DC Unregulated & DC Regulated

file nos. 7969-3330, 3331

CALL FOR MITI MODELS

Tamura wall plug-ins enable smaller, cooler running designs - with no safety agency restrictions. End-products will be lighter, more portable, easier to build and less costly. Over 30 million units shipped last year - no returns. 600 OEM models with UL, CSA, VDE, MITI, CEE and SAA listings are available. See more DC regulated models from 15 to 60 watts in this section, AC/AC models in Transformers and battery chargers in Batteries.

DC OUTPUT UNREGULATED - WITH VDE

VDE MODEL NO.	RATED OUTPUT		OUTPUT VDC [1]			PLUG TYPE	PRICE (qty)			
	VOLTS DC	ma DC	100% FL 198VAC	100% FL 242VAC	10% FL 242VAC		1-9	10-24	25-99	100up
818F4225	6.0	400	5.40	7.20	8.70	I	$16.70	$14.20	$13.40	$11.70
525F4421	6.0	1200	5.20	7.20	9.50	I	32.70	27.80	26.20	22.90
818F4120	9.0	500	7.90	10.60	13.90	I	17.60	15.00	14.10	12.30
818F4124	12.0	500	10.40	14.00	19.10	O	17.60	15.00	14.10	12.30
525F4425	12.0	1000	10.20	13.50	18.10	I	32.70	27.80	26.20	22.90

Note 1: Typical output voltage for % load (FL) and line (VAC) indicated.

DC OUTPUT REGULATED -

VDE MODEL No.	RATED OUTPUT		REGULATION		PLUG TYPE	PRICE (qty)			
	VOLTS DC	ma DC	LINE VDC	LOAD VDC		1-9	10-24	25-99	100up
818FR4104	6.0	400	±0.10	±0.15	I	$24.30	$20.70	$19.40	$17.00
818FR4107	9.0	300	±0.10	±0.15	I	24.30	20.70	19.40	17.00
818FR4109	12.0	250	±0.10	±0.15	I	24.30	20.70	19.40	17.00

FEATURES

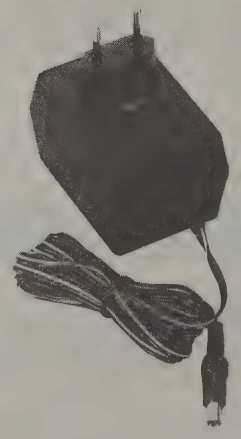
- VDE Licensed (Europe). Input: 220VAC ±10%, 50Hz.
- EMI: Meets VDE 0871, Class B.
- Short Circuit Protection.
- Thermal Protection.
- 100% Testing.
- Temp Range: 0 to +40°C.
- Case Temp Rise: 35°C max.
- Oper Humidity: 10-90% RH.
- Mat'l: ABS resin/UL 94-V0.
- Color: Black.
- No Audible Noise.

REGULATED MODELS:

- Load Reg: Spec'd for ±20%
- chg from 80% FL.
- Line Reg: At FL, 10% lline chg.
- Ripple: 10mv rms typ.

FIG. 1 UL/CSA

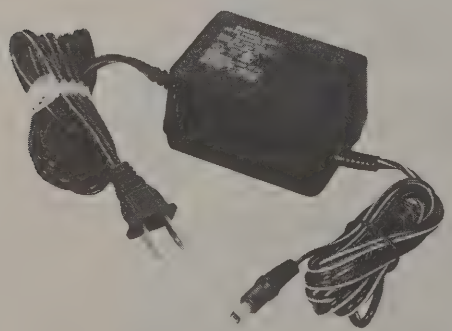
FIG. 3 VDE



MECHANICAL DIMENSION TABLE

SERIES PREFIX	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
212A	53 (2.09)	36 (1.42)	35 (1.38)	120 (4.23)	1
216A	53 (2.09)	36 (1.42)	38 (1.50)	140 (4.94)	1
310A	60 (2.36)	45 (1.77)	35 (1.38)	150 (5.29)	1
310F	58 (2.28)	45 (1.77)	39 (1.54)	190 (6.70)	2
318A	60 (2.36)	45 (1.77)	42 (1.65)	190 (6.70)	1
416A	61 (2.40)	55 (2.17)	41 (1.59)	230 (8.11)	1
420A	61 (2.40)	55 (2.17)	41 (1.59)	270 (9.52)	1
420AR	61 (2.40)	55 (2.17)	41 (1.59)	270 (9.52)	1
521A	85 (3.35)	63 (2.48)	52 (2.05)	520 (18.34)	3
525F	100 (3.94)	68 (2.68)	62 (2.44)	610 (21.52)	3
630A	114 (4.49)	75 (2.96)	61 (2.40)	1134 (40.00)	3
811A	84 (3.31)	56 (2.20)	35 (1.38)	260 (9.17)	1
816A, AR	81 (3.19)	59 (2.32)	52 (2.03)	297 (10.48)	1
818F, FR	75 (2.95)	55 (2.17)	50 (1.97)	370 (13.05)	2
820A	82 (3.23)	60 (2.36)	50 (1.97)	420 (14.81)	1
820A-G	82 (3.23)	60 (2.36)	55 (2.17)	420 (14.81)	1
825A	82 (3.23)	60 (2.36)	50 (1.97)	490 (17.28)	1
825A-G	82 (3.23)	60 (2.36)	55 (2.17)	490 (17.28)	1
825AR-G	86 (3.39)	69 (2.90)	57 (2.24)	630 (22.22)	1

FIG. 2 PLUG TO PLUG



OUTPUT PLUG DIMENSIONS

PLUG TYPE	D1 (mm)	D2 (mm)	L (mm)	MALE/ FEMALE	TIP (+/-)	FIG No.
I	5.5	2.10	9.5	FEMALE	-	4
F	5.0	2.50	11.5	FEMALE	-	4
L	5.5	2.10	16.0	FEMALE	+	4
O	5.5	2.55	12.40	FEMALE	-	4
SI	5 Pin DIN Connector				N/A	N/A
U	Universal/Reversible Connector				REV	6
Y	3.5	3.00	14.0	MALE	+	5

FIG. 4 FEMALE

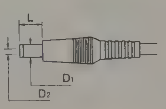


FIG 5. MALE

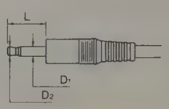
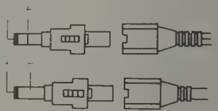


FIG. 6 "U" PLUG



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TAMURA WALL PLUG-INS, 120VAC, 60Hz.

DC Unregulated & DC Regulated

file no. E82180

file no. LR38236

CALL FOR MITI MODELS

DC OUTPUT UNREGULATED - WITH UL & CSA

UL/CSA MODEL No.	RATED OUTPUT		OUTPUT VDC [1]			UL [2]	CSA [3]	PLUG [4]	PRICE (qty)			
	VOLTS DC	ma DC	100% FL 108VAC	100% FL 132VAC	10% FL 132VAC				1-9	10-24	25-99	100up
318A2212	3.0	500	2.60	3.70	5.40	UL*	L	I	$7.70	$6.50	$6.20	$5.40
212A2220	4.5	150	3.80	5.20	7.35	UL*C	L	Y	7.00	5.90	5.60	4.90
216A4222	4.5	350	3.50	5.20	8.70	UL*C	C	F	7.30	6.20	5.80	5.10
416A2219	4.5	600	4.10	5.60	7.40	UL*C	L	I	9.10	7.70	7.30	6.40
310A2223	6.0	200	5.00	6.90	10.40	UL*	L	I	6.90	5.90	5.50	4.80
318A2226	6.0	300	4.35	6.30	8.60	UL*	L	I	7.60	6.50	6.10	5.30
318A4227	6.0	400	5.10	7.10	9.60	UL*	L	I	8.10	6.90	6.50	5.70
416A2226	6.0	600	5.10	7.00	10.20	UL*C	L	I	9.10	7.70	7.30	6.40
820A4660	6.0	1200	5.10	7.00	9.40	UL	C	I	17.70	15.00	14.20	12.40
825A2617	6.0	2000	5.10	6.80	9.70	ULC	C	I	24.10	20.50	19.30	16.90
521A4318	7.0	1200	6.50	8.60	10.40	UL	L	I	20.70	17.60	16.60	14.50
310A2223	7.0	100	6.50	8.50	11.00	UL*	L	I	6.90	5.90	5.50	4.80
318A2138	7.0	300	5.80	7.90	12.00	UL*	L	I	7.70	6.50	6.20	5.40
420A2128	7.0	500	6.60	8.80	12.30	UL*	L	I	9.10	7.70	7.30	6.40
318A4248	8.5	100	7.50	9.70	11.10	UL*	L	I	7.90	6.70	6.30	5.50
310A2223	9.0	50	7.50	9.50	11.20	UL*	L	I	6.90	5.90	5.50	4.80
212A2136	9.0	100	7.40	10.60	16.20	UL*C	L	I	7.00	5.90	5.60	4.90
318A2138	9.0	150	7.90	10.20	12.40	UL*	L	I	7.70	6.50	6.20	5.40
420A2128	9.0	300	7.70	10.00	12.60	UL*	L	I	9.10	7.70	7.30	6.40
416A4136	9.0	500	7.90	10.60	14.40	UL*	L	I	11.40	9.70	9.10	8.00
820A4465	9.0	900	7.80	10.10	13.40	UL	C	I	15.60	13.30	12.50	10.90
521A4312	9.0	1200	7.10	10.00	12.40	UL	L	I	20.70	17.60	16.60	14.50
825A4620G	9.0	1200	7.80	10.40	13.70	ULC	L	I	16.90	14.40	13.50	11.80
420A4246	10.0	500	8.80	11.70	14.40	UL*	L	I	9.30	7.90	7.40	6.50
318A2045	12.0	150	10.50	13.80	17.80	UL*	L	I	7.60	6.50	6.10	5.30
318A4146	12.0	200	10.30	13.50	17.60	UL*C	L	L	8.90	7.60	7.10	6.20
416A2141	12.0	300	10.30	13.60	19.10	UL*C	L	F	8.90	7.60	7.10	6.20
420A4141	12.0	500	10.20	13.60	17.40	UL*	L	I	9.70	8.20	7.80	6.80
820A4470	12.0	700	10.40	13.70	17.50	UL	C	I	15.60	13.30	12.50	10.90
825A4425G	12.0	900	10.40	13.80	17.00	UL*C	L	I	17.40	14.80	13.90	12.20
521A4317	12.0	1000	10.20	13.80	17.10	UL	L	I	23.10	19.60	18.50	16.20
630A4304	12.0	1700	10.15	14.20	17.40	UL	L	I	41.40	35.20	33.10	29.00
630A4402	13.5	1500	11.70	15.80	18.50	UL	L	I	41.40	35.20	33.10	29.00
318A2045	13.8	70	11.10	15.60	18.10	UL*	C	I	7.60	6.50	6.10	5.30
420A2249	14.0	350	12.10	15.80	12.20	UL*	L	I	9.10	7.70	7.30	6.40
820A4276G	14.0	700	12.20	16.10	21.60	ULC	L	I	15.60	13.30	12.50	10.90
416A2081	15.0	90	11.70	15.90	17.80	UL*C	L	I	9.10	7.70	7.30	6.40
825A4429	15.0	800	13.00	17.35	21.40	UL*C	L	I	16.90	14.40	13.50	11.80
630A4703	15.2	1500	12.50	18.00	22.00	UL	L	I	41.40	35.20	33.10	29.00
820A4279G	16.0	400	13.90	18.10	21.70	ULC	L	I	15.60	13.30	12.50	10.90
420A4151	17.5	310	14.50	20.15	24.05	UL*C	L	I	10.30	8.80	8.20	7.20
416A2045	18.0	100	16.10	20.30	24.10	UL*C	C	I	8.90	7.60	7.10	6.20
820A4080G	18.0	500	15.30	21.00	24.90	ULC	L	I	14.70	12.50	11.80	10.30
420A4143	20.0	280	17.30	22.40	27.30	UL*	L	I	9.90	8.40	7.90	6.90
630A4201	23.0	1100	20.00	26.40	30.40	UL	L	I	41.40	35.20	33.10	29.00
318A4049	24.0	50	21.40	27.10	30.30	UL*	L	I	8.40	7.10	6.70	5.90
811A4214	3-9 [5]	300	4.60	6.25	8.10	UL*C	L	U	15.40	13.10	12.30	10.80

SINGLE & TRIPLE OUTPUT DC REGULATED - WITH UL & CSA

UL/CSA MODEL No.	RATED VDC	DC ma	REGULATION		UL [2]	CSA [3]	PLUG [4]	PRICE (qty)			
			LINE VDC	LOAD VAC				1-9	10-24	25-99	100up
420AR4301	3.0	400	±0.10	+0.18	UL*	L	I	$14.00	$11.90	$11.20	$9.80
420AR4203	5.0	350	±0.15	+0.15	UL*	C	I	14.90	12.70	11.90	10.40
816AR4201	5.0	600	±0.10	+0.15	UL	C	I	22.10	18.80	17.70	15.50
420AR4207	6.0	400	±0.10	+0.15	UL*C	C	I	14.90	12.70	11.90	10.40
816AR4103	9.0	400	±0.10	+0.15	UL*	L	I	21.40	18.20	17.10	15.00
420AR4106	12.0	200	±0.18	+0.20	UL*	C	I	13.70	11.60	11.00	9.60
816AR4104	12.0	300	±0.10	+0.15	UL	C	I	22.00	18.70	17.60	15.40
825AR2401G	5.0 +12.0 -12.0	800 100 100	±0.10 ±0.10 ±0.10	+0.20 +0.15 +0.15	UL	L	S	34.90	29.70	27.90	24.40

Note 1: Typical output voltage for % load (FL) and line (VAC) indicated.
Note 2: "UL", UL 1310 listed; "UL*:, UL 1310 listing incl. UL 1411 recognized xfmr;
"C", UL approved for battery chgr ckts (contact battery mfgr for recommended volt.)
Note 3: Complies (C) with or is listed (L) to CSA C22.2, No. 223.66
Note 4: See output plug table for dimensions, gender and polarity.
Note 5: Five switched output voltages of 3.0, 4.5, 6.0, 7.5 & 9.0VDC with universal, polarity reversing, output plugs. Ratings are for 6.0VDC setting.

FEATURES

- Input: 120VAC ±10%, 60Hz.
- EMI: Meets FCC Part 15.
- Short Circuit Protection.
- Thermal Protection.
- Transformer: 3 Flange Bobbin.
- 100% Testing.
- US 3 - Blade Ground Plug Avail
- Temp Range: 0 to +40°C.
- Case Temp Rise: ≤35°C.
- Oper Humidity: 10-90% RH.
- Mat'l: ABS resin/UL 94-V0.
- Color: Black.
- No Audible Noise.

REGULATED MODELS:

- Load Reg: Spec'd for ±20% chg from 80% FL.
- Line Reg: At FL, 10% line chg.
- Ripple: 10mv rms typ.

INPUT 120VAC 60Hz
CAUTION
ATTENTION
CAUTION
ATTENTION

CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 909/676-9482 or CALL: (909) 699-1270.

TAMURA 15 to 60 WATT SWITCH-MODE REGULATED DC POWER SOURCES

Wall Plug-In and Table Top Models.

file nos. E132244
E82180

file nos. LR65893
LR44447

file no. 7969-3336

file nos.
91-33935 91-36510 91-36511
91-32733 91-33935 91-36510
91-46238 91-36511 91-42741
91-42569 91-42702

file no. E132244

For applications requiring more power from an external power source, Tamura offers 15, 20, 30, 40 and 60 watt output ratings in compact, light weight, wall plug-in and table top cases for world wide use.

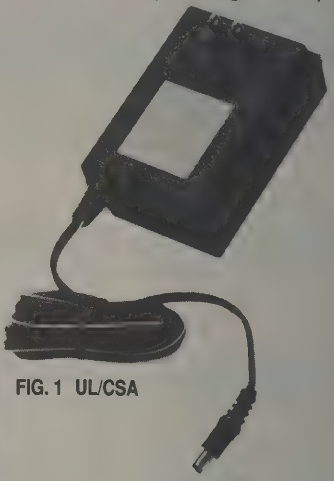


FIG. 1 UL/CSA

FEATURES

- World Wide AC Input.
- UL 1310 Listed: 15/20/30W.
- UL 1950 Recognized: 40/60W.
- No Minimum Load.
- Input Surge: ≤50A; ≤20A, 20/30W.
- Efficiency: 65%-70% typ.
- Ripple/Noise (p-p): 100mV, 20/30W; 5V-6V, 40/60W; 150mV, 9V-17.5V 40/60W; 200mV, 15W.
- Hold-Up: ≥10msec; ≥5msec, 15W.
- Overload Protection: ≥110% FL .
- Operating Temp: 0°C to +40°C.
- Storage Temp: -10°C to +70°C.
- Operating Humidity: 10-90% RH.
- Storage Humidity: 5-95% RH.
- Withstand Voltage: 1.5kVrms; VDE model, 3kVrms.
- Insulation Resistance: ≥50MΩ @ 500VDC.
- EMI: FCC part 15J Class B; VDE 0871 Class B.
- AC Input Connector: IEC type #320 receptacle (40/60W)

15, 20 & 30 WATT MODELS: 90-132VAC, 47-63Hz. FOR UL/CSA TYPE WALL PLUG

MODEL No.	CASE SIZE	RATED VDC	DC AMP	LINE[1] REG.	LOAD REG. @ .5FL		PLUG	PRICE (qty)		
					VDC	AMP		1-9	10-24	25-99
SWA-0502	20W	5	3.5	±0.1	5.20	1.75	I	$54.80	$51.50	$47.10
SWA-0503	30W	5	4.0	±0.1	5.20	2.00	I	62.30	58.60	53.60
SWA-0601	15W	6	2.0	±0.2	6.60	1.00	I	45.40	42.70	39.00
SWA-0602	20W	6	3.5	±0.1	6.20	1.75	I	54.80	51.50	47.10
SWA-0603	30W	6	4.0	±0.1	6.20	2.00	I	62.30	58.60	53.60
SWA-0701	15W	7	1.7	±0.2	7.70	0.85	I	45.40	42.70	39.00
SWA-0901	15W	9	1.5	±0.3	9.50	0.75	I	45.40	42.70	39.00
SWA-0902	20W	9	2.5	±0.1	9.15	1.25	I	54.80	51.50	47.10
SWA-0903	30W	9	3.0	±0.1	9.15	1.50	I	62.30	58.60	53.60
SWA-1201	15W	12	1.3	±0.4	12.40	0.65	I	45.40	42.70	39.00
SWA-1202	20W	12	2.0	±0.1	12.10	1.00	I	54.80	51.50	47.10
SWA-1203	30W	12	2.5	±0.1	12.10	1.25	I	62.30	58.60	53.60
SWA-1501	15W	15	1.0	±0.4	15.50	0.50	I	45.40	42.70	39.00
SWA-1502	20W	15	1.6	±0.1	15.10	0.80	I	54.80	51.50	47.10
SWA-1503	30W	15	2.0	±0.1	15.10	1.00	I	62.30	58.60	53.60
SWA-1702	20W	17	1.25	±0.1	17.15	0.63	I	54.80	51.50	47.10
40 & 60 WATT TABLE-TOP MODELS: WORLD WIDE 90-264VAC, 47-63Hz. WITH IEC 320 INPUT PLUG										
SWA-0504W	40W	5	5.0	±0.2	5.30	2.50	I	91.60	86.10	78.80
SWA-0506W	60W	5	7.5	±0.2	5.35	3.75	I	113.40	106.60	97.50
SWA-0604W	40W	6	4.2	±0.2	6.25	2.10	I	91.60	86.10	78.80
SWA-0606W	60W	6	6.3	±0.2	6.30	3.15	I	113.40	106.60	97.50
SWA-0904W	40W	9	3.0	±0.2	9.20	1.50	I	91.60	86.10	78.80
SWA-0906W	60W	9	4.5	±0.2	9.25	2.25	I	113.40	106.60	97.50
SWA-1204W	40W	12	3.0	±0.2	12.20	1.50	I	91.60	86.10	78.80
SWA-1206W	60W	12	4.5	±0.2	12.25	2.25	I	113.40	106.60	97.50
SWA-1504W	40W	15	2.5	±0.2	15.20	1.25	I	91.60	86.10	78.80
SWA-1506W	60W	15	4.0	±0.2	15.25	2.00	I	113.40	106.60	97.50
SWA-1704W	40W	17.5	2.3	±0.2	17.65	1.15	I	91.60	86.10	78.80
SWA-1706W	60W	17.5	3.5	±0.2	17.70	1.75	I	113.40	106.60	97.50
15 WATT VDE WALL MODELS: 198-264VAC, 47-63Hz. FOR EUROPEAN WALL PLUG										
SWA-0601AE	15W	6	2.0	±0.2	6.60	1.00	I	49.94	46.90	42.90
SWA-0901AE	15W	9	1.5	±0.2	9.55	0.75	I	49.94	46.90	42.90
SWA-1201AE	15W	12	1.3	±0.2	12.50	0.65	I	49.94	46.90	42.90
SWA-1501AE	15W	15	1.0	±0.2	15.50	0.50	I	49.94	46.90	42.90

Note 1: Line regulation in VDC, over rated VAC input.

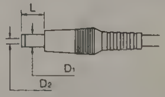
FIG. 2 VDE

FIG. 3 40W & 60W

MECHANICAL DIMENSION TABLE

CASE SIZE	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
15W	94 (3.70)	67 (2.64)	41 (1.61)	283 (10)	1
15W (VDE)	102 (4.02)	70 (2.76)	50 (1.97)	340 (12)	2
20W	107 (4.21)	71 (2.80)	44 (1.73)	368 (13)	1
30W	120 (4.72)	76 (2.99)	46 (1.81)	425 (15)	1
40W	160 (6.30)	80 (3.15)	65 (2.56)	680 (24)	3
60W	200 (7.87)	100 (3.94)	66 (2.60)	851 (30)	3

FIG. 4 OUTPUT CONNECTOR
PLUG I



O.D. = 5.50mm
I.D. = 2.10mm
L = 9.5mm
Tip = (-)

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TAMURA BATTERY CHARGERS

Wall Plug-In, 120VAC, 60Hz.

file no. E82180

file no. LR38236

CALL FOR MITI MODELS

Tamura battery chargers are particularly suited for charging NiCd, lead acid and Gel-Cell batteries. They are UL 1310 listed for battery charger circuits. Contact the battery manufacturer for recommended voltage and current. For additional UL/CSA/VDE models see DC Power Supplies section for DC regulated and unregulated models and Transformers section for AC to AC models.

FEATURES

- UL Listed For Battery Charger Ckts.
- UL 544 Medical Capability.
- Thermal Overload Protection.
- 100% Testing.
- Transformer: 3 flange bobbin.
- US 3-Blade Ground Plug Available.
- Temp Range: 0 to +40°C.
- Case Temp Rise: ≤35°C.
- Oper Humidity: 10-90% RH.
- Material: Black ABS resin/UL 94-V0.
- No Audible Noise.

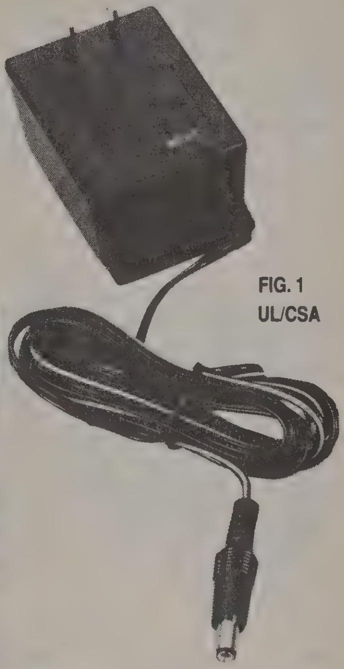


FIG. 1 UL/CSA

BATTERY CHARGER - 120VAC, 60Hz.

UL/CSA MODEL No.	RATED OUTPUT		OUTPUT VAC[1]			UL[2]	CSA[3]	PLUG[4]	PRICE (qty)			
	VOLTS DC	ma DC	100% FL 108VAC	100% FL 132VAC	10% FL 132VAC				1-9	10-24	25-99	100up
212A2220	4.5	150	3.80	5.20	7.35	UL*	L	Y	$7.00	$5.90	$5.60	$4.90
216A4222	4.5	350	3.50	5.20	8.70	UL*	C	F	7.30	6.20	5.80	5.10
416A2219	4.5	600	4.10	5.60	7.40	UL*	L	I	9.10	7.70	7.30	6.40
420AR4207	6.0	400	--------------REGULATED--------------			UL*	C	I	14.90	12.70	11.90	10.40
825A2617	6.0	2000	5.10	6.80	9.70	UL	C	I	24.10	20.50	19.30	16.90
212A2136	9.0	100	7.40	10.60	16.20	UL*	L	I	7.00	5.90	5.60	4.90
825A4620G	9.0	1200	7.80	10.40	13.70	UL	L	I	16.90	14.40	13.50	11.80
318A4146	12.0	200	10.30	13.50	17.60	UL*	L	L	8.90	7.60	7.10	6.20
416A2141	12.0	300	10.30	13.60	19.10	UL*	L	F	8.90	7.60	7.10	6.20
825A4425G	12.0	900	10.40	13.80	17.00	UL*	L	I	17.40	14.80	13.90	12.20
820A4276G	14.0	700	12.20	16.10	21.60	UL	L	I	15.60	13.30	12.50	10.90
820A4279G	16.0	400	13.90	18.10	21.70	UL	L	I	15.60	13.30	12.50	10.90
416A2045	18.0	100	16.10	20.30	24.10	UL*	C	I	8.90	7.60	7.10	6.20
811A4214	3-9[5]	300	4.60	6.25	8.10	UL*	L	U	15.40	13.10	12.30	10.80

Note 1: Typical output voltage for % load (FL) and line (VAC) indicated.
Note 2: UL notations: UL, UL 1310 listed; UL*, UL 1310 listing includes a UL 1411 recognized transformer.
Note 3: Complies (C) with or is listed (L) to CSA 22.2, No. 223/66.
Note 4: See output plug table for dimensions, gender and polarity.
Note 5: Five switched output voltages of 3.0, 4.5, 6.0, 7.5 & 9.0VDC with universal, polarity reversing, output plugs. Ratings are for 6.0VDC setting.

TAMURA CARSON CA
AC-DC POWER SUPPLY
416A4136
INPUT AC 120V 60Hz 9W
OUTPUT DC 9V 500mA
USE WITH AUDIO, VIDEO
COMPUTER & TELEPHONE
WITHOUT ANTENNA CONNECTIONS.
LISTED
E82180
2BA-4140
LR38236
MADE IN TAIWAN

MECHANICAL DIMENSION TABLE

SERIES PREFIX	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
212A	53 (2.09)	36 (1.42)	35 (1.38)	120 (4.23)	1
216A	53 (2.09)	36 (1.42)	38 (1.50)	140 (4.94)	1
318A	60 (2.36)	45 (1.77)	42 (1.65)	190 (6.70)	1
416A	61 (2.40)	55 (2.17)	41 (1.59)	230 (8.11)	1
420AR	61 (2.40)	55 (2.17)	41 (1.59)	270 (9.52)	1
811A	84 (3.31)	56 (2.20)	35 (1.38)	260 (9.20)	1
820A-G	82 (3.23)	60 (2.36)	55 (2.17)	420 (14.81)	1
825A-G	82 (3.23)	60 (2.36)	55 (2.17)	490 (17.28)	1

OUTPUT PLUG DIMENSIONS

PLUG TYPE	D1 (mm)	D2 (mm)	L (mm)	MALE/ FEMALE	CTR PIN (+/-)	FIG No.
I	5.5	2.10	9.5	FEMALE	-	2
F	5.0	2.50	11.5	FEMALE	-	2
L	5.5	2.10	16.0	FEMALE	+	2
U	------Universal/Reversible Connector------				rev	4
Y	3.5	3.00	14.0	MALE	+	3

FIG. 2 FEMALE

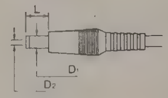


FIG. 3 MALE

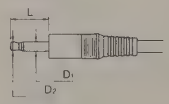
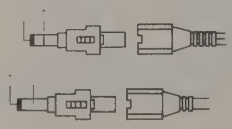


FIG. 4 UNIVERSAL/REVERSIBLE



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GENERAL SPECIFICATIONS

- Input:

120VAC	60Hz	UL/CSA	North America.
220VAC	50Hz	VDE/TUV	Europe
100VAC	50Hz	JIS	Japan.
240VAC	50Hz	BSI/SAA	UK, Australia, S.Africa.

- Output: ±0.5VDC rated load.
- Temperature: 0°C to +40°C full load conditions.
- Dielectric Withstand Voltage: UL CSA JIS 1500VAC 1 Minute
  VDE BSI TUV SAA 4000VAC 1 Minute
- Enclosure: Noryl SE-100J, Cyclolac ABS or Equivalent.
- O/P Cord: 6 feet AWG 24 or heavier.
- Safety: UL, CSA, JIS, VDE, TUV, BSI, SAA.
- MTBF: 30000 Hours at 25°C full load.
- QA: MIL-STD-105D.

DC 6 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-0603	6.0	30ma
AD-0610	6.0	100
AD-0620	6.0	200
AD-0630M	6.0	300
AD-0640M	6.0	400
AD-0650M	6.0	500
AD-0630	6.0	300
AD-0640	6.0	400
AD-0650	6.0	500
AD-0660	6.0	600
AD-0670	6.0	700
AD-0680	6.0	800
AD-0690	6.0	900
AD-061A	6.0	1A
AD-062A	6.0	2A

DC 12 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-1205	12.0	50
AD-1210	12.0	100
AD-1215	12.0	150
AD-1220M	12.0	200
AD-1220	12.0	200
AD-1230	12.0	300
AD-1235	12.0	350
AD-1240	12.0	400
AD-1245	12.0	450
AD-1250	12.0	500
AD-1260	12.0	600
AD-1270	12.0	700
AD-1280	12.0	800
AD-1290	12.0	900
AD-121A	12.0	1A
AD-121A2	12.0	1.2A

DC 18 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-1815	18.0	150
AD-1820	18.0	200
AD-1825	18.0	250
AD-1830	18.0	300
AD-1835	18.0	350
AD-1840	18.0	400
AD-1845	18.0	450
AD-1850	18.0	500
AD-1860	18.0	600
AD-1870	18.0	700
AD-1880	18.0	800
AD-1890	18.0	900

DC 7.5 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-0710	7.5	100ma
AD-0720	7.5	200
AD-0730M	7.5	300
AD-0740M	7.5	400
AD-0730	7.5	300
AD-0740	7.5	400
AD-0750	7.5	500
AD-0760	7.5	600
AD-0770	7.5	700
AD-0780	7.5	800
AD-0790	7.5	900
AD-071A	7.5	1A

DC 15 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-1515	15.0	150
AD-1520	15.0	200
AD-1525	15.0	250
AD-1530	15.0	300
AD-1535	15.0	350
AD-1540	15.0	400
AD-1540L	15.0	400
AD-1550	15.0	500
AD-1560	15.0	600
AD-1570	15.0	700
AD-1580	15.0	800
AD-1590	15.0	900
AD-151A	15.0	1A

DC 20 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-2010	20.0	100
AD-2015	20.0	150
AD-2020	20.0	200
AD-2025	20.0	250
AD-2030	20.0	300
AD-2030L	20.0	300
AD-2035	20.0	350
AD-2040	20.0	400
AD-2045	20.0	450
AD-2050	20.0	500
AD-2060	20.0	600
AD-2070	20.0	700

DC 9 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-0903	9.0	30
AD-0905	9.0	50
AD-0910	9.0	100
AD-0920M	9.0	200
AD-0930M	9.0	300
AD-0920	9.0	200
AD-0930	9.0	300
AD-0940	9.0	400
AD-0950	9.0	500
AD-0960	9.0	600
AD-0960L	9.0	600
AD-0970	9.0	700
AD-0980	9.0	800
AD-0990	9.0	900
AD-091A	9.0	1000
AD-091A5	9.0	1500

DC 16 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-1605	16.0	50
AD-1610	16.0	100
AD-1615	16.0	150
AD-1620	16.0	200
AD-1625	16.0	250
AD-1630	16.0	300
AD-1635	16.0	350
AD-1645	16.0	450
AD-1650	16.0	500
AD-1655	16.0	550
AD-1660	16.0	600
AD-1670	16.0	700
AD-1680	16.0	800
AD-161A	16.0	1A

DC 24 VOLTS

MODEL NO.	OUTPUT	
	VOLTAGE (VDC)	CURRENT (MA)
AD-2410	24.0	100
AD-2415	24.0	150
AD-2420	24.0	200
AD-2425	24.0	250
AD-2425L	24.0	250
AD-2430	24.0	300
AD-2435	24.0	350
AD-2440	24.0	400
AD-2450	24.0	500
AD-2460	24.0	600

ALL ABOVE MODELS CAN BE CHANGED TO AC/AC OUTPUT.

See our catalog page in the Wire and Cable section...C•1813

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LINEAR POWER SUPPLY

MODEL NO.	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (MA)	REGULATION
AD-51ARB	5	1000	5%
AD-51A5RB	+5	1500	5%
AD-5129	+5V	1200	5%
	+12V	200	3%
	-12V	200	3%
AD-51274	+5V	700	5%
	+12V	600	5%

REGULATED AC ADAPTOR

MODEL NO.	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (MA)	NO LOAD VOLTAGE (VDC)	REGULATION
AD-095ORG	9	500	9.45	5%
AD-124ORG	12	400	12.6	5%
AD-062ORG	+8V	200	+8.4	5%
	-8V	200	-8.4	5%
AD-053OR	+5.2V	300	+5.3	5%
	+12V	200	+12.6	5%
A-01	+5V	850	+5.3	5%
	+12V	125	+12.6	5%
	-12V	125	-12.6	5%

PLUG IN BATTERY CHARGER

MODEL NO.	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (MA)	NO LOAD VOLTAGE (VDC)	CHARGE RATE
AD-0610	6	100	10.5	1.2AHR/15HR
AD-0630M	5	300	10.5	1.2AHR/6HR
AD-0680	6	800	10.5	1.2AHR/2HR
AD-061A	6	1000	10.5	1.2AHR/1.5HR
AD-1215	12	150	21	1.2AHR/10HR
AD-1250	12	500	21	1.2AHR/3HR
AD-1280	12	800	21	1.2AHR/2HR

SWITCHING POWER SUPPLY

SPECIFICATION:

INPUT SPECIFICATIONS

Input Voltage	100VAC to 250VAC
Input Frequency	47Hz to 63 Hz
Fusing	Internal
Hold up Time	20MS

OUTPUT SPECIFICATIONS

Line Regulation	
All Output	±0.2%
Load Regulation	
Output #1	±3%
Outut #2	±5%
Output #3	±10%
Ripple & Noise, 20 MHz BW	
All Output	1% Max.

GENERAL SPECIFICATIONS

Efficiency	73% Min.
Cooling	Convection
Operating Temperature	0°c to 40°C
Storage Temperature	-20°C to 85°C
Temperature Coefficient	+/-0.03%/°C
MTBF	50.000 Hours

Meets FCC Class "B" And VDE Class "A"

OUTPUT ELECTRICAL SPECIFICATION:

25 WATTS

PART NUMBER	OUTPUT #1	OUTPUT #2	OUTPUT #3
TDA05401	5V - 4.0A		
TDA12201	12V - 2.0A		
TDA24111	24V - 1.1A		
TDA05252	5V - 2.5A	+12V - 1.0A	
TDA05203	5V - 2.0A	+12V - 1.0A	-12V - 0.2A
TDA05303	5V - 3.0A	+12V - 0.5A	-12V - 0.2A

43 WATTS

PART NUMBER	OUTPUT #1	OUTPUT #2	OUTPUT #3
TDB05601	5V - 6.0A		
TDB12361	12V - 3.6A		
TDB24181	24V - 1.8A		
TDB05302	5V - 3.0A	+12V - 2.0A	
TDB05502	5V - 5.0A	+12V - 1.0A	
TDB05303	5V - 3.0A	+12V - 2.0A	-12V - 0.3A

Output #1 Must Have A Minimum Of 20% Rated Load For Power Supply To Operate Properly

See our catalog page in the Wire and Cable section...C•1813

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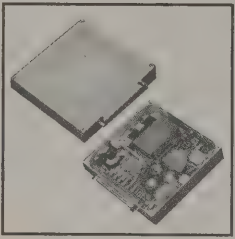
TECHNIPOWER

"MIL-SPEC" & "MIL-QUAL" MODULAR POWER SUPPLIES FROM TECHNIPOWER

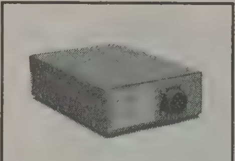
These advanced, high reliability, modular power supplies are the economical, proven alternative to expensive custom supplies. Choose from a large selection that are suitable for the most demanding Mil-Spec and industrial applications. Ask about modifications.



"MIL-SPEC" 300 Series DC/DC Converters — 175 Watts

For high-density applications where high reliability, light weight and small size are essential.

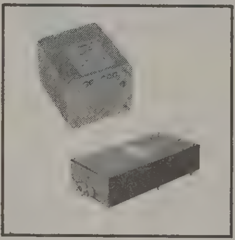
These compact units incorporate a full range of advanced performance features — soft start, tight regulation, high efficiency, low ripple, remote sensing, voltage adjust. EMI filtering, undervoltage, overvoltage, short circuit, and over current protection.



AC Source Models TVC:
105 to 125 VAC
DC Source Models TYC:
21 to 30 VDC

"Mil-Qual" Triple Output Switchers ... Field Repairable Or Sealed Models

The efficiency and size advantages of a switcher ... the desirable output of a linear ... plus high density packaging! These Technipower "Mil-Qual" Triple Output Switchers come in fully sealed models to meet Mil-901 for severe shock and extreme environment use; and in field repairable models for harsh environment, moderate shock applications! Included are a Mil-type connector input/output and a special EMI/RFI filtering circuit. MTBF is rated at more than 100,000 hours, and full power is provided at max operating temperatures — no derating. These high efficiency (80%) switchers also feature Mil-704A transient protection; have a 47-430 Hz input range, are conductively cooled, and exhibit a power range to 300 W. They are designed to meet reliability guide lines for NAV/MAT P-4855, and are ideal for military ground-base and airborne uses, surface and submarine naval systems, aerospace and space optics. Numerous industrial applications can be found wherever harsh environment and/or rugged conditions exist, such as for oil well exploration, mining, rail systems, mobile communications, and rugged terrain construction.



Harsh Environment "Mil-Qual" Switchers

Fully encapsulated, partially encapsulated or open frame, these switching power supplies are designed for high thermal application. With as low as 0.1% overall source/load effects, 0.1% PARD and 500 microsecond recovery.

VC-80 Series
AC-DC Converters. Partially encapsulated, 2.8 to 125 VDC, to 450 Watts output. 110,000 hours MTBF @ 80°C base

HF-80/HFC-80 Series
AC-DC, DC-DC stabilized. Partially encapsulated, 2.8 to 250 VDC, to 375 Watts. 70,000 hours MTBF @ 80°C base.

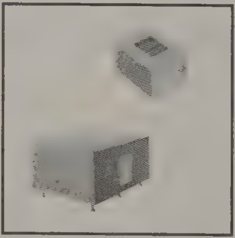
YC-95 Series
Ruggedized DC-DC Converters. Hermetically sealed, 2.8 to 125 VDC, to 450 Watts. 110,000 hours MTBF @ 95°C base.

CD-95/CDC-95 Series
Stabilized DC-DC Converters. Encapsulated, 2.8 to 250 VDC, to 275 Watts. 60,000 hours MTBF @ 95°C base.

CL/CLC Series
AC-DC, DC-DC, open frame stabilized converters. 3 to 32 VDC, to 256 Watts. 50,000 hours MTBF.

SCR-80 Series
Stabilized AC-DC phase control. High current, partially encapsulated, 5 to 160 VDC, to 2,000 Watts.

RA-80 Series
Special circuit AC-DC. Programmable from zero. Partially encapsulated, 0 to 160 VDC, to 1000 Watts.



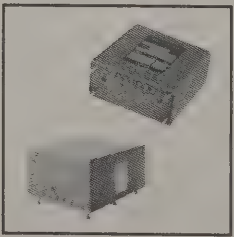
Harsh Environment "Mil-Qual" Linear Supplies

Ultra high reliability for military and industrial harsh environments. These fully encapsulated AC-DC supplies are designed for use in extreme MIL environments. Source/load effects are as low as 0.05% with 1 mV rms PARD and 50 Microsec. recovery.

PM-95 Series
Stabilized AC-DC modules. Fully encapsulated, 3 to 325 VDC, to 800 Watts. 80,000 hours MTBF @ 95°C base.

DPM-95, TDPM-95 Series
Stabilized, AC-DC, dual output, tracking and non-tracking. 12 to 15 VDC, to 150 Watts. 50,000 hours MTBF @ 95°C base.

F-115, FD-115 Series
Stabilized, AC-DC modules. 3 to 325 VDC, to 500 Watts. 50,000 MTBF @ 115°C base.



"Mil-Spec" Linear Supplies

For industrial, military and commercial use. The partially encapsulated AC-DC stabilizers are designed for moderate environments. They have 0.05% load effect, 1 mV rms PARD and generally have 50 microsecond recovery.

PL-80 Series
Lower cost, high density, stabilized AC-DC modules. 3 to 152 VDC, to 75 Watts. 120,000 hours MTBF @ 80°C base.

P-80 Series
Fully encapsulated, series stabilized DC modules. 3 to 325 VDC, to 800 Watts. 100,000 hours MTBF @ 80°C base.

MC-65 Series
Series stabilized, DC-DC modules. Up to 30% more current. 3 to 152 VDC, to 750 Watts. 1,000,000 hours MTBF @ 65°C base.

DP-80, TDP-80 Series
Tracking and non-tracking, AC-DC, dual output. 6 to 150 VDC, to 10 Watts. 50,000 hours MTBF @ 80°C base.

NP-80 Series
Non-stabilized, low cost, 3 to 1,000 VDC, to 975 Watts. 250,000 hours MTBF @ 80°C base

Custom Capabilities For Module Rack Mounts Available

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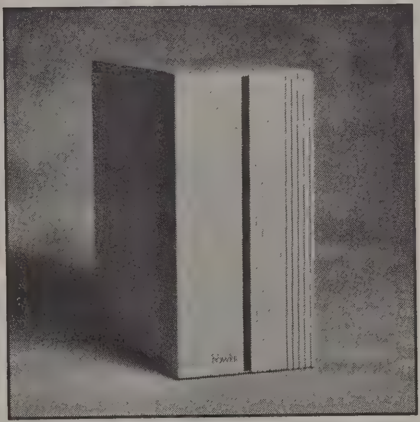
TECHNIPOWER

ALL TECHNIPOWER UPS AND SURGE PRODUCTS COVERED BY $25,000 CONNECTED EQUIPMENT INSURANCE

Executive Series

- Microprocessor control
- On line double conversion
- Excellent brownout capabilities
- Voltage regulation
- 1% frequency regulation
- Continuous sine wave output
- Total harmonic distortion of <5%
- Available in 800, 1,000, 1,250 and 1,500 VA



Dual Power Series

- On line, no transfer time
- 90% efficiency
- Pure sine wave
- Patented energy recovery circuit
- Double power path transfer
- Total harmonic distortion <5%
- Available in 600, 900, 1,250 and 1,600 VA

Double Life Surge Suppressors

- Redundant surge circuitry
- EMI and noise filtration
- Protection on all three lines
- Visual indicator on second surge circuit
- Lifetime warranty
- Ten second delay

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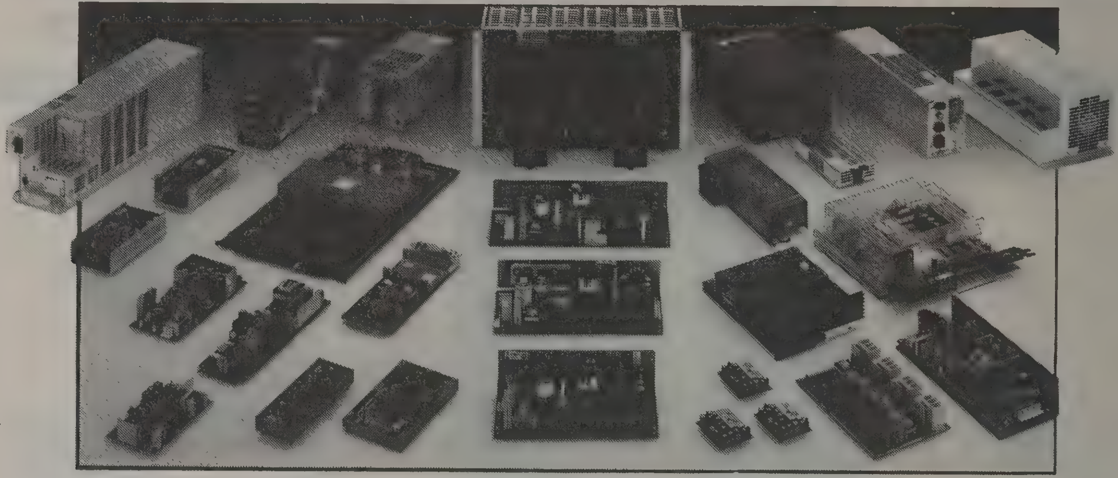
DOWNSVIEW, ONT. M3J 3E5
TEL: (416) 630-8108
FAX: (416) 638-0553

SWITCH MODE POWER SUPPLIES & DC - DC CONVERTERS



TECTROL has over twenty years of switching power supply and DC-DC converter experience. With hundreds of proven designs in service, Tectrol offers a wide variety of products to satisfy the most exacting customer needs.

- STANDARD PRODUCTS
- CUSTOM DESIGNS
- MILITARY PRODUCTS

PRODUCT

Switching Power Supplies and DC-DC Converters covering a power range from 1 to 2000 Watts are available in various topologies, configurations and packages. All Tectrol products are designed to meet International Safety requirements such as UL, CSA, VDE, BSI, and conform to FCC and/or VDE Class A and B emission standards.

- 1 TO 2000 WATTS
- UNIVERSAL (90-264V) INPUT
- MODULAR & SEMI - MODULAR DESIGNS
- REDUNDANT (N+1) SYSTEMS
- 1 MHZ RESONANT CONVERTERS

MARKET SERVED

We are a qualified power supply vendor to many major multinational corporations.

- TELECOMMUNICATIONS
- COMPUTER & PERIPHERALS
- PROCESS CONTROL
- MEDICAL
- AEROSPACE & MILITARY

ENGINEERING AND MANUFACTURING

Tectrol is recognized as one of the most technically advanced manufacturers of Switching Power Supplies and DC-DC converters world-wide. Automation enables Tectrol to provide consistent product quality, high volume production and competitive prices for the benefit of our customers.

- AUTO-INSERTION EQUIPMENT
- SURFACE-MOUNT FACILITIES
- PASS THROUGH PRODUCTION LINE
- AUTOMATED TESTING

HIGH RELIABILITY POWER SUPPLY (N+1) PARALLEL REDUNDANT APPLICATIONS with CURRENT SHARING AND HOT-PLUG CAPABILITY

(OTHER REDUNDANT SYSTEMS AVAILABLE INCLUDING TM-600)

FEATURES		MODEL	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	DIMENSION
SP0840 SERIES - 115/230 VAC OPERATION SWITCH SELECTABLE, MULTI-OUTPUT SWITCHING POWER SUPPLY								
- FULLY REGULATED OUTPUT, ADJUSTABLE, FLOATING - EFFICIENCY ABOVE 75% - FORCED CURRENT SHARING (FCS) CIRCUIT OUTPUTS 1-4 - ACTIVE PRE-LOAD ON MAIN OUTPUT- NO MIN. LOAD - AC POWER FAIL WARNING AND DC - OK SIGNALS	300W	SP0840/10	5V 40A	12V 7A	12V 7A	5V 10A	12V 7A	5.0x13.75x2.8 127x350x71
		SP0840/15	5V 40A	12V 7A	12V 7A	5V 10A	24V 5A	
		SP0840/16	5V 40A	12V 7A	12V 7A	12V 7A	12V 7A	
		SP0840/17	5V 40A	12V 7A	12V 7A	12V 7A	5V 10A	
		SP0840/18	5V 40A	12V 7A	12V 7A	12V 7A	24V 5A	
		SP0840/19	5V 40A	15V 7A	15V 7A	15V 7A	24V 5A	

NOTE: DIMENSIONS ARE IN INCHES AND MILLIMETER

FOR FURTHER INFORMATION ON STANDARD, CUSTOM, SEMI-CUSTOM AND MILITARY POWER PRODUCTS, PLEASE CONTACT TECTROL

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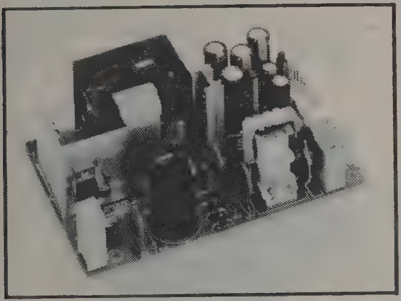
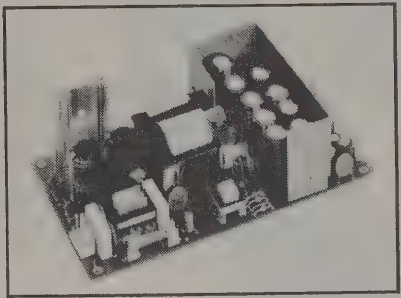
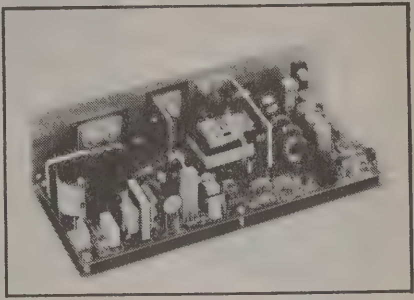
UNIVERSAL INPUT SERIES (90-264 VAC)


TO51


TO70


TO221

STANDARD FEATURES:
- EFFICIENCY ABOVE 70%
- SHORT CIRCUIT PROTECTED
- MEETS FCC, VDE EMI STANDARDS
- LOW RIPPLE & NOISE
- UL, CSA (TUV) VDE APPROVED (OR IN PROCESS OF APPROVAL)
- OVER VOLTAGE PROTECTION
- CURRENT & POWER LIMITED
- INRUSH CURRENT LIMITED & SOFT START

FEATURES		MODEL	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	DIMENSION
TO-31, TO-41, TO-51 SERIES -UNIVERSAL INPUT, SINGLE/MULTI-OUTPUT								
-VERY LOW CROSS-REGULATION BETWEEN MAIN AND AUXILIARY RAILS	30W	TO-31/10	5V 3A	+12V 1.5A	–12V .35A			3.0x5.0x1.45 76x127x37
		TO-31/11	5V 3A	+24V 0.8A	–12V .35A			
		TO-31/12	5V 3A	+15V 1.5A	–15V .35A			
	40W	TO-39/10A	5V 4A	+12V 2A				3.0x5.0x1.45 76x127x37
		TO-39/10B	5V 4.5A	+12V 2A	–12V .35A			
	50W	TO-51/10	5V 6A	+12V 2A	–12V 0.5A	–5V 0.1A		3.75x5.7x1.7 95x145x43
		TO-51/12	5V 6A	+15V 1.5A	–15V 0.5A	–5V 0.1A		
		TO-51/11	12V 3A	+24V 1A	–12V 0.5A	–5V 0.1A		
	65W	TO-65/10	5V 6A	+12V 3A	–12V 1.5A	–5V 0.5A		3.5 x6x1.54 90 x153x39
		TO65/11	5V 6A	+12V 3A	24V 1A	–12V 1.5A		
		TO65/12	5V 6A	+15V 3A	–15V 1.5A	–5V 0.5A		
		TO65/13	5V 3.5A	+12V 4A				
		TO65/17	5V 6A	+15V 3A	24V 1A	–15V 1.5A		
TO-70 SERIES - 115/230 VAC SELECTABLE, MULTI-OUTPUT								
-POWER TRADING BETWEEN SECONDARIES -UL, CSA & VDE 0806/IEC380(TUV) & IEC950 -MEETS FCC & VDE EMI STANDARDS -UP TO 5 REGULATED OUTPUTS	70W	TO-70/10	5V 8A	+12V 3.5A	+24V 1A	–12V 1.5A	–5V 1A	4.25x7.75x1.9 108x197x48
		TO-70/11	5V 8A	+15V 3A	+24V 1A	–12V 1.5A	–5V 1A	
		TO-70/12	5V 10A	+12V 2A	+24V 1A	–12V 1.5A	–5V 1A	
		TO-70/13	5V 6A	+12V 4A	+24V 1A	–12V 1.5A	–5V 1A	
		TO-70/14	5V 8A	+15V 3A	+24V 1A	–15V 1.5A	–12V 1A	
TO-81, TO-101, TO-131, TO151, TO161, TO221 SERIES - UNIVERSAL INPUT, MULTI-OUTPUT								
-VERY LOW CROSS-REGULATION BETWEEN MAIN AND AUXILIARY RAILS -POWER GOOD SIGNAL	80W	TO-81/10	5V 10A	+12V 3A	–12V 1.25A	+12V 1A		4.0x6.5x1.6 102x165x41
		TO-81/11	5V 10A	+12V 3A	–12V 1.25A	+24V 1A		
		TO-81/17	5V 10A	+15V 1.5A	–15V 1.5A	+24V 1A		
		TO-81/19	5V 10A	+15V 3A	–15V 1.5A	+12V 1A		
	100W	TO-101/10	5V 12A	+12V 3.5A	–12V 1.5A	–5V 0.3A		4.25x7.75x1.9 108x197x48
		TO-101/11	5V 12A	+12V 3.5A	–12V 1.5A	+24V 1.5A		
		TO-101/12	5V 12A	+15V 3.5A	–15V 1.5A	–5V 0.3A		
		TO-101/14	5V 10A	+24V 3.5A	–12V 1A	+12V 1.5A		
		TO-101/13	12V 5A	+24V 4A	–12V 1.5A	–5V 0.3A		
	130W	TO-131/10	5V 15A	+12V 4A	–12V 1.5A	–5V 0.3A		4.5x7.75x2.3 114x197x58
		TO-131/11	5V 15A	+12V 4A	–12V 1.5A	+24V 1.5A		
		TO-131/12	5V 15A	+15V 4A	–15V 1.5A	–5V 0.3A		
		TO-131/14	5V 12A	+24V 4A	–12V 1A	+12V 1.5A		
		TO-131/13	12V 6A	+24V 4A	–12V 1.5A	–5V 0.3A		
*NOTE: TO149 HAS 115/230V SELECTABLE INPUT RANGE.	150W*	TO-149/10	5V 25A	+12V 3A	–12V 3A			4.45x7.5x2 113x191x51
		TO-149/12	5V 25A	+15V 3A	–15V 3A			
	150W	TO-151/10	5V 25A	+12V 4A	–12V 3A			4.45x7.5x2 113x191x51
		TO-151/12	5V 25A	+15V 4A	–15V 3A			
	160W	TO-161/10	5V 25A	+12V 4A	–12V 1.5A	–5V 0.8A		5.0x9.0x2.5 127x229x63.5
		TO-161/11	5V 25A	+24V 3A	–12V 1.5A	+12V 1A		
		TO-161/12	5V 25A	+15V 1.5A	–15V 1.5A	–5V 0.8A		
		TO-161/13	5V 15A	+12V 8A	–12V 1.5A	–5V 0.8A		
	220W	TO-221/10	5V 30A	+12V 6A	–12V 1.5A	–5V 1A		5.0x9.0x2.5 127x229x63.5
		TO-221/11	5V 25A	+24V 4A	–12V 1.5A	+12V 1.5A		
		TO-221/12	5V 30A	+15V 6A	–15V 1.5A	–5V 1A		
		TO-221/13	5V 15A	+12V 10A	–12V 2.5A	–5V 1A		
		TO-221/14	5V 35A	+12V 2A	–12V 2A			
TO-351 SERIES - UNIVERSAL INPUT, MULTI-OUTPUT								
-POWER GOODS SIGNAL -OPTIONAL FAN COVER ASSEMBLY	350W	TO-351/10	5V 50A	+12V 7A	–12V 6A	–5V 1A		5"x9"x2.5" (127x229x63.5)
		TO-351/11	5V 50A	+24V 4A	–12V 6A	–5V 1A		
		TO-351/12	5V 50A	+15V 6A	–15A 6A	–5V 1A		

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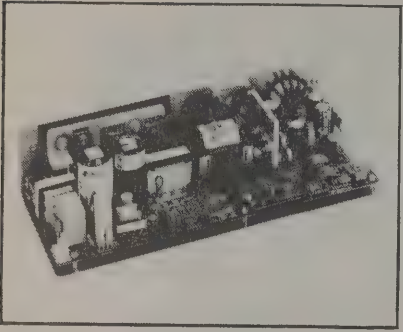
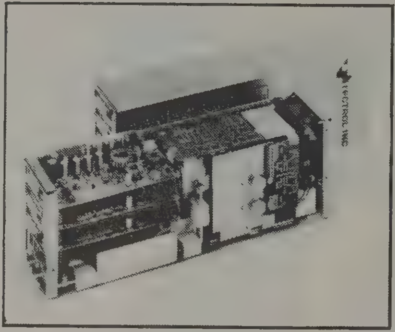
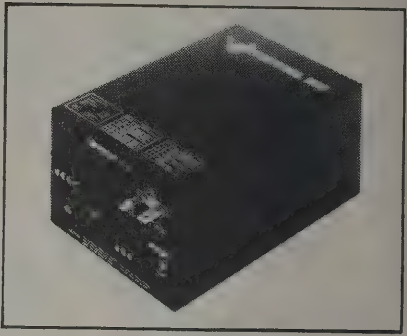
SEMI-MODULAR & MODULAR POWER SUPPLIES


TO204 / TO304


TM600


TO825

STANDARD FEATURES:
- 77-86% EFFICIENCY
- INHIBIT - ACTIVE LOW
- CURRENT LIMITED OUTPUTS
- POWER TRADING BETWEEN SECONDARIES
- OVER TEMPERATURE PROTECTION
- OVER VOLTAGE PROTECTION
- UL, CSA & (TUV)VDE APPROVED (OR IN PROCESS OF APPROVAL)
- MEETS FCC & VDE EMI STANDARDS

FEATURES		MODEL	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	DIMENSION
TO-204, TO-304, TO-404 SERIES - SEMI-MODULAR POWER SUPPLY								
- SHORT CIRCUIT PROTECTED - INRUSH CURRENT LIMITED & SOFT START - NO CROSS REG. BETWEEN MAIN & AUX. - HIGH SURGE LOAD CAPABILITY - REMOTE SENSING ON MAIN OUTPUT	200W	TO-204/11	5V 40A				SEE NOTE **	5.0x10.5x2.6 127x267x66
	250W	TO-204/10	5V 30A	12V 8A	12V 8A			
		TO-204/17	5V 30A	15V 8A	15V 8A			
		TO-204/12	12V 21A					
		TO-204/13	15V 17A					
		TO-204/14	24V 11A					
		TO-204/15	28V 9A					
		TO-204/16	48V 5.5A					
	350W	TO-304/10	5V 30A	12V 12A	12V 6A	24V 12A	SEE NOTE **	5.0x12.0x2.6 127x305x66
		TO-304/17	5V 30A	15V 12A	15V 6A	24V 12A		
		TO-304/18	5V 40A	12V 12A	12V 6A	24V 12A		
		TO-304/19	5V 40A	15V 10A	15V 6A	24V 12A		
		TO-304/12	12V 25A					
		TO-304/13	15V 20A					
		TO-304/14	24V 13A					
		TO-304/15	28V 11A					
		TO-304/16	48V 7A					
	450W	TO-404/10	5V 50A	12V 10A	12V 10A	+24V 12A	SEE NOTE **	5.0x14.0x2.6 127x356x66
		TO-404/17	5V 50A	15V 10A	15V 10A	+24V 12A		
		TO-404/11	5V 80A					
		TO-404/12	12V 38A					
		TO-404/13	15V 30A					
		TO-404/14	24V 19A					
		TO-404/15	28V 16A					
		TO-404/16	48V 10A					
TM-600 SERIES - MODULAR SWITCHING POWER SUPPLY								
- FULLY REGULATED & ADJUSTABLE OUTPUTS - OVER VOLTAGE SHUTDOWN ON ALL OUTPUTS - REMOTE SENSING ON ALL OUTPUTS - REDUNDANT (N+1), PARALLELABLE - MASTER & AUX. OUTPUT INHIBIT - UP TO 7 INDEPENDENTLY CONFIGURABLE OUTPUTS - FORCED CURRENT SHARING ON ALL SINGLE REGULATORS - UPS SYSTEM CAPABILITY	600W	TM-600/10	5V 80A	12V 10A	12V 10A	24V 4A		5.0x14.25x3.5 127X362X89
		TM-600/21	5V 80A	12V 10A	12V 10A	5V 15A		
		TM-600/22	5V 80A	15V 7A	15V 7A	24V 4A		
		TM-600/23	5V 80A	15V 7A	15V 7A	5V 15A		
		TM-600/24	5V 80A	+/-12V 5A	5V 5A	2.2V 15A		
		TM-600/25	5V 80A	+/-15V 4A	5V 4A	2.2V 15A		
		TM-600/11	5V 100A					
		TM-600/12	12V 50A					
		TM-600/13	15V 40A					
		TM-600/14	24V 25A					
		TM-600/15	28V 22A					
		TM-600/16	48V 13A					
TO-825 SERIES - HIGH-POWER SINGLE/MULTIPLE OUTPUT								
- UP TO 5 FULLY REGULATED OUTPUTS - FORCED CURRENT SHARING FOR PARALLEL REDUNDANT OPERATION - POWER FAIL WARNING - FRONT PANEL AC SELECT	825W	TO-825/10	5V 150A	24V 10A	12V 12A	12V 8A	5V 15A	8.0x5.0x11.75 203X127X298
		TO-825/18	5V 100A	24V 10A	12V 12A	12V 8A	5V 15A	
		TO-825/19	5V 100A	24V 10A	15V 10A	15V 6A	5V 15A	
		TO-825/20	5V 100A	24V 10A	12-15V 10A	12-15V 6A	5V 15A	
		TO-825/25	5V 100A	12V 12A	12V 10A	5V 15A	2.2V 15A	
		TO-825/12	12V 70A					
		TO-825/14	24V 35A					
		TO 825/10B	5V 150A	12V 20A	12V 20A			
TRM-1000 SERIES - MODULAR SWITCHING POWER SUPPLY								
- POWER FACTOR CORRECTED	1000W	TRM-1000/10	5V 150A	12V 15A	12V 10A	5V 15A		8.0x15.0x3.2 203x381x81
		TRM-1000/18	5V 150A	12V 10A	12V 10A	24V 10A		
		TRM-1000/19	5V 150A	15V 10A	15V 10A	24V 5A		

** NOTE :

MODULAR
ADD-IN REGULATORS
AVAILABLE FOR
TO-204, TO-304, TO-404
(OUTPUT 4, 5 AND/OR 6)

SINGLE	DUAL
2.2V 15A	+/-15V 8A
5V 15A	+/-12V 8A
12V 12A	+/-15V 8A
15V 10A	
24V 8A	

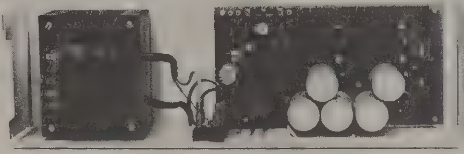
FOR FURTHER INFORMATION ON STANDARD, CUSTOM, SEMI-CUSTOM AND MILITARY POWER PRODUCTS, PLEASE CONTACT TECTROL

TECTROL INC
SWITCHING POWER PRODUCTS

39 KODIAK CRESCENT
DOWNSVIEW, ONT. M3J 3E5
TEL: (416) 630-8108
FAX: (416) 638-0553

DC LINEAR POWER SUPPLIES

IEC 380.435



GHOF 5 SERIES

CAT. NO.	VOLTS	AMPS
GHOF 5-5	5	25.0
GHOF 5-12	12	16.0
GHOF 5-15	15	15.0
GHOF 5-24	24	12.0
GHOF 5-28	28	10.0

GHOF 1 SERIES

CAT. NO.	VOLTS	AMPS
GHOF 1-5	5	3.0
GHOF 1-12	12	1.7
GHOF 1-15	15	1.5
GHOF 1-24	24	1.2
GHOF 1-28	28	1.0

GHOF 2 SERIES

CAT. NO.	VOLTS	AMPS
GHOF 2-5	5	6.0
GHOF 2-12	12	3.4
GHOF 2-15	15	3.0
GHOF 2-24	24	2.4
GHOF 2-28	28	2.0

GHOF N SERIES

CAT. NO.	VOLTS	AMPS
GHOF N-5	5	9.0
GHOF N-12	12	5.1
GHOF N-15	15	4.5
GHOF N-24	24	3.6
GHOF N-28	28	3.0

GHOF 3 SERIES

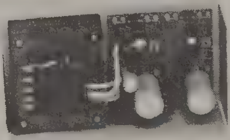
CAT. NO.	VOLTS	AMPS
GHOF 3-5	5	12.0
GHOF 3-12	12	7.0
GHOF 3-15	15	6.2
GHOF 3-24	24	4.8
GHOF 3-28	28	4.0

GHOF 4 SERIES

CAT. NO.	VOLTS	AMPS
GHOF 4-5	5	18.0
GHOF 4-12	12	10.2
GHOF 4-15	15	9.0
GHOF 4-24	24	6.0
GHOF 4-28	28	5.0

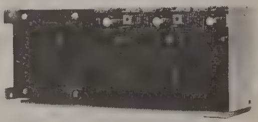
GHOF 1D SERIES

CAT. NO.	VOLTS	AMPS	VOLTS	AMPS
GHOF 1DA	12-15	1.5	12-15	1.5
GHOF 1DB	5	3.0	5	3.0
GHOF 1DC	5	3.0	12-15	1.5
GHOF 1DD	5	3.0	24	.4



GHOF 2D SERIES

CAT. NO.	VOLTS	AMPS	VOLTS	AMPS
GHOF 2DA	12-15	3.0	12-15	3.0
GHOF 2DB	5	6.0	5	6.0
GHOF 2DC	5	6.0	12-15	3.0
GHOF 2DD	5	6.0	24	2.3



GHDD / GHOF 2TA SERIES

CAT. NO.	VOLTS	AMPS	VOLTS	AMPS	VOLTS	AMPS
GHDD 100	24	2.0	5	1.5	5	0.5
GHDD 101	12-15	1.0	5	3.0	12-15	1.0
GHDD 102	24	2.0	5	1.0	12-15	0.7
GHOF 2TA	5	8.0	12-15	1.5	12-15	1.5

SPECIFICATIONS

AC Input
100/120/220/240 VAC + 10% −13% 47-63 Hz

Line Regulation
±.005% maximum over full range.

Load Regulation
±.015% from zero to full load.

Output Ripple
<1mV pk-pk (DC to 100kHZ)

Transient Response
Maximum deviation less than ±1%.
Recovers within 0.5% in less than 20µ sec.

Overvoltage Protection
SCR crowbar type standard on +5V outputs set to 6.2V ±200mV. Optional on other outputs.

Temperature

Operating	0-70° derated linearly above 50°C to 50% load at 70°C
Storage	−40°C to +85°C

Short Circuit and Overload Protection
Automatic, self recovering controlled profile foldback and delayed re-entrant foldback type.

Remote Inhibit
Standard on series N,3,4,5,2TA output 1.

Remote Sense
Standard on all models.

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DOWNSVIEW, ONT. M3J 3E5
TEL: (416) 630-8108
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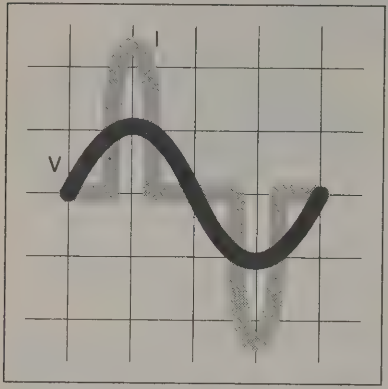
POWER FACTOR CORRECTED SWITCHING POWER SUPPLIES

Tectrol designs and manufactures Power Factor Corrected Power Supplies for medium to high power applications.



Some Advantages are:

a) **Maximum power is made available for end system use for any given branch circuit current rating.**

b) **Compliance with pending regulatory requirements (eg. IEC-555) for line current harmonic content limits.**

c) **Elimination of Neutral conductor current overload in 3-phase systems due to the additive nature of the harmonic current content generated by switching power supplies with no power factor correction.**

d) **Elimination of the unnecessary stress on the power distribution system caused by the "Wattless" component of the line current in an uncorrected power supply.**

On a 15 ampere setrvice, UL limits current draw to 80% of the branch circuit rating, i.e. 12A.

Output power is defined as Vin (rms) x Iin (rms) x Power Factor x Efficiency.

The typical Power Factor x Efficiency (PFE) product for an uncorrected supply is about (0.65 x 0.75) = 0.48. This results in a maximum output power available for system use of about 670W from a 115VAC/15A line.

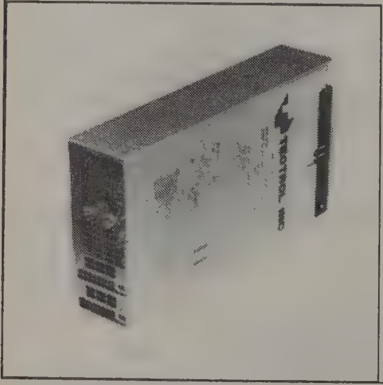
If the power factor is improved to 0.99 the available power is increased to 1024W, an increase of 53%.

Power Factor Corrected Unit - 1000W model

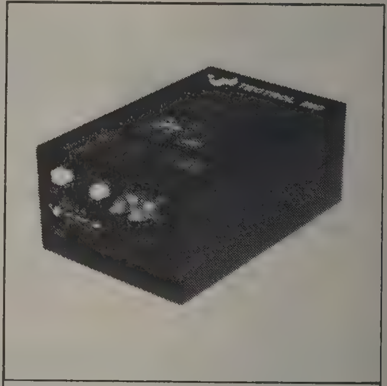
Input Ratings
Voltage: 85 - 265VAC / 47 - 63Hz
Current: Less than 12A rms
Power Factor: 0.99 typical.
Hold Up Time: 20msec minimum at 90VAC
Efficiency: 75% minimum
Surge withstand capability: To IEEE-587, Category A/B

Output Ratings
Single output models: 1000W; 5VDC / 200A to 48VDC / 21A
Multiple output models: Output 1: up to 750W, votages from 2.2VDC - 48VDC
Outputs 2 - 5: 150W or 250W per output, 2.2VDC - 48VDC

All outputs have low ripple and noise characteristics (<1%), and are fully regulated and adjustable.



Features
- Built in PFC circuity
- UL, CSA, & TUV approved
- FCC 20780 A & VDE 0871, level A
- Forced current sharing on main & single output modules
- Master remote ON / OFF
- Master remote latching shut down
- Advance thermal warning output
- AC power fail output
- Overload / Short circuit protected, all outputs
- Over voltage protected, all outputs
- Built in Forced-Air fan cooling



Tectrol is a leader in standard or custom packaged Power Factor Corrected multiple output power supplies for single unit stand alone applications or for parallel-redundant system applications with hot-plug-in capability.

Standard units are offered for 1000 - 1500W, in an 8" x 5" x 11 to 13" package.

Contact Tectrol for your PFC Power Supply solutions.

FOR FURTHER INFORMATION ON POWER FACTOR CORRECTED SWITCHING POWER SUPPLIES, PLEASE CONTACT TECTROL

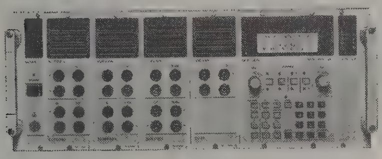
TEXMATE/GOSSEN: Precision Programmable DC Lab Power Supplies

GOSSEN Laboratory Power Supplies

Built to exacting IEC and DIN standards, Gossen-Metrawatt bus programmable DC lab power supplies are representative of the finest quality instrumentation from Europe's leading manufacturer. Most Gossen-Metrawatt products are now available in the USA from Texmate.

Four selectable DC output modules

with up to 8 isolated outputs



MSP-Konstanter from $3000 to $9000

Especially suited for demanding medical applications

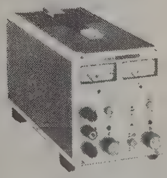
Four selectable DC output modules with up to 8 isolated outputs • Front panel manual and bus programmability • Constant voltage or constant current operation • Integral metering all outputs : voltage, current, power • Features low ripple, isolated outputs, remote sensing, 0-40°C operation, 2-speed cooling fan, series or parallel operation • Interface IEC-625, IEEE-488, RS-232C • Dimensions: 18"W x 7"H x 15.4" deep • Modules include: Single output 0-7VDC; 0-7amp; dual 0-8VDC; dual 0-3amp; dual 0-16VDC; dual 0-1.5amp; dual 0-40VDC, dual 0-0.6amp • 120/220VAC power input.

Analog Controllable Lab Power Supplies

System Konstanter

Series 14K	48W	from $650
Series 24K	96W, 128W	from $1100
Series 34G	320W	from$1950

Series 14K



Series 24K

Precision power supplies • Constant voltage/constant current • Benchtop or submodule for 19" rack • Optional interface to IEC625/IEEE 488 bus for computerized measurement and testing systems

Applications for Gossen Power Supplies

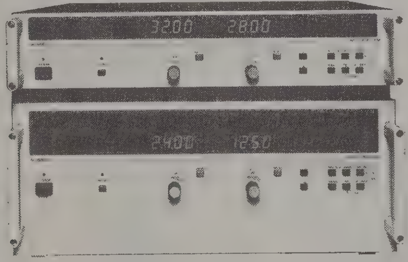
- Computer power supplies
- Super collider magnets
- Medical research laboratories
- Sonar/Microwave/Radar
- QC Testing
- Custom Power Supplies (100W to 100kW)

Fax us your specs for a custom quote.

Single Output System Power Supplies

with remote sensing

SSP-Konstanter from $2900 to $8200



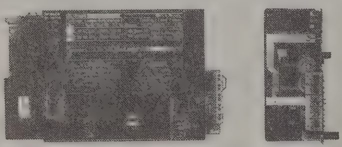
62N	0-25A, 500W max. or 0-50A, 1000W max.
64N	0-100A, 2000W max. or 0-150A, 3000W max.

Single output system DC power supplies • Manual and optional bus programmability • Integral volts/amps/power meters (4-digit LED) • Optional IEC-625, IEEE-488, RS-232C interfaces • Efficient primary switching regulation • Output ungrounded/isolated • Remote sensing • On/off fast response setability • Non-volatile memory of 255 settings • Master slave configurable • Dimensions: 19"W x 3.5"/7"H x 20" deep, 19" rack mountable • Model 62N power input: 208/240 VAC; Model 64N power input: 3Ø 208/240 VAC • Compact/Lightweight

Other Gossen Power Supply Products

For more than 30 years, Gossen-Metrawatt has been a leader in high quality economical power supply designs that meet the most stringent European standards.

Electronic Ballasts for Metal - halide lamps



Designed for metal-halide lamps 125 through 575W, approved for OSROM Series HTI and HMI, or any other lamp meeting these specifications.

DC to DC Converters 24V to 12V, 80 & 195W

For commercial vehicle applications. Most prestigious German vehicle manufacturers use Gossen-Metrawatt DC to DC converters.

Battery Charger for Automotive Industry

For 12V starter batteries

Konstanter Hi Current & Hi Voltage Systems

Voltage	6.5V-350V	3kV-12.5kV	3.5kV-6.5kV
Power	35W-250kW	7kW-250kW	14W-4.2kW

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MINIGLOSSARY

FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

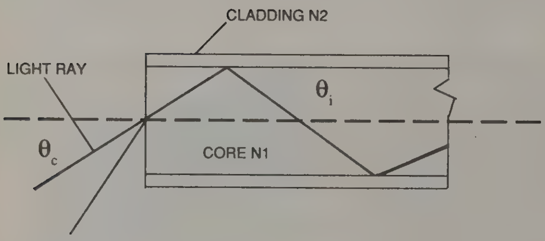
Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 µm.

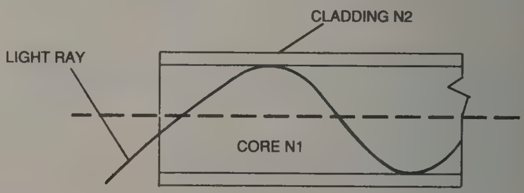
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

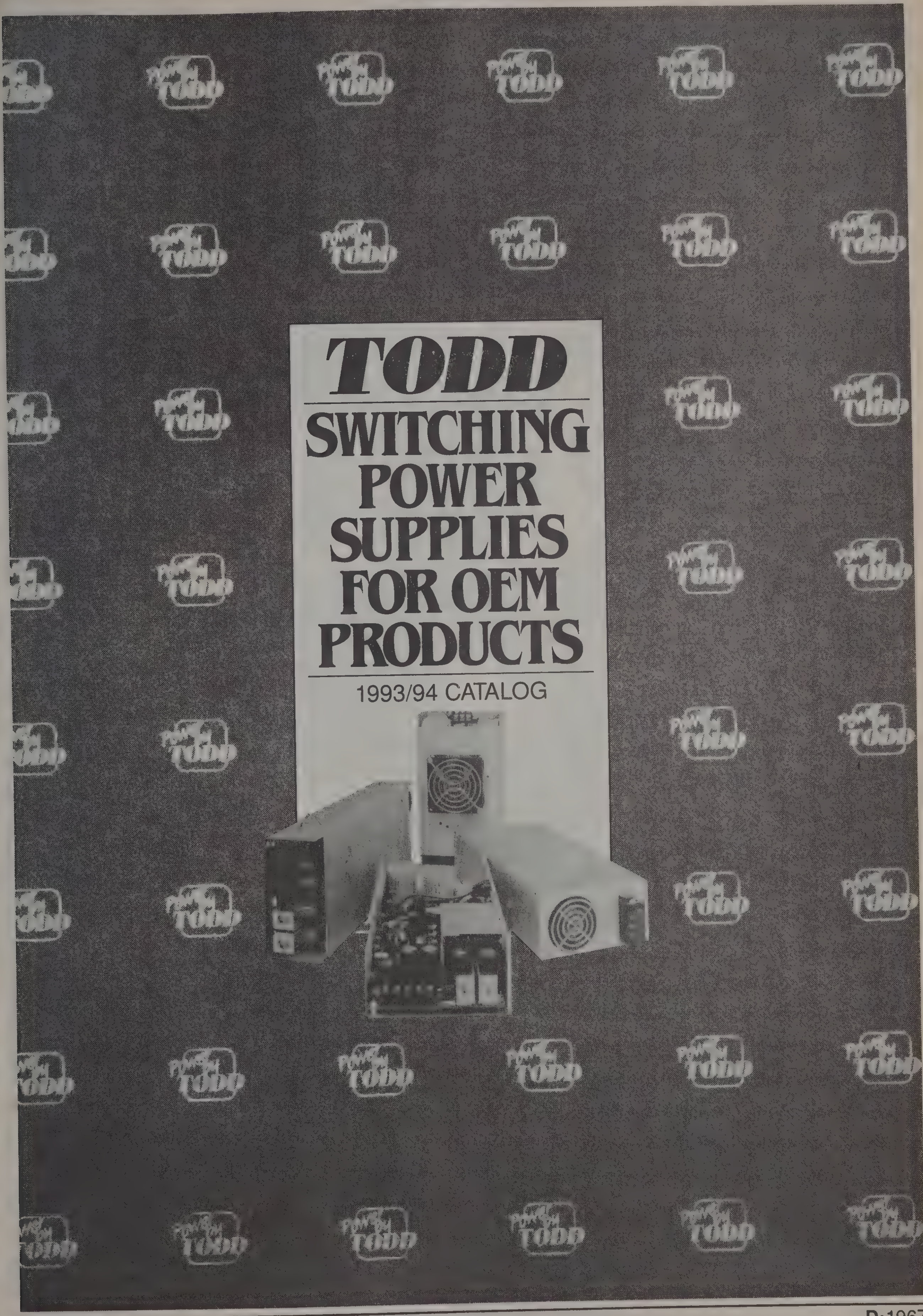
Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



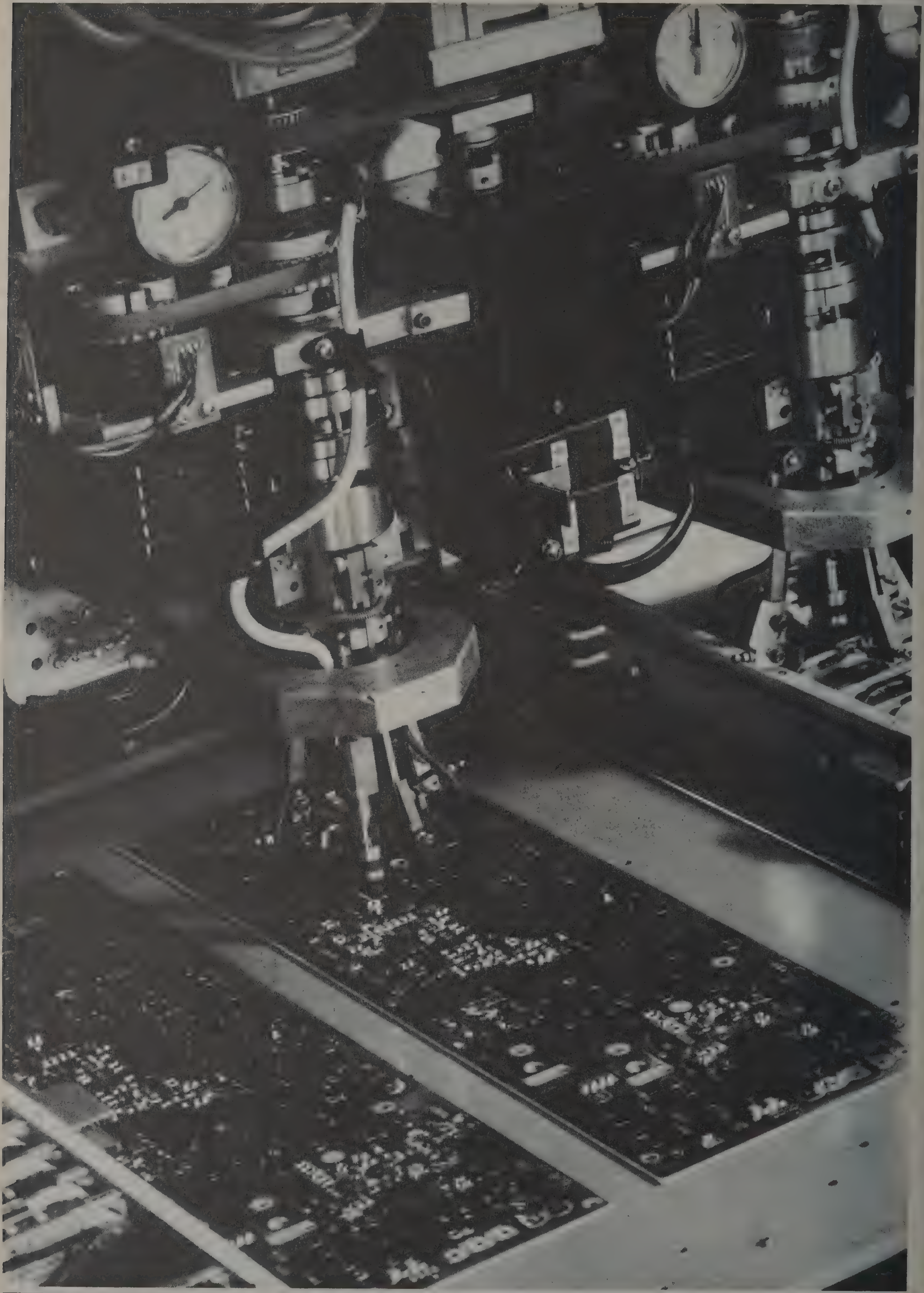
(b) Path of light rays in a graded index fiber.



TODD

SWITCHING POWER SUPPLIES FOR OEM PRODUCTS

1993/94 CATALOG



TODD

Todd Products Corp. is committed to consistently meet and exceed the customers' needs and expectations at the lowest possible cost...

INTRODUCTION TO TODD PRODUCTS CORP.

Todd Products Corp. is a designer and manufacturer of standard, modified standard and custom switching regulated power supplies. Our product range is one of the broadest available.

Todd started operations in 1968 and soon became known as an innovator in switching power supply technologies. Today we are recognized for many important accomplishments including our unique "Veri-Drive" low loss inverter topology and the extensive use of surface mount devices.

Our power supplies are used in a wide variety of OEM applications. Market segments include computer, medical, telecommunication, control, test and bus systems, and more.

Our outstanding reputation for reliability, technological innovation and service reaffirm the company's quality objective...

Todd Products Corp. is committed to consistently meet and exceed the customers' needs and expectations at the lowest possible cost through employee involvement at all levels.

Dedication to Total Quality Management is company wide. We are considered pioneers in Employee Stock Ownership Programs (ESOPs) through which the company is owned by its 230+ employees. Each employee accepts personal responsibility for the quality of our products and the success of the company.

Todd's headquarters is in Brentwood, NY, where a 52,000-square-foot facility combines executive offices, engineering, and manufacturing.

TOTAL QUALITY MANAGEMENT

Implementing and monitoring systems and procedures in a continuous improvement process is the focus of Todd's Total Quality Management efforts.

The evaluation of failure modes, implementation of corrective action and computerized tracking systems provide a continuous refinement process with measurable results.

Conformance to domestic and international safety and quality standards keeps the system effective. We were one of the first power supply manufacturers to start an ISO 9000 quality system and to apply for registration to ISO 9002.

We are certified to BABT 340, TUV Rhineland PSQA, CSA Custom Rectifier and UL Data Programs.

QUALITY FROM THE START

The worldwide focus on quality is serious business at Todd. Users of electronic systems demand the highest quality products and expect competitive prices.

We begin each project with a thorough understanding of each customer's needs and expectations. Given the required design parameters, with quality and performance as the desired result, our products are designed to meet demanding criteria for:

- Reliability
- Performance
- Dependable Dock-To-Stock Quality
- Conservative Derating
- Manufacturability/ Testability
- International Safety Approvals
- Serviceability

Before a new power supply goes into production, special reliability tests and pilot runs verify the design. This assures that all products meet the defined conditions of use. These tests also establish specifications for test department and inspection personnel.

Only when all of these prerequisites are satisfied can a quality product be manufactured.

MEETING OEM REQUIREMENTS WITH SUPERIOR TECHNOLOGY

At Todd, engineering, quality, manufacturing and sales departments work closely together to become an integral part of our customer's product development. Personnel from all departments learn each customer's requirements and respond with innovative and cost-effective solutions. This is done by applying conventional and proven new technologies.

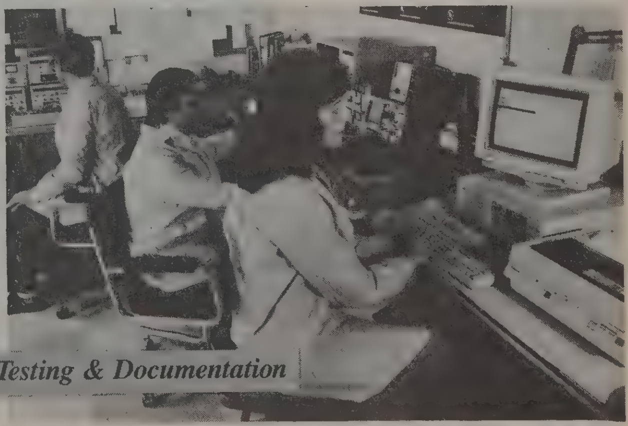
By employing a "zero-mass" approach to circuit topology, we achieve a low parts count and provide elegant solutions to OEM performance requirements. This insures circuit simplicity, high MTBF and robust reliability.

At Todd, engineering, quality, manufacturing and sales departments work closely together to become an integral part of our customer's product development.

TODD is MY company

Manufacturing Craftsmanship

Design Automation



Agency Testing & Documentation

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

TODD

All sections of the power supply design employ high-efficiency technology. The inverter configuration incorporates proprietary "Veri-Drive" circuitry. In addition, high efficiency Mag-amp regulators and high power MOSFET "Boost" converters are used.

Single board construction, extensive use of surface mount devices (SMD), and unique board layout allow for maximum use of air flow. This assures that component body temperature is reduced, and this increases overall reliability. The use of surface mount devices reduces the number of through-hole connections, further enhancing reliability and quality.

WORLD-CLASS MANUFACTURING FOR THE GLOBAL MARKET

Efficiency, performance, and value are needed for success in both domestic and international markets. Our multi-faceted approach to these principles is a major factor in our success and in the success of our OEM customers.

Todd's total commitment to quality is so intense that any employee can halt a production process when a quality problem is suspected.

JUST IN TIME MANUFACTURING

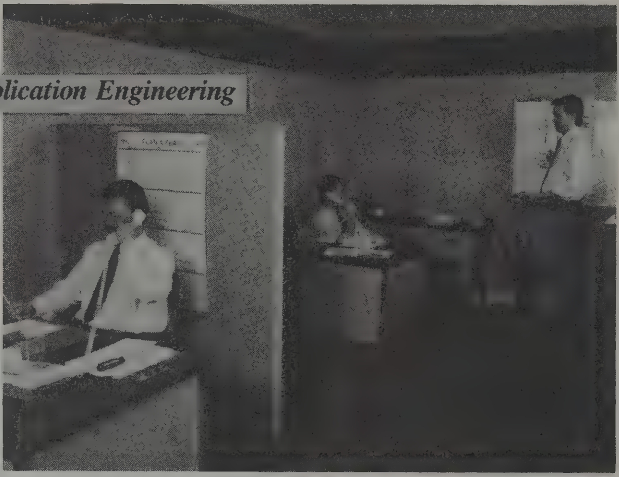
We work on a Just-in-Time basis throughout the manufacturing process. A computerized MRP system, common material usage and a "single piece flow" manufacturing line add to the success of JIT. Manufacturing includes only those activities which add value through continuous evaluation of methods and flow.

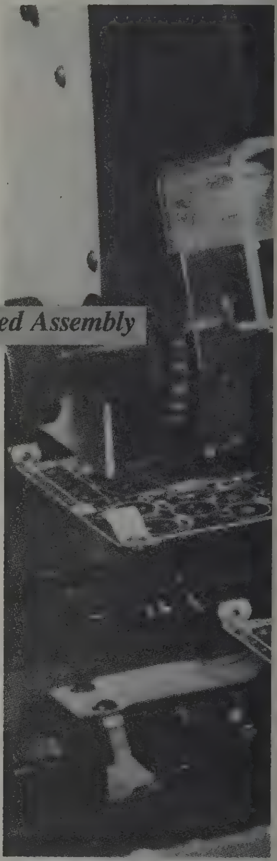
Using a dock-to-stock incoming system, three departments—purchasing, quality, and engineering—must approve vendors. Accepted vendors must prove their ability to provide consistent quality and on-time delivery. Vendor audits are performed regularly.

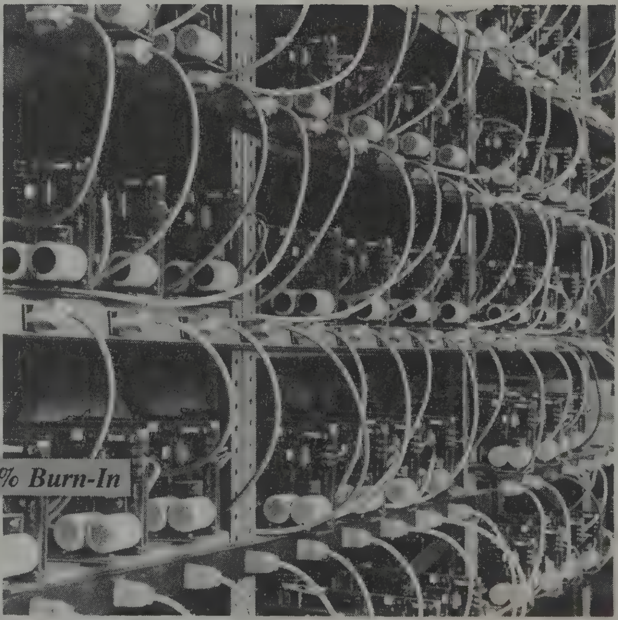
TRAINING

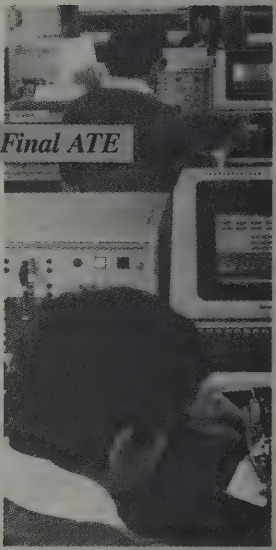
Foremost in achieving the highest quality is the effectiveness of any company's managers and production staff. At

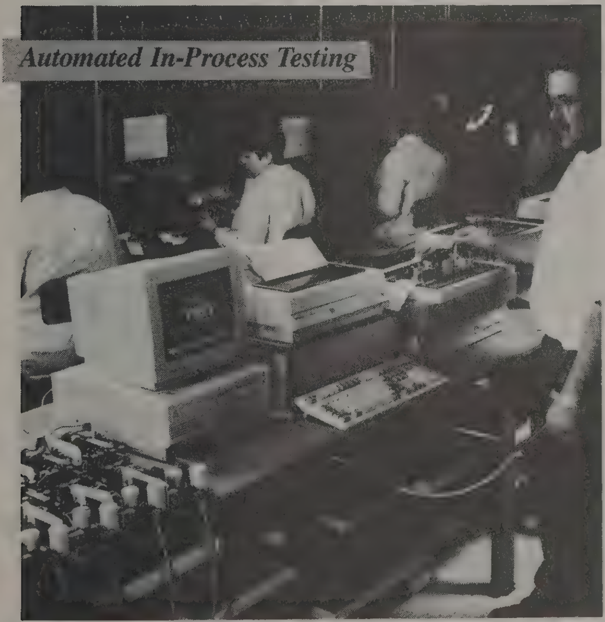
Contamination by cleaning solvents and electro-static discharge are typical manufacturing problems which we have eliminated.


Application Engineering


Automated Assembly


100% Burn-In


Final ATE



Todd, we achieve very high levels of effectiveness through initial training, frequent refresher training, and extensive cross-training. Our Total Employee Involvement Program teaches all aspects of achieving and maintaining quality. Personnel take a proactive stance rather than remain in a "wait and fail" mode. This is done in conformance with written standards for workmanship and quality. Todd's total commitment to quality is so intense that any employee can halt a production process when a quality problem is suspected.

AUTOMATION

Repeatability and verification are critical to manufacturing a product of world-class quality. Among the systems and equipment we utilize to assure repeatedly precise products are:

Automatic Test Equipment (ATE)—All populated circuit boards are checked on "Bed-of-Nails" automatic in-process testers. After mechanical assembly, all units are burned-in. All finished products are calibrated, tested and checked against specifications, safety agency guidelines and customer requirements.

Surface Mount Devices (SMD)—All PC boards are double sided with plated through-holes. Installation of surface mount devices and axial leaded components is automated. This keeps costs down, manufacturing repeatability high, and adds to superior reliability.

ESD AND CONTAMINATION CONTROL

We take steps to protect all power supplies from undetectable damage and insure long-term reliability. Contamination by cleaning solvents and electro-static discharge are typical manufacturing problems which we have eliminated.

CHEMICALS:

We do not use any chemicals that will degrade the long-term reliability of Todd power supplies or endanger the health of our employees.

ESD:

The following precautions protect against damage from electro-static discharge:

- Parts are received and kitted in dissipative bags and containers
- Work-in-process is moved in rigid dissipative containers
- Stations are equipped with dissipative bench and floor mats
- Personnel wear wrist or ankle grounding-straps
- Finished products are packed and shipped in protective bags
- Weekly audits of grounding equipment are made

MAGNETIC DEVICES

Magnetic devices have a critical role in the performance and safety of power supplies. To be certain that we have total control over all aspects of the magnetics which go into every Todd power supply, we design and build them ourselves.

CUSTOMER SERVICE

Everyone at Todd strives to provide the highest level of customer service in the industry. Our goal is to become the primary power supply vendor to each of our customers. Company growth has always been through expansion within our existing customer base. We know this can be achieved only when customer service is outstanding. Our promise of quality and service is backed by a two year warranty.

Magnetic devices have a critical role in the performance and safety of power supplies. To be certain that we have total control over all aspects of the magnetics which go into every Todd power supply, we design and build them ourselves.

TODD

How to Use This Power Supply Locator.

Todd Products Corp. has a wide range of switching power supplies. Available models range from 150 to 1500 watts; single and multiple output; AC or DC input. This Locator makes selection of the best power supply for your application simple. Here's how it works:

1. Determine your Input Voltage requirements: AC or DC.
2. Decide on your output needs: Single, Dual, Triple, or Quad output.
3. Calculate the maximum power the power supply must deliver.
4. Locate the appropriate section meeting these criteria.
5. Review the output current ratings of the products available within your needs.
6. Find detailed specifications for the model selected on the page shown in the locator.

Custom Designs

Custom Designs .... Page 28
If you cannot locate a standard product meeting your needs, please review the information on pages 28 and 29, and contact the factory.

Prices

Prices shown are list prices for small quantities. Companies needing production quantities can receive quantity pricing by contacting a Todd Products Area Business Manager, at the factory.

To Order

Terms and Conditions .... Page 30
Orders can be placed through your local representative or directly through the factory by calling 1-800-223-TODD, or 516-231-3366.

Technical Support

You can talk to an Engineer regarding applications, technical problems, etc., simply by calling our Toll Free Hot Line 1-800-223-TODD.

AC INPUT—SINGLE OUTPUT SERIES

		OUTPUT RATING	PWR OUT	SIZE	MODEL	LIST PRICE	PG
OUTPUT	5-VOLT	5V @ 30A	150w	9" x 5" x 2.5"	SC5-30	$215	24
		5V @ 50A	250w	9" x 5" x 2.5"	SC5-50	$285	24
		5V @ 70A	350w	11.5" x 5" x 2.5"	SC5-70	$345	26
		5V @ 100A	500w	11.5" x 5" x 2.5"	SC5-100	$465	26
		5V @ 200A	1000w	12" x 8" x 3.38"	SPF-1000-05	$950	10
		5V @ 300A	1500w	12" x 8" x 3.38"	SPF-1500-05	$1250	10
	12-VOLT	12V @ 15A	180w	9" x 5" x 2.5"	SC12-15	$215	24
		12V @ 21A	250w	9" x 5" x 2.5"	SC12-21	$285	24
		12V @ 30A	360w	11.5" x 5" x 2.5"	SC12-30	$345	26
		12V @ 42A	500w	11.5" x 5" x 2.5"	SC12-42	$465	26
		12V @ 84A	1000w	12" x 8" x 3.38"	SPF-1000-12	$950	10
		12V @ 125A	1500w	12" x 8" x 3.38"	SPF-1500-12	$1250	10
	15-VOLT	15V @ 12A	180w	9" x 5" x 2.5"	SC15-12	$215	24
		15V @ 17A	250w	9" x 5" x 2.5"	SC15-17	$285	24
		15V @ 24A	360w	11.5" x 5" x 2.5"	SC15-24	$345	26
		15V @ 34A	500w	11.5" x 5" x 2.5"	SC15-34	$465	26
		15V @ 67A	1000w	12" x 8" x 3.38"	SPF-1000-15	$950	10
		15V @ 100A	1500w	12" x 8" x 3.38"	SPF-1500-15	$1250	10
	24-VOLT	24V @ 7.5A	180w	9" x 5" x 2.5"	SC24-7.5	$215	24
		24V @ 11A	250w	9" x 5" x 2.5"	SC24-11	$285	24
		24V @ 15A	360w	11.5" x 5" x 2.5"	SC24-15	$345	26
		24V @ 21A	500w	11.5" x 5" x 2.5"	SC24-21	$465	26
		24V @ 42A	1000w	12" x 8" x 3.38"	SPF-1000-24	$950	10
		24V @ 63A	1500w	12" x 8" x 3.38"	SPF-1500-24	$1250	10
	28-VOLT	28V @ 6.5A	180w	9" x 5" x 2.5"	SC28-6.5	$215	24
		28V @ 9A	250w	9" x 5" x 2.5"	SC28-9	$285	24
		28V @ 13A	360w	11.5" x 5" x 2.5"	SC28-13	$345	26
		28V @ 18A	500w	11.5" x 5" x 2.5"	SC28-18	$465	26
		28V @ 36A	1000w	12" x 8" x 3.38"	SPF-1000-28	$950	10
		28V @ 54A	1500w	12" x 8" x 3.38"	SPF-1500-28	$1250	10
	48-VOLT	48V @ 3.7A	180w	9" x 5" x 2.5"	SC48-3.7	$215	24
		48V @ 5.5A	250w	9" x 5" x 2.5"	SC48-5.5	$285	24
		48V @ 8A	360w	11.5" x 5" x 2.5"	SC48-8	$345	26
		48V @ 11A	500w	11.5" x 5" x 2.5"	SC48-11	$465	26
		48V @ 21A	1000w	12" x 8" x 3.38"	SPF-1000-48	$950	10
		48V @ 32A	1500w	12" x 8" x 3.38"	SPF-1500-48	$1250	10

DC INPUT—SINGLE OUTPUT SERIES

		OUTPUT RATING	PWR OUT	SIZE	MODEL	LIST PRICE	PG
INPUT	24/28 VDC	5V @ 50A	250w	9" x 5" x 2.5"	DB5-50	$395	22
		12V @ 21A	250w	9" x 5" x 2.5"	DB12-21	$395	22
		15V @ 17A	250w	9" x 5" x 2.5"	DB15-17	$395	22
		24V @ 11A	250w	9" x 5" x 2.5"	DB24-11	$395	22
		28V @ 9A	250w	9" x 5" x 2.5"	DB28-9	$395	22
		48V @ 5.5A	250w	9" x 5" x 2.5"	DB48-5.5	$395	22
	48 VDC	5V @ 50A	250w	9" x 5" x 2.5"	DC5-50	$375	22
		12V @ 21A	250w	9" x 5" x 2.5"	DC12-21	$375	22
		15V @ 17A	250w	9" x 5" x 2.5"	DC15-17	$375	22
		24V @ 11A	250w	9" x 5" x 2.5"	DC24-11	$375	22
		28V @ 9A	250w	9" x 5" x 2.5"	DC28-9	$375	22
		48V @ 5.5A	250w	9" x 5" x 2.5"	DC48-5.5	$375	22

DC INPUT—MULTIPLE OUTPUT SERIES

		PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	SIZE	MODEL	LIST PRICE	PG
INPUT	24/28 VDC	275	+5V @ 45A	+12V @ 6.0A	−12V @ 6.0A		9" x 5" x 2.5"	DBT-273-0512	$550	22
		275	+5V @ 45A	+15V @ 5.0A	−15V @ 5.0A		9" x 5" x 2.5"	DBT-273-0515	$550	22
		275	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A		9" x 5" x 2.5"	DBX-273-0512	$550	22
		275	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	24V @ 1.5A	9" x 5" x 2.5"	DBX-274-1224	$550	22
		275	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	5.2V @ 2.0A	9" x 5" x 2.5"	DBX-274-1205	$550	22
	48 VDC	250	+5V @ 30A	+12V @ 5.0A	−12V @ 5.0A		9" x 5" x 2.5"	DCT-253-0512	$425	22
		250	+5V @ 30A	+15V @ 4.0A	−15V @ 4.0A		9" x 5" x 2.5"	DCT-253-0515	$425	22
		350	+5V @ 45A	+12V @ 6.0A	−12V @ 6.0A		9" x 5" x 2.5"	DCT-353-0512	$525	22
		350	+5V @ 45A	+15V @ 5.0A	−15V @ 5.0A		9" x 5" x 2.5"	DCT-353-0515	$525	22
		350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A		9" x 5" x 2.5"	DCX-353-0512	$525	22
		350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	24V @ 1.5A	9" x 5" x 2.5"	DCX-354-1224	$525	22
		350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	5.2V @ 2.0A	9" x 5" x 2.5"	DCX-354-1205	$525	22

Prices Subject to Change

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

POWER SUPPLY LOCATOR

AC INPUT—MULTIPLE OUTPUT SERIES

	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	SIZE	MODEL	PRICE	PG
DUAL/TRIPLE OUTPUT–AC INPUT	160	+5V @ 25A	+12V @ 4/9 Apk	12V @ 1.5A	—	9" x 5" x 2.5"	MDT-163-0512R	$225	18
	160	+5V @ 30A	+12V @ 1.50A	–12V @ 1.5A	—	9" x 5" x 2.5"	MTC-163-0512	$225	18
	160	+5V @ 30A	+15V @ 1.50A	–15V @ 1.5A	—	9" x 5" x 2.5"	MTC-163-0515	$225	18
	220	+5V @ 10A	+12V @ 10/16 Apk	–12V @ 1.0A	—	9" x 5" x 2.5"	MDT-223-1212R	$275	18
	220	+5V @ 30A	+12V @ 6/10 Apk	12V @ 2.5A	—	9" x 5" x 2.5"	MDT-223-0512R	$275	18
	250	+5V @ 30A	+12V @ 5.0A	–12V @ 5.0A	—	9" x 5" x 2.5"	MTC-253-0512	$355	12
	250	+5V @ 30A	+15V @ 4.0A	–15V @ 4.0A	—	9" x 5" x 2.5"	MTC-253-0515	$355	12
	250	+5V @ 35A	+12V @ 8/12 Apk	–12V @ 2.0A	—	9" x 5" x 2.5"	MTX-253-0512	$285	12
	350	+5V @ 30A	+12V @ 20/26 Apk	–12V @ 4.0A	—	9" x 5" x 2.5"	MSC-353-0512	$450	12
	350	+12V @ 30/36Apk	+5V @ 20A	–12V @ 4.0A	—	9" x 5" x 2.5"	MSC-353-1205	$450	12
	350	+5V @ 45A	+12V @ 6.0A	–12V @ 6.0A	—	9" x 5" x 2.5"	MTC-353-0512	$425	12
	350	+5V @ 45A	+15V @ 5.0A	–15V @ 5.0A	—	9" x 5" x 2.5"	MTC-353-0515	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	—	9" x 5" x 2.5"	MAX-353-0512	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	—	9" x 5" x 2.5"	MPS-353-0512	$425	20
	400	+5V @ 30A.	+12V @ 20/26Apk	–12V @ 4.0A	—	9" x 5.5" x 3.83"	MSC-353-0512F	$485	12
	400	+12V @ 30/36Apk	+5V @ 20.0A	–12V @ 4.0A	—	9" x 5.5" x 3.83"	MSC-353-1205F	$485	12
	400	+5V @ 20A	+12V @ 25/36 Apk	—	—	11.5" x 5" x 2.5"	MSC-402-0512	$485	14
	400	+5V @ 50A	+15V @ 6.5A	–15V @ 6.5A	—	11.5" x 5" x 2.5"	MTC-403-0515	$525	14
	400	+5V @ 70A	+12V @ 10/16 Apk	–12V @ 6.0A	—	11.5" x 5" x 2.5"	MAX-403-0512	$525	14
	500	+5V @ 70A	+15V @ 8.0A	–15V @ 8.0A	—	11.5" x 5" x 2.5"	MTC-503-0515	$565	14
	500	+5V @ 80A	+12V @ 10/16 Apk	–12V @ 10.0A	—	11.5" x 5" x 2.5"	MAX-503-0512	$565	14
	700	+5V @ 100A	+12V @ 12/20 Apk	–12V @ 10.0A	—	13.5" x 5" x 2.6"	MAX-703-0512	$695	16
	750	+5V @ 120A	+12V @ 12/20 Apk	–12V @ 10.0A	—	13.5" x 5" x 3.83"	MAX-753-0512	$745	16
	750	+5V @ 120A	+12V @ 20/27 Apk	–12V @ 6.0A	—	13.5" x 5" x 3.83"	MSC-753-0512	$745	16
	1000	+5V @ 150A	+12V @ 20/30 Apk	–12V @ 10.0A	—	12" x 8" x 3.38"	MAX-1003-0512	$1150	10
QUAD OUTPUT–AC INPUT	160	+5V @ 20A	+24V @ 3/6 Apk	+12V @ 1.0A	–12V @ 1.0A	9" x 5" x 2.5"	MDT-164-2412R	$225	18
	160	+5V @ 25A	+12V @ 4/9 Apk	+12V @ 1.0A	–12V @ 1.0A	9" x 5" x 2.5"	MDT-164-1212R	$225	18
	220	+5V @ 25A	+24V @ 4/8 Apk	+12V @ 1.5A	–12V @ 1.5A	9" x 5" x 2.5"	MDT-224-2412R	$275	18
	220	+5V @ 30A	+12V @ 6/10 Apk	+12V @ 1.5A	–12V @ 1.5A	9" x 5" x 2.5"	MDT-224-1212R	$275	18
	250	+5V @ 35A	+12V @ 8/12 Apk	–12V @ 4.0A	–5.2V @ 2.0A	9" x 5" x 2.5"	MAX-254-1205	$355	12
	250	+5V @ 35A	+12V @ 8/12 Apk	–12V @ 2.0A	5V @ 1.5A	9" x 5" x 2.5"	MTX-254-1205	$285	12
	250	+5V @ 35A	+12V @ 8/12 Apk	–12V @ 2.0A	12V @ 2.0A	9" x 5" x 2.5"	MTX-254-1212	$285	12
	250	+5V @ 35A	+12V @ 8/12 Apk	–15V @ 1.5A	15V @ 1.5A	9" x 5" x 2.5"	MTX-254-1215	$285	12
	250	+5V @ 35A	+12V @ 8/12 Apk	–12V @ 2.0A	24V @ 1.5A	9" x 5" x 2.5"	MTX-254-1224	$285	12
	350	+5V @ 40A	+15V @ 4.0A	–15V @ 4.0A	12V @ 2.0A	9" x 5" x 2.5"	MAX-354-1512	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–5.2V@ 10.0A	–12V @ 2.0A	9" x 5" x 2.5"	MAX-354-1252	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	–5.2V @ 2.0A	9" x 5" x 2.5"	MAX-354-1205	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	12V @ 2.0A	9" x 5" x 2.5"	MAX-354-1212	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	+24V @ 1.5A	9" x 5" x 2.5"	MAX-354-1224	$425	12
	350	+5V @ 50A	+24V @ 5/8 Apk	–12V @ 4.0A	12V @ 2.0A	9" x 5" x 2.5"	MAX-354-2412	$425	12
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	–5.2V @ 2.0A	9" x 5" x 2.5"	MPS-354-1205	$425	20
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	12V @ 2.0A	9" x 5" x 2.5"	MPS-354-1212	$425	20
	350	+5V @ 50A	+12V @ 8/12 Apk	–12V @ 4.0A	+24V @ 1.5A	9" x 5" x 2.5"	MPS-354-1224	$425	20
	400	+5V @ 70A	+12V @ 10/16 Apk	–5.2V@ 6.0A	12V @ 2.0A	11" x 5" x 2.5"	MAX-404-1252	$525	14
	400	+5V @ 70A	+12V @ 10/16 Apk	–12V @ 5.0A	12V @ 2.0A	11" x 5" x 2.5"	MAX-404-1212	$525	14
	500	+5V @ 80A	+12V @ 10/16 Apk	–5.2V@ 10.0A	12V @ 2.0A	11" x 5" x 2.5"	MAX-504-1252	$565	14
	500	+5V @ 80A	+12V @ 10/16 Apk	–12V @ 10.0A	5.2V @ 2.0A	11" x 5" x 2.5"	MAX-504-1205	$565	14
	500	+5V @ 80A	+12V @ 10/16 Apk	–12V @ 10.0A	12V @ 2.0A	11" x 5" x 2.5"	MAX-504-1212	$565	14
	500	+5V @ 80A	+12V @ 10/16 Apk	–12V @ 10.0A	+24V @ 2.0A	11" x 5" x 2.5"	MAX-504-1224	$565	14
	500	+5V @ 80A	+15V @ 10/16 Apk	– 5V @ 10.0A	15V @ 2.0A	11" x 5" x 2.5"	MAX-504-1552	$565	14
	500	+5V @ 80A	+24V @ 5/10 Apk	–12V @ 10.0A	12V @ 2.0A	11" x 5" x 2.5"	MAX-504-2412	$565	14
	700	+5V @ 100A	+12V @ 12/20 Apk	–5.2V@ 10.0A	12V @ 2.0A	13.5" x 5" x 2.6"	MAX-704-1252	$695	16
	700	+5V @ 100A	+12V @ 12/20 Apk	–12V @ 10.0A	5.2V @ 2.0A	13.5" x 5" x 2.6"	MAX-704-1205	$695	16
	700	+5V @ 100A	+12V @ 12/20 Apk	–12V @ 10.0A	12V @ 2.0A	13.5" x 5" x 2.6"	MAX-704-1212	$695	16
	700	+5V @ 100A	+12V @ 12/20 Apk	–12V @ 10.0A	+24V @ 2.0A	13.5" x 5" x 2.6"	MAX-704-1224	$695	16
	700	+5V @ 100A	+24V @ 6/10 Apk	–12V @ 10.0A	12V @ 2.0A	13.5" x 5" x 2.6"	MAX-704-2412	$695	16
	750	+5V @ 120A	+12V @ 12/20 Apk	–5.2V@ 10.0A	12V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-1252	$745	16
	750	+5V @ 120A	+12V @ 12/20 Apk	–12V @ 10.0A	5.2V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-1205	$745	16
	750	+5V @ 120A	+12V @ 12/20 Apk	–12V @ 10.0A	12V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-1212	$745	16
	750	+5V @ 120A	+12V @ 12/20 Apk	–12V @ 10.0A	+24V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-1224	$745	16
	750	+5V @ 120A	+15V @ 8.0 Apk	–15V @ 8.0A	12V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-1512	$745	16
	750	+5V @ 120A	+24V @ 6/10 Apk	–12V @ 10.0A	12V @ 2.0A	13.5" x 5" x 3.83"	MAX-754-2412	$745	16
	1000	+5V @ 150A	+12V @ 20/30 Apk	–12V @ 10.0A	3.3V @ 10.0A	12" x 8" x 3.38"	MAX-1004-1203	$1150	10
	1000	+5V @ 150A	+12V @ 20/30 Apk	–12V @ 10.0A	5V @ 10.0A	12" x 8" x 3.38"	MAX-1004-1205	$1150	10
	1000	+5V @ 150A	+12V @ 20/30 Apk	–12V @ 10.0A	12V @ 10.0A	12" x 8" x 3.38"	MAX-1004-1212	$1150	10
	1000	+5V @ 150A	+12V @ 20/30 Apk	–12V @ 10.0A	24V @ 5.0A	12" x 8" x 3.38"	MAX-1004-1224	$1150	10
	1000	+5V @ 150A	+15V @ 20/30 Apk	–15V @ 10.0A	12V @ 10.0A	12" x 8" x 3.38"	MAX-1004-1512	$1150	10
	1000	+5V @ 150A	+15V @ 20/30 Apk	–15V @ 10.0A	24V @ 5.0A	12" x 8" x 3.38"	MAX-1004-1524	$1150	10

Prices Subject to Change

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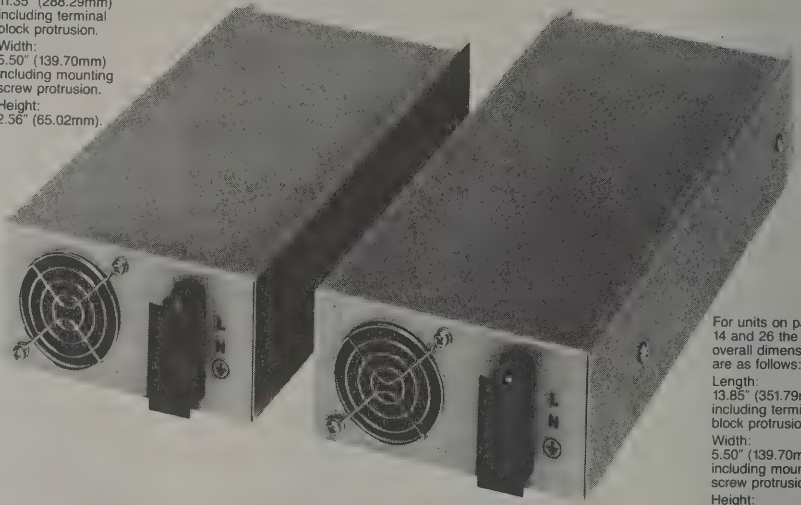
TODD

LOW-PROFILE COVER OPTION

New, low profile in-line cooling option for applications requiring special self-cooling or mounting configurations.

For units on pages 12, 20, 22, and 24 the overall dimensions are as follows:
Length:
11.35" (288.29mm) including terminal block protrusion.
Width:
5.50" (139.70mm) including mounting screw protrusion.
Height:
2.56" (65.02mm).



For units on pages 14 and 26 the overall dimensions are as follows:
Length:
13.85" (351.79mm) including terminal block protrusion.
Width:
5.50" (139.70mm) including mounting screw protrusion.
Height:
2.56" (65.02mm).

Features:

- Can be installed in locations where switching power supplies with top-mounted fans cannot be used
- End-panel fan and exhaust locations let multiple supplies be close-mounted either vertically or horizontally
- Smaller envelope requires less mounting space
- Self-cooling offers flexibility for power supply location within the overall system
- Lower volume, laminar air flow creates minimum disturbance to ambient system air and reduces overall noise
- All mounting surfaces are usable. Intake and exhaust are located in the front and back panel of the unit
- Fan position reinforces natural convection in vertically mounted units
- Covered input terminals comply with all safety regulations
- Adds only 2.35" to overall length of power supply
- Clean, contemporary look
- Available as low-cost option on most supplies (see chart)

The following switching power supply models accept low-profile **Option "V" Cover.**

Page 12
MAX-254
MAX-353
MAX-354
MTX-253
MTC-353
MSC-353 (350W)
MTX-253
MTX-254

Page 14
MAX-403
MAX-404
MAX-503
MAX-504
MTC-403
MTC-503

Page 20
MPS-353
MPS-354

Page 22
DC-ALL
DCT-ALL
DCX-ALL
DB-ALL
DBT-ALL
DBX-ALL

Page 24
SC-ALL (250W)

Page 26
SC-ALL (350W)
SC-ALL (360W)
SC-ALL (500W)
SC-ALL (520W)

Specify **Option "V" Cover** when ordering switching power supplies requiring low-profile cover option.

Consult factory for custom applications.

1000 WATTS
3.38″ x 8″ x 12″
SUPERMAX

Introducing SUPERMAX…
A New Concept in Power Supply Technology

1000 watts…Open frame technology…Designed-in power factor correction…Meets IEC 555-2… It's the new SUPERMAX series of switching power supplies and a whole new concept in power supply technology. With SUPERMAX, Todd Products has brought its advanced open frame switching power supply technololgy to the high power shoe box world. Now users of 1000 watt shoe box switchers have a superior alternative—the SUPERMAX 1000 with power factor correction to 0.99 designed-in, and the same flexible, high reliability, low cost designs that have made Todd's MAX series product line the industry standard in open frame switchers.

Designed-in Power Factor Correction

The SUPERMAX 1000 is the first 1000 watt power supply that incorporates power factor correction in the basic design. Unlike traditional shoe box switchers where power factor correction is an add-on, the SUPERMAX series was designed around a power factor correction base. The series incorporates a proprietary Todd design that optimizes both power factor and efficiency to achieve active power factor correction to 0.99 with efficiencies of over 75%, making it one of the best in the industry.

Operated from Standard AC Power Receptacles

As electronic systems have become more complex, the demand for power supplies with higher outputs, increased efficiencies, and lower power consumption has increased. A power factor of 0.99 and an efficiency of over 75% allows the SUPERMAX to be used in systems that must operate from standard AC power receptacles and draw less than 12 amps at 120 VAC. The SUPERMAX also meets the requirements of IEC 555-2 for harmonic line distortion, a specification that will be imposed on all systems sold in Europe.

The Smallest Power Factor Corrected 1000W Switcher

Housed in a low profile package, measuring 3.38″ × 8″ × 12″ versus traditional shoe box switchers that measure 5″ × 8″ × 12-15″, the SUPERMAX 1000 is the smallest power factor corrected 1000 watt unit available today. The package allows great flexibility in system mechanical design. Industry standard mounting allows three units to be mounted where two shoe box units were before.

High Reliability, Quick System Assembly, Low Cost

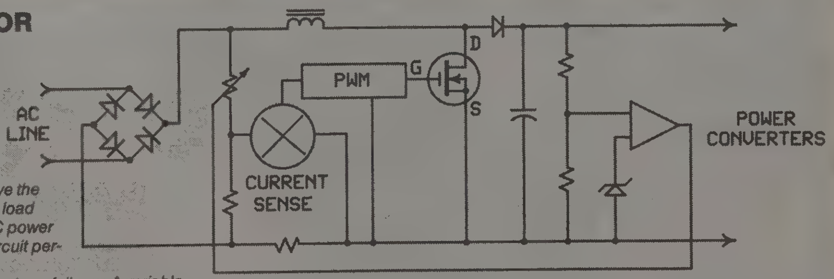
The SUPERMAX series was designed with several unique features and capabilities that ensure high reliability, lower cost, and improved system assembly. For example, customers have the option of self-cooling with internal ball-bearing fans, or a no-fan configuration for systems with supplied air cooling. Connectors are provided for AC input, outputs 2, 3 and 4, and status and control lines to facilitate high speed production assembly. This feature eliminates the barrier strip assembly process needed to install ring terminals during production and test.

The SUPERMAX features the proven and field tested reliability features that have made the MAX product lines an industry standard. These include MAGNA-FLUX mag amp control for 1% regulation on all outputs; true remote inhibit for system On/Off functions; VDE and FCC Class A RFI filtering; and International safety agency approvals (including IEC 950). All this at prices competitive with standard shoe box switchers without power factor correction.

Todd's SUPERMAX 1000 series is destined to be a super star.

SIMPLIFIED POWER FACTOR CORRECTOR CIRCUIT

Power factor is the ratio of power in watts to the product of volts and amperes flowing into a load. To minimize the amount of current required to supply power to the load, power factor should approach one. Unity power factor requires that the voltage and current be in phase as well as have the identical wave shape. The true unity power factor load looks purely resistive to the driving source, the AC power line. The Todd front end power factor corrector circuit performs this function.



The operation of the simplified schematic shown is as follows: A variable attenuator, controlled by a voltage regulating circuit, provides an attenuated replica of the line voltage to the AC line current sensing circuit. The current sensing circuit controls the charge and discharge of an energy storage choke to force the line current to track the line reference voltage. The circuit operates at a constant high frequency and forces continuous conduction of the choke when significant power is being drawn by the power supply load.

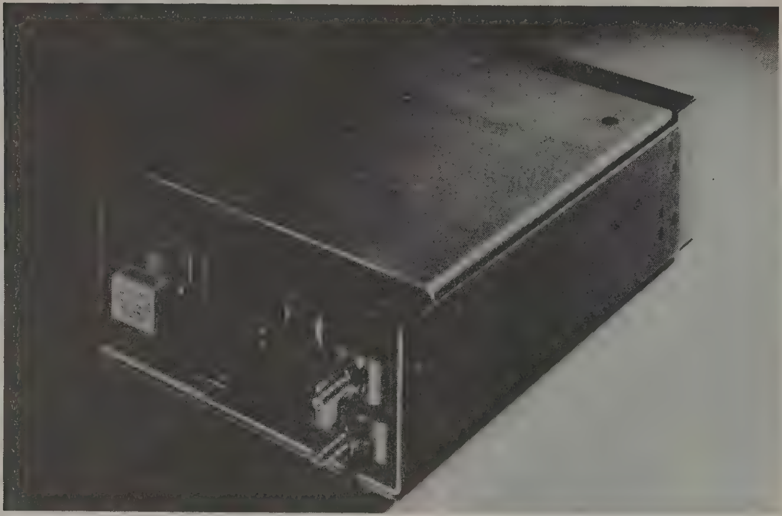
The output of the power factor corrector circuit is a regulated high voltage DC that feeds the output power converters of the power supply. Regulation is provided by sensing the voltage and controlling the attenuation of the variable attenuator which adjusts the reference to the current circuit. Regulation is maintained while keeping the power factor of the power supply at close to unity.

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

TODD

1000-1500 SINGLE OUTPUT
1000 WATT MULTI-OUTPUT
SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT
AVAILABLE
CONSULT FACTORY
FOR DETAILS



The Ultra-compact SUPERMAX 1000 and 1500

Featuring:

- Compact, low-profile package, only 3.38"H x 8"W x 12"L
- Active Power Factor Correction to 0.99
- Designed for low AC line distortion per IEC 555-2
- Aux. outputs are Todd MAGNA-FLUX mag amp regulated
- High-reliability, low-cost open frame technology
- Integral RFI filters meet EN 55022 level B and FCC, Class A
- True remote inhibit for system on/off

Now SUPERMAX, the smallest 1000 watt power factor corrected open frame switcher, is also available in single-output 1000 and 1500 watt versions. Incorporating all the innovation of the multi-output 1000 watt, Todd's SUPERMAX series offers high performance and low cost with reliable open frame technology. Connectors are provided for quick system assembly, and units can be operated without fans with sufficient customer-supplied airflow. SUPERMAX gives you all this and more at prices no higher than those of common shoe box switchers without pf correction.

1000 WATT—MULTI-OUTPUT DC INPUT 3.38" x 8" x 12"

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MAX-1003-0512	1000	+5V @ 150A	+12V @ 20/30 Apk	−12V @ 10A	—
MAX-1004-1203	1000	+5V @ 150A	+12V @ 20/30 Apk	−12V @ 10A	3.3V @ 10A
MAX-1004-1205	1000	+5V @ 150A	+12V @ 20/30 Apk	−12V @ 10A	5V @ 10A
MAX-1004-1212	1000	+5V @ 150A	+12V @ 20/30 Apk	−12V @ 10A	12V @ 10A
MAX-1004-1224	1000	+5V @ 150A	+12V @ 20/30 Apk	−12V @ 10A	24V @ 5A
MAX-1004-1512	1000	+5V @ 150A	+15V @ 20/30 Apk	−15V @ 10A	12V @ 10A
MAX-1004-1524	1000	+5V @ 150A	+15V @ 20/30 Apk	−15V @ 10A	24V @ 5A

1000 WATT
90-264 VAC INPUT—SINGLE OUTPUT

ADVANCE PRODUCT INFORMATION

MODEL	OUTPUT RATING	PWR OUT
SPF-1000-05	5V @ 200A	1000w
SPF-1000-12	12V @ 84A	1000w
SPF-1000-15	15V @ 67A	1000w
SPF-1000-24	24V @ 42A	1000w
SPF-1000-28	28V @ 36A	1000w
SPF-1000-48	48V @ 21A	1000w

1500 WATT
180-264 VAC INPUT—SINGLE OUTPUT

ADVANCE PRODUCT INFORMATION

MODEL	OUTPUT RATING	PWR OUT
SPF-1500-05	5V @ 300A	1500w
SPF-1500-12	12V @ 125A	1500w
SPF-1500-15	15V @ 100A	1500w
SPF-1500-24	24V @ 63A	1500w
SPF-1500-28	28V @ 54A	1500w
SPF-1500-48	48V @ 32A	1500w

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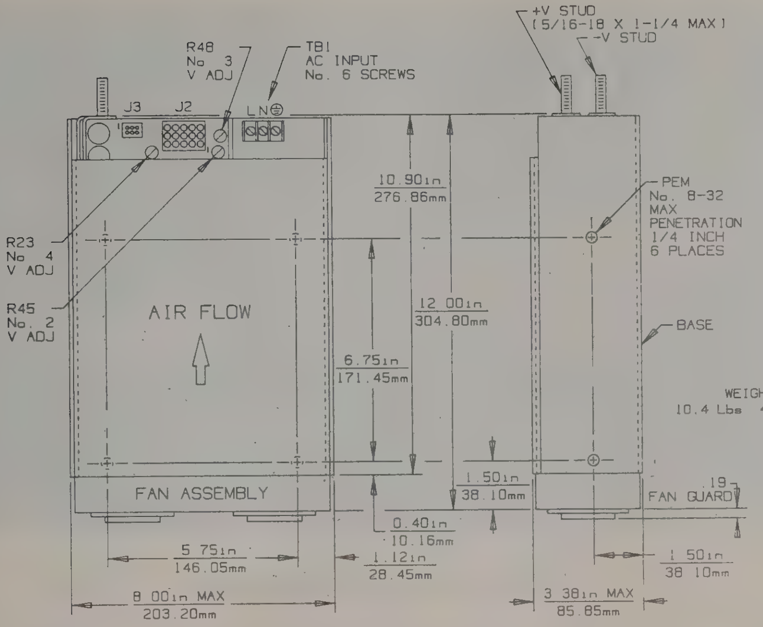
1000-1500 WATTS
3.38″ × 8″ × 12″
SUPERMAX



SPECIFICATIONS: ALL MODELS.

AC Input: 90-264 Vac continuous range, 47 to 63 Hz. Internally fused for 20 A.
Power Factor: 0.99 typical at full load.
Input Current: 12A max @ 120 Vac under full load conditions.
Adjustability: All outputs user adjustable.
Line & Load Reg: ±1% over AC input range and 0 to 100% load change. Main +5V output requires minimum load of 10%.
Ripple & Noise: Less than 0.2% rms, 1% p-p or 100mV, whichever is greater.
Remote Sense (Output #1): Compensates for 250 mV total line drop. Open sense lead protection.
Temperature Coefficient: 0.02% per degree C.
Stability: 0.1% over 8 hours after 30 minutes warm-up.
Transient Response (+5V): Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.
Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.
Overvoltage Protection (All outputs): Protects load against power supply induced overvoltage. Trip point is set at maximum 136% of nominal voltage.
Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.
Inrush: Cold Start AC current is less than 90 A at 115 Vac, 180 A at 230 Vac. Limited by surgistor.
Brownout Protection: Holds regulation to 85 Vac.
Thermal Protection: Shuts down power supply if overheated. Automatic recovery.
Holdup Time: 20 ms minimum after removal of power at full load and through input voltage range.
Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.
Efficiency: 75% typical.
Safety Agencies: Contact factory for status of UL1950 recognition, CSA22.2 #234 certification, and licensing by TUV to IEC950, VDE 0805, and class 1, SELV.
Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."
Output Isolation: Isolated from ground 50 V.
Reverse Voltage: Protected against reverse voltage up to supply current rating.
DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal.
Power Fail: Provide TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power, VMEbus compatible, provides 48ma sink current capability.
Cooling: Self-cooled with internal ball-bearing fans. Can be operated without fans with sufficient customer-supplied air flow.
Reliability: Over 100,000 hours, when calculated in accordance with MIL-HDBK-217E, and in Option "X" configuration.
Remote Inhibit: True inhibit shuts unit off with TTL "0" signal, or contact closure.

OPTIONS:

Option "X", System Cooling: Customer supplied air of 100 CFM through end of unit provides sufficient cooling for full power operation. Fans are not included with unit.

Consult factory for other available options.

AC INPUT (90-264 Vac Continuous Range)

FUNCTION	115 Vac	230 Vac	CONNECTOR
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8″ Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	LOCATION	NOTES	CONNECTOR
Output #1	Terminal marked +V	Main output	Stud 5/16-18 x 1 1/4″
	Terminal marked −V	5 Volt Rtn (common)	
Output #2	J2-1, J2-2 and J2-3(+)	Aux output	Pin header AMP MATE-N-LOK Type 350830-1. Mates with plug housing 350736-1 with Pins.
	J2-4, J2-5, and J2-6 (RTN)	Aux Return (common)	
Output #3	J2-7, J2-8, and J2-9(−)	Aux output	
	J2-4, J2-5 and J2-6 (RTN)	Aux Return (common)	
Output #4	J2-10, J2-11 and J2-12(+)	Floating output	
	J2-13, J2-14, and J2-15(−)		

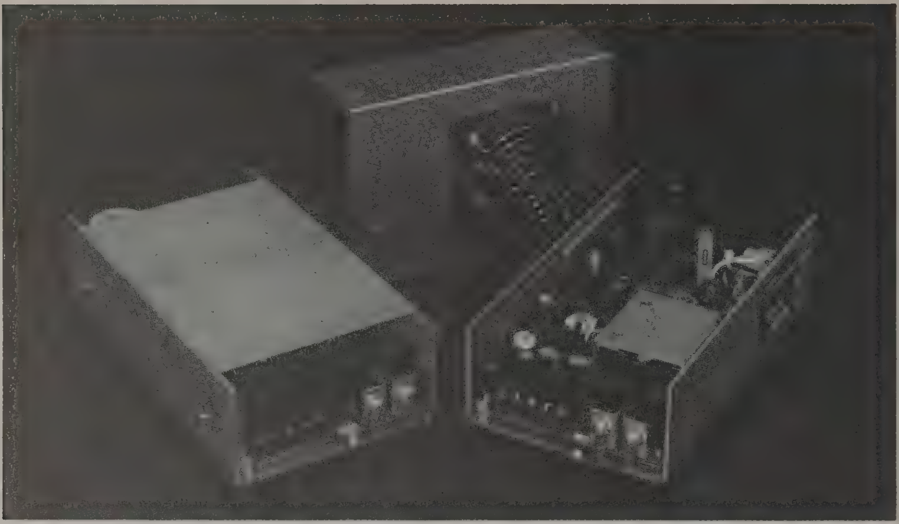
STATUS AND CONTROL

FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J3-1	Output #1 Sense	Pin header Molex 1625-6 Series with Sockets 1779 Series. Mates with plug housing 1625-6 Series with Pins Series 1560.
	J3-4	Output #1 Sense Rtn	
DC Power Good	J3-3	Reference to J3-4	
AC Power Fail	J3-5	Reference to J3-4	
Inhibit Input	J3-6	Short to J3-4	

TODD

MULTI-OUTPUT 250 – 350 WATT SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT AVAILABLE
CONSULT FACTORY FOR DETAILS



The 9-Inch Powerhouse

Featuring:

- Over 3 watts/in³ Power Density
- 80% Overall Efficiency
- Over 100,000 hours MTBF
- International Safety Requirements
- All outputs regulated ± 1%
- High Peak Currents for Motor Starting
- System Air or Self-Cooling Option
- AC Automatic Line Selection Option
- Available in 24, 28 or 48V dc input (See pg. 22)

STANDARD MAX SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MAX-254-1205	250	+5V @ 35A	+12V @ 8/12 Apk	−12V @ 4.0A	−5.2V @ 2.0A
MAX-353-0512	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	
MAX-354-1205	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	−5.2V @ 2.0A
MAX-354-1212	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	12V @ 2.0A
MAX-354-1224	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	+24V @ 1.5A
MAX-354-1252	350	+5V @ 50A	+12V @ 8/12 Apk	−5.2V @ 10.0A	−12V @ 2.0A
MAX-354-2412	350	+5V @ 50A	+24V @ 5/8 Apk	−12V @ 4.0A	+12V @ 2.0A
MAX-354-1512	350	+5V @ 40A	+15V @ 4.0A	−15V @ 4.0A	12V @ 2.0A

TELECOM MTC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3
MTC-253-0512	250	+5V @ 30A	+12V @ 5.0A	−12V @ 5.0A
MTC-253-0515	250	+5V @ 30A	+15V @ 4.0A	−15V @ 4.0A
MTC-353-0512	350	+5V @ 45A	+12V @ 6.0A	−12V @ 6.0A
MTC-353-0515	350	+5V @ 45A	+15V @ 5.0A	−15V @ 5.0A

MASS STORAGE MSC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3
MSC-353-0512	350	+5V @ 30A	+12V @ 20/26 Apk	−12V @ 4.0A
MSC-353-1205	350	+12V @ 30/36 Apk	+5V @ 20.0A	−12V @ 4.0A
MSC-353-0512F	400	+5V @ 30A	+12V @ 20/26 Apk	−12V @ 4.0A
MSC-353-1205F	400	+12V @ 30/36 Apk	+5V @ 20.0A	−12V @ 4.0A

SMALL COMPUTER MTX SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MTX-253-0512	250	+5V @ 35A	+12V @ 8/12 Apk	−12V @ 2.0A	
MTX-254-1205	250	+5V @ 35A	+12V @ 8/12 Apk	−12V @ 2.0A	5V @ 1.5A
MTX-254-1212	250	+5V @ 35A	+12V @ 8/12 Apk	−12V @ 2.0A	12V @ 2.0A
MTX-254-1215	250	+5V @ 35A	+12V @ 8/12 Apk	−15V @ 1.5A	15V @ 1.5A
MTX-254-1224	250	+5V @ 35A	+12V @ 8/12 Apk	−12V @ 2.0A	24V @ 1.5A

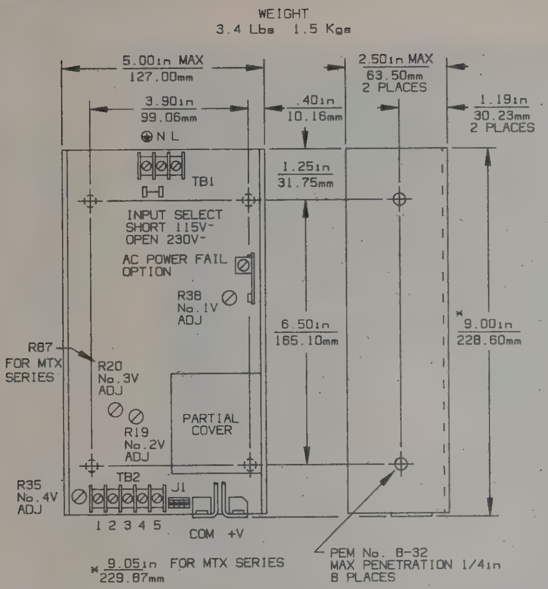
The appropriate 9-inch Powerhouse in your telecom product gives you the outputs you need for ISDN, LAN, and T1 applications, and standard voice and data networks. High current auxiliary outputs provide regulation characteristics for proper operation of line drivers, network interfaces and RS232 type outputs. Or, use a 9-inch Powerhouse in your computer-based product for needed output regulation, power for 50 Amps of Logic and four hard disk drives requirements.

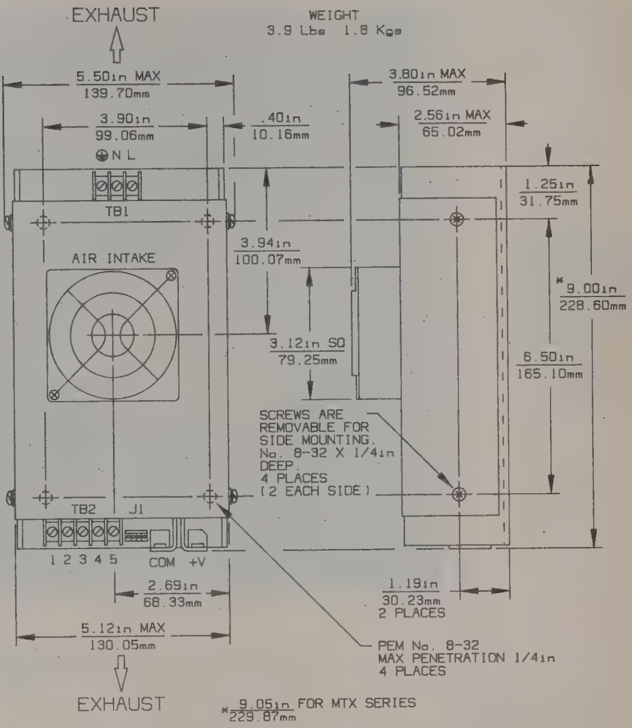
And, you can increase power by 40% as you add peripherals–without redesigning for a larger power supply by upgrading from the MDT 160/220 series.

Check the specifications of these low-profile, 9-inch Powerhouse switchers that give you more design freedom.

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

250-350 WATTS
9″ x 5″ x 2.5″
MAX MTC MSC MTX


WEIGHT
3.4 Lbs 1.5 Kgs
5.00in MAX 127.00mm
3.90in 99.06mm
2.50in MAX 63.50mm 2 PLACES
.40in 10.16mm
1.19in 30.23mm 2 PLACES
N L
TB1
1.25in 31.75mm
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL OPTION
R38 No.1V ADJ
6.50in 165.10mm
*9.00in 228.60mm
R87 FOR MTX SERIES
R20 No.3V ADJ
R19 No.2V ADJ
PARTIAL COVER
R35 No.4V ADJ
TB2
J1
1 2 3 4 5
COM +V
*9.05in 229.87mm FOR MTX SERIES
PEM No. 8-32 MAX PENETRATION 1/4in 8 PLACES


EXHAUST
WEIGHT
3.9 Lbs 1.8 Kgs
5.50in MAX 139.70mm
3.90in 99.06mm
.40in 10.16mm
N L
TB1
3.80in MAX 96.52mm
2.56in MAX 65.02mm
1.25in 31.75mm
3.94in 100.07mm
AIR INTAKE
*9.00in 228.60mm
3.12in SQ 79.25mm
6.50in 165.10mm
SCREWS ARE REMOVABLE FOR SIDE MOUNTING. No. 8-32 X 1/4in DEEP. 4 PLACES (2 EACH SIDE)
TB2
J1
1 2 3 4 5
COM +V
2.69in 68.33mm
1.19in 30.23mm 2 PLACES
5.12in MAX 130.05mm
PEM No. 8-32 MAX PENETRATION 1/4in 4 PLACES
EXHAUST
*9.05in 229.87mm FOR MTX SERIES

SPECIFICATIONS:

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option "A" for automatic line selection. Internally fused for 10 A.

Adjustability: All outputs user adjustable ±5% minimum.

Line & Load Reg: ±1% over AC input range and 0 to 100% load change. Output #1 requires minimum load of 10%.

Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.

Remote Sense (Output #1): Compensates for 250 mV total line drop. Open sense lead protection.

Temperature Coefficient: 0.02% per degree C.

Stability: 0.1% over 8 hours after 30 minutes warm-up.

Transient Response (Output #1): Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.

Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.

Overvoltage Protection (Output #1): Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 136% of nominal.

Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.

Inrush: Cold Start AC current is less than 10 A at 115 Vac, 18 A at 230 Vac. For MTX, 10 A at 115 Vac, 20 A at 230 Vac. Limited by surgistor.

Brownout Protection: Holds regulation to 85 Vac or 170 Vac.

Thermal Protection: Shuts down power supply if overheated. Automatic recovery.

Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.

Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.

Efficiency: 80% typical.

Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.

Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."

Output Isolation: Isolated from ground 50 V.

Reverse Voltage: Protected against reverse voltage up to supply current rating.

Cooling: 30 CFM required to achieve full ratings.

Reliability: Over 100,000 hours MTBF; when calculated in accordance with MIL-HDBK-217.

Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero.

OPTIONS:

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.

Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.

Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature.

Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal. Not available if Option "P" is selected.

Option "P", Power Fail: Provides TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48ma sink current capability. Not available if Option "G" is selected.

Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	0.187 Male Fastons
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8″ Centers
TB1-N	Neutral	Line 2	
TB1-⏚	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	MAX, MTC, MTX	MSC	CONNECTOR
Output #1	Terminal marked +V	Terminal marked +V	Bus Bars #10-32 Screws
	Terminal marked COM	Terminal marked COM	
Output #2	TB2-3 (+)	TB2-2	Barrier Strip #6-32 Screws 3/8″ centers
	TB2-4 (RTN)	TB2-1 (RTN)	
Output #3	TB2-5 (−)	TB2-3 (−)	
	TB2-4 (RTN)	TB2-1 (RTN)	
Output #4 (if provided)	TB2-1 (+)		
	TB2-2 (−)		

Note: Return (RTN) lines are connected to power supply common.

STATUS AND CONTROL

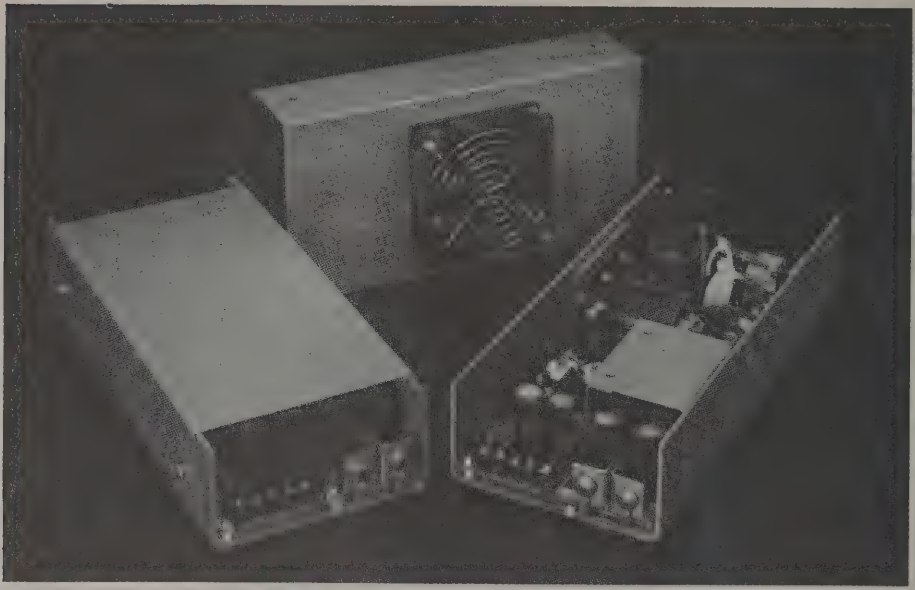
FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J1-1 (+S)	Output #1 Sense	AMP MTA Type #640456-4 Pin Header (locking)
	J1-2 (−S)	Output #1 Sense Rtn	
*AC Power Fail, or DC Power Good	J1-3 (PF)	Reference to J1-2 (−S)	
Inhibit Input	J1-4 (IH)	Short to J1-2 (−S)	

*Optional Function.

TODD

MULTI-OUTPUT 400 – 500 WATT SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT AVAILABLE
CONSULT FACTORY FOR DETAILS



The Bus Drivers

Featuring:

- 11.5″ x 5″ x 2.5″ Package
- Up to 3.5 watts/in³ Power Density
- 80% Overall Efficiency
- VMEbus and Multibus II System Compatibility
- Over 100,000 hours MTBF
- Meets International Safety Agency Requirements
- High Efficiency MAGNA-FLUX ±1% Post Regulators
- System Air or Self-Cooling Option
- AC Automatic Line Selection Option

STANDARD MAX SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MAX-403-0512	400	+5V @ 70A	+12V @ 10/16 Apk	−12V @ 6.0A	
MAX-404-1212	400	+5V @ 70A	+12V @ 10/16 Apk	−12V @ 5.0A	12V @ 2.0A
MAX-404-1252	400	+5V @ 70A	+12V @ 10/16 Apk	−5.2V @ 6.0A	12V @ 2.0A
MAX-503-0512	500	+5V @ 80A	+12V @ 10/16 Apk	−12V @ 10.0A	
MAX-504-1205	500	+5V @ 80A	+12V @ 10/16 Apk	−12V @ 10.0A	5.2V @ 2.0A
MAX-504-1212	500	+5V @ 80A	+12V @ 10/16 Apk	−12V @ 10.0A	12V @ 2.0A
MAX-504-1224	500	+5V @ 80A	+12V @ 10/16 Apk	−12V @ 10.0A	+24V @ 2.0A
MAX-504-1252	500	+5V @ 80A	+12V @ 10/16 Apk	−5.2V @ 10.0A	12V @ 2.0A
MAX-504-1552	500	+5V @ 80A	+15V @ 10/16 Apk	−5V @ 10.0A	15V @ 2.0A
MAX-504-2412	500	+5V @ 80A	+24V @ 5/10 Apk	−12V @ 10.0A	12V @ 2.0A

TELECOM MTC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3
MTC-403-0515	400	+5V @ 50A	+15V @ 6.5A	−15V @ 6.5A
MTC-503-0515	500	+5V @ 70A	+15V @ 8.0A	−15V @ 8.0A

MASS STORAGE MSC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2
MSC-402-0512*	400	+5V @ 20A	+12V @ 25/36 Apk

*Contact factory for detailed mechanical and electrical specifications. The drawings on opposite page do not represent this MSC product. The MSC-402 features input and output connectors, remote sense on Output #1 and Output #2, and remote on/off—all standard.

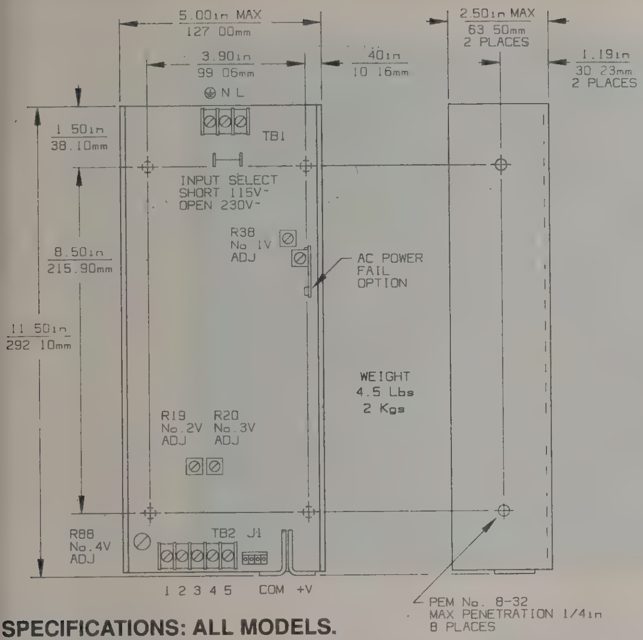
VMEbus and Multibus compatibility is only one feature of this series. You'll find switchers to power up to 80 Amps of Logic and four hard disk drives–with up to 16 Amps peak current to meet peripheral startup needs.

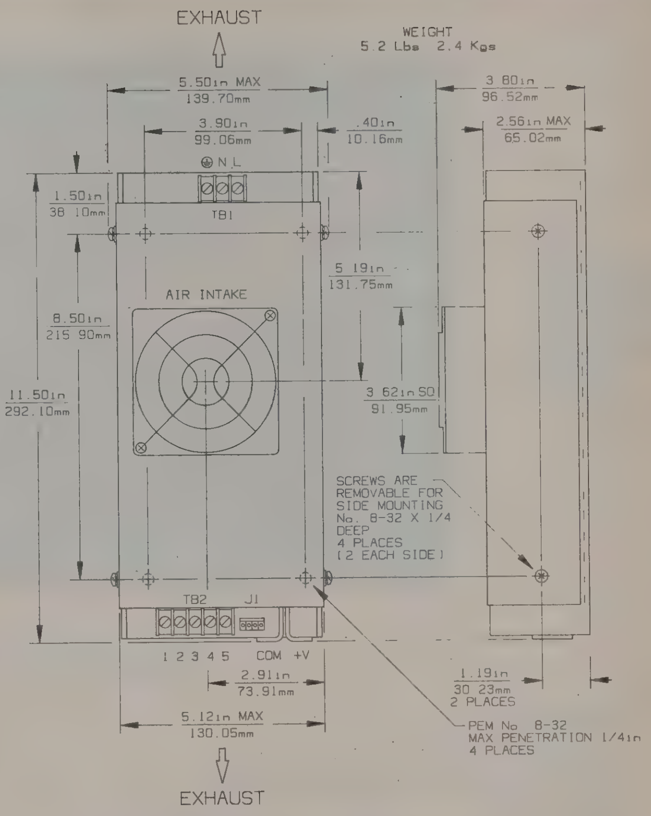
You'll find the outputs you need for ISDN, LAN, T1 applications and for standard voice and data networks. High current auxiliary outputs provide regulation characteristics for proper operation of line drivers, network interfaces, and RS232 type outputs. And, you can upgrade power output by 25% without redesigning for a larger power supply.

Check the specifications of these bus driving switching power supplies to find the right one for your products.

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

400-500 WATTS
11.5″ x 5″ x 2.5″
MAX MTC MSC


5.00in MAX
127.00mm
3.90in
99.06mm
.40in
10.16mm
2.50in MAX
63.50mm
2 PLACES
1.19in
30.23mm
2 PLACES
⊕ N L
TB1
1.50in
38.10mm
INPUT SELECT
SHORT 115V~
OPEN 230V~
R38
No.1V
ADJ
AC POWER
FAIL
OPTION
8.50in
215.90mm
11.50in
292.10mm
WEIGHT
4.5 Lbs
2 Kgs
R19 No.2V ADJ
R20 No.3V ADJ
R88
No.4V
ADJ
TB2 J1
1 2 3 4 5 COM +V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES


EXHAUST
WEIGHT
5.2 Lbs 2.4 Kgs
5.50in MAX
139.70mm
3.90in
99.06mm
.40in
10.16mm
3.80in
96.52mm
2.56in MAX
65.02mm
⊕ N L
TB1
1.50in
38.10mm
5.19in
131.75mm
AIR INTAKE
8.50in
215.90mm
11.50in
292.10mm
3.62in SQ
91.95mm
SCREWS ARE
REMOVABLE FOR
SIDE MOUNTING
No. 8-32 X 1/4
DEEP
4 PLACES
(2 EACH SIDE)
TB2 J1
1 2 3 4 5 COM +V
2.91in
73.91mm
5.12in MAX
130.05mm
1.19in
30.23mm
2 PLACES
PEM No. 8-32
MAX PENETRATION 1/4in
4 PLACES
EXHAUST

SPECIFICATIONS: ALL MODELS.

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option "A" for automatic line selection. Internally fused for 12 A.
Adjustability: All outputs user adjustable ±5% minimum, except where noted.
Line & Load Reg: ±1% over AC input range and 0 to 100% load change. Main +5V output requires minimum load of 10%.
Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.
Remote Sense (±5V): Compensates for 250 mV total line drop. Open sense lead protection.
Temperature Coefficient: 0.02% per degree C.
Stability: 0.1% over 8 hours after 30 minutes warm-up.
Transient Response (+5V): Output voltage returns to within 1% in less than 500 μsec for a 50% load change. Peak transient does not exceed 5%.
Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.
Overvoltage Protection (+5V): Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 6.8V.
Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.
Inrush: Cold Start AC current is less than 80 A at 115 Vac, 20 A at 230 Vac. Limited by surgistor.
Brownout Protection: Holds regulation to 85 Vac or 170 Vac.
Thermal Protection: Shuts down power supply if overheated. Automatic recovery.
Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.
Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.
Efficiency: 80% typical.
Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.
Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."
Output Isolation: Isolated from ground 50 V.
Reverse Voltage: Protected against reverse voltage up to supply current rating.
Cooling: 30 CFM required to achieve full ratings.
Reliability: Over 100,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.
Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero.

OPTIONS:

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.
Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.
Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature. 2.5" dim. increases to 3.8".
Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal. Not available if Option "P" is selected.
Option "P", Power Fail: Provides TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48ma sink current capability. Not available if Option "G" is selected.
Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	0.250 Male Fastons
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8" Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	MAX & MTC	MSC	CONNECTOR
Output #1	Terminal marked +V	Terminal marked +V	Bus Bars #1/4-20 Screws
	Terminal marked COM	Terminal marked COM	
Output #2	TB2-3 (+)	TB2-2 and TB2-3 (+)	Barrier Strip #6-32 Screws 3/8" centers
	TB2-4 (RTN)	TB2-1 and TB2-4 (RTN)	
Output #3	TB2-5 (−)	TB2-5 (−)	
	TB2-4 (RTN)	TB2-4 (RTN)	
Output #4 (if provided)	TB2-1 (+)		
	TB2-2 (−)		

Note: Return (RTN) lines are connected to power supply common.

STATUS AND CONTROL

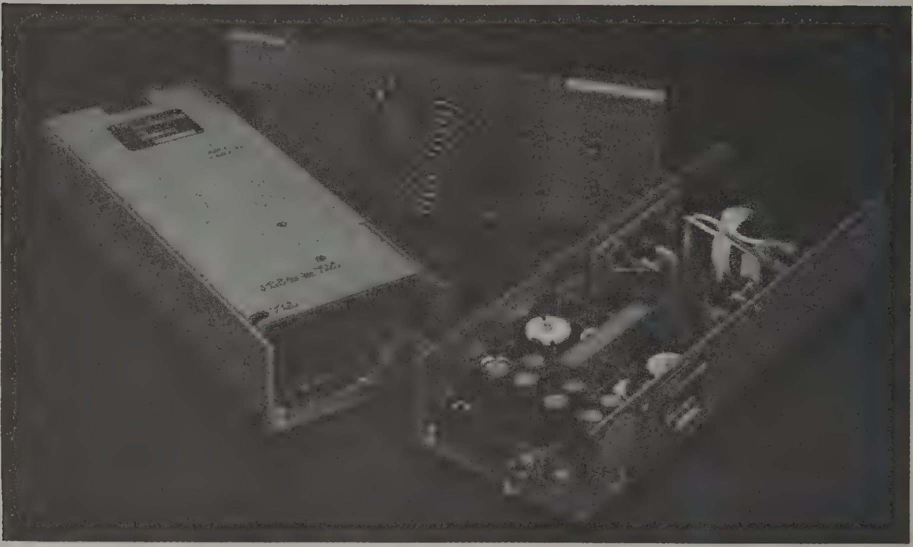
FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J1-1 (+S)	Output #1 Sense	AMP MTA Type #640456-4 Pin Header (locking)
	J1-2 (−S)	Output #1 Sense Rtn	
*AC Power Fail, or DC Power Good	J1-3 (PF)	Reference to J1-2 (−S)	
Inhibit Input	J1-4 (IH)	Short to J1-2 (−S)	

*Optional Function.

TODD

MULTI-OUTPUT
700 – 750 WATT
SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT
AVAILABLE
CONSULT FACTORY
FOR DETAILS



The Shoe Box Alternative

Featuring:

- Cost/Watt Savings of 30%
- 58% Smaller than Equivalent Shoe Box
- 4 watts/in^3
- Meets International Safety Agency Requirements
- All Outputs Fully Regulated
- High Peak Current for Motor Starting
- High Efficiency MAGNA-FLUX Post Regulators
- Reliability Approaching 100,000 hours MTBF
- AC Automatic Line Selection Option

Specify in the appropriate MAX-700 or MAX-750 and get new design freedom for your high-end computer products. Use a system air cooled MAX-700, an optional self-cooled MAX-700 or standard self-cooled MAX-750. You can reduce your product size by replacing a 5″ x 8″ x 11″ shoe box with a 58% smaller MAX-750. Build in power supply redundancy by replacing one shoe box switcher with two MAX-700's in the same space.

Check the specifications and dimensions of these alternatives to shoe box power supplies.

STANDARD MAX SERIES

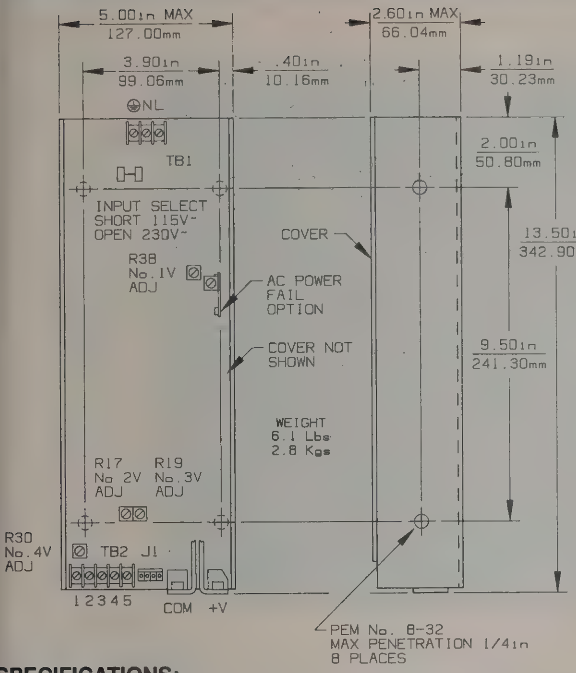
MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MAX-703-0512	700	+5V @ 100A	+12V @ 12/20 Apk	−12V @ 10.0A	
MAX-704-1205	700	+5V @ 100A	+12V @ 12/20 Apk	−12V @ 10.0A	5.2V @ 2.0A
MAX-704-1212	700	+5V @ 100A	+12V @ 12/20 Apk	−12V @ 10.0A	12V @ 2.0A
MAX-704-1224	700	+5V @ 100A	+12V @ 12/20 Apk	−12V @ 10.0A	+24V @ 2.0A
MAX-704-1252	700	+5V @ 100A	+12V @ 12/20 Apk	−5.2V @ 10.0A	12V @ 2.0A
MAX-704-2412	700	+5V @ 100A	+24V @ 6/10 Apk	−12V @ 10.0A	12V @ 2.0A
MAX-753-0512	750	+5V @ 120A	+12V @ 12/20 Apk	−12V @ 10.0A	
MAX-754-1205	750	+5V @ 120A	+12V @ 12/20 Apk	−12V @ 10.0A	5.2V @ 2.0A
MAX-754-1212	750	+5V @ 120A	+12V @ 12/20 Apk	−12V @ 10.0A	12V @ 2.0A
MAX-754-1224	750	+5V @ 120A	+12V @ 12/20 Apk	−12V @ 10.0A	+24V @ 2.0A
MAX-754-1252	750	+5V @ 120A	+12V @ 12/20 Apk	−5.2V @ 10.0A	12V @ 2.0A
MAX-754-1512	750	+5V @ 120A	+15V @ 8.0A	−15V @ 8.0A	12V @ 2.0A
MAX-754-2412	750	+5V @ 120A	+24V @ 6/10 Apk	−12V @ 10.0A	12V @ 2.0A

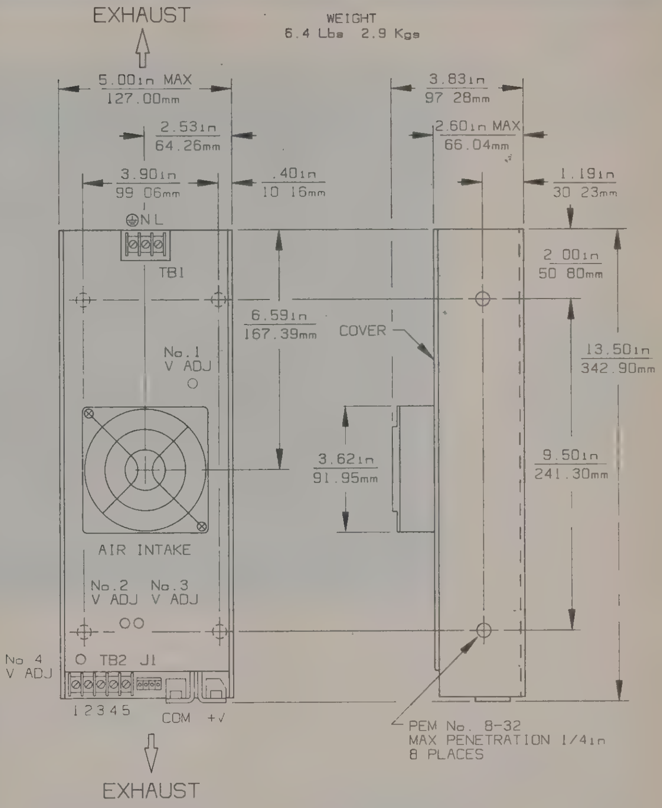
MASS STORAGE MSC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3
MSC-753-0512	750	+5V @ 120A	+12V @ 20/27 Apk	−12V @ 6A

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

700-750 WATTS
13.5″ x 5″ x 2.6″
MAX MSC


5.00in MAX
127.00mm
3.90in
99.06mm
.40in
10.16mm
2.60in MAX
66.04mm
1.19in
30.23mm
NL
TB1
INPUT SELECT
SHORT 115V~
OPEN 230V~
R38
No.1V
ADJ
COVER
AC POWER
FAIL
OPTION
COVER NOT
SHOWN
2.00in
50.80mm
13.50in
342.90mm
9.50in
241.30mm
WEIGHT
6.1 Lbs
2.8 Kgs
R17
No 2V
ADJ
R19
No.3V
ADJ
R30
No.4V
ADJ
TB2
J1
12345
COM
+V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES


EXHAUST
WEIGHT
6.4 Lbs 2.9 Kgs
5.00in MAX
127.00mm
2.53in
64.26mm
3.90in
99.06mm
.40in
10.16mm
3.83in
97.28mm
2.60in MAX
66.04mm
1.19in
30.23mm
NL
TB1
6.59in
167.39mm
COVER
2.00in
50.80mm
No.1
V ADJ
13.50in
342.90mm
3.62in
91.95mm
9.50in
241.30mm
AIR INTAKE
No.2
V ADJ
No.3
V ADJ
No 4
V ADJ
TB2
J1
12345
COM
+V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES
EXHAUST

SPECIFICATIONS:

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option “A” for automatic line selection. Internally fused for 15 A.

Adjustability: All outputs user adjustable ± 5% minimum, except where noted.

Line & Load Reg: ±1% over AC input range and 0 to 100% load change. Main +5V output requires minimum load of 10%.

Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.

Remote Sense (+5V): Compensates for 250 mV total line drop. Open sense lead protection.

Temperature Coefficient: 0.02% per degree C.

Stability: 0.1% over 8 hours after 30 minutes warm-up.

Transient Response (+5V): Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.

Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.

Overvoltage Protection (+5V): Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 6.8V.

Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.

Inrush: Cold Start AC current is less than 90 A at 115 Vac, 30 A at 230 Vac. Limited by surgistor.

Brownout Protection: Holds regulation to 85 Vac or 170 Vac.

Thermal Protection: Shuts down power supply if overheated. Automatic recovery.

Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.

Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.

Efficiency: 80% typical.

Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.

Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level “B”; and German Decree “VFG 243.”

Output Isolation: Isolated from ground 50 V.

Reverse Voltage: Protected against reverse voltage up to supply current rating.

Cooling: MAX-700 models require 60 CFM of air to achieve full ratings except when specifying option “F”, Fan Assembly. 750 watt models have built-in ball-bearing fan.

Reliability: Over 80,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.

Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero.

OPTIONS:

Option “A”, AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.

Option “F”, Fan Assembly: Integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature. 750 watt models have built-in ball-bearing fan.

Option “G”, DC Power Good: Provides a TTL “1” when output #1 is above 4.6 Vdc nominal. Not available if Option “P” is selected.

Option “P”, Power Fail: Provides TTL “0”, 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48ma sink current capability. Not available if Option “G” is selected.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	0.250 Male Fastons
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8″ Centers
TB1-N	Neutral	Line 2	
TB1-⏚	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	MAX & MTC	MISC	CONNECTOR
Output #1	Terminal marked +V	Terminal marked +V	Bus Bars #1/4-20 Screws
	Terminal marked COM	Terminal marked COM	
Output #2	TB2-3 (+)	TB2-2 and TB2-3 (+)	Barrier Strip #6-32 Screws 3/8″ centers
	TB2-4 (RTN)	TB2-1 and TB2-4 (RTN)	
Output #3	TB2-5 (−)	TB2-5 (−)	
	TB2-4 (RTN)	TB2-4 (RTN)	
Output #4 (if provided)	TB2-1 (+)		
	TB2-2 (−)		

Note: Return (RTN) lines are connected to power supply common.

STATUS AND CONTROL

FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J1-1 (+S)	Output #1 Sense	AMP MTA Type #640456-4 Pin Header (locking)
	J1-2 (−S)	Output #1 Sense Rtn	
*AC Power Fail, or DC Power Good	J1-3 (PF)	Reference to J1-2 (−S)	
Inhibit Input	J1-4 (IH)	Short to J1-2 (−S)	

*Optional Function.

TODD

MULTI-OUTPUT 160 – 220 WATT SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT AVAILABLE
CONSULT FACTORY FOR DETAILS

The Price Leaders

Featuring:

- 9″ x 5″ x 2.5″ Package
- TODD's Lowest-Cost Power Supplies
- Over 100,000 hours MTBF
- High Power Densities
- Meets International Safety Agency Requirements
- High Peak Currents for Motor Starting
- AC Automatic Line Selection Option

The leaders of TODD's lower priced switching power supplies, these units are ideal for new OEM Products which are designed for future expansions. Outputs start at 160 Watts and power needs can go to 350 Watts by using the MAX-350 series without changing the footprint.

You'll get up to 30 Amps for logic and memory and peak currents up to 16 Amps for motor starting in a package measuring only 9″ x 5″ x 2.5″. Other features like 100,000 hours MTBF reliability, high power densities, AC autoline select option, and meeting international safety requirements, give design flexibility, low price, and world-wide marketability.

Check the specifications of these "Price Leaders" for your next OEM computer-based or Telecom product design.

STANDARD MDT SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MDT-163-0512R	160	+5V @ 25A	+12V @ 4/9 Apk	12V @ 1.5A	
MDT-164-1212R	160	+5V @ 25A	+12V @ 4/9 Apk	+12V @ 1.0A	−12V @ 1.0A
MDT-164-2412R	160	+5V @ 20A	+24V @ 3/6 Apk	+12V @ 1.0A	−12V @ 1.0A
MDT-223-0512R	220	+5V @ 30A	+12V @ 6/10 Apk	12V @ 2.5A	
MDT-223-1212R	220	+5V @ 10A	+12V @ 10/16 Apk	−12V @ 1.0A	
MDT-224-1212R	220	+5V @ 30A	+12V @ 6/10 Apk	+12V @ 1.5A	−12V @ 1.5A
MDT-224-2412R	220	+5V @ 25V	+24V @ 4/8 Apk	+12V @ 1.5A	−12V @ 1.5A

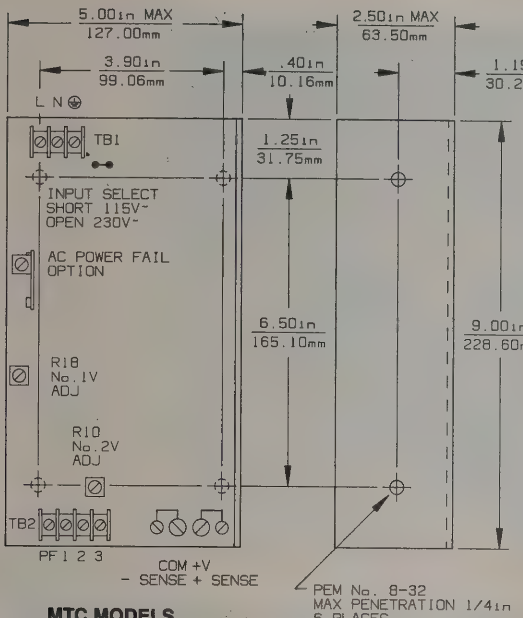
TELECOM MTC SERIES

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3
MTC-163-0512	160	+5V @ 30A	+12V @ 1.5A	−12V @ 1.5A
MTC-163-0515	160	+5V @ 30A	+15V @ 1.5A	−15V @ 1.5A

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

160-220 WATTS
9″ x 5″ x 2.5″
MDT MTC

WEIGHT
2.6 Lbs 1.2 Kgs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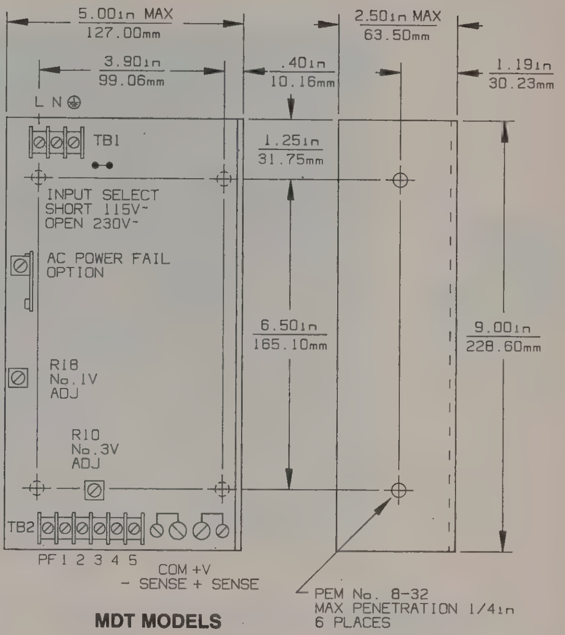
3.90in
99.06mm
2.50in MAX
63.50mm
.40in
10.16mm
1.19in
30.23mm
L N ⊕
TB1
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL
OPTION
1.25in
31.75mm
6.50in
165.10mm
9.00in
228.60mm
R18
No.1V
ADJ
R10
No.2V
ADJ
TB2
PF 1 2 3
COM +V
- SENSE + SENSE
PEM No. 8-32
MAX PENETRATION 1/4in
6 PLACES

MTC MODELS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99.06mm
2.50in MAX
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.40in
10.16mm
1.19in
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TB1
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL
OPTION
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6.50in
165.10mm
9.00in
228.60mm
R18
No.1V
ADJ
R10
No.3V
ADJ
TB2
PF 1 2 3 4 5
COM +V
- SENSE + SENSE
PEM No. 8-32
MAX PENETRATION 1/4in
6 PLACES

MDT MODELS

SPECIFICATIONS: ALL MODELS.

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. Internally fused for 7 A.

Adjustability: Main output and output #3 user adjustable ±5% minimum. Output #4 (Output #3 on MTC series) is not adjustable, and has ±5% initial accuracy.

Line & Load Reg: ±1% over AC input range and 0 to 100% load change. On MDT series only, Output #2 holds ±5% total regulation band, including the combined effects of line regulation, load regulation for a load change of ±40% from 60% initial load, and cross regulation due to a load change of ±25% on the +5V line from 60% initial load. Maximum combined currents on Output #1 and #2 cannot exceed Output #1 rating, except for MDT-223-1212R. Main +5V output requires a minimum load of 20%, for all models.

Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.

Remote Sense (±5V): Compensates for 250 mV total line drop. Open sense lead protection.

Temperature Coefficient: 0.02% per degree C.

Stability: 0.1% over 8 hours after 30 minutes warm-up.

Transient Response (+5V): Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.

Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.

Overvoltage Protection (+5V): Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 6.8V.

Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.

Inrush: Cold Start AC current is less than 16 A at 115 Vac, 32 A at 230 Vac. Limited by surgistor.

Brownout Protection: Holds regulation to 85 Vac or 170 Vac.

Thermal Protection: Shuts down power supply if overheated. Automatic recovery.

Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.

Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.

Efficiency: 75% typical.

Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.

Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."

Output Isolation: Isolated from ground 50 V.

Reverse Voltage: Protected against reverse voltage up to supply current rating.

Cooling: 30 CFM required to achieve full ratings at 220 watts. 160 watt models are convection cooled.

Reliability: Over 100,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.

OPTIONS:

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.

Option "P", Power Fail: Provides TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48ma sink current capability.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	#16 Bus jumper
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8″ Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	MDT-163 & MDT-223	MDT-164/224	MTC-163
Output #1	Terminal marked +5	Terminal marked +5	Terminal marked +5
	Terminal marked COM	Terminal marked COM	Terminal marked COM
Output #2	TB2-3 (+)	TB2-4 (+)	TB2-3 (+)
	TB2-4 (RTN)	TB2-5 (RTN)	TB2-2 (RTN)
Output #3	TB2-2 (+)	TB2-3 (+)	TB2-1 (−)
	TB2-1 (−)	TB2-2 (RTN)	TB2-2 (RTN)
Output #4 (if provided)		TB2-1 (−)	
		TB2-2 (RTN)	

Note: Return (RTN) lines are connected to power supply common.
Connector: All Outputs, #6-32 Screws.

STATUS AND CONTROL

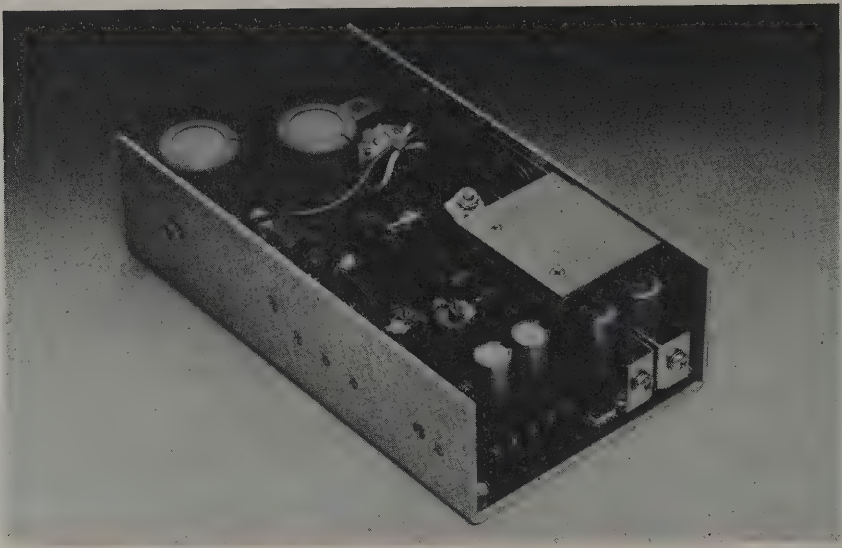
FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense (+5V line)	Terminal marked +S	Output #1 Sense	#6-32 Screws
	Terminal marked −S	Output #1 Sense Rtn	
* AC Power Fail	TB2-PF	Reference to −S	

*Optional Function

TODD

350 WATT SWITCHING POWER SUPPLY FOR N+1 REDUNDANCY

3V
MAIN OUTPUT AVAILABLE
CONSULT FACTORY FOR DETAILS



The Reliable Switcher for N+1 Redundancy and Parallel Power Sharing

Featuring:

- N+1 redundancy and parallel power sharing
- "Zero wire" power sharing system for optimum reliability
- 9" x 5" x 2.5" open frame package
- 250 watts from 5 Volts main output
- System air or self-cool option
- Overvoltage, overtemperature and overcurrent protection
- Soft start and remote inhibit

Todd's new MPS-350 multiple output switching power supplies are the ideal solutions for critical applications such as communications equipment and industrial controls. These often require parallel power sharing for expandable systems or redundant power supplies for reliability. With Todd's innovative "zero wire" power sharing technique, these switchers will provide a highly reliable, power sharing system.

When used for expandability, typical paralleling systems utilize complicated "third wire" power sharing techniques. Though expandability is achieved, system reliability is compromised in some failure modes, and glitches on the bus are possible.

The MPS Series, on the other hand, utilizes proprietary technology that does not require extra connections to achieve redundancy or to share power. This technology assures that all of the working supplies stay "on" and deliver current to the load allowing no glitches. The load sees consistent regulated voltage before, during, and after a power supply failure. With our MPS series, the user enjoys highly reliable power sharing, glitch-free performance, and minimum complexity.

You can build any number of these switchers into your system to allow paralleling for additional power or N+1 redundancy. The switcher can also be used alone as the basic building block power supply for future system expansion.

Housed in a low profile, open frame configuration measuring only 9"x5"x2.5", the MPS delivers 350 watts of power with a main output of 5 Volts at 50 Amps. The unit is designed to be cooled with system air or through an optional Fan/Cover assembly. Other features include: Overvoltage Protection, Overtemperature Protection, Soft Start, Remote Inhibit, Remote Sense, and Overcurrent Protection. DC Power Good, Auto-Ranging, Covers, and Fan/Covers are also available.

If your design calls for power sharing, redundancy, or expandability, check out the important features and specifications of this Todd switcher for a truly reliable, optimum power sharing system.

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MPS-353-0512	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4A	—
MPS-354-1205	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4A	−5.2V @ 2A
MPS-354-1212	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4A	12V @ 2A
MPS-354-1224	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4A	+24V @ 1.5A

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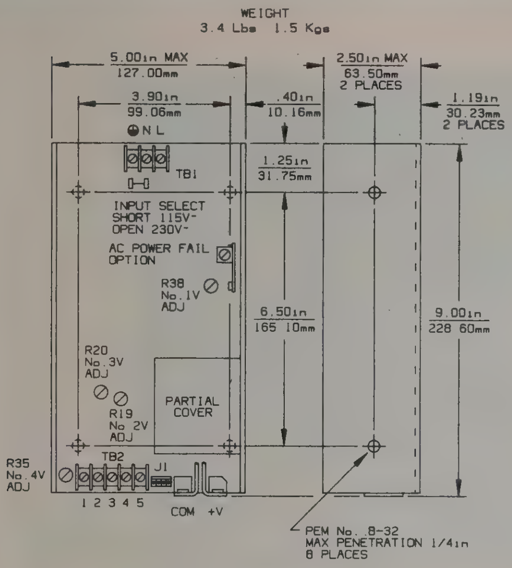
350 WATTS
9" × 5" × 2.5"
MPS


WEIGHT
3.4 Lbs 1.5 Kgs
5.00in MAX
127.00mm
3.90in
99.06mm
.40in
10.16mm
2.50in MAX
63.50mm
2 PLACES
1.19in
30.23mm
2 PLACES
⊕ N L
TB1
1.25in
31.75mm
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL
OPTION
R38
No.1V
ADJ
6.50in
165 10mm
9.00in
228 60mm
R20
No.3V
ADJ
R19
No 2V
ADJ
PARTIAL
COVER
R35
No.4V
ADJ
TB2
J1
1 2 3 4 5
COM +V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES

SPECIFICATIONS: ALL MODELS.

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option "A" for automatic line selection. Internally fused for 10 A.

Adjustability: All outputs user adjustable ± 5% minimum.

Line & Load Reg: + 5V Output: ±3% over AC input range and 10 to 100% load change. 10% minimum load required.

Line & Load Reg: Other Outputs: ±1% over AC input range and 0 to 100% load change. No minimum load required.

Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.

Remote Sense (± 5V): Compensates for 250 mV total line drop, in addition to "or-ing" diode drop. Open sense lead protection.

Temperature Coefficient: 0.02% per degree C.

Stability: 0.01% over 8 hours after 30 minutes warm-up.

Transient Response (+ 5V): Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.

Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.

Overvoltage Protection (+ 5V): Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 6.8V.

Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.

Inrush: Cold Start AC current is less than 10 A at 115 Vac, 18 A at 230 Vac. Limited by surgistor.

Brownout Protection: Holds regulation to 85 Vac or 170 Vac.

Thermal Protection: Shuts down power supply if overheated. Automatic recovery.

Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.

Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.

Efficiency: 80% typical.

Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.

Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."

Output Isolation: Isolated from ground 50 V.

Reverse Voltage: Protected against reverse voltage up to supply current rating.

Cooling: 30 CFM required to achieve full ratings.

Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero.

NOTE: External "or-ring" diode isolation is required for N+1 redundant operation.

OPTIONS:

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.

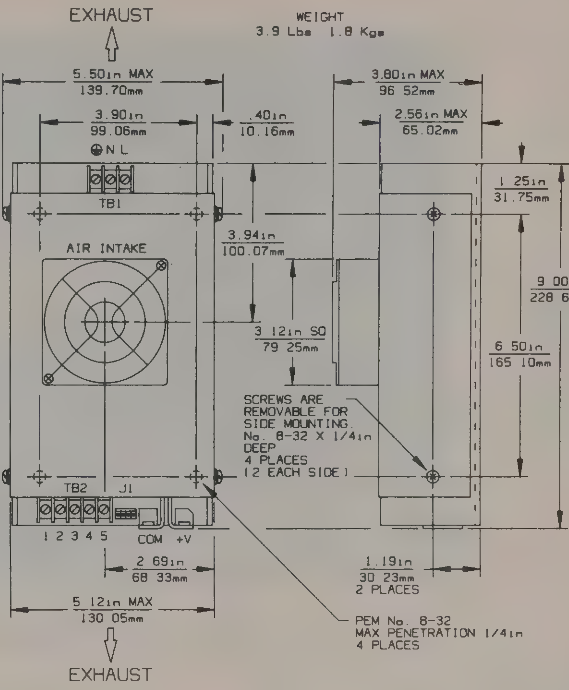
Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.

Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature.

Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal. Not available if Option "P" is selected.

Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

Consult factory for other available options.


EXHAUST
WEIGHT
3.9 Lbs 1.8 Kgs
5.50in MAX
139.70mm
3.90in
99.06mm
.40in
10.16mm
3.80in MAX
96 52mm
2.56in MAX
65.02mm
⊕ N L
TB1
1 25in
31.75mm
AIR INTAKE
3.94in
100.07mm
9 00in
228 60mm
3 12in SQ
79 25mm
6 50in
165 10mm
SCREWS ARE
REMOVABLE FOR
SIDE MOUNTING.
No. 8-32 X 1/4in
DEEP
4 PLACES
(2 EACH SIDE)
TB2
J1
1 2 3 4 5
COM +V
2 69in
68 33mm
1.19in
30 23mm
2 PLACES
5 12in MAX
130 05mm
PEM No. 8-32
MAX PENETRATION 1/4in
4 PLACES
EXHAUST

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	0.187 Fastons
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8" Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	LOCATION	NOTES	CONNECTOR
Output #1	Terminal marked +V		Buss Bars #10-32 Screws
	Terminal marked COM	5 Volt Common line	
Output #2	TB2-3 (+)		Barrier Strip #6-32 Screws 3/8" centers
	TB2-4 (RTN)	Aux Common	
Output #3	TB2-5 (–)		
	TB2-4 (RTN)	Aux Common	
Output #4 (if provided)	TB2-1 (+)	Return leg connected to Aux Common line. (See product listing)	
	TB2-2 (–)		

STATUS AND CONTROL

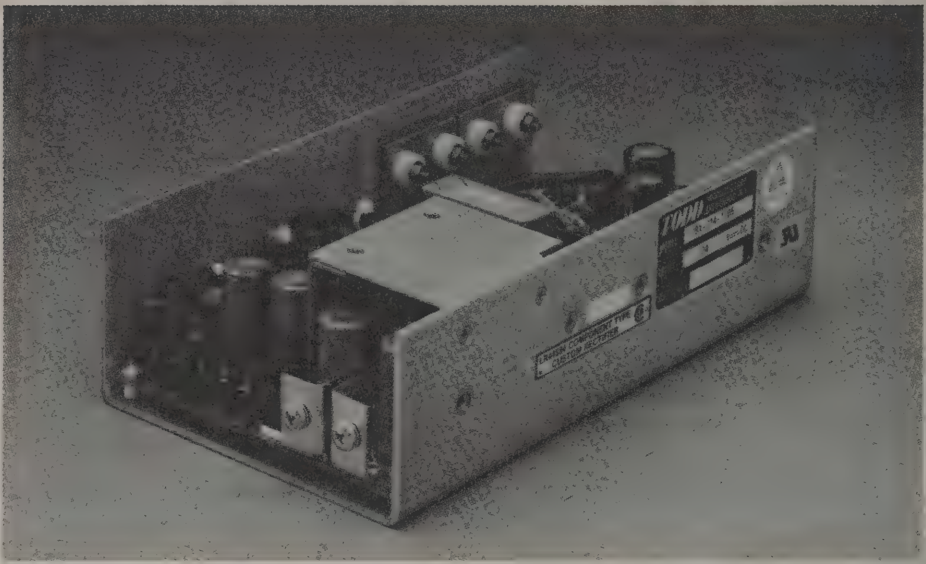
FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J1-1 (+S)	Output #1 Sense	AMP MTA Type #640456-4 Pin Header (locking)
	J1-2 (–S)	Output #1 Sense Rtn	
*DC Power Good	J1-3 (PF)	Reference to J1-2 (–S)	
Inhibit Input	J1-4 (IH)	Short to J1-2 (–S)	

*Optional Function

TODD

48 V or 24/28 VDC/DC CONVERTERS
250 WATT SINGLE OUTPUT
275-350 WATT MULTI-OUTPUT

3V
MAIN OUTPUT
AVAILABLE
CONSULT FACTORY
FOR DETAILS



The 24/28 or 48 V Input DC/DC Powerhouse

Featuring:

- Compact, only 9"L x 5"W x 2.5"H
- High efficiency MAGNA-FLUX Post Regulators
- Fully regulated mag amp outputs
- Over 100,000 hours MTBF per MIL-HDBK-217

Particularly suitable for critical, "can't fail" mobile or transportable systems, both DB and DC series offer fully regulated, high-efficiency mag amp output. All series share the same footprint, and DC, DCT and DCX units can be expanded to include isolation diodes and modified current sharing for redundancy (consult factory for availability). Optional DC power fail is available, as are optional fan and cover assemblies.

24/28 VDC INPUT— MULTI OUTPUT 9" x 5" x 2.5"

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
DBT-273-0512	275w	+5VDC @ 45A	+12VDC @ 6A	−12VDC @ 6A	—
DBT-273-0515	275w	+5VDC @ 45A	+15VDC @ 5A	−15VDC @ 5A	—
DBX-273-0512	275w	+5VDC @ 50A	+12VDC @ 8/12 Apk	−12VDC @ 4A	—
DBX-274-1224	275w	+5VDC @ 50A	+12VDC @ 8/12 Apk	−12VDC @ 4A	24VDC @ 1.5A
DBX-274-1205	275w	+5VDC @ 50A	+12VDC @ 8/12 Apk	−12VDC @ 4A	5.2VDC @ 2A

24/28 VDC INPUT—SINGLE OUTPUT 9" x 5" x 2.5"

MODEL	OUTPUT RATING	PWR OUT
DB5-50	5V @ 50A	250w
DB12-21	12V @ 21A	250w
DB15-17	15V @ 17A	250w
DB24-11	24V @ 11A	250w
DB28-9	28V @ 9A	250w
DB48-5.5	48V @ 5.5A	250w

48 VDC INPUT—SINGLE OUTPUT 9" x 5" x 2.5"

MODEL	OUTPUT RATING	PWR OUT
DC5-50	5V @ 50A	250w
DC12-21	12V @ 21A	250w
DC15-17	15V @ 17A	250w
DC24-11	24V @ 11A	250w
DC28-9	28V @ 9A	250w
DC48-5.5	48V @ 5.5A	250w

48 VDC INPUT—MULTI OUTPUT 9" x 5" x 2.5"

MODEL	PWR	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
DCT-253-0515	250	+5V @ 30A	+15V @ 4.0A	−15V @ 4.0A	—
DCT-253-0512	250	+5V @ 30A	+12V @ 5.0A	−12V @ 5.0A	—
DCT-353-0512	350	+5V @ 45A	+12V @ 6.0A	−12V @ 6.0A	—
DCT-353-0515	350	+5V @ 45A	+15V @ 5.0A	−15V @ 5.0A	—
DCX-353-0512	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	—
DCX-354-1224	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	24V @ 1.5A
DCX-354-1205	350	+5V @ 50A	+12V @ 8/12 Apk	−12V @ 4.0A	5.2V @ 2.0A

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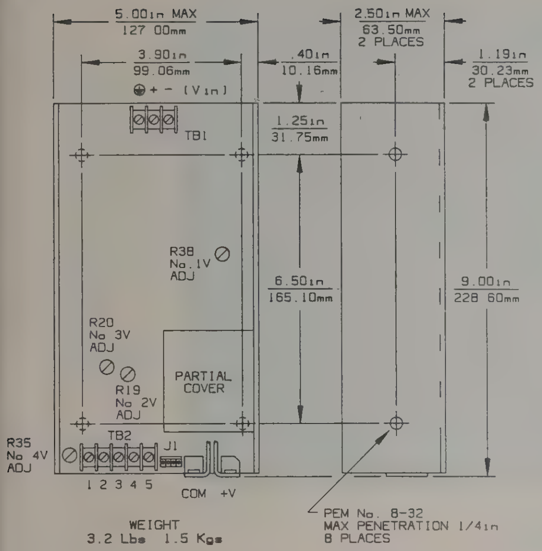
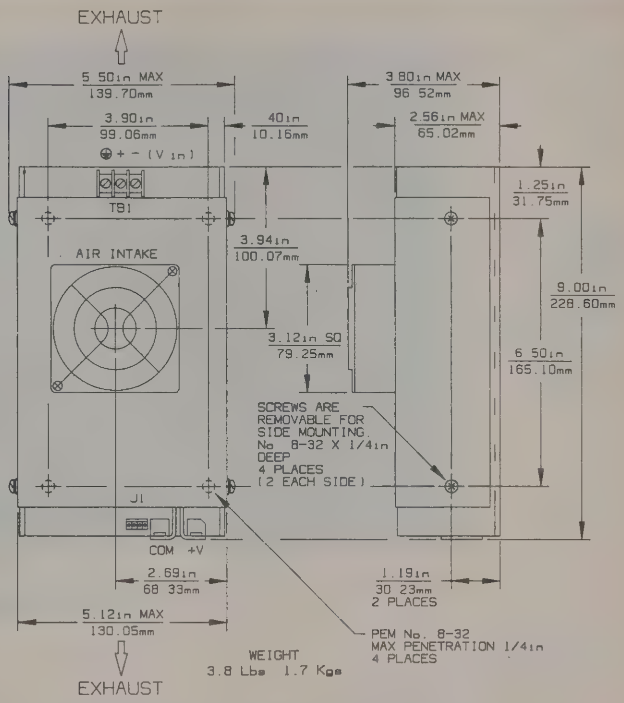
250-275-350 WATTS
9″ × 5″ × 2.5″
DB DBT DBX DC DCT DCX


5.00in MAX
127 00mm
3.90in
99.06mm
⊕ + − (Vin)
.40in
10.16mm
2.50in MAX
63.50mm
2 PLACES
1.19in
30.23mm
2 PLACES
TB1
1.25in
31.75mm
R38
No. 1V
ADJ
6.50in
165.10mm
9.00in
228 60mm
R20
No 3V
ADJ
R19
No 2V
ADJ
PARTIAL
COVER
R35
No 4V
ADJ
TB2
J1
1 2 3 4 5
COM +V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES
WEIGHT
3.2 Lbs 1.5 Kgs


EXHAUST
5 50in MAX
139.70mm
3.90in
99.06mm
⊕ + − (V in)
40in
10.16mm
3 80in MAX
96 52mm
2.56in MAX
65.02mm
TB1
1.25in
31.75mm
AIR INTAKE
3.94in
100.07mm
9.00in
228.60mm
3.12in SQ
79.25mm
6 50in
165.10mm
SCREWS ARE
REMOVABLE FOR
SIDE MOUNTING.
No 8-32 X 1/4in
DEEP
4 PLACES
(2 EACH SIDE)
J1
COM +V
2.69in
68 33mm
1.19in
30 23mm
2 PLACES
5.12in MAX
130.05mm
PEM No. 8-32
MAX PENETRATION 1/4in
4 PLACES
WEIGHT
3.8 Lbs 1.7 Kgs
EXHAUST

SPECIFICATIONS: ALL MODELS.

DC Input: 24 Vdc, nominal, 20 Vdc to 32 Vdc range, internally fused for 20A (DB, DBT and DBX series). 48 Vdc, nominal, 40.8 Vdc to 60 Vdc range, internally fused for 15A (DC, DCT and DCX series).

Adjustability: All outputs user adjustable ± 5% minimum, except where noted.

Line & Load Reg: ±1% over DC input range and 0 to 100% load change. Multiple output units require a minimum load of 10% on the +5V output when drawing full load on the auxiliary outputs.

Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.

Remote Sense: Compensates for 250 mV total line drop. Multioutput units provide remote sense on main (+5V) output only. Open sense lead protection is standard.

Temperature Coefficient: 0.02% per degree C.

Stability: 0.1% over 8 hours after 30 minutes warm-up.

Transient Response: Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.

Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.

Overvoltage Protection: Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 6.8V on +5V output of multioutput models. Single output models are set to limit overvoltage to 136% of nominal.

Peak Output Current: Dual current ratings define continuous and peak currents. The peak current shown can be delivered for a maximum period of 30 seconds.

Thermal Protection: Shuts down power supply if overheated. Automatic recovery.

Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.

Efficiency: 70-75% typical.

Output Isolation: Isolated from ground 50 V. Single output models rated at 48V nominal have 100V isolation.

Reverse Voltage: Protected against reverse voltage up to supply current rating.

Cooling: 30 CFM required to achieve full ratings.

Reliability: Over 100,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.

Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero.

OPTIONS:

Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.

Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature.

Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal.

Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

DC INPUT

FUNCTION	-48 Vdc	+24 Vdc	CONNECTOR
TB1-(−)	-48 Vdc Input	+24 Return	Barrier Strip #6-32 Screws 3/8" Centers
TB1-(+)	-48 Vdc Return	+24 Vdc Input	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	MDT-163 & MDT-223	MDT-164/224	MTC-163
Output #1 (All units)	Terminal marked +V		Buss Bars #10-32 Screws
	Terminal marked COM	5 Volt Common line	
Output #2 (Multiple-output units)	TB2-3 (+)		Barrier Strip #6-32 Screws 3/8" centers
	TB2-4 (RTN)	Aux Common	
Output #3 (Multiple-output units)	TB2-5 (−)		
	TB2-4 (RTN)	Aux Common	
Output #4 (Multiple-output units)	TB2-1 (+)	Floating Output	
	TB2-2 (−)		

STATUS AND CONTROL

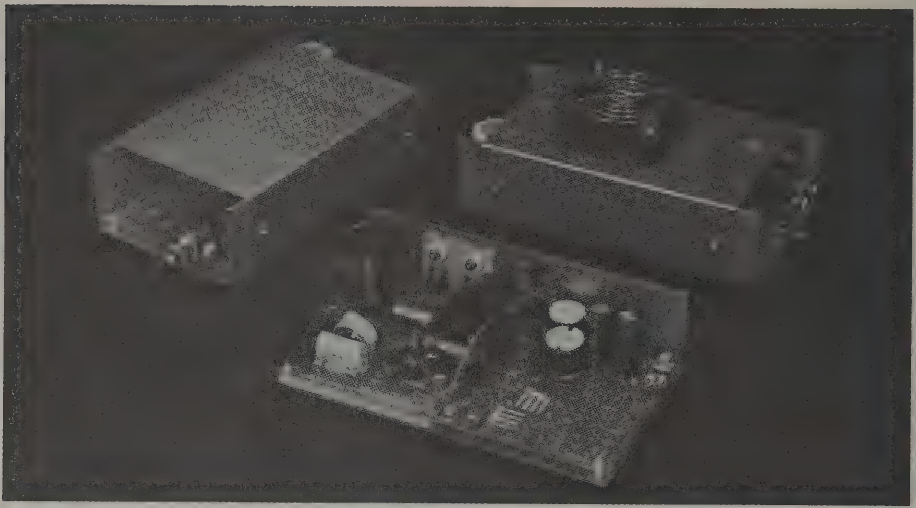
FUNCTION	LOCATION	NOTES	CONNECTOR
Remote Sense	J1-1 (+S)	Output #1 Sense	AMP MTA Type #640456-4 Pin Header (locking)
	J1-1 (−S)	Output #1 Sense Rtn	
*DC Power Good	J1-3 (PF)	Reference to J1-2 (−S)	
Inhibit Input	J1-4 (IH)	Short to J1-2 (−S)	

*Optional Function

TODD

SINGLE OUTPUT, MULTI-PURPOSE 150 – 250 WATT SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT
AVAILABLE
CONSULT FACTORY
FOR DETAILS



The Single Choice

Featuring:

- 9″ x 5″ x 2.5″ Package
- Output Voltages from 5V to 48V
- Meets International Safety Agency Requirements
- More than 100,000 hours MTBF
- Remote Sense, Thermal Protection, and OVP
- Units Cannot be Damaged by No-load or Low Line Conditions
- System Air or Self-Cooled Option
- AC Automatic Line Selection Option

Switchers in this series are the single choice for power supplies that must withstand the harsh environments that typify industrial control applications. Yet, they include the sophistication and advance design features that are needed to power computer and telecommunications systems.

Designed around TODD's proprietary VERI-DRIVE PLUS current fed inverter topology and unique monocoque construction, these switching power supplies are up to 31% smaller than competitive products and have efficiencies of up to 85%.

All of these SC Series Models are the single choice for worldwide marketability.

150 WATT 9″ x 5″ x 2.5″ L FRAME

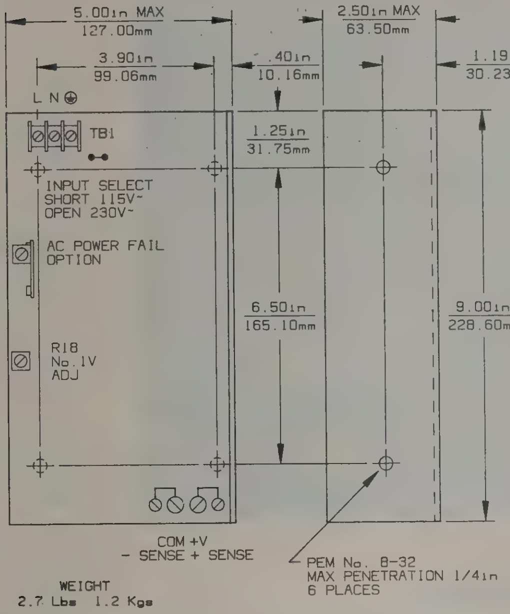
MODEL	OUTPUT RATING	PWR OUT
SC5-30	5V @ 30A	150w
SC12-15	12V @ 15A	180w
SC15-12	15V @ 12A	180w
SC24-7.5	24V @ 7.5A	180w
SC28-6.5	28V @ 6.5A	180w
SC48-3.7	48V @ 3.7A	180w

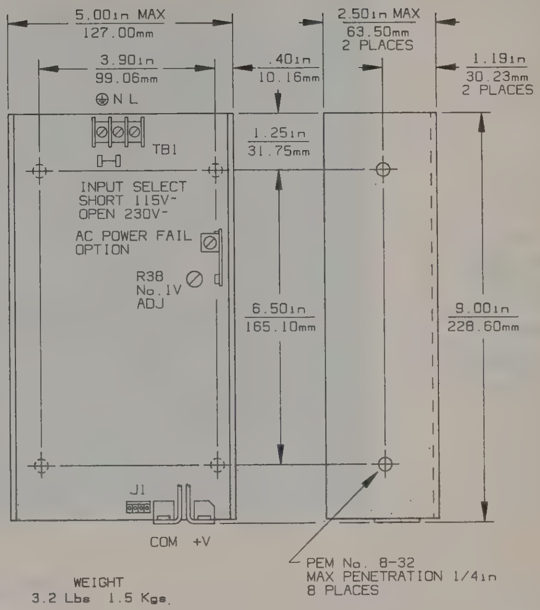
250 WATT 9″ x 5″ x 2.5″ U FRAME

MODEL	OUTPUT RATING	PWR OUT
SC5-50	5V @ 50A	250w
SC12-21	12V @ 21A	250w
SC15-17	15V @ 17A	250w
SC24-11	24V @ 11A	250w
SC28-9	28V @ 9A	250w
SC48-5.5	48V @ 5.5A	250w

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

150-250 WATTS
9″ x 5″ x 2.5″
SC


5.00in MAX
127.00mm
3.90in
99.06mm
.40in
10.16mm
2.50in MAX
63.50mm
1.19in
30.23mm
L N ⊕
TB1
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL
OPTION
R18
No. 1V
ADJ
1.25in
31.75mm
6.50in
165.10mm
9.00in
228.60mm
COM +V
− SENSE + SENSE
PEM No. 8-32
MAX PENETRATION 1/4in
6 PLACES
WEIGHT
2.7 Lbs 1.2 Kgs


5.00in MAX
127.00mm
3.90in
99.06mm
.40in
10.16mm
2.50in MAX
63.50mm
2 PLACES
1.19in
30.23mm
2 PLACES
⊕ N L
TB1
INPUT SELECT
SHORT 115V~
OPEN 230V~
AC POWER FAIL
OPTION
R38
No. 1V
ADJ
1.25in
31.75mm
6.50in
165.10mm
9.00in
228.60mm
J1
COM +V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES
WEIGHT
3.2 Lbs 1.5 Kgs

SPECIFICATIONS: ALL MODELS.

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option "A" for automatic line selection. 150 watt units fused for 7 A, 250 watt units fused for 10 A.
Adjustability: ±10% minimum.
Line & Load Reg: ±1% over AC input range and 0 to 100% load change.
Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.
Remote Sense: Compensates for 250 mV total line drop. Open sense lead protection.
Temperature Coefficient: 0.02% per degree C.
Stability: 0.1% over 8 hours after 30 minutes warm-up.
Transient Response: Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.
Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.
Overvoltage Protection: Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 136% of nominal.
Inrush: Cold Start AC current is less than 16 A at 115 Vac, 32 A at 230 Vac on 150 watt models, and 10 A at 115 Vac, 18 A at 230 Vac on 250 watt models. Limited by surgistor.
Brownout Protection: Holds regulation to 85 Vac or 170 Vac.
Thermal Protection: Shuts down power supply if overheated. Automatic recovery.
Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.
Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.
Efficiency: 80% typical.
Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.
Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."
Output Isolation: Isolated from ground 50 V, except 100 V for 48 Vdc models.
Reverse Voltage: Protected against reverse voltage up to supply current rating.
Cooling: 30 CFM required to achieve full rating.
Reliability: Over 100,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.
Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero. Not available in 150 or 180 watt units.

OPTIONS (ALL MODELS):

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.
Option "P", Power Fail: Provides TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48ma sink current capability. Not available if Option "G" is selected.

OPTIONS (250 WATT MODELS ONLY):

Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.
Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature.
Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal. Not available if Option "P" is selected.
Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	#18 Bus jumper
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8″ Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	150 Watt SC Series	250 Watt SC Series
Output Voltage	Terminal marked +5	Terminal marked +5
	Terminal marked COM	Terminal marked COM
Termination	Bus Bars #6-32 screws	Bus Bars #10-32 Screws

STATUS AND CONTROL

FUNCTION	150 Watt SC Series	250 Watt SC Series	CONNECTOR
Remote Sense	Terminal marked +S	J1-1 (+S)	150 Watt: #6-32 screws 3/8″ centers
	Terminal marked −S	J1-2 (−S)	
*AC Power Fail, or DC Power Good	TB2-PF (Ref to −S)	J1-3 (PF) Ref to −S	250 Watt: AMP MTA Locking Type #640456-4 Pin Header
Inhibit Input	Not Available	J1-4 (IH) Short to −S	

*Optional Function

TODD

SINGLE OUTPUT, MULTI-PURPOSE 350 – 500 WATT SWITCHING POWER SUPPLIES

3V
MAIN OUTPUT AVAILABLE
CONSULT FACTORY FOR DETAILS

The Single Choice

Featuring:

- 11.5″ x 5″ x 2.5″ Package
- Output Voltages from 5V to 48V
- Power Density to 3 watts/in³
- Meets International Safety Agency Requirements
- More than 100,000 hours MTBF
- Remote Sense, Thermal Protection, and OVP
- Units Cannot be Damaged by No-load or Low Line Conditions
- AC Automatic Line Selection Option

Consider this series for your single choice of switching power supplies used in the design of high end OEM products ranging from process controls to sophisticated telecommunications systems.

Incorporating TODD design features such as surface mount components and single PCB construction for high reliability, these switchers are rugged enough to withstand the harsh environments that typify industrial control applications and also incorporate the sophistication and advance design features needed to power computer and telecommunications systems.

Check out the specifications of this series, your single choice for single output switchers.

350 WATT SERIES 11.5″ x 5″ x 2.5″

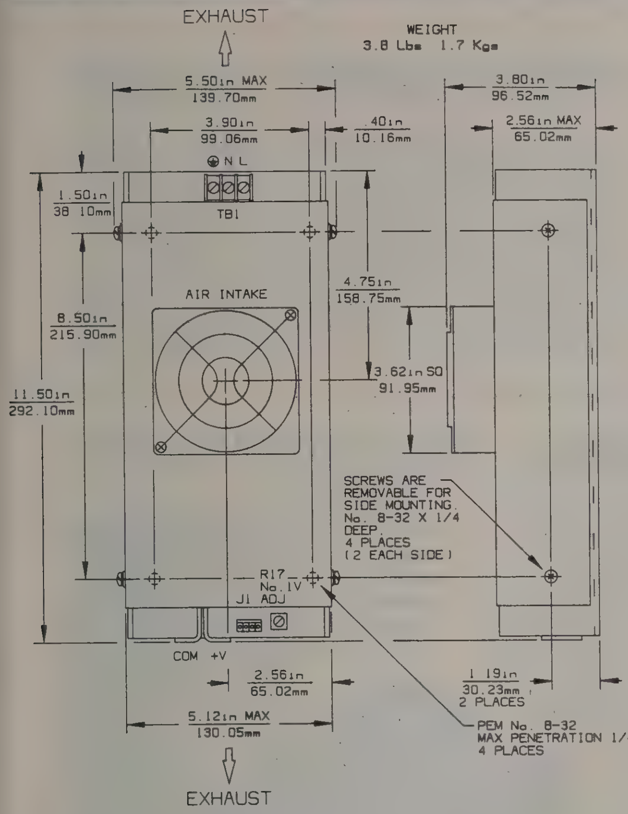
MODEL	OUTPUT RATING	PWR OUT
SC5-70	5V @ 70A	350w
SC12-30	12V @ 30A	360w
SC15-24	15V @ 24A	360w
SC24-15	24V @ 15A	360w
SC28-13	28V @ 13A	360w
SC48-8	48V @ 8A	360w

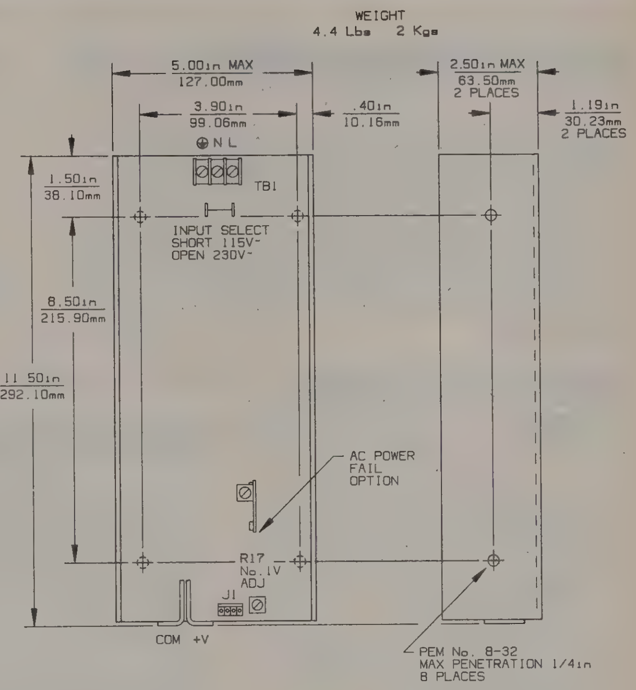
500 WATT SERIES 11.5″ x 5″ x 2.5″

MODEL	OUTPUT RATING	PWR OUT
SC5-100	5V @ 100A	500w
SC12-42	12V @ 42A	500w
SC15-34	15V @ 34A	500w
SC24-21	24V @ 21A	500w
SC28-18	28V @ 18A	500w
SC48-11	48V @ 11A	520w

TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717 • (516) 231-3366 • 1-800-223-TODD • FAX (516) 231-3473

350-500 WATTS
11.5″ x 5″ x 2.5″
SC


EXHAUST
WEIGHT
3.8 Lbs 1.7 Kgs
5.50in MAX
139.70mm
3.80in
96.52mm
3.90in
99.06mm
.40in
10.16mm
2.56in MAX
65.02mm
⊕ N L
1.50in
38 10mm
TB1
AIR INTAKE
4.75in
158.75mm
8.50in
215.90mm
3.62in SQ
91.95mm
11.50in
292.10mm
SCREWS ARE REMOVABLE FOR SIDE MOUNTING. No. 8-32 X 1/4 DEEP. 4 PLACES (2 EACH SIDE)
R17
No. 1V
ADJ
J1
COM +V
2.56in
65.02mm
1 19in
30.23mm
2 PLACES
5.12in MAX
130.05mm
PEM No. 8-32
MAX PENETRATION 1/4in
4 PLACES
EXHAUST


WEIGHT
4.4 Lbs 2 Kgs
5.00in MAX
127.00mm
2.50in MAX
63.50mm
2 PLACES
3.90in
99.06mm
.40in
10.16mm
1.19in
30.23mm
2 PLACES
⊕ N L
TB1
1.50in
38.10mm
INPUT SELECT
SHORT 115V~
OPEN 230V~
8.50in
215.90mm
11 50in
292.10mm
AC POWER
FAIL
OPTION
R17
No. 1V
ADJ
J1
COM +V
PEM No. 8-32
MAX PENETRATION 1/4in
8 PLACES

SPECIFICATIONS: ALL MODELS.

AC Input: 90-132 Vac/180-264 Vac, 47 to 63 Hz. User selectable. See Option "A" for automatic line selection. 350 watt units fused for 10 A, 500 watt units fused for 15 A.
Adjustability: ±10% minimum.
Line & Load Reg: ±1% over AC input range and 0 to 100% load change.
Ripple & Noise: Less than 0.2% rms, 1% p-p or 100 mV, whichever is greater.
Remote Sense: Compensates for 250 mV total line drop. Open sense lead protection.
Temperature Coefficient: 0.02% per degree C.
Stability: 0.1% over 8 hours after 30 minutes warm-up.
Transient Response: Output voltage returns to within 1% in less than 500 µsec for a 50% load change. Peak transient does not exceed 5%.
Overload Protection: All outputs are protected against overload and short circuit. Automatic recovery upon removal of fault.
Overvoltage Protection: Protects load against power supply induced overvoltage. Trip point is factory set so that output voltage cannot exceed 136% of nominal.
Inrush: Cold Start AC current is less than 80 A at 115 Vac, 20 A at 230 Vac. Limited by surgistor.
Brownout Protection: Holds regulation to 85 Vac or 170 Vac.
Thermal Protection: Shuts down power supply if overheated. Automatic recovery.
Holdup Time: 16 ms minimum after removal of power, at nominal line, full load.
Temperature Range: 0 to 50°C full ratings. Derate to half power at 70°C.
Efficiency: 80% typical.
Safety Agencies: Approved UL478, UL1950, CSA22.2 bulletins 1402c and #234, IEC950, VDE 0805/VDE 0806 class 1 SELV and EN 60 950.
Conducted RFI: Meets FCC Part 15, Subpart J, Class A; EN 55022 Level "B"; and German Decree "VFG 243."
Output Isolation: Isolated from ground 50 V, except 100 V for 48Vdc models.
Reverse Voltage: Protected against reverse voltage up to supply current rating.
Cooling: 30 CFM required to achieve full ratings.
Reliability: Over 100,000 hours MTBF, when calculated in accordance with MIL-HDBK-217.
Remote Inhibit: Contact closure to the negative sense line, drops output power to nominal zero. Not available in 150 watt units.

OPTIONS:

Option "A", AC Auto-Range: Automatically selects proper AC line voltage range to enable power operation at either 115 or 230 Vac, without user intervention.
Option "C", Cover: Limits contact with power supply interior. Add "C" suffix to model number.
Option "F", Fan/Cover Assembly: Cover with integral ball-bearing fan provides proper cooling to achieve full ratings, at 50°C ambient temperature.
Option "G", DC Power Good: Provides a TTL "1" when output #1 is above 4.6 Vdc nominal. Not available if Option "P" is selected.
Option "P", Power Fail: Provides TTL "0", 5 ms before output voltage goes out of regulation band, upon loss of AC power. VMEbus compatible, provides 48 ma sink current capability. Not available if Option "G" is selected.
Option "V": Low profile, end venting cover with integral ball-bearing fan. See page 8.

Consult factory for other available options.

AC INPUT

FUNCTION	115 Vac	230 Vac	CONNECTOR
Input Select	Short	Open	#18 Bus jumper
TB1-L	Line	Line 1	Barrier Strip #6-32 Screws 3/8" Centers
TB1-N	Neutral	Line 2	
TB1-⊕	Safety Ground	Safety Ground	

DC OUTPUT

FUNCTION	350 Watt SC Series	500 Watt SC Series
Output Voltage	Terminal marked +5 Terminal marked COM	Terminal marked +5 Terminal marked COM
5 Volt Unit Termination	Bus Bars #1/4-20 Screws	Bus Bars #1/4-20 Screws
12 Through 48 Volt unit Termination	Bus Bars #1/4-20 Screws	Bus Bars #1/4-20 Screws

STATUS AND CONTROL

FUNCTION	350 W and 500 W	NOTES	CONNECTOR
Remote Sense	J1-4 (+S)		AMP MTA Locking Type #640456-4 Pin Header
	J1-3 (−S)		
*AC Power Fail, or DC Power Good	J1-2 (PF)	Reference to −S	
Inhibit Input	J1-1 (IH)	Short to −S	

*Optional Function

TODD

OPTIMUM POWER SOLUTIONS

Quality starts with understanding customers' needs so that we can provide the optimum solution to meet their requirements. By developing close partnerships with our customers, we've been able to provide power solutions for hundreds of applications. With Todd as your power supply engineering partner, you'll have access to the best combination of a broad line of standard products, a low-cost modified or repackaged product, or a fully customized product designed specifically for your application.

MODIFIED STANDARDS

Our standard catalog product line is a comprehensive mix of over 100 units configured for applications in power ranges from 150 watts to 1500 watts. Since all of our standard products within a given series utilize a platform type of design, we are often able to easily modify a standard product to meet a customer's unique application. Each mother board is configurable to many different voltages and will support components and magnetics for a wide range of power. We can also modify performance features, mechanical and electrical characteristics, and options as the customer requires.

FROM BLOOD ANALYZERS TO ATMs

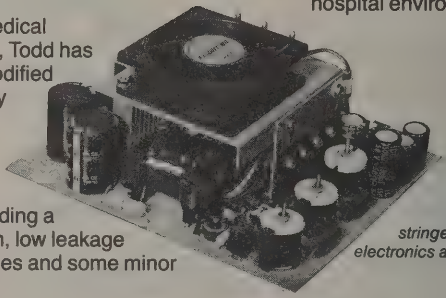
From our standard line to our highly customized designs, we've produced power supplies for hundreds of specialized applications. For example:

- Blood Analyzers
- Blood Processors
- Patient Attached Monitors
- VXIbus Computers
- Work Stations
- Graphics Processors
- Ruggedized Computer Systems
- Automobile Diagnostics
- Automatic Teller Machines
- Lottery Terminals
- High Definition TV Transmitters
- PBX Systems
- Paging Systems

MEDICAL ELECTRONICS

Very demanding requirements are imposed on power supplies used in medical electronics equipment, with reliability being paramount. The requirements of UL544 and IEC601 for patient attachment, for example, impose stringent AC line leakage limits.

Working closely with medical equipment manufacturers, Todd has provided cost-effective modified standards as well as highly customized designs that meet their requirements. For example, Todd engineers were able to modify a standard supply by including a special transformer design, low leakage RFI filters, AC input changes and some minor repackaging with no transformer isolation required. The results were a reliable, field proven unit, meeting the medical leakage requirements, and incorporating the special line transient suppression to survive line voltage transients sometimes found in hospital environments.

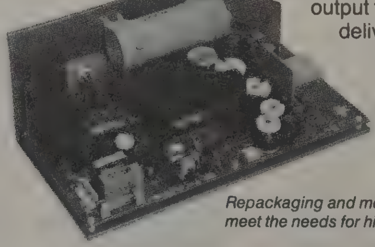


Designed from the ground up, this power supply meets the needs of a stringent medical electronics application.

HIGH PEAK CURRENT PRINTERS

Impact printers used in applications ranging from lottery terminals to ATM machines, place unusual load requirements on the power supply. For example, a system using a 4 output power supply, with an average power demand of 200 watts would require the 24 volt printer output to deliver peak currents of 55 amps, or over 1300 watts. How the power supply handles these peak currents impacts greatly on cost, reliability, and system performance.

Todd engineers were able to identify the critical factors required by the customer for his marketplace, and offer a modified standard to meet his needs. Modifications included incorporating high peak power capability to the inverter, adding an averaging filter, and special control functions to indicate proper DC output. Input and output connectors were added for faster system assembly, and the chassis was custom shaped for easy mounting.



Repackaging and modifications to a standard supply meet the needs for high peak current printers.

OPTIMUM POWER SOLUTIONS

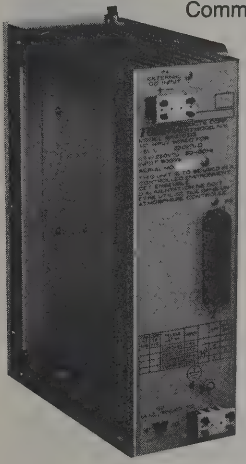
REPACKAGED STANDARDS

Many times we can offer our customers a repackaged standard to meet specific system requirements. For example, we can repackage a standard product to include a special electrical feature, or a "bell or whistle" by revising the pc board artwork. Or we can repackage a standard product for a special mechanical requirement, such as connectivity. We can convert a standard power supply into a very low profile unit to fit into a pre-existing envelope or mounting arrangement. A "repackaged" standard is often the best solution to a customer's special need.

FULL CUSTOM POWER SUPPLIES

Sometimes a customer's requirements are so unique that the power supply must be designed from the ground up. With Todd as your power supply partner, you'll have access to one of the best and most experienced engineering teams in the power supply industry. Since our inception we have been specialists in producing fully captive designs with customized form, fit, and functions. Working closely with our customers' engineering and program management people, our goal is to ensure that each power supply will be the optimum design.

COMMUNICATIONS EQUIPMENT



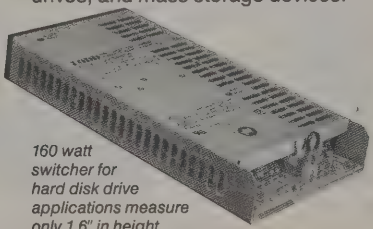
Custom-design plug-in switcher for PBX systems.

Communications equipment manufacturers of PBX, central office equipment and other critical applications, require a high degree of reliability from their power sources.

A unique plug-in switching power supply provided the optimum solution for a leading telecom manufacturer. For this PBX application, Todd engineers designed a 395 watt, plug-in chassis, switching power supply. The unit connects into the backplane to provide DC power to the PBX cards. It features free convection cooling, DC battery back-up and meets the customer's critical reliability requirements.

PERIPHERALS

The Todd standard product line includes an extensive series of power supplies that meet a broad range of computer applications. When a recent customer requirement for a low profile switcher could not be met with a standard product, Todd engineers designed a 160 watt switcher, measuring only 1.6″ in height, that met all of the customer's requirements for use in SCSI drives, removable hard drives, and mass storage devices.



160 watt switcher for hard disk drive applications measure only 1.6″ in height.

CALL THE SWITCHER SPECIALISTS

- 3-Volt Logic Requirements
- Special Mechanical Configurations
- Unique Performance Requirements

Just one phone call will put you in touch with a Todd Products switching power supply specialist. Our highly trained staff is here to help you solve your power supply problems. We can suggest a proven design from our large array of standard-built products, or we may recommend a modification of a stock unit to solve your applications problem. If appropriate, we can engineer and design a custom system that will suit your requirements exactly. With Todd as your power supply partner, you are assured of a timely and cost-effective answer to even your most difficult switching power supply problems.

The solution to your specific problem begins by dialing:

1-800-223-8633

TODD

SWITCHING POWER SUPPLIES FOR OEM PRODUCTS

TODD
is
MY
company
Quality Is Customer Satisfaction

Every TODD Power Supply is built with pride by employee-owners.

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POWER SUPPLIES
TODD PRODUCTS CORP., 50 EMJAY BLVD., BRENTWOOD, NEW YORK 11717
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FAX (516) 231-3473

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	**D•2221**
Batteries, Product Selection Guide	**D•1419**
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C•1003**
Capacitors, Product Selection Guide	**A•1003**
Coils, Chokes, Inductors, Product Selection Guide	**A•1179**
Connectors, Terminals & Sockets, Product Selection Guide	**C•1139**
Cores, Magnets & Ferrites	**A•1317**
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A•1326**
DC-DC Converters	**D•2049**
DC Power Supplies, Product Selection Guide	**D•1488**
Delay Lines, Product Selection Guide	**A•1513**
Discrete Semiconductors, Product Selection Guide	**A•2130**
Displays, Readouts, & CRTs, Product Selection Guide	**B•1017**
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C•1557**
Fiber Optics, Product Selection Guide	**B•1200**
Filters, Power, Product Selection Guide	**A•1584**
Filters, Signal, Product Selection Guide	**A•1617**
Instruments, Test & Measuring, Product Selection Guide	**D•1215**
Interconnection Systems, Product Selection Guide	**C•1670**
Keyboards & Keypads, Product Selection Guide	**B•1818**
Lamps, Lights, & Indicators, Product Selection Guide	**B•1131**
Microwave Components, Product Selection Guide	**A•1719**
Military Qualified Products List	**B•1002**
Motors, Drives, & Rotating Components, Product Selection Guide	**B•1231**
Oscilloscopes, Product Selection Guide	**D•1402**
Panel Hardware, Product Selection Guide	**C•1522**
Panel Meters, Analog & Digital, Product Selection Guide	**D•1336**
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A•2053**
Power Supplies, AC, Product Selection Guide	**D•2221**
Power Supplies, DC, Product Selection Guide	**D•1488**
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B•1341**
Relays, Product Selection Guide	**B•1401**
Resistors, Product Selection Guide	**A•1859**
Solenoids, Product Selection Guide	**B•1626**
Switches, Product Selection Guide	**B•1658**
Thermal Components, Product Selection Guide	**B•1857**
Transducers & Encoders, Product Selection Guide	**B•1911**
Transformers, Product Selection Guide	**A•2229**
Wire & Cable, Product Selection Guide	**C•1701**

TOP-LINK

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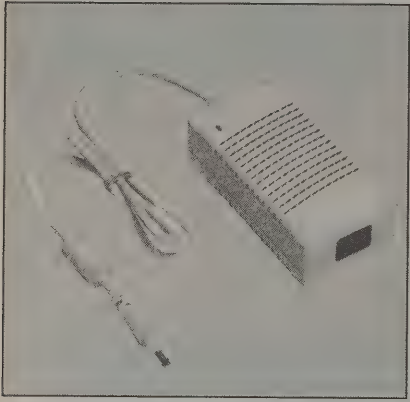
FAX: (408) 946-8098



30W SINGLE and DUAL OUTPUT ADAPTOR (Universal Input)

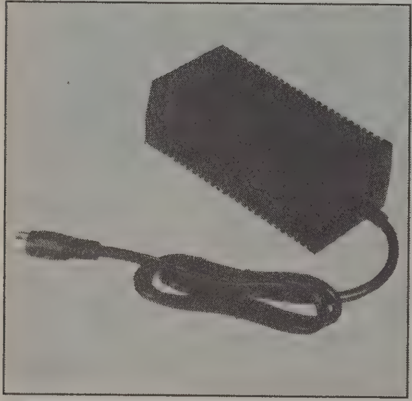
DIM: 148mm (5.83") x 75mm (2.96") x 45mm H (1.78")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-093(P)	9.5V/3A				V	V	V	
PSA-122(P)	12V/2.5A				V	V	V	
PSA-152(P)	15V/2A				V	V	V	
PSA-161(P)	16.5V/1.8A				V	V	V	
PSA-171(P)	17V/1.75A				V	V	V	
PSA-181(P)	18V/1.65A				V	V	V	
PSA-241(P)	24V/1.25A				V	V	V	
PSM-3021A	5V/2A	12V/1.5A			V	V		V
PSM-3021G	5V/4A	12V/0.5A			V	V		

40W DUAL ADAPTOR/CHARGER (Universal Input)

DIM: 166mm (6.54") x 80mm (3.15") x 45mm H (1.78")

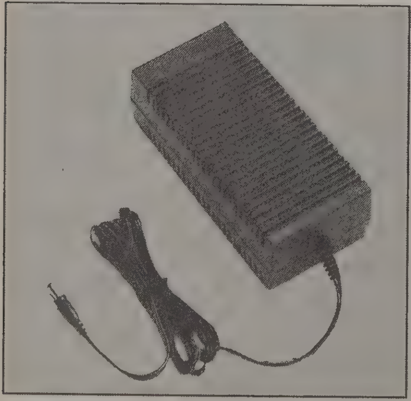
MODEL	O/P1	CHARGE OUTPUT	UL	CSA	TUV	VDE
PSA-4641	18V/1A	1.0A	V	V	V	
PSA-4642	16V/1.25A	1.2A	V	V	V	
PSA-4643	6V/2.5A	1.8A	V	V	V	
PSA-4646	20V/0.7A	1.2A	V	V		V



40W MULTIPLE OUTPUT ADAPTOR (Universal Input)

DIM: 166mm (6.54") x 80mm 3.15") x 56.5mm H (2.23")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-46-201	5V/4A	12V/2A			V	V	V	
PSA-46-301	5V/3A	12V/2A	-12V/0.3A		V	V	V	
PSA-46-303	5V/3A	12V/2A	-5V/0.3A		V	V	V	
PSA-46-304	5V/3A	15V/1.6A	-15V/0.3A		V	V	V	



50W SINGLE OUTPUT ADAPTOR (Universal Input)

DIM: 166mm (6.54") x 80mm (3.15") x 56.5mm H (2.23")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-053(P)	5V/3A				V	V	V	
PSA-104(P)	10V/4A				V	V	V	
PSA-124(P)	12V/4.2A				V	V	V	
PSA-153(P)	15V/3.6A				V	V	V	
PSA-163(P)	16.5V/3A				V	V	V	
PSA-173(P)	17V/3.2A				V	V	V	
PSA-183(P)	18V/3A				V	V	V	
PSA-202(P)	20V/2.6A				V	V	V	
PSA-242(P)	24V/2.2A				V	V	V	

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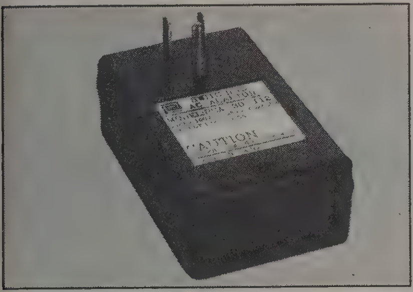
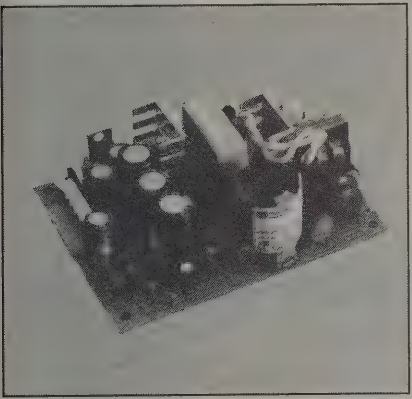


30W MINI ADAPTOR (Wall Plug-In)

DIM: 95mm (3.74") x 60mm (2.36") x 36mm H (1.42")

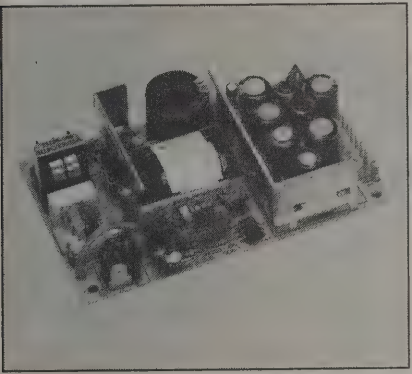
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA
PSA-30-105	5V/4A				V	V
PSA-30-112	12V/2.5A				V	V
PSA-30-115	15V/2A				V	V
PSA-30-124	24V/1.2A				V	V



25W OPEN P.C.B. TYPE (Universal Input)

DIM: 101.6mm (4.0") x 76.2mm (3.0") x 32mm H (1.26")

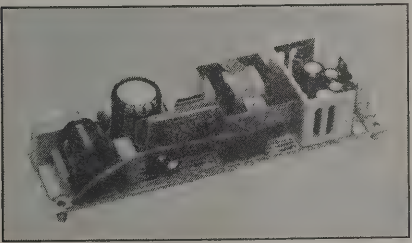
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-25-105	5V/4A				V	V		V
PSA-25-112	12V/2A				V	V		V
PSA-25-115	15V/1.6A				V	V		V
PSA-25-124	24V/1.1A				V	V		V
PSA-25-201	5V/1.5A	12V/1.5A						
PSA-25-301	5.1V/2A	12V/1A	-12V/0.3A		V	V		V
PSA-25-303	5.1V/2A	12V/1A	-5V/0.3A		V	V		V
PSA-25-305	5.1V/2A	15V/1.5A	-15V/0.5A		V	V		V



40W OPEN P.C.B. TYPE (Universal Input)

DIM: 127mm (5.0") X 76.2mm (3.0") X 30mm H (1.2")

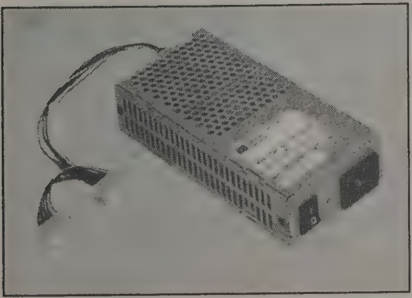
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-4005	5V/6A				V	V	V	V
PSA-4012	12V/3A				V	V	V	V
PSA-4015	15V/2.5A				V	V	V	V
PSA-4024	24V/1.5A				V	V	V	V
PSA-4031	5.1V/3A	12V/2A	-12V/0.5A		V	V	V	V
PSA-4032	5.1V/4A	12V/0.5A	-12V/0.5A		V	V	V	V
PSA-4033	5.1V/3A	12V/2A	-5V/0.5A		V	V	V	V
PSA-4034	5.1V/3A	15V/2A	-15V/0.5A		V	V	V	V
PSA-4035	5.1V/3A	24V/1A						



40W OPEN P.C.B. TYPE (Universal Input)

DIM: 177.8mm (7") X 50.8mm (2") X 32mm (1.26")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-40-271	5V/3A	12V/2A			V	V	V	



40W SHIELDED SWITCHER SUPPLIES (Universal Input)

DIM: 157mm (6.2") X 81mm (3.2") X 38mm H (1.5)

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSM-403-301	5V/6A	12V/0.7A	-12V/0.2A		V	V		V

@28 CFM

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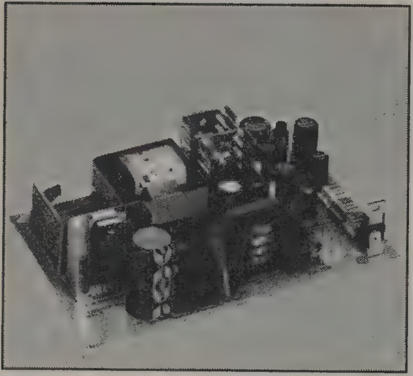
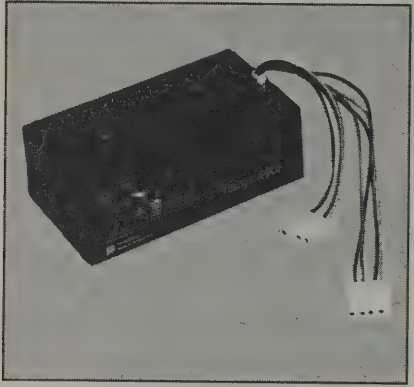


50W OPEN P.C.B. TYPE (Universal Input)

DIM: 160mm (6.3") x 100mm (3.94") x 41mm H (1.6")

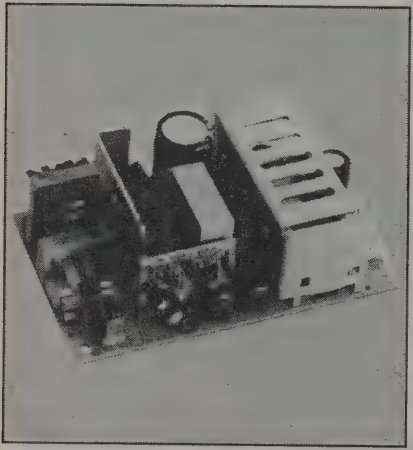
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-5031	5V/5A	12V/2A	-12V/0.5A		V	V		V
PSA-5032	5V/5A	15V/2A	-15V/0.5A		V	V		V
PSA-5033	5V/5A	12V/2A	-5V/0.5A		V	V		V



50W ENCLOSED (Universal Input)

DIM: 144mm (5.67") x 80mm (3.15") x 48mm H (1.89")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV
PSA-5231	5V/4A	12V/2A	-12V/0.5A		V	V	V

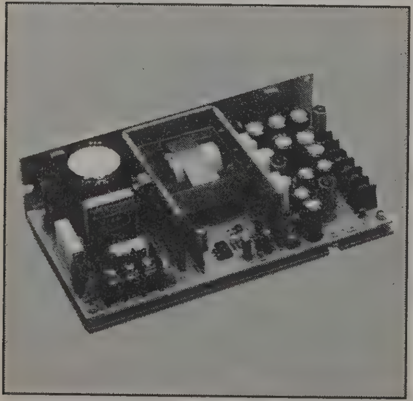


60W OPEN P.C.B. TYPE (Universal Input)

DIM: 127mm (5.0") x 76.2mm (3.0") x 40mm H (1.58")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-60-105	5V/16A				V	V		V
PSA-60-112	12V/6.6A				V	V		V
PSA-60-115	15V/5.3A				V	V		V
PSA-60-124	24V/3.3A				V	V		V
PSA-60-148	48V/1.6A							
PSA-60-202	5.1V/8A	24V/1.8A						
PSA-60-203	5.1V/6A	12V/4.5A						
PSA-60-301	5.1V/8A	12V/3A	-12V/0.5A		V	V		V
PSA-60-302	5.1V/8A	12V/1.8A	-12V/1.8A					
PSA-60-303	5.1V/8A	12V/3A	-5V/0.5A		V	V		V
PSA-60-304	5.1V/8A	15V/2A	-15V/0.5A					

@20 CFM



110W L BRACKET TYPE (Universal Input)

DIM: 172.2mm (6.8") X 96.52mm (3.8") x 43.6mm H (1.72")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-110-105	5V/22A				V	V	V	
PSA-110-112	12V/9.0A				V	V	V	
PSA-110-115	15V/7.3A				V	V	V	
PSA-110-124	24V/4A				V	V	V	
PSA-110-401	5V/10A	-12V/0.3A	12V/4.5A	-5V/0.75A	V	V	V	
PSA-110-402	5V/9A	-12V/0.75A	12V/0.75A	12V/3.5A	V	V	V	
PSA-110-403	5V/9A	12V/0.75A	-12V/0.75A	24V/1.75A	V	V	V	

@20 CFM

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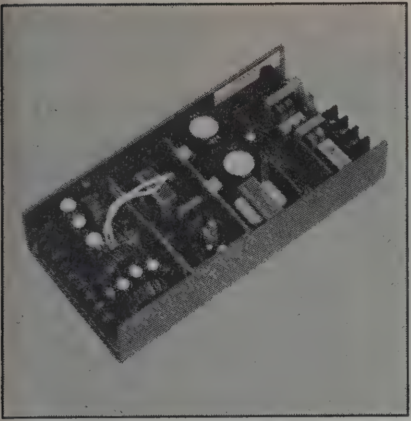
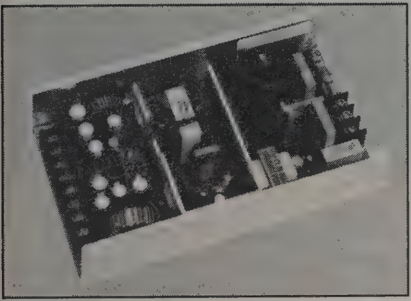


150W U BRACKET TYPE (Auto-Sensing Input)

DIM: 198.16mm (7.8") x 96.52mm (3.8") x 38.1mm H (1.5")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV
PSA-1500U	5V/15A	-5V/1A	12V/1A	12V/5A	V	V	V
PSA-1501U	5V/15A	12V/1A	-12V/1A	24V/3A	V	V	V
PSA-1502U	5V/15A	-15V/1A	15V/1A	-5V/5A	V	V	V
PSA-1503U	5V/30A				V	V	V
PSA-1504U	12V/12A				V	V	V
PSA-1505U	24V/6A				V	V	V
PSA-1506U	5V/15A	12V/6A			V	V	V
PSA-1507U	5V/15A	12V/1A	12V/6A		V	V	V
PSA-1508U	5V/15A	12V/1A	12V/6A	-5V/5A	V	V	V
PSA-1509U	5V/15A	-5V/1A	-12V/1A	12V/5A	V	V	V

@30 CFM



200W U BRACKET TYPE (Auto-Sensing Input)

DIM: 203.2mm (8") x 114.3mm (4.5") x 50.4mm H (2")

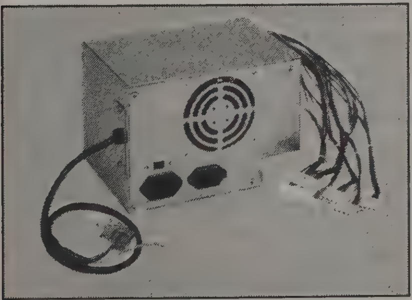
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV
PSA-2041U	5V/25A	-5V/2A	-12V/2A	12V/5A	V	V	V
PSA-2042U	5V/25A	12V/2A	-12V/2A	12V/5A	V	V	V
PSA-2044U	5V/25A	-12V/2A	12V/2A	24V/2.5A	V	V	V

@30 CFM

POWER SUPPLY FOR PS2

DIM: 150mm (5.91") x 140mm (5.51") x 86mm H (3.39")

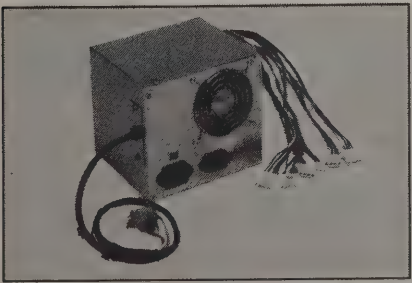
MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	VDE	NORDIC
PSA-1400C	5V/19A	-5V/0.3A	12V/4A	-12V/0.5A	V	V	V	
PSA-2054C	5V/23A	-5V/0.3A	12V/9A	-12V/0.5A	V	V	V	V



POWER SUPPLY FOR AT

DIM: 212mm (8.35") x 150mm (5.91") x 150mm H (5.91")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	TUV	VDE
PSA-2020C	5V/22.5A	-5V/0.3A	12V/9A	-12V/0.5A	V	V		V
PSA-300	5V/30A	-5V/0.5A	12V/12A	-12V/0.5A	V	V	V	



POWER SUPPLY FOR PC

DIM: 165mm (6.5") x 150mm (5.91") x 151mm H (5.94")

MODEL	O/P1	O/P2	O/P3	O/P4	UL	CSA	VDE
PSA-2056C	5V/23A	-5V/0.3A	12V/9A	-12V/0.5A	V	V	V

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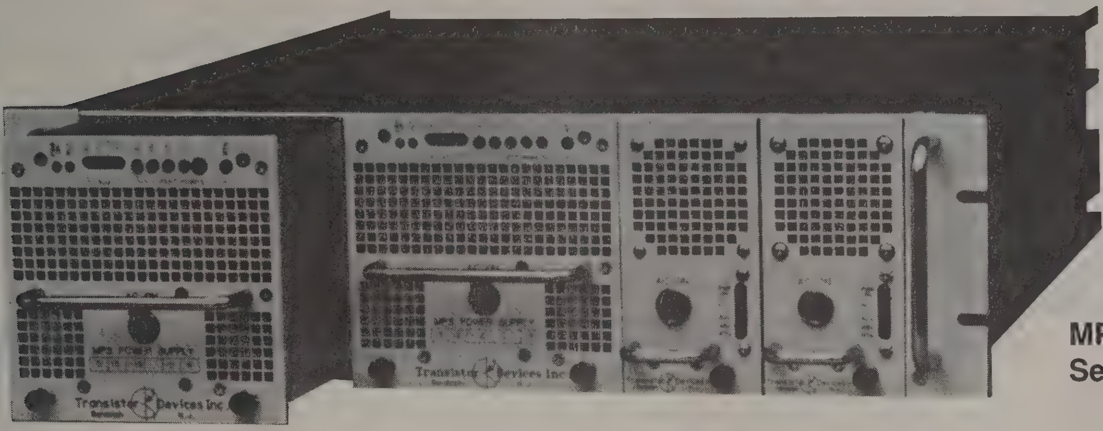

MPS Series

- WORLD CLASS - Line Current Harmonic Reduction Per IEC 555.2, / FAA 2100E, and DOD-STD-1399/300
- WORLD POWER - Input 88-264V, 47-63 Hz or 40-60V DC
- N+1 PARALLEL REDUNDANCY - With battery backup
- HOT BUS PLUG-IN - For Zero Down Time
- ONE TO FIVE OUTPUTS - For each module as selected by the customer

500W Modules are 1/6 Rack Wide by 4 7/8" High
1000W Modules are 1/3 Rack Wide by 4 7/8" High
3000W Modules are 1/3 Rack Wide by 6 5/8" High

INPUT SPECIFICATIONS

INPUT VOLTAGE: 88-264V AC or 40-60V DC

INPUT FREQUENCY: 47-63 Hz - Single phase

INPUT PROTECTION: Front panel circuit breaker on each module

EFFICIENCY: 72-80% including cooling and redundant diodes

POWER FACTOR: .98 Typical

LINE CURRENT HARMONICS: <5% THD @ full load

PEAK INRUSH CURRENT: 5 times full load operating current

CONDUCTED EMI: FCC-15, Subpart J, Class A and VDE 0871, Class A

SAFETY STANDARDS: UL1950, IEC950, CSA 22.2 #950

OUTPUT SPECIFICATIONS

LINE REGULATION: ±.1% + 10mV

LOAD REGULATION: ±.1% + 10mV

RIPPLE AND NOISE: Less than 50mV P-P or .5% +25mV, whichever is greater.

OVERVOLTAGE AND OVERCURRENT PROTECTION: Factory adjustable

HOLDUP TIME: 20 msec at any input line voltage.

PARALLEL LOAD SHARING - MAIN OUTPUT: Single wire interconnect.

PARALLEL LOAD SHARING - OTHER OUTPUTS: Droop of regulation characteristics 200mV or 1% of the output voltage, which ever is greater.

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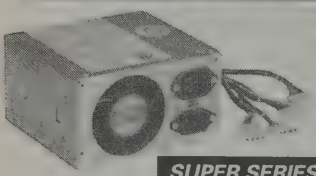
SUPER SERIES SWITCHING POWER SUPPLIES



FEATURES

- Shout Circuit Protection
- Over Voltage Protection
- Over Current Protecton
- UL/CSA/VDE Requirements
- VDE Class B
- 100% Burn-In Test

APPLICATIONS

- Clone Computers
- Industrial Control Computers
- Instrumentation
- General Purpose

SUPER SERIES: 100, 200 WATTS, CASE SIZE - 5.90" LONG X 5.51" WIDE X 3.40" HIGH

WATAGE	MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)																RIPPLE & NOISE (pk-pk)				REGULATION % LINE/LOAD			
		+5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC		+48VDC									
		MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V4	V1	V2	V3	V4
150W	SUPER 2150	2.8	18.0	0	.03	0.5	4.2	0	0.3	–	–	–	–	–	–	–	–	1%	2%	1%	2%	+5/-4	±5	±5	±5
200W	SUPER 2200	3.0	20.0	0	0.3	0.5	7.3	0	0.3	–	–	–	–	–	–	–	–	1%	2%	1%	2%	+5/-4	±6	±3	±1
250W	SUPER 2250	3.0	25.0	0	0.5	0.5	10.0	0	0.3	–	–	–	–	–	–	–	–	1%	2%	1%	2%	+5/-4	±5	±5	±5
200W	SUPER 2200-1	3.5	40.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	50mV				1%/3%			
200W	SUPER 2200-2	–	–	–	–	2.0	16.6	–	–	–	–	–	–	–	–	–	–	100mV				1%/3%			
200W	SUPER 2200-3	–	–	–	–	–	–	–	–	1.3	13.3	–	–	–	–	–	–	100mV				1%/3%			
200W	SUPER 2200-4	–	–	–	–	–	–	–	–	–	–	–	–	0.8	8.3	–	–	200mV				1%/3%			
200W	SUPER 2200-5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.4	4.1	300mV				1%/3%			

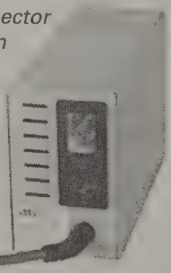
TABLETOP SERIES UNIVERSAL SWITCHING POWER SUPPLIES

FEATURES

- Communications Systems
- 20MS Hold-Up Time
- Lighted On-Off Switch
- Shelded Output Cable
- Military Applications
- IEC fused Connector
- Instrumentation
- High Efficiency
- Class B Filter

APPLICATIONS

- Process control Equipment
- Hard Disk Systems
- External Floppy Systems
- Tape Back-Up Systems
- Modems
- Terminals
- Small Computer Systems



TT SERIES: 30 WATTS, CASE SIZE - 7" LONG X 2.60" WIDE X 4.30" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)														RIPPLE & NOISE (pk-pk)			REGULATION % LINE/LOAD		
	+5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC							
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3
UV330-1TT	0.2	1.5	–	–	0	1.5	0	0.3	–	–	–	–	–	–	50mV	100mV	100mV	1%/5%	1%/5%	2%/5%
UV330-2TT	0.2	1.5	0	0.3	0	1.5	–	–	–	–	–	–	–	–	50mV	100mV	100mV	1%/1%	1%/5%	1%/3%
UV330-3TT	0.2	2.0	–	–	–	–	–	–	0.2	2.0	–	–	–	–	50mV	100mV		1%/1%	1%/3%	
UV330-4TT	0.2	1.5	–	–	–	–	–	–	0.1	1.2	0.1	0.3	–	–	50mV	100mV	100mV	1%/1%	1%/3%	1%/5%
UV330-5TT	0.2	2.0	–	–	–	–	–	–	–	–	–	–	0.2	0.75	50mV	150mV		1%/1%	1%/5%	
UV330-6TT	0.2	6.0	–	–	–	–	–	–	–	–	–	–	–	–	50mV			1%/1%		
UV330-7TT	–	–	–	–	0.1	2.0	–	–	–	–	–	–	–	–	100mV			1%/1%		
UV330-8TT	–	–	–	–	–	–	–	–	0.1	2.5	–	–	–	–	100mV			1%/1%		
UV330-9TT	–	–	–	–	–	–	–	–	–	–	–	–	0.1	1.3	150mV			1%/1%		

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 30 WATTS

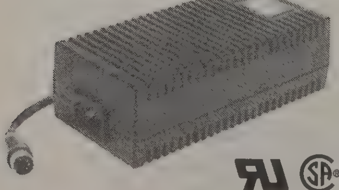
DESKTOP SERIES UNIVERSAL SWITCHING POWER SUPPLIES

FEATURES

- EMI VDE Class B
- No Minimum Load Required
- Single And Multiple Output
- Universal Input 90VAC To 260VAC

APPLICATIONS

- Computer Peripherals
- Hard Disk Drives
- Tape Drives
- Modems
- Test Instrumentation Products



DT330 SERIES: 30 WATTS, CASE SIZE - 6.5" LONG X 3.15" WIDE X 2.25" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)										RIPPLE & NOISE (pk-pk)			REGULATION % LINE/LOAD		
	+5VDC		-5VDC		+12VDC		-12VDC		+18VDC							
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3
DT330-1	0.2	2.0	–	–	0	1.5	0	0.3	–	–	50mV	100mV	100mV	1%/5%	1%/5%	2%/5%
DT330-2	0.2	3.5	–	–	0	1.0	–	–	–	–	50mV	100mV		1%/5%	1%/5%	
DT330-3	–	–	–	–	–	–	–	–	0.2	2.0	100mV			1%/5%		

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 30 WATTS

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MF SERIES

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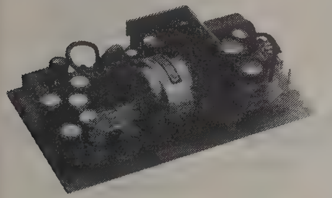
FEATURES

- *High Surge Output*
- *115/230V Selectable*
- *Main Output Adjustable*
- *Compact & Low Cost*
- *Overload Protection*
- *Overvoltage Protection*
- *Short Circuit Protection*
- *100% Hi-Pot Tested*
- *100% Cycling Burn-In*
- *High Efficiency*
- *Built-In Line Filter, FCC Level A*

APPLICATIONS

- *Portable Computer Systems*
- *Instrumentation*
- *CRT Terminal*
- *Color Monitor*
- *Plotter*
- *Printer*
- *Robotics*
- *General Purpose*



MF330 SERIES: 30 WATTS, BOARD SIZE - 5.12" LONG X 2.76" WIDE X 1.30" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)														RIPPLE & NOISE (pk-pk)			LINE REGULATION %			LOAD REGULATION %		
	+5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC										
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3	V1	V2	V3
MF330-1	0.30	3.00	–	–	0.00	1.00	0.00	0.25	–	–	–	–	–	–	50mV	100mV	100mV	0.5	1.0	1.0	1.0	3.0	8.0
MF330-2	0.30	3.00	0.00	0.05	0.00	1.00	–	–	–	–	–	–	–	–	50mV	100mV	100mV	0.5	1.0	1.0	1.0	3.0	8.0
MF330-3	–	–	–	–	0.00	2.50	–	–	–	–	–	–	–	–	100mV			0.2			0.3		
MF330-4	0.30	3.00	0.00	0.20	–	–	–	–	0.00	1.00	–	–	–	–	50mV	100mV	100mV	0.5	1.0	1.0	1.0	5.0	8.0
MF330-5	0.00	6.00	–	–	–	–	–	–	–	–	–	–	–	–	50mV			0.5			1.0		
MF330-6	0.35	3.50	–	–	–	–	–	–	–	–	–	–	0.05	0.50	50mV	100mV		0.5	0.5		1.0	1.0	
MF330-7	0.20	2.00	–	–	0.00	1.75	–	–	–	–	–	–	–	–	50mV	100mV		0.5	0.5		1.0	3.0	
MF330-8	0.20	2.00	–	–	–	–	–	–	0.07	0.70	0.07	0.70	–	–	50mV	100mV	100mV	0.5	0.5	0.5	1.0	5.0	5.0
MF330-9	–	–	–	–	–	–	–	–	0.10	1.00	0.10	1.00	–	–	100mV	100mV		0.5	0.5		0.5	5.0	
MF330-10	–	–	–	–	–	–	–	–	–	–	–	–	0.00	1.25	100mV			0.5			0.5		
MF330-11	0.60	3.00	–	–	–	–	0.00	0.25	0.00	1.00	–	–	–	–	50mV	100mV	100mV	0.5	5.0	5.0	1.0	5.0	8.0

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 40 WATTS
NOTE: MF330 SERIES ONLY HAS UL APPROVALS

MF339 SERIES: 40 WATTS, BOARD SIZE-5.00" LONG X 3.00" WIDE X 1.57" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)														RIPPLE & NOISE (pk-pk)			LINE REGULATION %			LOAD REGULATION %		
	+5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC										
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3	V1	V2	V3
MF339-1	0.60	3.00	–	–	0.00	2.00	0.00	0.30	–	–	–	–	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
MF339-2	0.60	3.00	–	–	–	–	–	–	0.00	1.60	0.00	0.30	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
MF339-3	0.60	3.00	0.00	0.30	0.00	2.00	–	–	–	–	–	–	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
MF339-4	0.80	8.00	–	–	–	–	–	–	–	–	–	–	–	–	100mV			1.0			1.0		
MF339-5	–	–	–	–	–	–	0.40	3.50	–	–	–	–	–	–	100mV			1.0			1.0		
MF339-6	–	–	–	–	–	–	–	–	0.04	2.50	–	–	–	–	100mV			1.0			1.0		
MF339-7	–	–	–	–	–	–	–	–	–	–	–	–	0.20	1.50	100mV			1.0			1.0		
MF339-8	0.00	0.50	–	–	–	–	–	–	–	–	–	–	0.20	1.50	100mV	50mV		1.0	1.0		1.0	1.0	
MF339-9	0.60	3.00	–	–	–	–	0.00	0.20	–	–	–	–	0.00	1.00	50mV	120mV	50mV	1.0	5.0	1.0	1.0	5.0	1.0

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 40 WATTS

UV SERIES

UNIVERSAL INPUT SWITCHING POWER SUPPLIES

FEATURES

- *90 To 260 VAC Universal Input*
- *Compact & Low Cost*
- *Overload Protection*
- *Overvoltage Protection*
- *Short Circuit Protection*
- *100% Hi-Pot Tested*
- *100% Cycling Burn-In*
- *Built-In Line Filter To Meet Class B*
- *High Efficiency*

APPLICATIONS

- *Hard Disk Subsystems*
- *External Floppy Disk Systems*
- *External Tape Backup*
- *Terminals*
- *Modems*
- *Printers And Plotters*

UV330 SERIES: 30 WATTS, BOARD SIZE-5.12" LONG X 2.76" WIDE X 1.14" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS)														RIPPLE & NOISE (pk-pk)			LINE REGULATION %			LOAD REGULATION %		
	+5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC										
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3	V1	V2	V3
UV330-1	0.20	1.50	–	–	0.00	1.50	0.00	0.30	–	–	–	–	–	–	50mV	100mV	100mV	1.0	1.0	1.0	1.0	3.0	5.0
UV330-2	0.20	1.50	0.00	0.30	0.00	1.50	–	–	–	–	–	–	–	–	50mV	100mV	100mV	1.0	1.0	1.0	1.0	3.0	5.0
UV330-3	0.20	2.00	–	–	0.10	1.50	–	–	–	–	–	–	–	–	50mV	100mV		1.0	1.0		1.0	3.0	
UV330-4	0.20	1.50	–	–	–	–	–	–	0.10	1.20	0.10	0.30	–	–	50mV	100mV	100mV	1.0	1.0	1.0	1.0	3.0	5.0
UV330-5	0.20	2.00	–	–	–	–	–	–	–	–	–	–	0.10	0.75	50mV	150mV		1.0	1.0		1.0	5.0	
UV330-6	0.20	6.00	–	–	–	–	–	–	–	–	–	–	–	–	50mV			1.0			1.0		
UV330-7	–	–	–	–	0.10	2.50	–	–	–	–	–	–	–	–	100mV			1.0			1.0		
UV330-8	–	–	–	–	–	–	–	–	0.10	2.00	–	–	–	–	100mV			1.0			1.0		
UV330-9	–	–	–	–	–	–	–	–	–	–	–	–	0.10	1.30	150mV			1.0			1.0		

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 30 WATTS

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UV SERIES

UNIVERSAL INPUT SWITCHING POWER SUPPLIES

FEATURES

- *90 To 260 VAC Universal Input*
- *Compact & Low Cost*
- *Overload Protection*
- *Overvoltage Protection*
- *Short Circuit Protection*
- *100% Hi-Pot Tested*
- *100% Cycling Burn-In*
- *Built-In Line Filter*
- *High Efficiency*
- *Short Circuit Protection*

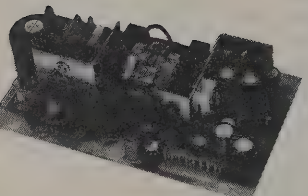
APPLICATIONS

- *Robotics, Instrumentation*
- *Color Monitor, CRT Terminal*
- *External Tape Backup*
- *Terminals*
- *Portable Computer Systems*
- *Printers And Plotters*

UV 340 SERIES: 40 WATTS, BOARD SIZE-5.00" LONG X 3.00" WIDE X 1.18" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS) +5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC		RIPPLE & NOISE (pk-pk)			LINE REGULATION %			LOAD REGULATION %		
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V1	V2	V3	V1	V2	V3
UV340-1	0.60	3.00	–	–	0.00	2.00	0.00	0.30	–	–	–	–	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
UV340-2	0.60	3.00	–	–	–	–	–	–	0.00	1.60	0.00	0.30	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
UV340-3	0.60	3.00	0.00	0.30	0.00	2.00	–	–	–	–	–	–	–	–	50mV	100mV	100mV	1.0	3.0	3.0	1.0	3.0	3.0
UV340-4	0.80	8.00	–	–	–	–	–	–	–	–	–	–	–	–	100mV			1.0			1.0		
UV340-5	–	–	–	–	0.40	3.50	–	–	–	–	–	–	–	–	100mV			1.0			1.0		
UV340-6	–	–	–	–	–	–	–	–	0.40	2.70	–	–	–	–	100mV			1.0			1.0		
UV340-7	–	–	–	–	–	–	–	–	–	–	–	–	0.20	1.70	100mV			1.0			1.0		
UV340-12	0.40	3.00	–	–	0.20	2.00	–	–	–	–	–	–	–	–	50mV	100mV		1.0	3.0		1.0	3.0	

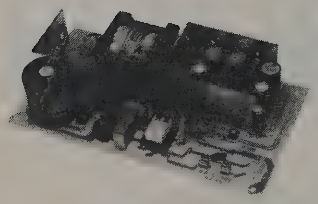
NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 40 WATTS



UV365 SERIES: 65 WATTS, BOARD SIZE-6.00" LONG X 3.50" WIDE X 1.69" HIGH

MODEL NUMBER	OUTPUT LOAD CURRENT (AMPS) +5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC		RIPPLE & NOISE (pk-pk)				LINE/LOAD REGULATION %			
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V4	V1	V2	V3	V4
UV365-1	0.50	5.50	0.00	0.50	0.20	2.50	0.00	0.50	–	–	–	–	–	–	50mV	100mV	100mV	100mV	1.0	6.0	3.0	6.0
UV365-2	0.50	6.00	–	–	0.20	2.50	0.00	0.50	–	–	–	–	–	–	50mV	100mV	100mV		1.0	3.0	6.0	
UV365-3	0.50	5.50	0.00	0.50	0.20	3.00	–	–	–	–	–	–	–	–	50mV	100mV	100mV		1.0	6.0	3.0	
UV365-4	0.50	6.00	–	–	0.20	3.00	–	–	–	–	–	–	–	–	50mV	100mV			1.0	3.0		
UV365-5	0.50	13.00	–	–	–	–	–	–	–	–	–	–	–	–	100mV				1.0			
UV365-6	–	–	–	–	0.30	5.50	–	–	–	–	–	–	–	–	100mV				1.0			
UV365-7	–	–	–	–	–	–	–	–	0.30	4.50	–	–	–	–	100mV				1.0			
UV365-8	–	–	–	–	–	–	–	–	–	–	–	–	0.20	3.00	100mV				1.0			

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 65 WATTS



UV385 SERIES: 85 WATTS, BOARD SIZE-7.75" LONG X 4.25" WIDE X 1.69" HIGH

MODEL NUMBER	TB2 +5VDC		-5VDC		+12VDC		-12VDC		+15VDC		-15VDC		+24VDC		RIPPLE & NOISE (pk-pk)				LINE/LOAD REGULATION %			
	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	MIN	RATED	V1	V2	V3	V4	V1	V2	V3	V4
UV385-1	0.50	8.00	0.00	0.50	0.20	3.00	0.00	0.50	–	–	–	–	–	–	50mV	100mV	100mV	100mV	1.0	6.0	3.0	6.0
UV385-2	0.50	8.50	–	–	0.20	3.00	0.00	0.50	–	–	–	–	–	–	50mV	100mV	100mV		1.0	3.0	6.0	
UV385-3	0.50	8.00	0.00	0.50	0.20	3.50	–	–	–	–	–	–	–	–	50mV	100mV	100mV		1.0	3.0	6.0	
UV385-4	0.50	8.50	–	–	0.20	3.50	–	–	–	–	–	–	–	–	50mV	100mV			1.0	3.0		
UV385-5	0.50	8.00	–	–	–	–	–	–	0.10	1.50	0.10	1.50	–	–	50mV	100mV	100mV		1.0			
UV385-6	0.50	17.00	–	–	–	–	–	–	–	–	–	–	–	–	100mV				1.0			
UV385-7	–	–	–	–	0.30	7.00	–	–	–	–	–	–	–	–	100mV				1.0			
UV385-8	–	–	–	–	–	–	–	–	0.30	6.00	–	–	–	–	100mV				1.0			
UV385-9	–	–	–	–	–	–	–	–	–	–	–	–	0.20	3.80	100mV				1.0			
UV385-10	0.50	4.00	–	–	–	–	–	–	0.00	.050	0.00	0.50	0.10	2.00	50mV	100mV	100mV		1.0	3.0	6.0	

NOTE: EACH OUTPUT CAN PROVIDE A PEAK LOAD CURRENT FOR 30 SECONDS, BUT TOTAL CONTINUOUS LOAD CANNOT EXCEED 65 WATTS

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

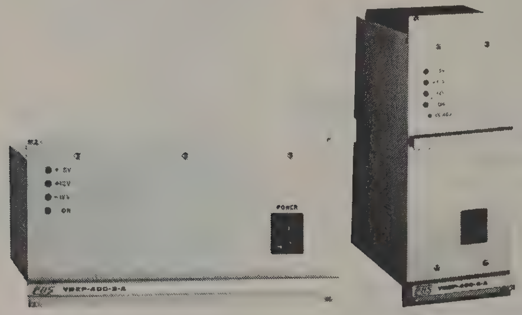
TRI SOURCE INC. Power Supplies

VMEP SERIES VMEbus/Eurocard Modular AC-DC Switching Power Supplies

The Power Pac™ VMEP Series is a group of high-efficiency switching power supplies in 130 models, with capacities ranging from 120 to 800 watts, and a large selection of outputs. The supplies are designed specifically for VMEbus and incorporate VMEbus-compatible signals ACFAIL and SYSRESET.

Power switch and indicator light, and LED indicators for the three outputs are located on the front panel. Input, output, system logic, and sensing connections are made on the back through connectors, or studs for high-current connections.

The units are designed for total environmental compatibility—physical and electrical—with VMEbus systems.



FEATURES

- Dual input 115/230 VAC @ 47-63 Hz
- Wide choice of outputs
- ±0.2% or 10mV max line/load regulation
- EMI filtering
- System logic interface
- Parallel operation/power sharing optional
- SMT construction
- Modular configuration
- Fully isolated outputs
- 50KHz switching frequency
- Floating grounds for choice of output polarity

Notes on Sizes:

Single height (3U)—5.06″ (128.5mm)
Double height (6U)—10.3″ (261.8mm)
Depth of all units—6.73″ (171mm)
Single-height units are about twice the width of double-height units of similar capacity. Widths are given in the tables that follow, at the head of each group.

NOTES ON RATINGS

The output current ratings in the charts indicate the maximum steady-state current that can be drawn from the appropriate output at 50°C. The total wattage drawn from all outputs shall not exceed the unit output wattage rating.

The 120- and 200-Watt unit ratings are for convection cooling. With forced air cooling of 40cfm the total output power rating of these units can be increased by 30%.

Auxiliary outputs have a peak current rating of 115% of ratings shown (20 sec. duration).

***NOTE:** The VMEP200-6 Series is also available with 48VDC input. Please order DC-input series as VMEC200-6-X, where X designates the desired outputs, as in the table above.

FIVE YEAR WARRANTY

VMEP SERIES—Models, Ranges, Outputs, Sizes

OUTPUT VOLTAGE→	5	12	15	24	* *
Part No.	Current in Amps DC				Case Size
VMEP120-X-A	22.0	4.0/2.0			6U × 8HP
VMEP120-X-B	22.0		3.0/1.5		
VMEP120-X-C	22.0/4.0	4.0			
VMEP120-X-D	22.0/2.0			2.0	
VMEP120-X-E	22.0/4.0	2.0			
VMEP120-X-F	22.0	4.0		1.0	
VMEP200-X-A*	34.0	4.0/3.6			6U × 16HP or 3U × 36HP
VMEP200-X-B	34.0		3.0/2.9		
VMEP200-X-C	34.0/8.7	4.0			
VMEP200-X-D	34.0	3.6		2.0	
VMEP200-X-E	34.0/10.0			1.8	
VMEP200-X-F	34.0	4.0		1.8	
VMEP200-X-G	10.0/8.7	14.0			
VMEP200-X-H	10.0	14.0/3.6			
VMEP200-X-J	10.0	14.0		1.8	
VMEP200-X-K	10.0/8.7			7.0	
VMEP200-X-L	10.0	3.6		7.0	
VMEP200-X-M		4.0/3.6		7.0	
VMEP400-X-A	68.0	8.0/7.2			6U × 20HP or 3U × 48HP
VMEP400-X-B	68.0		6.0/5.8		
VMEP400-X-C	68.0/12.0	8.0			
VMEP400-X-D	68.0	7.2		4.0	
VMEP400-X-E	68.0/12.0			3.6	
VMEP400-X-F	68.0	8.0		3.6	
VMEP400-X-G	12.0/12.0	28.0			
VMEP400-X-H	12.0	28.0/7.2			
VMEP400-X-J	12.0	28.0		3.6	
VMEP400-X-K	12.0/12.0			14.0	
VMEP400-X-L	12.0	7.2		14.0	
VMEP400-X-M		8.0/7.2		14.0	
VMEP600-X-A	102.0	12.0/10.8			6U × 28HP
VMEP600-X-B	102.0		10.0/8.7		
VMEP600-X-C	102.0/26.0	12.0			
VMEP600-X-D	102.0	10.8		6.0	
VMEP600-X-E	102.0/29.0			5.5	
VMEP600-X-F	102.0	12.0		5.4	
VMEP600-X-G	29.0/12.0	42.0			
VMEP600-X-H	29.0	42.0/10.8			
VMEP600-X-J	29.0	42.0		5.4	
VMEP600-X-K	29.0/12.0			21.0	
VMEP600-X-L	29.0	10.8		21.0	
VMEP600-X-M		12.0/10.8		21.0	
VMEP800-X-A	134.0	16.0/12.0			6U × 42HP or 3U × 84HP
VMEP800-X-B	134.0		13.0/11.5		
VMEP800-X-C	134.0/36.0	12.0			
VMEP800-X-D	134.0	12.0		8.0	
VMEP800-X-E	134.0/36.0			7.2	
VMEP800-X-F	134.0	16.0		7.2	
VMEP800-X-G	36.0/12.0	56.0			
VMEP800-X-H	36.0	56.0/12.0			
VMEP800-X-J	36.0	56.0		7.2	
VMEP800-X-K	36.0/12.0			28.0	
VMEP800-X-L	36.0	12.0		28.0	
VMEP800-X-M	36.0	16.0/12.0		28.0	

SIGNIFICANCE OF MODEL NUMBERS

For convenience in using this brochure, we have devised a system of model numbers as follows:

VMEC	XXX	-	X	-	X
Designates type	Designates total power		Designates height in VMEBus height units (1u=1.75″[44.45mm])		(Suffix) designates outputs as given in table

*** * NOTE:** 48 VDC output available on special order.

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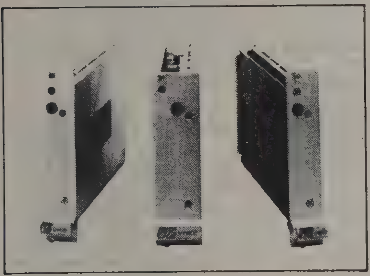
TRI SOURCE INC. Power Supplies

VMEC SERIES Modular DC-DC Converters

Designed specifically for VMEbus applications, these switchmode converters draw their DC input from the main supply or other external source, providing additional regulated DC outputs.
DC Input: 10-18VDC or 20-36VDC
Regulation: ±0.2% line/load.



VMEC SERIES—Models, Ranges, Outputs, Sizes

OUTPUT VOLTAGE→	02	05	12	15	24	36	48	
Part No.	Current in Amps DC							Case Size
40 WATT UNITS								
VMEC40-3-A-XX*	8.0							3U × 5HP
VMEC40-3-B-XX		8.0						
VMEC40-3-C-XX			3.3					
VMEC40-3-D-XX				2.6				
VMEC40-3-E-XX					1.7			
VMEC40-3-F-XX						1.1		
VMEC40-3-G-XX							0.8	
VMEC40-3-H-XX	4.0		1.7					
VMEC40-3-J-XX			1.7/1.7					
VMEC40-3-K-XX				1.3/1.3				
VMEC40-3-L-XX		4.0	1.7					
VMEC40-3-M-XX		4.0			0.9			
80 WATT UNITS								
VMEC80-3-A-XX	16.0							3U × 7HP
VMEC80-3-B-XX		16.0						
VMEC80-3-C-XX			6.6					
VMEC80-3-D-XX				5.2				
VMEC80-3-E-XX					3.4			
VMEC80-3-F-XX						2.2		
VMEC80-3-G-XX							1.6	
VMEC80-3-H-XX	8.0		3.4					
VMEC80-3-J-XX			3.4/3.4					
VMEC80-3-K-XX				2.6/2.6				
VMEC80-3-L-XX		8.0	3.4					
VMEC80-3-M-XX		8.0			1.8			

*Specify nominal input voltage: – 12 for 12VDC, – 24 for 24VDC, (48VDC opt.)

FEATURES

- 3U Eurocard format
- Wide choice of outputs
- EMI filtering
- Isolated outputs
- Floating grounds
- Remote sense
- Remote on/off
- Overvoltage protection
- Overload protection
- Line/load regulation < ±0.2%

KS SERIES Telecommunications AC-DC Power Sources

Regulated/unregulated, optional battery back-up

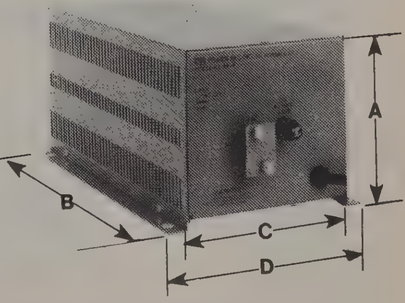
Power Pac™ KS Series power sources are designed for the key/PBX telephone system OEM and similar applications. Models have single outputs of either 24VDC or 48VDC. Input is 117VAC ±10%, 60 Hz, fuse protected. 230VAC ±10%, 50 Hz, is optional.

The units with the battery back-up circuitry ("B" and "D" models) charge stand-by batteries, not included, monitor line and output voltage, and automatically switch to batteries when needed. Normal operation is resumed when line voltage is restored.

Models, ratings and sizes

OUTPUT VOLTAGE→	24	48	
Part No.	Current in Amps DC		Case
BASIC (UNREGULATED) UNITS			
KSA100-XX	4.0	2.0	KS3
KSA200-XX	7.0	4.0	KS5
KSA400-XX	15.0	8.0	KS7
UNREGULATED, W/ BATTERY BACK-UP CIRCUIT			
KSB100-XX	4.0	2.0	KS5
KSB200-XX	7.0	4.0	KS5
KSB400-XX	15.0	8.0	KS7
CONSTANT VOLTAGE (FERRORESONANT) UNITS			
KSC100-XX	4.0	2.0	KS5
KSC200-XX	7.0	4.0	KS5
KSC400-XX	15.0	8.0	KS7
FERRORESONANT W/ BATTERY BACK-UP CIRCUIT			
KSD100-XX	4.0	2.0	KS5
KSD200-XX	7.0	4.0	KS5
KSD400-XX	15.0	8.0	KS7

*Specify output voltage req'd - 24 or 48VDC



DIMENSIONS
(refer to models listing for case designation)

CASE	A	B	C	D
KS3	4.75" (120mm)	9" (229mm)	6" (152mm)	7.5" (190mm)
KS5	5.75" (146mm)	12" (305mm)	6" (152mm)	7.5" (190mm)
KS7	5.25" (133mm)	12" (305mm)	9" (229mm)	10.5" (267mm)

REGULATION:

	A, B Models	C, D Models
Line	DC output proportional to input	±1%
Load	10% (50-100% change)	7% (25-100% change)
Ripple	5.0% RMS	0.5% RMS

FEATURES

- Reliable, conservative design
- Convection cooled
- 6-foot, 3-wire line cord
- Short circuit/overload protected
- 80–90% efficiency
- Low cost UPS protection

FIVE YEAR WARRANTY

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TRI SOURCE INC. Power Supplies

EP SERIES Linear Open Frame Power Supplies

The EP Series of open-frame linear power supplies are conservatively-rated, convection-cooled units that provide low-noise, highly-regulated DC power required by test equipment, machine controls, and other sensitive applications. Available in single (EP), dual (EPD) and triple (EPT) output configurations, many of these models can be shipped from stock in small quantity.

FEATURES

- Rugged, conservative design
- High quality, high reliability
- Custom outputs/configurations welcomed
- Low noise, high regulation
- Overload protection: foldback current limiting on all outputs
- Overvoltage protection: standard on all outputs (can be deleted by request)
- Floating grounds for choice of output polarity
- Safety covers optional
- Five-year warranty
- UL recognized

SPECIFICATIONS

Input voltage: 105/152 or 210/250 VAC, 47/440 Hz.

Output voltage/current: See rating in table. Current ratings are for 57/440 Hz. Derate 10% at 50 Hz.

Output adj. range: ±5% or .5 VDC minimum.

Regulation: ±0.15% Line & Load combined.

Ripple: 1.5 mV RMS, 5 mV pk-pk max.

Stability: ±0.1% for 8 hours after warm-up.

Temperature operating: 0°C to 71°C continuous.

Temperature derating: Derate 2%/°C above 40°C.

Temperature coefficient: Better than 0.03%/°C.

Cooling: Convection cooled.

Overload protection: Built-in foldback type current limit circuit to protect against overload and short circuit condition, with automatic recovery. Set to operate at 120 to 135% of full load current at 40°C.

Overvoltage protection: Built-in SCR crowbar set at 120-130% of nominal output.

Remote sense: Standard on size 2C and larger.

Output polarity: Floating, either side may be grounded.

Shielding: Electrostatic shield between primary and secondary of transformer.

Transient response: 50μsec for a 50% load change to recover within ±10 mV band.

EP, EPD, EPT Models, ratings and sizes

OUTPUT VOLTAGE→			+05	−05	+06	−06	+12	−12	+12/+15	−12/−15	+15	−15	+24	−24	+28	−28	+36	−36	+48	−48	CALL
		Part No.	Current in Amps DC														Case Size: Inches/Millimeters				
LINEARS	SINGLE	EP6A-XX-0V	1.2		1.0		0.5				0.5		0.4		0.35		3.750 × 3.000 × 0.375"/ 95 × 76 × 35mm				
		EP1B-XX-0V	3.0		3.0		1.7				1.5		1.2		1.0		4.875 × 4.000 × 1.625"/124 × 102 × 165mm				
		EP2C-XX-0V	6.0		6.0		3.4				3.0		2.4		2.0		5.625 × 4.875 × 2.500"/143 × 124/ 64mm				
		EP8C-XX-0V	9.0		8.5		5.1				4.5		3.3		3.0		7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EP3D-XX-0V	12.0		12.0		6.8				6.0		5.0		4.4		9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EP9D-XX-0V	18.0		18.0		10.8				9.5		7.2		6.0		14.000 × 4.875 × 2.750"/366 × 124 × 70mm				
		EP4E-XX-0V	25.0		23.0		15.0				14.0		11.0		10.0		16.750 × 4.875 × 4.875"/425 × 124 × 124mm				
		EP5F-XX-0V	50.0		46.0		30.0				28.0		22.0		20.0		16.750 × 4.875 × 4.875"/425 × 124 × 124mm				
	DUAL	EPD1B-12-0V							0.7	0.7							4.750 × 4.000 × 2.250"/121 × 102 × 57mm				
		EPD7H-05-0V	3.0	3.0													7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPD7H-06-0V			2.5	2.5											7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPD7H-12-0V					1.7	1.7									7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPD7H-15-0V									1.5	1.5					7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPD3D-05-0V	6.0	6.0													9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPD3D-06-0V			5.0	5.0											9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPD3D-12-0V					3.4	3.4									9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPD3D-15-0V									3.0	3.0					9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPD9D-12-0V					5.0	5.0									14.000 × 4.875 × 2.750"/356 × 124 × 70mm				
		EPD9D-15-0V									5.0	5.0					14.000 × 4.875 × 2.750"/356 × 124 × 70mm				
		EPD4D-36-0V															15.000 × 6.125 × 5.000"/381 × 156 × 127mm				
	TRIPLE	EPT0-05-0V	1.0	0.25			0.25										4.750 × 3.375 × 3.375"/121 × 86 × 86mm				
		EPT0-12-0V	1.0				0.25	0.25									4.750 × 3.375 × 3.375"/121 × 86 × 86mm				
		EPT5-12-0V	2.0				0.4	0.4									6.500 × 4.000 × 1.625"/165 × 102 × 41mm				
		EPT1-24-0V	2.0										1.5	1.5			12.000 × 5.875 × 5.500"/305 × 149 × 140mm				
		EPT1-05-0V	3.0	0.4													7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPT7-12-0V	3.0				0.6	0.6									7.000 × 4.875 × 2.750"/178 × 124 × 70mm				
		EPT8-12-0V	3.0				1.0	1.0									10.250 × 4.000 × 2.500"/260 × 102 × 64mm				
		EPT5-15-0V	3.0								0.8	0.8					10.250 × 4.000 × 2.500"/260 × 102 × 64mm				
		EPT1-12-0V	3.0				1.5	1.5									9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPT1-15-0V	3.0								1.3	1.3					9.000 × 4.875 × 2.750"/229 × 124 × 70mm				
		EPT2-12-0V	6.0				1.7	1.7									12.000 × 6.000 × 6.000"/305 × 152 × 152mm				
		EPT2-15-0V	6.0								1.3	1.3					11.000 × 4.875 × 2.750"/279 × 124 × 70mm				
		EPT2-24-0V	3.0										3.0	3.0			11.000 × 4.875 × 2.750"/279 × 124 × 70mm				
		EPT3-12-0V	6.0				3.0	3.0									16.750 × 4.875 × 4.875"/425 × 124 × 124mm				
		EPT3-15-0V	6.0								2.8	2.8					16.750 × 4.875 × 4.875"/425 × 124 × 124mm				
		EPT9-12-0V	12.0				1.7	1.7									14.00 × 4.875 × 2.750"/356 × 124 × 70mm				
		EPT9-15-0V	12.0								1.5	1.5					14.000 × 4.875 × 2.750"/356 × 124 × 70mm				
		EPT4-12-0V	12.0				3.4	3.4									16.750 × 4.875 × 4.875"/425 × 124 × 124mm				
		EPT4-15-0V	12.0								3.0	3.0					16.750 × 4.875 × 4.875"/425 × 124 × 124mm				

[1] Specify desired output voltage in place of "XX"

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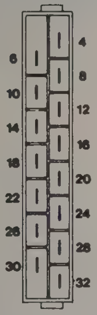
TRI SOURCE INC. Power Supplies

Output Connections and Dimensions of All Models

VMEP-120

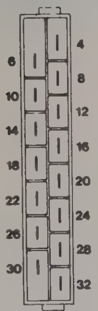


P1 Connector*

Pin No	Function
4	+ V1
6	V1Return
8	+ V1
10	V1Return
12	+ V1
14	V1Return
16	+ V1Sense
18	V1 Return Sense
20	+ V2
22	V2/V3 Return
24	- V3
26*	Power Fail
28*	System Reset
30	NC
32	Chassis Ground

*Optional

VMEP-200-3-*
VMEP-400-3-*
VMEP-200-6-
VMEP-400-6-



P1 Connector*

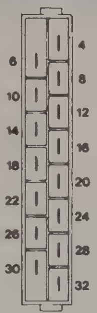
Pin No	Function
4	+ Sense
6	+ V1
8	+ V1
10	+ V1
12	+ V1
14	+ V1
16	+ V1
18	V1 Return
20	V1 Return
22	V1 Return
24	V1 Return
26	V1 Return
28	V1 Return
30	- Sense
32	Chassis Ground

P2 Connector

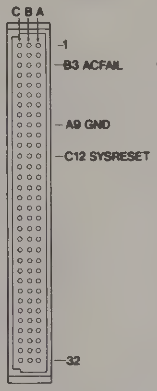
Pin No	Function
4	Remote Shutdown
6	NC
8	AC Fail
10	NC
12	SYS Reset
14	NC
16	V2 + Sense
18	+ V2
20	V2 - Sense
22	- V2
24	V3 + Sense
26	+ V3
28	V3 - Sense
30	- V3
32	Chassis Ground

* For Models VMEP-200-3, VMEP-400-3-, V1 connections will be made by threaded studs located as shown in the figure below.

VMEP-600-3-*
VMEP-800-3-*
VMEP-600-6-
VMEP-800-6-



P1 Connector*



P2 Connector

Pin No	Function
4	Remote Shutdown
6	NC
8	V2 + Sense
10	+ V2
12	+ V2
14	+ V2
16	- V2
18	- V2
20	- V2
22	V2 - Sense
24	V3 + Sense
26	+ V3
28	V3 - Sense
30	- V3
32	Chassis Ground

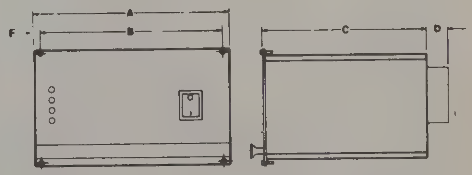
* For Models VMEP-600-3-, VMEP-800-3-, V1 connections will be made by threaded studs located as shown in the firgure below.

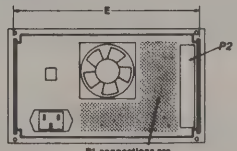
Dimensions of all models 3U in height (5.06"/128.5mm)

Model No.		A		B	C	D	E	F
VMEP-200-3	mm	182.6	(36 HP)	167.7	170.8	—	178.0	7.4
	in.	7.19		6.60	6.72	—	7.0	0.29
VMEP-400-3-	mm	243.5	(48 HP)	228.6	170.8	25.0	239.0	7.4
	in.	9.59		9.0	6.72	0.98	9.41	0.29
VMEP-600-3-	mm	319.7	(63 HP)	304.8	170.8	25.0	315.2	7.4
	in.	12.59		12.0	6.72	0.98	12.41	0.29
VMEP-800-3-	mm	426.4	(84 HP)	411.5	170.8	32.0	421.9	7.4
	in.	16.79		16.20	6.72	1.26	16.61	0.29
VMEC-40-3-	mm	25.4	(5 HP)	—	170.8	—	—	—
	in.	1.0		—	6.72	—	—	0.29
VMEC-80-3-	mm	35.6	(7 HP)	—	170.8	—	—	7.4
	in.	1.4			6.72	—	—	0.29
VMEC - 120 Planned								

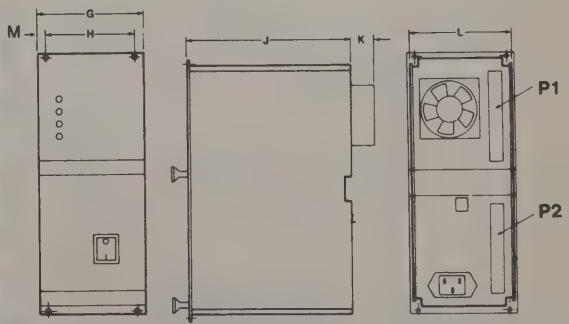
Dimensions of all models 6U in height (10.3"/261.8mm)

Model		G		H	J	K	L	M
VMEP-120-6-	mm	40.38	(8 HP)	—	176.53	—	35.56	7.5
	in	1.59		—	6.95	—	1.4	.29
VMEP-200-6-	mm	81.0	(16 HP)	66.1	170.8	—	76.4	7.4
	in.	3.19		2.6	6.73	—	3.01	0.29
VMEP-400-6-	mm	101.4	(20 HP)	86.4	170.8	25.0	96.8	7.4
	in.	3.99		3.4	6.73	0.98	3.81	0.29
VMEP-600-6-	mm	142.0	(28 HP)	127.0	170.8	25.0	137.4	7.4
	in.	5.59		5.0	6.72	0.98	5.41	0.29
VMEP-800-6-	mm	213.1	(42 HP)	198.1	170.8	32.0	208.5	7.4
	in.	8.39		7.8	6.72	1.26	8.21	0.29
VMEC-80-6-	mm	25.4	(5 HP)	—	170.8	—	—	7.4
	in.	1.00		—	6.72	—	—	0.29
VMEC-160-6-	mm	30.6	(7 HP)	—	170.8	—	—	7.4
	in.	1.4		—	6.72	—	—	0.29





P1 connections are within shaded area



MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

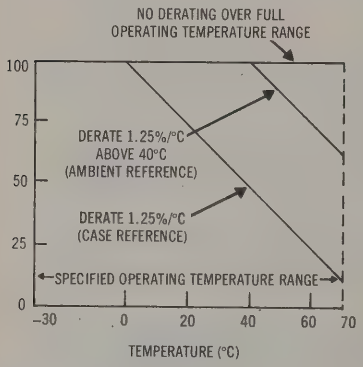


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

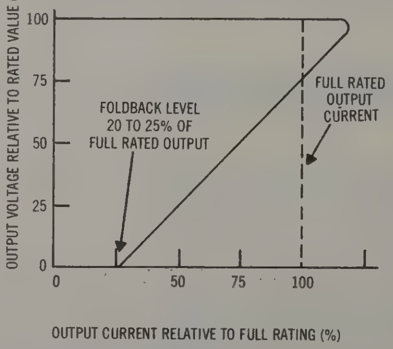


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

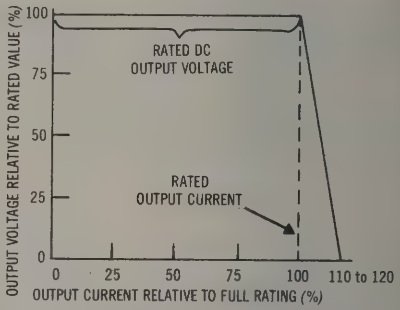


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

High Voltage is easier with
ULTRAVOLT
REGULATED HIGH VOLTAGE
UP TO **125 WATTS** IN THE PALM OF YOUR HAND

ULTRAVOLT
MODEL NO 6C24-P125
SERIAL NO: 93060015.
800-876-POWER
CS 9002, Ronkonkoma, NY 11779

Chassis Mountable DC to DC HV Power Supplies

- High Efficiency (85% to 90%)
- Models **from 125VDC** to 6KV
- Regulated Adjustable Output from 0 to Max Voltage
- Small **18 In^3 Size**
- Low Output Ripple
- Voltage and Current Monitors STD
- 60 Watt Output also Available
- Off-the-shelf Standard Products

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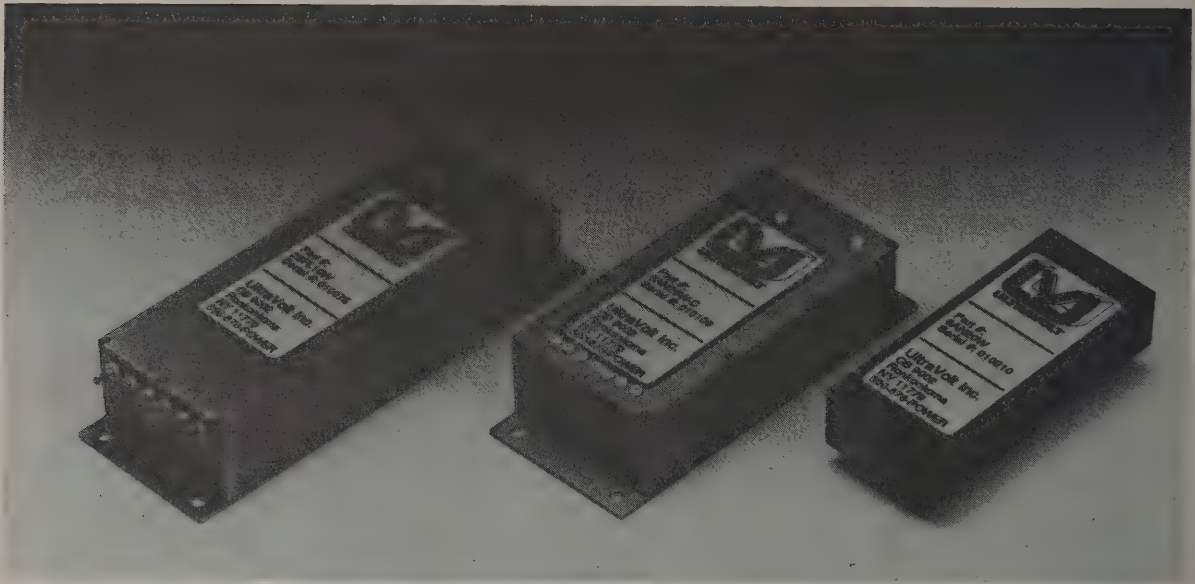
"Making High Voltage Easier"

UltraVolt, Inc.
CS 9002, Ronkonkoma, NY 11779

TELE 800-876-POWER FAX 516-363-2423

ULTRAVOLT

"Making High Voltage Easier"



PCB Mountable High Voltage Power Supplies

- **Regulated**
- High Efficiency (80% to 90%)
- Small 4.3 In^3 Size
- 9-32VDC Input Range
- Full Output Current from 0 to Maximum Output Voltage
- DAC Ready
- IDC Compatible Input Pins
- "A" Series **Low Ripple** 4 Watt or 20 Watt Output Power Supplies
- "C" Series Fast Rise/**Cap Charging** 20 Watt Output Power Supplies
- Off-the-shelf Standard Products
- Outputs as low as **125**VDC up through 15KV

Accessories

- "- F" Ripple Stripper Filter (less than .001%)
- "- M" Mu-metal Shield
- "- C" Chassis Mount RF Tight Metal Case

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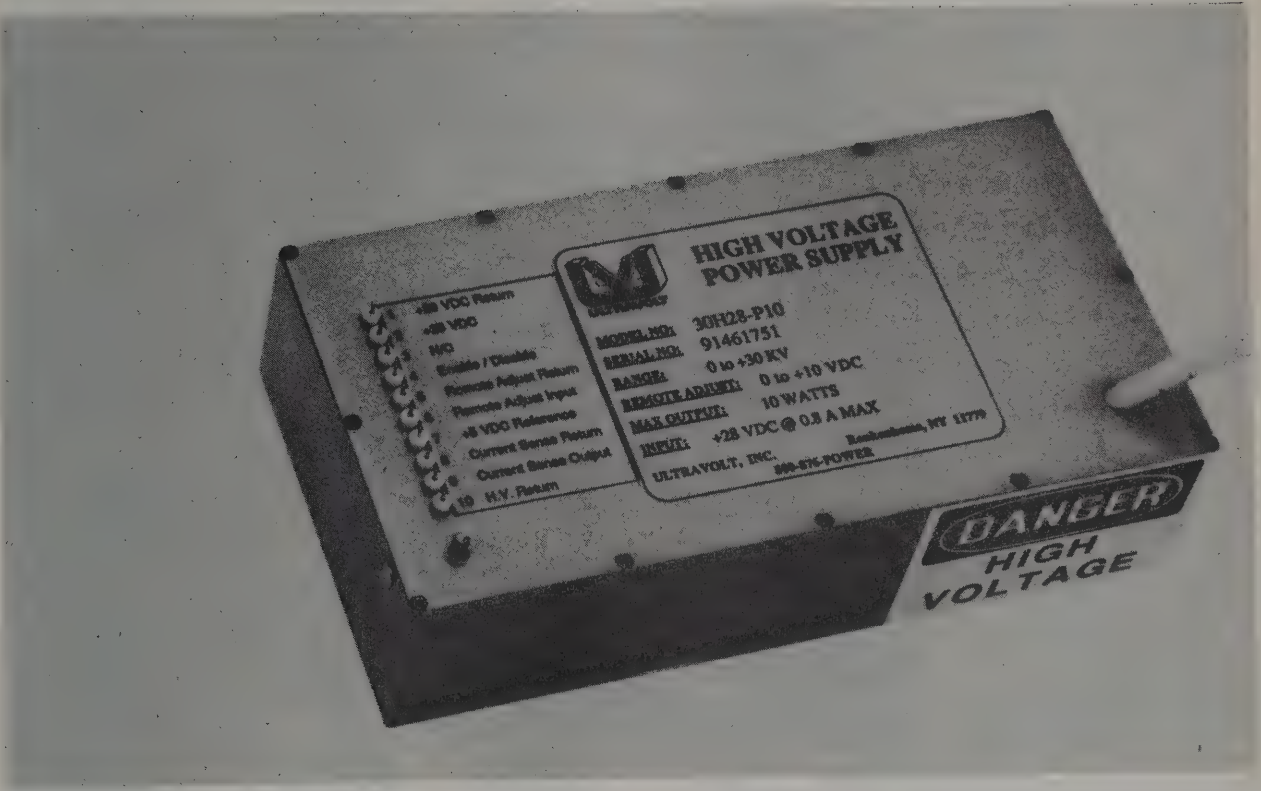
HIGH VOLTAGE POWER SUPPLY
MODEL NO: 30H28-P10
SERIAL NO: 91461751
RANGE: 0 to +30 KV
REMOTE ADJUST: 0 to +10 VDC
MAX OUTPUT: 10 WATTS
INPUT: +28 VDC @ 0.8 A MAX
ULTRAVOLT, INC.
Ronkonkoma, NY 11779
800-876-POWER
1 +28 VDC Return
2 +28 VDC
3 N/C
4 Enable / Disable
5 Remote Adjust Return
6 Remote Adjust Input
7 +5 VDC Reference
8 Current Sense Return
9 Current Sense Output
10 H.V. Return
DANGER
HIGH VOLTAGE

Precision Instrument High Voltage Power Supplies

- **Constant Power Capability:** 10 Watts from **30KV down to 2KV**
- Precise True Output Current Monitor
- 0 to 30KV Linear Gain Programming
- Low 25 PPM Temperature Coefficient
- RF/Magnetic Tight CRS Case
- High Stability/High Reliability
- Compact 42 In^3 Package
- Unipolar Positive (30H28-P10) or Negative (30H28-N10) Models
- Off-the-shelf Standard Products
- 2 to 5KV, 2 to 15KV models also available

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CS 9002, Ronkonkoma, NY 11779

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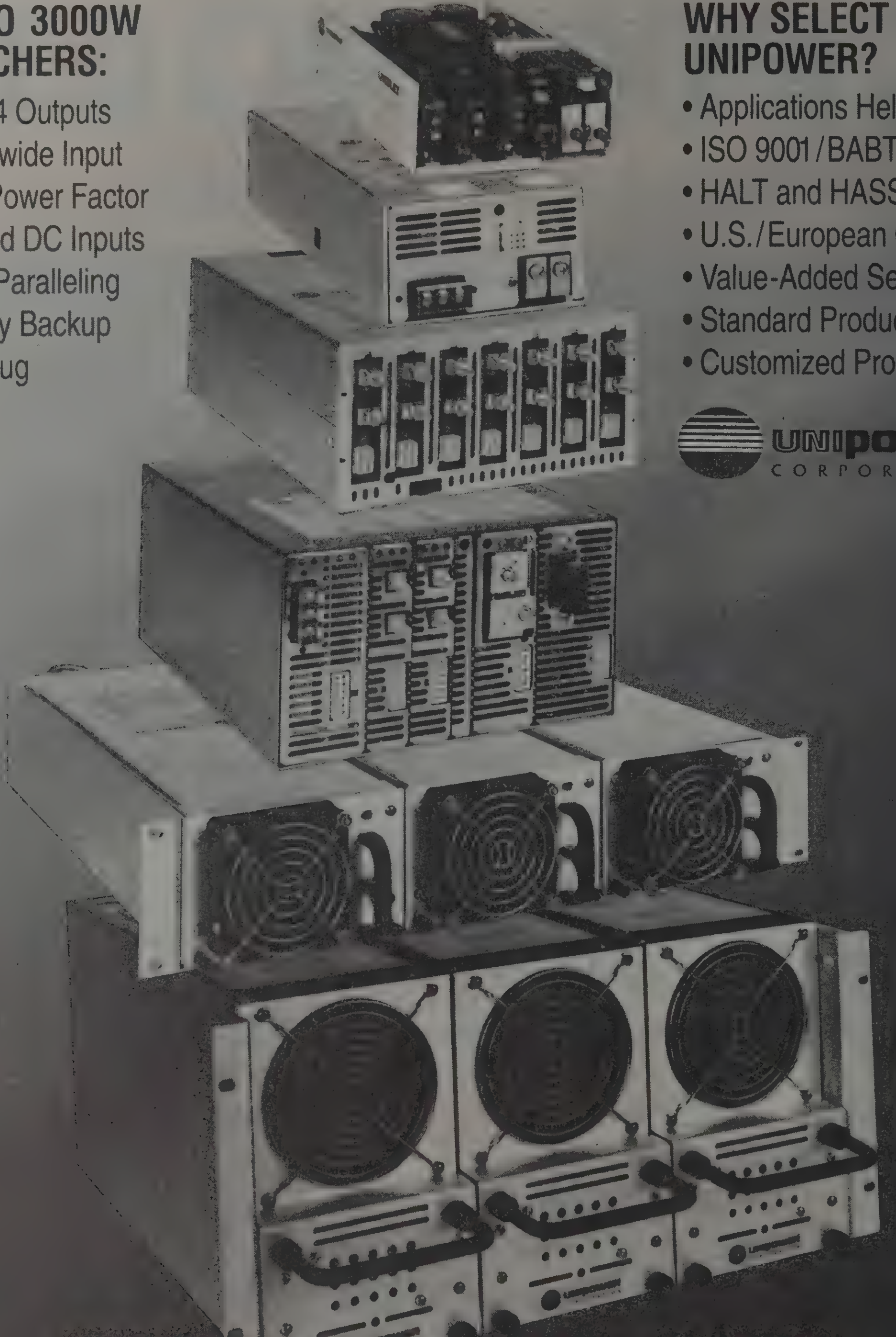
250 TO 3000W SWITCHERS:

- 1 to 14 Outputs
- Worldwide Input
- 0.98 Power Factor
- AC and DC Inputs
- N+1 Paralleling
- Battery Backup
- Hot Plug



WHY SELECT UNIPOWER?

- Applications Help
- ISO 9001/BABT
- HALT and HASS
- U.S./European Ops.
- Value-Added Service
- Standard Products
- Customized Products

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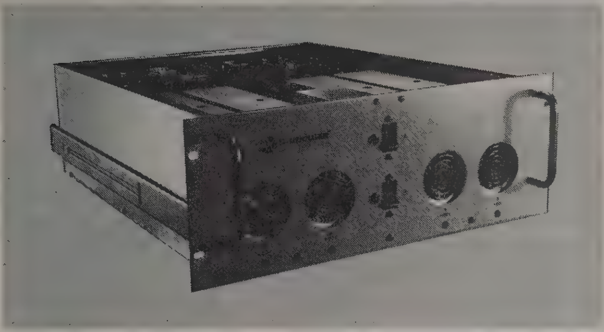
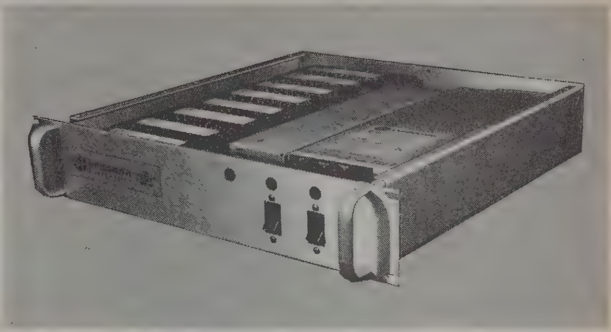
CUSTOMIZED POWER SOLUTIONS



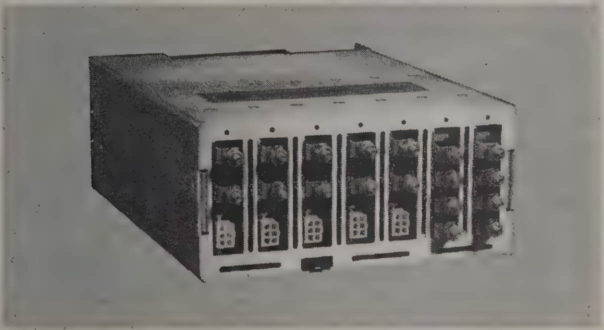
RACK MOUNT POWER SYSTEM

This 19″ rack mount power system was engineered for a remote communications station. Four standard P Series units are connected in a redundant configuration. Circuit breakers, alarm circuits, indicator lights and rear mounted terminal strips complete the package.



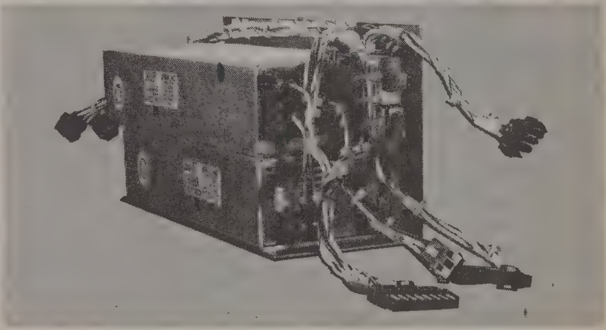
TOTAL UPS CAPABILITY

The B Series Battery Backup Switchers are available in standard 19″ rack packaging. These configurations include sealed lead acid batteries, circuit breakers for AC input and battery input as well as indicator lights to signal battery ready and battery operation.



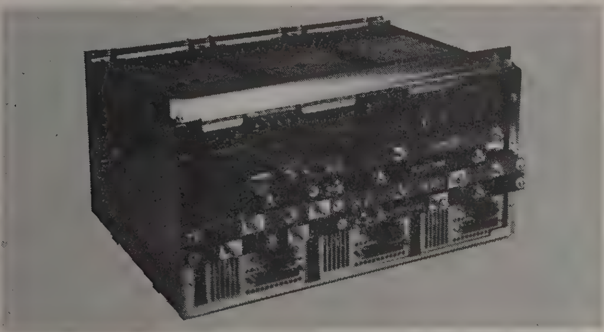
MULTI OUTPUT VME/VXI

This multi output configurable power supply can accommodate up to seven single or dual modules providing up to 14 outputs. With a maximum power of 800 watts it is ideally suited for standard bus applications including VME and VXI.



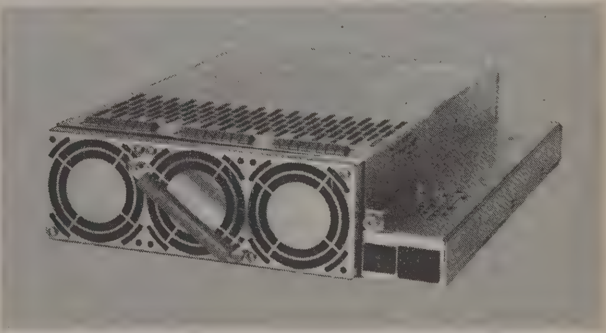
COMPLETE POWER SYSTEM

The customer for this special multi output power system needed a complete package including mounting bracket and cables with connectors. This customized solution "plugs" into the equipment and is securely mounted with built in "L" hooks and two fasteners.



2400W FAULT-TOLERANT POWER SYSTEM

This power system, customized for a large memory peripheral, has three H Series power supplies connected to current share with N + 1 redundancy. It has a triple output at 2400 watts total power, with battery backup.



500W FAULT-TOLERANT POWER SYSTEM

This 500 watt power system is customized for a computer peripheral application. It is N + 1 redundant with built-in isolation diodes and uses UNIMOD® U Series power modules.

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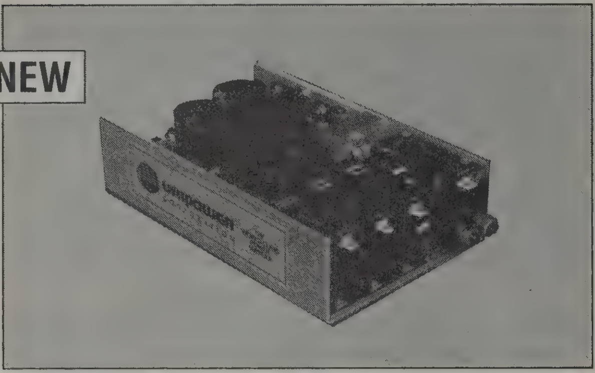
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

X SERIES: FLEXIBLE/MODULAR

1-4 Outputs, 140-500 Watts

NEW



KEY FEATURES

- Power Density To 6W/Cu. Inch
- UNIFLEX™ Modular Construction
- Ultra-Compact: 2.1 × 5 × 8 Inches
- Wide Range Adjust. Aux. Outputs
- Two Week Prototype Delivery
- Redundant N + 1 Capability
- 12V Main Avail. On Multi Outputs
- Open Frame Or Cased Versions

OPTIONS

- Worldwide Autorange 115/230VAC
- Class B EMI Filter
- Top-Mounted Fan With Cover
- End-Mounted Fan With Case

OTHER FEATURES

- Outputs From 2VDC To 36VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Special Output Configurations
- Current Sharing Parallel Operation
- 130 kHz MOSFET Switching
- 70% Efficiency
- Soft Start
- Inrush Current Limiting
- Tight Regulation & Low Noise
- Overload And Overvoltage Protection
- Thermal Protection
- EMI Input Filter
- Remote Sense And Inhibit
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range, All Outputs	2.4 Or 3 To 1
Line Regulation[1]	±0.1%
Load Regulation[2], NL-FL	0.1%
Ripple and Noise[3]	1.0% or 50mV
Hold-Up Time	20 msec.
Dynamic Response[4]	300 usec. max.
Temperature Coefficient	0.02%/°C
Overvoltage Protection, All Outputs	Power Shutdown
Remote Sense[5]	All Outputs

INPUT SPECIFICATIONS

Voltage Range, (Jumper Or Auto Range)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current, Cold Start	68A Peak, max.
Input EMI Filter, Conducted	FCC & VDE Class A or B
Input Protection	Internal Fuse

GENERAL SPECIFICATIONS

Efficiency[6]	70%, min.
Switching Frequency	130 kHz
Output Isolation, To Gnd & Other Outputs	±700VDC

ENVIRONMENTAL SPECIFICATIONS

Operating Temp. Range, Rated Load	0°C to 50°C
Derating 50°C To 70°C	2.5%/°C
Storage Temperature Range	−40°C to +85°C
Cooling Required[7],	400 LFM min.
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions	See Case Drawings
Weight, Standard	3.5 lbs. (1.6kg)
Top Fan Cooled	3.7 lbs. (1.7kg)
End Fan With Case	4.2 lbs. (1.9kg)

NOTES:
1. Measured over AC input range.
2. Remote sense must be connected.
3. Whichever is greater. 20MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.
6. For models with 5V or higher output voltages.
7. Two options with fan are available. See "Option" table.

UL 1950 CSA 22.2, No. 234 TUV EN 60 950

All specifications subject to change without notice.

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STANDARD MODELS (Consult factory for non-standard configurations).

MAX WATTS[1]	MODEL NUMBER	MAIN OUTPUT V1	AUX.[2] OUTPUT V2	AUX.[2] OUTPUT V3	AUX.[2] OUTPUT V4
140 230 350	XB1000 XE9000 XE2000	2V70A 3.3V70A 5V70A			
400	XF3000 XF4000 XF5000 XF7000	12V34A 15V27A 24V17A 48V8.5A			
400	XF2330 XF2440	5V60A[5] 5V60A[5]	12V12A (5-15V) 15V10A (5-15V)	1212A (5-15V) 15V10A (5-15V)	
500	XG2330 XG2440	5V70A[5] 5V70A[5]	12V12A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 15V10A (5-15V)	
400	XF2332 XF2442 XF2335 XF2445	5V60A[5] 5V60A[5] 5V60A[5] 5V60A[5]	12V12A (5-15V) 15V10A (5-15V) 12V12A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 15V10A (5-15V) 12V12A (5-15V) 15V10A (5-15V)	5V15A (2-6V) 5V15A (2-6V) 24V6A (15-36V) 24V6A (15-36V)
500	XG2332 XG2442 XG2335 XG2445	5V70A[5] 5V70A[5] 5V70A[5] 5V70A[5]	12V12A (5-15V) 15V10A (5-15V) 12V12A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 15V10A (5-15V) 12V12A (5-15V) 15V10A (5-15V)	5V15A (2-6V) 5V15A (2-6V) 24V6A (15-36V) 24V6A(15-36V)

UNIFLEX™ WIDE RANGE FIELD ADJUSTABLE OUTPUTS

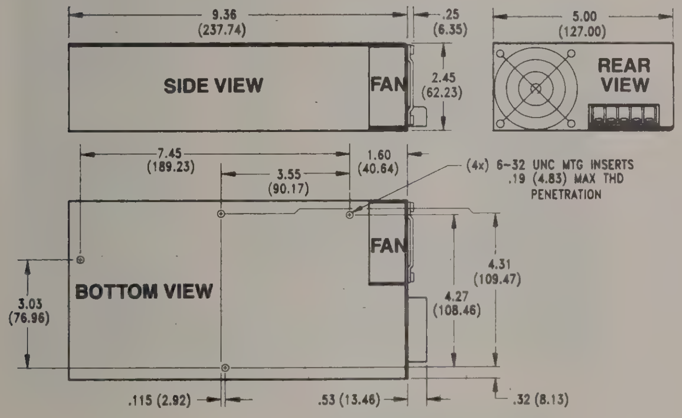
AVAILABLE AUXILIARY OUTPUT MODULES		
VOLTAGE RANGE, ADJ.	MAXIMUM CURRENT	MAX. WATTS
2V TO 6V	15A	90W
5V TO 15V	12A	150W
15V TO 36V	7A	150W

	OPTIONS[3]
A	Autorange (115/230VAC)
C	Class B EMI Filter[4]
F	Current Share (All Outputs)
M	Top-Mounted Fan with Cover
N	End-Mounted Fan with Case

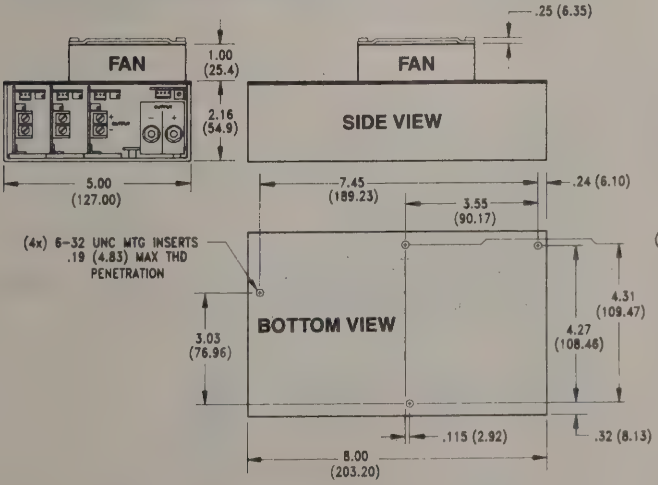
NOTES:
1. Maximum continuous total output power must not exceed the maximum power rating.
2. Maximum continuous auxiliary output power must not exceed the maximum power rating shown for each auxiliary output module.
3. Add suffix letters to model for options.
4. Available only with option N.
5. 12V main available (consult factory).

MATING PLUGS
All connectors have standard 25 mil. (0.6mm) square, 0.1 inch (2.5mm) center, pins.

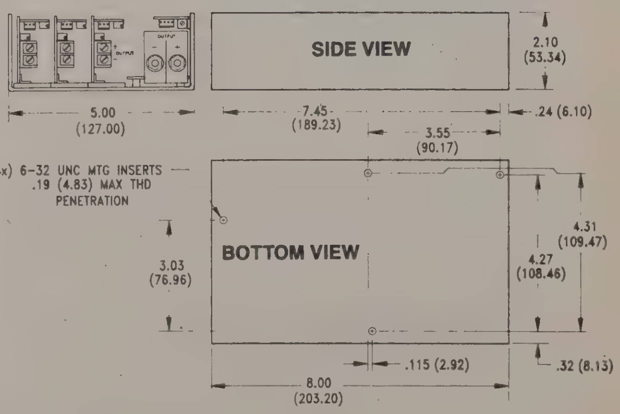
OPTION N, END-MOUNTED FAN WITH CASE


9.36
(237.74)
.25
(6.35)
5.00
(127.00)
SIDE VIEW
FAN
2.45
(62.23)
REAR VIEW
7.45
(189.23)
1.60
(40.64)
3.55
(90.17)
(4x) 6-32 UNC MTG INSERTS
.19 (4.83) MAX THD
PENETRATION
FAN
BOTTOM VIEW
3.03
(76.96)
4.31
(109.47)
4.27
(108.46)
.115 (2.92)
.53 (13.46)
.32 (8.13)

OPTION M, TOP-MOUNTED FAN WITH COVER


FAN
1.00
(25.4)
2.16
(54.9)
FAN
.25 (6.35)
SIDE VIEW
5.00
(127.00)
7.45
(189.23)
.24 (6.10)
3.55
(90.17)
(4x) 6-32 UNC MTG INSERTS
.19 (4.83) MAX THD
PENETRATION
BOTTOM VIEW
3.03
(76.96)
4.31
(109.47)
4.27
(108.46)
.115 (2.92)
.32 (8.13)
8.00
(203.20)

STANDARD VERSION, OPEN FRAME


SIDE VIEW
2.10
(53.34)
5.00
(127.00)
7.45
(189.23)
.24 (6.10)
3.55
(90.17)
(4x) 6-32 UNC MTG INSERTS
.19 (4.83) MAX THD
PENETRATION
BOTTOM VIEW
3.03
(76.96)
4.31
(109.47)
4.27
(108.46)
.115 (2.92)
.32 (8.13)
8.00
(203.20)

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

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FAX: (305) 971-1837

FET SERIES: LOW PROFILE
1-5 Outputs, 250 & 350 Watts

NEW

KEY FEATURES
- Low Profile Cases (2.46 Inches)
- Power Density To 2.5 Watts/Cu. Inch
- Jumper Selectable 115/230 VAC
- Redundant N + 1 Capability
- 150,000 Hours MTBF

OPTIONS
- Worldwide Autorange
- Isolated Output 4
- Remote AC

OTHER FEATURES
- Outputs From 5VDC To 48VDC
- Full Output Power To 40°C
- Special Output Configurations
- Current Sharing Parallel Operation
- 75 kHz Switching
- 70% Min. Efficiency
- Mag. Amp. Regulation
- EMI Input Filter
- DC Ball Bearing Fan (FET 350)
- Soft Start
- Inrush Current Limiting
- Overload and Overvoltage Protection
- Remote Sense On Output 1
- AC Power Fail Signal
- Safety Agency Approvals
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range	±5%
Line Regulation[1]	±0.5% max.
Load Regulation[2], Outputs 1 & 4	±1.0% max.
Outputs 2 & 3	±2.0% max.
Output 5	±4.0% max.
Cross Regulation[3], Output 5	±6.0% max.
Ripple and Noise[4], All Outputs	2.0% pk to pk
Hold-Up Time	20 msec., min.
Dynamic Response[5]	500 usec. max.
Temperature Coefficient	0.05%/°C, max.
Overvoltage Protection, Main Output	SCR Crowbar
Remote Sense[6]	Output 1

INPUT SPECIFICATIONS

Voltage Range, User Selectable (jumper)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current, Cold Start	50A Peak
Input EMI Filter, Conducted	FCC & VDE Class A
Input Protection	Internal Fuse

GENERAL SPECIFICATIONS

Efficiency	70%, min.
Switching Frequency	75 kHz
MTBF[7]	150,000 hours

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 70°C
Derating 40°C To 70°C	1.67%/°C
Storage Temperature Range	−40°C to +85°C
Cooling[8],	Internal DC Ball Bearing Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum & Steel
Dimensions	See Case Drawings
Weight	4 lbs. (1.8kg)

NOTES:
1. 96-132, 192-264 VAC line change.
2. 60% ± 40% load change. Remote sense must be connected on main output.
3. 60% ± 40% output 1 load change.
4. DC-30MHz differential measurement.
5. 4% maximum deviation with recovery to within 1% for 25% step change in load.
6. 0.25V maximum load cable voltage drop.
7. Full load @ 25°C per MIL HDBK 217E.
8. FET250 models do not have fan and require 20 CFM of forced air cooling.

LISTED PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 234

BS 7002
EN 60 950

All specifications subject to change without notice.

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FAX: (305) 971-1837

STANDARD MODELS

(The following models are standard configurations of main and auxiliary outputs. For special configurations not listed contact the factory.)

MAX WATTS[1,2]	MODEL NUMBER	OUTPUT V1	OUTPUT V2	OUTPUT V3	OUTPUT V4[1]	OUTPUT V5
250	FET251-12/C	12V 20.5A	—	—	—	—
	FET251-15/C	15V 16.5A	—	—	—	—
	FET251-24/C	24V 10.0A	—	—	—	—
	FET251-36/C	36V 6.5A	—	—	—	—
	FET251-48/C	48V 5.0A	—	—	—	—
	FET253-1/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	—	—
	FET253-2/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	—	—
	FET254-1/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+24V 3.0A(5A)	
	FET254-2/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+24V 3.0A(5A)	
	FET254-3/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	—	−5V 3.0A
	FET254-4/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	—	−5V 3.0A
	FET254-5/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+12V 6.0A(10A)	—
	FET254-6/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+12V 6.0A(10A)	—
	FET254-7/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−48V 2.0A(3A)	—
	FET254-8/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	−48V 2.0A(3A)	—
	FET254-9/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−5.2V 6.0A(10A)	—
	FET255-1/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+24V 3.0A(5A)	−5V 3.0A
	FET255-2/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+24V 3.0A(5A)	−5V 3.0A
	FET255-3/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+12V 6.0A(10A)	−5V 3.0A
	FET255-4/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+12V 6.0A(10A)	−5V 3.0A
	FET255-5/C	+5V 30.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−48V 2.0A(3A)	−5V 3.0A
	FET255-6/C	+5V 30.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	−48V 2.0A(3A)	−5V 3.0A
350	FET351-12/C	12V 29.0A	—	—	—	—
	FET351-15/C	15V 23.0A	—	—	—	—
	FET351-24/C	24V 14.5A	—	—	—	—
	FET351-36/C	36V 9.5A	—	—	—	—
	FET351-48/C	48V 7.0A	—	—	—	—
296W	FET353-1/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	—	—
290W	FET353-2/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	—	—
350W	FET354-1/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+24V 5.0A(8A)	—
350W	FET354-2/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+24V 5.0A(8A)	—
316W	FET354-3/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	—	−5V 4.0A
310W	FET354-4/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	—	−5V 4.0A
350W	FET354-5/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+12V 10.0A(15A)	—
350W	FET354-6/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+12V 10.0A(15A)	—
350W	FET354-7/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−48V 3.0A(4A)	—
350W	FET354-8/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	−48V 3.0A(4A)	—
350W	FET354-9/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−5.2V 10.0A(15A)	—
350	FET355-1/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+24V 5.0A(8A)	−5V 4.0A
	FET355-2/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+24V 5.0A(8A)	−5V 4.0A
	FET355-3/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	+12V 10.0A(15A)	−5V 4.0A
	FET355-4/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	+12V 10.0A(15A)	−5V 4.0A
	FET355-5/C	+5V 40.0A	+12V 4.0A(7A)	−12V 4.0A(7A)	−48V 3.0A(4A)	−5V 4.0A
	FET355-6/C	+5V 40.0A	+15V 3.0A(5A)	−15V 3.0A(5A)	−48V 3.0A(4A)	−5V 4.0A

	OPTIONS
A	Auto Range (115/230VAC) (FET350 Series Only)
F	Isolated Output 4
RM	Remote AC

MATING PLUGS AND PINS

1 or 2 × 0.1″ 4-way, accepting Molex 6471 Series-Interface.

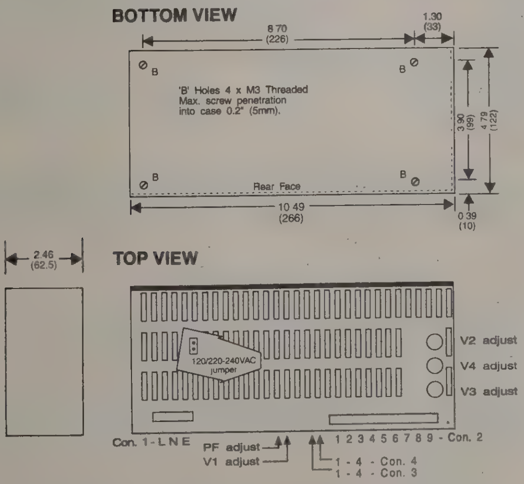
Housing: Molex 22-01-2045

Pins: Molex 08-05-0032

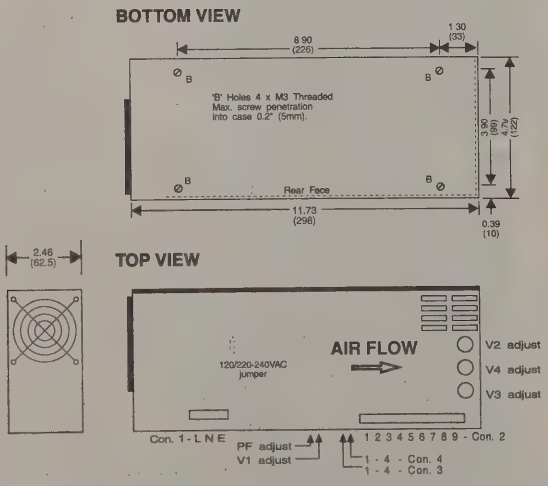
NOTES:

1. Maximum peak output power with a duration of 30 seconds in any 5 minutes is 300W for FET250 Series and 400W for FET350 Series.
2. For FET250 Series, requires 20 CFM of forced air cooling. For free air convection, reduce output power to 200W.

FET250 SERIES


BOTTOM VIEW
8 70
(226)
1.30
(33)
B
'B' Holes 4 x M3 Threaded
Max. screw penetration
into case 0.2" (5mm).
3 90
(99)
4 79
(122)
Rear Face
10 49
(266)
0 39
(10)
2.46
(62.5)
TOP VIEW
120/220-240VAC
jumper
V2 adjust
V4 adjust
V3 adjust
Con. 1 - L N E
PF adjust
V1 adjust
1 2 3 4 5 6 7 8 9 - Con. 2
1 - 4 - Con. 4
1 - 4 - Con. 3

FET350 SERIES


BOTTOM VIEW
8 90
(226)
1 30
(33)
B
'B' Holes 4 x M3 Threaded
Max. screw penetration
into case 0.2" (5mm).
3 90
(99)
4 79
(122)
Rear Face
11.73
(298)
0.39
(10)
2.46
(62.5)
TOP VIEW
120/220-240VAC
jumper
AIR FLOW
V2 adjust
V4 adjust
V3 adjust
Con. 1 - L N E
PF adjust
V1 adjust
1 2 3 4 5 6 7 8 9 - Con. 2
1 - 4 - Con. 4
1 - 4 - Con. 3

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

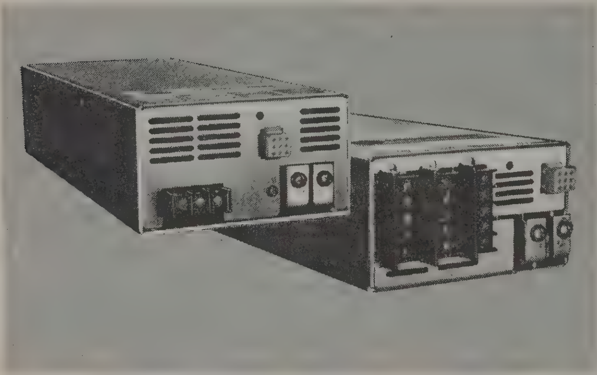
UNIPOWER
CORPORATION

**WORLD CLASS
POWER
SOLUTIONS**

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

P SERIES: LOW PROFILE

1-7 Outputs, 240-800 Watts



KEY FEATURES

- Low Profile Cases (From 2.75")
- Power Density To 3.6W/Cubic Inch
- Switch Selectable 115/230VAC
- Redundant N + 1 Capability
- 12V Main On Multi For Disc Drives
- No Load Oper. (Single & Aux. Outputs)

OPTIONS

- Worldwide Autorange 115/230VAC
- DC Input (42V To 56V)
- Battery Backup Connector
- DC "OK" Signal
- No Load Operation (Main On Multi)
- Current Share/Monitor (Main Output)
- Current Share (Auxiliary Outputs)
- Reverse Air Flow

OTHER FEATURES

- Outputs From 2VDC To 48VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Special Output Configurations
- 100Khz MOSFET Switching
- Efficiency To 85%
- MTBF To 110,000 Hours
- Surface Mount Technology
- Hi-Rel Hybrid Control Circuits
- Current Share On All Outputs
- Modular Auxilliary Outputs
- Mag Amp Regulation
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit, Margin
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range, All Outputs	±5%
Line Regulation[1]	0.2% or 10 mV, max.
Load Regulation[2], NL-50% FL, 50%FL-FL	0.2% or 10 mV, max.
Cross Regulation[2], Multi-Output	0.2% or 10 mV, max.
Ripple and Noise[3]	
Main Output	1.0% or 50 mV, max.
Auxiliary Outputs	1.5% or 75 mV, max.
Hold-Up Time	20 msec., min.
Dynamic Response[4]	500 usec., max.
Temperature Coefficient	0.02%/°C, max.
Overvoltage Protection, All Outputs	Power Shutdown
Remote Sense[5]	All Outputs Except 2A Auxiliaries

INPUT SPECIFICATIONS

AC OPERATION

Voltage Range, User Selectable (Switch)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Electronic Inrush Current Limiting	40A Peak
Input EMI Filter, Conducted	FCC & VDE Class A
Input Protection	Internal Fuse

DC OPERATION

Input Voltage	42 to 56 VDC
Input Protection	Internal Fuse

GENERAL SPECIFICATIONS

Efficiency	70 to 85%
Switching Frequency	100 kHz
MTBF[6]	Up to 110,000 hrs.
Input To Output Isolation	3000 VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 65°C
Derating 50°C to 65°C	2.4%/°C
Storage Temperature Range	−40°C to +85°C
Cooling	Internal DC Ball Bearing Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions	See Case Drawings
Weight:	
250W, 400W, 500W, 600W Single	4.0 lbs. (1.8 kg.)
400W, 500W Multi	6.0 lbs. (2.7 kg.)
650W, 800W Multi	8.5 lbs. (3.9 kg.)

NOTES:
1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.
6. Full load @ 25°C per MIL HDBK 217E.

LISTED PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 220 or No. 234

TUV EN 60 950

All specifications subject to change without notice.

UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

STANDARD MODELS

(The following models are standard configurations of main and auxiliary modules. For special configurations of available auxiliary modules consult factory).

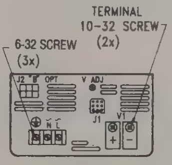
MAX WATTS[1]	MODEL NUMBER[2]	OUTPUT V1	OUTPUT V2[3]	OUTPUT V3[3]	OUTPUT V4[3]	OUTPUT V5[3]	CASE
250	PD 1000	2V65A					10
	PD 2000	5V50A					
	PD 3000	12V21A					
	PD 4000	15V17A					
	PD 5000	24V11A					
	PD 7000	48V5A					
400	PF 1000	2V100A					
	PF 9000	3.3V100A					
	PF 2000	5V80A					
	PF 3000	12V34A					
	PF 4000	15V27A					
	PF 5000	24V17A					
	PF 7000	48V8.5A					
500	PG 2000	5V100A					
	PG 5000	24V21A					
	PG 7000	48V10.5A					
600	PH 5000	24V25A					
	PH 7000	48V12.5A					
400	PF 2330	5V60A	12V8A(12)	12V8A(12)			15
	PF 2440	5V60A	15V7A	15V7A			
	PF 3250	12V25A	5V10A	24V4A(6)			
500	PG 2330	5V75A	12V8A(12)	12V8A(12)			
	PG 2440	5V75A	15V7A	15V7A			
650	PJ 2330	5V85A	12V10A(15)	12V10A(15)			25
	PJ 2440	5V85A	15V7A	15V7A			
800	PM 2330	5V100A	12V10A(15)	12V10A(15)			
	PM 2440	5V100A	15V7A	15V7A			
400	PF 2233	5V60A	5V10A	12V8A(12)	12V8A(12)		15
	PF 2244	5V60A	5V10A	15V7A	15V7A		
	PF 2335	5V60A	12V8A(12)	12V8A(12)	24V4A(6)		
	PF 2445	5V60A	15V7A	15V7A	24V4A(6)		
500	PG 2233	5V75A	5V10A	12V8A(12)	12V8A(12)		
	PG 2244	5V75A	5V10A	15V7A	15V7A		
	PG 2335	5V75A	12V8A(12)	12V8A(12)	24V4A(6)		
	PG 2445	5V75A	15V7A	15V7A	24V4A(6)		
650	PJ 2233	5V85A	5V20A	12V10A(15)	12V10A(15)		25
	PJ 2244	5V85A	5V20A	15V7A	15V7A		
	PJ 2335	5V85A	12V10A(15)	12V10A(15)	24V5A(7)		
	PJ 2445	5V85A	15V7A	15V7A	24V5A(7)		
800	PM 2233	5V100A	5V20A	12V10A(15)	12V10A(15)		
	PM 2244	5V100A	5V20A	15V7A	15V7A		
	PM 2335	5V100A	12V10A(15)	12V10A(15)	24V5A(7)		
	PM 2445	5V100A	15V7A	15V7A	24V5A(7)		
400	PF 21233	5V60A	2V10A	5V10A	12V2A	12V2A	15
	PF 22333	5V60A	5V10A	12V2A	12V2A	12V8A(12)	
	PF 22335	5V60A	5V2A	12V2A	12V8A(12)	24V4A(6)	
500	PG 21233	5V75A	2V10A	5V10A	12V2A	12V2A	
	PG 22333	5V75A	5V10A	12V2A	12V2A	12V8A(12)	
	PG 22335	5V75A	5V2A	12V2A	12V8A(12)	24V4A(6)	

AVAILABLE AUXILIARY MODULES		
2V10A	12V2A	24V5A(7)[4]
2V20A[4]	12V8A(12)	12/12V2A
5V2A	12V10A(15)[4]	15/15V2A
5V10A	15V7A	5/12V2A
5V20A[4]	24V4A(6)	

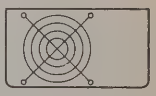
OPTIONS[2]	
A	Auto Range 115/230VAC[5]
B	Battery Backup Connector (250/500W)
D	DC "OK" Signal
E	No Load Operation (Main of Multi)
F	Current Share/Monitor (Main)
H	Current Share (Aux. Outputs)
P	Pluggable Aux. Conn. (Case 15)
Q	DC Input (Consult Factory)
R	Reverse Air Flow (Consult Factory)

NOTES:
1. Maximum continuous total output power must not exceed the maximum power rating.
2. Add suffix letters to model number for options.
3. Auxiliary output number does not represent output location.
4. 650 and 800 Watt only.
5. Standard on 650 and 800 Watt

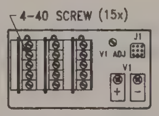
( ) Peak Current for 30 seconds Max.


TERMINAL
10-32 SCREW
(2x)
6-32 SCREW
(3x)
J2 "B" OPT
V ADJ
N
L
J1
V1
+
−

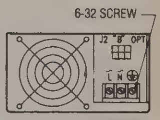
FRONT VIEW CASE #10



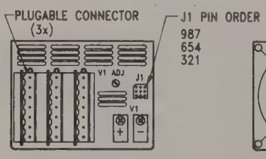
REAR VIEW CASE #10


4-40 SCREW (15x)
J1
V1 ADJ
V1
+
−

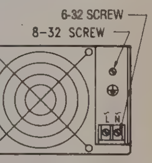
FRONT VIEW CASE #15


6-32 SCREW
J2 "B" OPT
L
N

REAR VIEW CASE #15

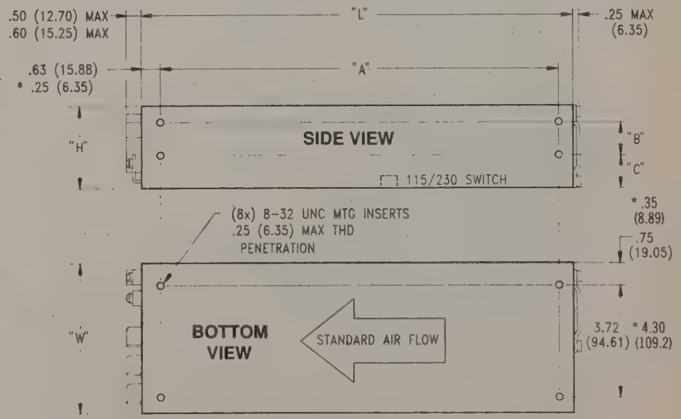

PLUGABLE CONNECTOR
(3x)
J1 PIN ORDER
987
654
321
V1 ADJ
J1
V1
+
−

FRONT VIEW CASE #25


6-32 SCREW
8-32 SCREW
L
N

REAR VIEW CASE #25

CASE STYLE	DIMENSIONS		INCHES (mm)			
	H	W	L	A	B	C
10	2.75 (69.8)	5.00 (127)	12.15 (308.6)	11.62 (295.15)	1.00 (25.4)	0.75 (19.05)
15	2.75 (69.8)	5.00 (127)	14.30 (363.2)	13.20 (335.28)	1.10 (27.94)	1.10 (27.94)
25	3.80 (96.52)	5.00 (127)	14.30 (363.2)	12.38 (314.45)	1.10 (27.94)	1.33 (33.78)


.50 (12.70) MAX
* .60 (15.25) MAX
"L"
.25 MAX
(6.35)
.63 (15.88)
* .25 (6.35)
"A"
"H"
SIDE VIEW
"B"
"C"
115/230 SWITCH
(8x) 8-32 UNC MTG INSERTS
.25 (6.35) MAX THD
PENETRATION
* .35
(8.89)
.75
(19.05)
"W"
BOTTOM
VIEW
STANDARD AIR FLOW
3.72
(94.61)
* 4.30
(109.2)

* CASE 10 ONLY

MATING PLUGS AND PINS	
J1 mating plug: Molex 03-06-2092	Male pins are 02-06-2103
J2 mating plug: Molex 15-31-1063	Male pins are 02-06-2103
Case 25 auxilary output mating plugs are LMI 20620701000	
Case 15 auxilary output mating plugs are LMI 20620501000	

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

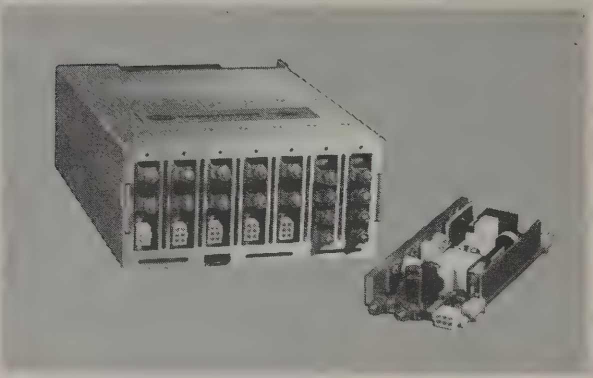
UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

U-SERIES: MODULAR/CONFIGURABLE

3-14 Outputs, 400-800 Watts



KEY FEATURES

- Fully Modular UNIMOD® Construction
- Custom Configuration Of Std Modules
- Worldwide Auto Range (115/230VAC)
- Wide Output Adjust. Range
- Two Week Prototype Delivery
- Redundant N + 1 Capability
- Global Inhibit, Remote On-Off
- No Load Operation
- Ideal For VME/VXI Applications

OPTIONS

- Current Share On Single Modules
- Reverse Air Flow

OTHER FEATURES

- Outputs From 2VDC To 48VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Dual And Single Output Modules
- Independent Switching Regulators
- 100Khz MOSFET Switching
- Efficiency To 85%
- MTBF To 100,000 Hours
- Surface Mount Technology
- DC Power Good (Each Module)
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range	See Table Next Page
Line Regulation[1]	0.2% or 10 mV, max.
Load Regulation[2]	
Single Output Modules	0.2% or 10mV, max.
Dual Output Modules	0.5% or 25mV, max.
Cross Regulation[2]	0.2% or 10 mV, max.
Ripple and Noise[3]	1% or 50 mV, max.
Hold-Up Time	20 msec., min.
Dynamic Response[4]	500 usec., max.
Temperature Coefficient	0.02%/°C, max.
Overvoltage Protection, All Outputs	Power Shutdown
Remote Sense[5]	All Single Output Modules

INPUT SPECIFICATIONS

Voltage Range, (Auto Range)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current	80A Peak
Input EMI Filter, Conducted	FCC & VDE Class A
Input Protection	Internal Fuse

GENERAL SPECIFICATIONS

Efficiency	70 to 85%
Switching Frequency	100 kHz
MTBF[6]	Up to 100,000 hrs.
Input To Output Isolation	3000 VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 65°C
Derating 50°C to 65°C	3.3%/°C
Storage Temperature Range	−40°C to +85°C
Cooling	Internal DC Ball Bearing Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions	3.75″H × 8″W × 11″L
Weight	8.0-10.0 lbs. (3.6-4.5 kg.)

NOTES:
1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.
6. Full load @ 25°C per MIL HDBK 217E.

LISTED PRODUCTION FACILITY
UL 1950
CSA 22.2, No. 234
TUV EN 60 950

All specifications subject to change without notice.

UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

HOW TO ORDER

The U Series 800W UNIMOD® power supply allows the user to specify up to seven of the fifteen available output modules in virtually any combination within the 800 watt total output power[1] capability of the supply. Determining the model designation of the desired configurations is as simple as listing the output modules selected.

Example: Six output power supply with current share option:

Qty	Description	Module	Watts
1	2V40A	B	80
2	5V40A	G	400
2	12V10A	H	240
1	24V5A	M	120
		Total	840

		Series	Modules	Option
Model	**=**	**UM**	**— B G G H H M —**	**H**
			See Module Table	See Option Table

Position of modules will be determined by the factory.
Filler panels will be provided as needed for empty slots.

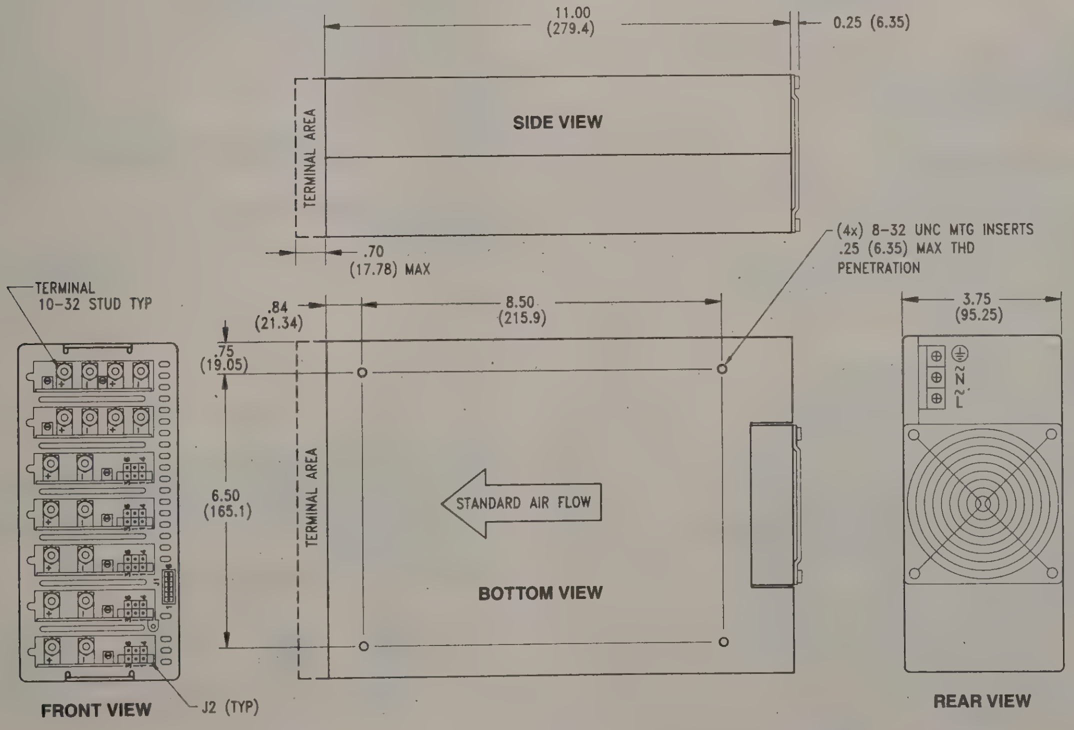
NOTES:
1. The maximum total load for all modules must not exceed 800 watts.
2. The maximum load power and current must not exceed the rated values for each module.

AVAILABLE OUTPUT MODULES[2]			
VOLTAGE/ CURRENT	**WATTS**	**ADJUST RANGE**	**MODULE CODE**
2V40A	80	±10%	B
3.3V40A	132	±10%	C
5V20A 5V40A	100 200	4.5-6.5V 4.5-6.5V	F G
12V10A 12V20A	120 240	10.8-16.5V 10.8-16.5V	H J
15V8A 15V16A	120 240	10.8-16.5V 10.8-16.5V	K L
24V5A 24V10A	120 240	20-30V 20-30V	M N
48V2.5A 48V5A	120 240	±10% ±10%	P Q
5V5A/12V5A	85	±10%	R
12V5A/12V5A	120	±10%	S
15V4A/15V4A	120	±10%	T

For special modules consult factory.

OPTIONS	
H	Current Share on all Single Modules
R	Reverse Air Flow (Consult factory)

MATING PLUGS AND PINS	
J1 Mating plug: AMP 102-241-4	Female pins are 1-87756-6
J2 mating plug: Molex 39-01-2065	Female pins are 39-00-0078


11.00
(279.4)
0.25 (6.35)
SIDE VIEW
TERMINAL AREA
.70
(17.78) MAX
(4x) 8-32 UNC MTG INSERTS
.25 (6.35) MAX THD
PENETRATION
TERMINAL
10-32 STUD TYP
.84
(21.34)
8.50
(215.9)
.75
(19.05)
3.75
(95.25)
6.50
(165.1)
TERMINAL AREA
STANDARD AIR FLOW
BOTTOM VIEW
J1
N
L
FRONT VIEW
J2 (TYP)
REAR VIEW

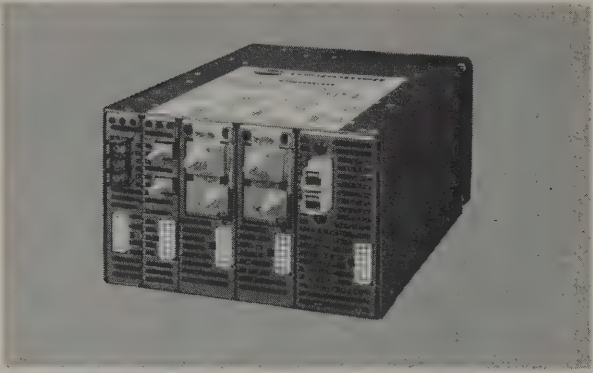
ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

H SERIES: MODULAR/CONFIGURABLE
3-12 Outputs, 600-1200 Watts



KEY FEATURES

- Fully Modular UNIMOD® Construction
- .98 Power Factor (UNIFACTOR®)
- Patented Circuit (U.S. Patent 4,831,508)
- Custom Configuration of Std Modules
- Two Week Prototype Delivery
- Low Harmonic Current Distortion
- Designed To Meet IEC555-2 And IEC601
- Worldwide Auto Range (115/230 VAC)
- Battery Backup Module
- Redundant N + 1 Capability
- Global Inhibit, Remote On-Off
- No Load Operation
- Class A or Class B EMI Filter
- Ideal For VME/VXI Applications

OPTIONS

- Current Share On Single Modules
- Reverse Air Flow
- Battery Backup
- Isolated Alarm Circuit

OTHER FEATURES

- Outputs From 2 VDC To 48 VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Single Outputs Can Be Paralleled
- Independent Switching Regulators
- 100Khz MOSFET Switching
- Efficiency To 85%
- MTBF To 100,000 Hours
- Surface Mount Technology
- DC Power Good (Each Module)
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit, Margin
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range	± 10%
Line Regulation[1]	0.2% or 10 mV, max.
Load Regulation[2]	0.2% or 10 mV, max.
Cross Regulation[2]	0.5% or 25 mV. max.
Ripple and Noise[3]	1% or 100 mV. max.
Hold-Up Time	20 msec., min.
Dynamic Response[4]	500 usec., max.
Temperature Coefficient	0.02%/°C, max.
Overvoltage Protection, All Outputs	Power Shutdown
Remote Sense[5]	All Single Output Models
Total Output Power	1000W @ 120 VAC 1200W @ 220-240 VAC

INPUT SPECIFICATIONS

Voltage Range, (Auto Range)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current	80A Peak
Input EMI Filter	(HPA) FCC & VDE Class A (HPB) VDE Class B
Input Protection	Internal Fuse
Power Factor	0.98

GENERAL SPECIFICATIONS

Efficiency	70 to 85%
Switching Frequency	100 kHz
MTBF[6]	Up to 100,000 hrs.
Input To Output Isolation	5700 VDC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 70°C
Derating 50°C to 70°C	2.5%/°C
Storage Temperature Range	− 40°C to + 85°C
Cooling	Internal DC Ball Bearing Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Steel
Dimensions	HPA: 5″H × 8″W × 11″L HPB: 5″H × 9″W × 11″L
Weight	15 to 24 lbs. (6.7-10.9 kg.)

NOTES:
1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.
6. Full load @ 25°C per MIL HDBK 217E.

LISTED PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 234

TÜV Rheinland
TUV EN 60 950
IEC 601 (HPB)

All specifications subject to change without notice.

UNIPOWER
CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

HOW TO ORDER

The H Series 1200W UNIMOD® power supply allows the user to specify up to 6 of the available 27 modules, including a battery backup module, in a wide range of combinations. Maximum continuous total output power of the combination selected must not exceed 1200 watts at 220 VAC input (1000 watts at 120 VAC input). The total number of *slots* occupied by the selected modules must not exceed 6.

Determining the model designation of the desired combination is as simple as listing the code of the modules selected.

Example: Four output supply with Class A EMI filter, battery backup and current share option:

Qty	Description	Module	Slots	Watts
1	5V100A	2G	1.5	500
1	12V20A	3D	1	240
1	24V10A	5D	1	240
1	Battery Backup	UB	2	
		Total	5.5	980

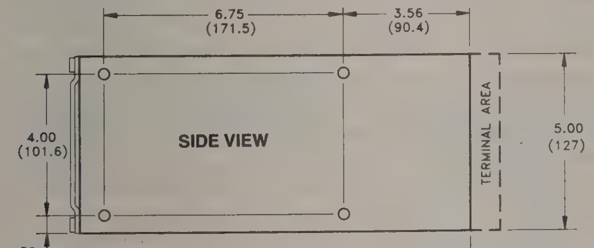
	Series	Modules	Options
Model =	**HPA –**	**2G 3D 5D UB –**	**H**
	Class A Input Filter (A) Class B Input Filter (B)	See Module Table	See Option Table

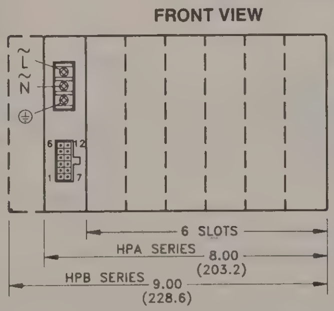
Note: Position of modules will be determined by the factory.
Filler panels will be provided as needed for emply slots.

AVAILABLE MODULES			
VOLTAGE CURRENT	WATTS[1]	MODULE CODE	SLOTS REQ'D
2V40A	80	1A	1
2V100A	200	1D	1.5
3.3V40A	132	9B	1
3.3V100A	330	9E	1.5
5V20A	100	2A	1
5V40A	200	2C	1
5V100A	500	2G	1.5
5V200A	1000	2N	3
12V10A	120	3A	1
12V20A	240	3D	1
12V50A	600	3H	1.5
12V100A	1200	3P	3
15V8A	120	4A	1
15V16A	240	4D	1
15V40A	600	4H	1.5
24V5A	120	5A	1
24V10A	240	5D	1
24V25A	600	5H	1.5
24V50A	1200	5P	3
28V21.4A	600	6H	1.5
48V5A	240	7D	1
48V12.5A	600	7H	1.5
48V25A	1200	7P	3
5V5A/12V5A	85	23A	1
12V5A/12V5A	120	33C	1
15V4A/15V4A	120	44C	1
Battery Backup Module		UB	2

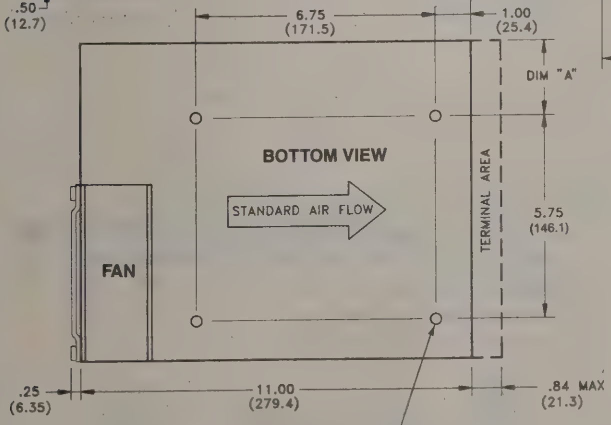
1. Maximum continuous total output power must not exceed 1200 watts at 220 VAC input (1000 watts at 115 VAC input).

OPTIONS	
H	Current Share (All Single Modules)
R	Reverse Air Flow (Consult Factory)
L	Isolated Alarm Circuit


6.75
(171.5)
3.56
(90.4)
4.00
(101.6)
SIDE VIEW
TERMINAL AREA
5.00
(127)
.50
(12.7)


FRONT VIEW
L
N
6 12
1 7
6 SLOTS
HPA SERIES 8.00
(203.2)
HPB SERIES 9.00
(228.6)

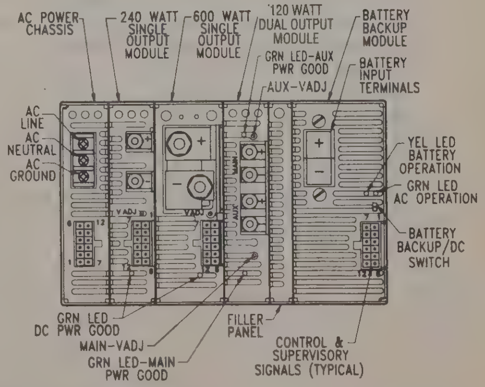
MATING PLUGS AND PINS
Control & supervisory signal mating plugs: Molex 39-01-2125 Female pins are 39-00-0039
Battery input mating plugs: Anderson no. 5916G4 (black for – input) and no. 5916G7 (red for + input) housings with no. 5900 contacts.


6.75
(171.5)
1.00
(25.4)
DIM "A"
BOTTOM VIEW
STANDARD AIR FLOW
FAN
TERMINAL AREA
5.75
(146.1)
.25
(6.35)
11.00
(279.4)
.84 MAX
(21.3)

(8x) 8-32 UNC MTG. INSERTS
.13 (3.3) MAX. PENETRATION

	DIM "A"
HPA SERIES	1.13 (28.7)
HPB SERIES	2.13 (54.1)

TERMINALS:
AC Input,
No. 6-32 Screws
1 Slot Modules,
No. 10-32 Studs
1.5 & 3 Slot Modules,
No. 1/4-20 Studs


AC POWER CHASSIS
240 WATT SINGLE OUTPUT MODULE
600 WATT SINGLE OUTPUT MODULE
120 WATT DUAL OUTPUT MODULE
BATTERY BACKUP MODULE
GRN LED-AUX PWR GOOD
AUX-VADJ
BATTERY INPUT TERMINALS
AC LINE
AC NEUTRAL
AC GROUND
YEL LED BATTERY OPERATION
GRN LED AC OPERATION
BATTERY BACKUP/DC SWITCH
GRN LED DC PWR GOOD
MAIN-VADJ
GRN LED-MAIN PWR GOOD
FILLER PANEL
CONTROL & SUPERVISORY SIGNALS (TYPICAL)

ALL DIMENSIONS IN INCHES (mm) All specifications subject to change without notice

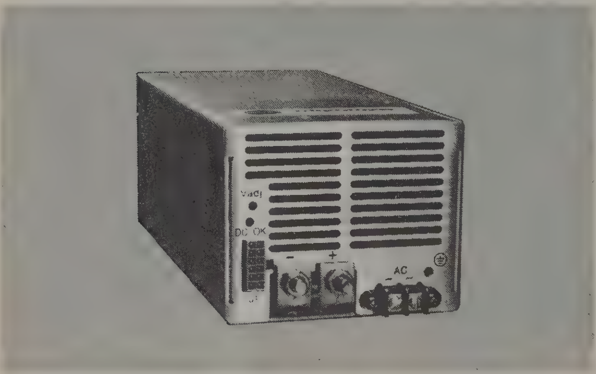
UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

F SERIES: POWER FACTOR CORRECTED

Single Output, 650-1000 Watts



KEY FEATURES

- .98 Power Factor (UNIFACTOR®)
- Patented Circuit (U.S. Pat 4,831,508)
- Low Harmonic Current Distortion
- Designed To Meet IEC 555-2
- Worldwide Auto Range (115/230VAC)
- Compact 4″ & 5″ × 5″ × 12″ Cases
- Power Density To 3.3W/Cubic Inch
- Redundant N + 1 Capability
- No Load Operation
- LED Output Power Indicator

OPTIONS

- DC "OK" Signal With Inverse
- Current Share and Current Monitor
- Reverse Air Flow

OTHER FEATURES

- Outputs From 2VDC To 48VDC
- Full Output Power To 50°C
- 100Khz MOSFET Switching
- Efficiency To 85%
- MTBF To 100,000 Hours
- Surface Mount Technology
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit, Margin
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range	±10%
Line Regulation[1]	0.2% or 10 mV, max.
Load Regulation[2]	0.2% or 10 mV, max.
Ripple and Noise[3]	1% or 50 mV, max.
Hold-Up Time	20 msec., min.
Dynamic Response[4]	500 usec., max.
Temperature Coefficient	0.02%/°C, max.
Overvoltage Protection	Power Shutdown
Remote Sense[5]	Standard

INPUT SPECIFICATIONS

Voltage Range, (Auto Range)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current	80A Peak
Input EMI Filter, Conducted	FCC & VDE Class A
Input Protection	Internal Fuse
Power Factor	0.98

GENERAL SPECIFICATIONS

Efficiency	70 to 85%
Switching Frequency	100 kHz
MTBF[6]	Up to 100,000 hrs.
Input To Output Isolation	3000 VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 65°C
Derating 50°C to 65°C	3.3%/°C
Storage Temperature Range	−40°C to +85°C
Cooling	Internal DC Ball Bearing Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions	See Case Drawings
Weight:	
650W	13.0 lbs. (5.9 kg.)
800W & 1000W	14.0 lbs. (6.4 kg.)

NOTES:
1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop.
6. Full load @ 25°C per MIL HDBK 217E.
7. 5VDC standard, consult factory for 3.3, 12, or 24VDC

LISTED BABT PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 234

TUV EN 60 950
VDE 0805

All specifications subject to change without notice.

UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

STANDARD MODELS

MAX WATTS[1]	MODEL NUMBER[2]	OUTPUT	CASE
650	FJ 1000	2V130A	40
	FJ 9000	3.3V130A	
	FJ 2000	5V130A	
	FJ 3000	12V55A	
	FJ 4000	15V44A	
	FJ 5000	24V28A	
	FJ 6000	28V24A	
	FJ 7000	48V14A	
800	FM 1000	2V160A	42
	FM 9000	3.3V160A	
	FM 2000	5V160A	
	FM 3000	12V67A	
	FM 4000	15V54A	
	FM 5000	24V34A	
	FM 6000	28V29A	
	FM 7000	48V17A	
1000	FN 1000	2V200A	
	FN 9000	3.3V200A	
	FN 2000	5V200A	
	FN 3000	12V84A	
	FN 4000	15V67A	
	FN 5000	24V42A	
	FN 6000	28V36A	
	FN 7000	48V21A	

For special output voltages, consult factory.

OPTIONS[2]	
D	DC "OK" With Inverse
F	Current Share and Current Monitor
R	Reverse Air Flow[3] (Consult Factory)

NOTES:
1. Maximum continuous total output power must not exceed the maximum power rating.
2. Add suffix letters to model numbers for additional options.
3. Requires Derating From 40°C to 65°C of 1.7%/°C.

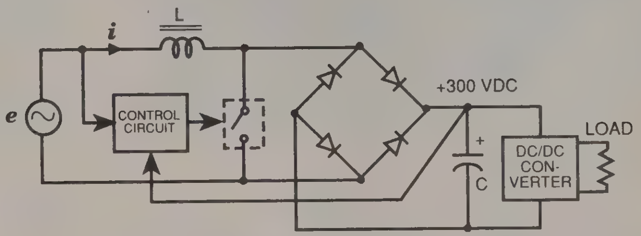
DIMENSIONS INCHES (mm)	CASE STYLE	
	40	42
H	4.00 (101.6)	5.00 (127.0)
W	5.00 (127.0)	5.00 (127.0)
L	12.00 (304.80)	12.50 (317.50)
A	.40 (10.16)	.40 (10.16)
B	10.27 (260.86)	10.27 (260.86)
C	.56 (14.22)	.56 (14.22)
D	3.89 (98.81)	3.89 (98.81)

MATING PLUGS AND PINS
J1 mating plug: Molex 39-01-2125 Female pins are 39-00-0039

ACTIVE LOW-FREQUENCY POWER FACTOR CORRECTION

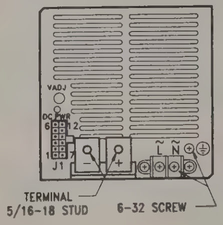
Active low-frequency (LF) power factor correction circuits operate at a switching frequency of twice the line frequency, 100 or 120Hz, and in synchronism with it. This method uses an active switch, a LF inductor and a control circuit to provide power factor correction.

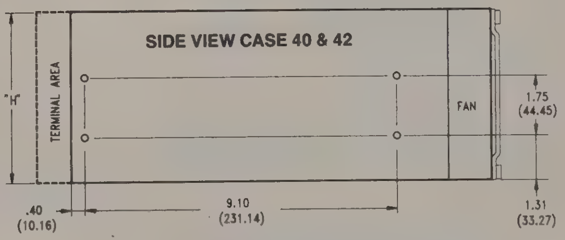
One way to implement active LF correction is shown below. This circuit, in simplified form, is the patented UNIFACTOR® technique used by UNIPOWER in its switching power supplies. It was chosen because of its simplicity and the fact that it provides the best overall performance with minimum impact on size, efficiency, reliability, EMI and cost.


L
i
e
CONTROL CIRCUIT
+300 VDC
LOAD
+
C
DC/DC CON-VERTER

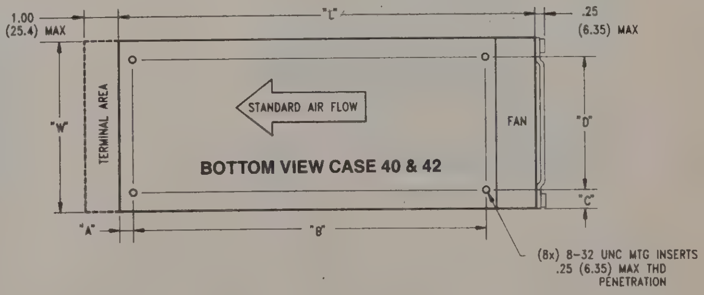
SIMPLIFIED CIRCUIT FOR ACTIVE, LOW-FREQUENCY POWER FACTOR CORRECTION.

FRONT VIEW CASE 40 & 42


VADJ
DC PWR
6
12
1
7
J1
−
+
L
N
TERMINAL 5/16-18 STUD
6-32 SCREW


TERMINAL AREA
"H"
FAN
1.75 (44.45)
1.31 (33.27)
.40 (10.16)
9.10 (231.14)

SIDE VIEW CASE 40 & 42


1.00 (25.4) MAX
"L"
.25 (6.35) MAX
TERMINAL AREA
STANDARD AIR FLOW
FAN
"W"
"D"
"C"
"A"
"B"
(8x) 8-32 UNC MTG INSERTS .25 (6.35) MAX THD PENETRATION

BOTTOM VIEW CASE 40 & 42

ALL DIMENSIONS IN INCHES (mm) All specifications subject to change without notice

UNIPOWER
CORPORATION

**WORLD CLASS
POWER
SOLUTIONS**

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

J SERIES: INDUSTRY STANDARD
1-4 Outputs, 500-1200 Watts

KEY FEATURES

- Industry Standard 5″ × 8″ Cases
- Power Density To 3.3W/Cubic Inch
- Jumper Selectable 115/230VAC
- Redundant N + 1 Capability
- No Load Operation (Single Output)

OPTIONS

- DC "OK" Signal
- Current Share and Current Monitor (Main Output)
- Reverse Air Flow

OTHER FEATURES

- Outputs From 2VDC To 48VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Current Sharing Parallel Operation
- Efficiency To 75%
- MTBF To 85,000 Hours
- Unique Integral Thermal Design
- Synchronous Switching Regulators
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit, Margin
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Output Voltage Adjustment Range, All Outputs	±5%
Line Regulation[1]	0.2% or 10 mV, max.
Load Regulation[2], NL-FL	0.2% or 10 mV, max.
Cross Regulation[2], Multi-Output	0.2% or 10 mV, max.
Ripple and Noise[3]	
Main Output	1.0% or 50 mV, max.
Auxiliary Outputs	1.5% or 75 mV, max.
Hold-Up Time	20 msec., min.
Dynamic Response[4]	200 µsec., max.
Temperature Coefficient	0.02%/°C, max.
Overvoltage Protection. All Outputs	Power Shutdown
Remote Sense[5]	All Outputs

INPUT SPECIFICATIONS

Voltage Range, User Selectable (Jumpers)	90 to 132 VAC 180 to 264 VAC
Input Frequency	47 to 63 Hz
Inrush Current: 500W	30A Peak
800 W	40A Peak
1000W, 1200W	75A Peak
Input EMI Filter, Conducted	FCC & VDE Class A
Input Protection	Internal Fuse

GENERAL SPECIFICATIONS

Efficiency	70 to 75%
Switching Frequency	20 KHz
MTBF[6]	Up to 85,000 hrs.
Input To Output Isolation	3000 VAC

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	0°C to 71°C
Derating 50°C to 71°C	2.4%/°C
Storage Temperature Range	−40°C to +85°C
Cooling	Ball Bearing Internal Fan
Vibration	Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock	Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions	See Case Drawings

Weight:

500W Single	12 lbs. (5.4 kg.)	1200W Single	15 lbs. (6.8 kg.)
800W Single	12 lbs. (5.4 kg.)	500W Multi	14 lbs. (6.4 kg.)

NOTES:

1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.
6. Full load @ 25°C per MIL HDBK 217E.

LISTED PRODUCTION FACILITY

UL 478

CSA 22.2, NO. 220

TUV IEC 380 VDE 0806

All specifications subject to change without notice.

UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

STANDARD MODELS (Consult factory for non-standard configurations).

MAX WATTS[1]	MODEL NUMBER[2]	OUTPUT V1	OUTPUT V2	OUTPUT V3	OUTPUT V4	CASE
500	JG 1000	2V160A				50
	JG 2000	5V100A				
	JG 3000	12V42A				
	JG 4000	15V33A				
	JG 5000	24V21A				
	JG 6000	28V18A				
	JG 7000	48V10A				
800	JM 1000	2V180A				
	JM 2000	5V160A				
	JM 3000	12V67A				
	JM 4000	15V54A				
	JM 5000	24V34A				
	JM 6000	28V29A				
	JM 7000	48V17A				
1000	JN 1000	2V210A				
	JN 2000	5V200A				
	JN 3000	12V83A				
	JN 4000	15V66A				
	JN 5000	24V42A				
	JN 6000	28V36A				
	JN 7000	48V21A				
1200	JP 1000	2V240A				
	JP 2000	5V240A				
	JP 3000	12V100A				
	JP 4000	15V80A				
	JP 5000	24V50A				
	JP 6000	28V42A				
	JP 7000	48V25A				
500	JG 2330	5V80A	12V10A	12V5A		
	JG 2440	5V80A	15V10A	15V5A		
500	JG 2133	5V80A	2V10A	12V5A	12V3A	
	JG 2233	5V80A	5V10A	12V5A	12V3A	
	JG 2332	5V80A	12V10A	12V5A	5V3A	
	JG 2335	5V80A	12V10A	12V5A	24V3A	
	JG 2442	5V80A	15V10A	15V5A	5V3A	

	OPTIONS[2]
D	DC "OK" Signal
F	Current Share/Monitor (Main)
R	Reverse Air Flow

NOTES:
1. Maximum continuous total output power must not exceed the maximum power rating.
2. Add suffix letters to model number for options.

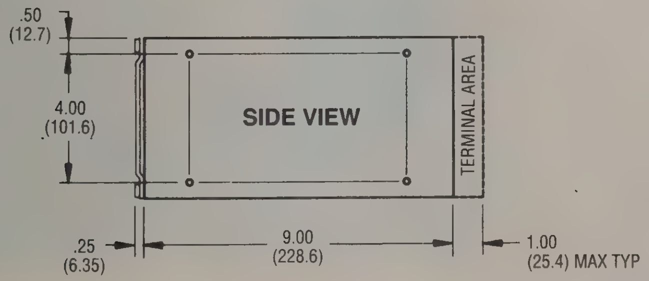
MATING PLUGS AND PINS

Single Output, 500W to 1200W, Case 50

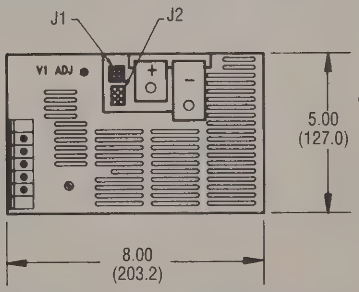
J1 mating plug: Molex 03-06-2092
J2 mating plug: Molex 03-06-2061
Male pins are all 02-06-2103

Multi Output, 500W, Case 50

J1 mating plug: Molex 03-06-2092
J2 mating plug: Molex 03-06-2122
J3 mating plug: Molex 03-06-2061
Male pins are all 02-06-2103

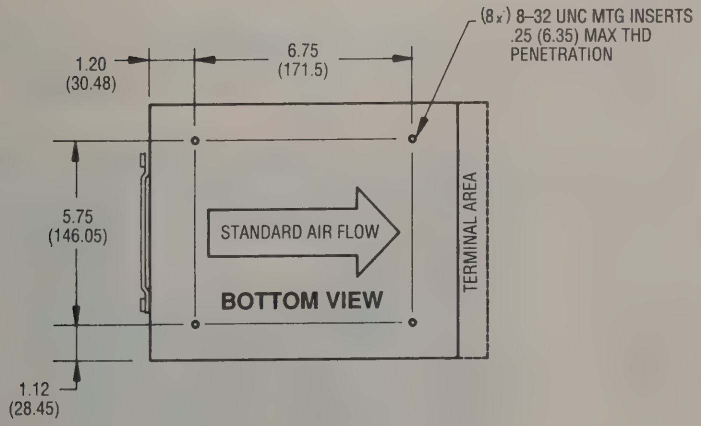


.50
(12.7)
4.00
(101.6)
SIDE VIEW
TERMINAL AREA
.25
(6.35)
9.00
(228.6)
1.00
(25.4) MAX TYP

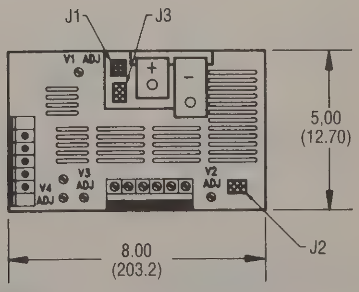


J1
J2
V1 ADJ
5.00
(127.0)
8.00
(203.2)

FRONT VIEW CASE #50 SINGLE



(8x) 8–32 UNC MTG INSERTS
.25 (6.35) MAX THD
PENETRATION
1.20
(30.48)
6.75
(171.5)
5.75
(146.05)
STANDARD AIR FLOW
BOTTOM VIEW
TERMINAL AREA
1.12
(28.45)



J1
J3
V1 ADJ
V4 ADJ
V3 ADJ
V2 ADJ
5.00
(12.70)
8.00
(203.2)
J2

FRONT VIEW CASE #50 MULTI

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

UNIPOWER
CORPORATION

WORLD CLASS
POWER
SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

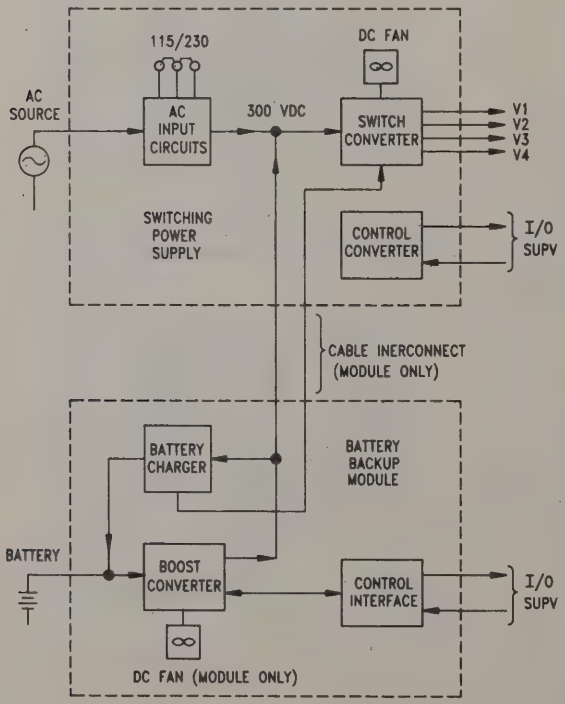
BATTERY BACKUP SWITCHERS
1-8 Outputs, 250-1200 Watts

GENERAL FEATURES

- Provides UPS Capability
- Simpler & More Efficient Than UPS
- AC And Battery Inputs
- Uses Sealed Lead-Acid Battery
- Automatic Transfer To Battery
- Transient-Free Battery Transfer
- Integral Battery Charger
- Charger Control & Supv. Circuitry
- Battery Protective Circuits
- Ideal For Fault-Tolerant Systems
- 19 Inch Rack Mount Available
- Safety Agency Approvals

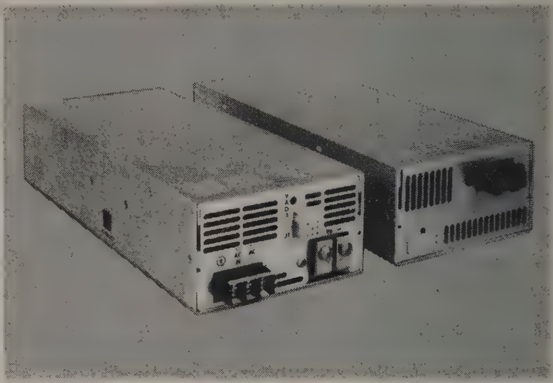
PRINCIPLES OF OPERATION

These units accept 115/230 VAC and 48 VDC input from an externally connected sealed lead-acid battery. Power to the output is normally provided by power flow from the AC input through a conventional off-line switching circuit. The battery is charged by an internal charging circuit. When AC failure is sensed, energy is drawn from the battery through a switching up-converter to keep the main converter operational to supply its rated output. The unit has control and monitor features to assure proper transfer of power between the AC source and the battery without disturbing the load.

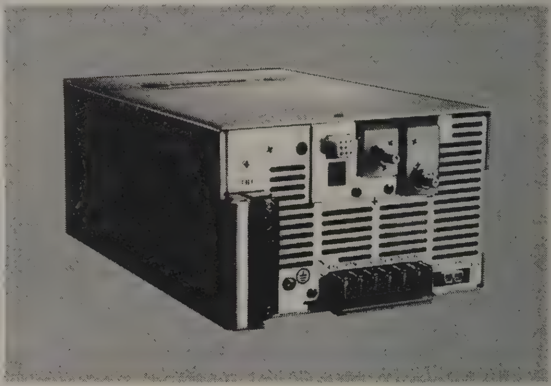

115/230
DC FAN
AC SOURCE
AC INPUT CIRCUITS
300 VDC
SWITCH CONVERTER
V1
V2
V3
V4
SWITCHING POWER SUPPLY
CONTROL CONVERTER
I/O SUPV
CABLE INERCONNECT (MODULE ONLY)
BATTERY CHARGER
BATTERY BACKUP MODULE
BATTERY
BOOST CONVERTER
CONTROL INTERFACE
I/O SUPV
DC FAN (MODULE ONLY)

NOTE: This diagram shows a P Series power supply with cable-connected battery backup module. For the J Series the battery backup is integral with the power supply, and for the H Series the battery backup is a plug-in module. All use the above topology.

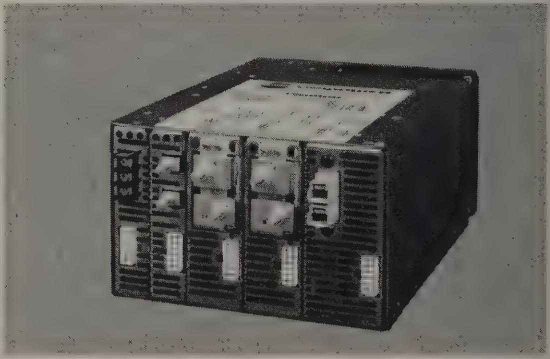
P SERIES BATTERY BACKUP
1-7 Outputs, 250-600 Watts



J SERIES BATTERY BACKUP
1-4 Outputs, 750 Watts



H SERIES BATTERY BACKUP
1-8 Outputs, 500-1200 Watts



UNIPOWER CORPORATION

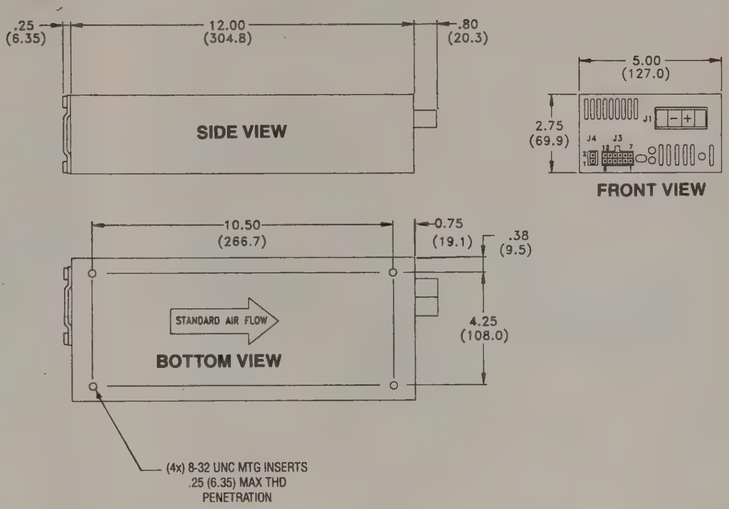
WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

P SERIES

KEY FEATURES

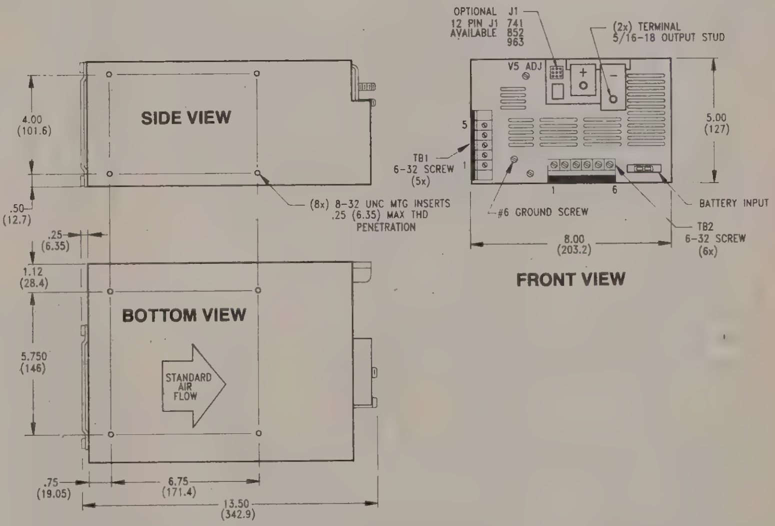
- 24V Or 48V Battery Operation
- 24V: Up To 500W Output
- 48V: Up To 600W Output
- Separate Remotable Batt. Backup Unit
- 24V Input Range: 21 To 29 VDC
- 48V Input Range: 40.5 To 56 VDC
- Reverse Voltage Protection
- Switch-Selectable 115/230 VAC
- 7 Different Output Voltages Available
- Low-Profile Cases
- 100 kHz MOSFET Switching
- Uses Surface-Mount Technology
- Thermal Protection & Warning
- FCC & VDE Level A Input Filter
- See P Series For Full Specs.


.25 (6.35)
12.00 (304.8)
.80 (20.3)
SIDE VIEW
5.00 (127.0)
2.75 (69.9)
J1
J4
J3
FRONT VIEW
10.50 (266.7)
0.75 (19.1)
.38 (9.5)
STANDARD AIR FLOW
BOTTOM VIEW
4.25 (108.0)
(4x) 8-32 UNC MTG INSERTS .25 (6.35) MAX THD PENETRATION

J SERIES

KEY FEATURES

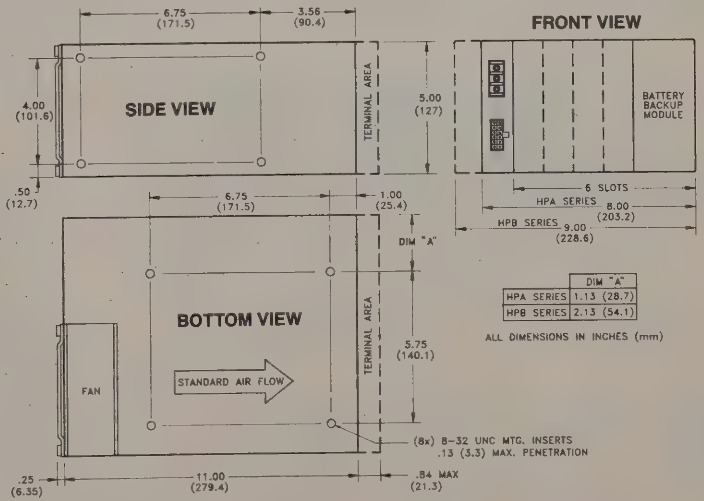
- 48V Battery Operation
- Integral Battery Backup
- Input Voltage Range: 40.5 To 56 VDC
- Low Battery Shutdown: 37.5 To 40 VDC
- Reverse Voltage Protection
- Jumper-Selectable 115/230 VAC Input
- FCC & VDE Level A Input Filter
- Current Share & Monitor On Main Output
- Thermal Protection & Warning
- Industry Standard 5 × 8 Inch Cases
- Overload & Overvoltage Protection
- Outputs From 2 To 48 VDC
- See J Series For Full Specs.


OPTIONAL 12 PIN J1 AVAILABLE
J1 741 852 963
(2x) TERMINAL 5/16-18 OUTPUT STUD
V5 ADJ
SIDE VIEW
4.00 (101.6)
5.00 (127)
TB1 6-32 SCREW (5x)
(8x) 8-32 UNC MTG INSERTS .25 (6.35) MAX THD PENETRATION
#6 GROUND SCREW
BATTERY INPUT
TB2 6-32 SCREW (6x)
8.00 (203.2)
FRONT VIEW
.50 (12.7)
.25 (6.35)
1.12 (28.4)
BOTTOM VIEW
5.750 (146)
STANDARD AIR FLOW
.75 (19.05)
6.75 (171.4)
13.50 (342.9)

H SERIES

KEY FEATURES

- 48V Battery Operation
- Plug In Battery Backup Module
- Input Voltage Range: 40 To 60 VDC
- Low Battery Shutdown: 38 To 42 VDC
- Reverse Voltage Protection
- Autoranging 115/230 VAC
- FCC & VDE Level A or B Input Filter
- Fully Modular Power System
- AC/Battery Operation LEDs
- AC Power-Factor Corrected
- 26 Selectable Plug In Modules
- Redundant N + 1 Capability
- See H Series For Full Specs.


6.75 (171.5)
3.56 (90.4)
FRONT VIEW
4.00 (101.6)
SIDE VIEW
TERMINAL AREA
5.00 (127)
BATTERY BACKUP MODULE
6 SLOTS
HPA SERIES 8.00 (203.2)
HPB SERIES 9.00 (228.6)
.50 (12.7)
6.75 (171.5)
1.00 (25.4)
DIM "A"
DIM "A"
HPA SERIES 1.13 (28.7)
HPB SERIES 2.13 (54.1)
ALL DIMENSIONS IN INCHES (mm)
BOTTOM VIEW
TERMINAL AREA
5.75 (140.1)
FAN
STANDARD AIR FLOW
(8x) 8-32 UNC MTG. INSERTS .13 (3.3) MAX. PENETRATION
.25 (6.35)
11.00 (279.4)
.84 MAX (21.3)

ALL DIMENSIONS IN INCHES (mm) All specifications subject to change without notice

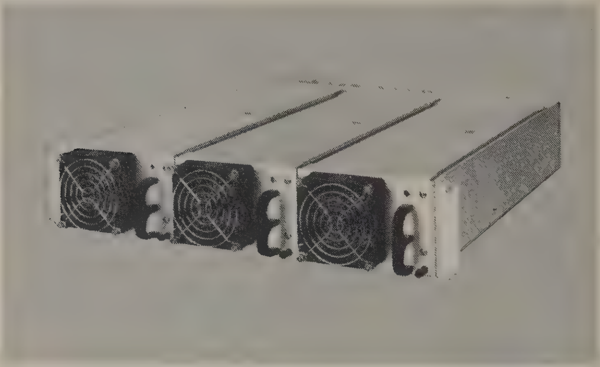
UNIPOWER CORPORATION

WORLD CLASS POWER SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

TP SERIES: HOT PLUG N + 1

1-12 Outputs, Up To 3000 Watts



KEY FEATURES

- P Series Units In A Pluggable Case
- 250 To 600 Watts Per Unit
- 1 To 4 Outputs Per Unit
- Outputs From 2VDC To 48VDC
- N + 1 Redundancy
- Current Share On All Outputs
- Integral Isolation Diodes
- True Hot Plug Replacement
- High Reliability Connectors
- Up To 6 Units Per Chassis
- Standard 19″ Rack Mountable
- Standard 3.5″ and 7″ Panel Height
- LED DC Power Good Indicators
- Each Unit Independently Cooled
- User Serviceable DC Ball Bearing Fan
- Pluggable Interface Termination

OTHER FEATURES

- Similar To Low Profile P Series

NOTE: All output, input, general and environmental specifications are similar to the P Series. Consult factory for mating connectors.

POWER SUPPLY OPTIONS	
A	Worldwide Autorange 115/230VAC
E	No Load Operation (Main On Multi)
Q	DC Input (42V To 56V)
R	Reverse Air Flow

LISTED BABT PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 234

TUV Rheinland TUV EN 60 950

SPECIFICATIONS

All output, input, general and environmental specifications are similar to the P Series.

STANDARD MODEL NUMBERS

At least two model numbers must be specified: One or more for the power supplies and one for the chassis configuration.

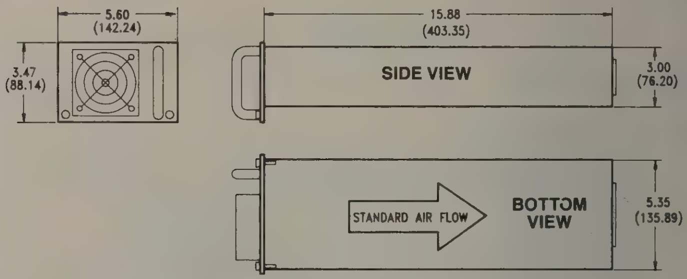
Power Supplies: Any P Series 250 to 600 watt model. Add "T" to the "P" in model number. For example: A PF2330 in a hot plug case is TPF2330.

Chassis Configuration:

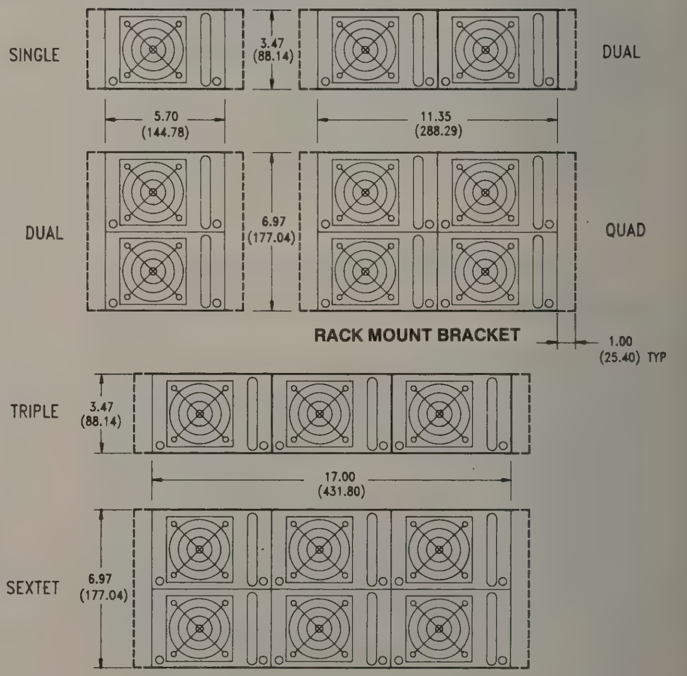
T W X Y Z

Z — No. of outputs
Y — No. of slots (1-6)
X — No. of rows (1 or 2)
W — Height: 2U (3.5″)
4U (7.0″)

POWER SUPPLY CASE


5.60
(142.24)
3.47
(88.14)
15.88
(403.35)
SIDE VIEW
3.00
(76.20)
STANDARD AIR FLOW
BOTTOM VIEW
5.35
(135.89)

CHASSIS CONFIGURATIONS (17.50 DEEP)


SINGLE
3.47
(88.14)
DUAL
5.70
(144.78)
11.35
(288.29)
DUAL
6.97
(177.04)
QUAD
RACK MOUNT BRACKET
1.00
(25.40) TYP
TRIPLE
3.47
(88.14)
17.00
(431.80)
SEXTET
6.97
(177.04)

FRONT VIEWS

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

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WORLD CLASS
POWER
SOLUTIONS

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TEL: (305) 974-2442
FAX: (305) 971-1837

TH SERIES: HOT PLUG N + 1

3-12 Outputs, Up To 3600 Watts

NEW

KEY FEATURES

- H Series In A Pluggable Case
- Up To 1200 Watts Per Unit
- 1 To 4 Outputs Per Unit
- .98 Power Factor (UNIFACTOR®)
- Outputs From 2VDC To 48VDC
- Battery-Backup Capability
- True Fault-Tolerant Operation
- N + 1 Redundancy
- Current Share On All Outputs
- Integral Isolation Diodes
- True Hot Plug Replacement
- High Reliability Connectors
- 1 To 3 Units Per System
- Standard 19″ Rack Mountable
- LED DC Power Good Indicators
- Each Unit Independently Cooled
- Worldwide Autorange
- Class A EMI Filter
- Pluggable Interface Termination

OTHER FEATURES

- Similar To Modular/Configurable H Series

POWER SUPPLY OPTIONS	
L	Isolated Alarm Circuit
R	Reverse Air Flow

NOTE: All output, input, general and environmental specifications are similar to the H Series. Consult factory for mating connectors.

PRODUCTION FACILITY

UL 1950

CSA 22.2, No. 234

TÜV Rheinland
EN 60 950

STANDARD MODEL NUMBERS

At least two model numbers must be specified: One or more for the power supplies and one for the chassis configuration.

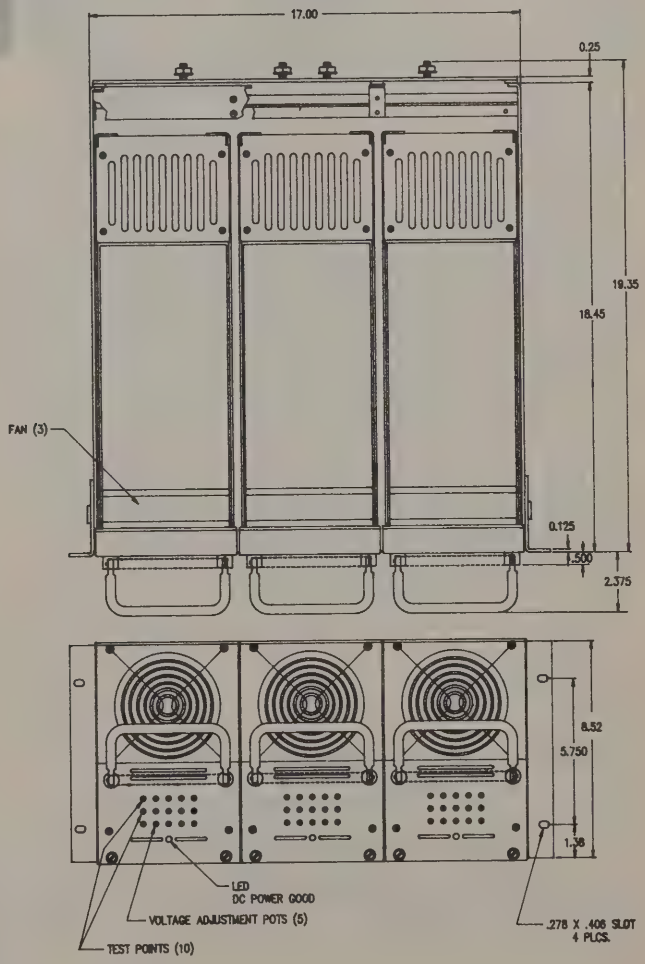
Power Supplies: Many H Series models. Add "T" to the "H" in model number. For example: An HPA2G3H5DUB in a hot plug chassis is a THPA2G3H5DUB.

Chassis Configuration:

T W X Y Z

Z — No. of outputs
Y — No. of slots (1, 2 or 3)
X — No. of rows (1 or 2)
W — Height: 5U (8.75″)

CHASSIS CONFIGURATION



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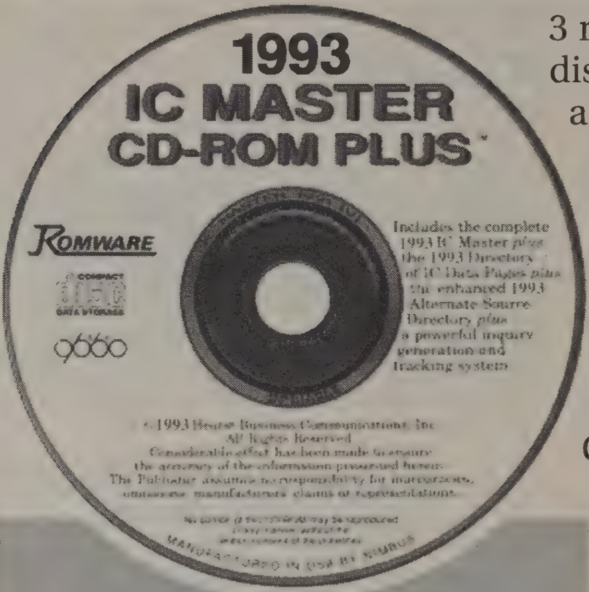
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Oil-Free Capacitor Charging Power Supplies

Universal Voltronics, a division of Thermo Voltek and Thermo Electron Corp., has been a leader in the High Voltage industry for over 30 years. Our products include: • High Voltage Switching Supplies to 30KW • High Voltage Linear Power Supplies to 400KV and 500KW • Precisely regulated high voltage power supplies to 500KV • High voltage line type and hard tube modulators • Solid state pulse generators to 100KV • Microwave component test sets • High voltage dividers • Isolation Transformers, standard line from 10kV to 250kV • High Voltage DC Power Packs, 2kV to 40kV • Multi-megajoule, megamp capacitor bank systems • Crowbar protection circuits.

Universal Voltronics' new High Frequency Transformer Rectifier eliminates the need for oil/insulating fluid. The result is:

- *Compact, lightweight packaging*
- *30%-40% reduction in peak power drawn from source*
- *Average power which is equal to peak power*
- *The highest safety–reduced risk of fire or accident*
- *Highest efficiency.*

HIGH VOLTAGE
ON
OFF/RESET
POWER ON
NEGATIVE
REMOTE
FAULT
KILOVOLTS
MILLIAMPERES
KV ADJUST
MA ADJUST
POWER

APPLICATIONS INCLUDE:

- Medical/Industrial Lasers
- X-ray Lithography
- E-Beam/Plasma Etching
- EMP/Flash X-Ray Simulators
- Industrial Welding/Heat Treating
- Magnetic Metal Forming

AVAILABLE WITH FULL CONTROLS

- 10 Turn Voltage Control
- 10 Turn Current Control
- 3½ Digit Voltmeter
- HV On/Off Control
- Indicator Lamps
- 3½ Digit Ammeter

TYPE BRI-(KV)-5KJ SPECIFICATIONS

Standard Maximum Output Voltages	Average Current at 100% Voltage	Average Current at 75% Voltage and below
1 kV	10 A	13.3A
2.5 kV	4 A	5.3 A
5 kV	2 A	2.7 A
10 kV	1 A	1.3 A
25 kV	400 mA	533 mA
35 kV	285 mA	380 mA
50 kV	200 mA	267 mA
70 kV	140 mA	190 mA

At voltages between 75% and 100% of maximum, derate current such that kV x mA = 10,000.
Other voltages and currents available, special order.

Charge Rate:	5 kJ/S PK 5 kJ/S AVG @ Frequency < 200Hz 4 kJ/S AVG @ Frequency = 2 kHz derate linearly from 200 Hz to 2kHz
Charge Voltage Regulation:	Plus or minus .5% to 2kHz 100 ppm/°CTC Plus or minus .1% available as an option
Efficiency:	87% at full load
Input Voltage:	190 - 260V 50-400 Hz 3 phase 20A max. standard
Power Factor:	>85%
Inrush Current:	<20A
Protection:	Overvoltage (internally adjustable) also protects against open circuit Prefire detection Auto inhibit with adjustable recharge delay Latched load detection Overcurrent Over temperature Internal & external interlocks
Packaging:	7" High, 19" rack mount panel, 21" Deep, 45-70 lbs depending on voltage.
To Order:	Specify kV and Polarity; Example BRI-5-5kJ-P is a 5kV, positive supply.

Universal Voltronics
A Division of Thermo Voltek • A Thermo Electron Corporation
• 27 Radio Circle Drive • Mt. Kisco, New York 10549 • 914/241-1300 • Fax: 914/241-3129

Universal Voltronics

A DIVISION OF THERMO VOLTEK • A THERMO ELECTRON CORP.

BRC SERIES 500 WATTS TO 30kW

High Voltage Switching Power Supplies for OEM and End User Applications

TABLE OF RATINGS

Output Voltage (KV)	Output Current (MA)	Model Number
0-5	100	BRC-5-100
	200	BRC-5-200
	400	BRC-5-400
	800	BRC-5-800
	1200	BRC-5-1200
	2000	BRC-5-2000
	4000	BRC-5-4000
	6000	BRC-5-6000
0-10	50	BRC-10-50
	100	BRC-10-100
	200	BRC-10-200
	400	BRC-10-400
	600	BRC-10-600
	1000	BRC-10-1000
	2000	BRC-10-2000
	3000	BRC-10-3000
0-20	25	BRC-20-25
	50	BRC-20-50
	100	BRC-20-100
	200	BRC-20-200
	300	BRC-20-300
	500	BRC-20-500
	1000	BRC-20-1000
	1500	BRC-20-1500
0-30	16	BRC-30-16
	33	BRC-30-33
	60	BRC-30-60
	120	BRC-30-120
	200	BRC-30-200
	320	BRC-30-320
	650	BRC-30-650
	1000	BRC-30-1000
0-50	10	BRC-50-10
	20	BRC-50-20
	40	BRC-50-40
	80	BRC-50-80
	120	BRC-50-120
	200	BRC-50-200
	400	BRC-50-400
	600	BRC-50-600
0-100	5	BRC-100-5
	10	BRC-100-10
	20	BRC-100-20
	40	BRC-100-40
	60	BRC-100-60
	100	BRC-100-100
	200	BRC-100-200
	300	BRC-100-300
0-150	3.3	BRC-150-3.3
	6.6	BRC-150-6.6
	12	BRC-150-12
	25	BRC-150-25
	40	BRC-150-40
	60	BRC-150-60
	130	BRC-150-130
	200	BRC-150-200
0-200	2.5	BRC-200-2.5
	5	BRC-200-5
	10	BRC-200-10
	20	BRC-200-20
	30	BRC-200-30
	50	BRC-200-50
	100	BRC-200-100
	150	BRC-200-150

UVC's MOSFET and IGBT - Based Switching Power supplies offer the highest level of reliability and quality and are supported by UVC's thirty years of expertise as a High Voltage Industry Leader. Our Switching Power Supplies have Low Stored Energy and are Arc and Short Circuit Protected.

FEATURES:

- Compact and lightweight
- Low stored energy
- Low EMI
- Precision regulation
- Arc and short circuit protection
- Low ripple
- High stability
- 110V input standard up to 1.5kW
- 220V input standard above 1.5kW (380V available upon request)

APPLICATIONS:

- Medical/Industrial Lasers
- Ion Implantation
- Electrostatic Paint/Powder Deposition
- X-ray Lithography
- E-Beam/Plasma Etching
- EMP/Flash X-Ray Simulators
- Industrial Curing/Welding/Heat Treating
- Isotope Separation
- E-Beam Evaporation

BRC 10,000
BRC 4000
KILOVOLTS
MILLIAMPERES
HIGH VOLTAGE
POWER

Features:

Front Panel Controls:

On-Off circuit breaker and Power-On light
HV-On pushbutton and light
HV-Off pushbutton and light
Voltage and Current controlled by locking 10 turn potentiometer, 0.1% resolution
Meters are single range 2% FS analog

Packaging:

Laboratory models are designed for standard 19 in. rack mountng. OEM and Airborne models are designed to the system requirements

Options:

Reversible output, Digital meters, Custom voltage and current ranges.

Remote controls – Consult Factory

Typical Specifications:

Input:	115V 1ø or 208V 3ø (1000W and above)
Output:	Adjustable, 0 to full rating. Rated current may be drawn at any voltage setting
Voltage Regulation:	± 0.01% for line voltage of 105 – 125 volts. ± 0.01% no load to full load
Current Regulation:	Line, ± 0.01% for line voltage Between 100 – 125 volts Load, less than 100 μa over compliance range of 10% to 100%
Ripple:	0.01% of rated V at full load
Stability:	.02%/hour, 0.05%/8 hours after warm up
Polarity:	Fixed, positive or negative Specify at time of order

Universal Voltronics
A Division of Thermo Voltek • A Thermo Electron Corporation
• 27 Radio Circle Drive • Mt. Kisco, New York 10549 • 914/241-1300 • Fax: 914/241-3129

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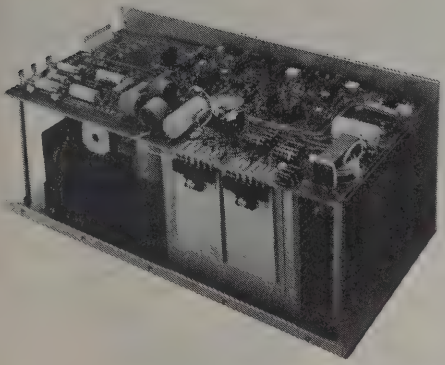
High Voltage Power Supplies Optimized for OEM Applications from Universal Voltronics



Ensure the highest level of reliability and quality in your system with high voltage power supplies from Universal Voltronics. UVC has delivered thousands of high voltage power supplies for laser and other applications which require precision regulation. Our high frequency systems are compact, easy to use, designed to operate without ballast resistors in either the CW or pulse modes in gas discharge applications and provide full power at 75% of maximum kV.

	MODELS		
	500W	**1000W**	**2000W**
Maximum Continuous Output Voltage**	50kv	50kv	50kv
Maximum CW Power Output	500W	1000W	2000W
Voltage regulation from 20 to 50 kV	±5% of FS*	±5% of FS*	±5% of FS*
Current regulation	±.5% of FS	±.5% of FS	±.5% of FS
Switching frequency	40kHz	40kHz	40kHz
Input Voltage and Current	105–125VAC 50/60Hz 1 Ø, 7A	105–125VAC 50/60Hz 1 Ø, 15A	105–125VAC 50/60Hz 1 Ø, 28A
	200–250VAC 50/60Hz 1 Ø, 4A	200–250VAC 50/60Hz 1 Ø, 8A	200–250VAC 50/60Hz 1 Ø, 15A
	N.A.	N.A.	190-240VAC 3 Ø, 8A
Ripple	5% RMS*		
Metering Signals-Voltage	0–10V = 0–50kV		
Metering Signals-Current	0–10 = 0–full scale		
Internal Setpoint Controls	one turn potentiometers		
Remote Setpoint Signals	same as metering signals		
Remote HV on Signal	+5V @ 3.5mA into opto-isolator or contact closure		
MECHANICAL			
Size	13" x 6.75" x 5.25"		
Weight	12.25 pounds		
HV Insulation	HV assembly potted in repairable RTV		
Mounting Position	any		
HV Output	dry cable well		
Interface connector	10 PIN panduit		
Air Cooled by Internal Fan (Standard on all units)		Optional water cooled	Optional water cooled

*.5% available by special order

**Other standard voltages include 15, 25, and 40kV (Special voltages available upon request)

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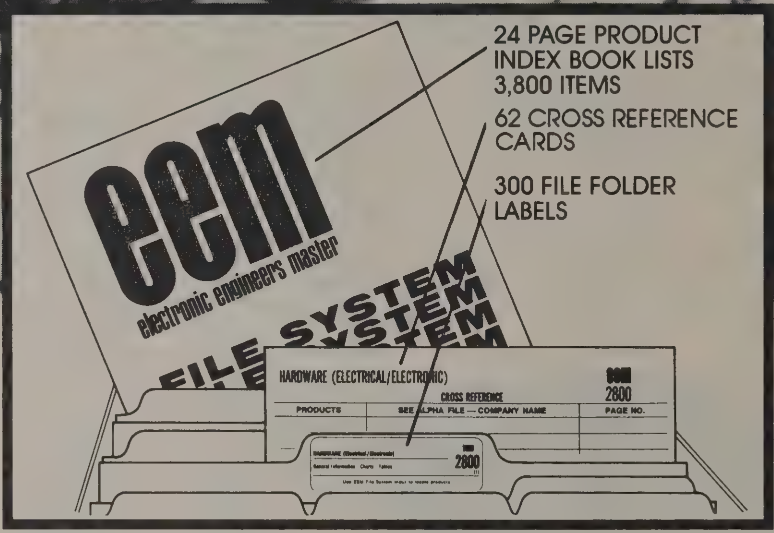
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ALL NEW with this edition of EEM

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

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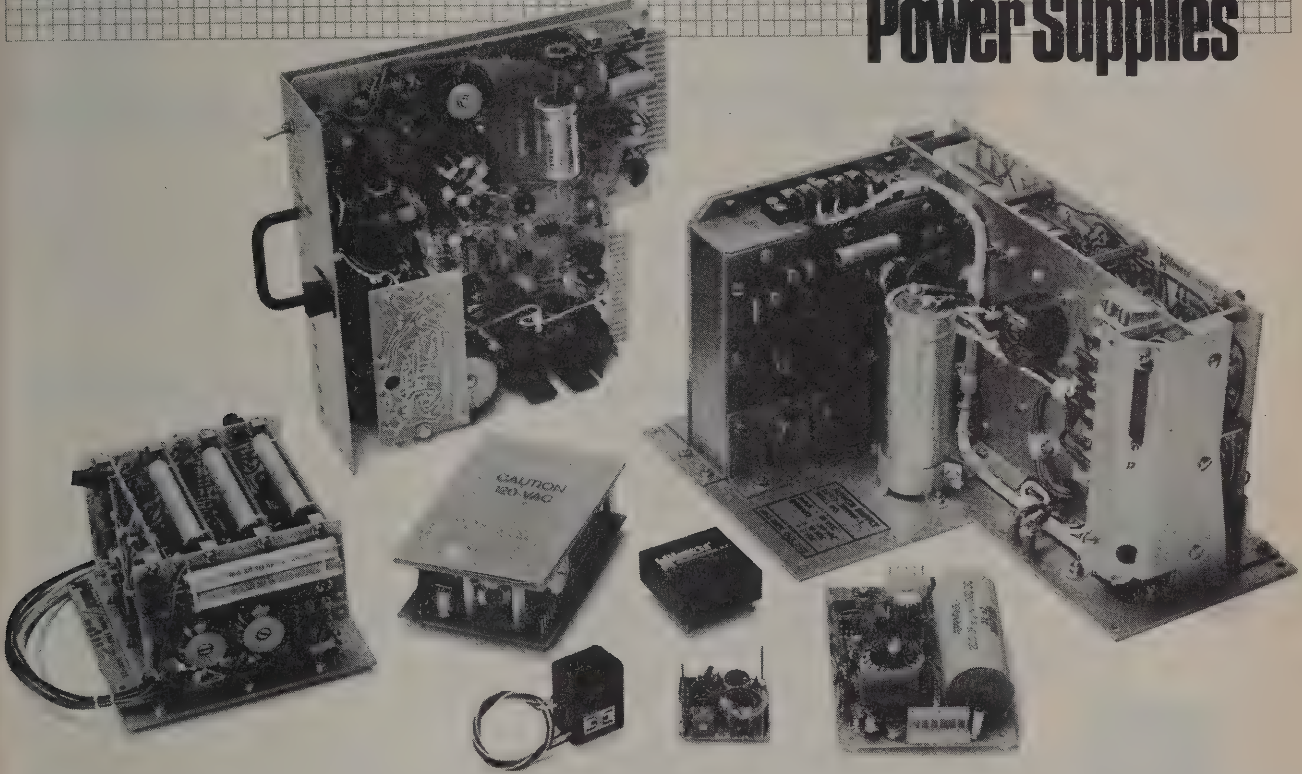
Wilmore

Custom-Designed Power Supplies



- **Multiple Output**
- **High Voltage**
- **Open Frame**
- **Encapsulated**
- **Modular**

The majority of our work is the design and manufacture of custom switching power supplies and dc-to-dc converters.
More than twenty years ago our transistor-switching power supplies began flying on spacecraft. Today we ship thousands of custom-designed industrial power supplies each month to a wide base of original equipment manufacturers. We are familiar with environments as demanding as diesel locomotives and as favorable as air-conditioned equipment bays. Our products operate daily from telecom and utility station batteries, vehicular electrical systems, low-voltage industrial ac circuits, and commercial ac power. We probably have had experience with applications similar to yours.

We combine the ability to deliver prototypes quickly and the production resources to manufacture competitively.
Systems engineers and power supply designers face the difficult task of electrically, mechanically, and thermally integrating a power supply into the system. The task can be further complicated by time constraints. Wilmore excels at this phase of program support, delivering carefully-conceived prototypes often in just a few weeks. Our responsiveness continues through to the production phase. Wilmore's two assembly plants in North Carolina were built from the ground up to produce power supplies in volume. We are a competitive domestic manufacturer with the flexibility to meet difficult production schedules.

Our New Products Group would like to hear from you.
Your inquiry will be answered promptly by the people who will be responsible for the design and prototyping of your power supply. If you need a quotation on your completed specification, or if you just want to discuss your application, please give our New Products Group a call. We would appreciate the opportunity to help solve your power conversion problems.

WILMORE ELECTRONICS CO., INC.
P.O. Box 1329, Hillsborough, N.C. 27278 • Telephone: (919) 732-9351
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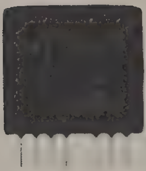
Xentek
DC-DC CONVERTERS

FEATURES

- Largest Selection in 2Vdc to 5Vdc Input Range
- Low Cost
- High Reliability (1,000,000 Hr MTBF)
- Industry's Smallest
- Isolated and Non-Isolated Models
- LCD Models



Model	Input Vdc	Output Vdc	Output mA	Regulation (%) Line	Regulation (%) Load	Stability %/°C	Eff %	Pkg Type	Dimensions LxWxH (in)
NON-ISOLATED BATTERY INPUT									
BPSA-0205S	2.0-3.5	+5	40	±1.5	±1.5	0.1	50	SIP	0.67x0.24x0.47
BNSA-0205S	2.0-3.5	-5	40	±1.5	±1.5	0.1	50	SIP	0.67x0.24x0.47
BPSA-0212S	2.0-3.5	+12	20	±1.5	±1.5	0.03	50	SIP	0.67x0.24x0.47
BNSA-0212S	2.0-3.5	-12	20	±1.5	±1.5	0.03	50	SIP	0.67x0.24x0.47
NON-ISOLATED INVERTING									
NNSA-0505S	4.5-5.5	-5	60	±1.0	±1.5	0.1	55	SIP	0.67x0.24x0.47
NNSB-0505S	4.5-5.5	-5	100	±1.0	±1.5	0.1	60	SIP	0.79x0.35x0.63
NNSC-0505S	4.5-5.5	-5	200	±1.0	±1.5	0.1	60	SIP	0.87x0.39x0.79
NNSA-0512S	4.5-5.5	-12	25	±1.0	±1.5	0.03	55	SIP	0.67x0.24x0.47
NNSB-0512S	4.5-5.5	-12	40	±1.0	±1.5	0.03	60	SIP	0.79x0.35x0.63
NNSC-0512S	4.5-5.5	-12	80	±1.0	±1.5	0.03	60	SIP	0.87x0.39x0.79
NNSA-0515S	4.5-5.5	-15	20	±1.0	±1.5	0.03	55	SIP	0.67x0.24x0.47
NNSB-0515S	4.5-5.5	-15	33	±1.0	±1.5	0.03	60	SIP	0.79x0.35x0.63
NNSC-0515S	4.5-5.5	-15	67	±1.0	±1.5	0.03	60	SIP	0.87x0.39x0.79
NNSA-0523S	4.5-5.5	-22.5	12	±1.0	±1.2	0.02	55	SIP	0.67x0.24x0.47
NON-ISOLATED VOLTAGE BOOSTING									
NPSA-0512S	4.5-5.5	+12	25	±1.0	±1.5	0.03	65	SIP	0.67x0.24x0.47
NPSB-0512S	4.5-5.5	+12	40	±1.0	±1.5	0.03	60	SIP	0.79x0.35x0.63
NPSC-0512S	4.5-5.5	+12	80	±1.0	±1.5	0.03	60	SIP	0.87x0.39x0.79
NPSA-0515S	4.5-5.5	+15	20	±1.0	±1.5	0.03	65	SIP	0.67x0.24x0.47
NPSB-0515S	4.5-5.5	+15	33	±1.0	±1.5	0.03	60	SIP	0.79x0.35x0.63
NPSC-0515S	4.5-5.5	+15	67	±1.0	±1.5	0.03	55	SIP	0.79x0.35x0.63
NPSB-0524S	4.5-5.5	+24	20	±1.5	±2.0	0.03	55	SIP	0.79x0.35x0.63
NPSC-0524S	4.5-5.5	+24	40	±1.5	±2.0	0.03	55	SIP	0.87x0.39x0.79
ISOLATED									
IPDA-0512S	4.5-5.5	±12	12.5	±1.5	±2.5	0.03	60	SIP	0.83x0.35x0.79
IPDB-0512S	4.5-5.5	±12	21	±1.5	±2.5	0.03	60	SIP	0.91x0.35x0.87
IPDC-0512S	4.5-5.5	±12	42	±1.5	±2.5	0.03	60	SIP	0.98x0.35x0.94
IPDA-0515S	4.5-5.5	±15	10	±1.5	±2.5	0.03	60	SIP	0.83x0.35x0.79
IPDB-0515S	4.5-5.5	±15	17	±1.5	±2.5	0.03	60	SIP	0.91x0.35x0.87
IPDC-0515S	4.5-5.5	±15	34	±1.5	±2.5	0.03	60	SIP	0.98x0.35x0.94
IPSA-0524S	4.5-5.5	24	12.5	±1.5	±2.5	0.03	60	SIP	0.83x0.35x0.79
IPSB-0524S	4.5-5.5	24	21	±2.0	±2.5	0.03	60	SIP	0.91x0.35x0.87
IPSC-0524S	4.5-5.5	24	42	±2.0	±2.5	0.03	60	SIP	0.98x0.35x0.94

Model	Type	Input Vdc	Output Vdc	Output mA	Regulation (%)	Ripple mV (p-p)	Eff %	Pkg Type	Dimensions LxWxH (mm)
DC-DC CONVERTERS FOR LCD APPLICATIONS									
HNN-01	+5V Input	4.5-5.5	-24	20	±5.0	200	70	SIP	35x9.5x4.3
HNN-02	w/o RMT	4.5-5.5	-23	20	±5.0	200	70	SIP	35x9.5x4.3
HNN-03		4.5-5.5	-22	20	±5.0	200	70	SIP	35x9.5x4.3
HNH-01	+5V Input	4.5-5.5	-24	20	±5.0	200	70	SIP	35x9.5x4.3
HNH-02	w/RMT	4.5-5.5	-23	20	±5.0	200	70	SIP	35x9.5x4.3
HNH-03	(Active HI)	4.5-5.5	-22	20	±5.0	200	70	SIP	35x9.5x4.3
HNL-01	+5V Input	4.5-5.5	-24	20	±5.0	200	70	SIP	35x9.5x4.3
HNL-02	w/RMT	4.5-5.5	-23	20	±5.0	200	70	SIP	35x9.5x4.3
HNL-03	(ActiveLO)	4.5-5.5	-22	20	±5.0	200	70	SIP	35x9.5x4.3
HWN-01	Wide Range Input	10-25	-24	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-02	w/o RMT	10-25	-23	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-03		10-25	-22	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-01	Wide Range Input	10-25	-24	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-02	w/ RMT	10-25	-23	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-03	(ActiveHI)	10-25	-22	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-01	Wide Range Input	10-25	-24	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-02	w/o RMT	10-25	-23	30	±5.0	200	80	SIP	29.5x10.5x7
HWN-03	(ActiveLO)	10-25	-22	30	±5.0	200	80	SIP	29.5x10.5x7

Xentek
A Taiyo Yuden Company
1770 La Costa Meadows Drive ▪ San Marcos, CA 92069 ▪ (619) 471-4001 ▪ Fax (619) 471-4021

Xentek
LCD POWER MODULES

Xentek low profile DC to AC Inverters are designed for driving cold cathode fluorescent lamp (CCFL) backlighting for LCD displays.

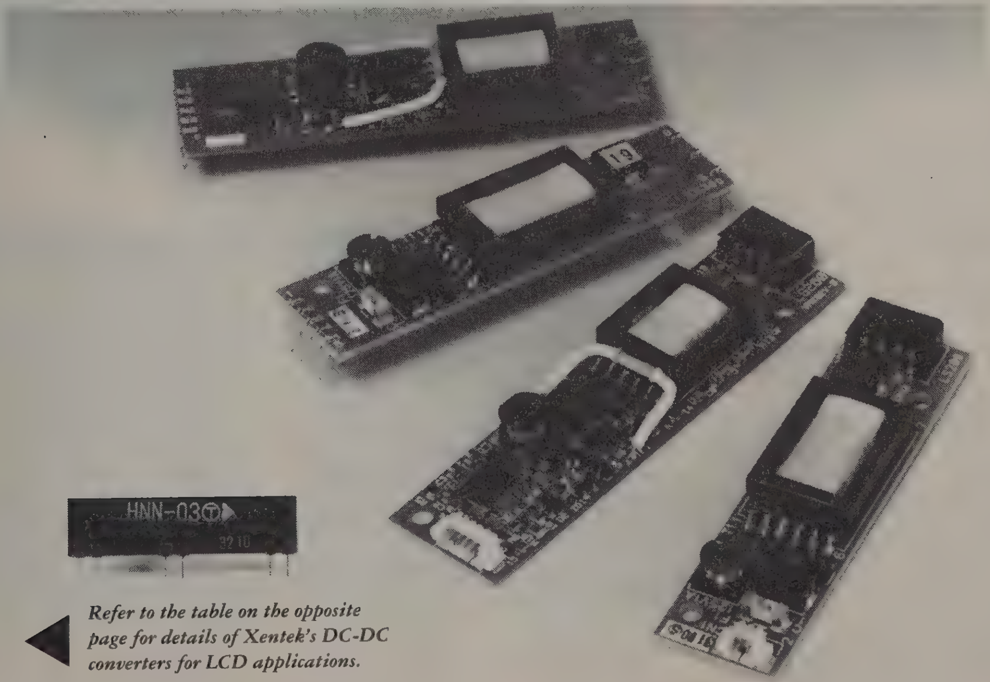
In addition, Xentek offers a line of super-compact DC-DC converters custom designed for use in LCD modules.

Xentek LCD CCFL modules and DC-DC converters, designed and manufactured by Taiyo Yuden, Xentek's parent company, are recommended by Sharp, Epson, Optrex, Hitachi, Toshiba, and other LCD manufacturers.

CCFL POWER MODULE SPECIFICATIONS

Part Number	Input Voltage (Vdc)	Open Circuit Voltage (AC Vrms)	Output Current (Typical) (mA rms)	Brightness Control	Mounting Method	LCD Module
LS220	10 - 16	1200	7.0	YES	DIP	Sharp LM64P80 or equivalent
LS260	10 - 16	1200	6.5	YES	CONN	Sharp LM64P80 or equivalent
LS300	10.8 - 13.2	1000	6.2	NO	DIP	Sharp LM64P80 or equivalent
LS280	10.8 - 13.2	1000	6.2	NO	CONN	Sharp LM64P80 or equivalent

Note: Connector – DIP-Dual In Line PCB mountable type (see specification for further details).
Conn-Mitsumi connectors are used per Sharp LCD module specifications.
Contact factory for more standard inverters and custom inverter requirements.



◀ *Refer to the table on the opposite page for details of Xentek's DC-DC converters for LCD applications.*

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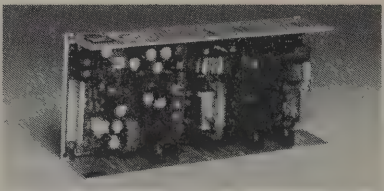
Xentek
SWITCHMODE POWER SUPPLIES

FEATURES

- NEW Auto-Ranging Models
- Up to 3.0 Watts/in^3
- Four Regulated, Adjustable Outputs
- On-board EMI Filtering
- Low PARD (1% max)
- Overload, Overvoltage, Reverse Voltage & Thermal Protection
- Two-year Warranty

SPECIFICATIONS

AC Input: 90-132/180-264VAC, 47-63Hz, Auto-ranging (AR Models); Jumper selected (SX Models).
Input Protection: Fuse.
Inrush Current: 32A, max.
Input Transient Protection: Meets IEEE 587, Category A.
Efficiency: 75% typical.
Hold-up Time: 20ms.
AC Power Fail Signal: TTL low 5ms before loss of regulation.
MTBF: 100,000 Hrs, minimum.
EMI Filtering: VDE 0871/6.78 and FCC Level A (SX Models), FCC Level B (AR Models).
Adjustability: ±5%, all outputs.
Line & Load Regulation: 1%, max on all outputs.
Cross Regulation: Negligible.
Remote Sense: Compensates for 0.5 volt cable drop on main output.
Remote ON/OFF: TTL low signal, standard on all models rated >300W.
PARD: 1%, max, all outputs.
Output Overshoot: None on turn-on or turn-off.
Overload Protection: Input and output protection, standard.
Reverse Voltage Protection: Full current rating, all outputs.
Transient Response: 2% max for 25% load change; recovery to within 1% in <500µs.
Stability: ±0.1% for 24 Hrs.
Temperature Coefficient: 0.02%/°C.
Operating Temperature: 0-50°C, full rating. Derate to 50% at 70°C.
Storage Temperature: -55°C to +85°C.
Safety: Meets UL 478; UL 1012; CSA 22.2 No. 220, Electrical Bulletin 1402C; VDE 0804; VDE 0806; IEC380; IEC435.



150/175[1] WATTS

Main Output:
+5Vdc/15A, max; 3A, min.

AUXILIARY OUTPUTS

AR175[2]-	Aux 1	Aux 2	Aux 3
81000	+12V/6A (8A)	12V/2A (3A)	5V/1A (1.5A)
81010	+12V/6A (8A)	12V/2A (3A)	12V/1A (1.5A)
81030	+12V/6A (8A)	24V/1A (1.5A)	5V/1A (1.5A)
81040	+12V/6A (8A)	24V/1A (1.5A)	5V/1A (1.5A)
81050	+15V/6A (8A)	15V/2A (3A)	5V/1A (1.5A)
81060	+24V/4A (5A)	12V/2A (3A)	5V/1A (1.5A)
81070	+24V/4A (5A)	12V/2A (3A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 9.50" x 4.25" x 2.00"
AR Models: 11.50" x 4.25" x 2.00"

175/200[1] WATTS

Main Output:
+5Vdc/20A, max; 3A, min.

AUXILIARY OUTPUTS

AR200[2]-	Aux 1	Aux 2	Aux 3
81500	+12V/6A (8A)	12V/2.5A (3A)	5V/1A (1.5A)
81510	+12V/6A (8A)	12V/2.5A (3A)	12V/1A (1.5A)
81530	+12V/6A (8A)	24V/1A (1.5A)	5V/1A (1.5A)
81540	+12V/6A (8A)	24V/1A (1.5A)	5V/1A (1.5A)
81550	+15V/6A (8A)	15V/2.5A (3A)	5V/1A (1.5A)
81560	+24V/4A (5A)	12V/2.5A (3A)	5V/1A (1.5A)
81570	+24V/4A (5A)	12V/2.5A (3A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 9.50" x 4.25" x 2.25"
AR Models: 11.50" x 4.25" x 2.25"

225/300[1] WATTS

Main Output:
+5Vdc/40A, max; 5A, min.

AUXILIARY OUTPUTS

AR300[2]-	Aux 1	Aux 2	Aux 3
82000	12V/10A	12V/2A (3A)	5V/1A (1.5A)
82010	12V/10A	12V/2A (3A)	12V/1A (1.5A)
82030	12V/10A	24V/1A (1.5A)	5V/1A (1.5A)
82040	12V/10A	24V/1A (1.5A)	5V/1A (1.5A)
82050	15V/10A	15V/2A (3A)	5V/1A (1.5A)
82060	24V/5A (6A)	12V/2A (3A)	5V/1A (1.5A)
82070	24V/5A (6A)	12V/2A (3A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 10.00" x 5.00" x 2.50"
AR Models: 12.00" x 5.00" x 2.50"

245/325[1] WATTS

Main Output:
+5Vdc/45A, max; 5A, min.

AUXILIARY OUTPUTS

AR325[2]-	Aux 1	Aux 2	Aux 3
82300	12V/10A	12V/2A (3A)	5V/1A (1.5A)
82310	12V/10A	12V/2A (3A)	12V/1A (1.5A)
82330	12V/10A	24V/1A (1.5A)	5V/1A (1.5A)
82340	12V/10A	24V/1A (1.5A)	12V/1A (1.5A)
82350	15V/10A	15V/2A (3A)	5V/1A (1.5A)
82360	24V/5A (6A)	12V/2A (3A)	5V/1A (1.5A)
82370	24V/5A (6A)	12V/2A (3A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 10.00" x 5.00" x 2.50"
AR Models: 12.00" x 5.00" x 2.50"

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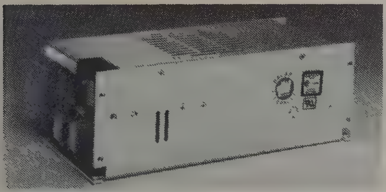


350[3] WATTS

Main Output:
+5Vdc/45A, max; 5A, min.

AR350[2]-	Aux 1	Aux 2	Aux 3
82500	12V/12A (14A)	12V/2.5A (3A)	5V/1A (1.5A)
82510	12V/12A (14A)	12V/2.5A (3A)	12V/1A (1.5A)
82530	12V/12A (14A)	24V/1A (1.5A)	5V/1A (1.5A)
82540	12V/12A (14A)	24V/1A (1.5A)	12V/1A (1.5A)
82550	15V/12A (14A)	15V/2.5A (3A)	5V/1A (1.5A)
82560	24V/6A (7A)	12V/2.5A (3A)	5V/1A (1.5A)
82570	24V/6A (7A)	12V/2.5A (3A)	12V/1A (1.5A)

AUXILIARY OUTPUTS

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 10.00" x 5.00" x 3.50"
AR Models: 12.00" x 5.00" x 3.50"

400[4] WATTS

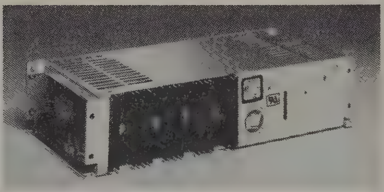
Main Output:
+5Vdc/50A, max; 5A, min.

AUXILIARY OUTPUTS

AR400[2]-	Aux 1	Aux 2	Aux 3
83000	12V/10A	12V/6A (8A)	5V/1A (1.5A)
83010	12V/10A	12V/6A (8A)	12V/1A (1.5A)
83030	12V/10A	24V/4A (5A)	5V/1A (1.5A)
83040	12V/10A	24V/4A (5A)	12V/1A (1.5A)
83050	15V/10A	15V/6A (8A)	5V/1A (1.5A)
83060	24V/5A (6A)	12V/6A (8A)	5V/1A (1.5A)
83070	24V/5A (6A)	12V/6A (8A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 10.50" x 5.00" x 2.50"
AR Models: 12.50" x 5.00" x 2.50"



425[4] WATTS

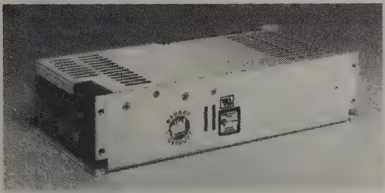
Main Output:
+5Vdc/60A, max; 7A, min.

AUXILIARY OUTPUTS

AR425[2]-	Aux 1	Aux 2	Aux 3
83500	12V/12A (14A)	12V/6A (8A)	5V/1A (1.5A)
83510	12V/12A (14A)	12V/6A (8A)	12V/1A (1.5A)
83530	12V/12A (14A)	24V/4A (5A)	5V/1A (1.5A)
83540	12V/12A (14A)	24V/4A (5A)	12V/1A (1.5A)
83550	15V/12A (14A)	15V/6A (8A)	5V/1A (1.5A)
83560	24V/6A (7A)	12V/6A (8A)	5V/1A (1.5A)
83570	24V/6A (7A)	12V/6A (8A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 10.50" x 5.00" x 3.50"
AR Models: 12.50" x 5.00" x 3.50"



450[4] WATTS

Main Output:
+5Vdc/60A, max; 7A, min.

AUXILIARY OUTPUTS

AR450[2]-	Aux 1	Aux 2	Aux 3
84000	12V/12A (14A)	12V/6A (8A)	5V/1A (1.5A)
84010	12V/12A (14A)	12V/6A (8A)	12V/1A (1.5A)
84030	12V/12A (14A)	24V/4A (5A)	5V/1A (1.5A)
84040	12V/12A (14A)	24V/4A (5A)	12V/1A (1.5A)
84050	15V/12A (14A)	15V/6A (8A)	5V/1A (1.5A)
84060	24V/6A (7A)	12V/6A (8A)	5V/1A (1.5A)
84070	24V/6A (7A)	12V/6A (8A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 11.50" x 5.00" x 2.50"
AR Models: 13.50" x 5.00" x 2.50"

500[3] WATTS

Main Output:
+5Vdc/70A, max; 7A, min.

AUXILIARY OUTPUTS

AR500[2]-	Aux 1	Aux 2	Aux 3
84500	12V/12A (14A)	12V/6A (8A)	5V/1A (1.5A)
84510	12V/12A (14A)	12V/6A (8A)	12V/1A (1.5A)
84530	12V/12A (14A)	24V/4A (5A)	5V/1A (1.5A)
84540	12V/12A (14A)	24V/4A (5A)	12V/1A (1.5A)
84550	15V/12A (14A)	15V/6A (8A)	5V/1A (1.5A)
84560	24V/6A (7A)	12V/6A (8A)	5V/1A (1.5A)
84570	24V/6A (7A)	12V/6A (8A)	12V/1A (1.5A)

Note: Current shown in parentheses is peak rating.

Dimensions:
SX Models: 11.50" x 5.00" x 3.50"
AR Models: 13.50" x 5.00" x 3.50"

Notes

[1] Higher rating achieved when fan cooling (30 CFM airflow) is employed; the lower rating is with convection cooling.

[2] Auto-Ranging models are shown in table; for jumper-selected input, replace "AR" in the model number with "SX". For example:

Model AR300-82000 is auto-ranging version; Model SX300-82000 has jumper-selected input.

[3] Unit equipped with built-in fan.

[4] Fan cooling (30 CFM airflow) required.

Other voltage/current combinations are available in OEM quantities.

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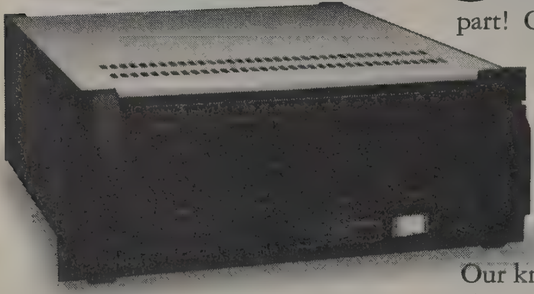
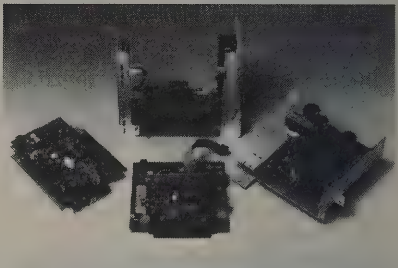
Xentek
CUSTOM / RACK POWER SUPPLIES



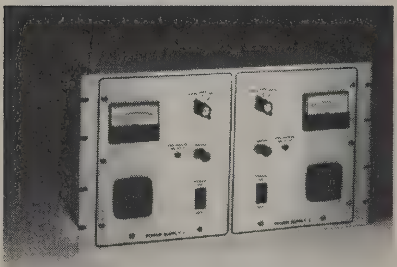


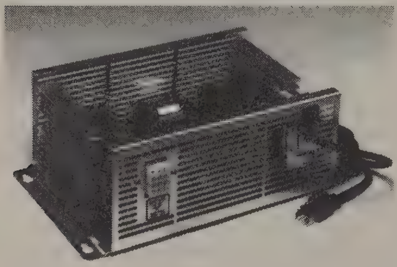
Satisfying your custom and rack power supply requirements is a big part of our business – a very big part! Over two-thirds of our business is in moderate to high volume OEM custom supplies and rack systems– both switchers and linears.

DESIGN EXPERTISE

Our knowledge and experience in power electronics, magnetics and electronic packaging, coupled with our advanced CAD/CAM systems, result in truly innovative solutions to your power supply needs.

Our engineers are skilled in advanced power electronics design techniques that include the use of custom hybrid circuits designed by Xentek and produced by Taiyo Yuden, our parent company. And as many of the products shown here demonstrate, creative packaging plays an essential role in custom and rack system design.





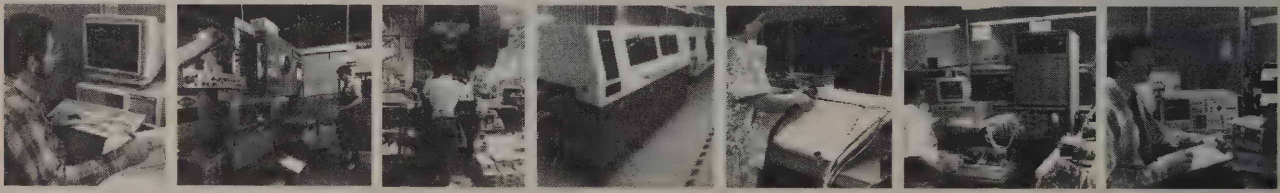
TOTAL MANUFACTURING

Xentek has the skills and the resources it takes to produce your custom power supply or rack system. In our vertically integrated production facilities, we have the equipment and the skilled personnel to produce intricate metalwork, fabricate complex transformers, assemble printed circuits and manufacture cable harnesses. We do our own plating, anodizing, painting and silk-screening.

We have a fully equipped safety compliance testing facility and screen-room facilities for FCC/VDE EMI/RFI testing.

Finally, after burn-in, every power supply we produce is fully tested using our advanced computer-based power supply test equipment.

Vertical Integration–from design to production to final test–the Xentek advantage!



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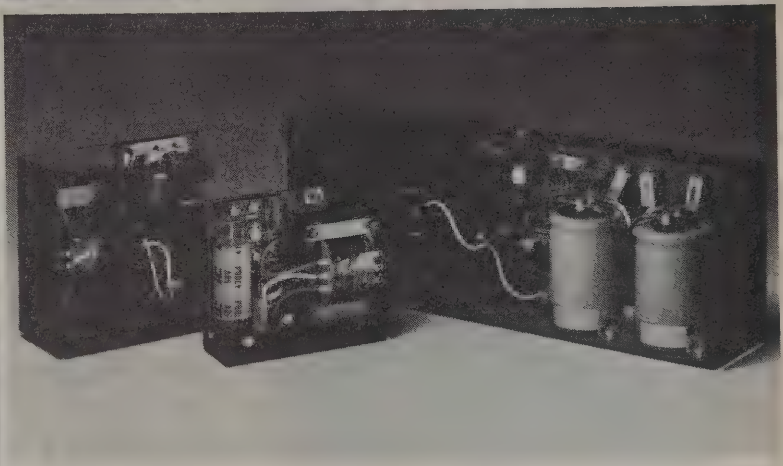
Xentek
LINEAR POWER SUPPLIES

EXTENDED PERFORMANCE SERIES

Dash No.	Output Range (Vdc)	Output Current (A) XE 20	XE 30	XE 60	XE 90	XE 120	XE 180	XE 240
-5	5	4.0	6.0	12.0	18.0	25.0	36.0	50.0
-5	6	3.3	5.0	10.0	13.0	18.0	26.0	36.0
-12	11	2.5	4.2	8.4	11.1	12.9	18.7	25.8
-12	12	2.4	4.0	8.0	10.2	12.1	18.1	24.2
-12	13	2.2	3.7	7.4	9.6	11.5	16.6	23.0
-15	14	2.2	3.5	7.0	9.0	11.0	16.0	22.0
-15	15	2.1	3.3	6.6	8.4	10.3	14.7	20.6
-15	16	1.9	3.0	6.0	7.6	9.5	13.8	19.0
-24	20	1.6	2.4	4.8	6.2	7.6	10.4	15.2
-24	21	1.6	2.4	4.8	6.2	7.6	10.4	15.2
-24	22	1.5	2.2	4.4	5.7	7.0	10.1	14.0
-24	23	1.5	2.2	4.4	5.7	7.0	10.1	14.0
-24	24	1.2	2.0	4.0	5.0	6.5	9.3	13.0
-24	25	1.2	2.0	4.0	5.0	6.5	9.3	13.0
Mechanical Specifications								
L (in)		4.50	5.75	6.25	8.50	12.00	9.62	11.94
W (in)		4.00	4.38	5.25	5.50	5.62	8.50	9.25
H (in)		2.75	3.50	4.87	4.87	4.88	4.88	4.88
Wt (lbs)		2.8	4.8	9.1	12.3	18.3	24.5	32.5

OEM SERIES

Dash No.	Output Range (Vdc)	Output Current (A) XPX 20	XPX 30	XPX 45	XPX 60	XPX 90
-5	5	4.0	6.0	9.0	12.0	18.0
-5	6	3.3	5.0	7.5	10.0	13.0
-12	11	2.5	3.0	5.0	6.8	10.5
-12	12	2.4	3.0	4.8	6.5	10.0
-12	13	2.2	2.7	4.4	6.1	9.6
-24	21	1.5	2.4	3.8	5.2	6.7
-24	22	1.5	2.4	3.8	5.2	6.7
-24	23	1.2	2.3	3.6	5.0	6.0
-24	24	1.2	2.3	3.6	5.0	6.0
-48	48	-	1.2	-	-	-
-100	75	-	0.8	-	-	-
-100	100	-	0.6	-	-	-
-150	110-150	-	0.4	-	-	-
-180	150-190	-	-0.3	-	-	-
-250	190-220	-	0.25	-	-	-
-250	220-250	-	0.2	-	-	-
Mechanical Specifications						
L (in)		4.87	5.62	7.00	9.00	14.00
W (in)		4.00	4.88	4.88	4.87	4.88
H (in)		1.97	2.95	3.38	3.39	3.39
Wt (lbs)		2.3	4.1	6.0	7.5	12.5



FEATURES

Extended Performance Series (XE)

- 20W to 240W (at 5Vdc)
- Adjustable output voltage ranges from 5Vdc to 25Vdc
- 0 to 55°C without derating
- Electrostatically Shielded Xfmr
- Foldback Current Limiting
- Short Circuit and Reverse Voltage Protection
- 115/230VAC input

OEM Series (XP)

- 20W to 90W (at 5Vdc)
- Adjustable output voltage ranges from 5Vdc to 24Vdc (up to 250Vdc on XP30)
- 0 to 40°C without derating
- Foldback Current Limiting
- Short Circuit and Reverse Voltage Protection

Unregulated Series (XU)

- 15W to 1000W
- Excellent Source of Bulk dc Power for Distributed Power Systems
- Best Cost-per Watt Value

SPECIFICATIONS

XE & XP Series

Input:
115/230 (XE), 115 (XP) VAC±10%, 47-440Hz. (Derate output current 15% at 400Hz.)

Output:
Floating, adjustable with multi-turn cermet pots over range per table.

Line Regulation:
±0.05% for 10% line change. (0.2% for 20% change.)

Load Regulation:
±0.05% for 50% load change. (0.2% for 100%.)

Transient Response:
<50µs for 50% load change.

Noise and Ripple:
0.1% peak-to-peak.

Operating Temperature:
0-55°C (XE), 0-40°C (XP, XE20). Derate 2%/°C to 71°C.

Temperature Coefficient:
±0.01%/°C, max.

Stability:
±0.1% max for 24 hrs, after warmup.

XU Series

Input: 115/230VAC,50/60Hz.

Output:
Floating fixed output at full load rating per model selection chart.

Load Regulation:
15%, 0-50% of rating, typical.
9%, 50-100% rating , typical.

Ripple:
3% rms, max at full load.

Operating Temperature:
0-50°C. (Derate 2%/°C to 71°C.)

Overcurrent Protection: Fuse.

UNREGULATED SERIES

Dash No.	15XXU Vdc/A	30XXU Vdc/A	60XXU Vdc/A	100XXU Vdc/A	200XXU Vdc/A	500XXU Vdc/A	750XXU Vdc/A	1000XXU Vdc/A
-7	7.5/1.8	7.5/3.0	7.5/6.0	8.5/10.0	-	-	-	-
-12	11.0/1.2	12.0/2.4	12.0/4.8	12.5/7.0	-	-	-	-
-16	17.0/0.9	16.0/1.8	16.0/3.6	17.0/6.0	-	-	-	-
-24	25.0/0.6	26.5/1.2	26.5/2.4	25.5/3.5	27.5/7.5	24.6/20.0	24.0/30.0	24.0/40.0
-48	48.0/0.3	48.0/0.6	48.0/1.2	48.0/1.8	47.0/4.0	48.0/10.0	48.0/15.0	48.0/20.0
Mechanical Specifications								
L (in)	4.62	5.88	6.25	7.12	8.10	9.00	9.50	9.00
W (in)	2.62	3.19	3.69	4.00	5.00	5.62	8.00	9.00
H (in)	2.09	2.62	3.00	3.25	3.88	4.62	5.56	5.38
Wt (lbs)	1.5	2.6	4.0	6.3	12.3	20.5	31.0	33.0

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COMPUTER™ PRODUCTS

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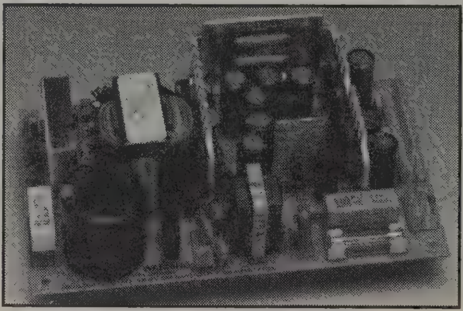
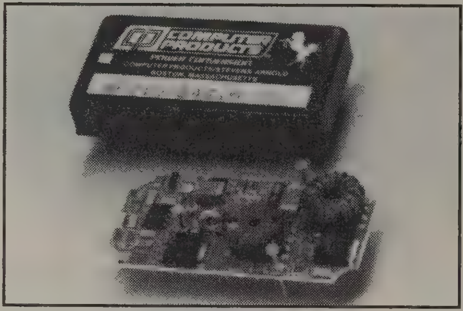
Telephone: (510) 657-6700, Fax: (510) 683-6400



AC/DC Switchers

- General Purpose, Universal Input, 25W to 1500W
  - Medical Approved Versions
  - FCC/VDE B Versions
- External Supplies with Battery Charging Option
- Modular Power Supply, 1-6 Outputs, PFC, 1200W
- Encapsulated & Linear Power Supplies



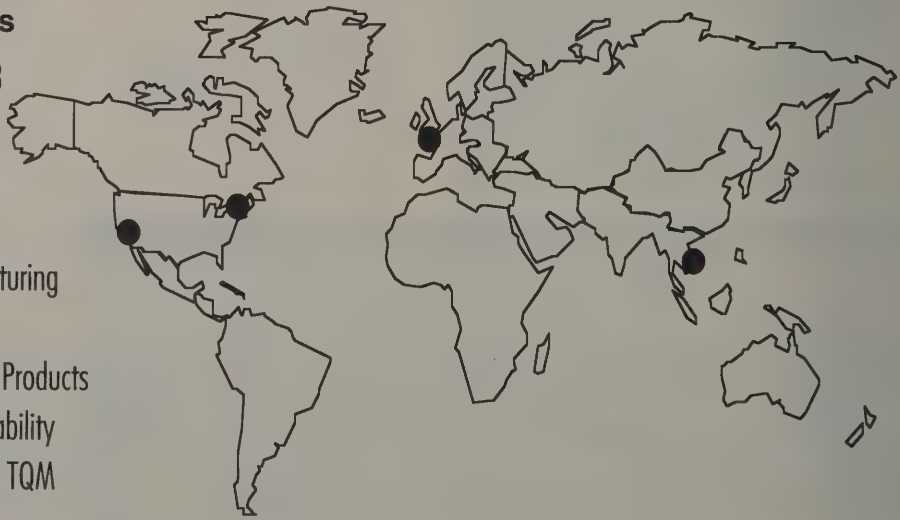
DC/DC Converters

- High Density, 5W to 200W, NFC, AFC5-F, BASiX™ Series
- High Performance, 15W to 30W WR15/WR30 Series
- General Purpose, 0.5W to 100W
- Non-Isolated, 5W to 360W

GLOBAL CAPABILITIES

Computer Products

- Established in 1968
- ISO9000 Certification
- Agency Approvals
- Worldwide Manufacturing Operations
- Over 300 Standard Products
- Custom Design Capability
- Statistical Control & TQM



For **Immediate Technical/Sales Assistance**, use our FAX FORM on the inside front cover of this book.

DC-DC CONVERTERS

Manufacturer	Starting EEM Page No.	Output Wattage Range, W	Number of Outputs (max.)	Input Voltage Range, V	Output Voltage Range, V	Output Current Range, I	Isolation Voltage (Vdc min.)	Power Density (W/IN^3)	EMI/RFI Shielding (yes/no)	Regulated Outputs (yes/no)	Applications
AAK Corp.	D•2052	up to 5	1, 2, 3	1, 2, 3	5-28	5, ±15		500		Both	
ACON	D•2058	2-200	1, 2, 3, 5	9-75	3.3, ±15	to 1.5A	500	up to 38		Yes	
Advanced Analog	D•2067	√	√	√	√	√	√		Yes		Military, aerospace, radiation environments, 'S'-level
Apex Microtechnology	D•2068	6W, 22.5W	1, 2	11-50; 14-50	3-30; 5-30	.2-4	500	20W/in^3; 17 w/1i^3	Yes	Yes	
Applied Power Conversion	D•2056	50-4500W	7	12V-500V	5V-150	1A-160A			Yes	Yes	Data processing, communications, telecommunications
Astec Standard Power	D•2071	5-40W	1, 2, 3	4-72	5, ±15	to 1.5A	500			Yes	
Bel-Fuse Inc.	D•2074	750 mW	1, 2	5-48	±5, ±15	75mA	500			Yes	
Burr-Brown Power Convertibles	D•2077	up to 300W	1, 2, 3	5-48	±5, ±15		1000		Yes	Yes	
Calex Manufacturing Co. Inc.	D•2083	1.8-100	3	4.75-72	3.3-30	60mA-10 Amps	700	up to 25W/In^3	Yes	Yes	Telecommunications systems, process control, medical equipment
Computer Products	D•2090	1W-360W	4 24, 48, 300	5, 12, 15, 12, 15, 24, 48	1.2, 3.3, 5,	up to 40A	3000VAC 36W/in^3	up to	Yes	Yes	Distributed power, telecom, datacom, industrial, instrumentation, aerosapce, computers
Conversion Devices	D•2096	up to 60W	1, 2, 3	.5-48	±5, ±15		500	up to 10		Yes	
Cosel/USA, Inc.	D•2098	750mW	1, 2	4.5-63	5, ±15	350mA					
Custom Power Systems	D•2082		1, 2				500			Yes	
Datel	D•2099	30	1,2,3	4.6V-72V	5, 12, 15, ±5, ±12, ±15	1000mA-6000mA	500	12	Yes	Yes	Telecom, instrumentation, computers, power distribution systems
		20	1,2,3	4.6V-72V	2.1V, 3.3V, 5, 12, 15, ±5, ±12, ±15	800mA-10000mA	500	12	Yes	Yes	Telecom, instrumentation, computers, power distribution systems
		15	1,2,3	4.6V-72V	3.3V, 5, 12, 15, ±5, ±12, ±15	500mA-5000mA	500	10	Yes	Yes	Telecom, instrumentation, computers, power distribution systems
		10	1,2,3	4.7V-72V	5, 12, 15, ±5, ±12, ±15	330mA-2000mA	500	13.3	Yes	Yes	Telecom, instrumentation, computers, power distribution systems
		5	1,2,3	4.6V-72V	5, 12, 15, ±5, ±12, ±15	1000mA-200mA	500	10	Yes	Yes	Telecom, instrumentation, computers, power distribution systems
		3	1,2,3	4.5V-72V	5, 12, 15, ±5, ±12, ±15	200mA-250mA	1000	7	No	Yes	Telecom, instrumentation, computers, power distribution systems
Electronic Measurements	D•2104	up to 200	1, 2, 3	12-300	5, 12, 15, 24		500	up to 29			
Endicott Research Group	D•2106	up to 25	1, 2	5-15	5-500		600			Yes	
Fee-Fil-Mag	D•2109	8W	1, 2	5-12	–9					Yes	

DC-DC CONVERTERS (cont'd)

Manufacturer	Starting EEM Page No.	Output Wattage Range, W	Number of Outputs (max.)	Input Voltage Range, V	Output Voltage Range, V	Output Current Range, I	Isolation Voltage (Vdc min.)	Power Density (W/IN^3)	EMI/RFI Shielding (yes/no)	Regulated Outputs (yes/no)	Applications
International Power Sources	D•2110	1-240W	3	5-400V	5-15V	30mA-25A	500VDC	22W/in^3	Yes	Yes	Telecom, process control, computer, EDP, instrumentation, portable systems
Interpoint Corp.	D•2112	285W	4	16-40	4.95-28.00	48 Amps	500VDC	70W/in^3	Yes	Yes	Military/aerospace, hi-rel industrial, medcal electronics
Intronics	D•2124	up to 100	1, 2	4.5-72	5, ±15	up to 1.5A	500			Yes	
JBM Electronics	D•2127	5	1, 2		5, –12	5, 9	300mA				
Kappa Technologies	D•2128	5	1, 2	5-12	5-15					Yes	
Logitek Inc.	D•2130	300	1, 2, 3	AC DC			1000	up to 16	Yes		Military/Aerospace
Melcher, Inc.	D•2131	50	1, 2, 3	8-220	5-48	up to 8A	4000		Yes	Yes	
Modular Devices	D•2136	up to 120	1, 2, 3, 10	12-270	2-3000						Military/Aerospace
Pico Electronics	D•2137	up to 100	1, 2, 3	5-380	5-250	200mA			Yes	Yes	
Polytron Devices	D•2292	1W-100W	4	4.5-80Vdc	5Vdc-125Vdc	50mA-12A	500Vdc-3000Vdc	30W/in^3	Yes	Yes	
Powercube/ Unitrode	D•2186	up to 300W	3	48V, 300V, 150V, 24	2.6V-48VDC	up to 60 Amps	42-42VDC	up to 82W/In^3	5 sided	Yes	Computer, machine tool control, distributed power, (N+1) redundancy, telecommunication, mobile radio base stations/small telephone switches
Raytheon/MSD	D•2199	5	1, 2	5-48						Yes	
Ro Associates, Inc.	D•2202	up to 250	1, 2, 3	up to 300			500			Yes	
Semiconductor Circuits, Inc.	D•2207	1-40	3	5-72	5-48	65mA-8A	500	10-12W	Yes	Yes	Telecommunications, process control, geo survey, mini computers, test equipment
Shindengen America.	D•2210	<1W-150W	3	5V-60V	2V-24V	0.1A-30.0A	500V	25W/in^3	Yes	Yes	Telecom, industrial, cellular, satellite, communications
Tri-Mag Inc.	D•2212	50	6	5VDC-72VDC	3.3VDC-350VDC	15 Amp	500VDC & 2500VDC	6W/In^3	Yes	Yes	Telecommunications, industrial and test, battery-powered, medical, computer and peripheral, distributed power systems, local area network, vacuum fluorescent display
Valor Electronics	D•2215	2W	1	5 or 12	9 or 12	to 250mADC	500 or 2000		No	Both	10BASE2/5 adapter cards, flash memory
Voltex Co.	D•2217	up to 200	1-4							Yes	
Wilmore Electronics	D•2218	2-4000W	1-4	12-250V	5-130V	up to 160A	≥1500V	to 3.0W/in^3	Yes	Yes	Telecommuncations, SCADA systems, mobile communications, cellular communcation sites (powering communications and electronic equipment on locomotives and light-rail vehicles), and other similar applications

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

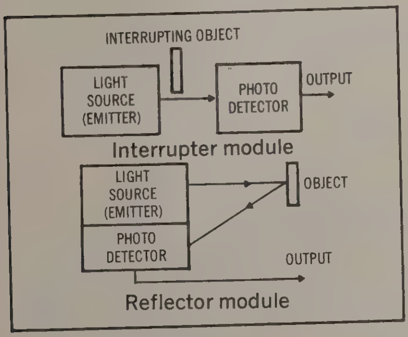
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

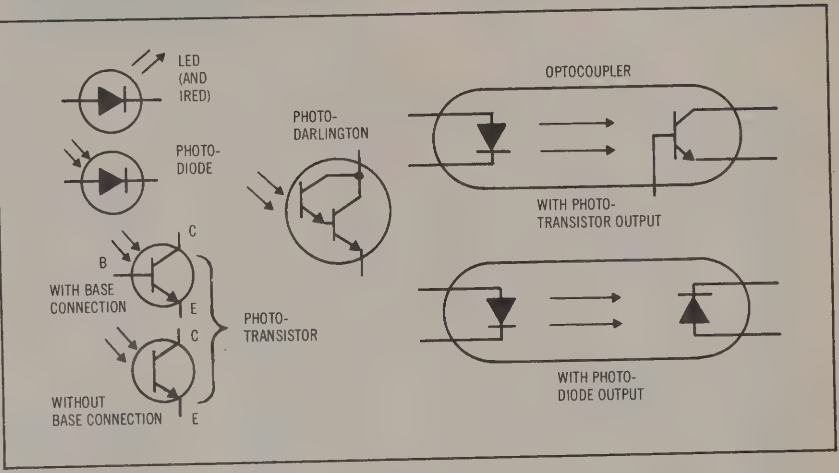
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

AAK CORPORATION

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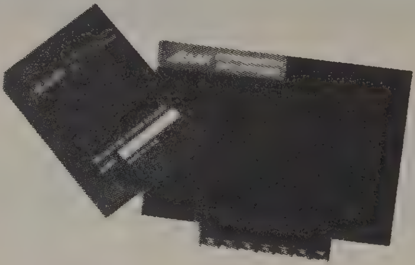
uP MULTI-OUTPUT POWER SUPPLIES

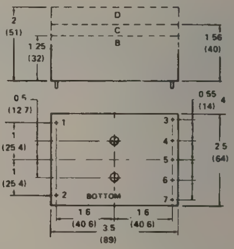
New higher power triple MT series and T series are perfect for uP's process controllers, shift registers, RAM and ROM arrays. The common outputs are floating when complete isolation is required. Both plug-in for PC Board applications and chassis mounts on 7 terminal pin modules are available.

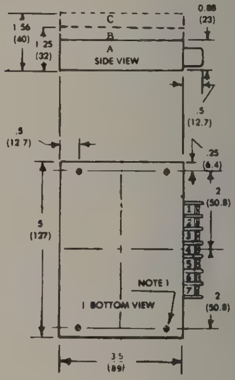


OUTPUT VOLT/CURR (Vdc) (mA) Single	 VOLT/CURR (Vdc) (mA) Dual	REGULATION Line/Load % Single	 Line/Load % Dual	PARD mV rms	CASE	MODEL SERIES	PRICING 1-9	 10-Up
TRIPLE OUTPUT (T) SERIES								
5/500	±12/100	0.1/0.1	.05/.05	1	1B	T12.1-.5	$107.00	$ 96.00
5/1000	±12/250	0.1/0.1	.05/.05	1	1C	T12.25-1	117.00	105.00
5/1500	±12/350	0.1/0.1	.05/.05	1	1D	T12.35-1.5	127.00	114.00
5/2000	±12/450	0.1/0.2	.05/.1	1.5	1D	T12.45-2	137.00	123.00
5/500	±15/100	0.1/0.1	.05/.05	1	1B	T15.1-.5	107.00	96.00
5/1000	±15/200	0.1/0.1	.05/.05	1	1C	T15.2-1	117.00	105.00
5/1500	±15/300	0.1/0.1	.05/.05	1	1D	T15.3-1.5	127.00	114.00
5/2000	±15/400	0.1/0.2	.05/.1	1.5	1D	T15.4-2	137.00	123.00
TRIPLE OUTPUT (MT) SERIES								
5/500	±12/100	0.1/0.1	0.5/0.5	1	2A	MT12.1-5	99.00	89.00
5/1000	±12/250	0.1/0.1	.05/.05	1	2B	MT12.25-1	109.00	98.00
5/1500	±12/350	0.1/0.1	.05/.05	1	2C	MT12.35-1.5	119.00	107.00
5/2000	±12/450	0.1/0.2	.05/.1	1.5	2C	MT12.45-2	129.00	116.00
5/2500	±12/500	0.1/0.2	.05/.1	1.5	2D	MT12.5-2.5	139.00	125.00
5/3000	±12/550	0.1/0.2	.05/.15	1.5	2D	MT12.55-3	149.00	134.00
5/3500	±12/600	0.1/0.2	.05/.2	1.5	2D	MT12.6-3.5	159.00	143.00
5/4000	±12/650	0.1/0.25	.05/.25	1.5	2D	MT12.65-4	169.00	152.00
5/500	±15/100	0.1/0.1	.05/.05	1	2A	MT15.1-.5	99.00	89.00
5/1000	±15/200	0.1/0.1	.05/.05	1	2B	MT15.2-1	109.00	98.00
5/1500	±15/300	0.1/0.1	.05/.05	1	2C	MT15.3-1.5	119.00	107.00
5/2000	±15/400	0.1/0.2	.05/.1	1.5	2C	MT15.4-2	129.00	116.00
5/2500	±15/450	0.1/0.2	.05/.1	1.5	2D	MT15.45-2.5	139.00	125.00
5/3000	±15/500	0.1/0.2	.05/.15	1.5	2D	MT15.5-3	149.00	134.00
5/3500	±15/550	0.1/0.2	.05/.2	1.5	2D	MT15.55-3.5	159.00	143.00
5/4000	±15/600	0.1/0.25	.05/.25	1.5	2D	MT15.6-4	169.00	152.00

Four mount inserts 4.40×0.1 (2.5) dp. min. Seven pins, 0.040 (1.0) dia.×0.2 (5.1) lg. min. 5V Common A isolated from ±V Common B.

All Dimensions are in inches and (mm).





GENERAL SPECIFICATIONS	
Input Voltage	105 to 132 VAC @47-420Hz
Output Voltage Accuracy	1% Fixed
Operating Temp.	−25°C to 71°C
Temp. Coefficient	0.015% per °C
Storage Temp.	−55°C to 85°C
Input Isolation	50 Megohms

100% current fold-back on all 1 amp or greater single output models current limiting on all dual output models from ±V to common.

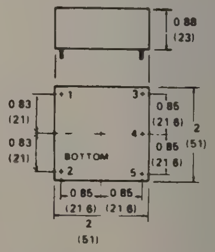
MINIATURIZED PC MOUNT POWER SUPPLIES

The mini-sized modules conserve PC board space with a small 2″×2″ area. Pins may be inserted from the side to obtain a smaller 2″×.88″ PC board area at no extra charge. M series are priced below all competitors with equivalent specifications.'

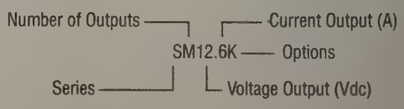
AAK CORPORATION
DC/DC CONVERTER

OUTPUT VOLTAGE Vdc	 CURRENT mA	REGULATION LINE %	 LOAD %	PARD mV rms	CASE	MODEL SERIES	PRICING 1-9	 10-Up
MICRO (M) SERIES Single Output								
5	200	0.2	0.3	2	7	MM5.2	$35.00	$32.00
6	150	0.2	0.3	2	7	MM6.15	38.00	34.00
12	120	0.2	0.3	2	7	MM12.12	38.00	34.00
15	100	0.15	0.2	2	7	MM15.1	38.00	34.00
24	30	0.1	0.15	2	7	MM24.03	38.00	34.00
30	30	0.1	0.15	2	7	MM30.03	38.00	34.00
Dual Output								
±5	50	0.2	.25	2	7	MD5.05	39.00	35.00
±6	50	0.2	.25	2	7	MD6.05	39.00	35.00
±12	30	0.1	.15	2	7	MD12.03	37.00	33.00
±12	50	0.1	.20	2	7	MD12.05	39.00	35.00
±15	30	0.1	.15	2	7	MD15.03	37.00	33.00
±15	50	0.1	.20	2	7	MD15.05	39.00	35.00

For Chassis Mount version of M Series add C before M and add $3.50 to unit price.



SAMPLE MODEL NO.



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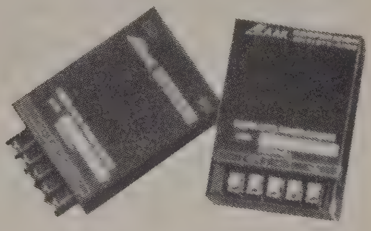
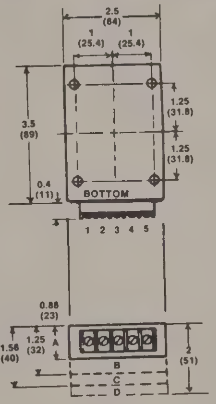
CHASSIS MOUNT POWER SUPPLIES

OUTPUT		REGULATION		PARD mV rms	CASE	MODEL SERIES	PRICING	
VOLTAGE Vdc	CURRENT (mA)	LINE %	LOAD %				1-9	10-Up
CHASSIS MOUNTING BUDGET-PRICED (B) SERIES **Single Output**								
5 to 6	500	.1	.2	2	4A	CBM(5 tc 6).5	$ 45.70	$ 39.40
	1000	.1	.2	2	4B	CBM(5 to 6)1	55.60	49.30
Dual Output								
±12 to ±15	±100	.1	.1	1	4A	CBD(12 to 15).1	49.10	45.70
	±200	.1	.1	1	4B	CBD(12 to 15).2	59.00	54.50
CHASSIS MOUNTING STANDARD (C) SERIES **Single Output**								
2 to 4	500	.05	.05	1	4A	CM(2 to 4).5	52.00	47.00
	1000	.05	.1	1	4B	CM(2 to 4)1	66.00	59.00
	2000	.1	.2	1.5	4C	CM(2 to 4)2	92.00	83.00
5 to 6	300	.05	.05	1	4A	CM(5 to 6).3	42.00	38.00
	500	.05	.1	1	4A	CM(5 to 6).5	52.00	47.00
	1000	.05	.1	1	4B	CM(5 to 6)1	66.00	59.00
	2000	.08	.15	2	4C	CM(5 to 6)2	92.00	83.00
	3000	.1	.2	2.5	4D	CM(5 to 6)3	116.00	104.00
	4000	.15	.25	2.5	4E	CM(5 to 6)4	138.00	124.00
7 to 11	200	.05	.05	1	4A	CM(7 to 11).2	53.00	48.00
	400	.05	.05	1	4A	CM(7 to 11).4	66.00	59.00
	800	.05	.1	1	4B	CM(7 to 11).8	78.00	70.00
	1500	.05	.15	1.5	4C	CM(7 to 11)1.5	88.00	79.00
	2500	.1	.2	2	4D	CM(7 to 11)2.5	106.00	95.00
12 to 14	200	.05	.05	1	4A	CM(12 to 14).2	54.00	49.00
	600	.05	.1	1	4B	CM(12 to 14).6	73.00	66.00
	1000	.05	.1	1	4C	CM(12 to14)1	85.00	77.00
	2000	.08	.15	2	4D	CM(12 to 14)2	95.00	86.00
15 to 17	200	.05	.05	1	4A	CM(15 to 17).2	68.00	61.00
	600	.05	.05	1	4C	CM(15 to 17).6	80.00	72.00
	1000	.05	.1	1	4D	CM(15 to 17)1	90.00	81.00
	2000	.08	.15	2	4D	CM(15 to 17)2	105.00	95.00
18 to 23	200	.05	.08	1	4A	CM(18 to 23).2	69.00	62.00
	600	.05	.08	1	4C	CM(18 to 23).6	81.00	73.00
	1000	.05	.1	1	4D	CM(18 to 23)1	91.00	82.00
24 to 29	100	.05	.08	1	4A	CM(24 to 29).1	52.00	47.00
	200	.05	.08	1	4C	CM(24 to 29).2	70.00	63.00
	800	.05	.08	1	4D	CM(24 to 29).8	82.00	74.00
30 to 35	100	.05	.08	1	4A	CM(30 to 35).1	53.00	48.00
	400	.05	.08	1	4C	CM(30 to 35).4	71.00	64.00
	800	.05	.08	1	4D	CM(30 to 35).8	83.00	75.00
36 to 41	100	.05	.08	1	4A	CM(36 to 41).1	54.00	49.00
	400	.05	.08	1	4C	CM(36 to 41).4	72.00	65.00
	800	.05	.08	1	4D	CM(36 to 41).8	84.00	76.00
42 to 48	100	.05	.08	1	4A	CM(42 to 48).1	55.00	50.00
	200	.05	.08	1	4B	CM(42 to 48).2	60.00	54.00
	600	.05	.08	1	4D	CM(42 to 48).6	79.00	71.00
Dual Output								
±5 to ±10	60	.02	.02	1	4A	CD(5 to 10).06	51.00	46.00
	200	.02	.02	1	4B	CD(5 to 10).2	71.00	64.00
	600	.05	.05	1	4C	CD(5 to 10).6	108.00	97.00
	1000	.05	.1	1	4D	CD(5 to 10)1	131.00	118.00
±11 to ±18	60	.02	.02	1	4A	CD(11 to 18).06	62.00	56.00
	200	.05	.05	1	4B	CD(11 to 18).2	80.00	72.00
	500	.05	.1	1	4D	CD(11 to 18).5	109.00	98.00
	800	.05	.15	1.5	4D	CD(11 to 18).8	124.00	112.00
±19 to±24	60	.02	.02	1	4A	CD(10 to 24).06	62.00	56.00
	200	.05	.05	1	4B	CD(19 to 24).2	81.00	73.00
	400	.05	.05	1	4D	CD(19 to 24).4	102.00	92.00
	600	.05	.1	1.5	4D	CD(19 to 24).6	116.00	104.00

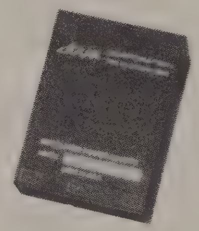
NOTE: Insert the exact voltage required in place of the bracketed voltage ranges in MODEL SERIES column.
For top mounted barrier strip, add suffix—T.
For ±1 Volt Variable, add suffix—V.

The Chassis (C) series uses a low profile front mounted or Top (T suffix) mounted, 5-terminal barrier strip.



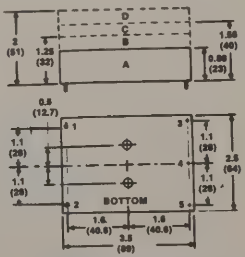


PC BOARD MOUNT POWER SUPPLIES



NOTE: PC Board Mount (S) series identical to Chassis Mount (C) series. To order replace C with S and subtract with $2.00 from C series pricing.

ACOPIAN, COMPUTER PRODUCTS, DATEL, MIL, LAMBDA, WALL, etc. configurations and mounting available at lower pricing.



GENERAL SPECIFICATIONS	
Input Voltage	105 to 132 VAC @ 47-420Hz
Output Voltage Accuracy	1% Fixed
Operating Temp.	−25°C to 71°C
Temp. Coefficient	0.015% per °C
Storage Temp.	−55°C to 85°C
Input Isolation	50 Megohms

100% current fold-back on all 1 amp or greater single output models current limiting on all dual output models from ±V to common.

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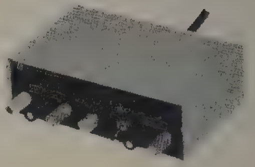
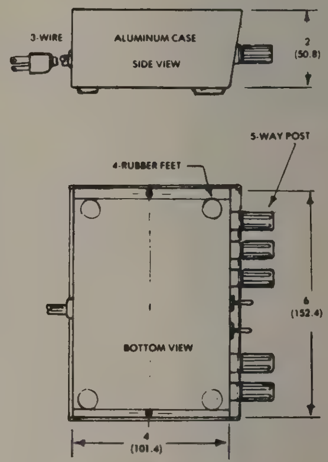
The L-Line of field proven rugged encapsulated Lab units still remain the lowest priced of any competitive line.

LABORATORY POWER SUPPLIES

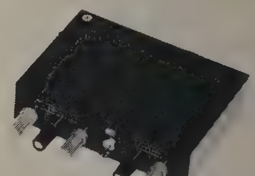
OUTPUT VOLT/CURR (Vdc) (mA) Single	 VOLT/CURR (Vdc) (mA) Dual	REGULATION Line/Load % Single	 Line/Load % Dual	PARD mV rms	CASE TYPE	MODEL SERIES NO.	PRICING 1-9
TRIPLE OUTPUT (ALT) SERIES							
5/2000	±12/450	0.1/0.2	.05/0.1	1	AL	ALT12.45-2	$139.00
5/2500	±12/500	0.1/0.2	.05/0.1	1.5	AL	ALT12.5-2.5	149.00
5/3000	±12/550	0.1/0.2	.05/.15	1.5	AL	ALT12.55-3	155.00
5/3500	±12/600	0.1/0.2	.05/0.2	1.5	AL	ALT12.6-3.5	161.00
5/4000	±12/650	0.1/.25	.05/.25	1.5	AL	ALT12.65-4	166.00
5/4500	±12/700	0.1/.25	.05/.25	1.5	AL	ALT12.7-4.5	171.00
5/5000	±12/750	0.1/.25	.05/.25	1.5	AL	ALT12.75-5	176.00
5/2000	±15/400	0.1/0.2	.05/0.1	1.5	AL	ALT15.4-2	139.00
5/2500	±15/450	0.1/0.2	.05/0.1	1.5	AL	ALT15.45-2.5	149.00
5/3000	±15/500	0.1/0.2	.05/.15	1.5	AL	ALT15.5-3	156.00
5/3500	±15/550	0.1/0.2	.05/0.2	1.5	AL	ALT15.55-3.5	161.00
5/4000	±15/600	0.1/.25	.05/.25	1.5	AL	ALT15.6-4	166.00
2-WAY DUAL							
5 ±12/15	1000 ±200	0.01	0.05	1	AL	ALT12/15-1	129.00
5 ±12/15	2000 ±360	0.01	0.05	1	AL	ALT12/15-2	135.00
New ±12/15 volt models include Toggle Control ±12V to ±15V, 1% fixed.							
TRIPLE OUTPUT (LT) SERIES FIXED 1%							
5/1000	±12/250	0.5/0.1	.05/0.1	1	5B	LT12.25-1	109.00
5/1500	±12/300	.05/.15	.05/0.1	1	5C	LT12.3-1.5	119.00
5/2000	±12/350	0.1/0.2	.05/0.1	1	5C	LT12.35-2	129.00
5/2500	±12/400	0.1/0.2	.05/0.1	1.5	5D	LT12.4-2.5	139.00
5/3000	±12/450	0.1/0.2	.05/.15	1.5	5D	LT12.45-3	149.00
5/3500	±12/500	0.1/0.2	.05/0.2	1.5	5D	LT12.5-3.5	159.00
5/1000	±15/200	.05/0.1	.05/0.1	1	5B	LT15.2-1	109.00
5/1500	±15/250	.05/0.1	.05/0.1	1	5C	LT15.25-1.5	119.00
5/2000	±15/300	0.1/.15	.05/0.1	1	5C	LT15.3-2	129.00
5/2500	±15/350	0.1/0.2	.05/0.1	1.5	5D	LT15.35-2.5	139.00
5/3000	±15/400	0.1/0.2	.05/.15	1.5	5D	LT15.4-3	149.00
5/3500	±15/450	0.1/0.2	.05/0.2	1.5	5D	LT15.45-3.5	159.00

All LT MODELS include: 3 wire 6 ft. AC lind cord, LED indicator lamp



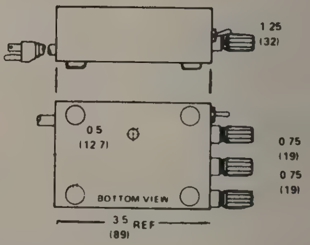


CASE AL



OUTPUT VOLTAGE (Vdc)	 CURRENT (mA)	REGULATION LINE %	 LOAD %	PARD mV rms	CASE	MODEL SERIES	PRICING 1-9	 10-Up
SINGLE OUTPUT (LM) SERIES FIXED 1%								
2 to 4	500	.05	.05	1	6B	LM(2 to 4).5	$ 69.00	$ 62.00
	1000	.05	.1	1	6B	LM(2 to 4)1	79.00	71.00
	2000	.1	.2	2	6C	LM(2 to 4)2	89.00	80.00
5 to 16	1000	.05	.1	1	6B	LM(5 to 16)1	85.00	77.00
	1500	.05	.1	1	6B	LM(5 to 16)1.5	89.00	80.00
	2000	.08	.15	2	6C	LM(5 to 16)2	96.00	86.00
	2500	.1	.2	2	6D	LM(5 to 16)2.5	102.00	92.00
	3000	.1	.2	2.5	6D	LM(5 to 16)3	115.00	104.00
17 to 28	600	.05	.1	1	6B	LM(17 to 28).6	79.00	71.00
	800	.05	.1	1	6C	LM(17 to 28).8	89.00	80.00
	1000	.05	.1	1	6C	LM(17 to 28)1	96.00	86.00
	1500	.05	.1	1.5	6D	LM(17 to 28)1.5	102.00	92.00
	2000	.08	.15	2	6D	LM(17 to 28)2	115.00	109.00
Dual Output (LD) Series								
±5 to ±11	400	.05	.05	1	6C	LD(5 to11).4	79.00	71.00
	600	.05	.05	1	6C	LD(5 to 11).6	89.00	80.00
	800	.05	.05	1.5	6D	LD(5 to 11).8	96.00	86.00
	1000	.05	.1	2	6D	LD(5 to 11)1	102.00	92.00
±12 to ±18	100	.02	.02	1	6B	LD(12 to 18).1	79.00	71.00
	200	.05	.05	1	6B	LD(12 to 18).2	89.00	80.00
	300	.05	.05	1	6C	LD(12 to 18).3	99.00	89.00
	400	.05	.05	1	6C	LD(12 to 18).4	105.00	95.00
	600	.05	.1	1	6D	LD(12 to 18).6	112.00	101.00
	800	.05	.15	1.5	6D	LD(12 to 18).8	120.00	108.00
	1000	.05	.2	2	6D	LD(12 to 18)1	129.00	116.00
±19 to ±30	100	.0	.02	1	6C	LD(19 to 30).1	79.00	71.00
	200	.05	.05	1	6C	LD(19 to 30).2	89.00	80.00
	400	.05	.05	1	6D	LD(19 to 30).4	99.00	89.00
	500	.05	.05	1	6D	LD(19 to 30).5	109.00	98.00

Case 5 Height in inches: B = 1.25. C = 1.50. D = 2.00



CASE 6
L Series

CONNECTING INSTRUCTIONS TERMINALS	 SINGLE OUTPUTS	 DUAL OUTPUTS
Red Term.	+5Vdc out	+Vdc out
Black Term.	Common Out	Common Out
Purple Term.	Not included	−Vdc Out

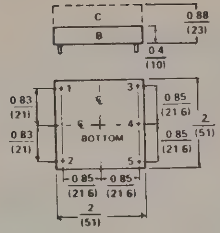
Earth Ground Connected to Threaded Insert on L Series.

AAK CORPORATION

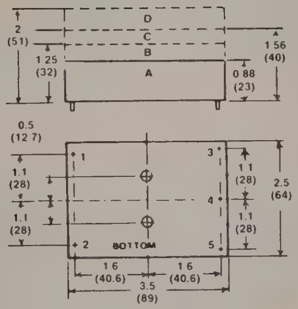
747 RIVER STREET, HAVERHILL, MA 01832 • 508-373-3769 • FAX 508-373-8881
73 NEWTON ROAD, PLAISTOW, NH 03865 • 603-382-2222 • FAX 603-382-6666

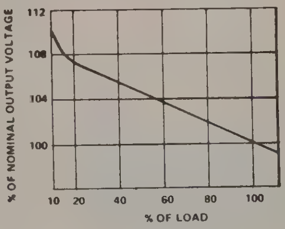
DC/DC CONVERTERS U SERIES, UNREGULATED

The U Series mini-high powered single and dual output DC/DC converters deliver unregulated outputs. Efficiency up to 85% is achieved and all outputs are short circuit protected.



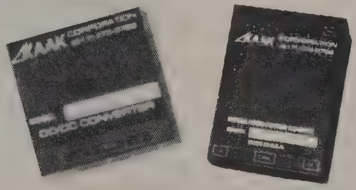
INPUT VOLT 10%	OUTPUT VOLT (Vdc)	CURR. (mA)	CASE	MODEL	PRICING 1-9	10-Up
SINGLE OUTPUT (U) UNREGULATED 5Vdc input reduce all output currents by 20%						
5 to 28	5	500	8C	U*S5.5	$ 69.00	$ 62.00
		1000	9A	U*S51	84.00	76.00
		1500	9A	U*S51.5	98.00	88.00
	12	300	8B	U*S12.3	69.00	62.00
		800	8C	U*S12.8	99.00	89.00
	15	250	8B	U*S15.25	69.00	62.00
		750	8C	U*S15.75	100.00	90.00
	24	200	8B	U*S24.2	69.00	62.00
		600	8C	U*S24.6	101.00	91.00
	28	100	8B	U*S28.1	69.00	62.00
		400	9A	U*S28.4	102.00	92.00
DUAL OUTPUT						
6 to 28	±5	450	8C	U*D5.45	79.00	71.00
		1000	9B	U*D51	119.00	107.00
	±12	350	8C	U*D12.35	79.00	71.00
		900	9B	U*D12.9	119.00	107.00
	±15	300	8C	U*D15.3	79.00	71.00
		800	9B	U*D15.8	119.00	107.00
TRIPLE OUTPUT						
6 to 28	VOLT/CURR	VOLT/CURR				
	5/500	±12/125	9C	U*T12.12-.5	125.00	113.00
	5/1000	±12/250	9D	U*T12.25-1	125.00	139.00





R, SERIES, REGULATED

The R Series high regulation, low noise DC/DC converters feature 65-75% efficiency, Pi-input filter to reduce input reflected ripple.



SINGLE OUTPUT (R) REGULATED
5Vdc input reduce all output currents by 20%

5V to 28	5	250	8B	R*S5.25	$ 79.00	$ 71.00
		500	8C	R*S5.5	89.00	80.00
		1000	9A	R*S51	109.00	98.00
	12	300	8B	R*S12.3	79.00	71.00
		800	9A	R*S12.8	109.00	98.00
	15	250	8B	R*S15.25	79.00	71.00
		750	9A	R*S15.75	109.00	98.00
	24	200	8B	R*S24.2	79.00	71.00
		600	9A	R*S24.6	109.00	98.00
	28	100	8B	R*S28.1	79.00	71.00
		400	9A	R*S28.4	109.00	101.00
DUAL OUTPUT						
6 to 28	±5	250	8C	R*D5.25	79.00	71.00
		750	9A	R*D5.75	99.00	89.00
	±12	150	8B	R*D12.15	89.00	80.00
		500	9A	R*D12.5	125.00	113.00
	±15	125	8B	R*D15.12	89.00	80.00
		450	9A	R*D15.45	125.00	113.00
TRIPLE OUTPUT						
6 to 28	VOLT/CURR	VOLT/CURR				
	5/300	±12/100	9B	R*T12.1-.3	139.00	125.00
	5/500	±12/200	9C	R*T12.2-.5	149.00	125.00

*Insert Input Voltage from 5 Vdc to 28 Vdc
For Chassis Mount version of R Series add C before R and add $3.50 to unit price.

U SERIES SPECIFICATIONS

PARAMETERS	LIMIT
Input Voltage Tolerance	±10%
Output Ripple and Noise (PARD)	28mV rms
Line Regulation	1% Vin
Load Regualtion	See Load Curve
Input Reflected Ripple	1% Ein (max)
Output Voltage Tolerance	±4%
In/Output Isolation	10 meg Ω
Temp. Coefficient	0.5%/°C
Short Circuit Prot.	Curr. Limit
Input Operating	4.75-5.25V
Voltage Range	10.8-13.2V
Operating Temp. Range	−25°C - +71°C
Storage Temp. Range	−55°C - +85°C
Efficiency	80-85%

R SERIES SPECIFICATIONS

PARAMETERS	LIMIT
Input Voltage Tolerance	±10%
Output Ripple and Noise (PARD)	1mV rms
Line Regulation	.05% Vin
Load Regualtion	.1%
Input Reflected Ripple	1% Ein (max)
Output Voltage Tolerance	±1% (fixed)
In/Output Isolation	400 VDC
Temp. Coefficient	0.02%/°C
Short Circuit Prot.	All Units
Input Operating	4.5-5.5
Voltage Range	10.8-13.2
Operating Temp. Range	−25°C - +71°C
Storage Temp. Range	−55°C - +85°C
Efficiency	65-75%

COMPACT 150-500 WATT SINGLE/MULTIPLE OUTPUT DC-DC CONVERTER

TBDC SERIES

TECHNOLOGY DYNAMICS INC
BERGENFIELD,NJ USA
V1
V4
V3
V2

Features/Options

- Rugged design in 5.5 x 3 x 10 package
- Available with several options
- Can be made for military environment

Table (1) TBDCS: Single Output

OUTPUT	MAX LOAD	MODEL NO.
5	50	TBDCS 5-50
12	40	TBDCS 12-40
24	20	TBDCS 24-20
28	15	TBDCS 28-15
48	10	TBDCS 48-10

Series: Multiple Output

Use Model TBDCM for Multiple Output.
Select first, second, third or fourth output from the tables below.
Second and third output must be equal in voltage and share common ground.
Output four is floating.

Example: P/N TBDCM 5-50 A2B2C1-Suffix
+5V 50A, -12V3A, +12V 4A, +5V 2A

INPUT VOLTAGE		
INPUT	RANGE	PREFIX CODE
28V	22-32V	P
48	42-56V	Q
OTHER	CONSULT FACTORY	X

Table (2)

OUTPUT #1 (V1)		
VDC	MAX AMP	MODEL
5	50	TBDCM-5-50
12	40	TBDCM-12-40
24	20	TBDCM-24-20
28	15	TBDCM-28-15
48	10	TBDCM-48-15

Table (3)

OUTPUT #2 (V2)	CODE
VDC @ MAX AMP	
-5V @ 3A	A1
-12V @ 3A	A2
-15V @ 3A	A3
-24V @ 2A	A4

Table (4)

OUTPUT #3 (V3)	CODE
VDC @ MAX AMP	
+5V @ 5A	B1
+12V @ 5A	B2
+15V @ 3A	B3
+24V @ 2A	B4

Table (5)

OUTPUT #4 (V4)	CODE
VDC @ MAX AMP	
5V @ 2A	C1
12V @ 2A	C2
15V @ 2A	C3
24V @ 2A	C4
48V @ 1A	C5

NOTE: Other voltages and currents available. Contact the factory. Maximum total output power cannot exceed 500 watts, maximum current per output cannot be exceeded.

Specifications

Efficiency: 75% typical
Line Regulation: ±.3%
Load Regulation: ±2%
Ripple: 1% max. peak to peak, not to exceed 100mV
Output Termination: "D" Subminiature connector

Agency Certifications

- Meets FCC Docket 20780, Class A and VDE 0871, Class A
- UL 1950, CSA 22.2-950, CSA 22.2-234 (Pending)

Options

- O Ring diode for Redundancy: Suffix-ORD

Protections

Overload and short circuit protection all outputs
Overvoltage: Recycle input to reset from latch
Fuse: 20A fuse at input
LED Indicators: Input Good
Output Good

Environmental

Operating Temperature: 0-55°C Ambient
(derate to 50% at 70°C)
Storage Temperature: -30°C to +80°C
Cooling: Internal fan

Mechanical Features

Size: 10.00" x 5.5" x 3.0"
Weight: 4.5 lbs. (2kg)

APPLIED POWER CONVERSION
DIVISION OF TECHNOLOGY DYNAMICS, INC.

APPLIED POWER CONVERSION
DIVISION OF **TECHNOLOGY DYNAMICS, INC.**
100 School Street, Bergenfield, NJ 07621 (201) 385-0500 • FAX (201) 385-0702

HIGH RELIABILITY STANDARD & CUSTOM POWER SYSTEMS

DC-DC CONVERTERS

COMMERICAL • MILITARIZED • FULL MIL
CUSTOM & STANDARD UNITS 50W TO 4500W

Slim line very compact and powerful unit intended primarily for data processing equip. All outputs are highly regulated and overload protected. The main output is O.V. protected. Operation range 0-50°C.

150W

SIZE: 9.5″ x 5.5″ x 2.2″

MODEL	INPUT	OUTPUTS
TDC150-1	−48V	5V 10A, ±12V 2.5A, ±15V 1A
TDC150-2	−48V	5V 10A, ±12V 2A, ±18V 1A
TDC150-3	+24V	5V 10A, ±12V 2.5A, ±15V 1A
TDC150-4	+24V	5V 10A, ±12V 2A, ±18V 1A

The TDI-517 is a high power DC-DC converter intended for a variety of applications where high capacity outputs are required. Options include meters, circuit breakers and LED indicators. Various input and output voltages are available.

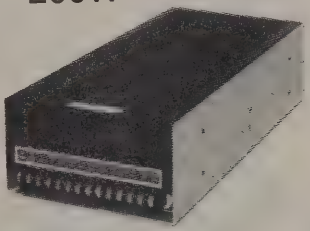
4.5KW

SIZE: 19.00" x 19.00" x 8.75"

MODEL	INPUT	OUTPUTS
TDI-517-1	400-500V	12V 375A
TDI-517-2	400-500V	24VDC 187A
TDI-517-3	400-500V	28VDC 160A

Designed as a universal DC-DC converter capable of providing up to 5 outputs and up to 200W. Specifically capable of withstanding high transients and noise at the input as present in utility stations. The unit is sold with a cover.

200W

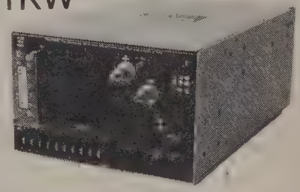


SIZE: 10.8″ x 5.5″ x 2.75″

MODEL	INPUT	OUTPUTS	
TDC200-1	12V	12V 8A	
TDC200-2	24V	5V 6A	12V 10A
TDC200-3	24V	5V 20A	
TDC200-4	24V	5V 3A, ±12V 1A, ±15V 1A	
TDC200-5	120V	5V 10A	12V 12A

High power DC/DC converter. Single and multiple outputs up to 1000 Watts. Rugged design for high shock and vibration.

1KW



SIZE: 5.00" x 8.00" x 12.50"

MODEL	INPUT	OUTPUTS	
NTDC-12-45	24V or 48V	12V	41A
NTDC-15-33	24V or 48V	15V	33A
NTDC-24-20	24V or 48V	24V	20A
NTDC-28-17	24V or 48V	28V	17A
NTDC-36-13	24V or 48V	36V	13A
NTDC-48-10	24V or 48V	48V	10A
MODEL	**INPUT**	**OUTPUTS**	
NTDC-12-83	24V or 48V	12V	83A
NTDC-15-66	24V or 48V	15V	66A
NTDC-24-42	24V or 48V	24V	42A
NTDC-28-36	24V or 48V	28V	36A
NTDC-36-27	24V or 48V	36V	27A
NTDC-48-20	24V or 48V	48V	20A

CUSTOM DESIGNS Single & multi output commercial and military ground support or vehicular applications. Battery or generator input. Designs to MIL-STD-704. Plug in units Switching frequency 25KHz or 100KHz.

PROTOTYPES IN 10 WEEKS!

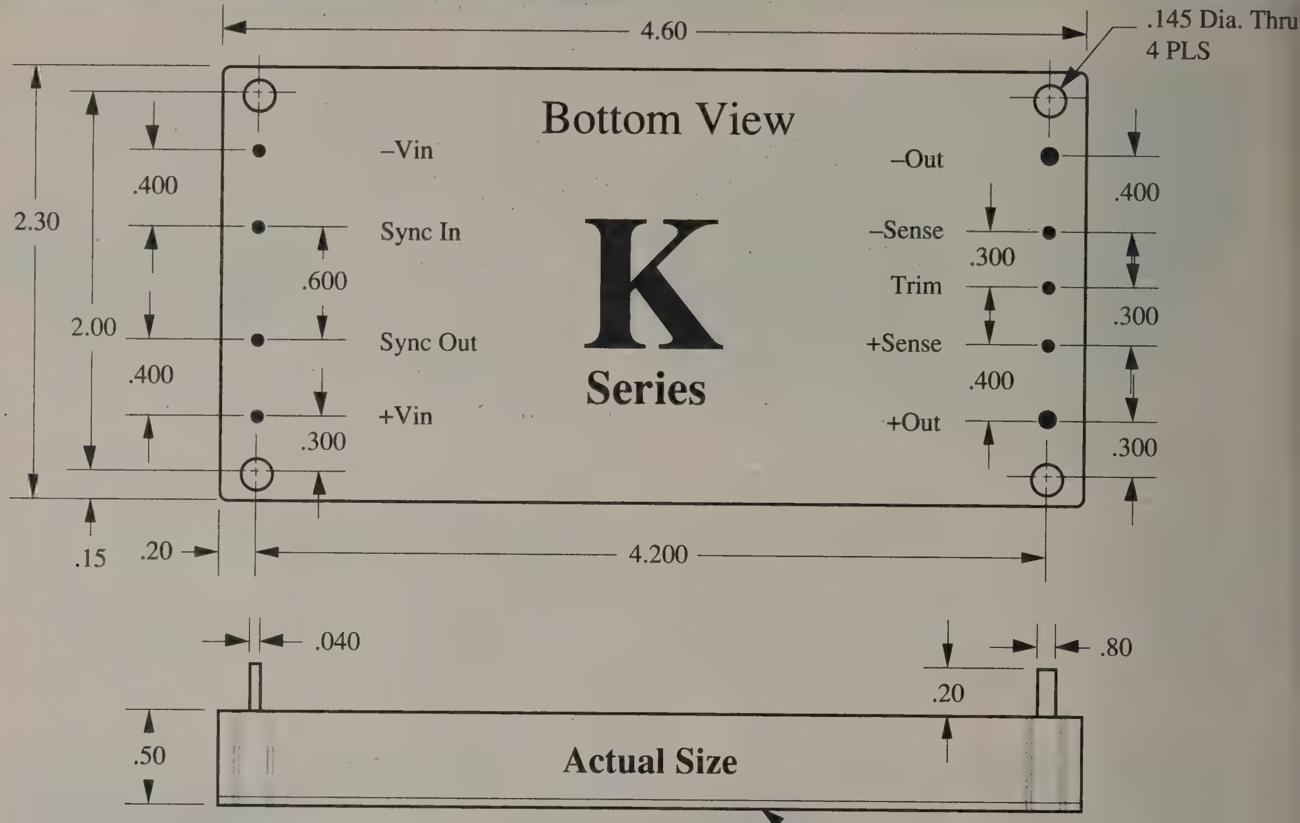
APC
APPLIED
POWER
CONVERSION
DIVISION OF
TECHNOLOGY DYNAMICS, INC.

APPLIED POWER CONVERSION
DIVISION OF **TECHNOLOGY DYNAMICS, INC.**
100 School Street, Bergenfield, NJ 07621 (201) 385-0500 • FAX (201) 385-0702

HIGH RELIABILITY STANDARD & CUSTOM POWER SYSTEMS

50-200 W Single DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


4.60
.145 Dia. Thru
4 PLS
Bottom View
K
Series
–Vin
Sync In
Sync Out
+Vin
–Out
–Sense
Trim
+Sense
+Out
2.30
2.00
.400
.600
.400
.300
.400
.300
.300
.400
.300
.15
.20
4.200
.040
.80
.20
.50
Actual Size

*** Optional :** On/Off Control & Current Sharing pins are available.

ALUMINUM HEATSINK SURFACE

Model # : **K xxx S xx xx**

- K — ACON Series #
- xxx — Output Power
  : 50, 75, 100, 150 and 200 Watts
- S — Single Output
- xx — Input Voltage
  12 : 10 - 20 Vdc
  24 : 18 - 36 Vdc
  48 : 36 - 72 Vdc
- xx — Output Voltage
  : 3.3V, 5V, 12V, 15V, 24V.

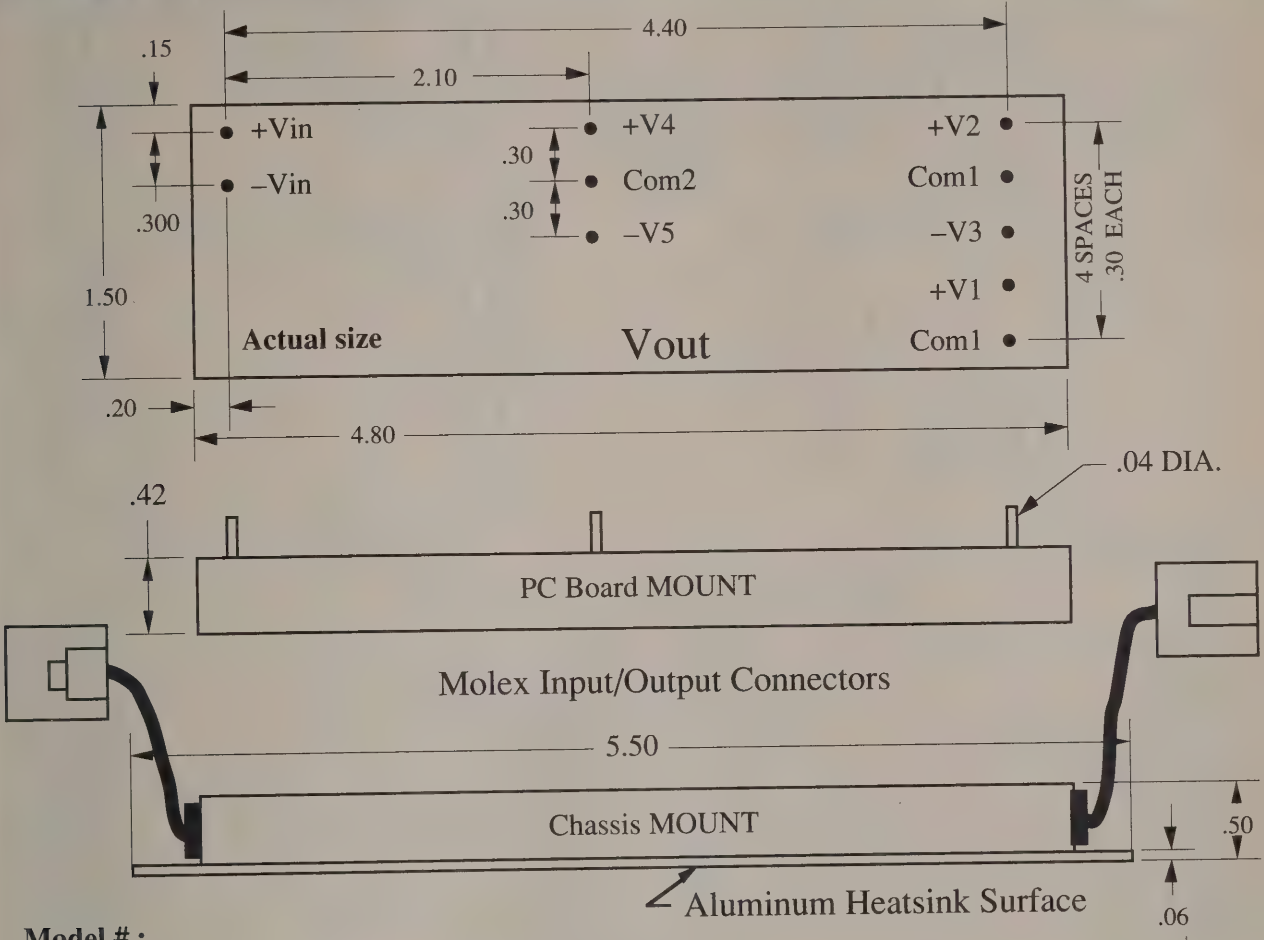
Power Density to 38 Watts/in³ . NEW!

Please call Toll Free : 1-800-336-8022

Other Input/Output Combinations are Available, Please Consult Factory.

20-50 W to 5 Outputs DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


4.40
2.10
.15
+Vin
–Vin
.300
1.50
+V4
Com2
–V5
.30
.30
+V2
Com1
–V3
+V1
Com1
4 SPACES
.30 EACH
Actual size
Vout
.20
4.80
.04 DIA.
.42
PC Board MOUNT
Molex Input/Output Connectors
5.50
Chassis MOUNT
.50
.06
Aluminum Heatsink Surface

Model # :

H xx X xx xx

- H: ACON Series #
- xx: Output Power
  : 20, 30, 40 and 50Watts
- X: # Output(s)
  S: single
  D: Dual
  T: Triple
  Q: Quad
  V: Five
- xx: Input Voltage
  12 : 09 - 18 Vdc
  24 : 18 - 36 Vdc
  48 : 36 - 72 Vdc
- xx: Output Voltage (s)
  : Any combination of voltages from 3-36Vdc. Two independent control loops can provide up to 3 regulated and 2 semi-regulated outputs.

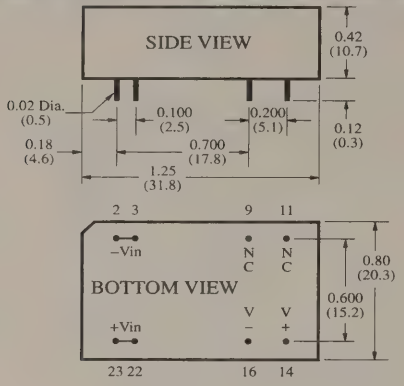
5 outputs in a Slim Package. NEW!

Please call Toll Free : 1-800-336-8022

Other Input/Output Combinations are Available, Please Consult Factory.

2 - 15 W Single, Dual & Triple DC-DC Converters

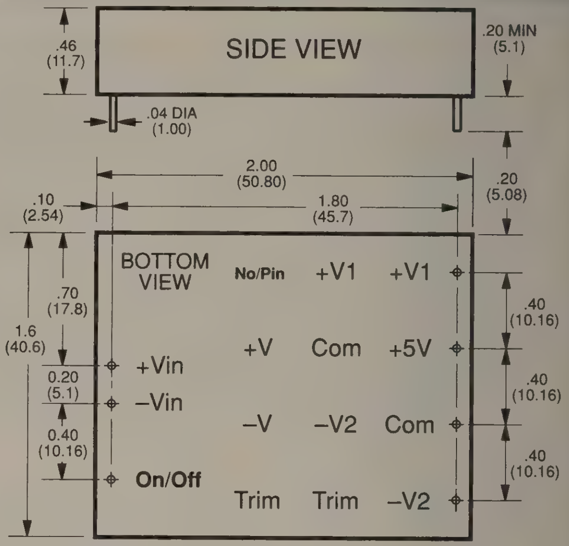
ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


SIDE VIEW
0.42
(10.7)
0.02 Dia.
(0.5)
0.100
(2.5)
0.200
(5.1)
0.12
(0.3)
0.18
(4.6)
0.700
(17.8)
1.25
(31.8)
2 3
9 11
–Vin
N C
N C
BOTTOM VIEW
0.80
(20.3)
0.600
(15.2)
V –
V +
+Vin
23 22
16 14

MODEL : CS

Actual Size

3 Watts


.46
(11.7)
SIDE VIEW
.20 MIN
(5.1)
.04 DIA
(1.00)
2.00
(50.80)
.20
(5.08)
.10
(2.54)
1.80
(45.7)
BOTTOM VIEW
No/Pin
+V1
+V1
.70
(17.8)
.40
(10.16)
1.6
(40.6)
+V
Com
+5V
+Vin
0.20
(5.1)
–Vin
.40
(10.16)
–V
–V2
Com
0.40
(10.16)
On/Off
.40
(10.16)
Trim
Trim
–V2

MODEL : ES ED ET

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

ALL DIMENSIONS IN INCHES (MM)

INPUT SPECIFICATIONS

Input Voltage Range .... See Table
Input Filter:
  Model C .... Low ESR Capacitor
  Model E .... 10–36 Vin:∏ Filter, 20–75 Vin:LC Filter
Remote On/Off Control (Model E only):
  On Control .... >5Vdc or Open Circuit
  Off Control .... <1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy .... ±1%, max.
Output Trim (Model E only) .... ±10%, max.
Line Regulation, LL–HL .... ±0.5%
Load Regulation (Dual Output with Balance Loads), NL/FL .. ±1.0%
Short Circuit Protection .... Indefinite
Transient Response .... <200µSec.
Ripple 35mVp-p
Noise, 20MHz BW .... 1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient .... ±0.02%/°C, max.
Efficiency .... C: 73%, E: 80%
Isolation Voltage, I/O .... 500Vdc, min.
Switching Frequency .... 200KHz, min.
Operating Ambient Temperature Range (Case Temp. +95° max):
  C:Thermal Resistance 20°C/Watt .... –25°C to +71°C
  E:Thermal Resistance 9°C/Watt .... –25°C to +60°C
Cooling .... Free-Air Convection
Storage Temperature Range .... –55°C to +105°C
Humidity .... 20% to 95% R.H. (non-condensing)
Weight .... C:1 oz. (28 grams),E:2 oz. (57 grams)
Case Material
  C: .... Phenolic
  E: .... Six-sided Metal
  (With Non-Conductive Seating Surface)

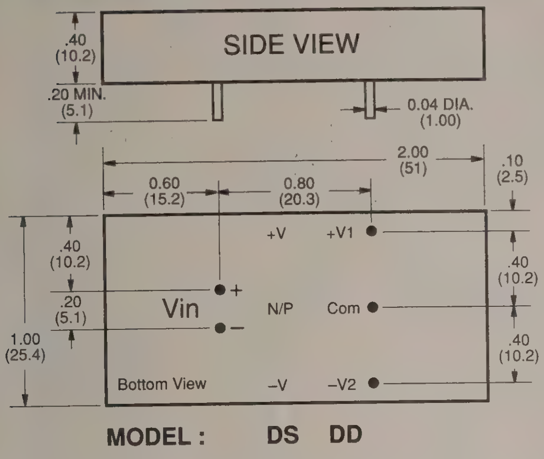
OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 36 Vdc IN	20 - 75 Vdc IN
3.3V	600mA	2	C2S1203	C2S2403	C2S4803	CW2S2403	CW2S4803
5V	600mA	3	C3S1205	C3S2405	C3S4805	CW3S2405	CW3S4805
12V	250mA	3	C3S1212	C3S2412	C3S4812	CW3S2412	CW3S4812
15V	200mA	3	C3S1215	C3S2415	C3S4815	CW3S2415	CW3S4815
24V	125mA	3	C3S1224	C3S2424	C3S4824	CW3S2424	CW3S4824
3.3V	3.0A	10	–	–	–	E10S2403	E10S4803
5V	3.0A	15	–	–	–	E15S2405	E15S4805
12V	1.25A	15	–	–	–	E15S2412	E15S4812
15V	1.00A	15	–	–	–	E15S2415	E15S4815
24V	0.63A	15	–	–	–	E15S2424	E15S4824
±5V	±1.5A	15	–	–	–	E15D2405	E15D4805
±12V	±0.63A	15	–	–	–	E15D2412	E15D4812
±15V	±0.50A	15	–	–	–	E15D2415	E15D4815
3.3, ±12V	1.5A, ±.32A	10	–	–	–	E15T2403-12	E15T4803-12
5.0, ±12V	1.5A, ±.32A	15	–	–	–	E15T2405-12	E15T4805-12
3.3, ±15V	1.5A, ±.25A	10	–	–	–	E15T2403-15	E15T4803-15
5.0, ±15V	1.5A, ±.32A	15	–	–	–	E15T2405-15	E15T4805-15

NEW!

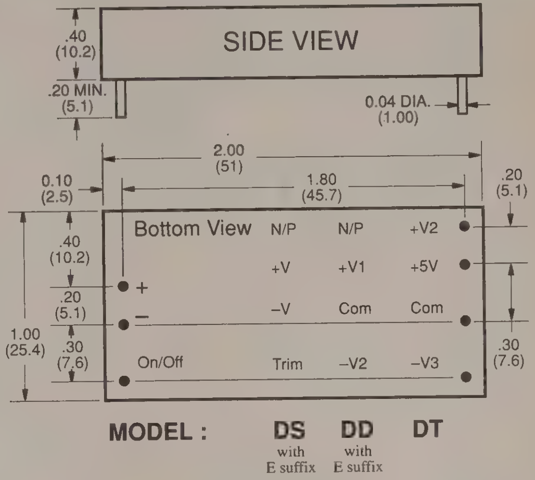
Please call Toll Free : 1-800-336-8022 Other Input/Output Combinations are Available, Please Consult Factory.

10 - 15 W Single, Dual, Triple DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


.40
(10.2)
SIDE VIEW
.20 MIN.
(5.1)
0.04 DIA.
(1.00)
2.00
(51)
.10
(2.5)
0.60
(15.2)
0.80
(20.3)
.40
(10.2)
.20
(5.1)
1.00
(25.4)
+V
+V1
Vin
+
–
N/P
Com
.40
(10.2)
.40
(10.2)
Bottom View
–V
–V2
MODEL : DS DD

Actual Size


.40
(10.2)
SIDE VIEW
.20 MIN.
(5.1)
0.04 DIA.
(1.00)
2.00
(51)
0.10
(2.5)
1.80
(45.7)
.20
(5.1)
Bottom View
N/P
N/P
+V2
+V
+V1
+5V
+
–V
Com
Com
–
.40
(10.2)
.20
(5.1)
1.00
(25.4)
.30
(7.6)
On/Off
Trim
–V2
–V3
.30
(7.6)
MODEL :
DS with E suffix
DD with E suffix
DT

***5V (4-7V Range) Input Model Available, Please Call Factory for Detail.**

ALL DIMENSIONS IN INCHES (MM)

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

INPUT SPECIFICATIONS

Input Voltage .... See Table
Input Filter .... LC Filter
Remote On/Off Control (E suffix only):
  On Control .... >5Vdc or Open Circuit
  Off Control .... <1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy (Main Output) .... ±1%, max.
Output Trim .... ±10%, max.
Line Regulation, LL–HL .... ±0.2%
Load Regulation (Main Output), NL/FL .... ±1.0%
Short Circuit Protection .... Indefinite
Transient Response .... <200µSec.
Ripple 35mVp-p
Noise, 20MHz BW .... 1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient .... ±0.02%/°C, max.
Efficiency 80%
Isolation Voltage, I/O .... 500Vdc, min.
Switching Frequency .... 200KHz, typ.
Thermal Resistance .... 10°C/Watt
Operating Ambient Temperature Range (Case Temp. +95°C max):
  10 Watts .... –25°C to +60°C
  15 Watts .... –25°C to +50°C
Cooling .... Free-Air Convection
Storage Temperature Range .... –55°C to +105°C
Humidity .... 20% to 95% R.H. (non-condensing)
Weight .... 2 oz. (56 grams)
Case Material .... Black Coated Metal
(With Non-Conductive Seating Surface)

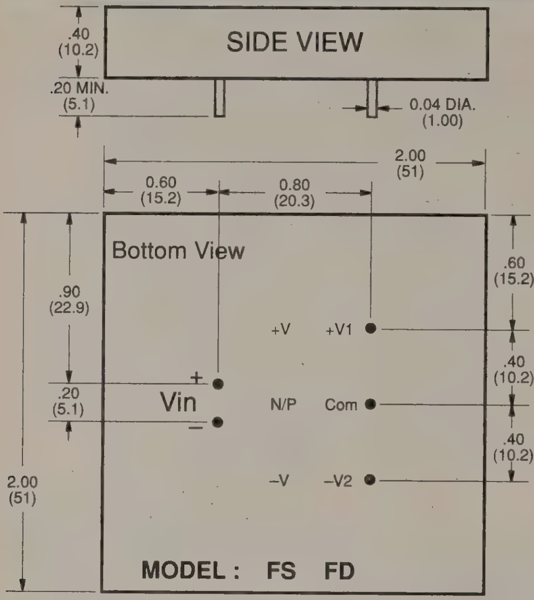
OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 36 Vdc IN	20 - 75 Vdc IN
3.3V	2.0A	6	D6S1203	D6S2403	D6S4803	DW6S2403	DW6S4803
3.3V	3.0A	10	D10S1203	D10S2403	D10S4803	–	–
5V	2.0A	10	D10S1205	D10S2405	D10S4805	DW10S2405	DW10S4805
5V	3.0A	15	D15S1205	D15S2405	D15S4805	–	–
12V	0.85A	10	D10S1212	D10S2412	D10S4812	DW10S2412	DW10S4812
12V	1.25A	15	D15S1212	D15S2412	D15S4812	–	–
15V	0.65A	10	D10S1215	D10S2415	D10S4815	DW10S2415	DW10S4815
15V	1.0A	15	D15S1215	D15S2415	D15S4815	–	–
24V	0.4A	10	D10S1224	D10S2424	D10S4824	DW10S2424	DW10S4824
24V	0.6A	15	D15S1224	D15S2424	D15S4824	–	–
±5V	±1.0A	10	D10D1205	D10D2405	D10D4805	DW10D2405	DW10D4805
±5V	±1.5A	15	D15D1205	D15D2405	D15D4805	–	–
±12V	±0.45A	10	D10D1212	D10D2412	D10D4812	DW10D2412	DW10D4812
±12V	±0.65A	15	D15D1212	D15D2412	D15D4812	–	–
±15V	±0.34A	10	D10D1215	D10D2415	D10D4815	DW10D2415	DW10D4815
±15V	±0.50A	15	D15D1215	D15D2415	D15D4815	–	–
+5, ±12V	+1.0, ±0.20A	10	D10T1205-12	D10T2405-12	D10T4805-12	DW10T2405-12	DW10T4805-12
+5, ±12V	+1.5, ±0.35A	15	D15T1205-12	D15T2405-12	D15T4805-12	–	–
+5, ±15V	+1.0, ±0.15A	10	D10T1205-15	D10T2405-15	D10T4805-15	DW10T2405-15	DW10T4805-15
+5, ±15V	+1.5, ±0.25A	15	D15T1205-15	D15T2405-15	D15T4805-15	–	–

Please call Toll Free : 1-800-336-8022

Other Input/Output Combinations are Available, Please Consult Factory.

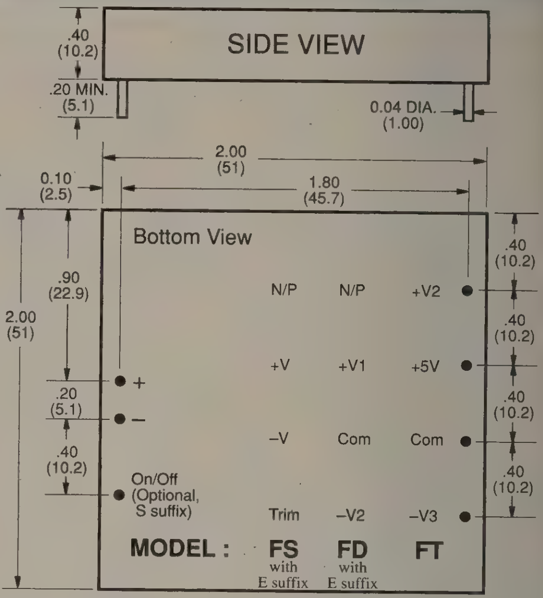
15 - 20 W Single, Dual, Triple DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


SIDE VIEW
.40 (10.2)
.20 MIN. (5.1)
0.04 DIA. (1.00)
2.00 (51)
0.60 (15.2)
0.80 (20.3)
Bottom View
.90 (22.9)
.20 (5.1)
2.00 (51)
.60 (15.2)
.40 (10.2)
.40 (10.2)
+V +V1
+ Vin −
N/P Com
−V −V2
MODEL : FS FD

Actual Size

***5V (4-7V Range) Input Model Available, Please Call Factory for Detail.**


SIDE VIEW
.40 (10.2)
.20 MIN. (5.1)
0.04 DIA. (1.00)
2.00 (51)
0.10 (2.5)
1.80 (45.7)
Bottom View
.90 (22.9)
2.00 (51)
.20 (5.1)
.40 (10.2)
.40 (10.2)
.40 (10.2)
.40 (10.2)
.40 (10.2)
N/P N/P +V2
+V +V1 +5V
+
−
−V Com Com
On/Off (Optional, S suffix)
Trim −V2 −V3
MODEL : FS with E suffix FD with E suffix FT

ALL DIMENSIONS IN INCHES (MM)

*Output Trim • Trim-Up / resistor from −V to Trim; Trim-Down / resistor from +V to Trim.

INPUT SPECIFICATIONS

Input Voltage	See Table
Input Filter	LC Filter
Remote On/Off Control:	
On Control	>5Vdc or Open Circuit
Off Control	<1.8V or Jumper to −Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy (Main Output)	±1%, max.
Output Trim	±10%, max.
Line Regulation, LL–HL	±0.2%
Load Regulation, NL/FL	±1.0%
Short Circuit Protection	Indefinite
Transient Response	<200µSec.
Ripple	35mVp-p
Noise, 20MHz BW	1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient	±0.02%/°C, max.
Efficiency	80%
Isolation Voltage, I/O	500Vdc, min.
Switching Frequency	200KHz, typ.
Thermal Resistance	7.5°C/Watt
Operating Ambient Temperature Range (Case Temp. +95°C max):	
15 Watts	−25°C to +60°C
20 Watts	−25°C to +50°C
Cooling	Free-Air Convection
Storage Temperature Range	−55°C to +105°C
Humidity	20% to 95% R.H. (non-condensing)
Dimensions	2.0" x 2.0" x 0.40"
Weight	2.2 oz. (63 grams)
Case Material	Black Coated Metal (With Non-Conductive Seating Surface)

OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 36 Vdc IN	20 - 75 Vdc IN
5V	3.0A	15	F15S1205	F15S2405	F15S4805	FW15S2405	FW15S4805
5V	4.0A	20	F20S1205	F20S2405	F20S4805	–	–
12V	1.25A	15	F15S1212	F15S2412	F15S4812	FW15S2412	FW15S4812
12V	1.67A	20	F20S1212	F20S2412	F20S4812	–	–
15V	1.00A	15	F15S1215	F15S2415	F15S4815	FW15S2415	FW15S4815
15V	1.34A	20	F20S1215	F20S2415	F20S4815	–	–
24V	0.65A	15	F15S1224	F15S2424	F15S4824	FW15S2424	FW15S4824
24V	0.85A	20	F20S1224	F20S2424	F20S4824	–	–
±5V	±1.5A	15	F15D1205	F15D2405	F15D4805	FW15D2405	FW15D4805
±5V	±2.0A	20	F20D1205	F20D2405	F20D4805	–	–
±12V	±0.65A	15	F15D1212	F15D2412	F15D4812	FW15D2412	FW15D4812
±12V	±0.83A	20	F20D1212	F20D2412	F20D4812	–	–
±15V	±0.50A	15	F15D1215	F15D2415	F15D4815	FW15D2415	FW15D4815
±15V	±0.67A	20	F20D1215	F20D2415	F20D4815	–	–
+5, ±12V	+1.5, ±0.35A	15	F15T1205-12	F15T2405-12	F15T4805-12	FW15T2405-12	FW15T4805-12
+5, ±12V	+2.0, ±0.41A	20	F20T1205-12	F20T2405-12	F20T4805-12	–	–
+5, ±15V	+1.5, ±0.25A	15	F15T1205-15	F15T2405-15	F15T4805-15	FW15T2405-15	FW15T4805-15
+5, ±15V	+2.0, ±0.33A	20	F20T1205-15	F20T2405-15	F20T4805-15	–	–

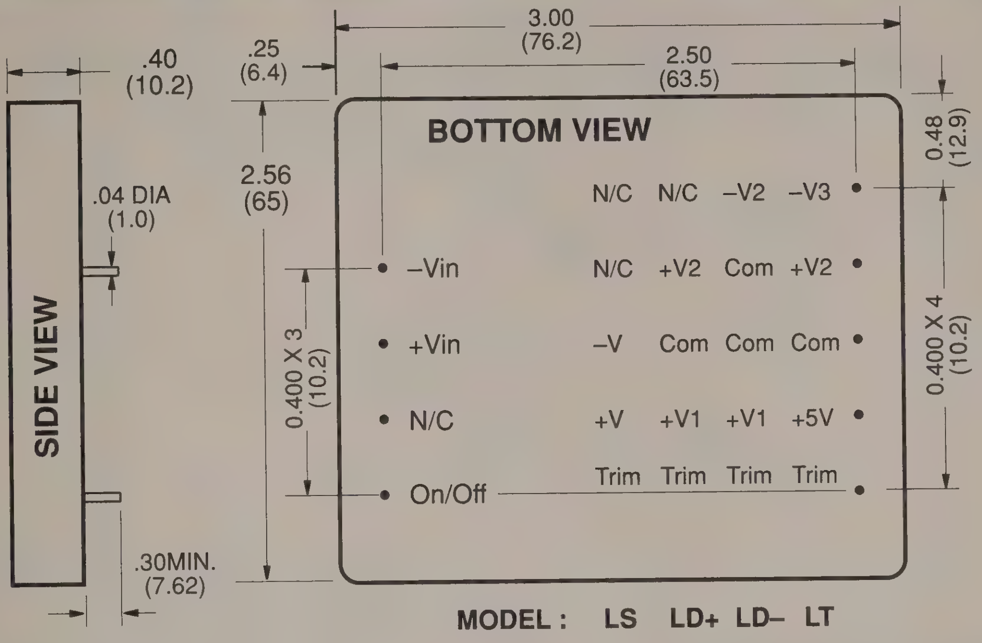
Please call Toll Free : 1-800-336-8022

Other Input/Output Combinations are Available, Please Consult Factory.

25 - 30 W Single, Dual, Triple DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371

Actual Size



ALL DIMENSIONS IN INCHES (MM)

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

Sense Leads (+S/–S) Compensate Output Line Drop, Connect to +V/–V Respectively If Not Used.

INPUT SPECIFICATIONS

Input Voltage	See Table
Input Filter	LC Filter
Remote On/Off Control:	
On Control	>5Vdc or Open Circuit
Off Control	<1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy (Main Output)	±1%, max.
Output Trim	±10%, max.
Line Regulation, LL–HL	±0.2%
Load Regulation, NL/FL	±1.0%
Short Circuit Protection	Indefinite
Transient Response	<200μSec.
Ripple	50mVp-p
Noise, 20MHz BW	1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient	±0.02%/°C, max.
Efficiency	80%
Isolation Voltage, I/O	500Vdc, min.
Thermal Resistance	5.5°C/Watt
Operating Case Temperature Range	–25°C to +95°C
Cooling	Free-Air Convection
Storage Temperature Range	–55°C to +105°C
Humidity	20% to 95% R.H. (non-condensing)
Dimensions	2.56" x 3.0" x 0.4"
Weight	4 oz. (105 grams)
Case Material	Black Coated Metal (With Non-Conductive Seating Surface)

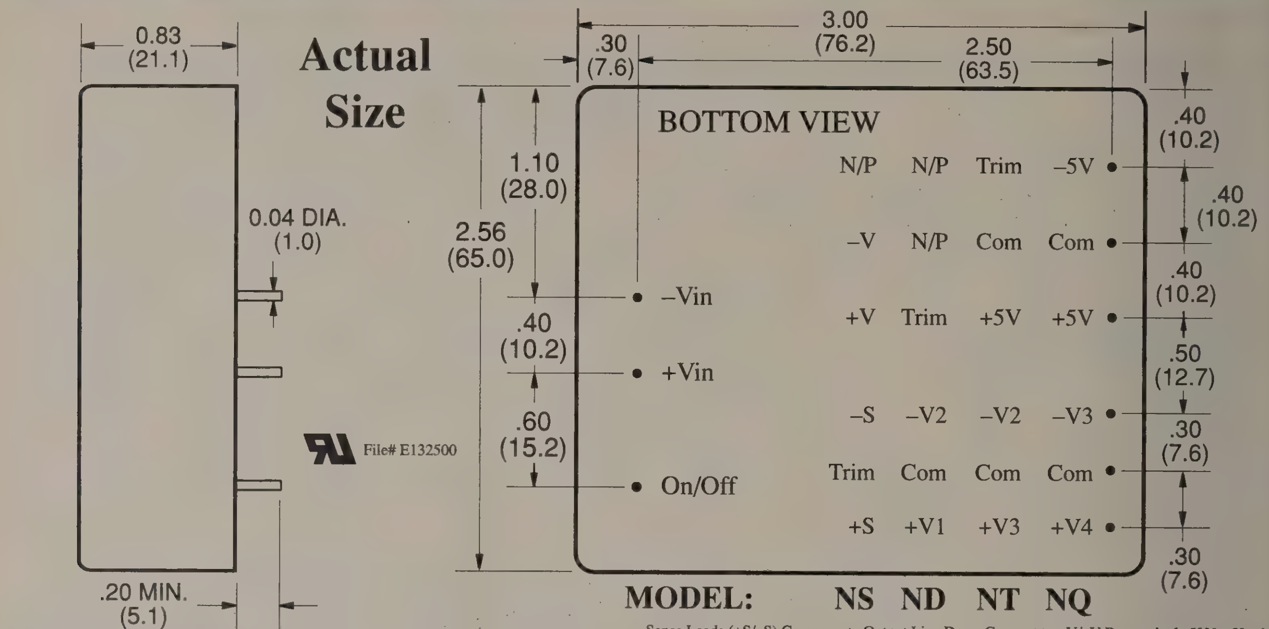
OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER 9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 36 Vdc IN	20 - 75 Vdc IN
5V	5A	25	L25S1205	L25S2405	L25S4805	LW25S2405	LW25S4805
12V	2.5A	30	L30S1212	L30S2412	L30S4812	LW30S2412	LW30S4812
15V	2.0A	30	L30S1215	L30S2415	L30S4815	LW30S2415	LW30S4815
24V	1.25A	30	L30S1224	L30S2424	L30S4824	LW30S2424	LW30S4824
±5V	±2.5A	25	L25D1205	L25D2405	L25D4805	LW25D2405	LW25D4805
+5, –12V	+4, –1A	30	L30D1205-12	L30D2405-12	L30D4805-12	LW30D2405-12	LW30D4805-12
±12V	±1.25A	30	L30D1212	L30D2412	L30D4812	LW30D2412	LW30D4812
±15V	±1.0A	30	L30D1215	L30D2415	L30D4815	LW30D2415	LW30D4815
+5, +12V	+4, +1A	30	L30D1205+12	L30D2405+12	L30D4805+12	LW30D2405+12	LW30D4805+12
+5, +24V	+4, +0.5A	30	L30D1205+24	L30D2405+24	L30D4805+24	LW30D2405+24	LW30D4805+24
+5, ±12V	+4.0, ±0.50A	30	L30T1205-12	L30T2405-12	L30T4805-12	LW30T2405-12	LW30T4805-12
+5, ±15V	+4.0, ±0.50A	30	L30T1205-15	L30T2405-15	L30T4805-15	LW30T2405-15	LW30T4805-15

Please call Toll Free : 1-800-336-8022

Other Input/Output Combinations are Available, Please Consult Factory.

25 - 30 W Single, Dual, Triple & Quad DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371



Sense Leads (+S/–S) Compensate Output Line Drop, Connect to +V/–V Respectively If Not Used.

ALL DIMENSIONS IN INCHES (MM)

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

INPUT SPECIFICATIONS

Input Voltage .... See Table
Input Filter .... Π(PI) Filter
Remote SHUT/DOWN Control
  On Control .... TTL High or Open Circuit
  Off Control .... <1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy (Main Output) .... ±1%, max.
Output Trim .... ±10%, max.
Line Regulation, LL–HL .... ±0.2%
Load Regulation, NL/FL .... ±1.0%
Short Circuit Protection .... Indefinite
Transient Response .... <200μSec.
Ripple 50mVp-p
Noise, 20MHz BW 1% or75mVp-p

GENERAL SPECIFICATIONS

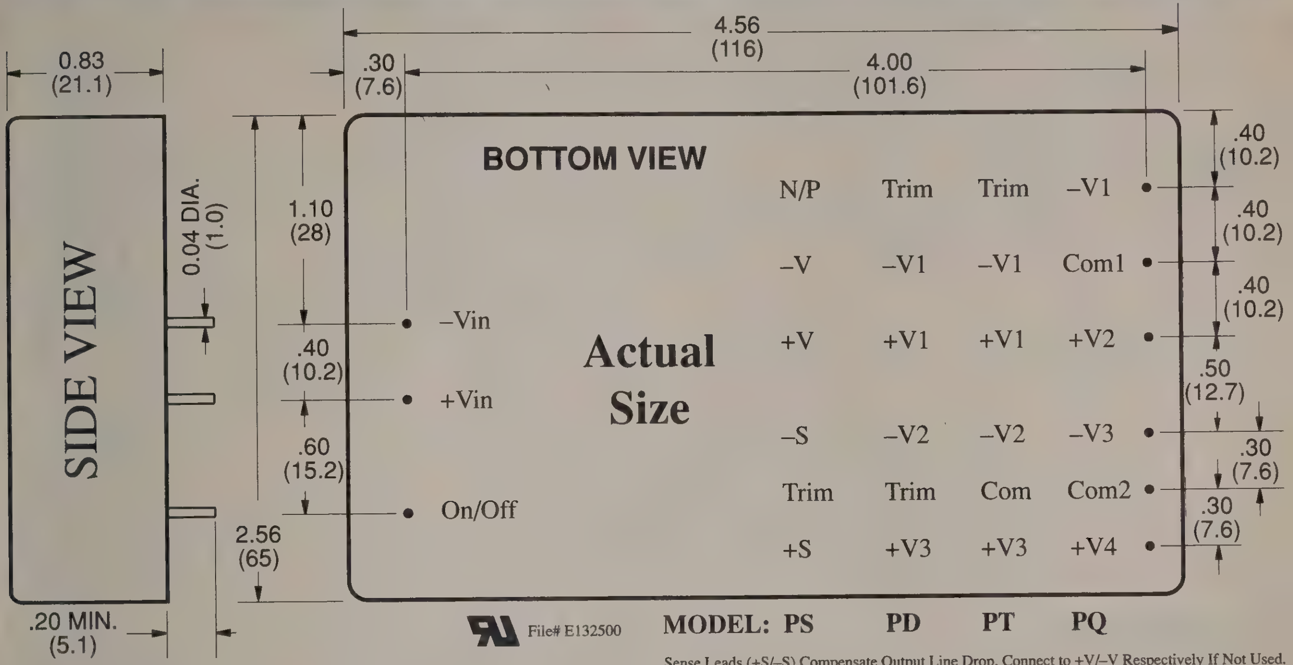
Temperature Coefficient .... ±0.02%/°C, max.
Efficiency 80%
Isolation Voltage, I/O .... 500Vdc, min.
Thermal Resistance .... 5°C/Watt
Operating Case Temperature Range .... –25°C to +85°C
Cooling .... Free-Air Convection
Storage Temperature Range .... –55°C to +105°C
Humidity .... 20% to 95% R.H. (non-condensing)
Dimensions .... 2.56" x 3.0" x 0.83"
Weight .... 4 oz. (105 grams)
Case Material .... Black Coated Metal
(With Non-Conductive Seating Surface)

OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 36 Vdc IN	20 - 75 Vdc IN
5V	4.0A	20	N20S1205	N20S2405	N20S4805	NW20S2405	NW20S4805
5V	5.0A	25	N25S1205	N25S2405	N25S4805	NW25S2405	NW25S4805
12V	1.7A	20	N20S1212	N20S2412	N20S4812	NW20S2412	NW20S4812
12V	2.5A	30	N30S1212	N30S2412	N30S4812	NW30S2412	NW30S4812
15V	1.4A	20	N20S1215	N20S2415	N20S4815	NW20S2415	NW20S4815
15V	2.0A	30	N30S1215	N30S2415	N30S4815	NW30S2415	NW30S4815
24V	1.2A	30	N30S1224	N30S2424	N30S4824	NW30S2424	NW30S4824
±5V	±2A	20	N20D1205	N20D2405	N20D4805	NW20D2405	NW20D4805
±5V	±3.0A	30	N30D1205	N30D2405	N30D4805	NW30D2405	NW30D4805
±12V	±0.8A	20	N20D1212	N20D2412	N20D4812	NW20D2412	NW20D4812
±12V	±1.25A	30	N30D1212	N30D2412	N30D4812	NW30D2412	NW30D4812
±15V	±0.7A	20	N20D1215	N20D2415	N20D4815	NW20D2415	NW20D4815
±15V	±1.0A	30	N30D1215	N30D2415	N30D4815	NW30D2415	NW30D4815
+5, ±12V	+2.5, ±0.33A	20	N20T1205-12	N20T2405-12	N20T4805-12	NW20T2405-12	NW20T4805-12
+5, ±12V	+3.0, ±0.42A	25	N25T1205-12	N25T2405-12	N25T4805-12	NW25T2405-12	NW25T4805-12
+5, ±15V	+2.5, ±0.25A	20	N20T1205-15	N20T2405-15	N20T4805-15	NW20T2405-15	NW20T4805-15
+5, ±15V	+2.5, ±0.34A	25	N25T1205-15	N25T2405-15	N25T4805-15	NW25T2405-15	NW25T4805-15
±5, ±12V	+3/–0.5,±0.5A	25	N25Q1205-12	N25Q2405-12	N25Q4805-12	–	–
±5, ±15V	+3/–0.5,±0.5A	25	N25Q1205-15	N25Q2405-15	N25Q4805-15	–	–

Please call Toll Free : 1-800-336-8022 Other Input/Output Combinations are Available, Please Consult Factory.

40 - 60 W Single, Dual, Triple & Quad DC-DC Converters

ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371



Sense Leads (+S/–S) Compensate Output Line Drop, Connect to +V/–V Respectively If Not Used.

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

ALL DIMENSIONS IN INCHES (MM)

INPUT SPECIFICATIONS

Input Voltage	See Table
Input Filter	Π(PI) Filter
Remote On/Off Control:	
On Control	TTL High or Open Circuit
Off Control	<1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Voltage Accuracy (Main Output)	±1%, max.
Output Trim	±10%, max.
Line Regulation, LL–HL	±0.2%
Load Regulation, NL/FL	±1.0%
Short Circuit Protection	Current Limit
Transient Response	<200µSec.
Ripple	50mVp-p
Noise, 20MHz BW	1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient	±0.02%/°C, max.
Efficiency	80%
Isolation Voltage, I/O	500Vdc, min.
Switching Frequency	100KHz, typ.
Thermal Resistance	4°C/Watt
Operating Case Temperature Range	–25°C to +85°C
Cooling	Free-Air Convection
Storage Temperature Range	–55°C to +105°C
Humidity	20% to 95% R.H. (non-condensing)
Dimensions (P)	2.56" x 4.56" x 0.83"
Weight	10 oz. (283 grams)
Case Material	Black Coated Metal (With Non-Conductive Seating Surface)

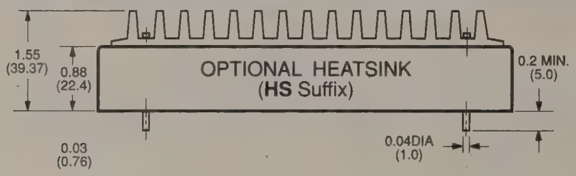
OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 30 Vdc IN	20 - 60 Vdc IN
5V	8.0A	40	P40S1205	P40S2405	P40S4805	P40S3005	P40S6005
12V	3.4A	40	P40S1212	P40S2412	P40S4812	P40S3012	P40S6012
15V	2.7A	40	P40S1215	P40S2415	P40S4815	P40S3015	P40S6015
24V	1.7A	40	P40S1224	P40S2424	P40S4824	P40S3024	P40S6024
5V, 5V	4A, 4A	40	P40D1205-05	P40D2405-05	P40D4805-05	P40D3005-05	P40D6005-05
5V, 12V	4A, 1.7A	40	P40D1205-12	P40D2405-12	P40D4805-12	P40D3005-12	P40D6005-12
5V, 12V	6A, 2.5A	60	P60D1205-12	P60D2405-12	P60D4805-12	P60D3005-12	P60D6005-12
12V, 12V	1.7A, 1.7A	40	P40D1212-12	P40D2412-12	P40D4812-12	P40D3012-12	P40D6012-12
15V, 15V	1.4A, 1.4A	40	P40D1215-15	P40D2415-15	P40D4815-15	P40D3015-15	P40D6015-15
5V, ±12V	4.0A, ±1.0A	40	P40T1205-12	P40T2405-12	P40T4805-12	P40T3005-12	P40T6005-12
5V, ±12V	6.0A, ±1.25A	60	P60T1205-12	P60T2405-12	P60T4805-12	P60T3005-12	P60T6005-12
5V, ±15V	4.0A, ±1.0A	40	P40T1205-15	P40T2405-15	P40T4805-15	P40T3005-15	P40T6005-15
5V, ±15V	6.0A, ±1.0A	60	P60T1205-15	P60T2405-15	P60T4805-15	P60T3005-15	P60T6005-15
12V, ±5V	2.0V, ±2.0A	40	P40T1212-05	P40T2412-05	P40T4812-05	P40T3012-05	P40T6012-05
±5V, ±12V	+4/–0.5A, ±1.0A	40	P40Q1205-12	P40Q2405-12	P40Q4805-12	P40Q3005-12	P40Q6005-12
±5V, ±15V	+4/–0.5A, ±1.0A	40	P40Q1205-15	P40Q2405-15	P40Q4805-15	P40Q3005-15	P40Q6005-15

Please call Toll Free : 1-800-336-8022

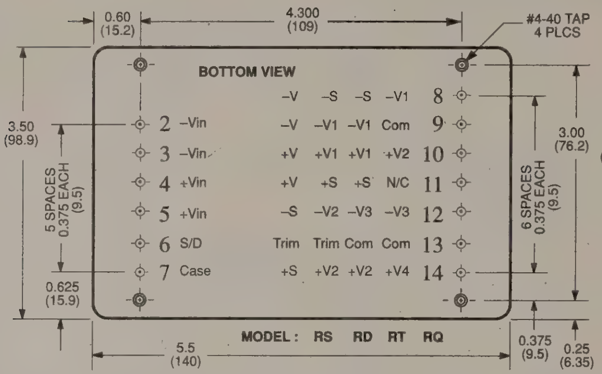
Other Input/Output Combinations are Available, Please Consult Factory.

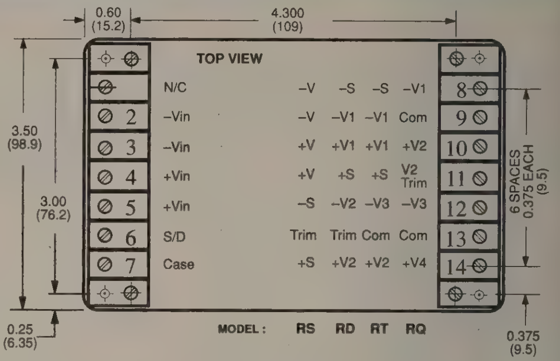
50 - 100 W Single, Dual, Triple & Quad DC-DC Converters

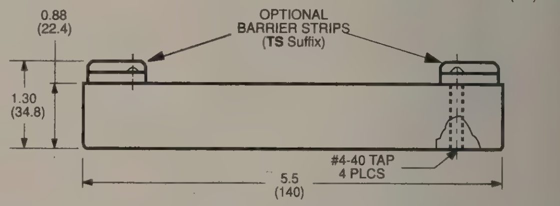
ACON, INC. 22 Bristol Dr., South Easton, MA 02375 • TEL:(508)230-8022 • FAX:(508)230-2371


1.55
(39.37)
0.88
(22.4)
OPTIONAL HEATSINK
(HS Suffix)
0.2 MIN.
(5.0)
0.03
(0.76)
0.04DIA
(1.0)

File# E149006


0.60
(15.2)
4.300
(109)
#4-40 TAP
4 PLCS
BOTTOM VIEW
3.50
(98.9)
5 SPACES
0.375 EACH
(9.5)
2 –Vin
3 –Vin
4 +Vin
5 +Vin
6 S/D
7 Case
–V –S –S –V1 8
–V –V1 –V1 Com 9
+V +V1 +V1 +V2 10
+V +S +S N/C 11
–S –V2 –V3 –V3 12
Trim Trim Com Com 13
+S +V2 +V2 +V4 14
3.00
(76.2)
6 SPACES
0.375 EACH
(9.5)
0.625
(15.9)
MODEL : RS RD RT RQ
5.5
(140)
0.375
(9.5)
0.25
(6.35)


0.60
(15.2)
4.300
(109)
TOP VIEW
3.50
(98.9)
3.00
(76.2)
N/C
2 –Vin
3 –Vin
4 +Vin
5 +Vin
6 S/D
7 Case
–V –S –S –V1 8
–V –V1 –V1 Com 9
+V +V1 +V1 +V2 10
+V +S +S V2 Trim 11
–S –V2 –V3 –V3 12
Trim Trim Com Com 13
+S +V2 +V2 +V4 14
6 SPACES
0.375 EACH
(9.5)
0.25
(6.35)
MODEL : RS RD RT RQ
0.375
(9.5)


0.88
(22.4)
OPTIONAL
BARRIER STRIPS
(TS Suffix)
1.30
(34.8)
#4-40 TAP
4 PLCS
5.5
(140)

*Output Trim • Trim-Up / resistor from –V to Trim; Trim-Down / resistor from +V to Trim.

Sense Leads (+S/–S) Compensate Output Line Drop, Connect to +V/–V Respectively If Not Used.

ALL DIMENSIONS IN INCHES (MM)

INPUT SPECIFICATIONS

Input Voltage	See Table
Input Filter	Π(PI) Filter
Remote On/Off Control:	
On Control	TTL High or Open Circuit
Off Control	<1.8V or Jumper to –Vin

OUTPUT SPECIFICATIONS

Output Voltage Accuracy	±1%, max.
Output Trim	±10%, max.
Line Regulation, LL–HL	±0.2%
Load Regulation, NL/FL	±1.0%
Short Circuit Protection	Current Limit
Transient Response	<200µSec.
Ripple & Noise, 20MHz BW	1% or 75mVp-p

GENERAL SPECIFICATIONS

Temperature Coefficient	±0.02%/°C, max.
Efficiency	80%
Isolation Voltage, I/O	500Vdc, min.
Switching Frequency	100KHz, typ.
Thermal Resistance	2.2°C/Watt
Operating Case Temperature Range	–25°C to +85°C
Cooling	Free-Air Convection
Storage Temperature Range	–55°C to +105°C
Humidity	20% to 95% R.H. (non-condensing)
Dimensions	3.5" x 5.5" x 0.90"
Weight	16 oz. (454 grams)
Case Material	Black Coated Metal (With Non-Conductive Seating Surface)

OUTPUT VOLTAGE	OUTPUT CURRENT	WATT	MODEL NUMBER				
			9 - 18 Vdc IN	18 - 36 Vdc IN	36 - 75 Vdc IN	10 - 30 Vdc IN	20 - 60 Vdc IN
5V	10.0A	50	R50S1205	R50S2405	R50S4805	R50S3005	R50S6005
5V	20.0A	100	R100S1205	R100S2405	R100S4805	-	-
12V	5.0A	60	R60S1212	R60S2412	R60S4812	R60S3012	R60S6012
12V	8.0A	100	R100S1212	R100S2412	R100S4812	-	-
15V	4.0A	60	R60S1215	R60S2415	R60S4815	R60S3015	R60S6015
15V	7.0A	100	R100S1215	R100S2415	R100S4815	-	-
24V	2.5A	60	R60S1224	R60S2424	R60S4824	R60S3024	R60S6024
24V	4.0A	100	R100S1224	R100S2424	R100S4824	-	-
5V, 5V	5.0A, 5.0A	50	R50D1205-05	R50D2405-05	R50D4805-05	R50D3005-05	R50D6005-05
5V, 12V	5.0A, 2.5A	55	R55D1205-12	R55D2405-12	R55D4805-12	R55D3005-12	R55D6005-12
5V, 12V	10.0A, 4.0A	100	R100D1205-12	R100D2405-12	R100D4805-12	-	-
12V, 12V	2.5A, 2.5A	60	R60D1212-12	R60D2412-12	R60D4812-12	R60D3012-12	R60D6012-12
15V, 15V	2.0A, 2.0A	60	R60D1215-15	R60D2415-15	R60D4815-15	R60D3015-15	R60D6015-15
5V, ±12V	5.0A, ±1.25A	55	R55T1205-12	R55T2405-12	R55T4805-12	R55T3005-12	R55T6005-12
5V, ±12V	10.0A, ±2.0A	100	R100T1205-12	R100T2405-12	R100T4805-12	-	-
5V, ±15V	5.0A, ±1.0A	55	R55T1205-15	R55T2405-15	R55T4805-15	R55T3005-15	R55T6005-15
5V, ±15V	10.0A, ±1.6A	100	R100T1205-15	R100T2405-15	R100T4805-15	-	-
12V, ±5V	2.5V, ±2.5A	55	R55T1212-05	R55T2412-05	R55T4812-05	R55T3012-05	R55T6012-05
12V, ±5V	5.0V, ±4.0A	100	R100T1212-05	R100T2412-05	R100T4812-05	-	-
±5V, ±12V	+5/–0.5A, ±1.25A	60	R60Q1205-12	R60Q2405-12	R60Q4805-12	R60Q3005-12	RW60Q6005-12
±5V, ±15V	+5/–0.5A, ±1.00A	60	R60Q1205-15	R60Q2405-15	R60Q4805-15	R60Q3005-15	RW60Q6005-15

Please call Toll Free : 1-800-336-8022 Other Input/Output Combinations are Available, Please Consult Factory.

Advanced Analog

Military DC/DC Converters

Model	DESC Standard Military Dwg.	Total Output Power (W)	Output Voltage (V) Current (A)	Input Voltage Range (V)	Number of Outputs	Line & Load Regulation	Ripple/ Noise (DC to 1 MHz)	Temp. Range	Package
ATO2812T	5962-91602	15	5V, 2A ±12V, 206mA	16-40	3	+0.3% +0.5%	50mV p-p 25mV p-p	–55°C to +125°C	D,E
ATO2815T	5962-90954	15	5V, 2A ±15V, 167mA	16-40	3	+0.3% +0.5%	50mV p-p 25mV p-p		
AFW2805S	Pending	50	+5V, 8A	16-50	1	+1%	80mV p-p	–55°C to +125°C	2.45 x 3.20 x .595
AHE2805S	5962-89683	15	5V. 0-3A	17-40	1	+1%	20mV p-p	–55°C to +125°C	A, B
AHE2812S	5962-91580	20	12V. 0-1.67A	17-40	1	+1%	30mV p-p		
AHE2815S	5962-91625	20	15V. 0-1.33A	17-40	1	+1%	30mV p-p		
AHE2812D	5962-92040	15	±12V.0-625mA	17-40	2	+1%	25mV p-p		
AHE2815D	5962-91575	15	±15V.0-500mA	17-40	2	+1%	25mV p-p		
AHF2805S	5962-91600	12	5V, 2.4A	16-40	1	+1%	50mV p-p	–55°C to +125°C	1.450 x 1.120 x .325
AHF2812S	5962-91664	12	12.1A	16-40	1	+1%	50mV p-p		
AHF2815S	5962-91606	12	15V, .8A	16-40	1	+1%	50mV p-p		
AHF2812D	5962-92111	12	±12V, .5A	16-40	2	+1%	50mV p-p		
AHF2815D	5962-92351	12	±15V, .4A	16-40	2	+1%	50mV p-p		
AHV2805S	5962-91773	15	5V, 3A	16-80	1	+1%	20mV p-p	–55°C to +125°C	2.12 x 1.12 x .405
AHV2812S	5962-92112	20	12V, 1.67A	16-80	1	+1%	25mV p-p		
AHV2815S	5962-92113	20	15V, 1.33A	16-80	1	+1%	25mV p-p		
AHV2812D	5962-92114	15	±12V, .625A	16-80	2	+1%	25mV p-p		
AHV2815D	5962-91774	15	±15V, .500A	16-80	2	+1%	25mV p-p		
AHV2812T	5962-92115	15	5V, 2A ±12V, .208A	16-80 16-80	3	+1%	80mV p-p 30mV p-p		1.95 x 1.345 x .405
AHV2815T	5962-92116	15	5V, 2A ±15V, .167A	16-80	3	+1%	80mV p-p 30mV p-p		
ASR2815T	Pending	4	+15V, .133A	16-80	2	+3%	50mV p-p	–55°C to +125°C	1.075 x 1.075 x .350
ASR2815T	Pending	3.2	+5V, .4A ±15V, .04A	16-80	3	+3%	80mV p-p		
ATR2812T	Pending	30	+5V, 4A ±12V, .625A	16-40	3	+1%	30mV p-p	–55°C to +125°C	2.7 x 1.345 x .410
ATR2815T	5962-92159	30	+5V, 4A ±15, .5A	16-40	3	+1%	30mV p-p		
ATW2805S	5962-91579	30	5V, 6A	19-40	1	+1.0%	10mV p-p	–55°C to +125°C	C
ATW2812S	5962-92110	30	12V, 2.5A	19-40	1	+1.0%	30mV p-p		
ATW2815S	5962-91599	30	15V, 2A	18-40	1	+1.0%	30MV p-p		
ATW2812D	5962-92109	30	±12V, 2.5A	18-40	2	+1.0%	50MV p-p		
ATW2815D	5962-91613	30	±15V, 2A	18-40	2	+1.0%	50mV p-p		

Specifications are typical values, input-to-output isolation @500VDC is 100M minimum.
The 5962 models are DESC standard military drawings that are fully compliant to MIL-STD-883C.
Advanced Analog is the first qualified source for these standard military drawings.
An optical EMI filter will reduce the input ripple current to levels below the limits imposed by Condition CEO3 of MIL-STD-461B.
The AFC461 Series has 4.0 amp max. input current. DESC selected item number 5915-91020.
Advanced Analog is listed on the QML for DC/DC converters EQ (EQC-90-65).
Commercial and Industrial versions are also available.
Radiation Tolerant Converters available in August/1993.

1. Up to 90% of full power is available from either output provided the total output does not exceed 30 watts.

Package

A. Standard - 2.12 x 1.12 x 0.495
B. Flange - 2.89 x 1.12 x 0.495
D. Standard - 1.950 x 1.345 x 0.500
E. Flange - 2.700 x 1.345 x 0.500

MIL-STD-1772 Certified and Qualified

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a division of Intech

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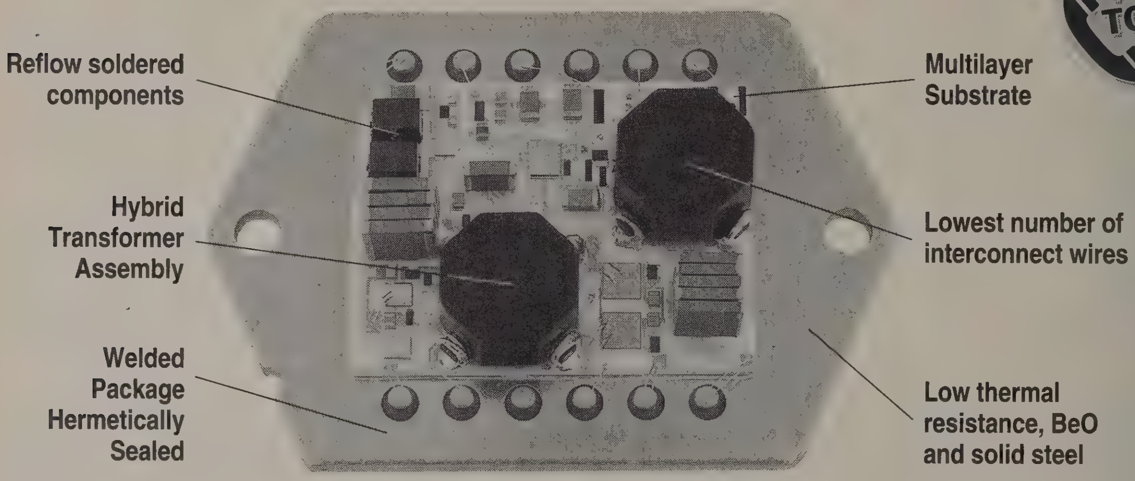
APEX HYBRID MANUFACTURING PROCESS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Hybrid Transformer Assembly
Welded Package Hermetically Sealed
Multilayer Substrate
Lowest number of interconnect wires
Low thermal resistance, BeO and solid steel

NEW INDUSTRY MANUFACTURING STANDARD—HIGH RELIABILITY

Apex dc/dc converters set a new industry standard with a true hybrid manufacturing process which utilizes a multilayer substrate and a one-step reflow solder process. The resulting absence of magnet wire and low number of components, provides an extremely clean unit with a lower production cost. Customer benefits include enhanced MTBF, increased long-term reliability and per unit price reductions.

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• Narrow form factor • Use of magnet wire for high current conductor routing	• Near square form factor • Multilayer substrate	• Thick film conductor routing in all directions • Improved heat flow to the outside
• Conventional pot cores or toroids	• Surface mounted hybrid magnetics	• Improved reliability • Reduced PIND
• Manual placement of magnet wire, soldered to circuits	• Internal components • 100% surface mounted • One-step, automated reflow soldering	• Reduced labor costs • Clean layout
• Lidded package is soldered • Tub package is welded but costly	• BeO, solid steel, welded package construction	• Lower cost • Hermetically sealed • Low thermal resistance • Extremely rugged
• Inherently high per unit costs	• Potentially lower per unit costs	• Cost savings realized by continuous improvement of manufacturing process lowers per unit costs

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DC/DC CONVERTERS

PRODUCT SELECTOR GUIDE

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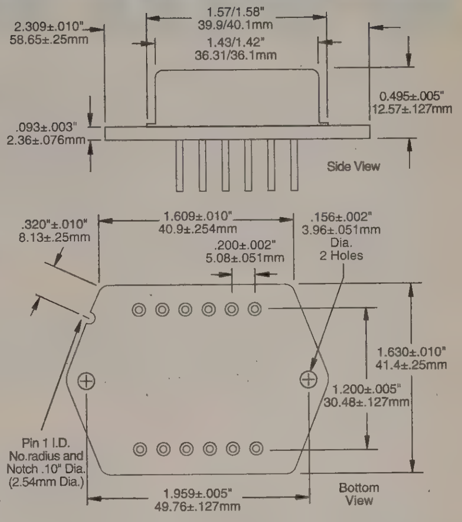
DB2800 SERIES

- Up to 22.5 watts output power
- 3 input voltage ranges
- Welded, hermetically sealed package
- Full military case temp range, no derating
  $T_{CASE} = -55°$ to $+125°C$

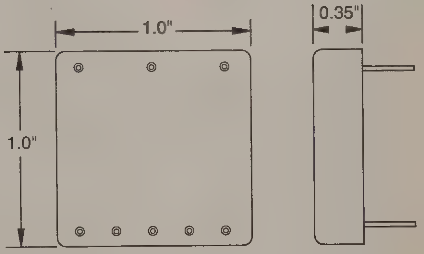

2.309±.010"
58.65±.25mm
1.57/1.58"
39.9/40.1mm
1.43/1.42"
36.31/36.1mm
0.495±.005"
12.57±.127mm
.093±.003"
2.36±.076mm
Side View
.320"±.010"
8.13±.25mm
1.609±.010"
40.9±.254mm
.156±.002"
3.96±.051mm
Dia.
2 Holes
.200±.002"
5.08±.051mm
1.630±.010"
41.4±.25mm
1.200±.005"
30.48±.127mm
Pin 1 I.D.
No.radius and
Notch .10" Dia.
(2.54mm Dia.)
1.959±.005"
49.76±.127mm
Bottom
View

The DB2800 series features remote shutdown, kelvin sense and indefinite short circuit protection. Reliability is enhanced by a low component count, all ceramic capacitors and low internal temperature gradients.

Model	Output Voltage	Output Current	Output Power	Input Voltage I_0 = Max	Temp Range	Efficiency
SINGLES						
DB2805S	5	4.00	20	16-40	–55/+125	76
DB2812S	12	1.88	22.5	14-40	–55/+125	79
DB2815S	15	1.50	22.5	15-40	–55/+125	80
DUALS						
DB2812D	±12	±0.84	22.5	14-50	–55/+125	79
DB2815D	±15	±0.75	22.5	15-50	–55/+125	79

DHC2800 SERIES

- Up to 6 watts output power
- 11 to 50Vdc input voltage range
- 20W/in³ power density
- Full military case temp range, no derating
  $T_{CASE} = -55°$ to $+125°C$

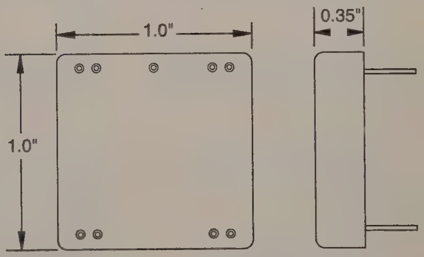


The DHC2800 series is designed for analog and digital systems, including 3 volt systems. The input voltage range exceeds the MIL-740E requirements. Current limiting, remote shutdown and output voltage adjustment are featureed in this series.

Model	Output Voltage	Output Current	Output Power	Input Voltage I_0 = Max	Temp Range	Efficiency
SINGLES						
DHC2803S	3	2	6	11-50	–55/+125	74
DHC2805S	5	1.20	6	11-50	–55/+125	76
DHC2812S	12	0.50	6	11-50	–55/+125	78
DHC2815S	15	0.40	6	11-50	–55/+125	78
DUALS						
DHC2812D	±12	±0.25	6	12-50	–55/+125	76
DHC2815D	±15	±0.200	6	12-50	–55/+125	76

FCD461 FILTERS

- Compliant to MIL-STD-461 CEO3
- 11 to 40Vdc input voltage
- Low DC Resistance 0.25Ω
- Full mil case temp range
  $T_{CASE} = -55°$ to $+125°C$



The FCD461 ripple current filter can drive a single DB2800 series converter operating on input voltages above 19 Vdc, and two DHC2800 series converters over their full input range. Both differential and common mode ripple current is filtered.

Model	Output Current	Ripple Rejection	DC Resistance	Power Dissipation	Temp Range	Clamping Voltage
FCD461	1.2A	13~100dB	0.25Ω	360mW	–55/+125	40

ENVIRONMENTAL SCREENING AVAILABLE

- Pre-cap visual inspection
- Stabilization bake
- Temperature cycle
- Constant acceleration
- Fine leak
- Gross leak
- Burn-in
- Final electrical test, over temperature
- Final external visual inspection

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eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymar, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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DC–DC CONVERTERS

ASTEC 2.25 TO 4.5 WATTS
SINGLE/DUAL OUTPUT DC/DC POWER CONVERTERS

ASTEC
MRS·2300·9

Astec Standard Power offers 16 different series of DC/DC power conversion products, ranging from 2.4 to 40 watts in single, dual, or triple output models. They feature MOSFET design, surface mount technology, an ultra-wide input range, overvoltage protection, continuous short circuit protection, high efficiency, 500 Vdc input/output isolation, regulated and unregulated outputs, ultra low noise Pi input filter, and output trim adjustability. These innovative, low-profile DC/DC converters are used in a wide range of applications, including telecommunications, test equipment, distributed power systems, process control, minicomputers, and geosurvey equipment.

FEATURES

MV Series—2.4 Watt Single/Dual output
- Regulated outputs • LC input filter

MB/MH Series—2.4 Watt Single/Dual output
- Unregulated outputs • LC input filter
- Continuous short circuit protection
- MOSFET design
- Efficiency to 80% • MTBF 1,000,000 hours

MQ Series—3 Watts single/dual outputs
- Ultra low noise Pi input filter
- Continuous short circuit
- Regulated output

SPECIFICATIONS

Model Number	Input Voltage Range VDC	Output Voltage	Output Current	Case HxWxL (ins)
MV Series				
MVS2030-2	4.75-5.25	5VDC	300mA	0.4x1.25x0.8
MVS7020-2	4.75-5.25	9VDC	200mA	0.4X1.25X0.8
MVS3020-2	4.75-5.25	12VDC	200mA	0.4x1.25x0.8
MVS4016-2	4.75-5.25	15VDC	160mA	0.4x1.25x0.8
MVD2020-2	4.75-5.25	±5VDC	±100mA	0.4x1.25x0.8
MVD3017-2	4.75-5.25	±12VDC	±85mA	0.4x1.25x0.8
MVD4014-2	4.75-5.25	±15VDC	±70mA	0.4x1.25x0.8
MB/MH Series				
MBS2018-2	4.5-5.5	5VDC	180mA	0.5x1.1x1.1
MBS2045-2	4.5-5.5	5VDC	450mA	0.5x1.1x1.1
MBS3007-2	4.5-5.5	12VDC	750mA	0.5x1.1x1.1
MBS3020-2	4.5-5.5	12VDC	200mA	0.5x1.1x1.1
MHD3020-2	4.5-5.5	±12VDC	±100mA	0.5x1.1x1.1
MHD4016-2	4.5-5.5	±15VDC	±80mA	0.5x1.1x1.1

Model Number	Input Voltage Range VDC	Output Voltage	Output Current	Case HxWxL (ins)
MQ Series				
MQS2060-2	4.5-5.5	5VDC	600mA	.4x2.0x2.0
MQS2060-3	10.8-15.0V	5VDC	600mA	.4x2.0x2.0
MQS2060-5	21.6-30.0V	5VDC	600mA	.4x2.0x2.0
MQD3007-2	4.5-5.5V	±12VDC	±35mA	.4x1.5x2.0
MQD3007-3	10.8-15.0V	±12VDC	±35mA	.4x1.5x2.0
MQD3007-5	21.6-30.0V	±12VDC	±35mA	.4x1.5x2.0
MQD3025-2	4.5-5.5V	±12VDC	±125mA	.4x2.0x2.0
MQD3025-3	10.8-15.0V	±12VDC	±125mA	.4x2.0x2.0
MQD3025-5	21.6-30.0V	±12VDC	±125mA	.4x2.0x2.0
MQD4006-2	4.5-5.5V	±15VDC	±30mA	.4x1.5x20
MQD4006-3	10.8-15.0V	±15VDC	±30mA	.4x1.5x20
MQD4006-5	21.6-30.0V	±15VDC	±30mA	.4x1.5x20
MQD4020-2	4.5-5.5V	±15VDC	±100mA	.4x20x2.0
MQD4020-3	10.8-15.0V	±15VDC	±100mA	.4x20x2.0
MQD4020-5	21.6-30.0V	±15VDC	±100mA	.4x20x2.0

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DC–DC CONVERTERS

ASTEC 5 TO 40 WATTS SINGLE/MULTIPLE OUTPUT DC/DC CONVERTERS

FEATURES

MX Series—3.0 to 3.6 Watt Single/Dual output
- Unregulated outputs • LC input filter
- Continuous short circuit protection
- Efficiency to 80% • MOSFET design
- 500 VDC I/O isolation • MTBF >1,000,000 hours

MK/MW Series—3.5 to 12 Watt Single/Dual output
- Unregulated outputs • Pi input filter
- Continuous short circuit protection
- Efficiency to 80% • MOSFET design
- 500VDC I/O isolation • MTBF 1,000,000 hours
- Alternative pin configuration

MA Series—4.5 Watt Single/Dual output
- Regulated outputs
- SMT-surface mount technology
- Continuous short circuit protection
- MOSFET design • 4:1 Ultra-wide input range

MP/MF Series—5 to 7.5 Watt Single/Dual output
- Regulated outputs • Pi input filter
- Continuous short circuit protection
- MOSFET Design • 500 VDC I/O isolation
- SMT—surface mount technology
- 4:1 Ultra-wide input range

ML Series—6 Watts Single/Dual outputs
- MOSFET Design • Surface Mount Technology
- 4:1 Ultra-wide Input Range • Regulated Outputs
- Continuous Foldback Short Circuit Protection
- 500 Vdc I/O Isolation • Efficiency 80% (typ)

MR Series—15 Watts Single/Dual outputs
- MOSFET Design
- Surface Mount Technology
- 4:1 Wide Input Range
- Continuous Foldback Short Circuit Protection
- Regulated Outputs • 500 V Isolation
- Six-sided Shielding

MS/MT Series—15 Watts Single/Dual/Triple Outputs
- 4:1 ultra-wide input range
  9-36VDC
  20-72VDC
- Remote on/off
- 85% efficiency
- Continuous short circuit protection
- Six-shielded shielding

SPECIFICATIONS

Model Number	Input Voltage Range VDC	Output Voltage	Output Current	Case HxWxL (ins)
MX Series				
MXS2060-2	4.5-5.5	5VDC	600mA	1.25x0.8x0.375
MXS7033-2	4.5-5.5	9VDC	330mA	1.25x0.8x0.375
MXS3030-2	4.5-5.5	12VDC	300mA	1.25x0.8x0.375
MXS4024-2	4.5-5.5	15VDC	240mA	1.25x0.8x0.375
MXD3030-2	4.5-5.5	±12VDC	150mA	1.25x0.8x0.375
MXD4024-2	4.5-5.5	±15VDC	120mA	1.25x0.8x0.375
MK/MW Series (MW Series Case Size .4x2.0x2.0)				
MKS2075-2	4.5-5.5	5VDC	750mA	0.375x2.0x2.0
MKS3060-2	4.5-5.5	12VDC	600mA	0.375x2.0x2.0
MKS3080-2	4.5-5.5	12VDC	800mA	0.375x2.0x2.0
MKD3060-2	4.5-5.5	±12VDC	±300mA	0.375x2.0x2.0
MKD3080-2	4.5-5.5	±12VDC	±400mA	0.375x2.0x2.0
MKD4060-2	4.5-5.5	±15VDC	±300mA	0.375x2.0x2.0
MKD4080-2	4.5-5.5	±15VDC	±400mA	0.375x2.0x2.0
MA Series				
MAS2075-2	4.5-5.25	5VDC	750mA	0.375x1.0x2.0
MAS3037-2	4.5-5.25	12VDC	375mA	0.375x1.0x2.0
MAS4030-2	4.5-5.25	15VDC	300mA	0.375x1.0x2.0
MAS2075-8	9-36	5VDC	750mA	0.375x1.0x2.0
MAS3037-8	9-36	12VDC	375mA	0.375x1.0x2.0
MAS4030-8	9-36	15VDC	300mA	0.375x1.0x2.0
MAS2075-9	20-72	5VDC	750mA	0.375x1.0x2.0
MAS3037-9	20-72	12VDC	375mA	0.375x1.0x2.0
MAS4030-9	20-72	15VDC	300mA	0.375x1.0x2.0
MAD3037-2	4.5-5.25	±12VDC	±185mA	0.375x1.0x2.0
MAD4030-2	4.5-5.25	±15VDC	±150mA	0.375x1.0x2.0
MAD3037-8	9-36	±12VDC	±185mA	0.375x1.0x2.0
MAD4030-8	9-36	±15VDC	±150mA	0.375x1.0x2.0
MAD3037-9	20-72	±12VDC	±185mA	0.375x1.0x2.0
MAD4030-9	20-72	±15VDC	±150mA	0.375x1.0x2.0
MP/MF Series				
MPS2100-2	4.5-5.5	5VDC	1000mA	0.4x2.0x2.0
MPS2100-8	9-36	5VDC	1000mA	0.4x2.0x2.0
MPS2100-9	20-72	5VDC	1000mA	0.4x2.0x2.0
MPS7066-2	4.5-5.5	9VDC	600mA	0.4x2.0x2.0
MPS7066-8	9-36	9VDC	600mA	0.4x2.0x2.0
MPS7066-9	2-72	9VDC	600mA	0.4x2.0x2.0
MPS3060-2	4.5-5.5	12VDC	600mA	0.4x2.0x2.0
MPS3060-8	9-36	12VDC	600mA	0.4x2.0x2.0
MPS3060-9	20-72	12VDC	600mA	0.4x2.0x2.0
MPS4050-2	4.5-5.5	15VDC	500mA	0.4x2.0x2.0
MPS4050-8	9-36	15VDC	500mA	0.4x2.0x2.0
MPS4050-9	20-72	15VDC	500mA	0.4x2.0x2.0
MPD3060-2	4.5-5.5	±12VDC	±300mA	0.4x2.0x2.0
MPD3060-8	9-36	±12VDC	±300mA	0.4x2.0x2.0
MPD3060-9	20-72	±12VDC	±300mA	0.4x2.0x2.0
MPD4050-2	4.5-5.5	±15VDC	±250mA	0.4x2.0x2.0
MPD4050-8	9-36	±15VDC	±250mA	0.4x2.0x2.0
MPD4050-9	20-72	±15VDC	±250mA	0.4x2.0x2.0

Model Number	Input Voltage Range VDC	Output Voltage	Output Current	Case HxWxL (ins)
ML Series				
MLS2100-2	4.5-5.5VDC	5VDC	1000mA	.4x2.0x1.0
MLS7060-2	4.5-5.5VDC	9VDC	600mA	.4x2.0x1.0
MLS3050-2	4.5-5.5VDC	12VDC	500mA	.4x2.0x1.0
MLS4040-2	4.5-5.5VDC	15VDC	400mA	.4x2.0x1.0
MLS2100-8	9-36VDC	5VDC	1000mA	.4x2.0x1.0
MLS3050-8	9-36VDC	12VDC	500mA	.4x2.0x1.0
MLS4040-8	9-36VDC	15VDC	400mA	.4x2.0x1.0
MLS2100-9	20-72VDC	5VDC	1000mA	.4x2.0x1.0
MLS3050-9	20-72VDC	12VDC	500mA	.4x2.0x1.0
MLS4040-9	20-72VDC	15VDC	400mA	.4x2.0x1.0
MLD3050-2	4.5-5.5VDC	±12VDC	±250mA	.4x2.0x1.0
MLD4040-2	4.5-5.5VDC	±15VDC	±200mA	.4x2.0x1.0
MLD3050-8	9-36VDC	±12VDC	±250mA	.4x2.0x1.0
MLD4040-8	9-36VDC	±15VDC	±200mA	.4x2.0x1.0
MLD3050-9	20-72VDC	±12VDC	±250mA	.4x2.0x1.0
MLD4040-9	20-72VDC	±15VDC	±200mA	.4x2.0x1.0
MR Series				
MRS2300-9	20-72V	5VDC	3000mA	.4x2x1.6
MRS3125-9	20-72V	12VDC	1250mA	.4x2x1.6
MRS4100-9	20-72V	15VDC	1000mA	.4x2x1.6
MRD3125-9	20-72V	±12VDC	±625mA	.4x2x1.6
MRD4100-9	20-72V	±15VDC	±500mA	.4x2x1.6
MS/MT Series				
MSS2300-8	9-36	5VDC	3000mA	.4x2.0x2.0
MTS2300-8	9-36	5VDC	3000mA	.4x2.0x2.0
MSS2300-9	20-72	5VDC	3000mA	.4x2.0x2.0
MTS2300-9	20-72	5VDC	3000mA	.4x2.0x2.0
MSS3125-8	9-36	12VDC	1250mA	.4x2.0x2.0
MTS3125-8	9-36	12VDC	1250mA	.4x2.0x2.0
MSS3125-9	20-72	12VDC	1250mA	.4x2.0x2.0
MTS3125-9	20-72	12VDC	1250mA	.4x2.0x2.0
MSS4100-8	9-36	15VDC	1000mA	.4x2.0x2.0
MTS4100-8	9-36	15VDC	1000mA	.4x2.0x2.0
MSS4100-9	20-72	15VDC	1000mA	.4x2.0x2.0
MTS4100-9	20-72	15VDC	1000mA	.4x2.0x2.0
MSD3125-8	9-36	±12VDC	±625mA	.4x2.0x2.0
MTD3125-8	9-36	±12VDC	±625mA	.4x2.0x2.0
MSD3125-9	20-72	±12VDC	±625mA	.4x2.0x2.0
MTD3125-9	20-72	±12VDC	±625mA	.4x2.0x2.0
MSD4100-8	9-36	±15VDC	±500mA	.4x2.0x2.0
MTD4100-8	9-36	±15VDC	±500mA	.4x2.0x2.0
MSD4100-9	20-72	±15VDC	±500mA	.4x2.0x2.0
MTD4100-9	20-72	±15VDC	±500mA	.4x2.0x2.0
MTT23210-8	9-36	+5/±12VDC	1500/±310mA	.4x2.0x2.0
MTT23210-9	20-72	+5/±12VDC	1500/±310mA	.4x2.0x2.0
MTT24200-8	9-36	+5/±15VDC	1500/±200mA	.4x2.0x2.0
MTT24200-9	20-72	+5/±15VDC	1500/±200mA	.4x2.0x2.0

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DC–DC CONVERTERS

ASTEC 5 TO 40 WATTS SINGLE/MULTIPLE OUTPUT DC/DC CONVERTERS

FEATURES

MJ Series—18-25 Watt Single, Dual, & Triple
- MOSFET Design • Surface Mount Technology
- 4:1 Ultra-wide Input Range
- Continuous foldback short circuit protection
- Regulated outputs
- 500 VDC I/O isolation • Efficiency to 85%

AA Series—25-40 Watt Single/Multi output
- Low profile
- 400 KHz switching frequency
- High efficiency
- Parallelable • Adjustable output

SPECIFICATIONS

Model Number	Input Voltage Range VDC	Output Voltage	Output Current	Case HxWxL (ins)
MJ Series				
MJS2350-8	9-36	5VDC	3500mA	0.83x2.5x3.0
MJS2350-9	20-72	5VDC	3500mA	0.83x2.5x3.0
MJS2500-8	9-36	5VDC	5000mA	0.83x2.5x3.0
MJS2500-9	20-72	5VDC	5000mA	0.83x2.5x3.0
MJS3150-8	9-36	12VDC	1500mA	0.83x2.5xx3.0
MJS3150-9	20-72	12VDC	1500mA	0.83x2.5x3.0
MJS2500-8	9-36	12VDC	2000mA	0.83x2.5x3.0
MJS2500-9	20-72	12VDC	2000mA	0.83x2.5x3.0
MJS4120-8	9-36	15VDC	1200mA	0.83x2.5x3.0
MJS4120-9	20-72	15VDC	1200mA	0.83x2.5x3.0
MJS2560-8	9-36	15VDC	1600mA	0.83x2.5x3.0
MJS2560-9	20-72	15VDC	1600mA	0.83x2.5x3.0
MJD3150-8	9-36	±12VDC	±750mA	0.83x2.5x3.0
MJD3150-9	20-72	±12VDC	±750mA	0.83x2.5x3.0
MJD2580-8	9-36	±12VDC	±1000mA	0.83x2.5x3.0
MJD2580-9	20-72	±12VDC	±1000mA	0.83x2.5x3.0
MJD4120-8	9-36	±15VDC	±600mA	0.83x2.5x3.0
MJD2520-9	20-72	±15VDC	±600mA	0.83x2.5x3.0
MJD2560-8	9-36	±15VDC	±800mA	0.83x2.5x3.0
MJD2560-9	20-72	±15VDC	±800mA	0.83x2.5x3.0
MJ Series Continued				
MJT23260-8	9-36	+5/±12VDC	2000/±310mA	0.83x2.5x3.0
MJT23260-9	20-72	+5/±12VDC	2000/±310mA	0.83x2.5x3.0
MJT23500-8	9-36	+5/±12VDC	3500/±750mA	0.83x2.5x3.0
MJT23500-9	20-72	+5/±12VDC	3500/±750mA	0.83x2.5x3.0
MJT24250-8	9-36	+5/±15VDC	2000/±260mA	0.83x2.5x3.0
MJT24250-9	20-72	+5/±15VDC	2000/±260mA	0.83x2.5x3.0
MJT24450-8	9-36	+5/±15VDC	3500/±500mA	0.83x2.5x3.0
MJT24450-9	20-72	+5/±15VDC	3500/±500mA	0.83x2.5x3.0

	Model Number	Input Voltage	Output Voltage	Output Current	Maximum Power
Single	AA7942A	19-35 V	5 V	8 A	40 W
	AA7946A	19-35 V	15 A	2 A	30 W
	AA7812A	35-63 V	5 A	8 A	40 W
	AA7816A	35-63 V	15 A	2 A	30 W
Dual	AA7944A	19-35 V	±12 V	2.5 A/2 A	30 W
	AA7814A	35-63 V	±12 V	2.5 A/2 A	30 W
Triple	AA7941A	19-35 V	5 V, ±12 V	5 A, ±1 A	25 W
	AA7945A	19-35 V	5 V, ±15 V	5 A, ±0.8A	25 W
	AA7811A	35-63 V	5 v, ±12 V	5 A, ±1A	25 W
	AA7815A	35-63 V	5 V, ±15 V	5 A, ±0.8 A	25 W

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DC/DC CONVERTERS 0710-DIP 0730-SIP

TECHNICAL INFORMATION

GENERAL SPECIFICATIONS

Isolation Voltage	500 VDC min.
Operating Temperature Range	−25 to 80°C
Storage Temperature Range	−55 to 110°C
Efficiency at Full Load, 12 and 15 Volt Output Types	75% min.
Efficiency at Full Load, 5 Volt Output Types	70% min.
Isolation Resistance	10^9 Ohm min.

INPUT SPECIFICATIONS

Input Voltage Range	±10%
Input Filter	Capacitor Type

OUTPUT SPECIFICATIONS

Voltage Accuracy	±5%
Load Voltage Regulation (1 mA min. load)	±10%
Line Voltage Regulation	1%/1% of Vin
Ripple and Noise, 20 MHz BW	50 mV p-p max.
Temperature Coefficient	0.03%/°C max.
Short Circuit Protection	1.0 second
Total Output Power (May be drawn from one pin)	750 mW

Specifications Subject to Change Without Notice

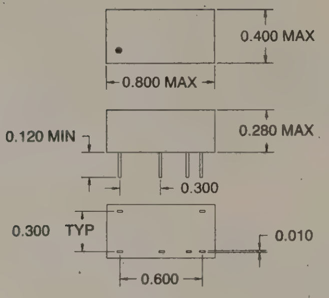
0.400 MAX
0.800 MAX
0.120 MIN
0.280 MAX
0.300
0.300 TYP
0.010
0.600

Fig. 1

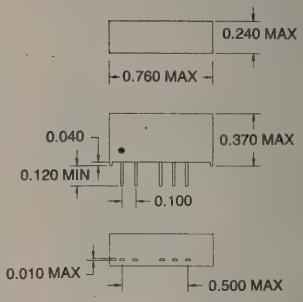
0.240 MAX
0.760 MAX
0.040
0.370 MAX
0.120 MIN
0.100
0.010 MAX
0.500 MAX

Fig. 2

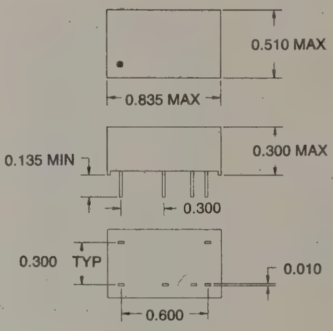
0.510 MAX
0.835 MAX
0.135 MIN
0.300 MAX
0.300
0.300 TYP
0.010
0.600

Fig. 3

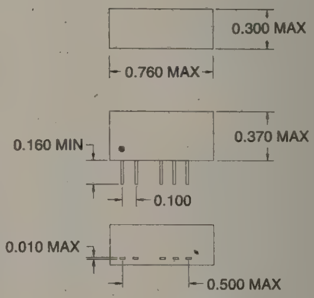
0.300 MAX
0.760 MAX
0.160 MIN
0.370 MAX
0.100
0.010 MAX
0.500 MAX

Fig. 4

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (Each Output) (mA)	Package Type
0710-0505-00	5	± 5	75	DIP (Fig. 1)
0710-0512-00	5	±12	30	DIP (Fig. 1)
0710-0515-00	5	±15	25	DIP (Fig. 1)
0730-0505-00	5	± 5	75	SIP (Fig. 2)
0730-0512-00	5	±12	30	SIP (Fig. 2)
0730-0515-00	5	±15	25	SIP (Fig. 2)
0710-1205-00	12	± 5	75	DIP (Fig. 1)
0710-1212-00	12	±12	30	DIP (Fig. 1)
0710-1215-00	12	±15	25	DIP (Fig. 1)
0730-1205-00	12	± 5	75	SIP (Fig. 2)
0730-1212-00	12	±12	30	SIP (Fig. 2)
0730-1215-00	12	±15	25	SIP (Fig. 2)
0710-2405-00	24	± 5	75	DIP (Fig. 1)
0710-2412-00	24	±12	30	DIP (Fig. 1)
0710-2415-00	24	±15	25	DIP (Fig. 1)
0730-2405-00	24	± 5	75	SIP (Fig. 2)
0730-2412-00	24	±12	30	SIP (Fig. 2)
0730-2415-00	24	±15	25	SIP (Fig. 2)
0710-4805-01	48	± 5	75	DIP (Fig. 3)
0710-4812-01	48	±12	30	DIP (Fig. 3)
0710-4815-01	48	±15	25	DIP (Fig. 3)
0730-4805-01	48	± 5	75	SIP (Fig. 4)
0730-4812-01	48	±12	30	SIP (Fig. 4)
0730-4815-01	48	±15	25	SIP (Fig. 4)

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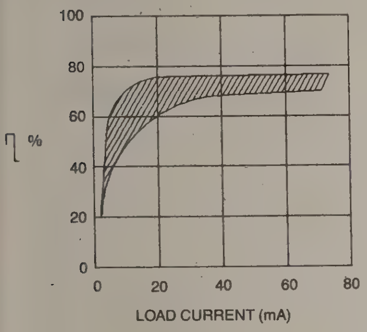
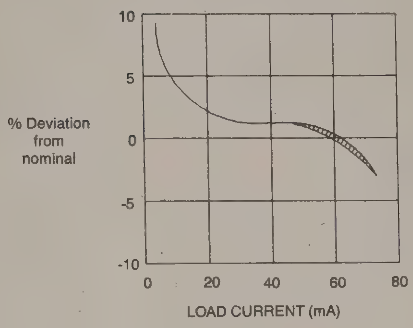
DC/DC CONVERTERS 0710-DIP 0730-SIP

±5 VOLT OUTPUT CONVERTERS

EFFICIENCY VS LOAD CURRENT



OUTPUT VOLAGE REGULATION



PART NUMBER

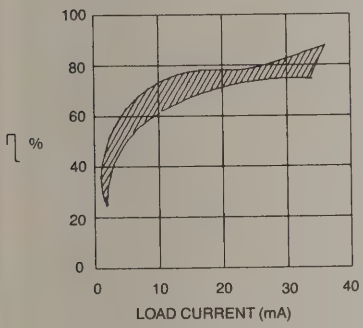
0710 - 05 15 - 00
0710 = DIP
0730 = SIP
Input Voltage
Output Voltage
Package Size

Example: DC/DC converter with 5 Volt input, ±15 Volt output in a DIP package.

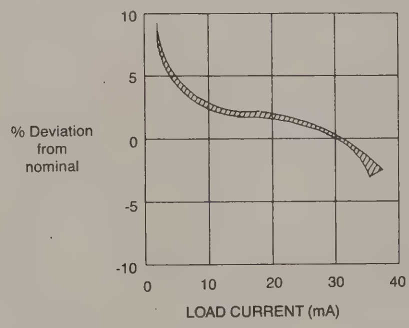
0710-0515-00

±12 VOLT OUTPUT CONVERTERS

EFFICIENCY VS LOAD CURRENT

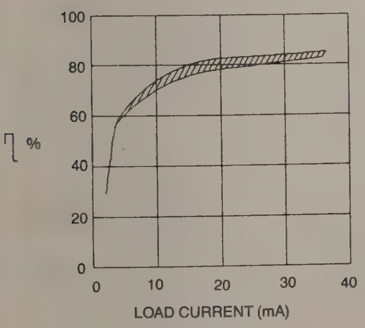


OUTPUT VOLAGE REGULATION

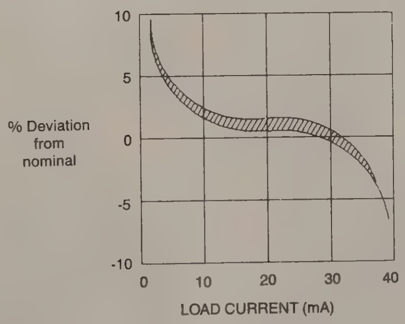


±15 VOLT OUTPUT CONVERTERS

EFFICIENCY VS LOAD CURRENT



OUTPUT VOLAGE REGULATION



Specifications Subject to Change Without Notice

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MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
0000	0	8-1	① NUL	② DLE	③ DS	④	⑤ SP	⑥ &	⑦ -	⑧					⑨	⑩	⑪	⑫ 0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	
				11				11				11	11	11		11	11	11	Zone Punches
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

BURR-BROWN®

DC/DC CONVERTER

POWER CONVERTIBLES™ PRODUCT PORTFOLIO

SERIES	POWER (WATTS)	INPUT VOLTAGES (PLUS OR MINUS)						OUTPUT VOLTAGES							# OF CHANNELS	OUTPUTS PER CHANNEL	REGULATION	ISOLATION VOLTAGE (TEST)	SHIELDING	SHORT CIRCUIT PROTECTION	NOTES
								PLUS OR MINUS				PLUS AND MINUS									
HPR1XX	0.75	5	12	15	24			5		12	15	5	12	15	1	S/D	U	750	NO	Momentary	SIP
HPR4XX	0.75	5	12	15	24			5		12	15	5	12	15	1	S/D	U	3000	NO	Momentary	HIGH ISOLATION SIP
PWR59XX	1.00	5	12	15	24			5	9	12	15	5	12	15	1	S/D	R	750	NO	Continuous	DIP
PWR11XX	1.50	5	12	15	24			5	9	12	15	5	12	15	1	S/D	U	500	NO	Momentary	DIP
PWR13XX	1.50	5	12	15				5		12	15	5	12	15	1	S/D	U	8000	NO	5 Seconds	HIGH ISOLATION DIP
PWR60XX	1.80	5	12	15	24			5					12	15	1	S/D	R	500	NO	Continuous	LOW COST STD PINOUT
PWR3XX	2.00	5	12	15	24	28	48	5		12	15	5	12	15	2	S/D	U	3000	YES	Continuous	DUAL CHANNEL
WP02R	2.00	4-20		18-36		36-72		5				5		15	1	S/D	R	500	NO	Continuous	WIDE INPUT RANGE DIP
LE02R	2.25	5	12						9						1	S	R	2000	NO	30 Seconds	LAN
LP02U	2.25	5	12						9						1	S	U	500	NO	Momentary	LAN
PWR12XX	3.00	5	12	15	24			5	9	12	15	5	12	15	1	S/D	U	500	NO	Momentary	DIP
HPR2XX	3.00	5	12	15	24							5	12	15	4	D	U	750	NO	Momentary	QUAD CHANNEL SIP
WP03R	3.00			18-36		36-72		5				5	12	15	1	S/D	R	500	NO	10 Seconds	WIDE INPUT RANGE DIP
PWR40XX	4.00	5	12	15	24			5		12			12	15	1	S/D	U	500/ 3000	NO	Momentary	HIGH ISOLATION OPTION 3000V
PWR5XX	4.00	5	12	15	24	28	48	5		12	15	5	12	15	4	S/D	U	750	YES	Momentary	QUAD CHANNEL
HPR7XX	5.00	5	12	15				5				5	12	15	1	S/D	U	500	YES	Momentary	SIP
PWR1546A	5.00	5												15	1	D	R	750	YES	Continuous	ULTRA LOW NOISE
PWR70XX	5.00	5	12	15	24		48	5				5	12	15	1	S/D	R	500	YES	Continuous	LOW COST STD PINOUT
PWR8XX	5.00	5	12	15	24	28	48	5					12	15	2	T	U	3000	YES	Momentary	TRIPLE OUTPUT
WP05R	5.00				24		48	5		12	15	5	12	15	1	S/D	R	500	YES	Continuous	WIDE INPUT RANGE DIP
PWR62XX	5.20	5	12	15	24	28	48	–5.2							1	S	R	500	YES	Continuous	ECL
PWR16XX	6.00	5	12	15	24			5		12			12	15	1	S/D	U	500	YES	Momentary	LOW COST STD PINOUT
PWR510X	9.00	5											12	15	1	D	R	750	YES	15 Seconds	LOW NOISE
WP15R	15.00	9-18		18-36		36-72		5			15		12	15	1	S/D/T	R	500	YES	Continuous	WIDE RANGE RANGE

Produced in July 1993.

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BURR-BROWN® BB P.O. Box 11400, Tucson, AZ 85734 Call: 1-800-548-6132 Fax: 1-602-741-3895

HPR1XX SERIES

0.75 WATTS UNREGULATED

- Low Cost
- Single-In-Line Package (SIP)
- Internal Input and Output Filtering
- Non-Conductive Case
- High Output Power Density: 10 Watts/Inch³
- Extended Temperature Range: –25°C to +85°C
- High Efficiency: to 80%

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT NO LOAD (mA)	INPUT CURRENT RATED LOAD (mA)	REFLECTED RIPPLE CURRENT (mAp-p)	EFFICIENCY (%)
HPR100	5	5	150	20	216	10	69
HPR102	5	15	50	20	199	5	75
HPR103	5	±5	±75	20	208	5	70
HPR104	5	±12	±30	20	192	5	78
HPR105	5	±15	±25	20	190	5	79
HPR106	12	5	150	10	90	5	69
HPR107	12	12	62	10	81	5	77
HPR108	12	15	50	10	78	5	80
HPR109	12	±5	±75	10	87	5	72
HPR110	12	±12	±30	10	78	5	80
HPR111	12	±15	±25	10	78	5	80
HPR112	15	5	150	8	72	5	69
HPR116	15	±12	±30	8	63	5	80
HPR117	15	±15	±25	8	63	5	80
HPR118	24	5	150	8	44	15	70
HPR120	24	15	50	8	41	15	76
HPR121	24	±5	±75	8	41	15	76
HPR122	24	±12	±30	8	40	15	78
HPR123	24	±15	±25	8	40	15	79

PWR59XX SERIES

.5 to 1 WATT REGULATED

- High Reliability
- 24-Pin DIP Package
- Internal Input and Output Filtering
- Short-Circuit Current Limited
- Thermal Overload Protection
- Built-In Stand-offs
- Industry Standard Pinout

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT NO LOAD (mA)	INPUT CURRENT RATED LOAD (mA)	REFLECTED RIPPLE CURRENT (mAp-p)	EFFICIENCY (%)	RATED OUTPUT POWER (mW)
PWR5900	5	5	100	40	175	10	57	500
PWR5901	5	9	111	40	345	10	57	1000
PWR5902	5	12	83	40	345	10	57	1000
PWR5903	5	15	67	40	345	10	57	1000
PWR5904	5	±5	±50	40	175	10	57	500
PWR5905	5	±12	±42	40	345	10	57	1000
PWR5906	5	±15	±33	40	345	10	57	1000
PWR5907	12	5	100	35	100	30	42	500
PWR5908	12	9	111	35	170	30	49	1000
PWR5909	12	12	83	35	150	30	55	1000
PWR5910	12	15	67	35	150	30	55	1000
PWR5911	12	±5	±50	35	76	30	55	500
PWR5912	12	±12	±42	35	150	30	55	1000
PWR5913	12	±15	±33	35	150	30	55	1000
PWR5914	15	5	100	30	76	20	44	500
PWR5915	15	9	111	30	135	20	50	1000
PWR5916	15	12	83	30	120	20	55	1000
PWR5917	15	15	67	30	120	20	55	1000
PWR5918	15	±5	±50	30	60	20	55	500
PWR5919	15	±12	±42	30	120	20	55	1000
PWR5020	15	±15	±33	30	120	20	55	1000
PWR5921	24	5	100	15	43	10	48	500
PWR5922	24	9	111	15	83	10	50	1000
PWR5923	24	12	83	15	73	10	55	1000
PWR5924	24	15	67	15	73	10	55	1000
PWR5925	24	±5	±50	15	40	10	55	500
PWR5926	24	±12	±42	15	73	10	60	1000
PWR5927	24	±15	±33	15	73	10	60	1000

PWR13XX SERIES

1.5 WATTS UNREGULATED

- High Isolation - 4000V Rating
- 8000V Isolation Test Voltage
- Barrier 100% Production Tested
- Low Barrier Capacitance - 10pf
- Low Leakage Current - 2µA Max
- 24-Pin DIP Package
- Internal Filtering

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT NO LOAD (mA)	INPUT CURRENT RATED LOAD (mA)	REFLECTED RIPPLE CURRENT (mAp-p)
PWR130	5	5	300	50	400	30
PWR1301	5	12	125	50	400	30
PWR1302	5	15	100	50	400	30
PWR1303	5	±5	±150	50	400	30
PWR1304	5	±12	±63	50	400	30
PWR1305	5	±15	±50	50	400	30
PWR1306	12	5	300	30	167	25
PWR1307	12	12	125	30	167	25
PWR1308	12	15	100	30	167	25
PWR1309	12	±5	±150	30	167	25
PWR1310	12	±12	±63	30	167	25
PWR1311	12	±15	±50	30	167	25
PWR1312	15	5	300	30	133	20
PWR1313	15	12	125	30	133	20
PWR1314	15	15	100	30	133	20
PWR1315	15	±5	±150	30	133	20
PWR1316	15	±12	±63	30	133	20
PWR1317	15	±15	±50	30	133	20

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WP02R SERIES

2 WATTS REGULATED

- Low-Cost
- Small DIP Package Size
- Full Power to +85°C
- Extended Temperature Range: –40°C TO +85°C
- Industry Standard Pinouts

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT		INPUT CURRENT		EFFICIENCY (%)
			MIN LOAD (mA)	RATED LOAD (mA)	MIN LOAD (mA)	RATED LOAD (mA)	
WP02R05S05	5	5	100	400	150	615	65
WP02R05D05	5	±5	±50	±200	150	580	69
WP02R05D15	5	±15	±20	±67	195	570	70
WP02R12S05	12	5	100	400	65	230	73
WP02R12D05	12	±5	±50	±200	65	225	75
WP02R12D12	12	±12	±21	±83	85	220	76
WP02R12D15	12	±15	±20	±67	85	220	76
WP02R15S05	15	5	100	400	50	180	75
WP02R15D05	15	±5	±50	±200	50	175	76
WP02R15D15	15	±15	±20	±67	65	175	77
WP02R24S05	24	5	100	400	40	120	69
WP02R24D05	24	±5	±50	±200	40	120	69
WP02R24D15	24	±15	±20	±67	40	120	70
WP02R48S05	48	5	100	400	20	60	69
WP02R48D05	48	±5	±50	±200	20	60	69
WP02R48D15	48	±15	±20	±67	20	60	70

PWR3XX SERIES

2 WATTS UNREGULATED

- Barrier Leakage Current 100% Tested at 240Vac
- 3000V Isolation Test Voltage
- Single or Dual Unregulated Outputs
- Wide Operating Temperature Range: –40°C to +100°C
- Input and Output Filtering
- Six-Sided Shielding

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	MAXIMUM INPUT CURRENT (mA)
PWR300	5	5	200	690
PWR301	5	12	84	690
PWR302	5	15	67	690
PWR303	5	±5	±100	690
PWR304	5	±12	±42	690
PWR305	5	±15	±34	690
PWR306	12	5	200	265
PWR307	12	12	84	265
PWR308	12	15	67	265
PWR309	12	±5	±100	265
PWR310	12	±12	±42	265
PWR311	12	±15	±34	265
PWR312	15	5	200	205
PWR313	15	12	84	205
PWR314	15	15	67	205
PWR315	15	±5	±100	205
PWR316	15	±12	±42	205
PWR317	15	±15	±34	205
PWR318	24	5	200	130
PWR319	24	12	84	130
PWR320	24	15	67	130
PWR321	24	±5	±100	130
PWR322	24	±12	±42	130
PWR323	24	±15	±34	130
PWR324	28	5	200	115
PWR325	28	12	84	115
PWR326	28	15	67	115
PWR327	28	±5	±100	115
PWR328	28	±12	±42	115
PWR329	28	±15	±34	115
PWR330	48	5	200	70
PWR331	48	12	84	70
PWR332	48	15	67	70
PWR333	48	±5	±100	70
PWR334	48	±12	±42	70
PWR335	48	±15	±34	70

LE02R SERIES

2.25 WATTS REGULATED

- Low Cost
- High Volume Assembly
- Internal Filtering
- Low Output Noise
- Surface Mount Construction
- Surface Mount Magnetics
- Enable Pin

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		EFFICIENCY (%)
				NO LOAD (mA)	RATED LOAD (mA)	
LE02R05S09	5	–9	225	85	650	64
LE02R12S09	12	–9	225	55	280	65

LP02U SERIES

2.25 WATTS UNREGULATED

- 24-Pin DIP Package
- Internal Filtering
- Low Output Noise
- Temperature Range: –25°C to +70°C
- Surface Mount Construction

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		EFFICIENCY (%)
				NO LOAD (mA)	RATED LOAD (mA)	
LP02U05S09	5	9	250	50	568	80
LP02U12S09	12	9	250	30	240	77

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HPR2XX SERIES

3 WATTS UNREGULATED

- Four Channels of Isolated Power
- High Output Power Density: > 9.4 Watts/Inch³
- High Efficiency: to 84%
- Low Cost
- High Isolation Voltage: 750V Continuous Input-to-Output and Channel-to-Channel

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)	EFFICIENCY (%)
				MIN LOAD (mA)	RATED LOAD (mA)		
HPR203	5	±5.2	±73	70	820	35	74
HPR204	5	±12	±30	75	750	35	80
HPR205	5	±15	±25	75	750	35	80
HPR210	12	±12	±30	30	305	15	82
HPR211	12	±15	±25	30	300	15	84
HPR216	15	±12	±30	20	240	15	83
HPR217	15	±15	±25	20	240	20	84
HPR221	24	±5	±75	20	170	20	74
HPR223	24	±15	±25	20	155	20	81

PWR12XX SERIES

3 WATTS UNREGULATED

- Low Cost
- Industry-Standard Package
- Single and Dual Outputs
- 24-Pin DIP Package
- Built-In Stand-offs
- Internal Input and Output Filtering

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)
				NO LOAD (mA)	RATED LOAD (mA)	
PWR1200	5	5	600	30	800	45
PWR1201	5	12	250	30	800	45
PWR1202	5	15	200	30	800	45
PWR1203	5	±5	±300	30	800	45
PWR1204	5	±12	±125	30	800	45
PWR1205	5	±15	±100	30	800	45
PWR1206	12	5	600	30	330	25
PWR1207	12	12	250	30	330	25
PWR1208	12	15	200	30	330	25
PWR1209	12	±5	±300	30	330	25
PWR1210	12	±12	±125	30	330	25
PWR1211	12	±15	±100	30	330	25
PWR1212	15	5	600	30	265	20
PWR1213	15	12	250	30	265	20
PWR1214	15	15	200	30	265	20
PWR1215	15	±5	±300	30	265	20
PWR1216	15	±12	±125	30	265	20
PWR1217	15	±15	±100	30	265	20
PWR1218	24	5	600	30	165	20
PWR1219	24	12	250	30	165	20
PWR1220	24	15	200	30	165	20
PWR1221	24	±5	±300	30	165	20
PWR1222	24	±12	±125	30	165	20
PWR1223	24	±15	±100	30	165	20
PWR1240	5	9	333	30	800	45
PWR1241	12	9	333	30	330	25
PWR1242	15	9	333	30	265	20
PWR1243	24	9	333	30	165	20

PWR40XX SERIES

4 WATTS UNREGULATED

- Low Cost
- Industry-Standard Package
- Single and Dual Outputs
- Internal Input and Output Filtering
- High Isolation Voltage Option Available

MODEL	MINIMUM INPUT VOLTAGE (VDC)	NOMINAL INPUT VOLTAGE (VDC)	MAXIMUM INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)
						NO LOAD (mA)	RATED LOAD (mAp-p)	
PWR4000	4.5	5	5.5	5	800	50	950	20
PWR4004	4.5	5	5.5	±12	±170	50	950	20
PWR4005	4.5	5	5.5	±15	±135	50	950	20
PWR4006	10.2	12	13.8	5	800	35	400	30
PWR4007	10.2	12	13.8	12	340	35	400	30
PWR4010	10.2	12	13.8	±12	±170	35	400	30
PWR4011	10.2	12	13.8	±15	±135	35	400	40
PWR4012	12.75	15	17.25	5	800	30	300	40
PWR4016	12.75	15	17.25	±12	±170	30	300	40
PWR4017	12.75	15	17.25	±15	±135	30	300	40
PWR4018	20.40	24	27.6	5	800	30	180	40
PWR4022	20.40	24	27.6	±12	±170	30	180	40
PWR4023	20.40	24	27.6	±15	±135	30	180	40

PWR70XX SERIES

5 WATTS REGULATED

- High Reliability
- Short-Circuit Protected
- Foldback Current Limit
- High Efficiency
- Linear Output Regulation
- Tracking Outputs
- Six-Sided Shielding
- Internal Input and Output Filtering
- Non-Conductive Case
- Industry Standard Pinout
- 500VDC Isolation

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)	EFFICIENCY (%)
				NO LOAD (mA)	RATED LOAD (mA)		
PWR7000	5	5	1000	50	1580	30	63
PWR7004	5	±12	±210	50	1490	30	67
PWR7005	5	±15	±167	50	1450	30	69
PWR7006	12	5	1000	30	620	30	67
PWR7010	12	±12	±210	30	580	30	72
PWR7011	12	±15	±167	30	570	30	73
PWR7012	15	5	1000	30	500	30	67
PWR7016	15	±12	±210	30	480	30	70
PWR7017	15	±15	±167	30	460	30	73
PWR7018	24	5	1000	30	320	30	65
PWR7022	24	±12	±210	30	310	30	67
PWR7023	24	±15	±167	30	305	30	68
PWR7030	48	5	1000	20	165	30	63
PWR7033	48	±5	±500	20	168	30	62

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WP05R SERIES
5 WATTS REGULATED

- Small Package Size: 1" X 2"
- Industry Standard Pinout
- Surface Mount Devices (SMD)
- Low-Cost Alternate Source
- Continuous Short Circuit Protection
- UL1950 Recognition (Some Models Pending)

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT		INPUT CURRENT		EFFICIENCY (%)
			MIN LOAD (mA)	RATED LOAD (mA)	MIN LOAD (mA)	RATED LOAD (mA)	
WP05R24S05	24	5	50	1000	20	265	78
WP05R24S12	24	12	21	417	20	255	82
WP05R24S15	24	15	17	333	20	250	83
WP05R24D05	24	±5	±25	±500	20	265	78
WP05R24D12	24	±12	±10	±208	20	255	82
WP05R24D15	24	±15	±8	±167	20	250	83
WP05R48S05	48	5	50	1000	13	135	78
WP05R48S12	48	12	21	417	13	127	82
WP05R48S15	48	15	17	333	13	125	83
WP05R48D05	48	±5	±25	±500	13	135	78
WP05R48D12	48	±12	±10	±208	13	127	82
WP05R48D15	48	±15	±8	±167	13	125	83

HPR7XX SERIES
5 WATTS UNREGULATED

- Efficiency >80%
- SIP Package
- High Power Density: > 16 Watts/Inch³
- Low Cost
- Single and Dual Outputs
- Internal Input and Output Filtering
- Six-Sided Shielding

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)	EFFICIENCY (%)
				MIN LOAD (mA)	RATED LOAD (mA)		
HPR700	5	5	1000	70	1250	15	80
HPR703	5	±5	±500	70	1250	15	80
HPR704	5	±12	±208	70	1190	15	84
HPR705	5	±15	±167	70	1190	15	84
HPR706	12	5	1000	25	490	15	80
HPR710	12	±12	±208	25	490	15	85
HHPR711	12	±15	±167	25	490	15	85
HPR712	15	5	1000	20	407	15	82
HPR717	15	±15	±167	20	392	15	85

PWR8XX SERIES
5 WATTS UNREGULATED

- Isolation Voltage Test Methods
- Per UL544, VDE750, & CSA C22.2 Dielectric Withstand Requirement
- Barrier Leakage Current 100% Tested at 240VAC
- 5V Single and ±12V or ±15V Dual Outputs
- Wide Oper. Temp Range: –40°C to +100°C • Input and Output Filtering
- Six-Sided Shielding

MODEL	NOMINAL INPUT VOLTAGE (VDC)	CHANNEL 1 RATED OUTPUT		CHANNEL 2 RATED OUTPUT		MAXIMUM INPUT CURRENT (MA)
		VOLTAGE (VDC)	CURRENT (MA)	VOLTAGE (MA)	CURRENT (MA)	
PWR800	5	5	250	±12	±156	1665
PWR801	5	5	250	±15	±125	1665
PWR802	12	5	250	±12	±156	695
PWR803	12	5	250	±15	±125	695
PWR804	15	5	250	±12	±156	555
PWR805	15	5	250	±15	±125	555
PWR806	24	5	250	±12	±156	345
PWR807	24	5	250	±15	±125	345
PWR808	28	5	250	±12	±156	295
PWR809	28	5	250	±15	±125	295
PWR810	48	5	250	±12	±156	170
PWR811	48	5	250	±15	±125	170

PWR16XX SERIES
5-6 WATTS UNREGULATED

- Typical Efficiency: 82%
- Low Cost
- Industry-Standard Package
- Single and Dual Outputs
- 100% Non-Conductive Case
- Six-Sided Shielding
- 20mVrms Ripple and Noise with no External Components

MODEL	MINIMUM INPUT VOLTAGE (VDC)	RATED INPUT VOLTAGE (VDC)	MAXIMUM INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	RATED OUTPUT CURRENT (mA)	INPUT CURRENT		REFLECTED RIPPLE CURRENT (mAp-p)
						NO LOAD (mA)	RATED LOAD (mA)	
PWR1600	4.5	5	5.5	5	1000	50	1220	60
PWR1604	4.5	5	5.5	±12	±250	50	1460	60
PWR1605	4.5	5	5.5	±15	±200	50	1460	60
PWR1606	10	12	14	5	1000	30	510	60
PWR1607	10	12	14	12	500	30	610	60
PWR1610	10	12	14	±12	±250	30	610	60
PWR1611	10	12	14	±15	±200	30	610	60
PWR1612	13	15	17	5	1000	30	410	60
PWR1616	13	15	17	±12	±250	30	490	60
PWR1617	13	15	17	±15	±200	30	490	60
PWR1618	21	24	28	5	1000	30	260	60
PWR1622	21	24	28	±12	±250	30	305	60
PWR1623	21	24	28	±15	±200	30	305	60

WP15R SERIES
15 WATTS REGULATED

- Wide Temperature Range: –40° to +85°
- High Efficiency: >75%
- Short-Circuit Protection
- Six-Sided Shielding
- Remote On/Off
- Overvoltage Protection
- <1mA Shutdown Idle Current

MODEL	NOMINAL INPUT VOLTAGE (VDC)	RATED OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT		INPUT CURRENT		EFFICIENCY (%)
			MIN LOAD (A)	RATED LOAD (A)	MIN LOAD (mA)	RATED LOAD (mA)	
WP15R12S05	12	5	0.75	3	750	1650	76
WP15R23S05	24	5	0.75	3	375	750	83
WP15R24S15	24	15	0.25	1	375	750	83
WP15R48S05	48	5	0.75	3	185	375	83
WP15R12D12	12	±12	±0.156	±0.625	750	1650	76
WP15R12D15	12	±15	±0.125	±0.5	750	1650	76
WP15R24D12	24	±12	±0.156	±0.625	375	750	83
WP15R24D15	24	±15	±0.125	±0.5	375	750	83
WP15R48D12	48	±12	±0.156	±0.625	185	375	83
WP15R48D15	48	±15	±0.125	±0.5	185	380	83
WP15R12T12	12	5, ±12	0.375, ±0.077	1.5, ±0.31	750	1650	75
WP15R12T15	12	5, ±15	0.375, ±0.063	1.5, ±0.25	750	1650	76
WP15R24T12	24	5, ±12	0.375, ±0.077	1.5, ±0.31	375	780	80
WP15R24T15	24	5, ±15	0.375, ±0.063	1.5, ±0.25	375	780	80
WP15R48T12	48	5, ±12	0.375, ±0.077	1.5, ±0.31	185	380	82
WP15R48T15	48	5, ±15	0.375, ±0.063	1.5, ±0.25	185	380	82

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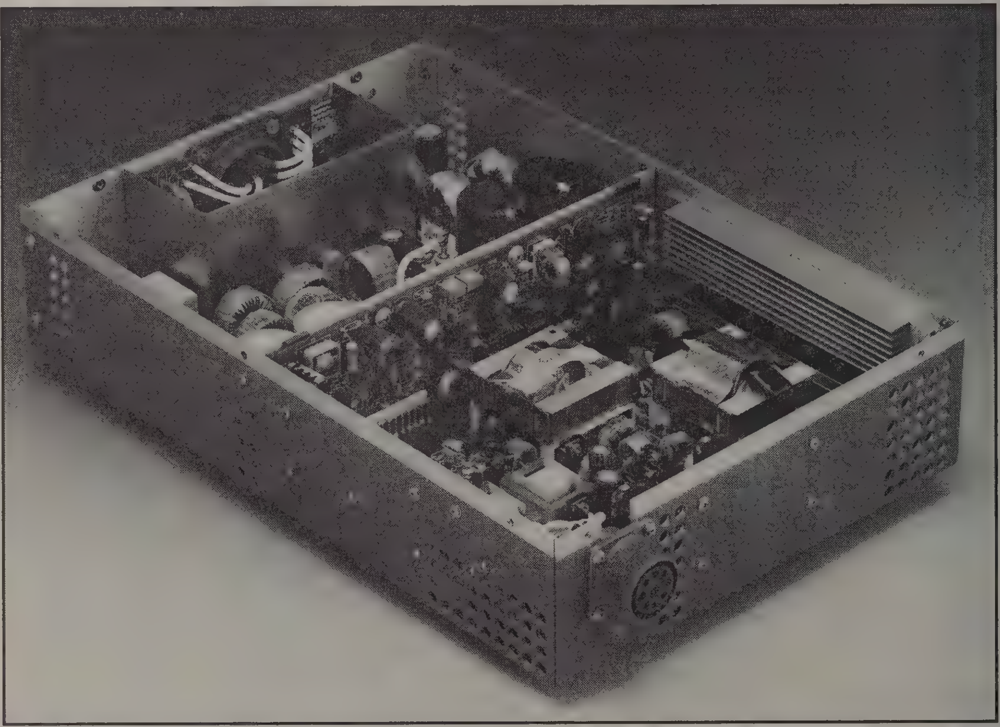

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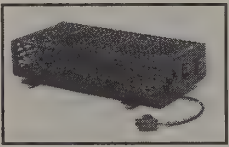

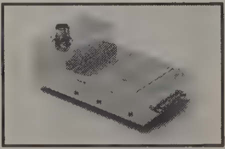

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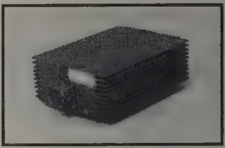

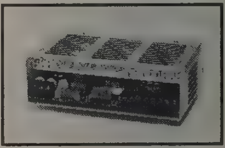

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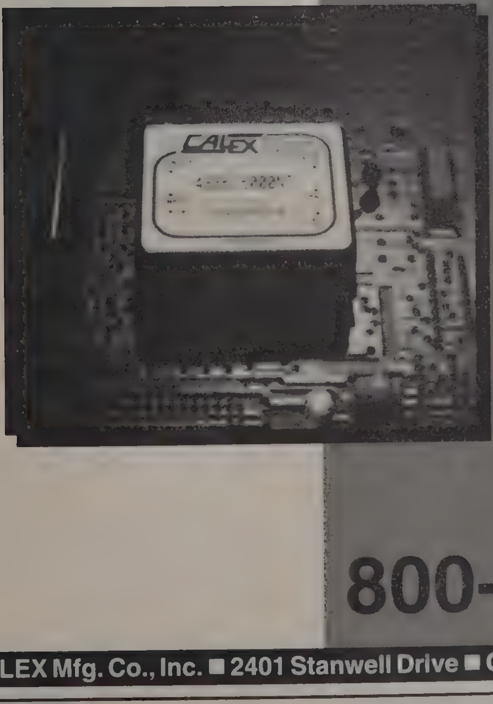

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5 VOLTS DC INPUT

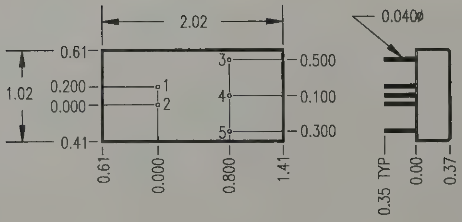
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
5	1000	4.75-5.25	5	10	59	D	5S5.1000
12	450	4.75-5.25	5	10	60	D	5S12.450
15	350	4.75-5.25	5	10	62	D	5S15.350
DUAL OUTPUT							
±12	±75	4.6-5.5	1.8	15	55	E	5D12.075
±12	±125	4.5-5.5	3	10	43	D	5D12.125A
±12	±185	4.75-5.25	4.5	10	62	D	5D12.185A
±15	±60	4.6-5.5	1.8	15	55	E	5D15.060
±15	±100	4.5-5.5	3	10	43	D	5D15.100A
±15	±150	4.75-5.25	4.5	10	62	D	5D15.150A

12 VOLTS DC INPUT

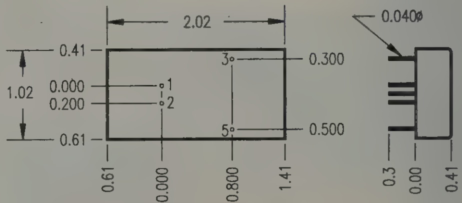
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
3.3	2000	9-18	6.6	60	78	E1	12S3.2000NT
3.3	4000	9-18	13	50	76	D1	12S3.4000NT
3.3	10 Amps	9-18	*	*	*	XC	12S3.10XC
5	1000	11.16-13.2	5	10	60	D	12S5.1000
5	1000	7-32	5	10	75	D	12S5.1000WF
5	1500	9-27	7.5	10	77	D	12S5.1500FW
5	2000	9-27	10	10	70	B1	12S5.2000
5	2000	9-18	10	60	77	E1	12S5.2000NT
5	3000	9-27	15	20	78	XC	12S5.3000XC
5	4000	9-18	20	50	79	D1	12S5.4000NT
5	5000	7-40	25	20	81	XC	12S5.5000UW
5	5000	9-36	25	20	79	U	24S5.5000XW
5	10 Amps	9-18	50	*	*	XC	12S5.10XC
5	10 Amps	9-18	50	20	77	U	12S5.10XW
12	500	11.16-13.2	6	10	68	D	12S12.500
12	625	9-27	7.5	10	81	D	12S12.625FW
12	900	9-18	11	60	81	E1	12S12.900NT
12	1000	9-27	12	10	70	B1	12S12.1000
12	1250	9-27	15	20	70	XC	12S12.1250XC
12	1700	9-18	21	50	79	D1	12S12.1700NT
12	1700	18-36	21	50	85	D1	24S12.1700NT
12	2500	9-36	30	20	81	U	24S12.2500XW
12	5000	9-18	60	20	79	U	12S12.5XW
12	5000	9-18	60	*	*	XC	12S12.5XC

*Preliminary Specifications - Call 800-542-3355 for Details

E CASE



E1 CASE



Call 800-542-3355 for each model's pin designation

2401 Stanwell Drive ■ Concord, CA 94520-4841 ■ (510)687-4411 ■ 800-542-3355 ■ FAX: (510)687-3333

DC/DC Converters

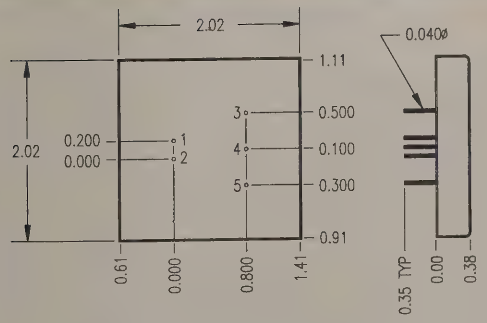
CALEX

12 VOLTS DC INPUT

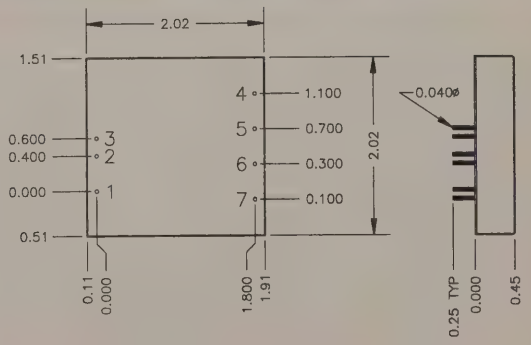
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
15	400	11.16-13.2	6	10	69	D	12S15.400
15	500	9-27	7.5	10	82	D	12S15.500FW
15	700	9-18	11	60	83	E1	12S15.700NT
15	800	9-27	12	10	70	B1	12S15.800
15	1000	9-27	15	20	82	XC	12S15.1000XC
15	1400	9-18	21	50	79	D1	12S15.1400NT
15	2000	9-36	30	20	83	U	24S15.2000XW
15	4000	9-18	60	*	*	XC	12S15.4XC
15	4000	9-18	60	20	82	U	12S15.4XW
DUAL OUTPUT							
±5	±1700	9-18	17	60	*	D1	12D5.1700NT
±5	±5000	9-18	50	*	*	XC	12D5.5000XC
±12	±75	10.8-13.8	1.8	15	57	E	12D12.075
±12	±250	11.16-13.2	6	10	67	D	12D12.250
±12	±500	9-27	12	10	70	B1	12D12.500
±12	±850	9-18	20	60	*	D1	12D12.850NT
±12	±1250	9-18	30	20	81	U	12D12.1250XW
±12	±2500	9-18	60	*	*	XC	12D12.2500XC
±15	±60	10.8-13.8	1.8	15	57	E	12D15.060
±15	±200	11.16-13.2	6	10	71	D	12D15.200
±15	±400	9-27	12	10	70	B1	12D15.400
±15	±700	9-18	21	60	*	D1	12D15.700NT
±15	±1000	9-18	30	20	81	U	12D15.1000XW
±15	±2000	9-18	60	*	*	XC	12D15.2000XC
TRIPLE OUTPUT							
5, ±12	800, ±185	9-36	8.5	20	78	XC	12T5.12UW
5, ±12	1500, ±310	9-18	15	20	78	XC	12T5.12SW
5, ±12	2500, ±500	10-20	25	20	80	XC	12T5.12XC
5, ±12	3000, ±500	9-36	27	35	83	XC	12T5.12LE
5, ±12	5000, ±1250	9-18	55	15	81	K	12T5.12K
5, ±15	800, ±150	9-36	8.5	20	78	XC	12T5.15UW
5, ±15	1500, ±150	9-18	15	20	78	XC	12T5.15SW
5, ±15	3000, ±400	9-36	27	35	83	XC	12T5.15LE
5, ±15	2500, ±400	10-20	25	20	80	XC	12T5.15XC
5, ±15	5000, ±1000	9-18	55	15	81	K	12T5.15K

*Preliminary Specifications - Call 800-542-3355 for Details

D CASE


2.02
0.040ø
1.11
3
0.500
0.200
1
2.02
4
0.100
0.000
2
5
0.300
0.91
0.61
0.000
0.800
1.41
0.35 TYP
0.00
0.38

D1 CASE


2.02
1.51
4
1.100
0.040ø
5
0.700
0.600
3
0.400
2
2.02
6
0.300
0.000
1
7
0.100
0.51
0.11
0.000
1.800
1.91
0.25 TYP
0.000
0.45

Call 800-542-3355 for each model's pin designation

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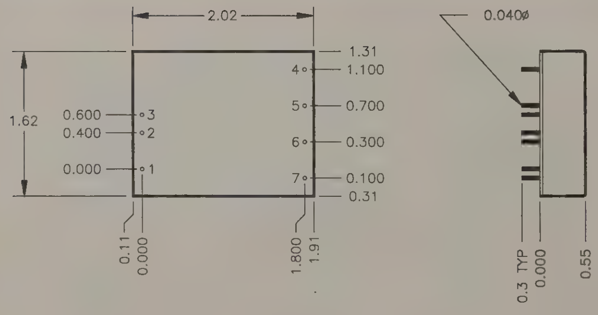
CALEX DC/DC Converters

24 VOLTS DC INPUT

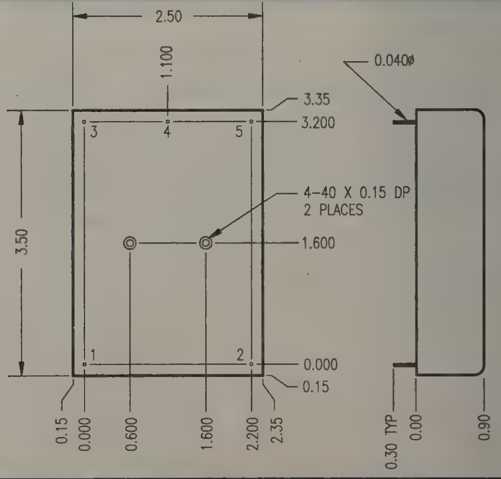
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
3.3	2000	18-36	6.6	60	80	E1	24S3.2000NT
3.3	4000	9-18	13	50	76	D1	12S3.4000NT
3.3	4000	18-36	13	50	80	D1	24S3.4000NT
3.3	5000	18-36	15	*	*	*	24S3.5000
3.3	10 Amps	18-36	30	*	*	XC	24S3.10XC
3.3	20 Amps	18-36	66	*	*	U	24S3.20XW
5	1000	22.32-26.4	5	10	60	D	24S5.1000
5	1000	26.04-30.8	5	10	62	D	28S5.1000
5	1000	20-60	5	10	75	D	48S5.1000FW
5	1500	9-27	7.5	10	77	D	12S5.1500FW
5	2000	12-36	10	10	70	B1	24S5.2000
5	2000	18-36	10	60	80	E1	24S5.2000NT
5	2000	36-72	10	60	80	E1	48S5.2000NT
5	3000	9-27	15	20	78	XC	12S5.3000XC
5	3000	20-60	15	20	79	J	48S5.3000TC
5	3000	24-72	15	20	79	XC	48S5.3000XC
5	4000	9-18	20	50	79	D1	12S5.4000NT
5	4000	18-36	20	50	83	D1	24S5.4000NT
5	5000	18-36	25	*	*	*	24S5.5000
5	5000	7-40	25	20	81	XC	12S5.5000UW
5	5000	9-36	25	20	79	U	24S5.5000XW
5	10 Amps	18-36	50	*	*	XC	24S5.10XC
5	10 Amps	18-36	50	20	77	U	24S5.10XW
5	20 Amps	18-36	100	*	*	U	24S5.20XW
12	500	22.32-26.4	6.0	10	68	D	24S12.500
12	500	26.04-30.8	6.0	10	67	D	28S12.500
12	625	9-27	7.5	10	81	D	12S12.625FW
12	900	18-36	11	60	85	E1	24S12.900NT
12	1000	12-36	12	10	70	B1	24S12.1000
12	1250	24-72	15	20	80	XC	48S12.1250XC
12	1250	9-27	15	20	81	XC	12S12.1250XC
12	1250	20-60	15	20	79	J	48S12.1250TC
12	1700	9-18	20	50	79	D1	12S12.1700NT
12	1700	18-36	20	50	85	D1	24S12.1700NT
12	2000	18-36	24	*	*	*	24S12.2000
12	2500	14-40	30	20	90	XC	24S12.2500UW
12	2500	9-36	30	20	81	U	24S12.2500XW

*Preliminary Specifications - Call 800-542-3355 for Details

J CASE


2.02
1.31
1.100
0.700
0.300
0.100
0.31
1.62
0.600
0.400
0.000
4
5
6
7
3
2
1
0.11
0.000
1.800
1.91
0.040ø
0.3 TYP
0.000
0.55

B1 CASE


2.50
1.100
0.040ø
3.35
3.200
3
4
5
4-40 X 0.15 DP
2 PLACES
1.600
3.50
1
2
0.000
0.15
0.15
0.000
0.600
1.600
2.200
2.35
0.30 TYP
0.00
0.90

Call 800-542-3355 for each model's pin designation

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DC/DC Converters

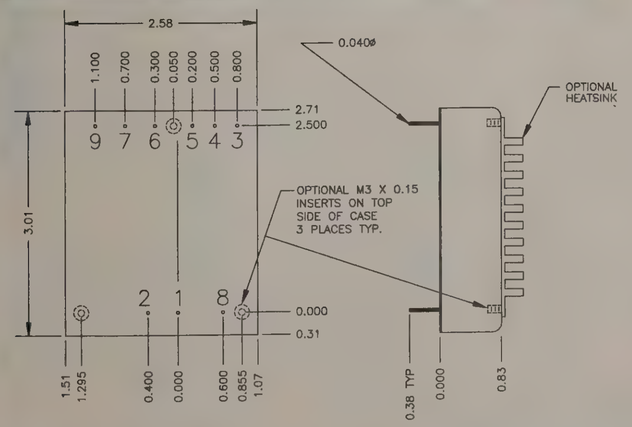
CALEX

24 VOLTS DC INPUT

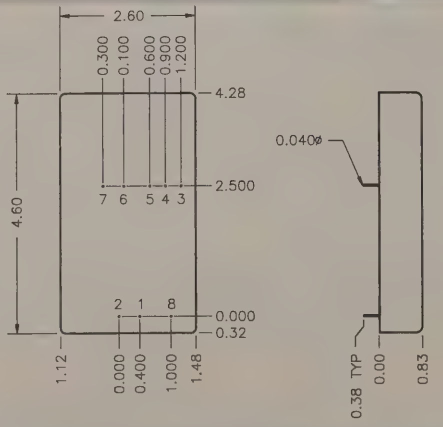
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
12	3500	14-40	42	20	90	XC	24S12.3500UW
12	5000	18-36	60	*	*	XC	24S12.5XC
12	5000	18-36	60	20	82	U	24S12.5XW
12	9000	18-36	108	*	*	U	24S12.9XW
15	400	22.32-26.4	6	10	69	D	24S15.400
15	400	26.04-30.8	6	10	69	D	28S15.400
15	500	9-27	7.5	10	82	D	12S15.500FW
15	700	18-36	11	60	86	E1	24S15.700NT
15	800	12-36	12	10	70	B1	24S15.800
15	1000	9-27	15	20	82	XC	12S15.1000XC
15	1000	24-72	15	20	82	XC	48S15.1000XC
15	1000	20-60	15	20	79	J	48S15.1000TC
15	1400	9-18	21	50	79	D1	12S15.1400NT
15	1400	18-36	21	50	86	D1	24S15.1400NT
15	1600	18-36	24	*	*	*	24S15.1600
15	2000	9-36	30	20	83	U	24S15.2000XW
15	3000	17-40	45	20	91	XC	24S15.3000UW
15	4000	18-36	60	*	*	XC	24S15.4XC
15	4000	18-36	60	20	84	U	24S15.4XW
15	7000	18-36	105	*	*	U	24S15.7XW
DUAL OUTPUT							
±5	±1000	18-54	10	10	60	B1	28D5.1000
±5	±1700	18-36	17	60	*	D1	24D5.1700NT
±5	±5000	18-36	50	*	*	XC	24D5.5000XC
±12	±250	22.32-26.4	6	10	67	D	24D12.250
±12	±250	26.04-30.8	6	10	67	D	28D12.250
±12	±500	12-36	12	10	70	B1	24D12.500
±12	±625	20-60	15	*	*	J	48D12.625TC
±12	±850	18-36	20	60	*	D1	24D12.850NT
±12	±1250	18-36	30	20	87	U	24D12.1250XW
±12	±2500	18-36	60	*	*	XC	24D12.2500XC
±15	±200	22.32-26.4	6	10	70	D	24D15.200
±15	±200	26.04-30.8	6	10	71	D	28D15.200
±15	±400	12-36	12	10	70	B1	24D15.400
±15	±500	20-60	15	*	*	J	48D15.500TC
±15	±700	18-36	21	60	*	D1	24D15.700NT
±15	±1000	18-36	30	20	87	U	24D15.1000XW
±15	±2000	18-36	60	*	*	XC	24D15.2000XC

*Preliminary Specifications - Call 800-542-3355 for Details

XC CASE


2.58
1.100
0.700
0.300
0.050
0.200
0.500
0.800
0.040ø
OPTIONAL HEATSINK
2.71
2.500
9 7 6 5 4 3
3.01
OPTIONAL M3 X 0.15 INSERTS ON TOP SIDE OF CASE 3 PLACES TYP.
2 1 8
0.000
0.31
1.51
1.295
0.400
0.000
0.600
0.855
1.07
0.38 TYP
0.000
0.83

U CASE


2.60
0.300
0.100
0.600
0.900
1.200
4.28
0.040ø
2.500
7 6 5 4 3
4.60
2 1 8
0.000
0.32
1.12
0.000
0.400
1.000
1.48
0.38 TYP
0.00
0.83

Call 800-542-3355 for each model's pin designation

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CALEX DC/DC Converters

24 VOLTS DC INPUT

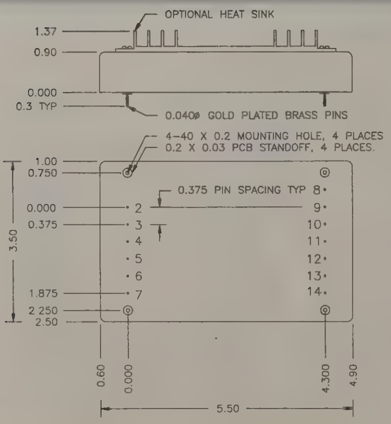
OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
TRIPLE OUTPUT							
5, ±12	800, ±185	9-36	8.5	20	78	XC	12T5.12UW
5, ±12	1500, ±310	18-36	15	20	78	XC	24T5.12SW
5, ±12	3000, ±500	9-36	27	35	83	XC	12T5.12LE
5, ±12	3000, ±625	18-72	30	35	85	XC	48T5.12LE
5, ±12	3000, ±625	18-36	30	20	85	XC	24T5.12XC
5, ±12	5000, ±1250	9-18	55	15	81	K	12T5.12K
5, ±15	800, ±150	9-36	8.5	20	78	XC	12T5.15UW
5, ±15	1500, ±250	18-36	15	20	78	XC	24T5.15SW
5, ±15	3000, ±400	9-36	27	35	83	XC	12T5.15LE
5, ±15	3000, ±500	18-72	30	35	85	XC	48T5.15LE
5, ±15	3000, ±500	18-36	30	20	85	XC	24T5.15XC
5, ±15	5000, ±1000	9-18	55	15	81	K	12T5.15K

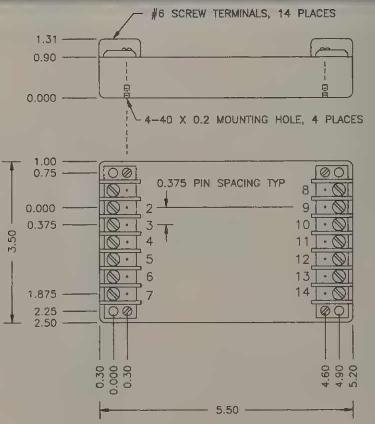
48 VOLTS DC INPUT

OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
3.3	2000	36-72	6.6	60	80	E1	48S3.2000NT
3.3	4000	36-72	13	50	80	D1	48S3.4000NT
3.3	5000	36-72	15	*	*	*	48S3.5000
3.3	10 Amps	36-72	30	*	*	XC	48S3.10XC
3.3	20 Amps	36-72	66	*	*	U	48S3.20XW
5	1000	20-60	5	10	75	D	48S5.1000FW
5	1500	36-72	7.5	10	80	D	48S5.1500FW
5	2000	24-72	10	10	70	B1	48S5.2000
5	2000	36-72	10	60	80	E1	48S5.2000NT
5	3000	24-72	15	20	79	XC	48S5.3000XC
5	3000	20-60	15	20	79	J	48S5.3000TC
5	4000	36-72	20	50	83	D1	48S5.4000NT
5	5000	20-72	25	20	80	U	48S5.5000XW
5	5000	36-72	25	*	*	*	48S5.5000
5	5000	36-72	25	20	84	J	48S5.5000NT
5	10 Amps	36-72	50	*	*	XC	48S5.10XC
5	10 Amps	36-72	50	15	78	U	48S5.10XW
5	20 Amps	36-72	100	*	*	U	48S5.20XW
12	500	44.64-52.8	6	10	66	D	48S12.500
12	625	36-72	7.5	10	82	D	48S12.625FW
12	900	36-72	11	60	85	E1	48S12.900NT
12	1000	24-72	12	10	70	B1	48S12.1000
12	1250	24-72	15	20	80	XC	48S12.1250XC

*Preliminary Specifications - Call 800-542-3355 for Details

K CASE


OPTIONAL HEAT SINK
1.37
0.90
0.000
0.3 TYP
0.040ø GOLD PLATED BRASS PINS
4–40 X 0.2 MOUNTING HOLE, 4 PLACES
0.2 X 0.03 PCB STANDOFF, 4 PLACES.
1.00
0.750
0.375 PIN SPACING TYP
0.000
0.375
3.50
1.875
2 250
2.50
2
3
4
5
6
7
8
9
10
11
12
13
14
0.60
0.000
4.300
4.90
5.50


#6 SCREW TERMINALS, 14 PLACES
1.31
0.90
0.000
4–40 X 0.2 MOUNTING HOLE, 4 PLACES
1.00
0.75
0.375 PIN SPACING TYP
0.000
0.375
3.50
1.875
2.25
2.50
2
3
4
5
6
7
8
9
10
11
12
13
14
0.30
0.000
0.30
4.60
4.90
5.20
5.50

Call 800-552-3355 for Specific Pin Designation

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DC/DC Converters

CALEX

48 VOLTS DC INPUT

OUTPUT VOLTAGE VDC	OUTPUT CURRENT mA	INPUT VOLTAGE RANGE VDC MIN/MAX	OUTPUT POWER WATTS	NOISE mV P-P (typ)	EFFICIENCY (typ) %	CASE SIZE	MODEL NUMBER
SINGLE OUTPUT							
12	1250	20-60	15	20	79	J	48S12.1250TC
12	1700	36-72	20	50	84	D1	48S12.1700NT
12	2000	36-72	24	*	*	*	48S12.2000
12	2500	20-72	30	20	82	U	48S12.2500XW
12	2500	36-72	30	20	86	J	48S12.2500NT
12	5000	36-72	60	*	*	*	48S12.5XC
12	5000	36-72	60	20	82	U	48S12.5XW
12	9000	36-72	108	*	*	U	48S12.9XW
15	400	44.64-52.8	6	10	68	D	48S15.400
15	500	36-72	7.5	10	85	D	48S15.500FW
15	700	36-72	11	60	86	E1	48S15.700NT
15	800	24-72	12	10	70	B1	48S15.800
15	1000	24-72	15	20	82	XC	48S15.1000XC
15	1000	20-60	15	20	79	J	48S15.1000TC
15	1400	36-72	21	50	85	D1	48S15.1400NT
15	1600	36-72	24	*	*	*	48S15.1600
15	2000	20-72	30	20	84	U	48S15.2000XW
15	2000	36-72	30	20	86	J	48S15.2000NT
15	4000	36-72	60	20	84	U	48S15.4XW
15	7000	36-72	105	*	*	U	48S15.7XW
DUAL OUTPUT							
±5	±1700	36-72	17	60	*	D1	48D5.1700NT
±5	±5000	36-72	50	*	*	XC	48D5.5000XC
±12	±250	44.64-52.8	6	10	64	D	48D12.250
±12	±400	20-60	10	20	79	J	48D12.400TC
±12	±500	24-72	12	10	70	B1	48D12.500
±12	±625	20-60	15	*	*	J	48D12.625TC
±12	±850	36-72	20	60	*	D1	48D12.850NT
±12	±1250	36-72	30	20	88	U	48D12.1250XW
±12	±2500	36-72	60	*	*	XC	48D12.2500XC
±15	±200	44.64-52.8	6	10	66	D	48D15.200
±15	±350	20-60	10	20	75	J	48D15.350TC
±15	±400	24-72	12	10	70	B1	48D15.400
±15	±500	20-60	15	*	*	J	48D15.500TC
±15	±700	36-72	21	60	*	D1	48D15.700NT
±15	±1000	36-72	30	20	88	U	48D15.1000XW
±15	±2000	36-72	60	*	*	XC	48D15.2000XC
TRIPLE OUTPUT							
5, ±12	800, ±185	18-72	8.5	20	78	XC	48T5.12UW
5, ±12	1500, ±310	36-72	15	20	78	XC	48T5.12SW
5, ±12	3000, ±625	18-72	30	35	85	XC	48T5.12LE
5, ±12	3000, ±625	36-72	30	20	85	XC	48T5.12XC
5, ±12	5000, ±1250	36-72	55	15	87	K	48T5.12K
5, ±15	800, ±150	18-72	8.5	20	78	XC	48T5.15UW
5, ±15	1500, ±250	36-72	15	20	78	XC	48T5.15SW
5, ±15	3000, ±500	18-72	30	35	85	XC	48T5.15LE
5, ±15	3000, ±500	36-72	30	20	85	XC	48T5.15XC
5, ±15	5000, ±1000	36-72	55	15	87	K	48T5.15K

*Preliminary Specifications - Call 800-542-3355 for Details

Call for a free copy of the CALEX DC/DC Converter Product Guide with detailed specifications, physical dimensions, UL approval and pricing information. To receive the material faster, we will FAX specific pages and/or data sheets to you at your request. Sample units are always available. Call 800-542-3355 today.

5 YEAR WARRANTY

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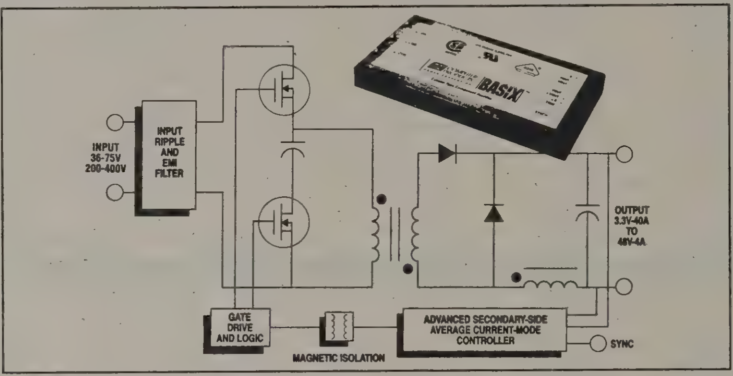
BASiX™

The BASiX High-Performance Series of High-density DC/DC power converters uses Computer Products' patented Resonant Transition Zero Voltage Switching together with advanced packaging to provide high performance with a power density of 36 watt/in^3. BASiX offers internal input and output filtering, protection features, true current sharing, redundancy and 40 amp output capability that are contained within the industry standard 4.6" x 2.4" x 0.5" package.

BASiX incorporates several state-of-the-art technological advances including constant 700 kHz switching frequency for high power density and easier system filtering, advanced average current-mode secondary side control enabling fast transient response, patented power train design providing efficiency that ranks among the highest in the industry, integrated magnetics resulting in improved output noise, constant current limit reducing sensitivity to the load at turn-on and an internal EMI filter limiting conducted emissions to VDE0871 Class A.

BASiX is a member of the Computer Products family of power conversion products which consist of more than 300 standard products to satisfy all your power system requirements both distributed and centralized.


INPUT 36-75V 200-400V
INPUT RIPPLE AND EMI FILTER
OUTPUT 3.3V-40A TO 48V-4A
GATE DRIVE AND LOGIC
MAGNETIC ISOLATION
ADVANCED SECONDARY-SIDE AVERAGE CURRENT-MODE CONTROLLER
SYNC
BASiX

ZERO VOLTAGE SWITCHING (ZVS) CUTS LOSSES TO YIELD HIGHER EFFICIENCY
Resonant Transition ZVS module combines flyback and forward-converter topologies

BASiX Series Features

- Full 200 watts @ 5 Vout
- 40 amps for 1.5 to 5 Vout
- Power Density of 36 W/in^3
- Up to 87% efficiency
- Fixed switching frequency
- Synchronization function
- Integrated magnetics
- VDE0871 Class A input noise
- UL, CSA, VDE safety approved
- Output ripple less than 50 mV
- Transient response less than 100 µsec
- Universal current sharing
- Easy implementation of true N+1 redundancy
- Latching OVP
- MTBF greater than 750,000 hours
- Under-voltage lockout circuitry
- Over-temperature protection
- Industry standard size
- Input voltage range to ETSI requirements

BASiX HIGH PERFORMANCE SERIES SPECIFICATIONS

INPUT	300 VOLT SERIES	48 VOLT SERIES	UNITS
Voltage range	200-400	36-75	VDC
Surge Voltage (1 second)	425	90	VDC
Conducted EMI[1]	100	100	dBµV
Conducted EMI with optional filter[1]	VDE0871A	VDE0871A	
On/off control current sink	1	1	mA
Current, shutdown	5	5	mA
Turn-on time (Vout settled to 1%)	50	10	msec
Control turn-on time	15	10	msec
Total input capacitance	0.6	10	µF

Specifications subject to change without notice **1.** EMI measured on either line into a 50Ω Line Impedance Stabilization Network with 120µF of the rated output voltage **2.** Overvoltage protection is tested with an external source which is not to exceed 150% of the rated output voltage. **3.** -40° to 85°C range available.

GOVERNOR'S AWARD FOR INDUSTRY QUALITY 1992

GOVERNOR'S AWARD FOR INDUSTRY PRODUCTIVITY 1992

For Sales or Technical Support, See Inside Front Cover of This Book.

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BASiX™

BASiX HIGH PERFORMANCE SERIES SPECIFICATIONS

OUTPUT		UNITS
Set point accuracy	±1	%Vout
Load regulation	±0.1	%Vout ± 10mV
Line regulation	±0.1	%Vout ,±10mV
Temperature drift	±0.02	%Vout/°C
Ripple, (0-20MHz) with optional filter	greater of 50 mV or 1/2% Vout P-P, 0.2% Vout rms	
Ripple, (0-20MHz	greater of 150 mV or 1/2% Vout P-P, 0.6% Vout rms	
OVP (latching)[2]	130 ±5	%Vout
Remote sense compensation	0.5	VDC
Trim range	±10%	%Vout
Current limit (auto recovery)	115 ±5	% full load
Current share accuracy	±10	% full load
Transient response (25-75% full load current) recovery to 1% of Vout	100	µsec

ISOLATION	300V SERIES	48V SERIES
Input-output test voltage	3000 VAC	2000 VAC
Input-baseplate test voltage	1500 VAC	1000 VAC
Output-baseplate test voltage	500 VAC	500 VDC
Input-output capacitance	1000 pF	1000 pF

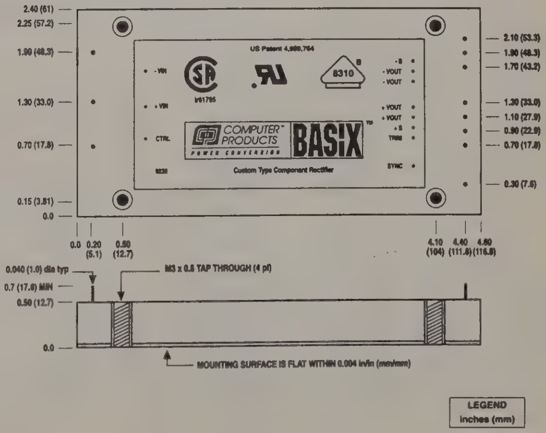
GENERAL	
Frequency synchronization range	±7% of switching frequency (see application information)
Operating baseplate temperature[3]	-20 to 85°C
Thermal protection	95°C minimum
Storage temperature	-20 to 125°C
Flammability	UL94-VO
Agency approval	UL, VDE, CSA (per IEC-950)
Weight	220g.

Specifications subject to change without notice **1.** EMI measured on either line into a 50Ω Line Impedance Stabilization Network with 120µF of the rated output voltage. **2.** Overvoltage protection is tested with an external source which is not to exceed 150% of the rated output voltage. **3.** -40° to 85°C range available.

BASiX MODEL SELECTION

Series BXA

POWER W	INPUT V	RANGE V	OUTPUT V	OPTIONS
130			03	
150			05	A-Input Noise Filter
200	48	N=40-60	05	R-Output Ripple Filter
200	300	W=36-75	12	E-Extended Temperature
200		W=200-400	15	
200			24	
200			48	


2.40 (61)
2.25 (57.2)
1.90 (48.3)
1.30 (33.0)
0.70 (17.8)
0.15 (3.81)
0.0
2.10 (53.3)
1.90 (48.3)
1.70 (43.2)
1.30 (33.0)
1.10 (27.9)
0.90 (22.9)
0.70 (17.8)
0.30 (7.6)
US Patent 4,980,764
- VIN
+ VIN
CTRL
-S
- VOUT
- VOUT
+ VOUT
+ VOUT
+S
TRIM
SYNC
LR61795
8310
COMPUTER PRODUCTS POWER CONVERSION
BASiX
9220
Custom Type Component Rectifier
0.0
0.20 (5.1)
0.50 (12.7)
4.10 (104)
4.40 (111.8)
4.60 (116.8)
0.040 (1.0) dia typ
M3 x 0.5 TAP THROUGH (4 pl)
0.7 (17.8) MIN
0.50 (12.7)
0.0
MOUNTING SURFACE IS FLAT WITHIN 0.004 in/in (mm/mm)
LEGEND
inches (mm)

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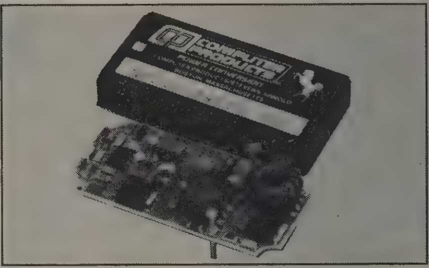
Isolated DC/DC Power Supplies

NFC FAMILY — Wide Input, Regulated, Single, Dual, & Triple Output, 10-100 Watt Converters

The NFC standard product line consists of seven series of DC/DC converters with output power ranging from 10 - 100 watts. All products will operate from wide range input voltages while providing isolated, tightly regulated single, dual and triple output voltages. Useable power densities as high as 25 W/in^3 and operation up to 71°C make the NFC family the ideal solution to a host of DC/DC converter requirements.



NFC FAMILY SPECIFICATIONS

Output Power (Watts)	Input Voltage		Output #1	Output #2	Output #3	Efficiency (%)	Regulation		Output Noise (P-P)	Size (L" x W" x H")	Model Number	Notes
	Nominal (VDC)	Range (VDC)					Line	Load				
10	12	9 - 18	5V @ 2.0A			79	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-12S05	1,2
10	12	9 - 18	12V @ 830mA			82	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-12S12	1,2
10	12	9 - 18	15V @ 670mA			82	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-12S15	1,2
10	12	9 - 18	+12V @ 420mA	-12V @ 420mA		81	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-12D12	1,2
10	12	9 - 18	+15V @ 330mA	-15V @ 330mA		81	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-12D15	1,2
10	24	18 - 36	5V @ 2.0A			81	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-24S05	1,2
10	24	18 - 36	12V @ 830mA			84	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-24S12	1,2
10	24	18 - 36	15V @ 670mA			84	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-24S15	1,2
10	24	18 - 36	+12V @ 420mA	-12V @420mA		82	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-24D12	1,2
10	24	18 - 36	+15V @ 330mA	-15V @ 330mA		82	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-24D15	1,2
10	48	36 - 72	5V @ 2.0A			82	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-48S05	1,2
10	48	36 - 72	12V @ 830mA			86	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-48S12	1,2
10	48	36 - 72	15V @ 670mA			86	±1%	±1%	50mV	2.00 x 1.00 x 0.38	NFC10-48S15	1,2
10	48	36 - 72	+12V @ 20mA	-12V @ 420mA		84	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-48D12	1,2
10	48	36 - 72	+15V @ 330mA	-15V @ 330mA		84	±1%	±2%	75mV	2.00 x 1.00 x 0.38	NFC10-48D15	1,2
15	48	20 - 72	5V @ 3.0A			80	±0.5%	±0.5%	75mV	2.00 x 1.6 x 0.46	NFC15-48S05	2,3,5
15	48	20 - 72	12V @ 1.25A			84	±0.5%	±0.5%	75mV	2.00 x 1.6 x 0.46	NFC15-48S12	2,3,5
15	48	20 - 72	15V @ 1.0A			85	±0.5%	±0.5%	75mV	2.00 x 1.6 x 0.46	NFC15-48S15	2,3,5
15	48	20 - 72	+12V @ 625mA	-12V @ 625mA		83	±0.5%	±1%	75mV	2.00 x 1.6 x 0.46	NFC15-48D12	2,3,5
15	48	20 - 72	+15V @ 500mA	-15V @ 500mA		84	±0.5%	±1%	75mV	2.00 x 1.6 x 0.46	NFC15-48D15	2,3,5
20	24	18 - 36	5V @ 4.0A			81	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-24S05	1,2
20	24	18 - 36	12V @ 1.67A			83	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-24S12	1,2
20	24	18 - 36	15V @ 1.33A			83	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-24S15	1,2
20	24	18 - 36	+12V @ 833mA	-12V @ 833mA		83	±0.1%	±2%	100mV	2.00 x 1.6 x 0.46	NFC20-24D12	1,2
20	24	18 - 36	+15V @ 666mA	-15V @ 666mA		84	±0.1%	±2%	100mV	2.00 x 1.6 x 0.46	NFC20-24D15	1,2
20	48	36 - 72	5V @ 4.0A			82	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-48S05	1,2
20	48	36 - 72	12V @ 1.67A			83	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-48S12	1,2
20	48	36 - 72	15V @ 1.33A			83	±0.1%	±0.25%	75mV	2.00 x 1.6 x 0.46	NFC20-48S15	1,2
20	48	36 - 72	+12V @ 833mA	-12V @ 833mA		85	±0.1%	±2%	100mV	2.00 x 1.6 x 0.46	NFC20-48D12	1,2
20	48	36 - 72	+15V @ 666mA	-15V@ 666mA		86	±0.1%	±2%	100mV	2.00 x 1.6 x 0.46	NFC20-48D15	1,2
25	12	9 - 18	5V @ 5.0A			82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-12S05	4,6
25	12	9 - 18	5V @5.0A	+12V @ 1.0A	-12V @ 1.0A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-12T05-12	4,6
25	12	9 - 18	5V @5.0A	+15V @ 0.8A	-15V @ 0.8A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-12T05-15	4,6
25	24	18 - 36	5V @5.0A			82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-24S05	4,6
25	24	18 - 38	5V @5.0A	+12V @ 1.0A	-12V @ 1.0A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-24T05-12	4,6
25	24	18 - 36	5V @5.0A	+15V @ 0.8A	-15V @ 0.8A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-24T05-15	4,6
25	48	36 - 72	5V @5.0A			82	Note 7	Note7	Note 7	3.0 x 3.0 x 0.4	NFC25-48S05	4,6
25	48	36 - 72	5V @5.0A	+12V @ 1.0A	-12V @ 1.0A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-48T05-12	4,6
25	48	36 - 72	5V @ 5.0A	+15V @ 0.8A	-15V @ 0.8A	82	Note 7	Note 7	Note 7	3.0 x 3.0 x 0.4	NFC25-48T05-15	4,6
40	24	18 - 36	5V @ 8.0A			80	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-24S05	2,8
40	24	18 - 36	12V @ 3.5A			82	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-24S12	2,8
40	24	18 - 36	15V @ 2.8A			82	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-24S15	2,8
40	24	18 - 36	5V @ 7.5A	+12V @ 0.75A	-12V @ 0.75A	80	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-24T05-12	2,8
40	24	18 - 36	5V @ 7.5A	+15V @ 0.75A	-15V @ 0.75A	80	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-24T05-15	2,8
40	48	36 - 72	5V @ 8.0A			81	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-48S05	2,8
40	48	36 - 72	12V @ 3.5A			83	Note 8	Note 3	100mV	2.2 x 2.2 x 0.5	NFC40-48S12	2,8
40	48	36 - 72	15V @ 2.8A			83	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-48S15	2,8
40	48	36 - 72	5V @ 7.5A	+12V @ 0.75A	-12V @ 0.75A	81	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-48T05-12	2,8
40	48	36 - 72	5V @ 7.5A	+15V @ 0.75mA	-15V @ 0.75A	81	Note 8	Note 8	100mV	2.2 x 2.2 x 0.5	NFC40-48T05-15	2,8
70	24	18 - 36	3.3V @ 20A			79	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-24S03	2,9
75	24	18 - 36	5V @ 15A			82	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-24S05	2,9
80	24	18 - 36	12V @ 6.3A			86	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-24S12	2,9
80	24	18 - 36	15V @ 5.0A			87	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-24S15	2,9
70	48	36 - 75	3.3V @ 20A			80	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-48S03	2,9
75	48	36 - 75	5V @ 15A			83	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-48S05	2,9
80	48	36 - 75	12V @ 6.3A			86	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-48S12	2,9
80	48	36 - 75	15V @ 5.0A			87	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC75-48S15	2,9
85	48	36 - 75	3.3V @ 25A			80	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC100-48S03	2,9
100	48	36 - 75	5V @ 20A			83	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC100-48S05	2,9
110	48	36 - 75	12V @ 8.5A			86	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC100-48S12	2,9
110	48	36 - 75	15V @ 7.0A			87	±0.1%	±0.1%	50mV	3.5 x 2.4 x 0.5	NFC100-48S15	2,9

Notes: For note references see page D1635.

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Other Series Specifications

Output Power (Watts)	Input Voltage		Output #1	Output #2	Output #3	Efficiency (%)	Regulation		Output Noise (P-P)	Size (L" x W" x H")	Model Number
	Nominal (VDC)	Range (VDC)					Line	Load			
PM600 SERIES - NARROW INPUT, REGULATED, SINGLE & DUAL OUTPUT, 0.5 - 1 WATT CONVERTERS											
0.5	5	4.5 - 5.5	5 V @ 100mA			38	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM621
1.0	5	4.5 - 5.5	12V @ 80mA			50	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM623
1.0	5	4.5 - 5.5	+12V @ 40mA	-12V @ 40mA		50	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM671
1.0	5	4.5 - 5.5	+15V @ 33mA	-15V @ 33mA		52	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM672
1.0	12	10.8 - 13.2	12V @ 80mA			55	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM633
1.0	12	10.8 - 13.2	+12V @ 40mA	-12V @ 40mA		55	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM681
1.0	12	10.8 - 13.2	+15V @ 33mA	-15V @ 33mA		55	±0.3%	±0.4%	20mV	1.25 x 0.8 x 0.4	PM682
DR SERIES - WIDE INPUT, REGULATED, SINGLE & DUAL OUTPUT, 3 WATT CONVERTERS											
3.0	24	18 - 36	5V @ 500mA			78	±1.5%	±2.5%	150mV	1.25 x .08 x 0.5	DR24S05/500G
3.0	24	18 - 36	12V @ 250mA			83	±1.5%	±2.5%	150mV	1.25 x .08 x 0.5	DR24S12/250G
3.0	24	18 - 36	+12V @ 125mA	-12V @ 125mA		82	±1.5%	±2.5%	150mV	1.25 x .08 x 0.5	DR24D12/125G
3.0	24	18 - 36	+15V @ 100mA	-15V @ 100mA		82	±1.5%	±2.5%	150mV	1.25 x .08 x 0.5	DR24D15/100G
3.0	48	36 - 72	5V @ 500mA			79	±1.5%	±2.5%	150mV	1.25 x .08 x 0.5	DR48S05/500G
AFC5-F SERIES - NARROW INPUT, REGULATED, SINGLE & DUAL OUTPUT, 5 WATT CONVERTERS											
5.0	5	4.65 - 5.25	5V @ 1.0A			64	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-05S05F
5.0	5	4.65 - 5.25	12V @ 420mA			69	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-05S12F
5.0	5	4.65 - 5.25	15V @ 350mA			70	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-05S15F
5.0	5	4.65 - 5.25	+12V @ 150mA	-12V @ 150mA		65	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-05D12F
5.0	5	4.65 - 5.25	+15V @ 150mA	-15V @ 150mA		65	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-05D15F
5.0	12	10.8 - 13.2	5V @ 1.0A			66	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-12S05F
5.0	12	10.8 - 13.2	12V @ 420mA			70	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-12S12F
5.0	12	10.8 - 13.2	15V @ 350mA			71	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-12S15F
5.0	12	10.8 - 13.2	+12V @ 150mA	-12V @ 150mA		65	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-12D12F
5.0	12	10.8 - 13.2	+15V @ 150mA	-15V @ 150mA		65	±0.5%	±0.5%	15mV	2.0 x 1.0 x 0.38	AFC5-12D15F
PM900 SERIES - NARROW INPUT, REGULATED, SINGLE & DUAL OUTPUT, 5 & 6 WATT CONVERTERS (Note 6)											
5.0	5	4.65 - 5.5	5V @ 1.0A			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM901
5.6	5	4.65 - 5.5	12V @ 470mA			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM903
6.0	5	4.65 - 5.5	15V @ 400mA			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM904
5.5	5	4.65 - 5.5	+12V @ 230mA	-12V @ 230mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM951
5.7	5	4.65 - 5.5	+15V @ 190mA	-15V @ 190mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM952
5.0	12	11.16 - 13.2	5V @ 1.0A			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM911
6.0	12	11.16 - 13.2	15V @ 400mA			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM914
5.5	12	11.16 - 13.2	+12V @ 230mA	-12V @ 230mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM961
5.7	12	11.16 - 13.2	+15V @ 190mA	-15V @ 190mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM962
5.0	24	22.32 - 26.4	5V @ 1.0A			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM921
5.5	24	22.32 - 26.4	+12V @ 230mA	-12V @ 230mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM971
5.0	48	44.64 - 52.8	5V @ 1.0A			65	±0.02%	±0.04%	10mV	2.0 x 2.0 x 0.42	PM941
5.5	48	44.64 - 52.8	+12V @ 230mA	-12V @ 230mA		67	±0.02%	±0.02%	6mV	2.0 x 2.0 x 0.42	PM991
C SERIES - NARROW INPUT, REGULATED, TRIPLE OUTPUT, 10 WATT CONVERTERS											
10	5	4.5 - 5.5	5V @ 750mA	+12V @ 165mA	-12V @ 165mA	47	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C05T12/165X
10	5	4.5 - 5.5	5V @ 750mA	+15V @ 165mA	-15V @ 165mA	50	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C05T15/165X
10	12	10 - 14	5V @ 750mA	+12V @ 165mA	-12V @ 165mA	47	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C12T12/165X
10	12	10 - 14	5V @ 750mA	+15V @ 165mA	-15V @ 165mA	50	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C12T15/165X
10	24	20 - 28	5V @ 750mA	+12V @ 165mA	-12V @ 165mA	50	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C24T12/165X
10	24	20 - 28	5V @ 750mA	+15V @ 165mA	-15V @ 165mA	54	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C24T15/165X
10	28	24 - 32	5V @ 750mA	+12V @ 165mA	-12V @ 165mA	50	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C28T12/165X
10	28	24 - 32	5V @ 750mA	+15V @ 165mA	-15V @ 165mA	54	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C28T15/165X
10	48	42 - 56	5V @ 750mA	+12V @ 165mA	-12V @ 165mA	51	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C48T12/165X
10	48	42 - 56	5V @ 750mA	+15V @ 165mA	-15V @ 165mA	54	Note 1	Note 1	40mV	3.0 x 2.56 x 0.75	C48T15/165X
ES SERIES - WIDE INPUT, REGULATED, TRIPLE OUTPUT, 15 WATT CONVERTERS											
15	12	9 - 18	5V @ 1.5A	+12V @ 0.31A	-12V @ 0.31A	78	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES12T12/310XC
15	12	9 - 18	5V @ 1.5A	+15V @ 0.25A	-15V @ 0.25A	78	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES12T15/250XC
15	12	9 - 18	5V @ 1.5A	-5V @ 0.5A	+12V @ 0.31A	78	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES12T05/500XC
15	24	18 - 36	5V @ 1.5A	+12V @ 0.31A	-12V @ 0.32A	80	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES24T12/310XC
15	24	18 - 36	5V @ 1.5A	+15V @ 0.25A	-15V @ 0.25A	80	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES24T15/250XC
15	24	18 - 36	5V @ 1.5A	-5V @ 0.5A	+12V @ 0.31A	80	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES24T05/500XC
15	48	36 - 72	5V @ 1.5A	+12V @ 0.31A	-12V @ 0.31A	82	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES48T12/310XC
15	48	36 - 72	5V @ 1.5A	+15V @ 0.25A	-15V @ 0.25A	82	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES48T15/250XC
15	48	36 - 72	5V @ 1.5A	-5V @ 0.5A	+12V @ 0.31A	82	±1%	±5%	50mV	3.0 x 2.56 x 0.83	ES48T05/500XC
WR-XC SERIES - WIDE INPUT, REGULATED, SINGLE & DUAL OUTPUT, 15 WATT CONVERTERS											
15	12	9 - 18	5V @ 3.0A			75	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR12S05/3000XC
15	12	9 - 18	+12V @ 625mA	-12V @ 625mA		82	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR12D12/625XC
15	12	9 - 18	+15V @ 500mA	-15V @ 500mA		82	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR12D15/500XC
15	24	18 - 36	5V @ 3.0A			77	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR24S05/3000XC
15	24	18 - 36	15V @ 1.0A			80	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR24S15/1000XC
15	24	18 - 36	+12V @ 625mA	-12V @ 625mA		84	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR24D12/625XC
15	24	18 - 36	+15V @ 500mA	-15V @ 500mA		84	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR24D15/500XC
15	48	36 - 72	5V @ 3.0A			77	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR48S05/3000XC
15	48	36 - 72	+12V @ 625mA	-12V @ 625mA		86	±0.2%	±1%	50mV	3.0 x 2.56 x 0.83	WR48D12/625XC

Notes: For note references see page D1635.

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Output Power (Watts)	Input Voltage		Output #1	Output #2	Output #3	Efficiency (%)	Regulation		Output Noise (P-P)	Size (L" x W" x H")	Model Number
	Nominal (VDC)	Range (VDC)					Line	Load			
WR-U SERIES - WIDE INPUT, REGULATED, SINGLE & DUAL OUTPUT, 30 WATT CONVERTERS											
30	12	9 - 18	+12V @ 1.25A	-12V @ 1.25A		82	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR12D12/1250U
30	24	18 - 36	5V @ 5.0A			77	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR24S05/5000U
30	24	18 - 36	+12V @ 1.25A	-12V @ 1.25A		84	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR24D12/1250U
30	24	18 - 36	+15V @ 1.0A	-15V @ 1.0A		84	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR24D15/1000U
30	48	36 - 72	5V @ 5.0A			78	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR48S05/5000U
30	48	36 - 72	12V @ 2.5A			81	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR48S12/2500U
30	48	36 - 72	15V @ 2.0A			81	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR48S15/2000U
30	48	36 - 72	+12V @ 1.25A	-12V @ 1.25A		86	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR48D12/1250U
30	48	36 - 72	+15V @ 1.0A	-15V @ 1.0A		86	±0.2%	±1%	50mV	4.56 x 2.56 x 0.83	WR48D15/1000U
WR-K SERIES - WIDE INPUT, REGULATED, SINGLE, DUAL, & TRIPLE OUTPUT, 50 & 60 WATT CONVERTERS											
50	12	9 - 18	5V @ 10A			80	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR12S05/50K
60	12	9 - 18	12V @ 5.0A			82	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR12S12/60K
60	12	9 - 18	12V @ 2.5A	12V @ 2.5A		82	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR12D12/60K
53.8	12	9 - 18	5V @ 5.0A	+12V @ 1.25A	-12V @ 1.25A	80	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR12T05-12/55K
60	24	18 - 36	12V @ 5.0A			83	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR24S12/60K
53.8	24	18 - 36	5V @ 5.0A	+12V @ 1.25A	-12V @ 1.25A	81	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR24T05-12/55K
55	24	18 - 36	5V @ 5.0A	+15V @ 1.0A	-15V @ 1.0A	81	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR24T05-15/55K
50	48	36 - 72	5V @ 10A			82	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48S05/50K
60	48	36 - 72	12V @ 5.0A			84	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48S12/60K
60	48	36 - 72	15V @ 4.0A			84	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48S15/60K
60	48	36 - 72	12V @ 2.5A	12V @ 2.5A		84	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48D12/60K
60	48	36 - 72	15V @ 2.0A	15V @ 2.0A		84	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48D15/60K
53.8	48	36 - 72	5V @ 5.0A	+12V @ 1.25A	-12V @ 1.25A	82	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48T05-12/55K
55	48	36 - 72	5V @ 5.0A	+15V @ 1.0A	-15V @ 1.0A	82	±1%	±1%	75mV	5.5 x 3.5 x 0.91	WR48T05-15/55K

WR FAMILY SPECIFICATIONS

Output Power (Watts)	Input Voltage		Output #1	Output #2	Output #3	Efficiency (%)	Regulation		Output Noise (P-P)	Size (L" x W" x H")	Model Number	Notes
	Nominal (VDC)	Range (VDC)					Line	Load				
WR15 & WR30 SERIES- WIDE INPUT, REGULATED, SINGLE OUTPUT, 15 & 30 WATT CONVERTERS												
15	12	9 - 18	5V @ 3.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR15-12S05	10-14,16
15	12	9 - 18	12V @ 1.25A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-12S12	10-14,16
15	12	9 - 18	15V @ 1.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-12S15	10-14,16
15	24	18 - 36	5V @ 3.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR15-24S05	10-14,16
15	24	18 - 36	12V @ 1.25A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-24S12	10-14,16
15	24	18 - 36	15V @ 1.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-24S15	10-14,16
15	48	36 - 75	5V @ 3.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR15-48S05	10-13,15,16
15	48	36 - 75	12V @ 1.25A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-48S12	10-13,15,16
15	48	36 - 75	15V @ 1.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR15-48S15	10-13,15,16
30	12	9 - 18	3.3V @ 5.0A			78	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-12S3V3	10-14,16
30	12	9 - 18	5V @ 5.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-12S05	10-14,16
30	12	9 - 18	12V @ 2.5A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-12S12	10-14,16
30	12	9 - 18	15V @ 2.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-12S15	10-14,16
30	24	18 - 36	3.3V @ 5.0A			78	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-24S3V3	10-14,16
30	24	18 - 36	5V @ 5.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-24S05	10-14,16
30	24	18 - 36	12V @ 2.5A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-24S12	10-14,16
30	24	18 - 36	15V @ 2.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-24S15	10-14,16
30	48	36 - 75	3.3V @ 5.0A			78	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-48S3V3	10-13,15,16
30	48	36 - 75	5V @ 5.0A			80	±0.2%	±1%	50mV	3.0 x 2.4 x 0.5	WR30-48S05	10-13,15,16
30	48	36 - 75	12V @ 2.5A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-48S12	10-13,15,16
30	48	36 - 75	15V @ 2.0A			82	±0.2%	±1%	100mV	3.0 x 2.4 x 0.5	WR30-48S15	10-13,15,16

NON-ISOLATED DC/DC POWER SUPPLIES

Output Power (Watts)	Input Voltage		Output #1	Output #2	Output #3	Efficiency (%)	Regulation		Output Noise (P-P)	Size (L" x W" x H")	Model Number
	Nominal (VDC)	Range (VDC)					Line	Load			
5 WATT TO 360 WATT CONVERTERS											
5.0		7 - 32	5V @ 1.0A			75	±0.5%	±0.5%	60 mV	2.0 x 2.0 x 0.4	WF12S05/1000Z
15		7 - 40	5V @ 3.0A			80	±0.5%	±0.5%	60 mV	3.0 x 2.56 x 0.37	LWM12S05/3000XA
25		7 - 40	5V @ 5.0A			80	±0.5%	±0.5%	60 mV	3.0 x 2.56 x 0.83	LWM12S05/5000XC
150 to 360		10 - 60	-4.5 to -30V @ 5.0A			75	±0.5%	±1%	250 mV	5.25 x 5.0 x 1.55	3T5AN-6130
150 to 360		10 - 60	+4.5 to +15V@20A			75	±0.5%	±1%	150 mV	5.25 x 5.0 x 1.55	3T20AP-6115
150 to 360		10 - 60	+4.5 to +30V@12A			75	±0.5%	±1%	150 mV	5.25 x 5.0 x 1.55	3T12AP-6130

Notes:
1. Load regulation from 10% to 100% full load (NFC10), 25% to 100% full load (NFC20). C Series line & load regulation; 1% main output, 0.1% auxiliary outputs. **2.** UL1950, CSA C22.2-234/950, EN60950, IEC950, EN41003, & VDE0805 approved or approvals pending. **3.** UL1459, 2nd Edition, Telecom approved. **4.** UL1950, IEC950, CSA C22.2-234/950 approved. **5.** Load regulation: singles - 25% to 100% full load; duals - 50% to 100% full load. **6.** VDE0871 Level B conducted noise. **7.** NFC25 Line Regulation: 0.2% for 5V Output, 1.5% for Auxiliary Outputs. NFC25 Load Regulation: 1% for 5V Output, Auxiliary Output regulation depends on 5V output loading. NFC25 Output Ripple: 80mV P-P for 5V Output, 150mV P-P for Auxiliary Outputs. Call CPI for more information. **8.** NFC40 Total Error Band: 3% for 5V Output, 5% for Auxiliary Outputs. Total Error Band includes initial set point and line & load regulation @ 25°C within stated limits. NFC40 output ripple measured with 0.1 µf ceramic cap at output pins Call CPI for more information. **9.** NFC75/NFC100 Output Ripple measured with 10µF tantalum capacitor across output. **10.** An optional input filter is available which allows the converter to meet VDE0871 Level A, VDE0878 Level A, and EN55022 Level A. Add the suffix "-F" to the model number. **11.** For extended operating temperature to +85°C, add the heatsink option suffix, "-1", to the model number. Maximum heatsink height is 0.5". **12.** Conducted noise to VDE0871 Level B and EN55022 Level B may be achieved by putting a capacitor across the input pins. Recommended capacitor: Sprague 120µF, 100V, 672D Series. **13.** Reverse voltage protection can be implemented by putting a fast blow fuse on the positive input rail. Rate the fuse for 48VDC @ 2A, 24VDC @ 4A, 12VDC @ 8A. **14.** Meets IEC801-4, IEC801-2. **15.** Input transient protection: 200VDC for 100ms. **16.** Load regulation from 25% to 100% F.L.

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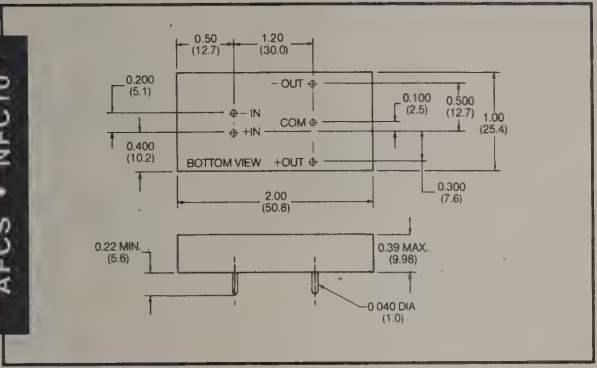
MECHANICAL DIAGRAMS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1.00 (25.4)
0.400 (10.2)
BOTTOM VIEW
+OUT
2.00 (50.8)
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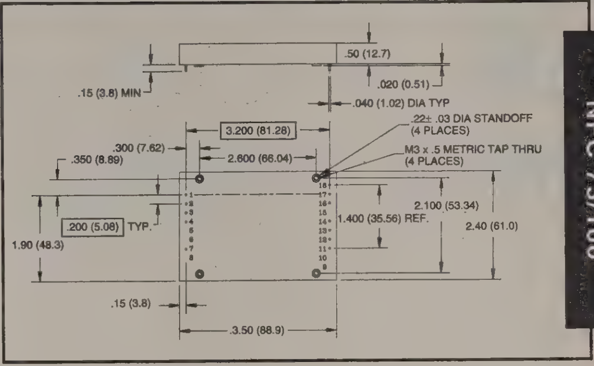
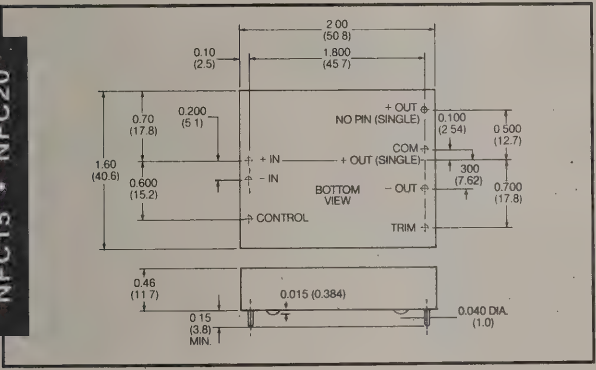
0.39 MAX. (9.98)
0.040 DIA (1.0)

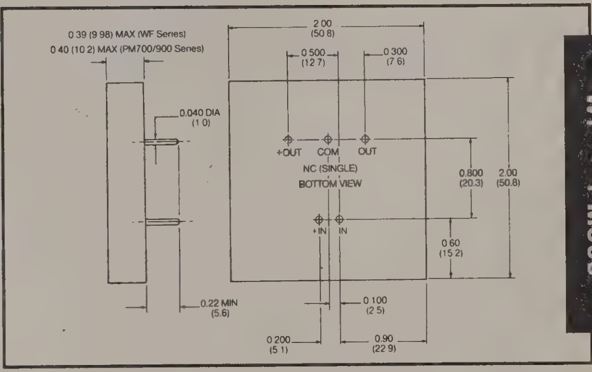
AFCS • NFC10


.50 (12.7)
.020 (0.51)
.15 (3.8) MIN
.040 (1.02) DIA TYP
.22± .03 DIA STANDOFF (4 PLACES)
3.200 (81.28)
M3 x .5 METRIC TAP THRU (4 PLACES)
.300 (7.62)
.350 (8.89)
2.600 (66.04)
2.100 (53.34)
1.400 (35.56) REF.
2.40 (61.0)
.200 (5.08) TYP.
1.90 (48.3)
.15 (3.8)
3.50 (88.9)

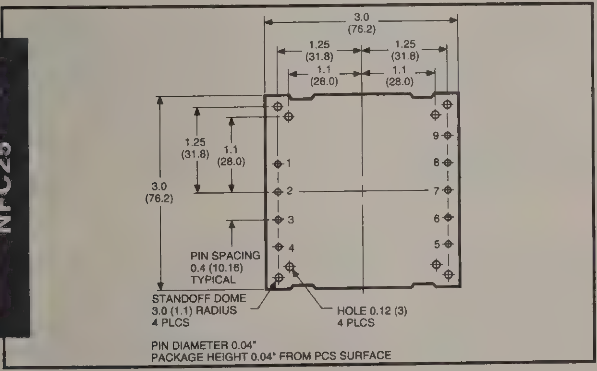
NFC 75/100


2.00 (50.8)
0.10 (2.5)
1.800 (45.7)
+ OUT
NO PIN (SINGLE)
0.70 (17.8)
0.200 (5.1)
0.100 (2.54)
0.500 (12.7)
1.60 (40.6)
+ IN
+ OUT (SINGLE)
COM
- IN
.300 (7.62)
0.600 (15.2)
BOTTOM VIEW
- OUT
0.700 (17.8)
CONTROL
TRIM
0.46 (11.7)
0.015 (0.384)
0.15 (3.8) MIN.
0.040 DIA. (1.0)

NFC15 • NFC20

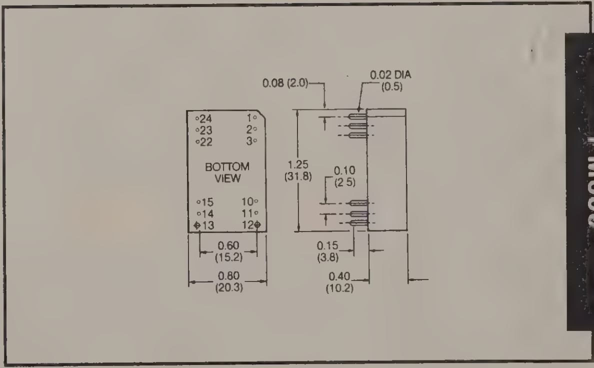

0.39 (9.98) MAX (WF Series)
0.40 (10.2) MAX (PM700/900 Series)
2.00 (50.8)
0.500 (12.7)
0.300 (7.6)
0.040 DIA (1.0)
+OUT
COM
OUT
NC (SINGLE)
BOTTOM VIEW
0.800 (20.3)
2.00 (50.8)
+IN
IN
0.60 (15.2)
0.22 MIN (5.6)
0.100 (2.5)
0.200 (5.1)
0.90 (22.9)

WF • PM900

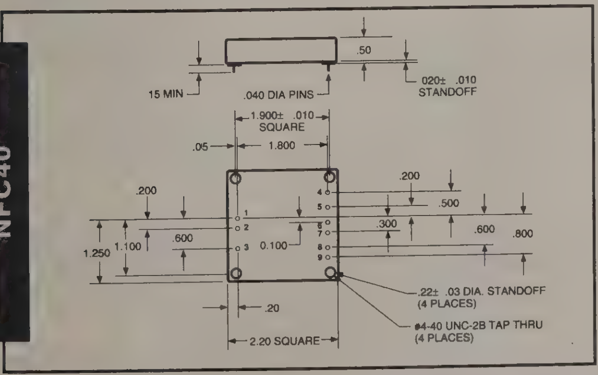

3.0 (76.2)
1.25 (31.8)
1.25 (31.8)
1.1 (28.0)
1.1 (28.0)
1.25 (31.8)
1.1 (28.0)
3.0 (76.2)
1
2
3
4
5
6
7
8
9
PIN SPACING 0.4 (10.16) TYPICAL
STANDOFF DOME 3.0 (1.1) RADIUS 4 PLCS
HOLE 0.12 (3) 4 PLCS

PIN DIAMETER 0.04"
PACKAGE HEIGHT 0.04" FROM PCS SURFACE

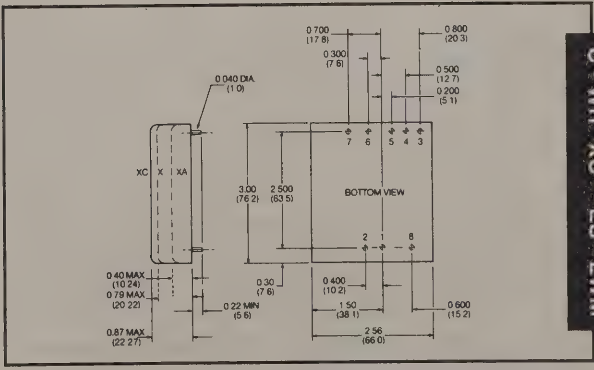
NFC25


0.08 (2.0)
0.02 DIA (0.5)
24
23
22
1
2
3
BOTTOM VIEW
1.25 (31.8)
0.10 (2.5)
15
14
13
10
11
12
0.60 (15.2)
0.15 (3.8)
0.80 (20.3)
0.40 (10.2)

PM600


.50
15 MIN
.040 DIA PINS
.020± .010 STANDOFF
1.900± .010 SQUARE
.05
1.800
.200
.200
.500
1
2
3
4
5
6
7
8
9
.300
.600
.800
.600
1.250
1.100
0.100
.20
.22± .03 DIA. STANDOFF (4 PLACES)
#4-40 UNC-2B TAP THRU (4 PLACES)
2.20 SQUARE

NFC40


0.700 (17.8)
0.800 (20.3)
0.300 (7.6)
0.500 (12.7)
0.200 (5.1)
0.040 DIA (1.0)
7
6
5
4
3
XC
X
XA
3.00 (76.2)
2.500 (63.5)
BOTTOM VIEW
2
1
8
0.40 MAX (10.24)
0.79 MAX (20.22)
0.30 (7.6)
0.22 MIN (5.6)
0.400 (10.2)
1.50 (38.1)
0.600 (15.2)
0.87 MAX (22.27)
2.56 (66.0)

C • WR "XC" • ES • LWM

CONVERSION DEVICES, INC.

EXCELLENCE IN POWER CONVERSION TECHNOLOGY

A large selection of regulated DC/DC Power Converter models with standard input voltage ranges from 0.5 to 48VDC, ±10 % to ±15 % tolerance. Also, wide 2:1 and 4:1 input ranges are available from 3W to 60W with very-low profile and dense package configurations. This new generation of DC/DC Converters utilizes surface mount technology for ruggedness, long-term reliability and performance. Maintaining conservative design rules throughout, complemented by quality manufacturing, test, and reliability standards, CDI accomplishes excellent component stress levels and high MTBFs.

APPLICATIONS:

- Telecommunications Equipment
- Data Communications Equipment
- Distributed Power Networks
- Data Acquisition Instrumentation
- Mobile/Battery Driven Equipment
- Local Area Networks
- Railroad/Transportation Equipment
- Process/Machine Control Equipment
- Automatic Test Instrumentation
- Robotics
- Aircraft

Series	Power Rating (Watts)	Efficiency % @ FL (Typ)	Number of Outputs	Input Voltage Range (VDC)	Input π (Pi) Filter	Isolation VDC (Min)	Output Voltage (VDC)	Output Ripple & Noise MV P-P (Typ)	Dimensions Inches (mm)	Regulation (± %)		Power Density W/In³ (Max)	Brief Description
										Line	Load		
100FR	1.0	57	2	5,12	Yes	500	5,12,15,±12,±15	50	1.27 x 0.62 x 0.40 (32.3 x 15.7 x 10.2)	0.5	0.5	3.17	24-Pin DIP Compatible, Low-Cost Regulated
100VFI ***NEW!***	1.5	75	2	5,12,15	No	4000	5,12,15,±12,±15	40	1.25 x 0.80 x 0.40 (31.8 x 20.3 x 10.2)	1.5	1.5	4.7	24-Pin DIP Compatible, Very High Isolation, High Efficiency,Low-Cost
100FS ***NEW!***	1.0	78	2	5,12	No	500	5,9,12,15,±5,±12,±15	150	0.76 x 0.24 x 0.37 (19.5 x 6.1 x 9.4)	1.2	10.0	14.7	SIP Compatible, Miniature,Unregulated/ Regulated, Low-Cost
200F/FA ***NEW!***	2.25	80	1	5,12	Yes	500	9	50	1.25 x 0.62 x 0.40 (31.8 x 15.7 x 10.2)	1.2	8.0	5.5	24-Pin DIP Compatible, Low-Cost for LAN Applications
200FS/FSR ***NEW!***	2.0/1.8	50	2	5,12	No	500	5,9,12,15,±5,±12,±15	150	1.25 x 0.34 x 0.57 (31.8 x 8.6 x 14.5)	1.2/0.3	8.0/0.5	8/7.2	SIP Compatible, Miniature, Unregulated/ Regulated, Low-Cost
200/300FR	2.0/3.0	62/64	2	5,12	Yes	500	5,12,15,±12,±15	50	1.25 x 0.80 x 0.40 (31.8 x 20.3 x 10.2)	0.5	0.5	6.35/9.5	24-Pin DIP Compatible, Low-Cost, Regulated, High Efficiency
50	0.5	40	1	5	Yes	500	5	15	1.25 x 0.8x 0.4 (32 x 20 x 10.2)	0.3	0.3	1.25	24-Pin, DIP, Regulated, up to 1 MHz Sw frequency, I/O Isolated , Dense package fo a wide range of instrumentation applications
100	1.0	52	1	5,12,18,24,28,48	•	•	5,12,15	•	•	•	•	2.50	•
200	2.0	55	1 & 2	•	•	500/1000	5,±12,±15	•	•	•	•	5.00	•
300	3.0	60	1 & 2	12,18,24,28,48	•	•	15,±15	•	•	•	•	7.50	•
200/300HFR	2.0/3.0	63	2	5,12,24,48	YES	1500	5,12,15,±12,±15	50	1.25 x 0.80 x 0.40 (31.8 x 20.3 x 10.2)	0.5	0.5	9.5	24-Pin DIP Compatible, High Volatage Isolation, Regulated, Low-Cost
200HI	2.0	55	1 & 2	5,12,24,28,48	YES	2000	5,12,15,±12,±15	20	1.25 x 0.8 x 0.4 (32 x 20 x 10.2)	0.3	0.3	5.00	24-Pin DIP Regulated, up to 1MHz Sw. for Frequency, Very High I/O Isolation Industrial and Medical Applications (3000V P-P)
300HI	3.0	60	1 &2	•	•	•	15,±15	•	•	•	•	7.50	•
200I	2.5	57	1 &2	5,12	YES	2500	-9,+15,-10	20	1.3 x 1.3 x 0.375 (33 x 33 x 9.5)	1.0	1.0	4.00	High Voltage Isolation of 2500VDC for LAN Applications
200E	2.5	65	1 &2	5,12,24,28,48	YES	500	5,±12	15	2.0 x 1.0 x 0.350 (51 x 25.5 x 8.96)	0.3	0.3	3.50	Economical , Very Low Profile, Regulated
300E	3.0	65	•	•	•	•	12,15,±15	•	•	•	•	4.30	•
500E	5.0	70	•	•	•	•	5,12,15,±12,±15	20	2.0 x 2.0 x 0.375 (51 x 51 x 9.5)	0.03(1) 0.3(2)	0.03(1) 0.3(2)	3.30	Economical, High Efficiency, Regulated
300UR ***NEW!***	3.0	80	2	10-40,18-72	YES	500	5,12,15,±5,±12,±15	150	1.25 x 0.80 x 0.40 (31.8 x 20.3 x 10.2)	0.5	0.5	9.5	24-Pin DIP Compatible, 4:1 Ultra-Wide Input Voltage Range, Regulated
300WFR ***NEW!***	3.0	84	2	18-36,36-72	YES	500	5,12,15,±5,±12,±15	150	1.25 x 0.80 x 0.40 (31.8 x 20.3 x 10.2)	0.5	0.5	9.5	24-Pin DIP Compatible,2:1 Wide Input Voltage Range, Regulated, Low-Cost
500	5.0	80	1 & 2	5,12,18,24,28,48	YES	500	5,12,15,±5,±12,±15	20	2.0 x 1.0 x 0.350 (51 x 25.5 x 8.96)	0.03	0.03	7.00	High Efficiency, Very Low Profile for a Wide Range of Distributed Power Applications
500UR ***NEW!***	5.0	80	2	10-40,18-72	YES	500	5,9,12,15,±12,±15	150	2.00 x 1.00 x 0.375 (50.8 x 25.4 x 9.52)	1.0	1.0	6.6	Compacy, 4:1 Ultra-Wide Input Range, Regulated
500UFR ***NEW!***	5.0	75	2	9-36,18-72	YES	500	5,9,12,15,±12,±15	100	2.00 x 2.00 x 0.40 (50.8 x 50.k8 x 10.2)	0.2	0.5	3.12	4:1 Ultra-Wide Input Voltage Range, High Efficiency, Regulated
1000WFR ***NEW!***	10.0	80	2	9-18,18-36,36-72	YES	500	5,9.12,15,±12,±15	50	2.00 x 2.00 x 0.40 (50.8 x 50.8 x 10.2)	0.2	0.5	6.25	2:1 Wide Input Voltage Range, High Efficiency, Low-Cost
600H	6.0	70	2	5,12,18,24,28,48	YES	500	±5,±12,±15	15	2.0 x 2.0 x 0.375 (51 x 51 x 9.5)	0.03	0.03	4.00	High Efficiency, Regulated, Very Low Noise, Low Profile for Instrumentation Applications
900H	9.0	70	1	•	•	•	5,12,15	•	•	•	•	8.00	•
1200H	12.0	75	2	•	•	•	±5,±12,±15	•	•				
1500UR ***NEW!***	15.0	80	2	10-40,18-72	YES	500	5,12,15,±5,±12,±15	150	2.00 x 2.00 x0.375 (50.8 x 50.8 x 9.52)	1.0	1.0	10.0	4:1 Ultra-Wide Input Voltage Range, High Efficency, Regulated, Compact
703	8.0	75	1	36-72	YES	500	3.3	25	2.0 x 1.0 x 0.375 (50.8 x 25.4 x 9.52)	0.5	0.5	10.6	3.3VDC Output, Compact, High Efficiency, Regulated
1603 ***NEW!***	16.0	80	1	9-18,18-36,36-72	YES	500	3.3	25	2.0 x 2.0 x 0.375 (50.8 x 50.8 x 9.52)	0.5	0.2	10.6	•

NOTES: (1) Single Output Models / (2) Dual Output Models

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CONVERSION DEVICES, INC.

EXCELLENCE IN POWER CONVERSION TECHNOLOGY

DC/DC Converters for all applications

KEY FEATURES:

- Very Low Profile Packages (0.300")
- Very High Power Density
- 4:1 Ultra-Wide Input Ranges
- Internal Input Filtering (π)
- High Switching Frequencies (>100KHz)
- Up to 4000VDC Voltage Isolation
- Remote ON/OFF Control
- 2 Year Warranty
- Efficiencies Up to 83% @ FL
- Line/Load Regulation up to ± 0.03%
- Very-Low Output Ripple & Noise
- Short Circuit Protection
- UL 1950 and CSA 22.2 Approvals
- Six-Sided EMI Shielded Cases
- 100% Burn-In @ Full Load
- Industry Standard Pin Outs

FROM 0.5W TO 60W SINGLE, DUAL OR TRIPLE OUTPUT, CHOOSE THE RIGHT DC/DC CONVERTER FOR YOUR APPLICATION:

Series	Power Rating (Watts)	Efficiency % @ FL (Typ)	Number of Outputs	Input Voltage Range (VDC)	Input π (Pi) Filter	Output Voltage (VDC)	Isolation Voltage (VDC Min.)	Regulation (± %)		Output Ripple & Noise MV P-P (Typ.)	Power Density W/In³ (Max.)	Dimensions Inches (mm)	Brief Description
								Line	Load				
700PW	7.5	80	1 & 2	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15	500	0.5(1) 1.0(2)	0.2(1) 1.0(2)	50	10.00	2.0 x 1.0 x 0.375 (51 x 25.5 x 9.5)	Wide input range, high density and low profile, high efficiency for Telecom and Portable Equipment.
800 *NEW!*	8.0	82	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	1000	0.5(1) 0.5(2) 0.5(3)	0.2(1) 1.0(2) 5.0(3)	Refer to Note 4	10.50	2.0 x 1.0 x 0.375 (51 x 25.5 x 9.5)	Wide input range, high density and low profile, high efficiency for Avionics and Portable Equipment.
1100 *NEW!*	8.0	82	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.5(1) 0.5(2) 0.5(3)	0.2(1) 1.0(2) 3.0(3)	Refer to Note 4	6.60	2.0 x 2.0 x 0.300 (51 x 51 x 7.6)	Wide input range, very low profile for Rugged Operating Environment. (-55°C to +85°C).
1500	15.0	85	1, 2 & 3	9-18, 18-36, 36-72	NO	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.2(1) 1.0(2) 5.0(3)	0.2(1) 1.0(2) 5.0(3)	Refer to Note 4	10.00	2.0 x 2.0 x 0.375 (51 x 51 x 9.5)	Wide input range, high density, very high efficiency for Telecom and Computer Instrumentation.
1600	16.0	85	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.5(1) 0.5(2) 5.0(3)	0.2(1) 1.0(2) 5.0(3)	Refer to Note 4	10.60	2.0 x 2.0 x 0.375 (51 x 51 x 9.5)	Wide input range, high density, very high efficiency for Avionics, Telecom and Computer Instrumentation.
1800 *NEW!*	16.0	80	1, 2 & 3	18-36	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	1000	0.5(1) 0.5(2) 0.5(3)	0.5(1) 1.0(2) 1.0(3)	Refer to Note 4	7.00	3.0 x 2.56 x 0.300 (76.2 x 66 x 7.6)	High density, very low profile and high efficiency for Avionics and Rugged Operating Environment applications. Wide operating temperature range (-55°C to +85°C).
2000	20.0	80	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.5(1) 0.5(2) 5.0(3)	0.5(1) 0.5(2) 5.0(3)	Refer to Note 4	3.50	3.0 x 2.56 x 0.750 (76.2 x 66 x 19))	Wide input range, high density, high efficiency for Telecom and Distributed Power Applications.
2100	20.0	85	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.2(1) 1.0(2) 5.0(3)	0.2(1) 1.0(2) 5.0(3)	Refer to Note 4	13.30	2.0 x 2.0 x 0.375 (51 x 51 x 9.5)	Wide input range, high density, very high efficiency for Telecom and Computer Applications.
2500	25.0	80	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 6, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.5(1) 0.5(2) 5.0(3)	0.5(1) 0.5(2) 5.0(3)	Refer to Note 4	4.30	3.0 x 2.56 x 0.750 (76.2 x 66 x 19)	Wide input range, high density, very high efficiency for Telecom and Distributed Power Applications.
3000LP	25-30	82	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	500	0.5(1) 1.0(2) 5.0(3)	0.5(1) 5.0(2) 5.0(3)	Refer to Note 4	10.40	3.0 x 2.56 x 0.375 (76.2 x 66 x 9.5)	Wide input range, very low profile, high density and high efficiency for Avionics, Transportation and Computer Instrumentation.
6000	50-60	83	1, 2 & 3	9-18, 18-36, 36-72	YES	5, 12, 15 ±5, ±12, ±15 5/±12, 5/±15	800	0.5(1) 0.5(2) 5.0(3)	0.5(1) 0.5(2) 5.0(3)	Refer to Note 4	6.85	4.56 x 2.56 x 0.750 (115.8 x 66 x 19) Without Heat Sink	Wide input range, high density, half the competitions volume for Telecom and Distributed Power Applications.

NOTES: (1) Single Output Models / (2) Dual Output Models / (3) Dual Output of Triple Output Models / (4) 1% of FS Output.

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Santa Clara, CA 95054

(408)980-5144
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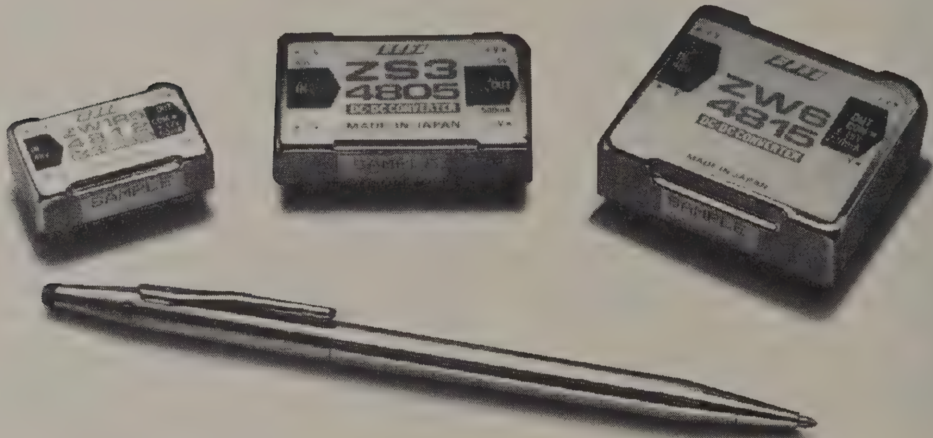
COSEL WORLD-WIDE DC-DC POWER CONVERTERS



DC TO DC CONVERTER

(SINGLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)			SIZE (W x H x D)		WEIGHT		SAFETY
			5V	12V	15V	(mm)	(inch)	(kg)	(lb.)	
ZS	ZS1R5	DC 4.5~6V (5)	0.25	0.12	0.1	33 x 10 x 21	1.30 x 0.39 x 0.83	0.025	0.06	
	ZS3	DC 10~15V (12)	0.5	0.25	0.2	47 x 10 x 30	1.85 x 0.39 x 1.18	0.035	0.08	
	ZS6	DC 20~30V (24)	1.0	0.50	0.4	47 x 14 x 42	1.85 x 0.55 x 1.65	0.070	0.15	
	ZS10	DC 35~63V (48)	1.6	0.70	0.6	47 x 14 x 42	1.85 x 0.55 x 1.65	0.075	0.17	

(MULTIPLE OUTPUT)

SERIES NAME	MODEL	INPUT VOLTAGE	OUTPUT VOLTAGE (V) / CURRENT (A)		SIZE (W x H x D)		WEIGHT		SAFETY
			+/-12V	+/-15V	(mm)	(inch)	(kg)	(lb.)	
ZW	ZW1R5	DC 4.5~6V (5)	0.06	0.05	33 x 10 x 21	1.30 x 0.39 x 0.83	0.025	0.06	
	ZW3	DC 10~15V (12)	0.12	0.10	47 x 10 x 30	1.85 x 0.39 x 1.18	0.036	0.08	
	ZW6	DC 20~30V (24)	0.25	0.20	47 x 14 x 42	1.85 x 0.55 x 1.65	0.070	0.15	
	ZW10	DC 35~63V (48)	0.45	0.35	47 x 14 x 42	1.85 x 0.55 x 1.65	0.075	0.17	

Technical data sheets are available upon request.

(See our DC Power Supplies in section 4000, pages D•1648-1650)

DATEL
INNOVATION and EXCELLENCE

DC/DC POWER CONVERTERS

Features

- ☐ *Single, Dual, Triple Outputs*
- ☐ *Wide Range Inputs:*
  - *18 to 72 Volts*
  - *9 to 36 Volts*
  - *4.6 to 13.2 Volts*
- ☐ *2.1 to 15V Outputs*
- ☐ *Superb Regulation (±0.2% Line, ±0.5% Load)*
- ☐ *Fully Isolated (500V)*
- ☐ *High Efficiency (>80%)*
- ☐ *Wide Temperature Range (-40°C to +105°C)*
- ☐ *Small:*
  - *3 Watts 1.25" x 0.8"*
  - *5 Watts 1" x 1"*
  - *10 Watts 2" x 1"*
  - *20 Watts 2" x 2"*
- ☐ *5 or 6-Sided Shielding*

DATEL
DWR-15/670-D24
DATEL
DC/DC CONVERTER
TWR-5/1500-15/250-D48
DATEL
DATEL
DC/DC CONVERTER
UWR-3.3/2500-D12
DATEL
DC/DC CONVERTER
DATEL
DC/DC CONVERTER
UWR-12/250-D12

UL CSA DVE IEC950 FCC

MADE IN USA

Custom Designs:

DATEL invites inquiries for virtually any large-volume, non-standard product. We fully appreciate that common systems designs often require uncommon power supplies. DATEL has developed a large library of custom and modified-standard designs. We may already have what you need. If we don't, we'll do our best to accomodate your requirements, in your time frame, and at your price.

DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1194 • Tel: (508) 339-3000 • FAX: (508) 339-6356

DATEL (UNITED KINGDOM) Basingstoke Tel: (256) 880444
DATEL (FRANCE) Montigney le Bretonneux Tel: (1) 3460-0101
DATEL (GERMANY) München Tel: (89) 53-43340
DATEL (JAPAN) Tokyo Tel: (3) 3779-1031 Osaka Tel: (6) 354-2025

For immediate assistance:
1-800-233-2765

DATEL®

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SINGLE OUTPUT

Wide Input Range DC/DC Converters

3, 10, 20 Watt

Features:

MADE IN USA

- Wide input range (2:1, 3:1, 4:1)
- Wide operating temperature (–25°C to +105°C)
- Efficiencies to 84%
- Compact size
- Fully isolated (500Vdc minimum)
- Superb line/load regulation
- Overcurrent and short circuit protection
- Reverse polarity input protection
- Synchronization and output voltage adjustment (20W models only)
- Outputs of 3.3V, 5V, 5.2V, 12V or 15V
- Shielded case (10W and 20W models only)

	OUTPUT			INPUT	EFF.	REGULATION		DERATING		PACKAGE*	
Model	V_{OUT} (Volts)	I_{OUT} (mA)	R/N Max. (mV, p-p)	Range (Volts)	(Min.)	Line	Load	Over Amb. Temp. (°C)	Factor (mA°/C)	Size	Connections
UWR-3.3/1800-D5	3.33	1800	50	4.75-7	70%	±1%	±2%	60	40	C2	P3
UWR-3.3/2500-D12	3.33	2500	50	9-18	75%	±1%	±2%	60	55	C2	P3
UWR-3.3/1800-D48	3.33	1800	75	18-72	73%	±1%	±2%	60	40	C2	P3
UWR-3.3/4250-D5	3.33	4250	75	4.6-13.2	73%	±1%	±2%	60	94	C4	P6
UWR-3.3/4850-D12	3.33	4850	75	9-18	75%	±1%	±2%	60	108	C4	P6
UWR-3.3/4850-D48	3.33	4850	100	18-72	79%	±1%	±2%	60	108	C4	P6
UWR-5/500-D5	5	500	120	4.5-9	70%	±0.5%	±0.5%	75	17	C1	P1
UWR-5/500-D12	5	500	120	9-18	70%	±0.5%	±0.5%	75	17	C1	P1
UWR-5/500-D48	5	500	120	18-72	75%	±0.5%	±0.5%	75	17	C1	P1
UWR-5/1600-D5	5	1600	50	4.75-7	73%	±0.2%	±0.5%	60	36	C2	P3
UWR-5/2000-D12	5	2000	50	9-18	79%	±0.2%	±0.5%	60	44	C2	P3
UWR-5/1800-D48	5	1800	75	18-72	78%	±0.2%	±0.5%	60	40	C2	P3
UWR-5/3000-D5	5	3000	75	4.6-13.2	78%	±0.2%	±0.5%	71	88	C4	P6
UWR-5/4000-D12	5	4000	50	9-18	82%	±0.2%	±0.5%	60	89	C4	P6
UWR-5/4000-D24	5	4000	75	9-36	80%	±0.2%	±0.5%	60	89	C4	P6
UWR-5/4000-D48	5	4000	100	18-72	81%	±0.2%	±0.5%	60	89	C4	P6
UWR-5.2/1500-D5	5.2	1500	75	4.75-7	73%	±0.2%	±0.5%	60	36	C2	P3
UWR-5.2/3000-D5	5.2	3000	75	4.6-13.2	78%	±0.2%	±0.5%	71	88	C4	P6
UWR-12/250-D5	12	250	150	4.5-9	72%	±0.5%	±0.5%	75	8	C1	P1
UWR-12/250-D12	12	250	150	9-18	72%	±0.5%	±0.5%	75	8	C1	P1
UWR-12/250-D48	12	250	150	18-72	82%	±0.5%	±0.5%	75	8	C1	P1
UWR-12/665-D5	12	665	85	4.7-7	75%	±0.2%	±0.5%	60	15	C2	P3
UWR-12/830-D12	12	830	75	9-18	81%	±0.2%	±0.5%	65	21	C2	P3
UWR-12/750-D48	12	750	85	18-72	81%	±0.2%	±0.5%	60	17	C2	P3
UWR-12/1250-D5	12	1250	120	4.6-13.2	79%	±0.2%	±0.5%	60	28	C4	P6
UWR-12/1650-D12	12	1650	120	9-18	82%	±0.2%	±0.5%	60	37	C4	P6
UWR-12/1650-D24	12	1650	100	9-36	81%	±0.2%	±0.5%	60	37	C4	P6
UWR-12/1650-D48	12	1650	100	18-72	82%	±0.2%	±0.5%	60	37	C4	P6
UWR-15/200-D5	15	200	150	4.5-9	72%	±0.5%	±0.5%	75	7	C1	P1
UWR-15/200-D12	15	200	150	9-18	72%	±0.5%	±0.5%	75	7	C1	P1
UWR-15/200-D48	15	200	150	18-72	82%	±0.5%	±0.5%	75	7	C1	P1
UWR-15/530-D5	15	530	75	4.7-7	74%	±0.2%	±0.5%	60	12	C2	P3
UWR-15/665-D12	15	665	85	9-18	82%	±0.2%	±0.5%	65	17	C2	P3
UWR-15/600-D48	15	600	100	18-72	81%	±0.2%	±0.5%	60	13	C2	P3
UWR-15/1000-D5	15	1000	150	4.6-13.2	80%	±0.2%	±0.5%	60	22	C4	P6
UWR-15/1300-D12	15	1300	150	9-18	84%	±0.2%	±0.5%	60	29	C4	P6
UWR-15/1300-D24	15	1300	100	9-36	81%	±0.2%	±0.5%	60	29	C4	P6
UWR-15/1300-D48	15	1300	100	18-72	84%	±0.2%	±0.5%	60	29	C4	P6

* Refer to the last page of DATEL's DC/DC Converter section for connections and detailed mechanical dimensions.

Contact DATEL for special requirements.

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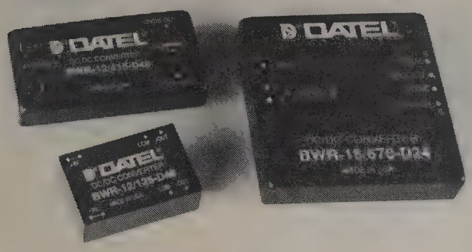
DUAL OUTPUT

Wide Input Range DC/DC Converters
3, 10, 20 Watt



Features

MADE IN USA

- Wide input range (2:1, 3:1, 4:1)
- Wide operating temperature (–25°C to +105°C)
- Efficiencies to 83%
- Fully isolated (500Vdc minimum)
- Excellent line/load regulation
- Overcurrent and short circuit protection
- Reverse polarity input protection
- Synchronization and output voltage adjustment (20W models only)
- Small size
- Outputs of ±5V, ±9V, ±12V and ±15V
- Shielded case (10 and 20 Watt models only)

	OUTPUT			INPUT	EFF.	REGULATION		DERATING		PACKAGE*	
Model	V_{OUT} (Volts)	I_{OUT} (mA)	R/N Max. (mV, p-p)	Range (Volts)	(Min.)	Line	Load	Over Amb. Temp (°C)	Factor (mA/°C)	Size	Connections
BWR-5/700-D5	±5	700	50	4.75-7	74%	±0.2%	±1%	65	17	C2	P4
BWR-5/800-D12	±5	800	50	9-18	78%	±0.2%	±1%	60	18	C2	P4
BWR-5/700-D48	±5	700	100	18-72	77%	±0.2%	±1%	65	17	C2	P4
BWR-5/1500-D5	±5	1500	75	4.6-13.2	78%	±0.2%	±1%	60	33	C4	P7
BWR-5/1700-D12	±5	1700	75	9-18	80%	±0.2%	±1%	60	38	C4	P7
BWR-5/1700-D24	±5	1700	100	9-36	80%	±0.2%	±1%	60	33	C4	P7
BWR-5/1700-D48	±5	1700	100	18-72	82%	±0.2%	±1%	60	38	C4	P7
BWR-9/850-D5	±9	850	150	4.6-13.2	78%	±0.2%	±1%	71	25	C4	P7
BWR-12/105-D5	±12	105	150	4.5-9	70%	±0.5%	±1%	75	3	C1	P2
BWR-12/125-D12	±12	125	150	9-18	75%	±0.5%	±1%	75	4	C1	P2
BWR-12/125-D48	±12	125	150	18-72	80%	±0.5%	±1%	75	4	C1	P2
BWR-12/335-D5	±12	335	50	4.75-7	73%	±0.2%	±1%	60	7	C2	P4
BWR-12/415-D12	±12	415	50	9-18	82%	±0.2%	±1%	65	10	C2	P4
BWR-12/415-D48	±12	415	50	18-72	79%	±0.2%	±1%	60	9	C2	P4
BWR-12/625-D5	±12	625	85	4.6-13.2	80%	±0.2%	±1%	71	18	C4	P7
BWR-12/830-D12	±12	830	85	9-18	83%	±0.2%	±1%	60	18	C4	P7
BWR-12/830-D24	±12	830	100	9-36	81%	±0.2%	±1%	60	18	C4	P7
BWR-12/830-D48	±12	830	85	18-72	82%	±0.2%	±1%	60	18	C4	P7
BWR-15/85-D5	±15	85	150	4.5-9	70%	±0.5%	±1%	75	3	C1	P2
BWR-15/100-D12	±15	100	150	9-18	75%	±0.5%	±1%	75	3	C1	P2
BWR-15/100-D48	±15	100	150	18-72	82%	±0.5%	±1%	75	3	C1	P2
BWR-15/275-D5	±15	275	50	4.75-7	73%	±0.2%	±1%	60	6	C2	P4
BWR-15/330-D12	±15	330	50	9-18	83%	±0.2%	±1%	65	8	C2	P4
BWR-15/330-D48	±15	330	50	18-72	80%	±0.2%	±1%	60	7	C2	P4
BWR-15/500-D5	±15	500	85	4.6-13.2	81%	±0.2%	±1%	60	11	C4	P7
BWR-15/670-D12	±15	670	85	9-18	83%	±0.2%	±1%	60	15	C4	P7
BWR-15/670-D24	±15	670	100	9-36	82%	±0.2%	±1%	60	5	C4	P7
BWR-15/670-D48	±15	670	85	18-72	82%	±0.2%	±1%	60	15	C4	P7

* Refer to the last page of DATEL's DC/DC Converter section for connections and detailed mechanical dimensions.

Contact DATEL for special requirements.

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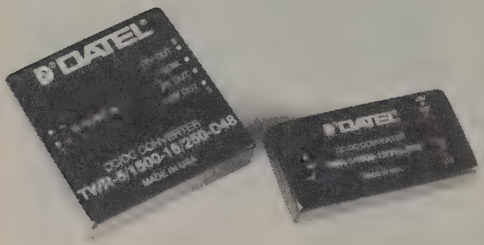
TRIPLE OUTPUT
Wide Input Range DC/DC Converters
10 and 15 Watt



Features

MADE IN USA

- Wide input range (2:1, 4:1)
- Wide operating temperature (–25°C to +105°C)
- Efficiencies to 82%
- Fully isolated (500Vdc minimum)
- Small size
- Shielded case
- Short circuit protection
- Outputs of +5V, ±12V or +5, ±15V
- "R" versions for enhanced regulation
- All parameters fully-tested by ATE
- Reverse polarity input protection
- Insulated case bottom (will not short PC etch)

	OUTPUT			INPUT	EFF.	DERATING		PACKAGE*	
Model	V_{OUT} (Volts)	I_{OUT} (mA)	R/N (mV, p-p)	Range (Volts)	(Min.)	Over Amb. Temp (°C)	Factor (mA/°C)	Size	Connec-tions
TWR-5/1000-12/125-D5	5	1000	75	4.7-7	73%	60	22	C3	P5
	±12	125	120				3		
TWR-5/1000-12/210-D12	5	1000	75	9-18	81%	60	22	C3	P5
	±12	210	120				5		
TWR-5/1200-12/250-D48	5	1200	75	18-72	81%	60	27	C4	P8
	±12	250	175				6		
TWR-5/1500-12/250-D48	5	1500	75	18-72	79%	60	33	C4	P8
	±12	250	175				6		
TWR-5/1800-12/200-D48	5	1800	75	18-72	81%	60	40	C4	P8
	±12	200	175				5		
TWR-5/800-15/150-D5	5	800	75	4.7-7	73%	60	17	C3	P5
	±15	150	150				3		
TWR-5/1000-15/200-D12	5	1000	75	9-18	82%	60	22	C3	P5
	±15	200	120				5		
TWR-5/1000-15/250-D48	5	1000	75	18-72	79%	60	22	C4	P8
	±15	250	175				6		
TWR-5/1500-15/250-D48	5	1500	75	18-72	81%	60	33	C4	P8
	±15	250	175				6		
TWR-5/1800-15/150-D48	5	1800	75	18-72	80%	60	40	C4	P8
	±15	150	175				3		

* Refer to the last page of DATEL's DC/DC Converter section for connections and detailed mechanical dimensions.

Load Regulation:

+5V	±2% (0-100%L)
±12 or ±15V	±5% (50-100%L), ±8% (20-100%L)
"R" Version	±1% (0-100%L)

Line Regulation:

+5V	±1%
±12 or ±15V	±5%

Notes:

1. ±12V/±15V outputs with external 10µF, 25V capacitor for -D5 and -D12 models.
2. "R" versions (-D48 models only) are available for enhanced load regulation. Simply add an "R" at the end of the part number when ordering.
3. All -D48 models are designed with factory-adjustable linear regulators.

Contact DATEL for special requirements.

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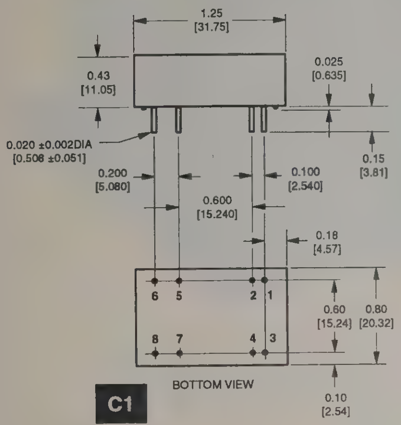
DC/DC CONVERTERS

Mechanical Specifications and I/O Connections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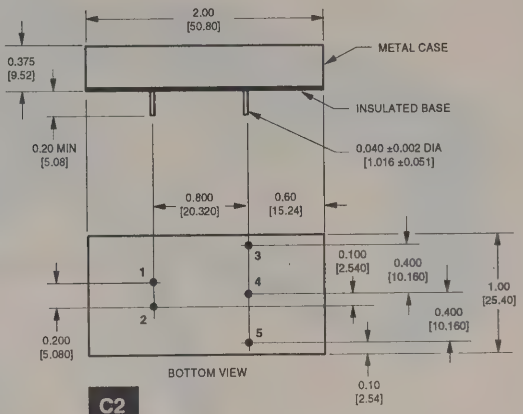
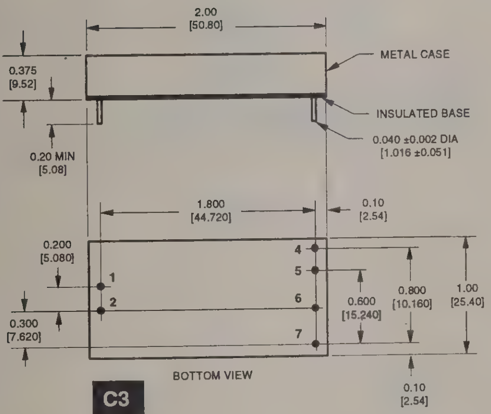
[31.75]
0.43
[11.05]
0.025
[0.635]
0.020 ±0.002DIA
[0.508 ±0.051]
0.200
[5.080]
0.100
[2.540]
0.15
[3.81]
0.600
[15.240]
0.18
[4.57]
6
5
2
1
8
7
4
3
0.60
[15.24]
0.80
[20.32]
0.10
[2.54]
BOTTOM VIEW

C1

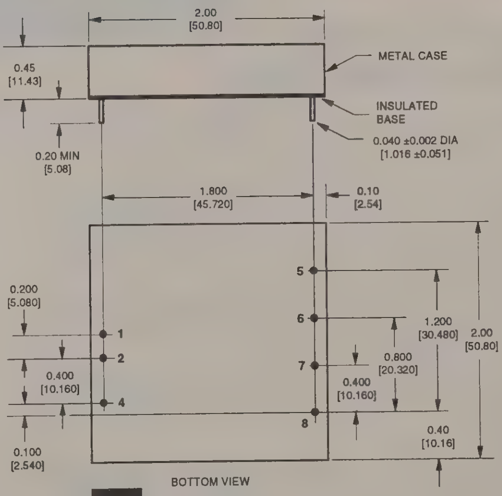

2.00
[50.80]
METAL CASE
0.375
[9.52]
INSULATED BASE
0.20 MIN
[5.08]
0.040 ±0.002 DIA
[1.016 ±0.051]
0.800
[20.320]
0.60
[15.24]
1
2
3
4
5
0.100
[2.540]
0.400
[10.160]
1.00
[25.40]
0.400
[10.160]
0.200
[5.080]
BOTTOM VIEW
0.10
[2.54]

C2


2.00
[50.80]
METAL CASE
0.375
[9.52]
INSULATED BASE
0.040 ±0.002 DIA
[1.016 ±0.051]
0.20 MIN
[5.08]
1.800
[44.720]
0.10
[2.54]
0.200
[5.080]
1
2
4
5
6
7
0.600
[15.240]
0.800
[10.160]
1.00
[25.40]
0.300
[7.620]
BOTTOM VIEW
0.10
[2.54]

C3

NOTES:
DIMENSIONS IN INCHES [MILLIMETERS]
TOLERANCES 2 PLACE ±0.02 [±0.51]
3 PLACE ±0.010 [±0.254]


2.00
[50.80]
METAL CASE
0.45
[11.43]
INSULATED BASE
0.040 ±0.002 DIA
[1.016 ±0.051]
0.20 MIN
[5.08]
1.800
[45.720]
0.10
[2.54]
0.200
[5.080]
5
6
7
8
1
2
4
1.200
[30.480]
2.00
[50.80]
0.800
[20.320]
0.400
[10.160]
0.400
[10.160]
0.40
[10.16]
0.100
[2.540]
BOTTOM VIEW

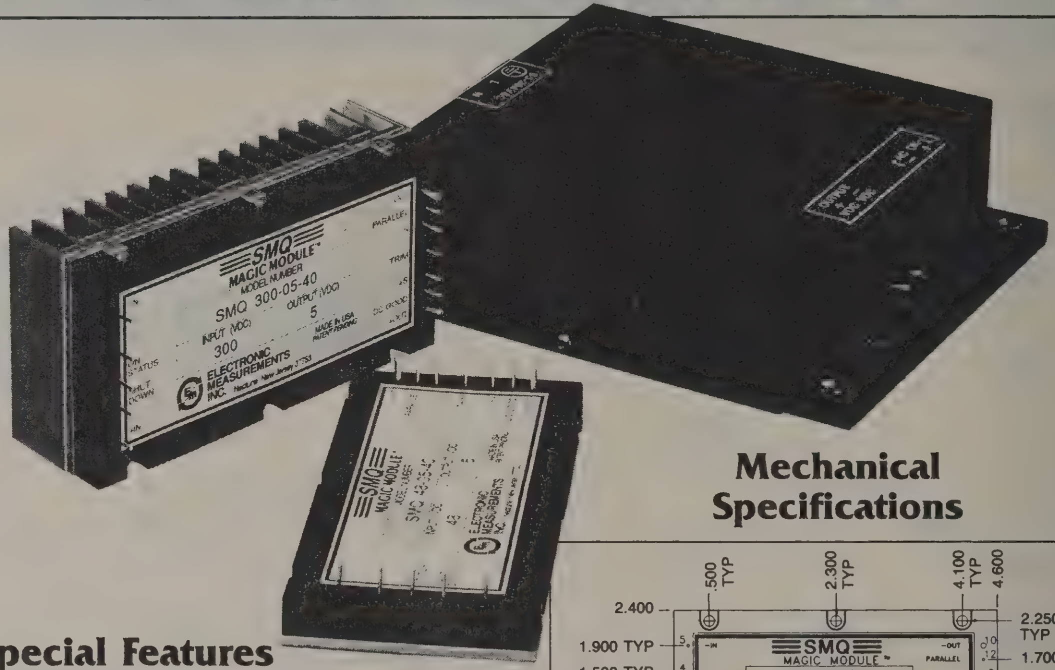
C4

PIN	P1	P2	P3	P4	P5	P6	P7	P8
1	+INPUT	+INPUT	+INPUT	+INPUT	+INPUT	+INPUT	+INPUT	+INPUT
2	+INPUT	+INPUT	–INPUT	–INPUT	-INPUT	-INPUT	-INPUT	-INPUT
3	–INPUT	–INPUT	+OUTPUT 1	+OUTPUT 1	NO PIN	NO PIN	NO PIN	NO PIN
4	–INPUT	–INPUT	NO PIN	COMMON	+OUTPUT 1	CONTROL	CONTROL	NO PIN
5	COMMON	COMMON	COMMON	–OUTPUT 2	–OUTPUT 2	NC	+OUTPUT 1	+OUTPUT 1
6	+OUTPUT 1	+OUTPUT 1	NA	NA	COMMON	+OUTPUT 1	COMMON	+OUTPUT 3
7	COMMON	COMMON	NA	NA	+OUTPUT 3	COMMON	–OUTPUT 2	COMMON
8	+OUTPUT 1	–OUTPUT 2	NA	NA	NA	TRIM	TRIM	–OUTPUT 2

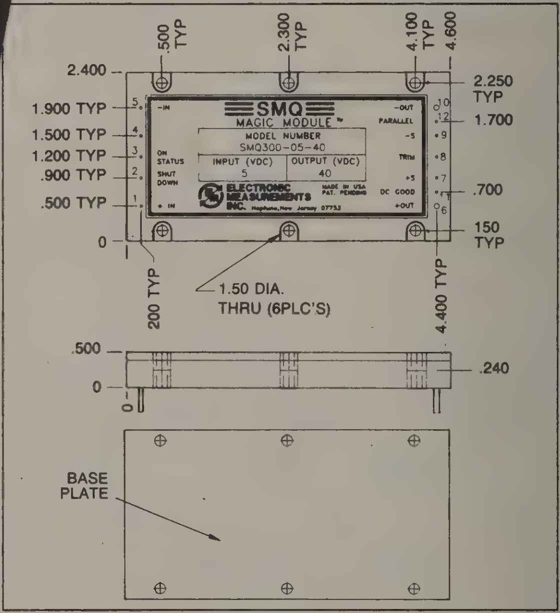
Note: Metal cases C2, C3, and C4 are connected internally to the –INPUT, except -D48 models whose case is connected to the +INPUT.

The MAGIC MODULE™

HIGH DENSITY DC-DC CONVERTERS


SMQ
MAGIC MODULE™
MODEL NUMBER
SMQ 300-05-40
INPUT (VDC)
300
OUTPUT (VDC)
5
MADE IN USA
PATENT PENDING
ELECTRONIC MEASUREMENTS INC.
ON STATUS
SHUT DOWN
PARALLEL
TRIM
DC GOOD

Mechanical Specifications


.500 TYP
2.300 TYP
4.100 TYP
4.600
2.400
2.250 TYP
1.900 TYP
1.500 TYP
1.200 TYP
.900 TYP
.500 TYP
0
1.700
.700
150 TYP
200 TYP
1.50 DIA. THRU (6PLC'S)
4.400 TYP
SMQ
MAGIC MODULE™
MODEL NUMBER
SMQ300-05-40
INPUT (VDC)
5
OUTPUT (VDC)
40
-IN
ON STATUS
SHUT DOWN
+ IN
-OUT
PARALLEL
-S
TRIM
+S
DC GOOD
+OUT
ELECTRONIC MEASUREMENTS INC.
MADE IN USA PAT. PENDING
.500
0
.240
BASE PLATE

Special Features of the SMQ Series

- More Watts Per Cubic Inch (29W/Cu. Inch for 5V/40 A unit)
- Proven Forward Converter Topology To Reduce Voltage and Current Stresses in Power MOSFET
- Fixed Frequency (250 KHz) For Reduced EMI, Better Stability and Greater Ease of Synchronization
- Short Circuit Current Limited to Negligible Level to Protect Load Circuit to Much Greater Degree Than Conventional Foldback Circuits
- Fast Response Overvoltage Protection Circuit Limits Voltage Excursions During Fault or Transient Condition
- Proprietary Planar Magnetics Design For Exceptional Repeatibility and Control of Leakage Inductance
- Excellent *Guaranteed* Transient Response

There are numerous approaches to designing a high-power-density DC converter. With some approaches, as with high frequency resonant topologies, the required component restrictions and circuit nuances can result in subtle but serious performance tradeoffs. For example, the high primary-side peak current, high-line voltage stresses and reduced transient response are often a problem. Operation under short circuit or overvoltage conditions can result in additional undesirable performance characteristics.

The advanced SMQ series has been designed to meet the high density power objectives without giving in to the above tradeoffs. It represents a blend of proven engineering with a careful application of advanced concepts in semiconductor technology, magnetics design, thermal management, fault protection and packaging. It represents performance without risk.

ELECTRONIC MEASUREMENTS, INC.
405 Essex Road, Neptune, NJ 07753 • Telephone: 908-922-9300 • FAX: 908-922-9334

The MAGIC MODULE™

HIGH DENSITY DC-DC CONVERTERS

Model Selection

NOMINAL INPUT VOLTAGE (VDC)	NOMINAL INPUT VOLTAGE (VDC)		OUTPUT VOLTAGE (VDC)				OUTPUT POWER (WATTS)
	MIN.	MAX.	5 V	12 V	15 V	24 V	
300	200	400	SMQ 300-05-40	SMQ 300-12-16	SMQ 300-15-13	SMQ 300-24-8	200
	(170)¹	(425)²	SMQ 300-05-30	SMQ 300-12-12	SMQ 300-15-10	SMQ 300-24-6	150
			SMQ 300-05-20	SMQ 300-12-8	SMQ 300-15-6	SMQ 300-24-4	100
			SMQ 300-05-15	SMQ 300-12-6	SMQ 300-15-5	SMQ 300-24-3	75
150	100	200	SMQ 150-05-40	SMQ 150-12-16	SMQ 150-15-13	SMQ 150-24-8	200
	(85)¹	(120)²	SMQ 150-05-30	SMQ 150-12-12	SMQ 150-15-10	SMQ 150-24-6	150
			SMQ 150-05-20	SMQ 150-12-8	SMQ 150-15-6	SMQ 150-24-4	100
			SMQ 150-05-15	SMQ 150-12-6	SMQ 150-15-5	SMQ 150-24-3	75
48	40	60	SMQ 48-05-40	SMQ 48-12-16	SMQ 48-15-13	SMQ 48-24-8	200
	(36)¹	(72)²	SMQ 48-05-30	SMQ 48-12-12	SMQ 48-15-10	SMQ 48-24-6	150
			SMQ 48-05-20	SMQ 48-12-8	SMQ 48-15-6	SMQ 48-24-4	100
			SMQ 48-05-15	SMQ 48-12-6	SMQ 48-15-5	SMQ 48-24-3	75
24	20	30	SMQ 24-05-30	SMQ 24-12-12	SMQ 24-15-10	SMQ 24-24-6	150
	(18)¹	(36)²	SMQ 24-05-15	SMQ 24-12-6	SMQ 24-15-5	SMQ 24-24-3	75
12	11	20	SMQ 12-05-20	SMQ 12-12-8	SMQ 12-15-6	SMQ 12-24-4	100
	(10)¹	(24)²	SMQ 12-05-10	SMQ 12-12-4	SMQ 12-15-3	SMQ 12-24-2	50

1. Voltage at which unit will support 75% of full load and still maintain load regulation.
2. Unit will withstand this input voltage for up to 10 seconds (maximum duty cycle of 1%)

Operational Ratings and Characteristics

INPUT	
Input Voltage	**(See above)**
Input Reflected Ripple	5% of Nominal Input Current
Turn-on Time	100 mS Typical

OUTPUT	
Voltage Accuracy	1%
Isolation (Input/Output), 24–48 V Input	1500 VDC Min.
Isolation (Input/Output), 300 V Input	4300 VDC Min.
Efficiency (Nominal Line/Full Load)	80% Typical–All Output Voltages
Switching Frequency	250 KHz Typical
Line Regulation	0.2%
Load Regulation	0.5%
Peak-to-Peak Output Ripple and Noise	3% (20 MHz Bandwidth)
Transient Response, 50–100% Full Load	500 μS Max.
Current Limit	110–125% of Full Load Rating
Overvoltage Protection (OVP)	115–135% of Nom. Output Voltage (Latches off until power is recycled)
Thermal Shutdown (Baseplate Temp.)	90–105°C (Auto Recovery)
Short Circuit Current Limit (Current at which shutdown occurs)	135% of Load Rating (Auto Recovery)
Maximum RMS Short Circuit Current	10% of Rated Output Current

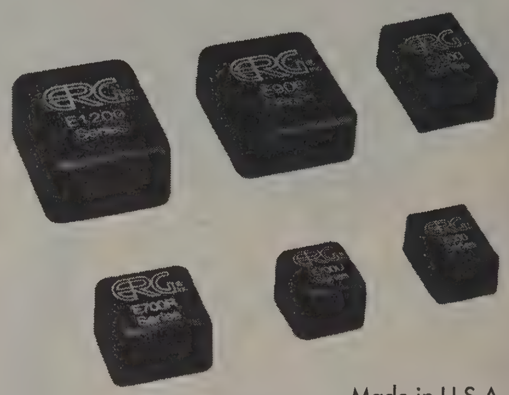
ELECTRONIC MEASUREMENTS, INC.
405 Essex Road, Neptune, NJ 07753 • Telephone: 908-922-9300 • FAX: 908-922-9334

The U.S. Power Supply Source for Information Displays

DC-DC CONVERTERS

DC-DC Converters for Gas Discharge Displays up to 25W

Convert low DC line voltage to the higher voltage levels required to activate multi-segment plasma gas dicharge displays (including bar graphs). ERG Converters eliminate the need for 200-250 vdc line.



Made in U.S.A.

Contact Factory for Voltage Requirements:

- Custom Design Variations for multi-segment, bar graph and dot matrix gas discharge and vacuum flourescent diplays
- Inputs from 5 vdc to 28 vdc
- Outputs from 5 vdc to 1,500 DC
- Single and dual outputs (up to 25W total)
- Regulated and unregulated
- Center Tap (voltages)

General Specifications

Converter Series	Input	Output	Size	Weight	Package
E700U	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.1" (27.94 mm)X 1.2" (30.48 mm)X .91" (23.11 mm) max. high	30 gms.	Plastic
E700R (Regulated)	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.43" (36.32 mm)X 1.5" (38.10 mm)X 1.03" (26.16 mm) max. high	40 gms.	Plastic
E500*	5, 9, 12, 15 vdc	Up to 3W unregulated (i.e. 200 vdc @ 15 ma)	1.00" (25.40 mm)X 1.38" (35.05 mm)X 0.70" (17.78 mm) high	20 gms.	Plastic
E1600	5, 9, 12, 15 vdc	Up to 6W unregulated (i.e. 200 vdc @ 24 ma)	1.30" (33.02 mm)X 1.88" (63.50 mm)X 0.82" (24.9 mm) high	44 gms.	Plastic
E900	5, 9, 12, 15 vdc	Up to 12W total, with single or dual outputs, unregulated; (i.e. Single: 250 vdc @ 30 ma Dual: 250 vdc @ 30 ma and - 16 vdc @ up to 200 ma to power the drive electronics in many applications using the Burroughs SELF-SCAN* or IEE* ARGUS displays)	2" (50.80 mm)X 2.5" (63.50 mm)X .98" (24.9 mm) high	122 gms.	Aluminum
E1200	12, 15 vdc standard (others to your spec)	Up to 25W unregulated (i.e. 250 vdc @ 100 ma)	2" (50.80 mm)X 2.5" (63.50 mm)X 1.19" (30.23 mm) high	185 gms.	Aluminum

* For high-volume requirements, E500 delivers same performance as E700 at significantly lower unit cost!

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 600V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0-70°C standard. Wider ranges available.

Endicott Research Group, Inc.
2601 Wayne Street • PO Box 269 • Endicott, NY 13760
Phone 607 754-9187 • FAX 607 754-9255
The U.S. Power Supply Source for Information Displays

The U.S. Power Supply Source for Information Displays

DC-DC/AC CONVERTERS FOR VF DISPLAYS

DC-DC/AC Converters for Vacuum Flourescent Displays up to 12W

E900 VF Series
E900 VF Series
E800 VF Series
E700 VF Series

Made in U.S.A.

No need for "special" multiple output power supplies. ERG converters produce both anode and filament voltages for VF displays up to 12W. Compatible with all major VF display makes.

Mount on your PC board as needed, where needed. ERG can tailor a "VF" Series Power Supply to match the voltage requirements of any Vacuum Flourescent Display or input voltage (DC) requirement.

Contact the factory for more information.

General Specifications

Converter Series	Input	Output	Size	Weight	Package
E700 VF up to 3W	5, 12 vdc (other inputs available.)	DC Anode voltage and Center tap (AC) filament voltage.	1.1" (27.94 mm)X 1.2" (30.48 mm)X .91" (23.11 mm) max. high	30 gms.	Plastic
E800 VF up to 6W	5, 12 vdc (other inputs available.)	Up to 6W max.	1.43" (36.32 mm)X 1.50" (38.10 mm)X 1.03" (26.16 mm) high	40 gms.	Plastic
E900 VF up to 12W	5, 12 vdc (other inputs available.)	Up to 12W max. (to 7.5W max. with 5V DC input)	2" (50.80 mm)X 2.5" (63.50 mm)X .98" (24.9 mm) high	122 gms.	Aluminum

Mounting:	P.C. board standard
Encapsulation:	All ERG converters are fully encapsulated
Isolation (in/out):	300V RMS (60 Hz. breakdown for 1 min.) standard
Temperature:	0-70°C standard. Wider ranges available. 85°C case max.

Endicott Research Group, Inc.
2601 Wayne Street • PO Box 269 • Endicott, NY 13760
Phone 607 754-9187 • FAX 607 754-9255
The U.S. Power Supply Source for Information Displays

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

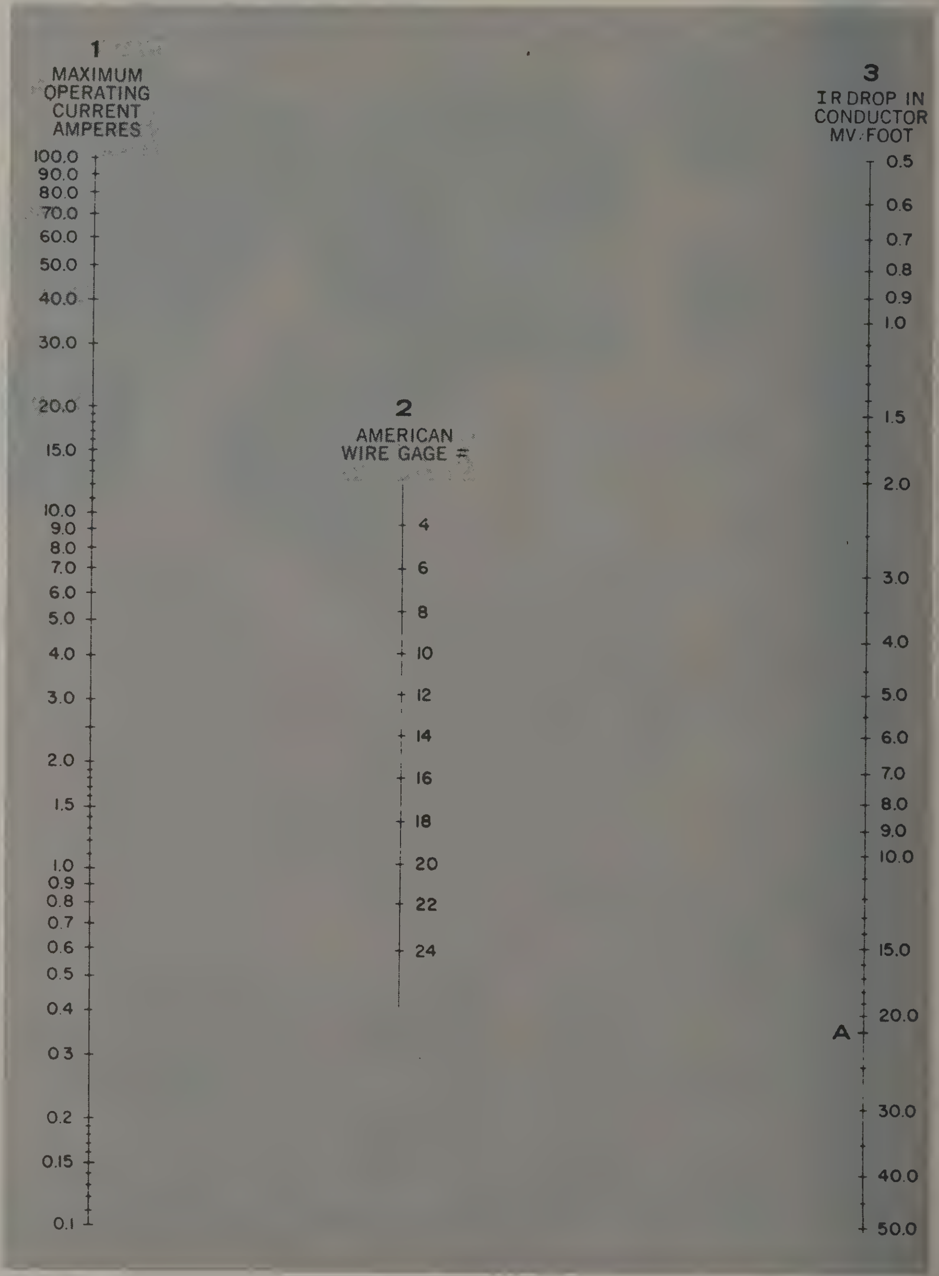
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

** Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

90Z Family for 802.2 Compliant On-Board Discrete DC/DC Converter

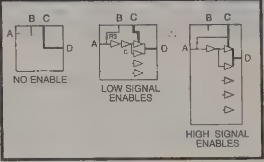
FEE Fil-Mag®

DC/DC Converter Magnetics

Key Features

- The cost of magnetic suppliers' overheads are eliminated
- The board can be laid out in a quick and efficient manner
- No guess work as to how to implement your own on-board converter
- Optimum space utilization
- Reduce EMI due to open construction
- No high cost failure items
- Pick-and-place magnetics in conjunction with OEM's selection of all SMD components
- Critical layout issue identified
- Output inductor is a common mode choke for further EMI reduction

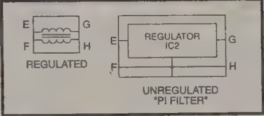
Enable Options



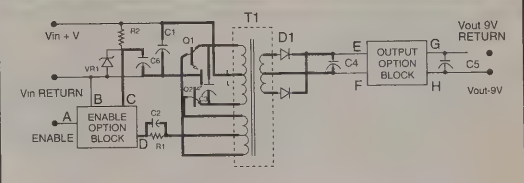
T1	VOLTAGE	
90Z021SM	5V to -9V	Unregulated
90Z022SM	5V to -9V	Regulated
90Z023SM	12V to -9V	Unregulated
90Z024SM	12V to -9V	Regulated

Note:
Refer to Bill of Material Matrix for building your own on-board DC/DC converter

Output Options

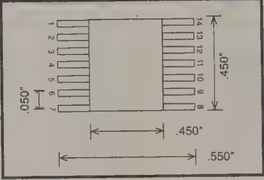


Schematic



NOTE: THE HEAVY LINES IN THE SCHEMATIC IDENTIFY CRITICAL LAYOUT AREAS. LINES BETWEEN THESE PARTS SHOULD BE KEPT AS SHORT AS POSSIBLE.

Mechanical



Ratings:
Operating Temperature: 0 to 70°C
Voltage Range: ±5%
Output Current Range: 100-225mA
Vout: 9 ±5%

Bill of Material Matrix for Building Your Own DC/DC Converter

T1 Part No.	90Z021SM	90Z022SM	90Z021SM	90Z022SM	90Z021SM	90Z022SM
Vin	5	5	5	5	5	5
Vout	-9	-9	-9	-9	-9	-9
Regulated?	NO	YES	NO	YES	NO	YES
Enable?	NO	NO	LOW	LOW	HIGH	HIGH
C1, C4, C5	A	A	A	A	A	A
C2	.01uF	.01uF	.01uF	.01uF	.01uF	.01uF
C3	2200pf	2200pf	2200pf	2200pf	2200pf	2200pf
C6	NONE	NONE	NONE	NONE	NONE	NONE
D1	B	B	B	B	B	B
R1	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W
R2	0OHM	0 OHM	0 OHM	0 OHM	0 OHM	0 OHM
R3	NONE	NONE	47K	47K	47K	47K
Q1, Q2	C	C	C	C	C	C
U1	NONE	NONE	74HCT04	74HCT04	74HCT04	74HCT04
U2	NONE	79M09	NONE	79M09	NONE	79M09
L1	23Z104SM	23Z104SM	23Z104SM	23Z104SM	23Z104SM	23Z104SM

T1 Part No.	90Z023SM	90Z024SM	90Z023SM	90Z024SM	90Z023SM	90Z024SM
Vin	12	12	12	12	12	12
Vout	-9	-9	-9	-9	-9	-9
Regulated?	NO	NO	NO	YES	NO	YES
Enable?	NO	NO	LOW	LOW	HIGH	HIGH
C1, C4, C5	A	A	A	A	A	A
C2	.01uF	.01uF	.01uF	.01uF	.01uF	.01uF
C3	2200pf	2200pf	2200pf	2200pf	2200pf	2200pf
C6	.1uF	.1uF	.1uF	.1uF	.1uF	.1uF
D1	B	B	B	B	B	B
R1	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W	1K, 1/8W
R2	1K, 1/4W	1K, 1/4W	1K, 1/4W	1K, 1/4W	1K, 1/4W	1K, 1/4W
R3	NONE	NONE	47K	47K	47K	47K
Q1, Q2	C	C	C	C	C	C
U1	NONE	NONE	74HCT04	74HCT04	74HCT04	74HCT04
U2	NONE	79M09	NONE	79M09	NONE	79M09
L1	23Z104SM	23Z104SM	23Z104SM	23Z104SM	23Z104SM	23Z104SM
VR1	MMBZ5232B	MMBZ5232B	MMBZ5232B	MMBZ5232B	MMBZ5232B	MMBZ5232B

CAP A

100uF 16V Electrolytic
6.8uF 16V Oscon
6.8uF 16V Tantalum
MVK16VC101MX810TP United Chemicon or equivalent
16SMR8M Sanyo Oscon or equivalent

DIODE B

>.2A, 25V Surface Mount MURD305 or equivalent

TRANSISTOR C

Surface Mount "2N2222" MMBT2222A or equivalent

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In the construction of the components described, the full intent of the specification will be met. FEE Fil-Mag, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products.

The information included herein is believed to be accurate and reliable. However, FEE Fil-Mag assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

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FEE Fil-Mag USA
9445 Farnham
San Diego, CA 9212
Tel (619) 569-6577
Fax (619) 569-6073

International
Power Sources, Inc.

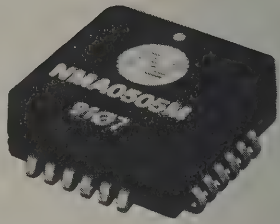
DC/DC Converters
1 Watt to 650 Watts

Switching Power Supplies
15 to 650 Watts

DC/DC CONVERTERS

1 Watt–2 Watt Epoxy Encapsulated DC/DC Converters
NEW! Now Available in Surface Mount

- 5, 12, 24 and 48 VDC Inputs
- SIP, DIL and SMT Packages
- 3000 VDC Isolation
- 0.12 in² board space
- 80% Efficiency
- 22 Watts per in³



Output Voltage	Output Current	Part Number			
		5VDC Input	12VDC Input	24VDC Input	48VDC Input
±5VDC	±100mA	NMA0505	NMA1205	NMA2405	NMA4805
±12VDC	±40mA	NMA0512	NMA1212	NMA2412	NMA4812
±15VDC	±30mA	NMA0515	NMA1215	NMA2415	NMA4815

Output Voltage	Output Currents	Part Numbers	
		5VDC Input	12VDC Input
5VDC	160mA	NME0505	NME1205
12VDC	84mA	NME0512	NME1212
15VDC	67mA	NME0515	NME1215

Output Voltage	Output Currents	Part Numbers	
		5VDC Input	12VDC Input
±5VDC	±200mA	NMH0505	NMH1205
±9VDC	±110mA	NMH0509	NMH1209
±12VDC	±85mA	NMH0512	NMH1212
±15VDC	±65mA	NMH0515	NMH1215

Add suffix "S" for single-in-line package, suffix "D" for dual-in-line package, suffix "M" for SMT

NEW!! NMF Regulated Series

- Fully regulated 1 watt output
- 5, 12, 24 and 48VDC inputs
- 0.18 in² of board space
- 1000 VDC isolation
- Ideal for flash memory

NEW!! NMV 3000 VDC Isolation Series

- 3000 VDC Isolation
- 1 Watt outputs
- 5, 12, 24 and 48VDC inputs
- 0.18 in² of board space
- 80% efficiency

1.5–6.0 Watt DC/DC Converters

- 5, 12, 24, 28 and 48 VDC Inputs
- Industry Standard Pinouts
- 500 VDC Isolation
- Input π Filters
- Fully Regulated Outputs
- Low Cost

BA SERIES

Output Voltage	Output Current	Input Voltage				
		5 VDC	12 VDC	24 VDC	28 VDC	48 VDC
5 VDC	300 mA	BA101	BA201	BA301	BA401	BA501
12 VDC	125 mA	BA102	BA202	BA302	BA402	BA502
15 VDC	100 mA	BA103	BA203	BA303	BA403	BA503
±12 VDC	±60 mA	BA104	BA204	BA304	BA404	BA504
±15 VDC	±50 mA	BA105	BA205	BA305	BA405	BA505

BC SERIES

Output Voltage	Output Current	Input Voltage				
		5 VDC	12 VDC	24 VDC	28 VDC	48 VDC
5 VDC	1.00A	BC101	BC201	BC301	BC401	BC501
12 VDC	0.47A	BC102	BC202	BC302	BC402	BC502
15 VDC	0.40A	BC103	BC203	BC303	BC403	BC503
±12 VDC	±0.23A	BC104	BC204	BC304	BC404	BC504
±15 VDC	±0.19A	BC105	BC205	BC305	BC405	BC505

International Power Sources, Inc. • 200 Butterfield Drive • Ashland, Massachusetts 01721
• TEL: 508/881-7434 • FAX: 508/879-8669

International Power Sources, Inc.

DC/DC CONVERTERS

WA/WB/WC/WH Series
3/5/7.5/15 Watt DC/DC Converters

INTERNATIONAL POWER SOURCES
WB 304

- 2:1 Input Range
- Isolated Outputs
- Efficiency to 80%
- 100 kHz Switching Frequency
- WA—24 Pin DIL Package
- Input π Filter
- Fully Regulated Ouputs
- Industry Standard Pinouts
- PCB Mountable
- WB/WC—2.0″×2.0″×.4″ Package

Model Number	Input Voltage	Output Voltage	Output Current	Input Current No Load	Input Current Full Load	% EFF
WA101	4.5-6.0 VDC	5 VDC	500mA	75mA	730mA	69
WA102	4.5-6.0 VDC	12 VDC	250mA	75mA	874mA	69
WA103	4.5-6.0 VDC	15 VDC	200mA	75mA	869mA	69
WA201	9-18 VDC	5 VDC	500mA	25mA	310mA	67
WA202	9-18 VDC	12 VDC	250mA	25mA	345mA	73
WA203	9-18 VDC	15 VDC	200mA	25mA	357mA	70
WA204	9-18 VDC	±5 VDC	250mA	25mA	320mA	65
WA205	9-18 VDC	±12 VDC	125mA	25mA	370mA	68
WA206	9-18 VDC	±15 VDC	100mA	25mA	370mA	68
WA301	18-36 VDC	5 VDC	500mA	15mA	150mA	70
WA302	18-36 VDC	12 VDC	250mA	15mA	170mA	74
WA303	18-36 VDC	15 VDC	200mA	15mA	174mA	72
WA304	18-36 VDC	±5 VDC	250mA	15mA	170mA	61
WA305	18-36 VDC	±12 VDC	125mA	15mA	186mA	67
WA306	18-36 VDC	±15 VDC	100mA	15mA	182mA	69
WA401	36-72 VDC	5 VDC	500mA	15mA	73mA	71
WA402	36-72 VDC	12 VDC	250mA	15mA	94mA	66
WA403	36-72 VDC	15 VDC	200mA	15mA	92mA	68
WA404	36-72 VDC	±5 VDC	250mA	15mA	85mA	61
WA405	36-72 VDC	±12 VDC	125mA	15mA	94mA	67
WA406	36-72 VDC	±15 VDC	100mA	15mA	94mA	67

NOTE: Nominal Input Voltage 5, 12, 24, or 48 VDC

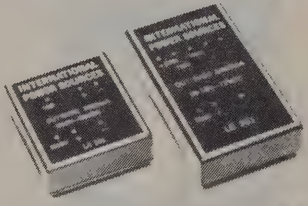
Input Voltage	Output Voltage	WB Series Output Current	WB Series Model Number	WC Series Output Current	WC Series Model Number
9-18 VDC	5 VDC	1000 mA	WB101	3000 mA	WC101
9-18 VDC	12 VDC	470 mA	WB102	1250 mA	WC102
9-18 VDC	15 VDC	400 mA	WB103	1000 mA	WC103
9-18 VDC	±12 VDC	±230 mA	WB104	±625 mA	WC104
9-18 VDC	±15 VDC	±190 mA	WB105	±500 mA	WC105
18-36 VDC	5 VDC	1000 mA	WB201	3000 mA	WC201
18-36 VDC	12 VDC	470 mA	WB202	1250 mA	WC202
18-36 VDC	15 VDC	400 mA	WB203	1000 mA	WC203
18-36 VDC	±12 VDC	±230 mA	WB204	±625 mA	WC204
18-36 VDC	±15 VDC	±190 mA	WB205	±500 mA	WC205
36-72 VDC	5 VDC	1000 mA	WB301	3000 mA	WC301
36-72 VDC	12 VDC	470 mA	WB302	1250 mA	WC302
36-72 VDC	15 VDC	400 mA	WB303	1000 mA	WC303
36-72 VDC	±12 VDC	±230 mA	WB304	±625 mA	WC304
36-72 VDC	±15 VDC	±190 mA	WB305	±500 mA	WC305

New!! WH Series
7.5 Watt DC/DC Converters

INTERNATIONAL POWER SOURCES

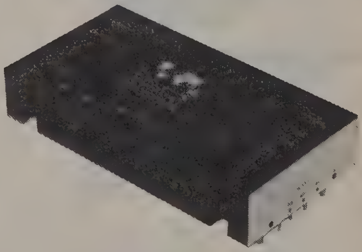
- 2:1 Input Range
- Isolated Outputs
- Single and Dual Outputs
- 2.0" X 1.0" X .4" Package

LA/LB/LP/LT Series
15-30 Watt DC/DC Converters



- 4:1 Input Range
- PCB Mountable
- Efficiency to 86%
- Industry Standard Pinouts
- 500 VDC Isolation
- Remote Sense/Disable

HD Series
50-240 Watt DC/DC Converters



Input	Single Output Modules 3.3V	5V	6V	12V	15V	24V	48V	Triple Output Modules 5V/12V*/12V*	5V/15V*/15V*	Pout Max.
12V (10-20V)	15A	12A	10A	5A	4A	2.5A	1.5A	10A/3A/3A	10A/2.5A/2.5A	60W
24V (20-36V)	25A	25A	20A	11A	9A	5.5A	3A	15A/3A/3A	15A/2.5A/2.5A	125W
48V (40-65V)	30A	30A	25A	14A	11A	7A	3.5A	20A/4A/4A	20A/3.5A/3.5A	150W
155V (115-180V)	35A	35A	30A	18A	15A	9A	4.5A	25A/4A/4A	25A/3.5A/3.5A	175W
300V (225-400V)	40A	40A	35A	20A	16A	10A	5A	25A/4A/4A	25A/3.5A/3.5A	200W

*8A surge for 5 seconds not to exceed maximum power rating.

- High Density DC/DC Converters
- Single/Triple Outputs to 240W
- Fixed Frequency Operation
- 70-90% Efficiency
- Industry Standard Footprint

International Power Sources. • 200 Butterfield Drive • Ashland, Massachusetts 01721
• TEL: 508/881-7434 • FAX: 508/879-8669

RELIABILITY

interpoint

The World-Wide Reliability Standard

Founded in 1969, as Integrated Circuits Incorporated (ICI), Interpoint is the premier world-wide supplier of high reliability dc-dc converters. Its components supply power on virtually every commercial airliner in the West, the space shuttle, the most advanced U.S. and European fighters, and in a wide variety of missile systems, ground vehicles, industrial applications and medical electronics.

Leading Edge Technology

Interpoint is a specialist in producing power supplies to military quality levels. It is listed on DESC's QML and offers SMD versions of qualified dc-dc converters.

Additionally, Interpoints's production facilities offer full MIL-STD-883 qualification, Statistical Process Controls, and audited verification of sources, processes, and procedures. High precision automated assembly and test equipment means the highest quality levels for both large and small production runs.

With over 500 team members worldwide, Interpoint offers a choice between U.S. manufacturing and wholly owned international production. Interpoint dc-dc converters– even those intended for industrial applications– are produced on the same lines as our military/aerospace models. They are all designed to provide the very highest levels of quality and reliability.

MILITARY/AEROSPACE Converters

These sealed, metal encased converters offer power solutions from 1 to 285 watts with the highest reliability, best performance, and smallest size in the industry. Environmental screening is available either to Interpoint procedures or MIL-STD-883.

Filter and Protection Modules

Matched to our military/aerospace converters, these modules bring Interpoint converters within MIL-STD-461's CEO3 noise limits and protect them against surges and spikes. Sealed, metal packages are standard. Optional environmental screening is also available.

HI-REL Industrial Converters

These metal or potted epoxy designs are intended for industrial applications that need higher reliability and smaller size than standard commercial grade parts.

Low Cost Minor Modifications

Interpoint can modify a standard part or design a completely new converter to your specifications. Just ask one of our application support engineers about custom services.

Call 1-800-822-8782

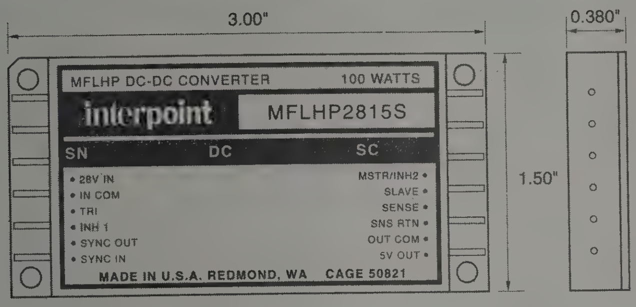
DC-DC CONVERTERS
MIL-STD-883
SMDs AVAILABLE

Interpoint is fully qualified for the processes necessary to build dc-dc converters to MIL-H-38534 and offers models compliant to MIL-STD-883. Interpoint is listed on DESC's Qualified Manufacturer's List (QML) and offers a wide variety of Standard Military Drawing (SMD) models. Call your Interpoint representative for status on our expanding list of qualified products.

Tel: (206) 882-3100
Fax: (206) 882-1990

10301 Willows Road
Redmond, WA 98052

MILITARY/ AEROSPACE DC - DC CONVERTERS

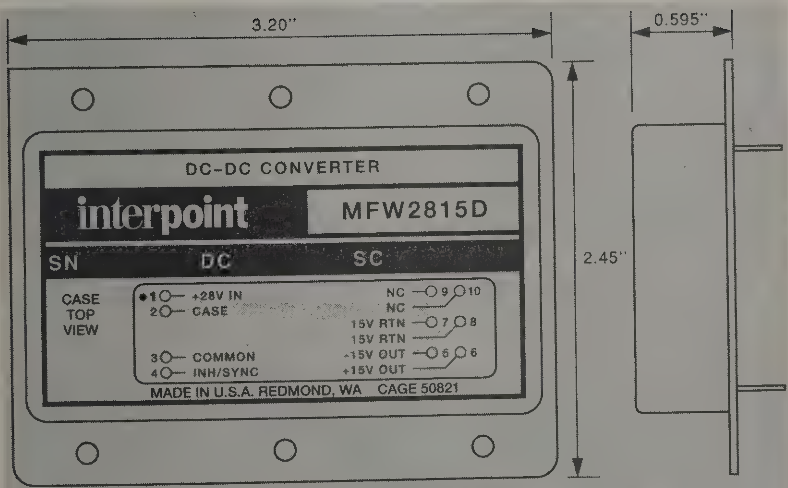

3.00"
0.380"
1.50"
MFLHP DC-DC CONVERTER
100 WATTS
interpoint
MFLHP2815S
SN
DC
SC
28V IN
IN COM
TRI
INH 1
SYNC OUT
SYNC IN
MSTR/INH2
SLAVE
SENSE
SNS RTN
OUT COM
5V OUT
MADE IN U.S.A. REDMOND, WA CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	A	EFF (%)	
MFLHP2805S	19 to 40	5	16	80	80
MFLHP2812S	19 to 40	12	7.5	85	90
MFLHP2815S	19 to 40	15	5.3	86	100

MFLHP SERIES

- **Up to 70 W/in³**
- **Up to 100 watts output power**
- **Paralleled current sharing**
- **-55° to +85°C case temp range**

The MFLHP Series converters use Interpoint's Asymmetrical Power Transfer™ technology to provide up to 100 watts output power in a welded metal case measuring only 1.5 x 3.0 x 0.38 inches. Multiple units may be paralleled to provide current sharing or N+1 redundancy. Constant current or constant voltage output is offered along with standard features that include undervoltage lockout, remote sense and sync. Mounting options include side-leaded cage mount or though hole styles. Operating temperature is -55 to +85° C. Environmental screening available.


3.20"
0.595"
2.45"
DC-DC CONVERTER
interpoint
MFW2815D
SN
DC
SC
CASE TOP VIEW
1 +28V IN
2 CASE
3 COMMON
4 INH/SYNC
NC 9 10
NC
15V RTN 7 8
15V RTN
-15V OUT 5 6
+15V OUT
MADE IN U.S.A. REDMOND, WA CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MFW283R5S	19.0 to 40.0	3.5	14,000	76	50
MFW2805S	19.0 to 40.0	5	12,000	80	60
MFW2812S	19.0 to 40.0	12	5830	83	70
MFW2815S	19.0 to 40.0	15	4670	83	70
MFW2812D	19.0 to 40.0	±12	±2920	83	70
MFW2815D	19.0 to 40.0	±15	±2330	84	70
MFW28512T	19.0 to 40.0	+5 ±12	4000 ±1670	84	60
MFW28515T	19.0 to 40.0	+5 ±15	4000 ±1330	84	60

MFW SERIES

- **Up to 70 watts– 1, 2, or 3 outputs**
- **19 to 40 Vdc input range**
- **Up to 84% typical efficiency**
- **-55°to +85°C case temp range**

The MFW converters provide up to 70 watts of power at up to 84% efficiency with single, dual or triple outputs. Outputs are regulated and isolated. On dual output models, up to 95% of rated power is available from either output. On triple output models, up to 83%, of rated power is available from each output. Packages are sealed plated steel with heat dissipating flange mounting. Environmental screening available.

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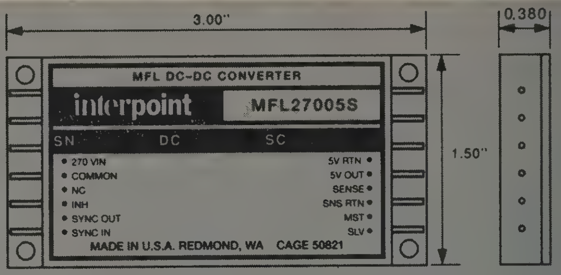
MILITARY/ AEROSPACE DC - DC CONVERTERS

MFL SERIES

- **28 or 270 Vdc input models**
- **Up to 65 watts output power**
- **Paralleled current sharing**
- **-55 to +125° C case temp range**

The MFL Series converters offer up to 65 watts output power in a sealed metal case measuring only 1.5 x 3.0 x 0.38 inches. Up to three units may be paralleled to provide a shared output of up to 185 watts. Standard features include undervoltage lockout, remote sense, and sync. Mounting options include side-leaded mount or through-hole styles. Operating temperature is -55 to +125° C. Environmental screening available.


3.00"
0.380
1.50"
MFL DC-DC CONVERTER
interpoint
MFL27005S
SN
DC
SC
270 VIN
COMMON
NC
INH
SYNC OUT
SYNC IN
5V RTN
5V OUT
SENSE
SNS RTN
MST
SLV
MADE IN U.S.A. REDMOND, WA CAGE 50821

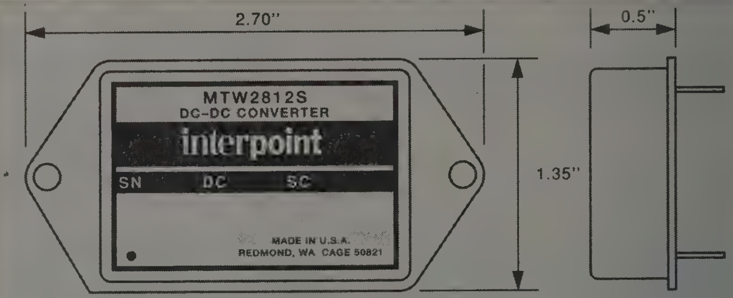
MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	A	EFF (%)	
MFL2805S	16 to 40	5	10.00	80	50
MFL2812S	16 to 40	12	5.00	82	60
MFL2815S	16 to 40	15	4.33	84	65
MFL2812D	16 to 40	±12	4.58*	80	55
MFL2815D	16 to 40	±15	4.00*	82	60
MFL27005S	160 to 400	5	10.00	80	50
MFL27012S	160 to 400	12	5.00	82	60
MFL27015S	160 to 400	15	4.33	84	65
MFL27028S	160 to 400	28	1.96	82	60
MFL27012D	160 to 400	±12	4.58*	80	55
MFL27015D	160 to 400	±15	4.00*	82	60

*Total; up to 90% from either output

MTW SERIES

- **Up to 30 watts output power**
- **19 to 40 Vdc input range**
- **Up to 83% typical efficiency**
- **-55° to +85°C case temp range**

The MTW Series offers 30 watt converters with regulated and isolated single or dual outputs at up to 86% efficiency. For dual outputs, up to 90% of full power is available from either output. Packages are sealed, plated steel. Environmental screening available.

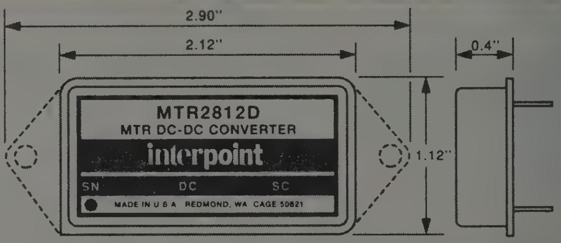

2.70"
0.5"
1.35"
MTW2812S
DC-DC CONVERTER
interpoint
SN
DC
SC
MADE IN U.S.A.
REDMOND, WA CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MTW2805S	19.0 to 40.0	5.0	6000	82	30
MTW2812S	18.0 to 40.0	12.0	2500	84	30
MTW2815S	18.0 to 40.0	15.0	2000	86	30
MTW2812D	18.0 to 40.0	±12.0	±1250	84	30
MTW2815D	18.0 to 40.0	±15.0	±1000	85	30

MTR SERIES

- **Up to 30 watts output power**
- **16 to 40 Vdc input range**
- **Up to 84% typical efficiency**
- **-55 to +125°C case temp range**

The high frequency MTR Series converters offer up to 30 watts output power in a hermetically sealed package only 1.12 x 2.12 x 0.4 inches – the same outline as our 15-watt MHE/MLP series. The parts offer full power operation from 16 to 40 Vdc input and over the full -55 to +125° C temperature range. Features for the isolated, regulated units include low-voltage lockout, remote sense, voltage trim, and sync. Single, dual, and triple outputs available. Environmental screening available.


2.90"
2.12"
0.4"
1.12"
MTR2812D
MTR DC-DC CONVERTER
interpoint
SN
DC
SC
MADE IN U S A REDMOND, WA CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	mA	EFF (%)	
MTR2805S	16 to 40	5	5000	78	25
MTR2812S	16 to 40	12	2500	83	30
MTR2815S	16 to 40	15	2000	84	30
MTR2812D	16 to 40	±12	2250*	81	30
MTR2815D	16 to 40	±15	1800*	83	30
MTR28512T**	16 to 40	+5 ±12	4000*** ±625	78	30
MTR28515T**	16 to 40	+5 ±15	4000*** ±500	78	30

*Total; up to 90% from either output
**Case dimension 2.7 x 1.35 x 0.4 inches.
***Max. for each output; total power may not exceed 30 watts.

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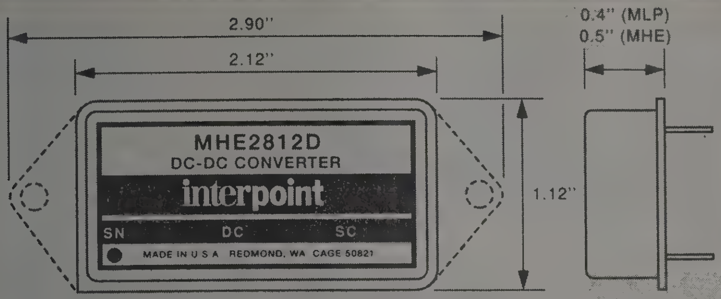
MILITARY/ AEROSPACE DC - DC CONVERTERS

MHE/MLP SERIES

- **Up to 20 watts output power**
- **9 to 16 and 16 to 40 Vdc input range**
- **Up to 86% typical efficiency**
- **-55° to +85°C case temp range**

High efficiency MHE/MLP converters feature single or dual isolated, regulated output voltages, wide input voltage range, and sealed, plated steel packages for military/ aerospace applications. MLP models offer low profile cases. Flange mount optional. Environmental screening available.

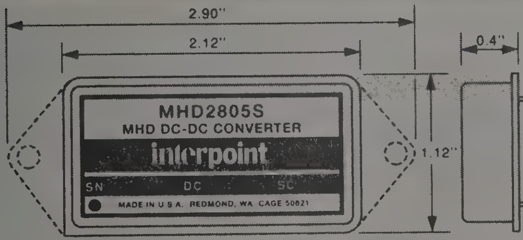

2.90''
2.12''
0.4'' (MLP)
0.5'' (MHE)
MHE2812D
DC-DC CONVERTER
interpoint
SN
DC
SC
MADE IN U S A REDMOND, WA CAGE 50821
1.12''

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MHE2805S	17.0 to 40.0	5.0	3000	81	15
MHE2812S	17.0 to 40.0	12.0	1667	82	20
MHE2815S	17.0 to 40.0	15.0	1333	83	20
MHE2812D	17.0 to 40.0	±12.0	±625	79	15
MHE2815D	17.0 to 40.0	±15.0	±500	79	15
MHE1205S	9.0 to 16.0	5.0	3000	81	15
MHE1212S	9.0 to 16.0	12.0	1250	82	15
MHE1215S	9.0 to 16.0	15.0	1000	83	15
MLP2805S	16.0 to 40.0	5.0	2000	81	10
MLP2812S	16.0 to 40.0	12.0	1250	82	15
MLP2815S	16.0 to 40.0	15.0	1000	83	15
MLP2812D	16.0 to 40.0	±12.0	±414	81	10
MLP2815D	16.0 to 40.0	±15.0	±333	81	10

MHD SERIES

- **Up to 20 watts output power**
- **1,2, or 3, outputs**
- **-55 to +125° C case temp range**
- **Case pinout and outline match MHE and MTO converters**

The MHD Series converters provide state-of-the-art dc-dc conversion with case outlines and pinouts that match our industry standard 28 V input MHE and MTO series products. The MHD series offers excellent audio rejection (up to 50dB), improved transient response, current limiting overload protection, 16 to 40 Vdc input, and -55 to +125° C full power operation. Height of the metal hermetic case is only 0.400 inch. Environmental screening optional.


2.90''
2.12''
0.4''
MHD2805S
MHD DC-DC CONVERTER
interpoint
SN
DC
SC
MADE IN U S A. REDMOND, WA CAGE 50821
1.12''

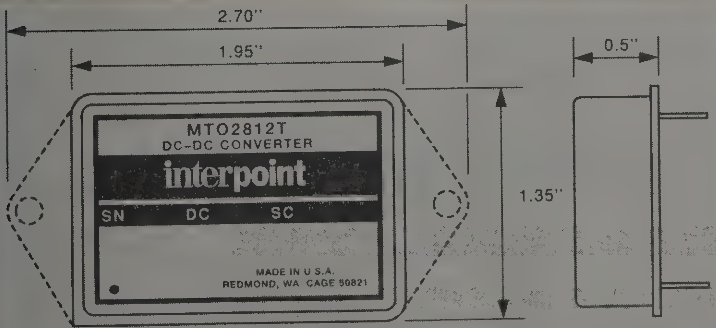
MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	mA	EFF (%)	
MHD2805S	16 to 40	5	3000	81	15
MHD2812S	16 to 40	12	1667	82	20
MHD2815S	16 to 40	15	1333	83	20
MHD2812D	16 to 40	±12	±625	81	15
MHD2815D	16 to 40	±15	±500	81	15
MHD28512T*	16 to 40	+5 ±12	2000 ±208	79	15
MHD28515T*	16 to 40	+5 ±15	2000 ±167	79	15

*Case dimension 2.7 x 1.35 x 0.4 inches.

MTO SERIES

- **Up to 15 watts – triple output**
- **16 to 36 Vdc input range**
- **Up to 79% typical efficiency**
- **-55° to +85° C case temp range**

MTO converters have three regulated output voltages with a common ground. All outputs are isolated from the input. Full rated output power can be drawn from the 5 Vdc output, or the dual outputs can be loaded as shown. Total power is up to 15 watts. Package is sealed, plated steel with optional flange. Environmental screening .


2.70''
1.95''
0.5''
MTO2812T
DC-DC CONVERTER
interpoint
SN
DC
SC
MADE IN U S.A.
REDMOND, WA CAGE 50821
1.35''

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MTO2812T	16.0 to 36.0	+5.0 ±12.0	2000 ±208	74	15
MTO2815T	16.0 to 36.0	+5.0 ±15.0	2000 ±167	75	15

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MILITARY/AEROSPACE DC - DC CONVERTERS

MRH SERIES

- **Radiation Hardened converter**
- **Up to 15 watts – 1, 2, or 3 outputs**
- **16 to 36 VDC input range**
- **-55° to +85°C case temp range**

MRH converters are radiation hardened to operate through 10^{13} neutrons/sq cm neutron fluence, 10^{11} rads(Si)/sec dose rates and 10^{5} rads(Si) total dose. Single, dual, or triple outputs are regulated and isolated. Up to 15 watts of power. Environmental screening available.

MQO SERIES

- **Up to 16.5 watts output power**
- **4 outputs (including -5 Vdc)**
- **Meets CE03, CS01, CS02, CS06, DO160B standards**
- **-55 to +125°C case temp range**

The new MQO Series dc-dc converters supply up to 16.5 watts in a four-output configuration. Outputs include +5 Vdc and -5 Vdc (often used for ECL applications) and either ±12 Vdc or ±15 Vdc. A built-in EMI filter and transient suppressor allows the unit to meet MIL-STD-461C's CE03 reflected ripple standard and CS01, CS02, CS06, and DO160B conducted susceptibility standards without any external components. An output holdup feature provides a low power flag and full output power holdup through transient dropout conditions. Metal hermetic case. Environmental screening optional.

MHF+ SERIES

- **Up to 15 watts output power**
- **16 to 40 Vdc input range**
- **Up to 82% typical efficiency**
- **-55 to +125° C case temp range**

An upgrade to our industry standard MHF Series, MHF+ Series converters provide up to 15 watts output power over the full -55 to +125° C temperature range. The sealed metal parts are available in welded hermetic packages that take up only 1.7 sq in. of board area and are only 0.325 inch high. Up to 82% efficiency. Single and dual outputs. Environmental screening optional.

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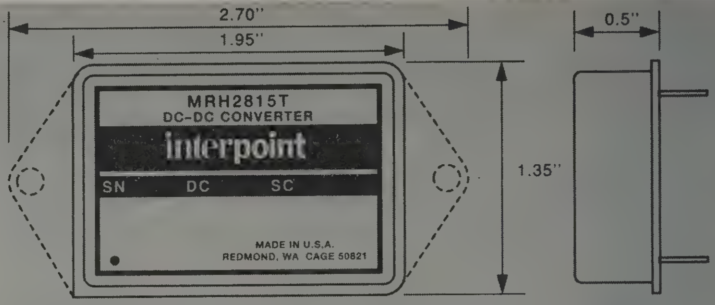
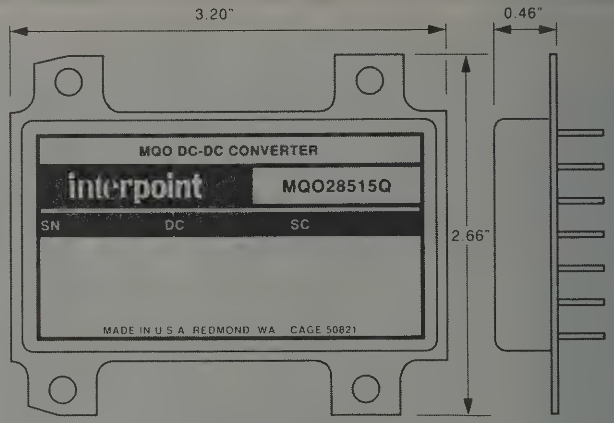
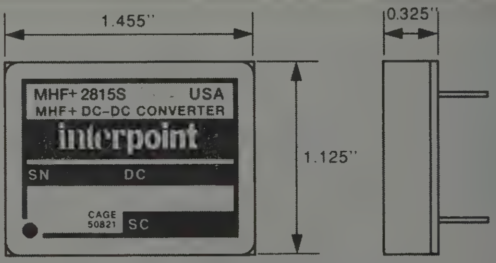


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MRH2805S	16.0 to 40.0	5	3000	77	15
MRH2812S	16.0 to 40.0	12	1250	80	15
MRH2815S	19.0 to 40.0	15	1000	81	15
MRH28L15S	16.0 to 36.0	15	1000	81	15
MRH2812D	16.0 to 40.0	±12	±625	80	15
MRH2815D	19.0 to 40.0	±15	±500	81	15
MRH28L15D	16.0 to 36.0	±15	±500	81	15
MRH2812T	16.0 to 36.0	+5 ±12	2000 ±500	72	15
MRH2815T	16.0 to 36.0	+5 ±15	2000 ±500	72	15



MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	mA	EFF (%)	
MQO28512Q	16 to 36	±5 -5 ±12	2000 -350 ±200	66	16.5
MQO28515Q	16 to 36	+5 -5 ±15	2000 350 ±167	66	16.5



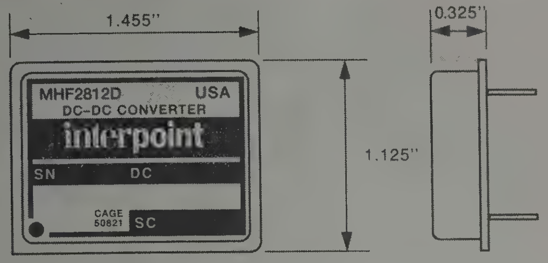
MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	mA	EFF (%)	
MHF+2805S	16 to 40	5	2400	77	12
MHF+2812S	16 to 40	12	1250	82	15
MHF+2815S	16 to 40	15	1000	81	15
MHF+2812D	16 to 40	±12	±625	82	15
MHF+2815D	16 to 40	±15	±500	81	15

MILITARY/ AEROSPACE DC - DC CONVERTERS

MHF SERIES

- **12 watts – low profile**
- **16 to 40 Vdc input range**
- **84% efficiency**
- **-55° to +125° C case temp range**

MHF Series converters provide 30 watts/in^3 power density in a low profile (.325 inch max) part. Regulated and isolated single or dual outputs provide up to 12 watts at up to 84% efficiency. Full power operation from -55° to +125°C. Environmental screening available.

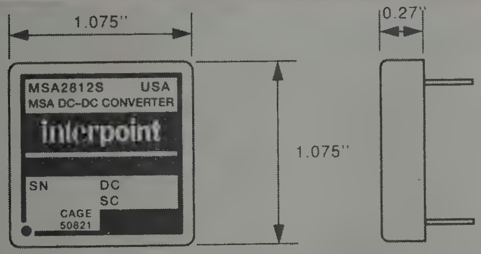


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MHF2805S	16.0 to 40.0	5	2000	77	10
MHF2812S	16.0 to 40.0	12	1000	81	12
MHF28L15S	16.0 to 36.0	15	800	82	12
MHF2815S	19.0 to 40.0	15	800	83	12
MHF2812D	16.0 to 40.0	±12	±500	81	12
MHF28L15D	16.0 to 36.0	±15	±400	82	12
MHF2815D	19.0 to 40.0	±15	±400	83	12

MSA SERIES

- **Up to 5 watts output power**
- **0.27 inch profile**
- **Up to 76% typical efficiency**
- **-55° to +125° C case temp range**

The MSA Series converters offer up to 5 watts output power in our lowest profile case – just 0.27 inch high. These regulated, isolated converters offer 600 kHz switching and full power operation over the full military temperature range. Audio rejection is up to 50 dB. No external capacitors are required. Metal sealed cases. Single and dual outputs. Environmental screening available.



MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX WATTS
		VDC	mA	EFF (%)	
MSA2805S	16 to 40	5	1000	73	5
MSA2812S	16 to 40	12	417	75	5
MSA2815S	16 to 40	15	333	76	5
MSA2812D	16 to 40	±12	417*	75	5
MSA2815D	16 to 40	±15	333*	76	5

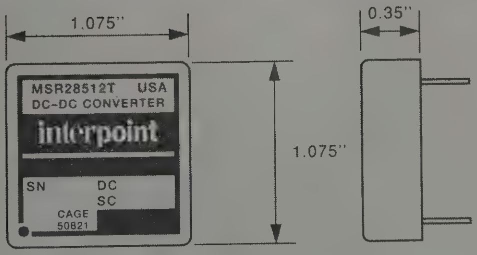
*Total; up to 90% from either output

MSR SERIES

- **Up to 4 watts output power**
- **16 to 32 Vdc input range**
- **Up to 75% typical efficiency**
- **-55° to +85°C case temp range**

MSR models offer up to 4 watts output power in single, dual, or triple outputs. Outputs are regulated and isolated from the input. The low-profile packages are sealed plated steel and less than 1.2 square inches. Environmental screening available.

Note: External output capacitors are required.



MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MSR2805S	16.0 to 32.0	5.0	700	72	3.5
MSR2812D	16.0 to 32.0	±12.0	±167	75	4.0
MSR2815D	16.0 to 32.0	±15.0	±133	75	4.0
MSR28512T	16.0 to 32.0	+5.0 ±12.0	400 ±50	70	3.2
MSR28515T	16.0 to 32.0	+5.0 ±15.0	400 ±40	70	3.2

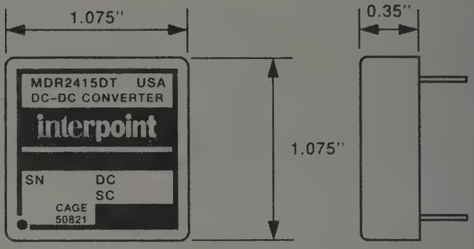
CALL (800) 822-8782 TO ORDER DATA SHEETS

MILITARY/ AEROSPACE DC - DC CONVERTERS

MDR SERIES

- **Up to 3 watts output power**
- **12, 24 and 28 Vdc input voltages**
- **Regulated, isolated outputs**
- **-55 to +85° C case temp range**

The MDR Series converters are fully isolated and offer the excellent regulation and low output ripple provided by a series output regulator. Sealed, plated steel package. Environmental screening available.

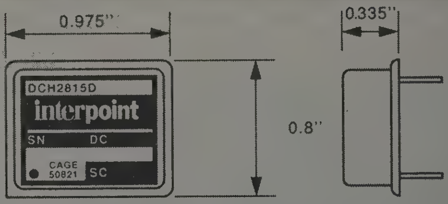


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
MDR1212DT	10.8 to 13.0	±12.0	±125	58	3.0
MDR1215DT	10.8 to 13.0	±15.0	±100	58	3.0
MDR2412DT	20.0 to 26.0	±12.0	±125	58	3.0
MDR2415DT	20.0 to 26.0	±15.0	±100	58	3.0
MDR2812DT	24.0 to 30.0	±12.0	±125	58	3.0
MDR2815DT	24.0 to 30.0	±15.0	±100	58	3.0

DCH SERIES

- **Up to 3 watts output power**
- **5, 12 and 28 Vdc input voltages**
- **Unregulated**
- **-55° to +100°C case temp range**

DCH models deliver up to 3 watts output power in single or dual isolated, unregulated outputs. The converters may be used in applications not requiring regulation or with external series regulators. Packages are sealed plated steel. Enivonmental screening is available.



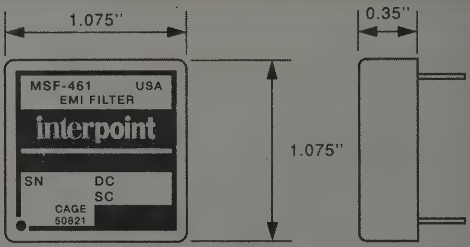
MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
DCH0505S	4.0 to 6.5	5.0	400	67	2.0
DCH0512S	4.0 to 6.5	12.0	208	72	2.5
DCH0512D	4.0 to 6.5	±12.0	±104	72	2.5
DCH0515D	4.0 to 6.5	±15.0	±83	72	2.5
DCH1205S	9.0 to 15.0	5.0	500	70	2.5
DCH1212S	9.0 to 15.0	12.0	250	72	3.0
DCH1212D	9.0 to 15.0	±12.0	±125	72	3.0
DCH1215D	9.0 to 15.0	±15.0	±100	72	3.0
DCH1228S	9.0 to 15.0	28.0	107	75	3.0
DCH1228D	9.0 to 15.0	±28.0	±53	75	3.0
DCH2805S	20.0 to 32.0	5.0	500	68	2.5
DCH2812S	20.0 to 32.0	12.0	250	75	3.0
DCH2812D	20.0 to 32.0	±12.0	±125	75	3.0
DCH2815D	20.0 to 32.0	±15.0	±100	75	3.0

EMI FILTERS & PROTECTION MODULES

MSF-461

- **MIL-STD accessory to MSR, MDR, DCH, and MDP series converters**
- **MIL-STD-704B thru D transient protection**
- **50 dB min reflected ripple current reduction**
- **-55° to +85°C case temp range**

In a sealed, plated steel case of less than 1.2 square inches, the MSF-461 brings MSR, MDR, DCH, and MDP dc-dc converters within MIL-STD-461's CE03 limits for reflected ripple current. Environmental screening available.



MODEL	VDC INPUT	MAX. CURRENT	MIN. ATTENUATION	COMPATIBLE CONVERTERS*
MSF-461	0 to 40.0	420 mA	50dB 50kHz to 50MHz	MSR, MDH, DCH, MDR

*For MIL-STO-461B CEO 3 limits for reflected ripple

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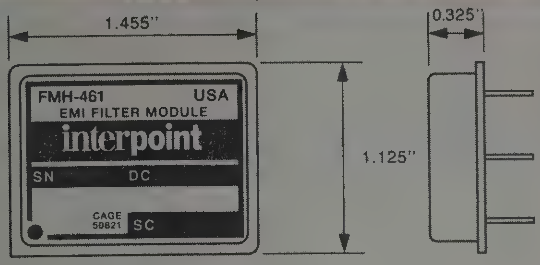
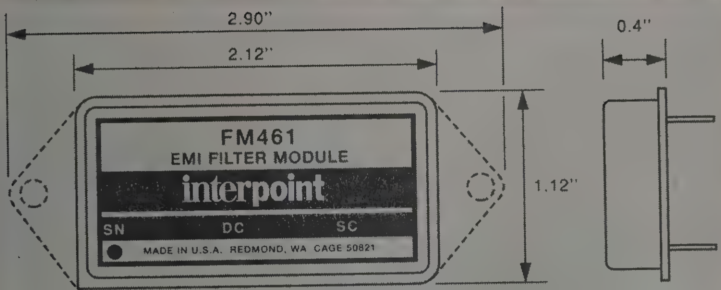
FILTERS & PROTECTION MODULES


1.455"
0.325"
1.125"
FMH-461 USA
EMI FILTER MODULE
interpoint
SN
DC
CAGE 50821
SC

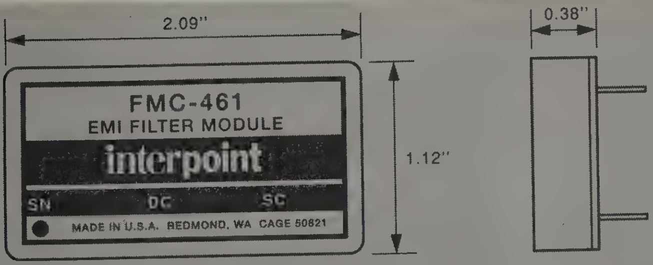
MODEL	VDC INPUT	MAX. CURRENT	MIN. ATTENUATION	COMPATIBLE CONVERTERS*
FMH-461	0 to 40.0	1.5 A	40dB 200kHz to 50MHz	MHE, MLP, MTO, MHL, MRH, MHF

*For MIL-STD-461B CE03 limits for reflected ripple


2.90"
2.12"
0.4"
1.12"
FM461
EMI FILTER MODULE
interpoint
SN
DC
SC
MADE IN U.S.A. REDMOND, WA CAGE 50821

MODEL	VDC INPUT	MAX. CURRENT	MIN. ATTENUATION	COMPATIBLE CONVERTERS
FMH-461	0 to 40.0	1.5 A	40dB 200kHz to 50MHz	MHE, MLP, MTO, MHL, MRH, MHF

*For MIL-STD-461B CE03 limits for reflected ripple


2.09"
0.38"
1.12"
FMC-461
EMI FILTER MODULE
interpoint
SN
DC
SC
MADE IN U.S.A. REDMOND, WA CAGE 50821

MODEL	VDC INPUT	MAX. CURRENT	MIN. ATTENUATION	COMPATIBLE CONVERTERS*
FMC-461	0 to 40.0	2.7 A	40dB 200kHz to 50MHz	MHE, MLP, MTO, MHL, MTW, MRH, MHF

*For MIL-STD-461B CE03 limits for reflected ripple

FM-461 SERIES

- **MIL-STD-461 accessories for high frequency dc-dc converters**
- **MIL-STD-704B through D transient protection**
- **40 dB min reflected ripple current reduction**
- **-55° to +85°C case temp range**

The FM-461, FMA-461, and FMB-461 filters bring MHE, MLP, MTW, MTO, MHL or MFW converters into compliance with MIL-STD-461B's CE03 limits for reflected input ripple current. The sealed, plated steel case has an optional flange. Environmental screening available.

FMH-461

- **Low profile MIL-STD-461 accessory**
- **MIL-STD-704B through D transient protection**
- **40dB min reflected ripple current reduction**
- **-55 to +125°C case temp range**

The lightweight (26 grams), low profile FMH-461 filter brings both high and low frequency converters into MIL-STD-461B's CE03 noise limits for reflected ripple. Up to 15 watt throughput over -55° to +125°C case temperature. Environmental screening available.

FMC-461

- **High temperature MIL-STD-461 accessory**
- **MIL-STD-704B through D transient protection**
- **40 dB min reflected ripple current reduction**
- **-55° to +125° C case temp range**

The FMC-461 will bring any Interpoint converter into compliance with MIL-STD-461B's CE03 reflected input ripple current limits up to its rated current. Welded bathtub case, -55 to 125°C case temperature operation, and environmental screening available.

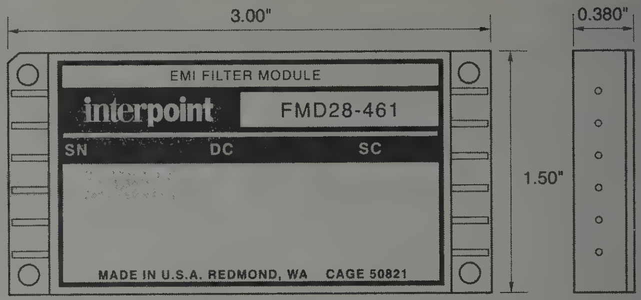
CALL (800) 822-8782 TO ORDER DATA SHEETS

FILTERS & PROTECTION MODULES

FMD/FME-461 SERIES

- **MIL-STD-461 accessories for high frequency dc-dc converters**
- **28 or 270 Vdc input**
- **33 dB min. reflected ripple current reduction**
- **-55° to +125°C case temp range**

The FMD/FME-461 filters will bring Interpoint high frequency power supplies into compliance with MIL-STD-461C's CEO3 limits for reflected ripple current. All models are available in the side-leaded package illustrated. The FMD28 model is available in a flanged down leaded package measuring 1.346 x 2.7 x 0.430 inches. Operating temperature is -55 to +125°C. Environmental screening available.

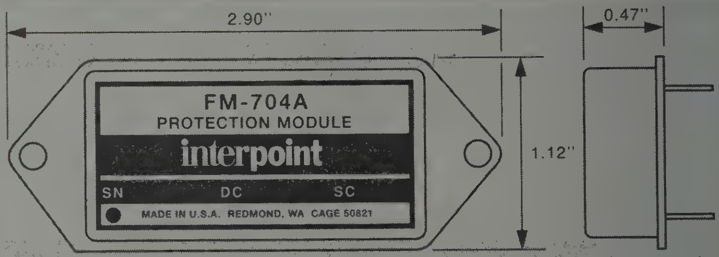


MODEL	VDC INPUT	MAX CURRENT	MIN ATTENUATION	COMPATIBLE CONVERTERS
FMD28-461	-40 to 40	7.0	60dB 200kHz to 50MHz	MSA, MHF, MHF+, MHE, MLP, MTO, MHL, MHD, MRH, MTR, MFL28
FMD70-461	-400 to 400	0.7	15dB 200kHz to 50MHz	MFL270
FME28-461	-40 to 40	15.0	60dB 200kHz to 50MHz	MSA, MHF, MHF+, MHE, MLP, MTO, MHL, MHD, MRH, MTR, MFL28
FME270-461	-400 to 400	1.5	15dB 200kHz to 50MHz	MFL270

FM-704A

- **Combined EMI filter and protection module**
- **Protects against surges and spikes**
- **40 watts throughput power**
- **-55° to +125°C case temp range**

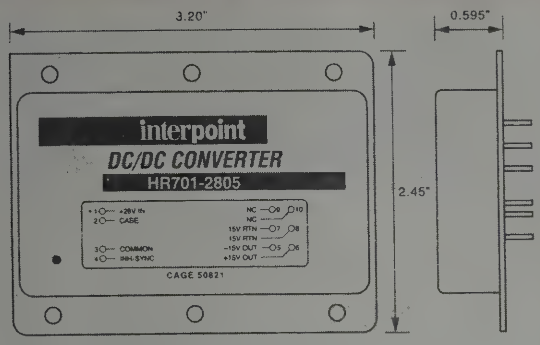
The FM-704A protection module protects any high frequency converter against MIL-STD-1275A and MIL-STD-704A surges and MIL-STD-461C CS06 spikes. Its filter element brings MHF+, MSA, MHE, MLP, MTO, MTW, MTR, MHD and MHL converters within MIL-STD-461B's CE03 noise limits. Up to 40 watts throughput from -55 to +125° C. Environmental screening available.



MODEL	VDC INPUT	MAX. OUTPUT POWER	MIN. ATTENUATION	SPIKE LIMIT	SURGE LIMIT
FM-704A	0 to 40.0	40 W	50dB 200kHz to 50MHz	400 V, 0.5 Ω imp	100 V, 0.5 Ω imp

CALL (800) 822-8782 TO ORDER DATA SHEETS

HI-REL INDUSTRIAL DC-DC CONVERTERS

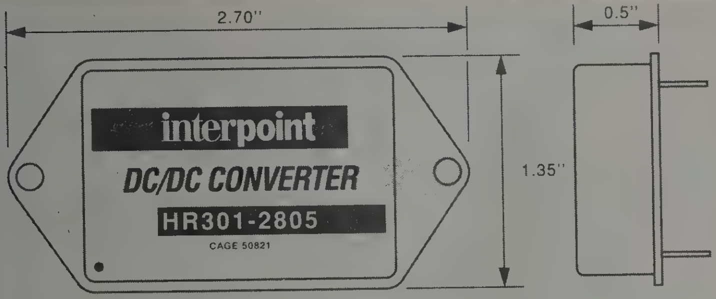

3.20"
0.595"
2.45"
interpoint
DC/DC CONVERTER
HR701-2805
1 +28V IN
2 CASE
3 COMMON
4 INH/SYNC
NC 9 10
NC
15V RTN 7 8
15V RTN
-15V OUT 5 6
+15V OUT
CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	A	EFF. %	
HR701-2805	19 to 40	5	12	80	60
HR701-2812	19 to 40	12	5.83	83	70
HR701-2815	19 to 40	15	4.67	83	70
HR702-2812	19 to 40	±12	5.5	83	70
HR702-2815	19 to 40	±15	4.4	83	70
HR703-2812	19 to 40	+5 ±12	4.2	84	60
HR703-2815	19 to 40	+5 ±15	3.33	84	60

HR700 Series

- **Up to 70 watts output power**
- **19 to 40 Vdc input range**
- **Up to 83% typical efficiency**
- **-20° to +70°C operation**

The HR700 Series converters provide up to 70 watts output power from single, dual or triple outputs in one package. The Hi-Rel Industrial class parts, like our military/aerospace converters, are sealed, plated steel.

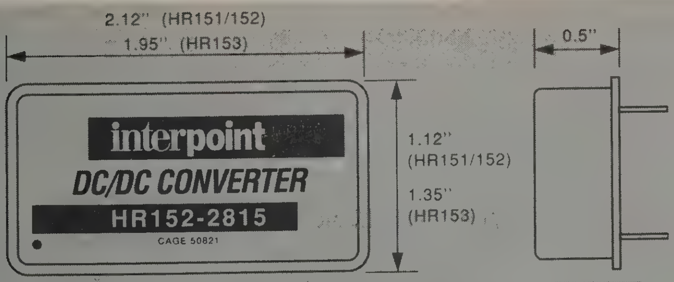

2.70"
0.5"
1.35"
interpoint
DC/DC CONVERTER
HR301-2805
CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
HR301-2805	18.0 to 36.0	5	6000	81	30
HR301-2812	18.0 to 36.0	12	2500	83	30
HR301-2815	18.0 to 36.0	15	2000	85	30
HR302-2812	18.0 to 36.0	±12	±1250	83	30
HR302-2815	18.0 to 36.0	±15	±1000	84	30

HR300 SERIES

- **Up to 30 watts output power**
- **Metal, sealed package**
- **1 or 2 outputs**
- **Up to 85% efficiency**

The HR300 Series offers Hi-Rel Industrial applications up to 30 watts output power and military levels of quality. HR300 converters provide single or dual regulated, isolated outputs and up to 85% efficency. Operating temperature range is from -20° to +70°C. Packages are sealed, plated steel.


2.12" (HR151/152)
1.95" (HR153)
0.5"
1.12"
(HR151/152)
1.35"
(HR153)
interpoint
DC/DC CONVERTER
HR152-2815
CAGE 50821

MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
HR151-2805	18.0 to 36.0	5	3000	81	15
HR151-2812	18.0 to 36.0	12	1667	82	20
HR151-2815	18.0 to 36.0	15	1333	83	20
HR151-1205	10.0 to 16.0	5	3000	81	15
HR151-1212	10.0 to 16.0	12	1250	82	15
HR151-1215	10.0 to 16.0	15	1000	83	15
HR152-2812	18.0 to 36.0	±12	±625	79	15
HR152-2815	18.0 to 36.0	±15	±500	79	15
HR153-2812	18.0 to 36.0	+5 ±12	2000 ±208	79	15
HR153-2815	18.0 to 36.0	+5 ±15	2000 ±167	79	15

HR150 SERIES

- **Up to 20 watts output power**
- **Metal, sealed package**
- **1, 2, or 3 outputs**
- **2 input voltage ranges**

The HR150 Series converters provide military program levels of reliability in a Hi-Rel Industrial class part. They provide up to 20 watts of power at up to 83% efficiency. Outputs are tightly regulated and are isolated from the input. Operating temperature range is from -20° to +70°C. Like our military/aerospace converters, the packages are sealed plated steel.

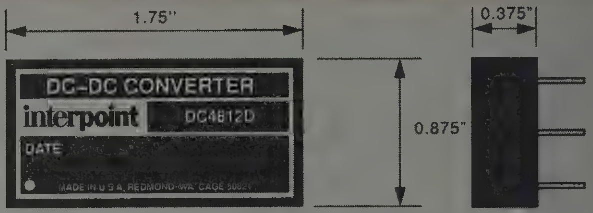
CALL (800) 822-8782 TO ORDER DATA SHEETS

HI-REL INDUSTRIAL DC-DC CONVERTERS

DC SERIES

- **Up to 6.4 watts of output power**
- **Isolated, unregulated outputs**
- **Rugged encapsulated construction**
- **4 input voltage ranges**

The DC Series of unregulated dc-dc converters consists of single and dual output models in four input voltage ranges. They can be used with external regulators or in applications that do not require regulated voltages. Operating ambient temperature range for these plastic encapsulated devices is -20° to +70°C.



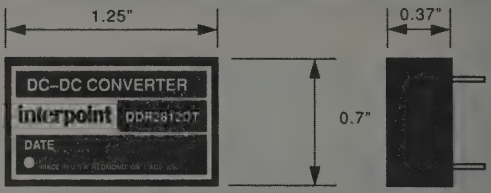
MODEL	VDC INPUT	OUTPUT @ FULL LOAD*			MAX. WATTS
		VDC	mA	EFF. %	
DC0512D	4.0 to 6.5	±12	±208	75	6.0
DC2812D	20.0 to 32.0	±12	±267	81	7.5
DC2815D	20.0 to 32.0	±15	±213	81	7.5
DC4805S	36.0 to 56.0	5	1000	70	6.25
DC4812S	36.0 to 56.0	12	530	80	7.5
DC4815D	36.0 to 56.0	±15	±213	80	7.5

*Full load = 80% max load

DDC SERIES

- **Up to 5 watts of output power**
- **Isolated, unregulated outputs**
- **24 pin DIP compatible package**
- **4 input voltage ranges**

The DDC models are unregulated and are designed to be used in applications where regulated voltages are not needed, or with external regulators. The outputs are isolated from the input. They can be operated over an ambient temperature range of -20 to +70°C, and they are encapsulated in plastic packages.

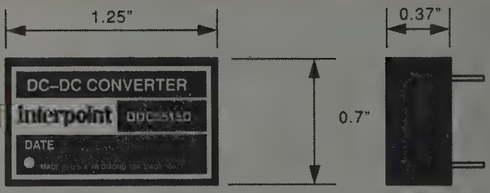


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
DDR0505S	4.5 to 5.5	5.0	400	45	2.0
DDR0512DT	4.5 to 5.5	±12.0	±104	52	2.5
DDR0515DT	4.5 to 5.5	±15.0	±83	52	2.5
DDR1205S	10.8 to 14.0	5.0	500	45	2.5
DDR1215DT	10.8 to 14.0	±15.0	±100	55	3.0
DDR2405S	20.0 to 28.0	5.0	500	45	2.5
DDR2415DT	20.0 to 28.0	±15.0	±100	55	3.0
DDR2805S	24.0 to 32.0	5.0	500	45	2.5
DDR2815DT	24.0 to 32.0	±15.0	±100	55	3.0

DDR SERIES

- **Up to 3 watts output power**
- **Isolated, regulated outputs**
- **24 pin DIP compatible package**
- **5 input voltage ranges.**

The DDR Series dc-dc converters are isolated and regulated. They are built with a nonsaturating core design to minimize reflected ripple and radiated noise. The rugged plastic 24-pin DIP packages are rated for operation from -20 to +70°C ambient.



MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
DDC0505S	4.0 to 6.5	5	800	63	4.0
DDC0512D	4.0 to 6.5	±12	±167	75	4.0
DDC0515D	4.0 to 6.5	±15	±133	75	4.0
DDC1205S	9.0 to 15.0	5	1000	68	5.0
DDC1212D	9.0 to 15.0	±12	±208	80	5.0
DDC1215D	9.0 to 15.0	±15	±167	80	5.0
DDC2805S	20.0 to 32.0	5	1000	70	5.0
DDC2812D	20.0 to 32.0	±12	±208	83	5.0
DDC2815D	20.0 to 32.0	±15	±167	83	5.0
DDC4805S	36.0 to 56.0	5	1000	72	5.0
DDC4812D	36.0 to 56.0	±12	±208	84	5.0
DDC4815D	36.0 to 56.0	±15	±167	84	5.0

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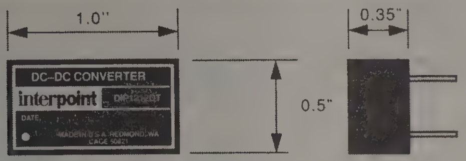
HI-REL INDUSTRIAL DC-DC CONVERTERS

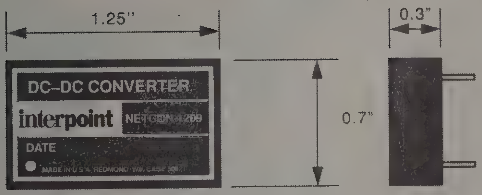


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
DIP512DT	4.5 to 5.5	±12.0	±42	52	1.0
DIP515DT	4.5 to 5.5	±15.0	±33	52	1.0
DIP1215DT	10.8 to 14.0	±15.0	±33	55	1.0
DIP2412DT	20.0 to 28.0	±12.0	±42	55	1.0
DIP2415DT	20.0 to 28.0	±15.0	±38	55	1.0
DIP2812DT	24.0 to 32.0	±12.0	±42	55	1.0
DIP2815DT	24.0 to 32.0	±15.0	±33	55	1.0

DIP SERIES

- **Up to 1.5 watts output power**
- **Up to 82% typical efficiency**
- **Wide input voltage ranges**
- **14 pin DIP compatible package**

The DIP switching regulator series consists of units that operate over a wide input voltage range, over a wide range of loads, with high efficiency. They are ideal for battery applications or wherever high efficiency and small size are important. The output common is connected internally to the input common. They are encapsulated in plastic packages and will operate over an ambient temperature range of -20°to +70°C.

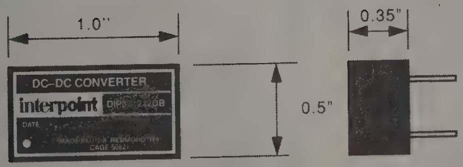


MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
		VDC	mA	EFF. %	
NETCON 0509	5.0	-9	140	62	1.26
NETCON 1209	12.0	-9	140	68	1.26

NETCON SERIES

- **Cheapernet/Ethernet compatible**
- **Up to 1.25 watts output power**
- **24 pin DIP package**
- **-9 Vdc output**

Built to IEEE 803.2 CSMA/CD specifications, the NETCONs are intended for use with the AM7990 chip family offered by AMD for LAN applications. The rugged plastic 24-pin DIP package is rated for operation from -20° to +70°C ambient.



MODEL	VDC INPUT	OUTPUT VDC	EFF. %	MAX. WATTS
DIP371205DP	3.0 to 7.0	+12 REGULATED/-5 UNREG.	75	1.25
DIP371212DP	3.0 to 7.0	+12 REGULATED/-12 UNREG.	75	1.25
DIP371212DB	3.0 to 7.0	±12 REG./BALANCE UNREG.	75	1.25
DIP371515DB	3.0 to 7.0	±15 REG./BALANCE UNREG.	75	1.25
DIP505SN	3.0 to 7.0	-5 REG. SINGLE OUTPUT	75	1.25
DIP1205SP	9.0 to 15.0	+5 REG. SINGLE OUTPUT	78	1.50
DIP121212DB	9.0 to 15.0	±12 REG./BALANCE UNREG.	78	1.50
DIP121515DB	9.0 to 15.0	±15 REG./BALANCE UNREG.	78	1.50
DIP240505DP	16.0 to 32.0	+5 REGULATED/-5 UNREG.	72	1.50
DIP241212DP	16.0 to 32.0	+12 REGULATED/-12 UNREG.	82	1.50
DIP241515DB	16.0 to 32.0	±15 REG./BALANCE UNREG.	82	1.50

DIP_DT SERIES

- **Up to 1 watt output power**
- **Isolated, regulated outputs**
- **14 pin DIP compatible package**
- **5 input voltage ranges**

DIP_DT Series converters can provide up to one watt of regulated, isolated output power. The ±12 Vdc and ±15 Vdc outputs are regulated by monolithic dual-tracking series regulators which provide good regulation and ripple characteristics. The plastic encapsulated packages are rated for operation from -20° to +70°C ambient.

CALL (800) 822-8782 TO ORDER DATA SHEETS

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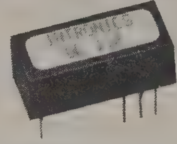
DC-DC CONVERTERS

DC 100 SERIES—0.5 WATT SINGLE OUTPUT

NEW



CASE DIMENSIONS: .89" X .39" X .33"

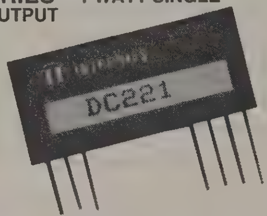
FEATURES

- Ultra-Miniature Package
- Fully Regulated
- Low Output Ripple and Noise
- High Reliability
- Input/Output Isolation
- Input Voltage: 5, 12, 24V
- Output Voltage: 5, 12, 15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-101	5V	5V	100mA
	DC-102	5V	12V	75mA
	DC-103	5V	15V	60mA
	DC-111	12V	5V	100mA
	DC-112	12V	12V	75mA
	DC-113	12V	15V	60mA
	DC-121	24V	5V	100mA
	DC-122	24V	12V	75mA
	DC-123	24V	15V	60mA

DC 200 SERIES—1 WATT SINGLE AND DUAL OUTPUT

NEW



CASE DIMENSIONS: 1.25" X .34" X .57"

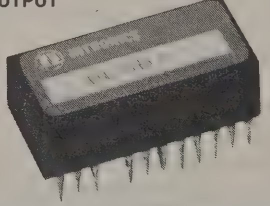
FEATURES

- 7 Pin SIP Package
- Fully Regulated (Except 9 Volt Output)
- Low Output Ripple and Noise
- High Reliability
- Input/Output Isolation
- Input Voltage: 5, 12, 24V
- Output Voltage: 5, 9, 12, 15, ±12, ±15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-201	5V	5V	200mA
	DC-202	5V	12V	125mA
	DC-203	5V	15V	100mA
	DC-211	12V	5V	200mA
	DC-212	12V	12V	125mA
	DC-213	12V	15V	100mA
	DC-221	24V	5V	200mA
	DC-222	24V	12V	125mA
	DC-223	24V	15V	100mA
DUAL	DC-208	5V	±12V	±60mA
	DC-209	5V	±15V	±50mA
	DC-218	12V	±12V	±60mA
	DC-219	12V	±15V	±50mA
	DC-228	24V	±12V	±60mA
	DC-229	24V	±15V	±50mA
LAN	DC-206	5V	9V	200mA
	DC-216	12V	9V	200mA

DC 500 SERIES—1.8 WATT SINGLE AND DUAL OUTPUT

NEW



CASE DIMENSIONS: 1.27" X .6" X .475" (SINGLE) 1.25" X .8" X .4" (DUAL)

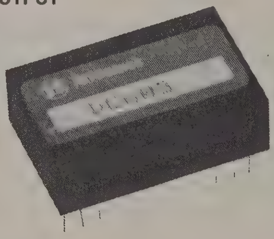
FEATURES

- Low Profile 24 Pin DIP Package
- Fully Regulated
- Low Output Ripple and Noise
- High Reliability
- Input/Output Isolation
- Input Voltage: 5, 12, 24V
- Output Voltage: 5, 9, 12, 15, ±5, ±12, ±15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-501	5V	5V	360mA
	DC-502	5V	12V	150mA
	DC-503	5V	15V	120mA
	DC-511	12V	5V	360mA
	DC-512	12V	12V	150mA
	DC-521	24V	5V	360mA
	DC-522	24V	12V	150mA
	DC-523	24V	15V	120mA
DUAL	DC-507	5V	±5V	±100mA
	DC-508	5V	±12V	±75mA
	DC-509	5V	±15V	±60mA
	DC-518	12V	±12V	±75mA
	DC-519	12V	±15V	±60mA
	DC-528	24V	±12V	±75mA
	DC-529	24V	±15V	±60mA
LAN	DC-506	5V	9V	200mA
	DC-516	12V	9V	200mA

DC 600 SERIES—3.0 WATT SINGLE AND DUAL OUTPUT

NEW



CASE DIMENSIONS: 1.25" X .8" X .5"

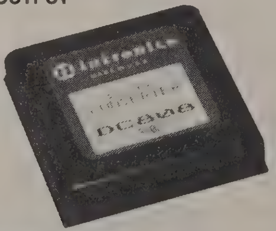
FEATURES

- Full 2:1 Input Range for Battery and Telecommunication Application
- Low Profile 12 Pin DIP Package
- Fully Regulated
- Low Output Ripple and Noise
- High Reliability
- Input/Output Isolation
- Continuous Short Circuit Protection
- Input Voltage: 5, 12, 24, 48V
- Output Voltage: 5, 12, 15, ±5, ±12, ±15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-601	4 5-6V	5V	500mA
	DC-602	4 5-6V	12V	250mA
	DC-603	4.5-6V	15V	200mA
	DC-611	9-18V	5V	500mA
	DC-612	9-18V	12V	250mA
	DC-613	9-18V	15V	200mA
	DC-621	18-36V	5V	500mA
	DC-622	18-36V	12V	250mA
	DC-623	18-36V	15V	200mA
	DC-631	36-72V	5V	500mA
	DC-632	36-72V	12V	250mA
	DC-633	36-72V	15V	200mA
DUAL	DC-617	9-18V	±5V	±250mA
	DC-618	9-18V	±12V	±125mA
	DC-619	9-18V	±15V	±100mA
	DC-627	18-36V	±5V	±250mA
	DC-628	18-36V	±12V	±125mA
	DC-629	18-36V	±15V	±100mA
	DC-637	36-72V	±5V	±250mA
	DC-638	36-72V	±12V	±125mA
	DC-639	36-72V	±15V	±100mA

DC 800 SERIES—5 WATT SINGLE AND DUAL OUTPUT

NEW



CASE DIMENSIONS: 2" X 2" X .4"

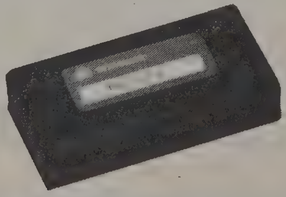
FEATURES

- Full 2:1 Input Range for Battery and Telecommunication Applications
- Continuous Short Circuit Protection
- Overvoltage Protection
- Six-sided Shielding
- Fully Regulated
- Input/Output Isolation
- High Reliability
- Input Voltage: 5, 12, 24, 48V
- Output Voltage: 5, 12, 15, ±12, ±15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-801	4.5-6V	5V	1000mA
	DC-802	4 5-6V	12V	400mA
	DC-803	4.5-6V	15V	333mA
	DC-811	9-18V	5V	1000mA
	DC-812	9-18V	12V	400mA
	DC-813	9-18V	15V	333mA
	DC-821	18-36V	5V	1000mA
	DC-822	18-36V	12V	400mA
	DC-823	18-36V	15V	333mA
	DC-831	36-72V	5V	1000mA
	DC-832	36-72V	12V	400mA
	DC-833	36-72V	15V	333mA
DUAL	DC-808	4 5-6V	±12V	±200mA
	DC-809	4.5-6V	±15V	±167mA
	DC-818	9-18V	±12V	±200mA
	DC-819	9-18V	±15V	±167mA
	DC-828	18-36V	±12V	±200mA
	DC-829	18-36V	±15V	±167mA
	DC-838	36-72V	±12V	±200mA
	DC-839	36-72V	±15V	±167mA

DC 900 SERIES—7.5 WATT SINGLE OUTPUT

NEW



CASE DIMENSIONS: 2" X 1" X .4"

FEATURES

- 2:1 Input Range for Battery and Telecommunication Applications
- High Efficiency
- High Reliability
- Fully Regulated and Isolated
- Overvoltage Protection
- Continuous Short Circuit Protection
- Six-sided Shielding
- Input Voltage: 12, 24, 48V
- Output Voltage: 5, 12, 15

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT
SINGLE	DC-911	9.5-18V	5V	1500mA
	DC-912	9.5-18V	12V	625mA
	DC-913	9.5-18V	15V	500mA
	DC-921	18-36V	5V	1500mA
	DC-922	18-36V	12V	625mA
	DC-923	18-36V	15V	500mA
	DC-931	36-72V	5V	1500mA
	DC-932	36-72V	12V	625mA
	DC-933	36-72V	15V	500mA

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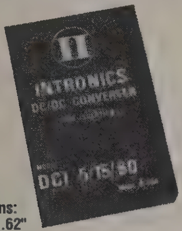
DC-DC CONVERTERS

DCI/DUAL OUTPUT—HIGH ISOLATION

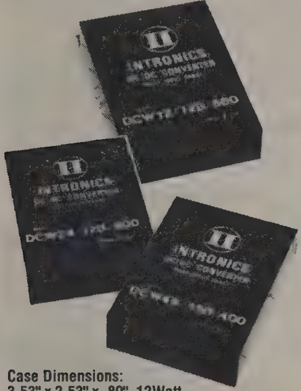


Case Dimensions:
3.02" x 2.02" x .62"

FEATURES
INPUT: 5, 12, 24, 28VDC
OUTPUT: ±12, ±15VDC
- Meets UL544 Leakage
- High Input/Output Isolation
- Short Circuit Current Limit
- No Heat Sink Required
- Excellent Regulation: 0.05% Line/Load

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (mA)
5/12/60	5 ±10%	±12	60
5/15/60	5 ±10%	±15	60
12/12/60	12 ±10%	±12	60
12/15/60	12 ±10%	±15	60
24/12/60	24 ±10%	±12	60
24/15/60	24 ±10%	±15	60
28/12/60	28 ±10%	±12	60
28/15/60	28 ±10%	±15	60

DCW SERIES 12—22 Watt Wide Input Range, Isolated



Case Dimensions:
3.53" x 2.53" x .89" 12Watt
3.53" x 2.53" x 1.27 15 Watt + 22 Watt
3.53" x 2.53" x 1.56 20 Watt

FEATURES
INPUT: 12, 24, 48VDC
OUTPUT: 5, 12, 15, ±12, ±15VDC
- Wide: 2:1 Input Range
- High Input/Output Isolation
- Short Circuit Protection
- No Heat Sink Required
- Direct PC Board Mounting
- Low Output Ripple
- Continuous Short Circuit Protection

SINGLE OUTPUTS

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS)
12/5/3000	9-18	5	3
12/5/4000	9-18	5	4
12/12/1700	9-18	12	1.7
12/15/1500	9-18	15	1.5
24/5/3000	18-36	5	3
24/5/4000	18-36	5	4
24/12/1700	18-36	12	1.7
24/15/1500	18-36	15	1.5
48/5/3000	36-72	5	3
48/5/4000	36-72	5	4
48/12/1700	36-72	12	1.7
48/15/1500	36-72	15	1.5
DUAL OUTPUTS			
12/12D/500	9-18	±12	500
12/15D/400	9-18	±15	400
24/12D/500	18-36	±12	500
24/15D/400	18-36	±15	400
48/12D/500	36-72	±12	500
48/15D/400	36-72	±15	400

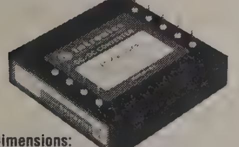
DC 700 SERIES 15-75 WATT

Case Dimensions:
2.50" x 3.00" x .81"

FEATURES
- Up to 12 watts/cubic inch
- Efficiency to 90%
- Ultra Wide Input Voltage Range
- Thermal Overload Protection
- Six-Sided Shielding, Low Thermal Gradient Copper Case
- Reverse Polarity Protection

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTS (VDC)	OUTPUT CURRENT (AMPS)
DC702	8-40	5	3
DC703	8-40	5	5
DC705	15-40	12	3
DC706	15-40	12	5
DC707	18-40	15	3
DC708	18-40	15	5

KZ 200 SERIES 25 WATT



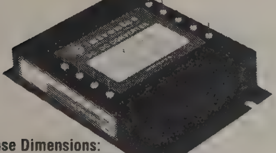
Case Dimensions:
3.00" x 3.00" x .70"

FEATURES
- Current Mode Control
- 200 KHz Switching Frequency
- Remote Control Shutoff
- Adjustable Output Voltage
- Low Voltage Shutdown
- Available in two pin configurations

*Power limited to 25 watts.

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTS (VDC)	OUTPUT CURRENT (AMPS)
KZ231	20-60	5	5.0
KZ232	20-60	12	2.1
KZ233	20-60	15	1.7
KZ238	20-60	5, 12, 12	4/0.5/0.5*
KZ239	20-60	5, 15, 15	4/0.5/0.5*
KZ241	36-72	5	5.0
KZ242	36-72	12	2.1
KZ243	36-72	15	1.7
KZ248	36-72	5, 12, 12	4/0.5/0.5*
KZ249	36-72	5, 15, 15	4/0.5/0.5*

KZ 300 SERIES 40 WATT



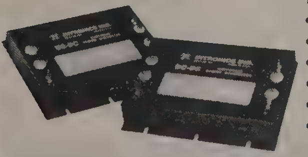
Case Dimensions:
4.225" x 3.00" x .80"

FEATURES
- Current Mode Control
- 200 KHz Switching Frequency
- Remote Control Shutoff
- Adjustable Output Voltage
- Low Voltage Shutdown

*Power limited to 40 watts.

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTS (VDC)	OUTPUT CURRENT (AMPS)
KZ331	20-60	5	8.0
KZ332	20-60	12	3.3
KZ333	20-60	15	2.7
KZ338	20-60	5, 12, 12	6,1,1*
KZ339	20-60	5, 15, 15	6,1,1*
KZ341	36-72	5	8.0
KZ342	36-72	12	3.3
KZ343	36-72	15	2.7
KZ348	36-72	5, 12, 12	6,1,1*
KZ349	36-72	5, 15, 15	6,1,1*

KZ 400 SERIES 100 WATT



Case Dimensions:
6.00" x 4.80" x 1.125"

FEATURES
- Current Mode Control
- 200 KHz Switching Frequency
- Remote Control Shutoff
- Adjustable Output Voltage
- Low Voltage Shutdown
- Over 100,000 Hrs MTBF per MIL STD 217D at 50°C + G.B. Environment

*Power limited to 100 watts.

MODEL	INPUT RANGE (VDC)	OUTPUT VOLTAGES (VDC)	OUTPUT CURRENT (AMPS)
KZ431	20-60	5	20.0
KZ432	20-60	12	8.3
KZ433	20-60	15	6.7
KZ434	20-60	24	4.1
KZ438	20-60	5, 12, 12	15, 2,2*
KZ439	20-60	5, 15, 15	15, 2,2*
KZ441	36-72	5	20.0
KZ442	36-72	12	8.3
KZ443	36-72	15	6.7
KZ444	36-72	24	4.1
KZ448	36-72	5, 12, 12	15, 2,2*
KZ449	36-72	5, 15, 15	15, 2,2*

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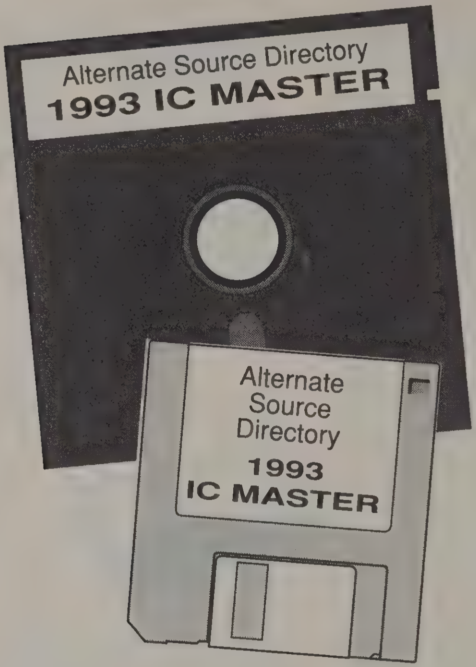
Hearst Engineering Software

ICMASD

Alternate Source Directory



The all new 1993 ICMASD-IC Alternate Source Directory on Disk is identical to the Alternate Source Directory Section contained in Volume Two of the printed version of the 1993 IC Master. All you need is an IBM XT/AT or 100% compatible personal computer with hard drive.

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Published annually in March

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jbm DC-DC Converters

TYPE DC-01/DC-02

1 to 2 Watts

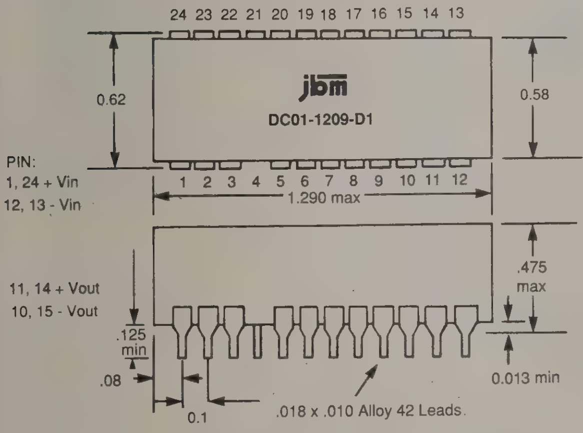
GENERAL FEATURES:

- Low profile PCB mount
- Input/Output isolated
- Low output ripple noise - 50 mVp-p
- Short circuit protection
- Input and output filtering
- High efficiency and reliability
- Low cost

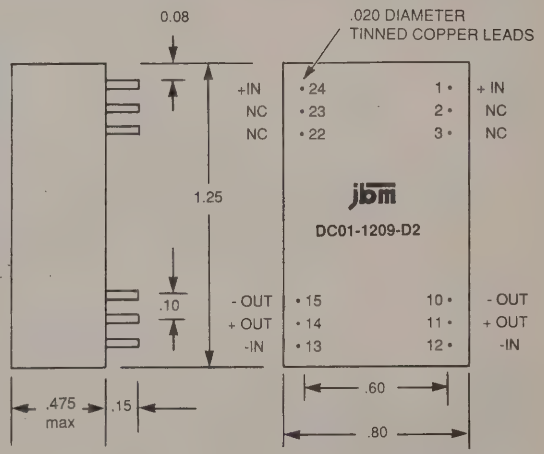
D1 PACKAGE ELECTRICAL SPECIFICATIONS (ISOLATION VOLTAGE: 500VRMS)

JBM Part No.	Input* (Vdc)	Output* (Vdc)	Output Current (mA)	Efficiency @ Full Load (%)	Regulation Line* (% V_{out}/% V_{in})	Regulation Load* (%)	Noise (mVp-p)
DC01-0505-D1	5.0	5.0	300	50 min	0.5	0.5	50 max
DC01-0509-D1	5.0	9.0	200	50 min	0.5	0.5	50 max
DC01-1209-D1	12.0	9.0	200	50 min	0.5	0.5	50 max
DC02-0509-D1	5.0	9.0	200	75 min	1.2	8	50 max
DC02-1209-D1	12.0	9.0	200	75 min	1.2	8	50 max

D1 PACKAGE


24 23 22 21 20 19 18 17 16 15 14 13
0.62
jbm
DC01-1209-D1
0.58
PIN:
1, 24 + Vin
12, 13 - Vin
1 2 3 4 5 6 7 8 9 10 11 12
1.290 max
.475
max
11, 14 + Vout
10, 15 - Vout
.125
min
.08
0.013 min
0.1
.018 x .010 Alloy 42 Leads

D2 PACKAGE


0.08
.020 DIAMETER
TINNED COPPER LEADS
+IN
NC
NC
• 24
• 23
• 22
1 •
2 •
3 •
+ IN
NC
NC
1.25
jbm
DC01-1209-D2
.10
- OUT
+ OUT
-IN
• 15
• 14
• 13
10 •
11 •
12 •
- OUT
+ OUT
-IN
.475
max
.15
.60
.80

Unit: Inch

D2 PACKAGE ELECTRICAL SPECIFICATIONS (ISOLATION VOLTAGE: 2000VRMS)

JBM Part No.	Input* (Vdc)	Output* (Vdc)	Output Current (mA)	Efficiency @ Full Load (%)	Regulation Line* (% V_{out}/% V_{in})	Regulation Load* (%)	Noise (mVp-p)
DC01-0505-D2	5.0	5.0	300	60 min	0.5	0.5	50 max
DC01-0509-D2	5.0	9.0	200	60 min	0.5	0.5	50 max
DC01-1209-D2	12.0	9.0	200	60 min	0.5	0.5	50 max
DC02-0509-D2	5.0	9.0	200	75 min	1.2	8	50 max
DC02-1209-D2	12.0	9.0	200	75 min	1.2	8	50 max

1. Input voltage range ±5% min.
2. Initial output tolerance ±5% max. at nominal Vin and max. output current.
3. Variation in otuput voltage with change in input voltage.
4. Load Regulation is for Load change from 20% to 100%

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KAPPA® TECHNOLOGIES INC.

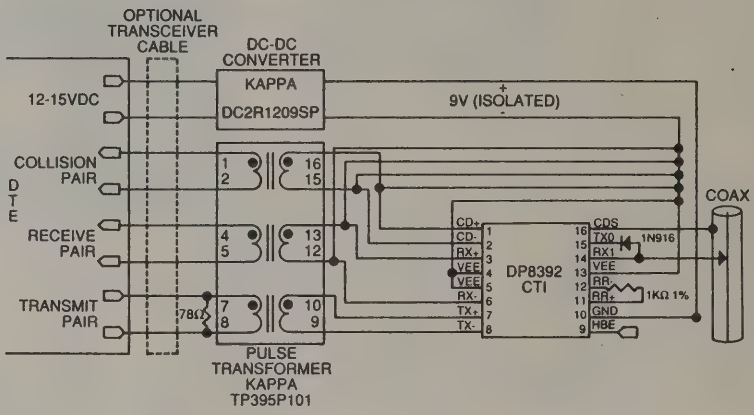
DC-DC Converters for Networking Applications

Features

- All units burned-in at maximum input voltage and temperature under full load
- Continuous short-circuit protection (reg'd units only)
- DIP and SMD package options
- Low output noise (50mV p-p regulated)
- Input ∏ filter available

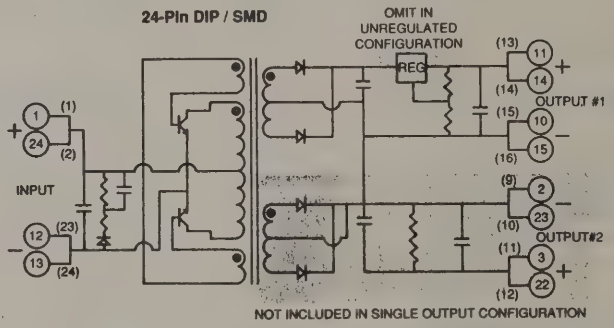
Typical Application

Cheapernet (10Base2) Transceiver or MAU


OPTIONAL TRANSCEIVER CABLE
DC-DC CONVERTER
KAPPA
DC2R1209SP
12-15VDC
9V (ISOLATED)
+
-
COLLISION PAIR
D T E
RECEIVE PAIR
TRANSMIT PAIR
78Ω
1
2
4
5
7
8
16
15
13
12
10
9
PULSE TRANSFORMER KAPPA TP395P101
CD+
CD-
RX+
VEE
VEE
RX-
TX+
TX-
DP8392 CTI
CDS
TXO
RX1
VEE
RR-
RR+
GND
HBE
1N916
1KΩ 1%
COAX

NOTE: "DP8392" is a National Semiconductor Coax Transceiver Interface.

Schematic Diagrams


24-Pin DIP / SMD
OMIT IN UNREGULATED CONFIGURATION
REG
INPUT
+
-
1
24
(1)
(2)
12
13
(23)
(24)
(13)
11
14
(14)
(15)
10
15
(16)
OUTPUT #1
+
-
(9)
2
23
(10)
(11)
3
22
(12)
OUTPUT#2
-
+
NOT INCLUDED IN SINGLE OUTPUT CONFIGURATION

NOTE: Pin numbers in parentheses are for 2000Vrms version.
Order Suffix: DCxxxxxxxG (24-Pin SMD), DCxxxxxxxP (24-Pin DIP)

Ratings

General Specifications

Switching Efficient at full load	
Regulated units	≥50%
Unregulated units	≥70%
Switching frequency (minimum)	
Regulated units	25KHz to 75KHz
Unregulated units	25KHz to 140KHz
Isolation, Input-to-Output (minimum)	>1000 Megohms @ 500Vrms or 2000Vrms

Input Specifications

Input Voltage	±5% (regulated); ±10% (unregulated)
Input Filtering	Capacitor-type (∏ network available)

Output Specifications

Output Power at full load	2.25 Watts max.
Output Voltage Accuracy	±3% (regulated); ±5% (unregulated)
Line Regulation	±0.2% max (regulated); ±5% max (unregulated)
Load Regulation	±1% max (regulated); ±5% max (unregulated)
Ripple and Noise (20Hz to 20MHz), p-p max	50mV (regulated); 100mV (unregulated)

Kappa Technologies Inc. • 1443 Pinewood Street Rahway, N.J. 07065 • Phone (908) 396-9400 • **Toll Free (800) 223-0603** • Fax (908) 388-4786

KAPPA® TECHNOLOGIES INC.

DC-DC Converters for Networking Applications

Environmental Specifications

Temperature Range .... -25°C to +70°C (oper); -40°C to +100°C (non-op)
Temperature Coefficient .... ±0.02%/°C maximum over Operating Range
Voltage Stability (24 hours) .... ±0.05% maximum
Humidity, non-condensing .... 20-95% RH
Cooling .... Free-air Convection
Electrical Derating .... None
Marking Permanency .... per Method 215 of MIL-STD-202
Lead Solderability .... per Method 208 of MIL-STD-202

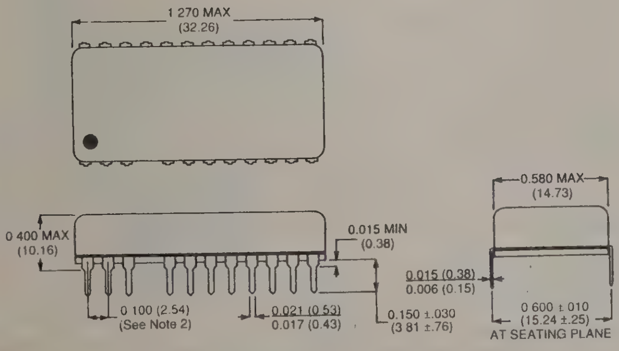
Electrical Specifications at nominal line, full load, +25°C (See "Ratings")

Kappa Part Number(1)	Input			Output #1		Output #2		Regulated Outputs
	Voltage (Vdc)	Current (mAdc)		Vnom (Vdc)	Imax (mAdc)	Vnom (Vdc)	Imax (mAdc)	
		No Load	Full Load					
DC2U0505S(*)	5.00	55	450	5.00	360	--	--	NO
DC2U0505D(*)	5.00	50	400	5.00	160	5.00	160	NO
DC2R0509S(*)	5.00	40	720	9.00	200	--	--	YES
DC2U0509S(*)	5.00	40	562	9.00	250	--	--	NO
DC2R0512S(*)	5.00	40	600	12.00	125	--	--	YES
DC2U0512S(*)	5.00	40	450	12.00	150	--	--	NO
DC2U0512D(*)	5.00	60	450	12.00	75	12.00	75	NO
DC2R0515S(*)	5.00	70	600	15.00	100	--	--	YES
DC2U0515S(*)	5.00	70	375	15.00	100	--	--	NO
DC2U0515D(*)	5.00	55	600	15.00	80	15.00	80	NO
DC2R1205S(*)	12.00	25	250	5.00	300	--	--	YES
DC2U1205S(*)	12.00	25	187	5.00	360	--	--	NO
DC2R1209S(*)	12.00	25	300	9.00	200	--	--	YES
DC2U1209S(*)	12.00	25	234	9.00	250	--	--	NO
DC2R1212S(*)	12.00	25	200	12.00	100	--	--	YES
DC2U1212S(*)	12.00	25	187	12.00	150	--	--	NO
DC2U1212D(*)	12.00	25	187	12.00	75	12.00	75	NO
DC2R1215S(*)	12.00	25	250	15.00	100	--	--	YES
DC2U1215S(*)	12.00	25	156	15.00	100	--	--	NO
DC2U1215D(*)	12.00	25	156	15.00	50	15.00	50	NO

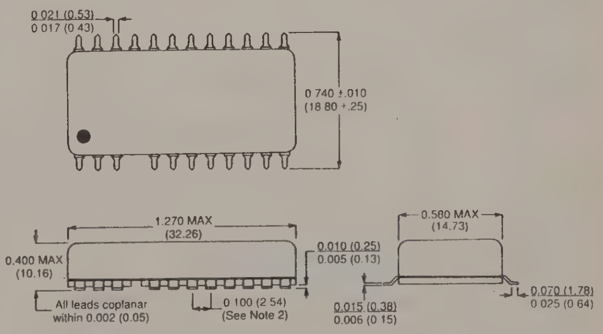
(*) Insert package code letter: "G" = Gull-Wing SMD; "P" = DIP

Package Outlines

24-pin Dual-In-Line


1 270 MAX
(32.26)
0.580 MAX
(14.73)
0 400 MAX
(10.16)
0.015 MIN
(0.38)
0.015 (0.38)
0.006 (0.15)
0 100 (2.54)
(See Note 2)
0.021 (0.53)
0.017 (0.43)
0.150 ±.030
(3 81 ±.76)
0 600 ± 010
(15.24 ±.25)
AT SEATING PLANE

24-pin Gull-Wing SMD


0 021 (0.53)
0 017 (0 43)
0 740 ±.010
(18 80 +.25)
1.270 MAX
(32.26)
0.580 MAX
(14.73)
0.400 MAX
(10.16)
0.010 (0.25)
0.005 (0.13)
All leads coplanar
within 0.002 (0.05)
0 100 (2 54)
(See Note 2)
0.015 (0.38)
0.006 (0 15)
0.070 (1.78)
0 025 (0 64)

Notes to Package Outlines:

1. Dimensions are expressed in inches (mm).
2. Lead spacing shall be measured within this zone.
   a. Shoulder and lead tip dimensions are to centerline of leads.
3. Tolerance non-cumulative.
4. Lead Material: Alloy 42 (Nickel/Iron per ASTM F-30) or equiv., electrotin-plated per MIL-T-10727.
5. Body Material: Plastic (epoxy or Diallyl Phthalate).
6. Round recessed hole in bottom-left corner, or notch on left end, denote lead no. 1
7. Body dimensions do not include molding flash which shall not exceed 0.006 (0.15).
8. Each lead is within ±0.010 (±0.25) radius of its true position at maximum material dimension.
9. Unit marking shall include manufacturer's name, part number, date code and index mark.

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Ω mega Plus
Power Supplies

MIL-SPEC POWER SUPPLIES

AC/DC Supplies

DC/DC Converters

General

The Omega Plus Series is a family of high density, compact, MIL-Spec switch mode power supplies. These advanced design power supplies accept a wide range of inputs, and are available in multiple output configurations. The Omega Plus Series is ideally suitable for airborne, shipboard, ground mobile, and C^3 applications. The Omega Plus Series of power supplies have been designed and qualified to the most stringent performance and environmental requirements.

Features

Ω MIL-SPEC
Ω UNIVERSAL AC/DC INPUT
Ω SINGLE AND MULTIPLE OUTPUTS
Ω HIGH DENSITY - LOW PROFILE
Ω OUTPUTS: 3.3V, 5V, 12V, 15V, 24V, 28V, 48V
Ω 3 YEAR WARRANTY
Ω ALTERNATE TEMPERATURE RANGE AVAILABLE

AC/DC Inputs

100 - 126 Vac, 47Hz - 460Hz 1 phase
200 - 252 Vac, 47Hz - 460Hz 1 phase
100 - 126 Vac, 47Hz - 460Hz 3 phase Delta
200 - 252 Vac, 47Hz - 460Hz 3 phase Delta
100 - 126 Vac, 47Hz - 460Hz 3 phase 4 wire Wye
100 - 126 Vac, 47Hz - 460Hz 3 phase 3 wire Wye
120 - 320 Vdc

MODEL	SIZE	VOLUME (CU./IN.)	WATTS (CU./IN.)
25S	2.50 x 3.00 x .80	6.0	3.4
50S	3.00 x 3.50 x .80	8.4	6.0
75S	3.25 x 4.25 x .80	11.0	6.8
75T	3.50 x 4.50 x .80	12.6	6.0
150S	4.50 x 5.75 x .80	20.7	7.3
150T	4.75x 6.00x .80	22.8	6.6
300S	6.00 x 6.50 x .80	31.2	10.0
300T	6.00 x 6.50 x .80	31.2	10.0

DC Inputs

14 - 36 Vdc; 18 - 36 Vdc

MODEL	SIZE	VOLUME (CU./IN.)	WATTS (CU./IN.)
25W	2.20 x 2.80 x .80	4.9	5.0
50W	2.50 x 3.50 x .80	7.0	7.2
75W	3.00 x 3.85 x .80	9.2	8.1
150W	3.50 x 4.50 x .80	12.6	12.0
300W	4.25 x 5.50 x .80	18.7	16.0

Typical Configuration Specifications

EFFICIENCY: 75% minimum (single and dual output models) and 70% minimum (multiple output models), measured at nominal input line and full load.

LINE REGULATION: Within 0.1% for input change from low line to high line, at constant load. For single, dual and main outputs 100 mV maximum for auxiliary outputs.

LOAD REGULATION: 0.1% for 0-100% of rated load at nominal input line for single, dual and main outputs. 150 mV for auxiliary outputs with 20% minimum main load.

AUXILIARY OUTPUT CROSS REGULATION: 1.0% maximum deviation when main output load changes from half load to full load.

PARD (Noise and Ripple): 25 mV RMS, 100 mV P-P at 25 MHz bandwidth for single, dual and main outputs. 200 mV for auxiliary outputs.

ISOLATION VOLTAGE: 1000 Vdc input to output, input to case. 200 Vdc output to case.

INSULATION RESISTANCE: 50 Megohm at 50 Vdc.

TEMPERATURE RANGE: Operating: -55°C to +100°C at 100% load. Temperature measured at base plate, conduction cooled via base plate only. Storage: -55°C to +125°C.

SHORT CIRCUIT PROTECTION: Under any short circuit condition, output voltage drops to less than one volt, with automatic recovery.

INRUSH CURRENT: Limited to 500% of nominal input current.

REMOTE ERROR SENSING: Sensing pins compensates for up to 0.5 volt drop on output leads.

OUTPUT TRACKING: Within 2%.

CURRENT LIMITING: Constant current, limited to 130% of rated output.

OVERVOLTAGE PROTECTION (Single Output): Automatic electronic shut down if voltage exceeds 30% of the nominal output.

INTERFACE: Hook-up via a D-subminiature connector.

QUALITY: We use only MIL qualified components, an inspection system which structly adheres to MIL-I-45208, and a quality control system which has been surveyed and approved in accordance with MIL-Q-9858A. Also, Logitek's facility is now qualified to MIL-STD-2000.

EMI/RFI CHARACTERISTICS: Meets MIL-STD-461C using test methods of MIL-STD-462.

ENVIRONMENTAL SPECIFICATIONS: Are to MIL-STD-810C for Shock; Acceleration; Humidity; Altitude;Salt Fog; Sand , Dust and Fungus.

HAMMER SHOCK: Per MIL-STD-901C.

CUSTOM & SPECIAL APPLICATIONS: Logitek's Engineering Departments is available to discuss your applications of our power supplies or to custom design to meet your system's requirements.

LOGITEK INC.™

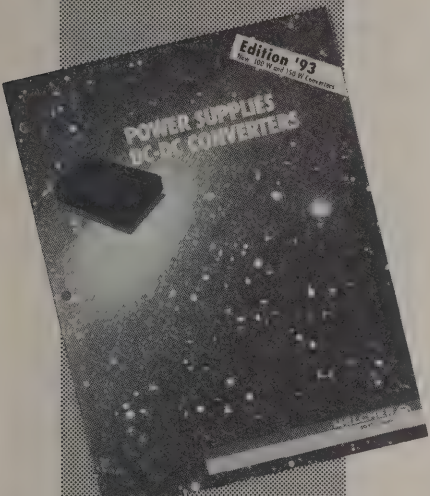
101 CHRISTOPHER STREET, RONKONKOMA, NY 11779
Phone: (516) 467-4200 Fax: 516-467-4090

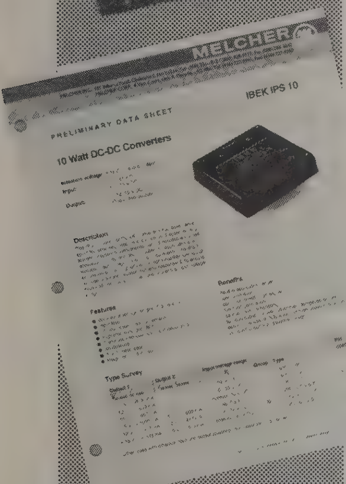
Certified
ISO 9001
EN 29001

MELCHER

MELCHER INC., 187 Billerica Road, Chelmsford, MA 01824
Tel. (508) 256-1812/ (800) 828-9712; Fax (508) 256-4642

RUGGED POWER SUPPLIES

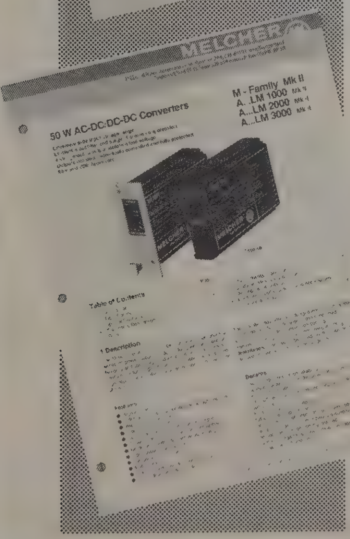



MELCHER

IBEK IPS 10

PRELIMINARY DATA SHEET

10 Watt DC-DC Converters


MELCHER

50 W AC-DC/DC-DC Converters

M - Family Mk II
A...LM 1000 Mk II
A...LM 2000 Mk II
A...LM 3000 Mk II

Dynamic behavior

• Input voltage range up to 1:10	many uses
• High efficiency up to 95%	low thermal stress and high reliability
• Constant efficiency over the whole input voltage range	stable operational conditions
• Continuously open/short circuit proof	self protected
• No derating within full temperature range	full load handling capability
• Excellent static and dynamic response	reliable and precise regulation
• Input undervoltage control and lock-out	no malfunction at low voltage levels

Mechanical design

• Compact design	high power at low volume
• Solid and robust construction	ideal for mobile application
• Aluminum case serving as heat sink and reducing RFI emissions	good heat flow inside the module and low RFI emissions

Environmental durability

• Ambient temperature range	−25°C...71°C
optional	−40°C...85°C
• Rel. humidity: IEC 68-2-3, MIL-810D/507.2	93% at 40°C during 56 days
• Shock: IEC 68-2-27, MIL-810D/516.3	100g, 9 shocks
• Bump; IEC 68-2-29, MIL-810D/516.3	40g, 6000 shocks
• Vibration: IEC 68-2-6, MIL-810D/514.3	5g/10g, 60...2000 Hz and 0.35mm/0.70mm (0.014"/0.028"), 10...60Hz
• Input transient and surge protection: IEC 801, IEC 571, RIA 12, VDE 0435, IEC 255.4	4kV/5kV
• High frequency disturbance resistance as per VDE 0435, IEC 255.4	1.0kV/2.5kV

Security approvals, RFI levels

• SEV	1061.1981, 1085.1983
• VDE	VDE 0805/EN 60950, IEC 960
• UL, CSA	UL 1950, C22.2 No.950-M89
• High isolation test voltage up to 4kV	VDE 0804, VDE 0806, IEC 380
• Low RFI: class B	VDE 0871, VDE 0878, EN 55011, EN 55022, FCC Part 15
• Low leakage currents: B,BF, CF	VDE 0750, IEC 601

Quality and reliability features

- Derated components
- Precision screening of high quality components
- Extensive research and development for design optimization
- 100% burn-in.. 24 h duration at = 70°C
- 100% function test and parameter test
- Calculated MTBF figures as per.................... MIL-HDBK 217-E
- ISO 9001 certification

Data sheets

- Comprehensive data sheets and application notes provide full information on each product family and individual type

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Certified

ISO 9001
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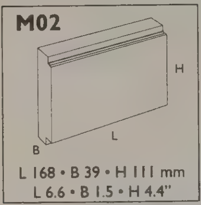
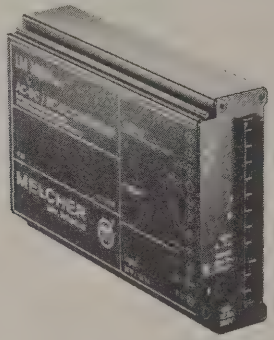
DC-DC CONVERTERS AND AC-DC CONVERTERS

50 WATTS 1-3 OUTPUTS





Approved by:

Programmable Output Voltage

All single output models can be programmed to any voltage between 0 and 110% of nominal. A control voltage (Vr) applied across two dedicated control pins program the output voltage (Vout) according to the following:

$$Vr = (Vo/Vo\ nom) \cdot 2.5V$$

In this way, dynamic control over the full voltage range can be programmed. The control pins can also be used for fixed voltage programming with a control resistor.

*Power Allocation in Multiple Output Modules

In addition to the standard types listed the output may vary according to customer requests. The maximum output power to 50 W in total can be allocated to the different outputs as per the following table. Indicated values as a sum exceed 100% but the maximum total output power must remain below 50W (40W when V_{01} =5.1V)

Output voltage $V_{o\,nom}$ (V)	Output 1 I_{onom} (A)	Output 2 $I_{o\,nom}$ (A)	Output 3 I_{onom} (A)
5.1	8.0	4.0	2.7
12.0	4.0	2.0	1.3
15.0	3.4	1.7	1.1
24.0	2.0	1.0	0.7
48.0	1.0		
maximum power	50%	50%	≈33%

AM - Through LM - Series

- Extremely wide input voltage range
- High efficiency and low thermal stress
- Isolation voltage: Input/output 4 kV_{rms} and output/output $200V_{rms}$
- Input transient suppression circuitry and effective input filter
- Approvals: UL1950, VDE 0805/IEC 950/EN 60950, IEC 801-1...4, IEC 571, RIA-12, 13 and VDE 0871 (VDE 0878): RFI suppression class A or B resp., depending on type
- Continuously open- and short-circuit proof
- Series connection of any outputs possible
- Parallel connection of main outputs possible
- Input under- / overvoltage lock-out
- Thermal protection circuit
- Inhibit input for switching the output voltage on and off (standard)
- Output voltages available between 2...52 VDC
- Output voltage control input (R)
- Inrush current limiting in certain models (standard built-in)
- Case M02: 19" rack-mount VME, DIN 41494, or chassis-mount

*AM...LM Standard Types (Other versions available)**

Output 1		Output 2		Output 3		Input Voltage Range and Efficiency [1]						Options
$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{imin}...V_{imax}$ V DC	η_{min} %	$V_{imin}...V_{imax}$ VDC	η_{min} %	$V_{imin}...V_{imax}$	η_{min} %	
						8...35		14...70		28...140		
5.1	8.0					AM1001-7R	72	BM1001-7R	74	CM1001-7R	74	-9 E[2] P M U A D
12.0	4.0					AM1301-7R	79	BM1301-7R	81	CM1301-7R	81	
15.0	3.4					AM1501-7R	80	BM1501-7R	82	CM1501-7R	82	
24.0	2.0					AM1601-7R	81	BM1601-7R	83	CM1601-7R	83	
48.0	1.0					AM1901-7R	81	BM1901-7R	83	CM1901-7R	83	
12.0	2.0	12.0	2.0			AM2320-7	78	BM2320-7	80	CM2320-7	80	
15.0	1.7	15.0	1.7			AM2540-7	78	BM2540-7	80	CM2540-7	80	
5.1	5.0	12.0	0.7	12.0	0.7	AM3020-7	70	BM3020-7	72	CM3020-7	72	
5.1	5.0	15.0	0.6	15.0	0.6	AM3040-7	70	BM3040-7	72	CM3040-7	72	

Output 1		Output 2		Output 3		Input Voltage Range and Efficiency [1]						Options
$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{o\,nom}$ V DC	$I_{o\,nom}$ A	$V_{imin}...V_{imax}$ V DC	η_{min} %	$V_{imin}...V_{imax}$ VDC	η_{min} %	$V_{imin}...V_{imax}$	η_{min} %	
						44...220		20...100		AC:85...264 DC:88...372		
5.1	8.0					DM1001-7R	75	FM1001-7R	75	LM1001-7R	73	-9 E[2] P M U A D
12.0	4.0					DM1301-7R	82	FM1301-7R	81	LM1301-7R	80	
15.0	3.4					DM1501-7R	83	FM1501-7R	83	LM1501-7R	81	
24.0	2.0					DM1601-7R	84	FM1601-7R	84	LM1601-7R	82	
48.0	1.0					DM1901-7R	84	FM1901-7R	84	LM1901-7R	82	
12.0	2.0	12.0	2.0			DM2320-7	81	FM2320-7	81	LM2320-7	79	
15.0	1.7	15.0	1.7			DM2540-7	81	FM2540-7	81	LM2540-7	79	
5.1	5.0	12.0	0.7	12.0	0.7	DM3020-7	73	FM3020-7	73	LM3020-7	71	
5.1	5.0	15.0	0.6	15.0	0.6	DM3040-7	73	FM3040-7	73	LM3040-7	71	

[1] Efficiency at V_{Inom} and $I_{o\,nom}$ [2] Option E for CM types only

MTBF Ratings and Device Hours

Values at specified Case Temperature	Module Types	Ground Benign 40°C	Ground Fixed 40°C		Ground Mobile 70°C	Unit 50°C
MTBF values (calculated in accordance with MIL-HDBK217E)	AM...LM1000-7R	320,000	130,000	40,000	35,000	h
	AM...LM2000-7	255,000	105,000	32,000	28,000	
	AM...LM3000-7	225,000	80,000	28,000	25,000	
Actual device hours Average values in hours per failure. Field data based on 4300h operating hours per year, over a 5 years period.	AM...LM1000-7R	760,000				h/f
	AM...LM2000-7	790,000				
	AM...LM3000-7	750,000				

Options

9 — Operational ambient temperature range TA:-40...71°C (-40...160°F)
P — Potentiometer for fine adjustment of V_o (±10% of $V_{o\,nom}$)
D — Adjustable input/output voltage monitors in different versions available
A — Testjacks for V_o on front panel

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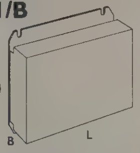
SWITCHING MODE REGULATORS

80-720W SINGLE OUTPUT

K01/B



L 168 • B 53 • H 140 mm
L 6.7 • B 2.1 • H 5.5"

PSK
POSITIVE SWITCHING REGULATOR
MELCHER

PSK

- All features of the PSR series in addition to the following:
- Input inrush current limiting circuit
- Integrated input filter
- Programmable output voltage control input (standard)
- Automatic current sharing in parallel operation
- Coincident triggering of crowbar in parallel operation
- Sense lines at the output
- Built-in fuse
- Complementary to PSR series
- Built-in test socket (standard)
- Inhibit input (standard)
- Case K01: 19" rack-mount VME, DIN 41494 or chassis mount

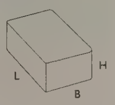
Output $V_{o\,nom}$ V DC	Output $I_{o\,nom}$ A	Input V_i V DC	Eff. η %	Case	Type Basic version T_A: -25...71°C	Available options
5.1	16.0	8 ...80	82	K01	PSK 5A16-7	9, E, P, C, B
12.0	16.0	15 ...80	89		PSK 1216-7	
24.0	16.0	29 ...80	91		PSK 2416-7	
36.0	16.0	42 ...80	94		PSK 3616-7	
12.0	12.0	18...144	90	K01	PSK 1212-7	
24.0	12.0	31...144	91		PSK 2412-7	
36.0	12.0	44...144	94		PSK 3612-7	
48.0	12.0	58...144	95		PSK 4812-7	
5.1	20.0	8 ...80	82	K01	PSK 5A20-7	
12.0	20.0	15 ...80	89		PSK 1220-7	
24.0	20.0	29 ...80	91		PSK 2420-7	
36.0	20.0	42 ...80	94		PSK 3620-7	
5.1	25.0	8 ...40	82		PSK 5A25-7	

Options

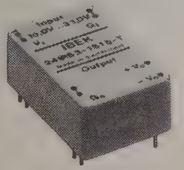
9 — Extended operational ambient temperature range T_A: -40...71°C (-40...160°F)
P— Potentiometer for fine adjustment of output voltage V_o (PSR ±8%, PSK ±10% of $V_{o\,nom}$)
C —Thyristor crowbar for output protection in the event of overvoltage
E — Inrush current limiting circuitry $I_{inrush} = V_i / 1\,\Omega$
B —Heat sink interface plate for chassis mount instead of standard heat sink

DC-DC CONVERTERS 3-10W SINGLE AND DUAL OUTPUT

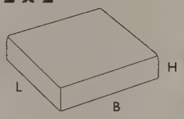
DIL 24



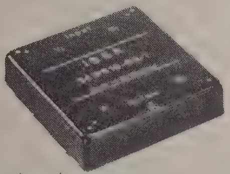
L 33 • B 20 • H 10.5 mm
L 1.3 • B 0.8 • H 0.4"



2 x 2



L 51 • B 51 • H 10.5 mm
L 2.0 • B 2.0 • H 0.4"



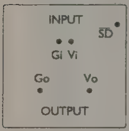
IPS 3, IPW 3

- Output power 3W
- Exceptionally wide input voltage range
- One or two outputs available
- High efficiency
- Input/output isolation 1400 V_{pp}/500 V_{rms} (IPW types: 3000 V_{pp}/1060 V_{rms})
- Input filter incorporated
- Shutdown control at input
- Short-circuit proof
- Module height 10.5 mm (0.4") only

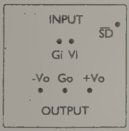
IPS 10

- Output power 10W
- Exceptionally wide input voltage range
- One or two outputs available
- High efficiency
- Input/output isolation 1400 V_{pp} / 500V_{rms}
- Input filter incorporated
- Shutdown control at input (on request)
- Continuously short-circuit proof
- Module height 10.5 mm (0.4") only

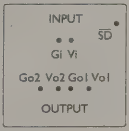
Pin configurations (bottom view)
Pin configurations C, B, D without shutdown $\overline{SD}$
Pin configurations G, F, H with shutdown $\overline{SD}$
Pin configuration to be specified with order (e.g. 24 IPS 10-12-TC)



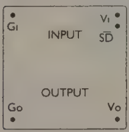
C, G



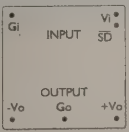
C, G



D, H



B, F



B, F

Options

S— Temperature range T_A: -40...85°C (-40...185°F)

IPS 3, IPW 3

Output 1 $V_{o\,nom}$ V DC	Output 1 $I_{o\,nom}$ mA	Output 2 $V_{o\,nom}$ V DC	Output 2 $I_{o\,nom}$ mA	Input V_i V DC	Eff. η %	Case	Type Basic version T_A: -25...71°C	Pin con-fig.	Available options
5	500	—	—			DIL 24	...IPS/...IPW 3-05-T	C, B G, F	S
12	250	—	—				...IPS/...IPW 3-12-T		
15	200	—	—				...IPS/...IPW 3-15-T		
5	250	-5	-250	24 IPS 3: 10...33	80		...IPS/...IPW 3-0505-T		
12	125	-12	-125	24 IPW 3: 10...33			...IPS/...IPW 3-1212-T		
15	100	-15	-100	48 IPS 3: 18...75	82		...IPS/...IPW 3-1515-T		
5	250	5	250	48 IPW 3: 18...75			...IPS/...IPW 3-05-05-T	D, H	
12	125	12	125				...IPS/...IPW 3-12-12-T		
15	100	15	100				...IPS/...IPW 3-15-15-T		
5	250	12	125				...IPS/...IPW 3-05-12-T		
5	250	15	100				...IPS/...IPW 3-05-15-T		

1) Common ground

IPS 10

5	2000	—	—	24 IPS 10: 10...33	80	2" x 2"	...IPS 10-05-T	C, B G, F	S
12	833	—	—				...IPS 10-12-T		
15	666	—	—				...IPS 10-15-T		
5	1000	-5	-1000	48 IPS 10: 18...75			...IPS 10-0505-T		
12	417	-12	-417				...IPS 10-1212-T		
15	333	-15	-333				...IPS 10-1515-T		

C — Pin configuration (see above)
B — Pin configuration (see above)
G — Pin configuration (see above)
F — Pin configuration (see above)
D — Pin configuration (see above)
H — Pin configuration (see above)

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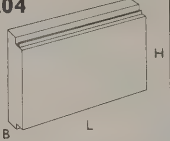
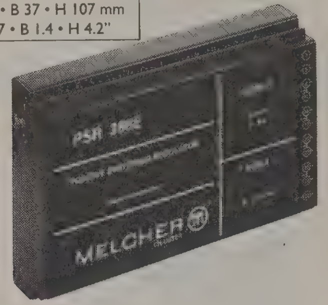
SWITCHING MODE REGULATORS

10-288W NON-ISOLATED SINGLE OUTPUT

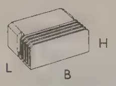
L04



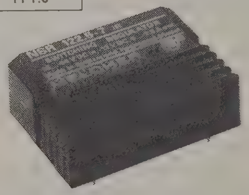
L 168 • B 37 • H 107 mm
L 6.7 • B 1.4 • H 4.2"



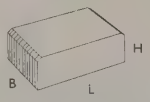
A01



L 50 • B 70 • H 25 mm
L 2.0 • B 2.8 • H 1.0"

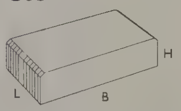


B02

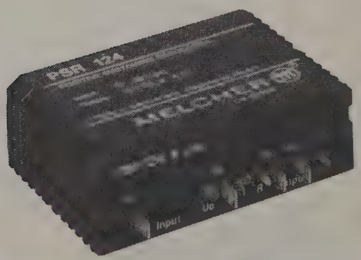


L 69 • B 106 • H 32 mm
L 2.7 • B 4.2 • H 1.3"

C03



L 88 • B 151 • H 32 mm
L 3.5 • B 5.9 • H 1.3"



PSL, PSR, PSB, PSC, NSR

- Output power up to 288W
- Exceptionally wide input voltage range
- Power MOS-FET technology
- Large number of options allowing unlimited applications
- Low input-output differential voltage
- Direct replacement for linear regulators
- Adjustable output voltage
- Undervoltage lockout
- Parallel operation possible
- Continuously open- and short-circuit proof
- Switching regulators with two and three outputs (PMB series) on special request

- ***NSR***-All features of PSR series but with negative going input and output relative to ground

Output $V_{o\,nom}$ V DC	Output $I_{o\,nom}$ A	Input V_i V DC	Eff. η %	Case	Type Basic version T_A: -25...71°C		Available options
5.1	10.0	8 ...80	76	L04	PSL 5A10-7R		9, L, i, P, C, D, A
5.1	12.0	7 ...40	81		PSL 5A12-7R		
12.0	8.0	15 ...80	89		PSL 128-7R		
15.0	8.0	19 ...80	89		PSL 158-7R		
24.0	8.0	29 ...80	94		PSL 248-7R		
36.0	8.0	42 ...80	94		PSL 368-7R		
5.1	7.0	15...144	77	L04	PSL 5A7-7R		9, L, i, P C, D, A
12.0	6.0	18...144	89		PSL 126-7R		
15.0	6.0	22.. 144	89		PSL 156-7R		
24.0	6.0	31...144	91		PSL 246-7R		
36.0	6.0	44.. 144	94		PSL 366-7R		
48.0	6.0	58. 144	96		PSL 486-7R		
5.0	2.0	8 ...80		A01	PSR52-7		i,Y
5.0	3.0	8 ...80	77	A01	PSR 53-7	NSR 53-7	9, i, P, R, Y
5.0	4.0	7 ...38	82		PSR 54-7	NSR 54-7	
5.0	5.0	7 ...35	82		PSA 55-7	NSA 55-7	
12.0	2.5	15 ...80	86		PSR122.5-7	NSR 122.5-7	
15.0	2.5	19 ...80	88		PSR152.5-7	NSR 152.5-7	
24.0	2.0	29 ...80	91		PSR 242-7	NSR 242-7	
36.0	2.0	42 ...80	94		PSR 362-7	NSR 362-7	
5.1	6.0	8 ...80	79	B02	PSB 5A6-7iR		9, L, P, C
5.1	7.0	7 ...40	81		PSB 5A7-7iR		
12.0	5.0	15 ...80	89		PSB 125-7iR		
15.0	5.0	19 ...80	89		PSB 155-7iR		
24.0	5.0	29 ...80	94		PSB 245-7iR		
36.0	5.0	42 ...80	94		PSB 365-7iR		
5.1	4.0	15...144	77	B02	PSB 5A4-7iR		
12.0	3.0	18...144	89		PSB 123-7iR		
15.0	3.0	22...144	89		PSB 153-7iR		
24.0	3.0	31 . 144	91		PSB 243-7iR		
36.0	3.0	44...144	94		PSB 363-7iR		
48.0	3.0	58...144	95		PSB 483-7iR		
5.0	10.0	8 ...80	76	C03		NSR 510-7	PSC types: 9,L,P,C,D NSR types: 9,L,i,R,P,C
5.0	12.0	7 ...38	81			NSR 512-7	
5.1	10.0	8 ...80	79		PSC5A10-7iR		
5.1	12.0	7 ...40	81		PSC5A12-7iR		
12.0	8.0	15 ...80	89		PSC128-7iR	NSR 128-7	
15.0	8.0	19 ...80	89		PSC158-7iR	NSR 158-7	
24.0	8.0	29 ...80	94		PSC248-7iR	NSR248-7	
36.0	8.0	42 ...80	94		PSC368-7iR	NSR368-7	
5.1	7.0	15...144	77	C03	PSC5A7-7iR		9,L,P,C,D
12.0	6.0	18...144	89		PSC126-7iR		
15.0	6.0	22...144	89		PSC156-7iR		
24.0	6.0	31...144	91		PSC246-7iR		
36.0	6.0	44...144	94		PSC366-7iR		
48.0	6.0	58...144	96		PSC486-7iR		

Options

9 — Extended operational ambient temperature range T_A: -40...71°C (-40...160°F)
L — Input filter for reduction of superimposed interference
i — Inhibit input for switching output voltage on and off with a logic signal
P — Potentiometer for fine adjustment of output voltage V_o (±8% of $V_{o\,nom}$)
R —Programmable output voltage control input PSR: 0...1.08 • $V_{o\,nom}$,
NSR: 0.65...1.08 $V_{o\,nom}$
C — Thyristor crowbar for output protection in the event of overvoltage
D — Adjustable input voltage monitor
Y — Case A01: Soldering pins for pcb-mounting-holes of Ø 1.4mm
A — Testjack on front panel for output voltage measurement

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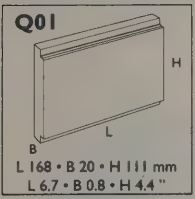
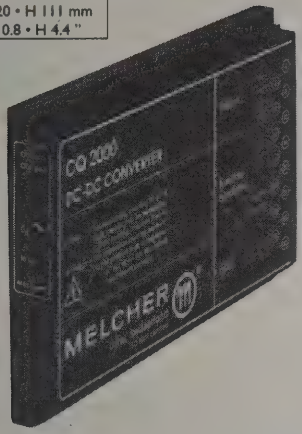
DC-DC CONVERTERS 100W SINGLE AND DUAL OUTPUTS





CQ 1000...CQ 2000

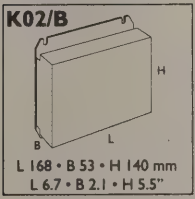
- Output power up to 100W
- Input voltage range for 48/60 V batteries
- High efficiency and low thermal stress
- Input/output isolation voltage 2kV$_{rms}$
- Efficient input filter: the complete solution
- Very low and short lasting inrush current
- Safety according to IEC 950 and EN 41003
- RFI as per VDE 0871/6.78, EN 55011 and EN 55022: level B
- Input under-/overvoltage lock-out
- Continuously open-and short-circuit proof
- Inhibit input for output on/off control
- Series-or parallel-connection of outputs
- True n+1 redundancy (hot plug-in)
- Thermal protection circuitry built-in
- Output voltage sensing (sense lines)
- Output voltage programming (R-input)
- Test sockets for V_{ol}
- 19" cassette (case Q01, fully enclosed) VME 41494, or chassis-mount

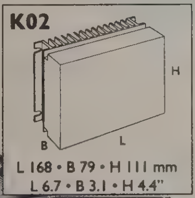
Output 1		Output 2		Input	Eff.	Case	Type	Options
V_o nom VDC	I_o nom A	V_o nom VDC	I_o nom A	V_i %	0 %		Basic version TA: -25...71°C	
5.1	16.0			38.4...75.0	85 to 90	Q01	CQ 1001-6R	Potentiometer for fine adjustment of V_o (±10% of V_o nom), excludes the R-function
12.0	8.0						CQ 2320-7R 1)	
15.0	6.6						CQ 2540-7R 1)	
24.0	4.4						CQ 2660-7R 1)	
24.0	4.0						CQ 2320-7R 2)	
30.0	3.3						CQ 2540-7R 2)	
48.0	2.2						CQ 2660-7R 2)	
12.0	4.0	12.0 3)	4.0				CQ 2320-7R	
15.0	3.3	15.0 3)	3.3				CQ 2540-7R	
24.0	2.2	24.0 3)	2.2				CQ 2660-7R	

1) Outputs in parallel-connection
2) Outputs in series-connection
3) Output # 2 semi-regulated

DC-DC CONVERTERS & AC-DC CONVERTERS

125-150W SINGLE AND DUAL OUTPUTS





CK through LK

- Output power up to 150W
- Extremely wide input voltage range
- High efficiency and low thermal stress
- Input/output isolation voltage 4kV$_{rms}$
- Input transient suppression circuitry and effective input filter
- Inrush current limiting in CK...LK modules
- Safety according to VDE0805, IEC950, EN60950, UL1950 and EN41003
- RFI according to VDE0878, EN55011 and EN55022, level B
- Input under-/overvoltage lock-out
- Continuously open-and short-circuit proof
- Series-or parallel-connection of outputs
- Thermal protection circuitry built-in
- Inhibit input for output on/off control
- Output voltages from 2 to 52 VDC
- Sense lines for output voltage sensing
- R-input for external output voltage adjustment (0...110% of $V_{o\ nom}$)
- 19" cassette (case K02, fully enclosed) VME 41494, or chassis mount

Output 1		Output 2		Input	Eff.	Case	Type	Options
V_o nom VDC	I_o nom A	V_o nom VDC	I_o nom A	V_i %	0 %		Basic version TA: -25...71°C	
5.1	25.0			CK: 28...140 DK: 44...220 EK 2): 67...385 FK: 20...100 LK: 88...372 LK: 85...264 VAC (47...440 Hz)	76 to 81	K02	CK...LK 1001-7R	9,E,P,D,T,B
12.0	12.0						CK...LK 1301-7R	
15.0	10.0						CK...LK 1501-7R	
24.0	6.0						CK...LK 2320-7R 1)	
30.0	5.0						CK...LK 2540-7R 1)	
48.0	3.0						CK...LK 2660-7R 1)	
12.0	6.0	12.0 3)	6.0				CK...LK 2320-7R	
15.0	5.0	15.0 3)	5.0				CK...LK 2540-7R	
24.0	3.0	24.0 3)	.3.0				CK...LK 2660-7R	

1) Outputs in series connection
2) EK types on customer request only
3) Output #2 semi-regulated

Options

9 — Extended temperature range T_A: – 40...71°C (– 40...160°F)
E — Active inrush current limitation circuitry, excludes the built-in passive element
P — Potentiometer for fine adjustment of V_O (40...110% • $V_{O\ nom}$)
D — Adjustable input/output voltage monitor; save data signal (different versions available
T — Automatic current sharing in parallel operating mode (3 modules max.)
B — Heat sink interface plate for mounting on metal surface (instead of standard heatsink)

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CUSTOM HYBRID
DC-DC CONVERTERS

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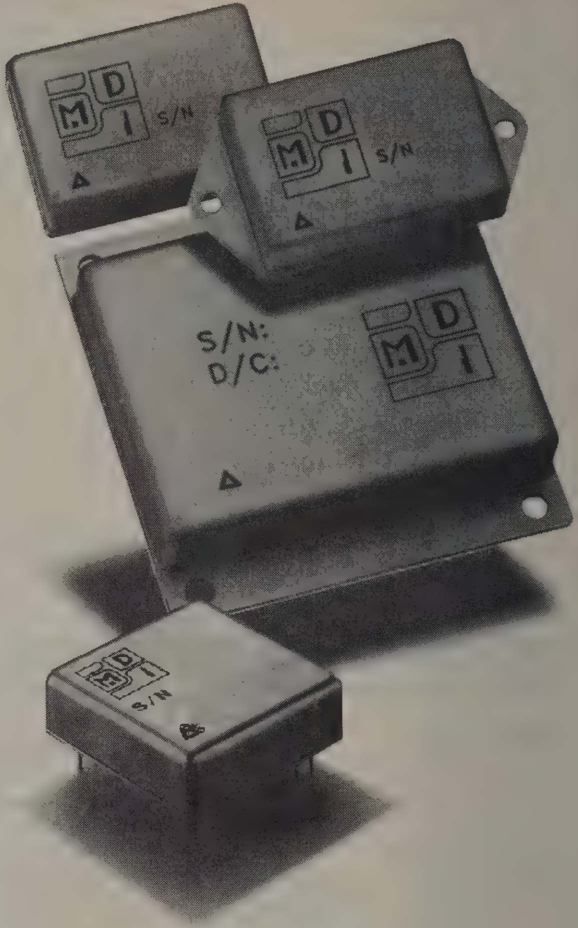

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- *Reasonable NRE and deliveries on custom derivatives*
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- *Output voltages from 2 VDC~3000 VDC*
- *Output power up to 120 Watts*
- *Ultra low power with high efficiency*
- *Multiple outputs, up to 10*
- *Sequenced outputs*
- *EMI and Tempest filtering*
- *Radiation hardened available*
- *Space, Military and Avionics*
- *Many packaging configurations available*
- *Tolerates severe surges and spikes (e.g. MIL-STD-704, 1275)*

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Request our "Custom Hybrid Specifier sheet"
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MILITARY DC-DC CONVERTERS . . . Series MR, *Wide Input Voltage, Single and Dual Outputs, up to 2½ Watts*	D•2158-59
DC-DC CONVERTERS . . . Series LR, Regulated, Isolated *Single and Dual Outputs, Wide Input Range 5 to 60 Volts, up to 5 Watts*	D•2160-61
DC-DC CONVERTERS . . . Series PLR, Regulated *Single and Dual Outputs, Wide Input Range up to 5 Watts, .300″ max. ht.*	D•2162-63
DC-DC CONVERTERS . . . Series IR, Regulated, Isolated *Single and Dual Outputs, Wide Input Range 5 to 60 Volts, up to 10 Watts*	D•2164-65
DC-DC CONVERTERS . . . Series JR, Regulated, Isolated *Single and Dual Outputs, Wide Input Range 18 to 60 Volts, up to 15 Watts*	D•2166-67
DC-DC CONVERTERS . . . Series KR, Regulated, Isolated *Single and Dual Outputs, Wide Input Range 18 to 60 Volts, up to 20 Watts*	D•2168-69
DC-DC CONVERTERS . . . Series NR, Regulated *Single, Dual and New Triple Outputs, Wide Input Range 18 to 72 Volts, up to 30 Watts*	D•2170-71
DC-DC CONVERTERS . . . Series LV, Regulated, Isolated *Wide Input 36-80 VDC, up to 10 Watts*	D•2172-73
DC-DC CONVERTERS . . . Series HV, Regulated, Isolated *Wide Input 70-170 VDC, up to 15 Watts*	D•2174-75

HIGH POWER DC-DC CONVERTERS

FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PA**–Wide Input 18-36V DC, Regulated, *17 Standard* ***Dual*** *and Single Models*	D•2176-77
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PB**–Wide Input 36-72V DC, Regulated, *17 Standard* ***Dual*** *and Single Models*	D•2178-79
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PC**–Wide Input 100-180V DC, Regulated, *17 Standard* ***Dual*** *and Single Models*	D•2180-81
FIXED FREQUENCY–DC-DC–100 WATTS . . . **Series PD**–Wide Input 200-380V DC, Regulated, *17 Standard* ***Dual*** *and Single Models*	D•2182-83
APPLICATION NOTES MECHANICAL CONFIGURATIONS	D•2184-85

AC-DC POWER SUPPLIES *(See Section 4000)*

D•1859

AC-DC LINEAR MODULES . . Series LAC/TLAC Regulated, Isolated *Single, Dual and Triple, Wide Input Range up to 10 Watts*	D•1860-61
AC-DC SWITCHERS . . . Series SW, Regulated, Isolated, Industrial *Low Profile .5″ ht., up to 15 Watts*	D•1862-63
AC-DC SWITCHERS . . . Series 5AC, Regulated, Isolated *Single and Dual, Lowest Profile 0.5″ ht., up to 5 Watts*	D•1864
AC-DC SWITCHERS . . . Series 10 AC, Regulated, Isolated *Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 10 Watts*	D•1865
AC-DC SWITCHERS . . . Series 30 AC, Regulated, Isolated *Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 30 Watts*	D•1866
AC-DC SWITCHERS . . . Series 50 AC, Regulated, Isolated *Single, Dual and Triple, Lowest Profile, 0.5″ ht., up to 55 Watts*	D•1867
AC-DC SWITCHERS . . . OFU 3, 4, 6 Universal Input, 85-264 VAC PCB Design *Multiple Outputs, up to 65 Watts*	D•1868-69
AC-DC SWITCHERS . . . OFB 5, 13 Fully Enclosed, Jumper Selectable *Multiple Outputs, up to 130 Watts*	D•1870-71
AC-DC SWITCHERS . . . OFJ 10, 20 PCB or L-bracket Design, Jumper Selectable *Multiple Outputs, up to 200 Watts*	D•1872-73

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

FAX: 914-699-5565

Delivery: Stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

SERIES A

3.3 Volts Output Now Standard
for PICO Part Numbers: 5A3.3S, 12A3.3S, 24A3.3S, 28A3.3S, 48A3.3S

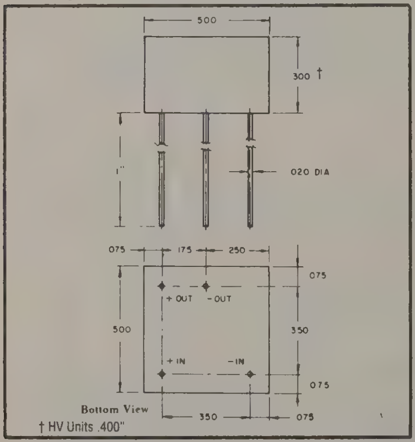
OPTIONS AVAILABLE
- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

Hi Reliability Ultra-Miniature DC-DC Converters

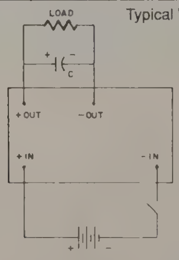
FEATURES
- Up to 1.25 watt output at 70°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Ultra-miniature size (0.3″ Height)
- 5 input voltage ranges 5, 12, 24, 28 and 48V DC
- 100 megohm @ 500V DC isolation
- Input/output isolation
- Single and dual output
- No heat sink required
- Up to 250V Output

New Series AT/DT
.200 height-
up to .75 Watts
see pages D•2146 &
D•2147

This series of unregulated DC-DC converters are produced in an ultra-miniature encapsulated package. 84 different models are available. The units feature single and dual outputs. They will operate over the temperature range of −25°C to +70°C. No heat sink is required.



Typical Weight: 3.5 Grams



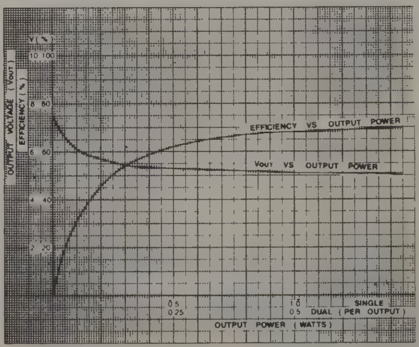
SERIES A - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5A5S	5	5	200	1	66	303	0.20	65	±0.25	56.55
5A9S	5	9	139	1.25	73	342	0.15	80	±0.3	56.55
5A12S	5	12	104	1.25	73	342	0.15	80	±0.4	56.55
5A15S	5	15	83	1.25	75	333	0.12	90	±0.4	56.55
5A24S	5	24	52	1.25	75	333	0.10	90	±0.5	56.55
5A28S	5	28	45	1.25	74	338	0.10	90	±0.5	56.55
5A48S	5	48	26	1.25	77	325	0.10	90	±0.7	56.55
5A100S	5	100	12.5	1.25	78	321	0.90	90	±3.0	80.12 †
5A150S	5	150	8.3	1.25	76	329	0.90	100	±3.0	80.12 †
5A200S	5	200	6.25	1.25	75	333	0.90	100	±3.0	80.12 †
5A250S	5	250	5	1.25	75	333	0.90	100	±3.0	80.12 †
12A5S	12	5	200	1	66	126	0.20	24	±0.25	56.55
12A9S	12	9	139	1.25	74	141	0.15	26	±0.3	56.55
12A12S	12	12	104	1.25	76	137	0.15	26	±0.4	56.55
12A15S	12	15	83	1.25	78	134	0.15	26	±0.4	56.55
12A24S	12	24	52	1.25	78	134	0.15	26	±0.5	56.55
12A28S	12	28	45	1.25	77	135	0.15	26	±0.5	56.55
12A48S	12	48	26	1.25	80	130	0.20	26	±0.7	56.55
12A100S	12	100	12.5	1.25	80	130	0.90	30	±3.0	80.12 †
12A150S	12	150	8.3	1.25	79	132	0.90	35	±3.0	80.12 †
12A200S	12	200	6.25	1.25	78	134	0.90	35	±3.0	80.12 †
12A250S	12	250	5	1.25	75	139	0.90	40	±3.0	80.12 †
24A5S	24	5	200	1	66	63	0.20	13	+0.25	56.55
24A9S	24	9	139	1.25	72	72	0.20	15	±0.3	56.55
24A12S	24	12	104	1.25	75	69	0.20	15	+0.4	56.55
24A15S	24	15	83	1.25	75	69	0.20	15	±0.4	56.55
24A24S	24	24	52	1.25	78	67	0.20	15	±0.5	56.55
24A28S	24	28	45	1.25	77	68	0.20	15	±0.5	56.55
24A48S	24	48	26	1.25	78	67	0.25	16	+0.7	56.55
24A100S	24	100	12.5	1.25	76	69	0.90	20	±3.0	80.12 †
24A150S	24	150	8.3	1.25	73	71	0.90	25	±3.0	80.12 †
24A200S	24	200	6.25	1.25	73	71	0.90	25	±3.0	80.12 †
24A250S	24	250	5	1.25	70	74	0.90	25	±3.0	80.12 †
28A5S	28	5	200	1	66	54	0.20	12	±0.25	56.55
28A9S	28	9	139	1.25	72	62	0.20	14	±0.3	56.55
28A12S	28	12	104	1.25	72	62	0.20	14	±0.4	56.55
28A15S	28	15	83	1.25	73	61	0.20	14	±0.4	56.55
28A24S	28	24	52	1.25	76	59	0.20	14	±0.5	56.55
28A28S	28	28	45	1.25	76	59	0.20	14	±0.5	56.55
28A48S	28	48	26	1.25	77	58	0.25	15	±0.7	56.55
28A100S	28	100	12.5	1.25	75	60	0.90	20	±3.0	80.12 †
28A150S	28	150	8.3	1.25	76	59	0.90	25	±3.0	80.12 †
28A200S	28	200	6.25	1.25	75	60	0.90	25	±3.0	80.12 †
28A250S	28	250	5	1.25	70	64	0.90	25	±3.0	80.12 †
48A5S	48	5	200	1	66	32	0.25	6	±0.25	60.70
48A9S	48	9	139	1.25	72	36	0.25	8	±0.3	60.70
48A12S	48	12	104	1.25	73	36	0.25	8	±0.4	60.70
48A15S	48	15	83	1.25	72	36	0.25	8	±0.4	60.70
48A24S	48	24	52	1.25	76	34	0.25	9	±0.5	60.70
48A28S	48	28	45	1.25	76	34	0.25	9	±0.5	60.70

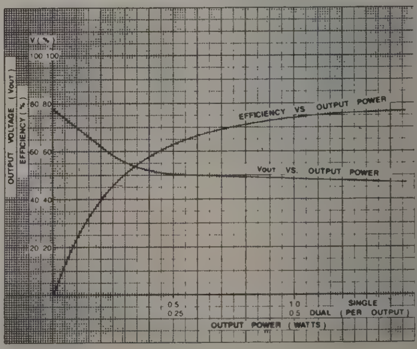
*For units with output voltages up to 48 volts, ripple is measured with 10μF, 75 volt high quality tantalum capacitor which is required across the output.
For units with output voltage of 100-250 volts use A 0.1μF, 300 volt capacitor which is required across output, and maintain at least 10% of rated load to prevent a voltage surge.

† HV Units .400″

SERIES A SINGLE & DUAL 12V-5V



SERIES A SINGLE & DUAL 5V-48V



453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 •
FAX 914-699-5565
PICO Electronics, Inc.

Low Profile .5″×.5″×.3″ Height! . . . up to 1.25 Watts

For Surface Mount versions of this series see pages D•2140 & 2141

No Heat Sink or Electrical Derating Required

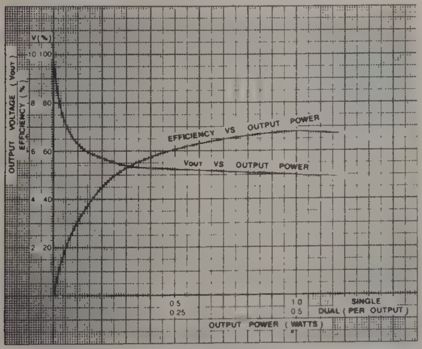
SERIES A - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5A5D	5	±5	100	0.5	66	303	0.20	65	±0.25	63.93
5A9D	5	±9	69	0.625	73	342	0.15	80	±0.3	63.93
5A12D	5	±12	52	0.625	73	342	0.15	80	±0.4	63 93
5A15D	5	±15	42	0.625	75	333	0.12	90	±0 4	63.93
5A24D	5	±24	26	0 625	75	333	0.10	90	±0.5	63.93
5A28D	5	±28	22	0.625	74	338	0.10	90	±0.5	63.93
5A48D	5	±48	13	0.625	77	325	0.10	90	±0.7	63.93
12A5D	12	±5	100	0.5	66	126	0.20	24	±0.25	63 93
12A9D	12	±9	69	0.625	74	141	0.15	26	±0.3	63 93
12A12D	12	±12	52	0.625	76	137	0.15	26	±0.4	63 93
12A15D	12	±15	42	0.625	78	134	0 15	26	±0.4	63.93
12A24D	12	±24	26	0.625	78	134	0.15	26	±0.5	63 93
12A28D	12	±28	22	0.625	77	135	0.15	26	±0.5	63.93
12A48D	12	±48	13	0.625	80	130	0.20	26	±0.7	63 93
24A5D	24	±5	100	0.5	66	63	0.20	13	±0.25	63.93
24A9D	24	±9	69	0.625	72	72	0.20	15	±0.3	63.93
24A12D	24	±12	52	0.625	75	69	0.20	15	±0.4	63.93
24A15D	24	±15	42	0.625	75	69	0.20	15	±0.4	63.93
24A24D	24	±24	26	0.625	78	67	0.20	15	±0.5	63.93
24A28D	24	±28	22	0.625	77	68	0.20	15	±0.5	63.93
24A48D	24	±48	13	0.625	78	67	0.25	16	±0.7	63.93
28A5D	28	±5	100	0.5	66	54	0.20	12	±0.25	63.93
28A9D	28	±9	69	0.625	72	62	0.20	14	±0.3	63.93
28A12D	28	±12	52	0.625	72	62	0.20	14	±0.4	63.93
28A15D	28	±15	42	0.625	73	61	0.20	14	±0.4	63.93
28A24D	28	±24	26	0.625	76	59	0.20	14	±0 5	63.93
28A28D	28	±28	22	0.625	76	59	0.20	14	±0.5	63.93
28A48D	28	±48	13	0.625	77	58	0.25	15	±0.7	63.93
48A5D	48	±5	100	0.5	66	32	0.25	6	±0.25	68.63
48A9D	48	±9	69	0.625	72	36	0.25	8	±0.3	68.63
48A12D	48	±12	52	0.625	73	36	0.25	8	±0.4	68.63
48A15D	48	±15	42	0.625	72	36	0.25	8	±0.4	68.63
48A24D	48	±24	26	0.625	76	34	0.25	9	±0.5	68.63
48A28D	48	±28	22	0.625	76	34	0.25	9	±0.5	68.63

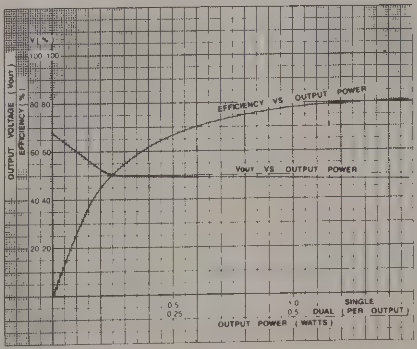
*For units with output voltages up to 48 volts, ripple is measured with 10µF, 75 volt high quality tantalum capacitor which is required across each output.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SERIES A SINGLE & DUAL 5V-5V



SERIES A SINGLE & DUAL 12V-48V



TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range:
5V models 4 to 6.5V DC
12V models 9 to 15V DC
24V models 17 to 28V DC
28V models 21 to 32V DC
48V models 25 to 50V DC

Output voltage tolerance at full load:
5V models ± 0.25V
9V models ± 0.3V
12V & 15V models ± 0.4V
24V & 28V models ± 0.5V
48V models ± 0.7V
100V, 150V, 200V & 250V models ± 3.0V

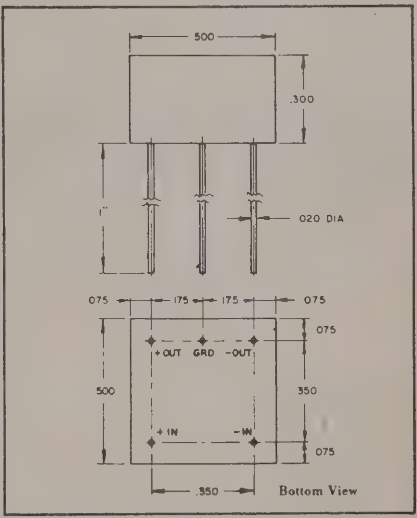
Converter frequency: 20 – 40 KHz

Output temperature coefficient:
0.05%/°C for 5V output.
0.04%/°C for 12 & 15V output.
0.02%/°C for 24, 28, 48, 100, 150, 200 and 250 volt outputs

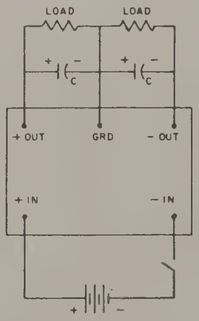
Operating temperature: –25°C to +70°C ambient. No heat sink is required.

Storage temperature: –55°C to +125°C

Isolation: 100 megohms min. @ 500V DC



Typical Weight: 3.5 Grams



PICO Electronics, Inc.
453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

For immediate engineering assistance or to place an order– Call Toll Free 800-228-9747

• FAX 914-699-5565

Delivery— stock to one week

SERIES SM

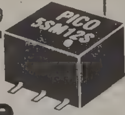
NEW SURFACE MOUNT DESIGN

SERIES SM SINGLE OUTPUT

3.3 Volts Output Now Standard
for Part Numbers: 5SM3.3S, 12SM3.3S, 24SM3.3S, 28SM3.3S, 48SM3.3S

OPTIONS AVAILABLE

- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

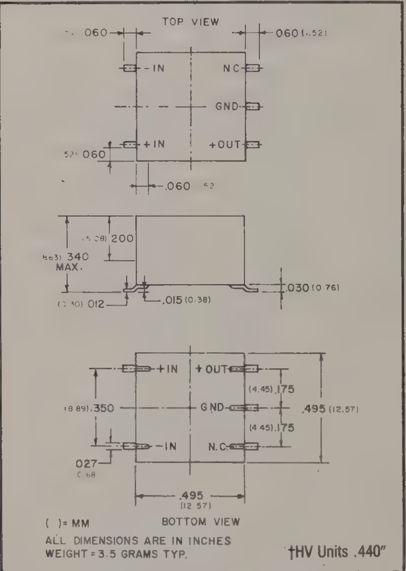


Hi Reliability Ultra-Miniature DC-DC Converters

FEATURES:

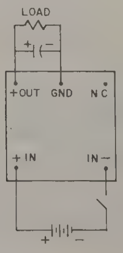
- New surface mount construction
- Up to 1.25 watt output at 70°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Ultra-miniature size (.340″ Height)
- 5 input voltage ranges 5, 12, 24, 28 and 48V DC
- 100 megohm @ 500V DC isolation
- Input/output isolation
- Single and dual output
- No heat sink required
- Up to 250V Output

This series of unregulated DC-DC converters are produced in an ultra-miniature encapsulated package, now compatible with your surface mount assembly. 84 different models are available. The units feature single and dual outputs. They will operate over the temperature range of −25°C to + 70°C. No heat sink is required.



( )= MM
ALL DIMENSIONS ARE IN INCHES
WEIGHT = 3.5 GRAMS TYP.

†HV Units .440″



Delivery— stock to one week

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5SM5S	5	5	200	1	66	303	0.20	65	+0.25	56.55
5SM9S	5	9	139	1.25	73	342	0.15	80	+0.3	56.55
5SM12S	5	12	104	1.25	73	342	0.15	80	+0.4	56.55
5SM15S	5	15	83	1.25	75	333	0.12	90	±0.4	56.55
5SM24S	5	24	52	1.25	75	333	0.10	90	±0.5	56.55
5SM28S	5	28	45	1.25	74	338	0.10	90	+0.5	56.55
5SM48S	5	48	26	1.25	77	325	0.10	90	+0.7	56.55
5SM100S	5	100	12.5	1.25	78	321	0.90	90	±3.0	80.12 †
5SM150S	5	150	8.3	1.25	76	329	0.90	100	±3.0	80.12 †
5SM200S	5	200	6.25	1.25	75	333	0.90	100	±3.0	80.12 †
5SM250S	5	250	5	1.25	75	333	0.90	100	±3.0	80.12 †
12SM5S	12	5	200	1	66	126	0.20	24	±0.25	56.55
12SM9S	12	9	139	1.25	74	141	0.15	26	±0.3	56.55
12SM12S	12	12	104	1.25	76	137	0.15	26	+0.4	56.55
12SM15S	12	15	83	1.25	78	134	0.15	26	±0.4	56.55
12SM24S	12	24	52	1.25	78	134	0.15	26	±0.5	56.55
12SM28S	12	28	45	1.25	77	135	0.15	26	±0.5	56.55
12SM48S	12	48	26	1.25	80	130	0.20	26	±0.7	56.55
12SM100S	12	100	12.5	1.25	80	130	0.90	30	±3.0	80.12 †
12SM150S	12	150	8.3	1.25	79	132	0.90	35	±3.0	80.12 †
12SM200S	12	200	6.25	1.25	78	134	0.90	35	±3.0	80.12 †
12SM250S	12	250	5	1.25	75	139	0.90	40	+3.0	80.12 †
24SM5S	24	5	200	1	66	63	0.20	13	±0.25	56.55
24SM9S	24	9	139	1.25	72	72	0.20	15	+0.3	56.55
24SM12S	24	12	104	1.25	75	69	0.20	15	±0.4	56.55
24SM15S	24	15	83	1.25	75	69	0.20	15	±0.4	56.55
24SM24S	24	24	52	1.25	78	67	0.20	15	±0.5	56.55
24SM28S	24	28	45	1.25	77	68	0.20	15	+0.5	56.55
24SM48S	24	48	26	1.25	78	67	0.25	16	+0.7	56.55
24SM100S	24	100	12.5	1.25	76	69	0.90	20	±3.0	80.12 †
24SM150S	24	150	8.3	1.25	73	71	0.90	25	±3.0	80.12 †
24SM200S	24	200	6.25	1.25	73	71	0.90	25	+3.0	80.12 †
24SM250S	24	250	5	1.25	70	74	0.90	25	±3.0	80.12 †
28SM5S	28	5	200	1	66	54	0.20	12	±0.25	56.55
28SM9S	28	9	139	1.25	72	62	0.20	14	+0.3	56.55
28SM12S	28	12	104	1.25	72	62	0.20	14	±0.4	56.55
28SM15S	28	15	83	1.25	73	61	0.20	14	±0.4	56.55
28SM24S	28	24	52	1.25	76	59	0.20	14	±0.5	56.55
28SM28S	28	28	45	1.25	76	59	0.20	14	±0.5	56.55
28SM48S	28	48	26	1.25	77	58	0.25	15	+0.7	56.55
28SM100S	28	100	12.5	1.25	75	60	0.90	20	±3.0	80.12 †
28SM150S	28	150	8.3	1.25	76	59	0.90	25	+3.0	80.12 †
28SM200S	28	200	6.25	1.25	75	60	0.90	25	±3.0	80.12 †
28SM250S	28	250	5	1.25	70	64	0.90	25	±3.0	80.12 †
48SM5S	48	5	200	1	66	32	0.25	6	+0.25	60.70
48SM9S	48	9	139	1.25	72	36	0.25	8	+0.3	60.70
48SM12S	48	12	104	1.25	73	36	0.25	8	±0.4	60.70
48SM15S	48	15	83	1.25	72	36	0.25	8	±0.4	60.70
48SM24S	48	24	52	1.25	76	34	0.25	9	±0.5	60.70
48SM28S	48	28	45	1.25	76	34	0.25	9	+0.5	60.70

*For units with output voltages up to 48 volts, ripple is measured with 10μF, 75 volt high quality tantalum capacitor which is required across the output.
For units with output voltage of 100-250 volts use A 0.1μF, 300 volt capacitor which is required across output, and maintain at least 10% of rated load to prevent a voltage surge.

†HV Units .440″

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: *OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT*

Input voltage range: 5V models 4 to 6.5V DC
12V models 9 to 15V DC
24V models 17 to 28V DC
28V models 21 to 32V DC
48V models 25 to 50V DC

Output voltage tolerance at full load: 5V models ± 0.25V
9V models ± 0.3V
12V & 15V models ± 0.4V
24V & 28V models ± 0.5V
48V models ± 0.7V
100V, 150V, 200V & 250V models ± 3.0V

Converter frequency: 20 – 40 KHz

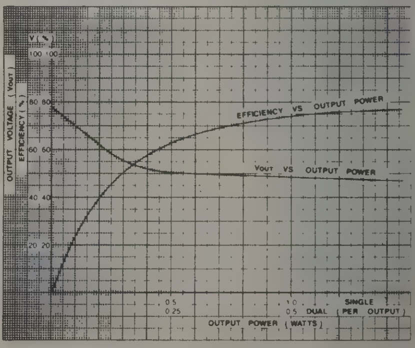
Output temperature coefficient: 0.05%/°C for 5V output
0.04%/°C for 12 & 15V output
0.02%/°C for 24, 28, 48, 100, 150, 200 and 250 volt outputs

Operating temperature: 25°C to +70°C ambient
No heat sink is required

Storage temperature: 55°C to +125°C

Isolation: 100 megohms min. @ 500V DC

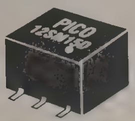
SERIES SM SINGLE & DUAL 5V-48V



For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747*** FAX 914-699-5565

SERIES SM

Low Profile .5″ × .5″ × .340″ Height . . .up to 1.25 Watts



No Heat Sink or Electrical Derating Required

NEW SURFACE MOUNT DESIGN

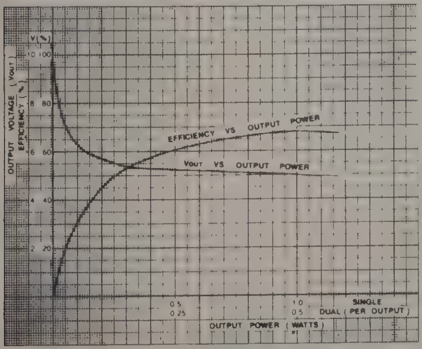
SERIES SM DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5SM5D	5	±5	100	0.5	66	303	0.20	65	±0.25	63.93
5SM9D	5	±9	69	0.625	73	342	0.15	80	±0.3	63.93
5SM12D	5	±12	52	0.625	73	342	0.15	80	±0.4	63.93
5SM15D	5	±15	42	0.625	75	333	0.12	90	±0.4	63.93
5SM24D	5	±24	26	0.625	75	333	0.10	90	±0.5	63.93
5SM28D	5	±28	22	0.625	74	338	0.10	90	±0.5	63.93
5SM48D	5	±48	13	0.625	77	325	0.10	90	±0.7	63.93
12SM5D	12	±5	100	0.5	66	126	0.20	24	±0.25	63.93
12SM9D	12	±9	69	0.625	74	141	0.15	26	±0.3	63.93
12SM12D	12	±12	52	0.625	76	137	0.15	26	±0.4	63.93
12SM15D	12	±15	42	0.625	78	134	0.15	26	±0.4	63.93
12SM24D	12	±24	26	0.625	78	134	0.15	26	±0.5	63.93
12SM28D	12	±28	22	0.625	77	135	0.15	26	±0.5	63.93
12SM48D	12	±48	13	0.625	80	130	0.20	26	±0.7	63.93
24SM5D	24	±5	100	0.5	66	63	0.20	13	±0.25	63.93
24SM9D	24	±9	69	0.625	72	72	0.20	15	±0.3	63.93
24SM12D	24	±12	52	0.625	75	69	0.20	15	±0.4	63.93
24SM15D	24	±15	42	0.625	75	69	0.20	15	±0.4	63.93
24SM24D	24	±24	26	0.625	78	67	0.20	15	±0.5	63.93
24SM28D	24	±28	22	0.625	77	68	0.20	15	±0.5	63.93
24SM48D	24	±48	13	0.625	78	67	0.25	16	±0.7	63.93
28SM5D	28	±5	100	0.5	66	54	0.20	12	±0.25	63.93
28SM9D	28	±9	69	0.625	72	62	0.20	14	±0.3	63.93
28SM12D	28	±12	52	0.625	72	62	0.20	14	±0.4	63.93
28SM15D	28	±15	42	0.625	73	61	0.20	14	±0.4	63.93
28SM24D	28	±24	26	0.625	76	59	0.20	14	±0.5	63.93
28SM28D	28	±28	22	0.625	76	59	0.20	14	±0.5	63.93
28SM48D	28	±48	13	0.625	77	58	0.25	15	±0.7	63.93
48SM5D	48	±5	100	0.5	66	32	0.25	6	±0.25	68.63
48SM9D	48	±9	69	0.625	72	36	0.25	8	±0.3	68.63
48SM12D	48	±12	52	0.625	73	36	0.25	8	±0.4	68.63
48SM15D	48	±15	42	0.625	72	36	0.25	8	±0.4	68.63
48SM24D	48	±24	26	0.625	76	34	0.25	9	±0.5	68.63
48SM28D	48	±28	22	0.625	76	34	0.25	9	±0.5	68.63

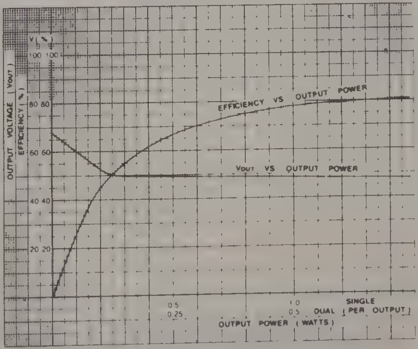
*For units with output voltages up to 48 volts, ripple is measured with 10μF, 75 volt high quality tantalum capacitor which is required across each output.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

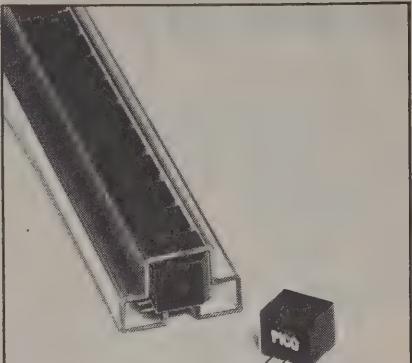
SERIES SM SINGLE & DUAL 5V-5V



SERIES SM SINGLE & DUAL 12V-48V

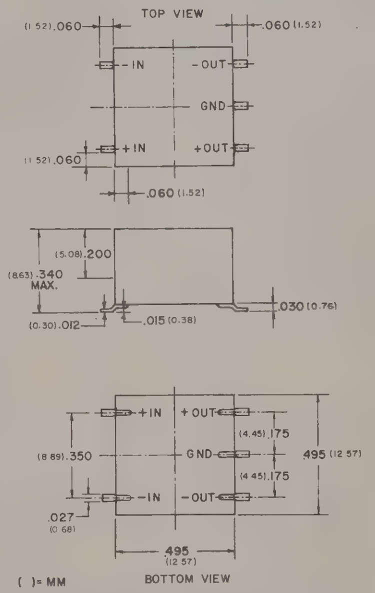


For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747***

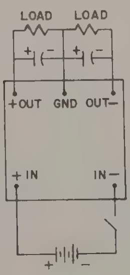


SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.



ALL DIMENSIONS ARE IN INCHES
WEIGHT = 3.5 GRAMS TYP



PICO
Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

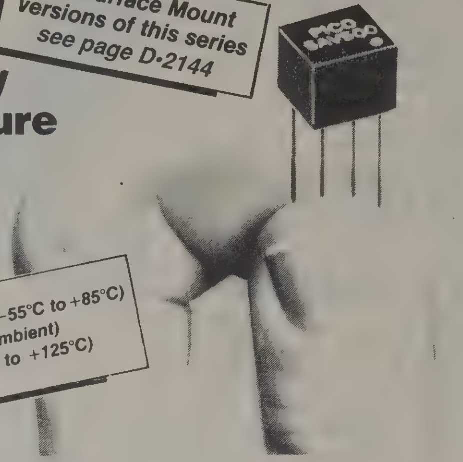
Delivery— stock to one week

• FAX 914-699-5565

SERIES AV .400 ht. up to 500 VDC output

Hi Voltage Hi Reliability Ultra-Miniature Isolated DC-DC Converters

For Surface Mount versions of this series see page D•2144



OPTIONS AVAILABLE
- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, burn in

- 1.25 watt output at 70° ambient
- Ultra-miniature size 0.400″ height, 4.0 grams weight, 0.1 cubic inches volume
- 4 input voltage ranges 5, 12, 24 and 28 VDC
- 100 megohm @ 1000 VDC input/output isolation
- MIL-STD 883 options available
- No heat sink or electrical derating required

This series of unregulated high voltage DC-DC converters are produced in an ultra-miniature encapsulated package. 36 different models are available. These single output isolated units will operate over the temperature range of −25° to +70°C with no heat sink or electrical derating. For military applications an operating temperature range −55°C to +85°C is available. An optional environmental screening package per MIL-STD-883 is also available.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range: ±10% all models

Output voltage tolerance at full load–nom. input: ±3%
Please keep loaded to minimum of 10% at all times.
Note: For tighter output voltage tolerances, please consult factory.

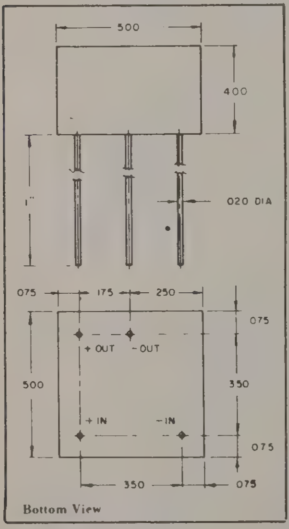
Converter frequency: 20 – 40 KHz

Output temperature coefficient: 0.02%/°C for all models

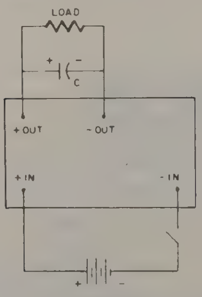
Operating temperature: −25°C to + 70°C ambient. No heat sink.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 1000V DC



Typical Weight: 4 Grams



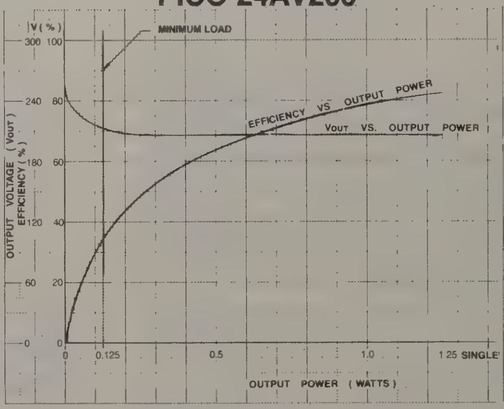
SERIES AV - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	FULL** LOAD OUTPUT VOLTAGE TOLERANCE (%)	PRICE 1–24
5AV100	5	100	12.50	1.25	78	321	0.90	±3	80.12
5AV150	5	150	8.30	1.25	76	329	0.90	±3	80.12
5AV200	5	200	6.25	1.25	75	333	0.90	±3	80.12
5AV250	5	250	5.00	1.25	75	333	0.90	±3	80.12
5AV300	5	300	4.16	1.25	70	357	1.20	±3	99.00
5AV350	5	350	3.57	1.25	70	357	1.20	±3	99.00
5AV400	5	400	3.12	1.25	70	357	1.20	±3	99.00
5AV450	5	450	2.77	1.25	70	357	1.50	±3	99.00
5AV500	5	500	2.50	1.25	70	357	1.50	±3	99.00
12AV100	12	100	12.50	1.25	80	130	0.90	±3	80.12
12AV150	12	150	8.30	1.25	79	132	0.90	±3	80.12
12AV200	12	200	6.25	1.25	78	134	0.90	±3	80.12
12AV250	12	250	5.00	1.25	75	139	0.90	±3	80.12
12AV300	12	300	4.16	1.25	75	139	1.20	±3	99.00
12AV350	12	350	3.57	1.25	75	139	1.20	±3	99.00
12AV400	12	400	3.12	1.25	75	139	1.20	±3	99.00
12AV450	12	450	2.77	1.25	75	139	1.50	±3	99.00
12AV500	12	500	2.50	1.25	75	139	1.50	±3	99.00
24AV100	24	100	12.50	1.25	76	69	0.90	±3	80.12
24AV150	24	150	8.30	1.25	73	71	0.90	±3	80.12
24AV200	24	200	6.25	1.25	73	71	0.90	±3	80.12
24AV250	24	250	5.00	1.25	70	74	0.90	±3	80.12
24AV300	24	300	4.16	1.25	73	71	1.20	±3	99.00
24AV350	24	350	3.57	1.25	73	71	1.20	±3	99.00
24AV400	24	400	3.12	1.25	73	71	1.20	±3	99.00
24AV450	24	450	2.77	1.25	73	71	1.50	±3	99.00
24AV500	24	500	2.50	1.25	73	71	1.50	±3	99.00
28AV100	28	100	12.50	1.25	75	60	0.90	±3	80.12
28AV150	28	150	8.30	1.25	76	59	0.90	±3	80.12
28AV200	28	200	6.25	1.25	75	60	0.90	±3	80.12
28AV250	28	250	5.00	1.25	70	64	0.90	±3	80.12
28AV300	28	300	4.16	1.25	73	61	1.20	±3	99.00
28AV350	28	350	3.57	1.25	73	61	1.20	±3	99.00
28AV400	28	400	3.12	1.25	73	61	1.20	±3	99.00
28AV450	28	450	2.77	1.25	73	61	1.50	±3	99.00
28AV500	28	500	2.50	1.25	73	61	1.50	±3	99.00

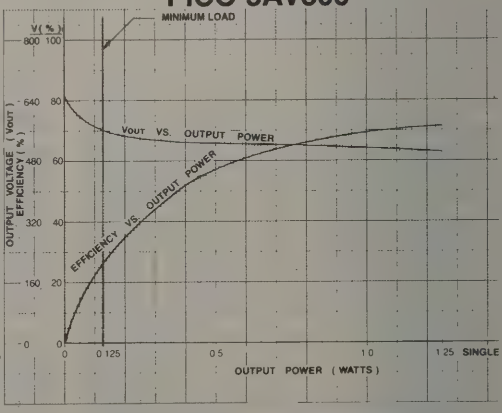
*Measured using 0.1µf, 1000 volt DC capacitor which is required across the output and maintain at least 10% of load at all times to prevent voltage surge. **For tighter tolerances consult factory.

Ordering Instructions:
No minimum.
Net 30 days F.O.B.
Mt. Vernon, New York.

PICO 24AV200



PICO 5AV500



*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES AV .500 ht. up to 1000 VDC output

Hi Voltage
Hi Reliability
Ultra-Miniature
Isolated
DC-DC
Converters

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, burn in

PICO
5AV500

For Surface Mount versions of this series see page D•2145

- 1.25 watt output at 70° ambient
- Ultra-miniature size 0.500″ height, 5.0 grams weight, .125 cubic inches volume
- 4 input voltage ranges 5, 12, 24 and 28 VDC
- 100 megohm @ 1500 VDC input/output isolation
- MIL-STD 883 options available
- No heat sink or electrical derating required

This series of unregulated high voltage DC-DC converters are produced in an ultra-miniature encapsulated package. 20 different models are available. These single output isolated units will operate over the temperature range of −25° to +70°C with no heat sink or electrical derating. For military applications an operating temperature range −55°C to +85°C is available. An optional environmental screening package per MIL-STD-883 is also available.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range: ±10% all models

Output voltage tolerance at full load–nom. input: ±3% Please keep loaded to minimum of 10% at all times.
Note: For tighter output voltage tolerances, please consult factory.

Converter frequency: 20 – 40 KHz

Output temperature coefficient: 0.02%/°C for all models

Operating temperature: −25°C to + 70°C ambient. No heat sink.

Storage temperature: −55°C to +125°C

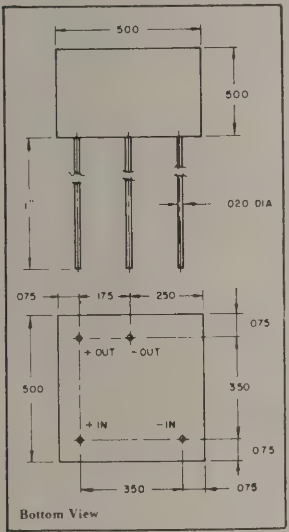
Isolation: 100 megohms min. @ 1500V DC

SERIES AV - SINGLE OUTPUT

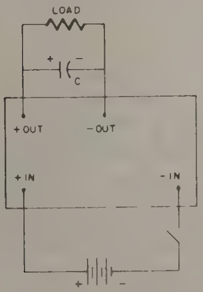
PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	FULL** LOAD OUTPUT VOLTAGE TOLERANCE (%)	PRICE 1–24
5AV600	5	600	2.08	1.25	70	357	3.0	±3	120.00
5AV700	5	700	1.79	1.25	70	357	3.0	±3	120.00
5AV800	5	800	1.56	1.25	70	357	3.0	±3	120.00
5AV900	5	900	1.39	1.25	70	357	3.0	±3	120.00
5AV1000	5	1000	1.25	1.25	70	357	3.0	±3	120.00
12AV600	12	600	2.08	1.25	70	149	3.0	±3	120.00
12AV700	12	700	1.79	1.25	70	149	3.0	±3	120.00
12AV800	12	800	1.56	1.25	70	149	3.0	±3	120.00
12AV900	12	900	1.39	1.25	70	149	3.0	±3	120.00
12AV1000	12	1000	1.25	1.25	70	149	3.0	±3	120.00
24AV600	24	600	2.08	1.25	70	74	3.0	±3	120.00
24AV700	24	700	1.79	1.25	70	74	3.0	±3	120.00
24AV800	24	800	1.56	1.25	70	74	3.0	±3	120.00
24AV900	24	900	1.39	1.25	70	74	3.0	±3	120.00
24AV1000	24	1000	1.25	1.25	70	74	3.0	±3	120.00
28AV600	28	600	2.08	1.25	70	64	3.0	±3	120.00
28AV700	28	700	1.79	1.25	70	64	3.0	±3	120.00
28AV800	28	800	1.56	1.25	70	64	3.0	±3	120.00
28AV900	28	900	1.39	1.25	70	64	3.0	±3	120.00
28AV1000	28	1000	1.25	1.25	70	64	3.0	±3	120.00

Ordering Instructions:
No minimum.
Net 30 days F.O.B.
Mt. Vernon, New York.

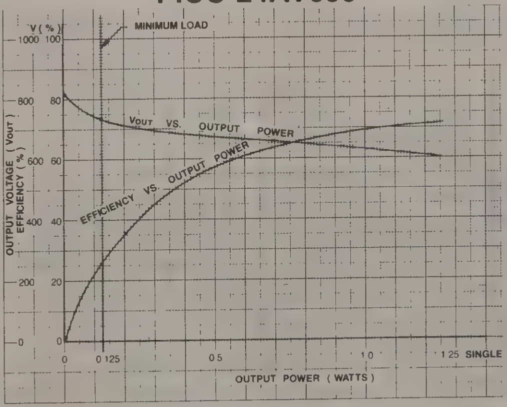
*Measured using 0.01µf, 3000 Volt DC capacitor which is required across the output and maintain at least 10% of load at all times to prevent voltage surge. **For tighter tolerances consult factory.



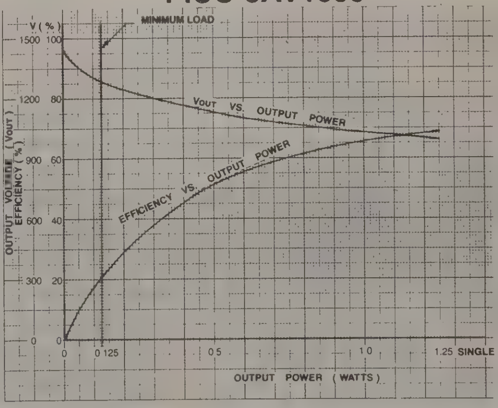
Typical Weight: 5 Grams



PICO 24AV600



PICO 5AV1000



For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

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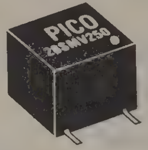
SERIES SMV

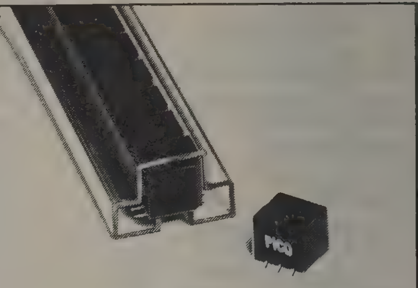
NEW SURFACE MOUNT DESIGN

Hi Voltage
Hi Reliability
Ultra-Miniature
Isolated
DC-DC Converters

.440″ ht. up to 500V DC output

OPTIONS AVAILABLE
- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*





SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range: ±10% all models

Output voltage tolerance at full load-nom. input: ±3%
Please keep loaded to minimum of 10% at all times.
Note: For tighter output voltage tolerances, please consult factory.

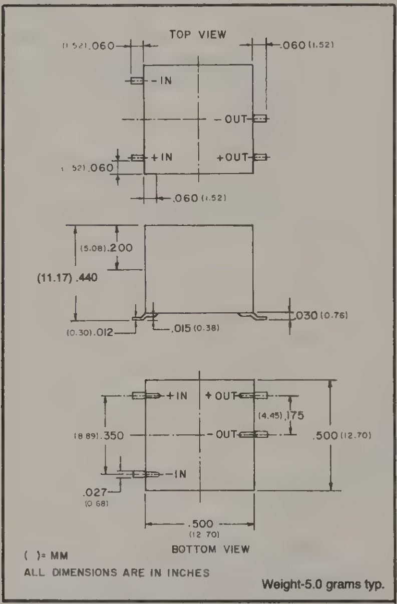
Converter frequency: 20 – 40 KHz

Output temperature coefficient: 0.02%/°C for all models

Operating temperature: −25°C to + 70°C ambient. No heat sink.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 1000V DC



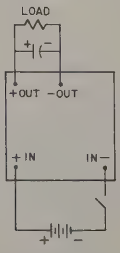
SERIES SMV—SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	FULL** LOAD OUTPUT VOLTAGE TOLERANCE (%)	PRICE 1–24
5SMV100	5	100	12 50	1 25	78	321	0 90	±3	80 12
5SMV150	5	150	8.30	1 25	76	329	0 90	±3	80 12
5SMV200	5	200	6 25	1 25	75	333	0 90	±3	80 12
5SMV250	5	250	5.00	1 25	75	333	0 90	±3	80 12
5SMV300	5	300	4 16	1 25	70	357	1 20	±3	99 00
5SMV350	5	350	3 57	1 25	70	357	1 20	±3	99 00
5SMV400	5	400	3.12	1 25	70	357	1 20	±3	99 00
5SMV450	5	450	2 77	1 25	70	357	1 50	±3	99 00
5SMV500	5	500	2.50	1 25	70	357	1 50	±3	99.00
12SMV100	12	100	12 50	1 25	80	130	0 90	±3	80 12
12SMV150	12	150	8 30	1.25	79	132	0 90	±3	80 12
12SMV200	12	200	6.25	1.25	78	134	0 90	±3	80 12
12SMV250	12	250	5 00	1 25	75	139	0 90	±3	80 12
12SMV300	12	300	4 16	1.25	75	139	1 20	±3	99 00
12SMV350	12	350	3 57	1.25	75	139	1 20	±3	99 00
12SMV400	12	400	3 12	1 25	75	139	1 20	±3	99 00
12SMV450	12	450	2 77	1 25	75	139	1 50	±3	99 00
12SMV500	12	500	2.50	1 25	75	139	1 50	±3	99 00
24SMV100	24	100	12.50	1 25	76	69	0 90	±3	80 12
24SMV150	24	150	8 30	1 25	73	71	0 90	±3	80 12
24SMV200	24	200	6 25	1 25	73	71	0 90	±3	80 12
24SMV250	24	250	5.00	1 25	70	74	0 90	±3	80 12
24SMV300	24	300	4 16	1 25	73	71	1 20	±3	99 00
24SMV350	24	350	3 57	1.25	73	71	1 20	±3	99 00
24SMV400	24	400	3 12	1.25	73	71	1 20	±3	99 00
24SMV450	24	450	2 77	1.25	73	71	1 50	±3	99 00
24SMV500	24	500	2.50	1 25	73	71	1 50	±3	99 00
28SMV100	28	100	12 50	1 25	75	60	0 90	±3	80 12
28SMV150	28	150	8 30	1.25	76	59	0 90	±3	80 12
28SMV200	28	200	6 25	1.25	75	60	0 90	±3	80 12
28SMV250	28	250	5 00	1.25	70	64	0 90	±3	80 12
28SMV300	28	300	4 16	1 25	73	61	1 20	±3	99 00
28SMV350	28	350	3 57	1.25	73	61	1 20	±3	99 00
28SMV400	28	400	3.12	1 25	73	61	1 20	±3	99 00
28SMV450	28	450	2 77	1.25	73	61	1 50	±3	99 00
28SMV500	28	500	2.50	1 25	73	61	1 50	±3	99 00

*Measured using 0.1µf, 1000 volt DC capacitor which is required across the output and maintain at least 10% of load at all times to prevent voltage surge.

**For tighter tolerances consult factory.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

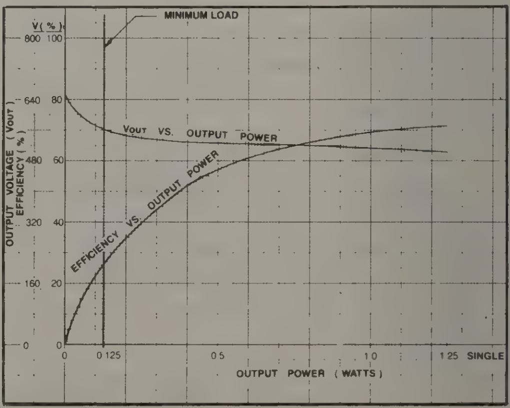


FEATURES:

- New surface mount construction
- 1.25 watt output at 70° ambient
- Ultra-miniature size .440″ height, 5.0 grams weight, 0.1 cubic inches volume
- 4 input voltage ranges 5, 12, 24 and 28 VDC
- 100 megohm @ 1000 VDC input/output isolation
- MIL-STD 883 options available
- No heat sink or electrical derating required

This series of unregulated high voltage DC-DC converters are produced in an ultra-miniature encapsulated package, now compatible with your surface mount assembly. 36 different models are available. These single output isolated units will operate over the temperature range of −25° to +70°C with no heat sink or electrical derating. For military applications an operating temperature range −55°C to +85°C is available. An optional environmental screening package per MIL-STD-883 is also available.

PICO 5SMV500



PICO
Electronics, Inc.
453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

*For immediate engineering assistance or to place an order– **Call Toll Free 800-228-9747***
• FAX 914-699-5565

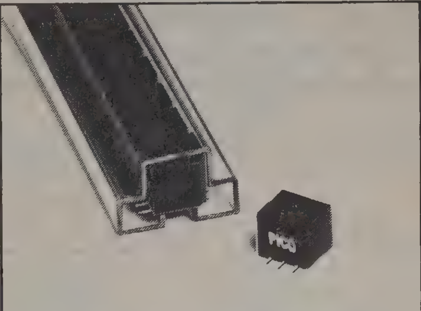
SERIES SMV

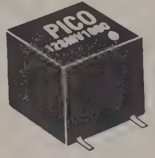
NEW SURFACE MOUNT DESIGN

Hi Voltage
Hi Reliability
Ultra-Miniature
Isolated
DC-DC Converters

.540″ ht. up to 1000V DC output

OPTIONS AVAILABLE
- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)





SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range: ±10% all models

Output voltage tolerance at full load–nom. input: ±3%
Please keep loaded to minimum of 10% at all times.

Note: For tighter output voltage tolerances, please consult factory.

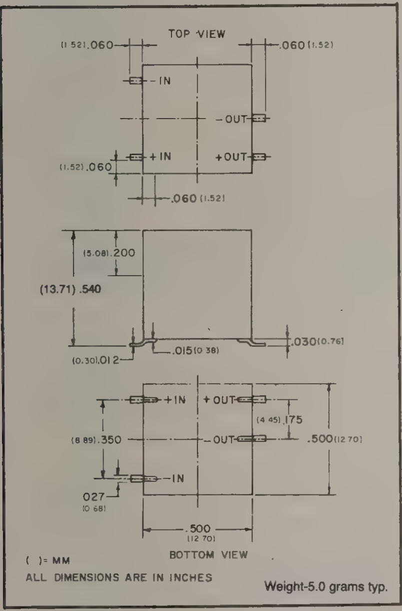
Converter frequency: 20 – 40 KHz

Output temperature coefficient: 0.02%/°C for all models

Operating temperature: −25°C to + 70°C ambient No heat sink.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 1500V DC



Weight-5.0 grams typ.

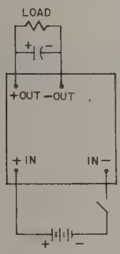
SERIES SMV—SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	FULL** LOAD OUTPUT VOLTAGE TOLERANCE (%)	PRICE 1–24
5SMV600	5	600	2.08	1.25	70	357	3.0	±3	120.00
5SMV700	5	700	1.79	1.25	70	357	3.0	±3	120.00
5SMV800	5	800	1.56	1.25	70	357	3.0	±3	120.00
5SMV900	5	900	1.39	1.25	70	357	3.0	±3	120.00
5SMV1000	5	1000	1.25	1.25	70	357	3.0	±3	120.00
12SMV600	12	600	2.08	1.25	70	149	3.0	±3	120.00
12SMV700	12	700	1.79	1.25	70	149	3.0	±3	120.00
12SMV800	12	800	1.56	1.25	70	149	3.0	±3	120.00
12SMV900	12	900	1.39	1.25	70	149	3.0	±3	120.00
12SMV1000	12	1000	1.25	1.25	70	149	3.0	±3	120.00
24SMV600	24	600	2.08	1.25	70	74	3.0	±3	120.00
24SMV700	24	700	1.79	1.25	70	74	3.0	±3	120.00
24SMV800	24	800	1.56	1.25	70	74	3.0	±3	120.00
24SMV900	24	900	1.39	1.25	70	74	3.0	±3	120.00
24SMV1000	24	1000	1.25	1.25	70	74	3.0	±3	120.00
28SMV600	28	600	2.08	1.25	70	64	3.0	±3	120.00
28SMV700	28	700	1.79	1.25	70	64	3.0	±3	120.00
28SMV800	28	800	1.56	1.25	70	64	3.0	±3	120.00
28SMV900	28	900	1.39	1.25	70	64	3.0	±3	120.00
28SMV1000	28	1000	1.25	1.25	70	64	3.0	±3	120.00

*Measured using 0.01µf, 3000 Volt DC capacitor which is required across the output and maintain at least 10% of load at all times to prevent voltage surge.

**For tighter tolerances consult factory.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

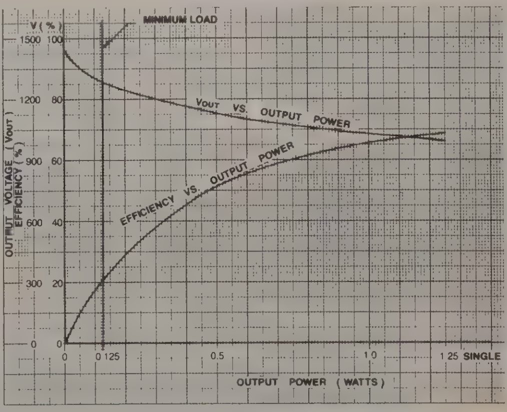


FEATURES:

- New surface mount construction
- 1.25 watt output at 70° ambient
- Ultra-miniature size .540″ height, 5.0 grams weight, .125 cubic inches volume
- 4 input voltage ranges 5, 12, 24 and 28 VDC
- 100 megohm @ 1500 VDC input/output isolation
- MIL-STD 883 options available
- No heat sink or electrical derating required

This series of unregulated high voltage DC-DC converters are produced in an ultra-miniature encapsulated package, now compatible with your surface mount assembly. 20 different models are available. These single output isolated units will operate over the temperature range of −25° to +70° with no heat sink or electrical derating. For military applications an operating temperature range −55°C to +85°C is available. An optional environmental screening package per MIL-STD-883 is also available.

PICO 5SMV1000

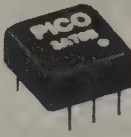


PICO
Electronics, Inc.
453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

For immediate engineering assistance or to place an order- ***Call Toll Free 800-228-9747*** • FAX 914-699-5565

SERIES AT/DT

High Reliability Ultra-Miniature, 0.2″ ht. Isolated DC-DC Converters



No Heat Sink or Electrical Derating Required

Low No Load Current for Battery Applications

3.3 Volts Output Now Standard
for PICO Part Numbers: 3AT3.3S, 5AT3.3S, 9AT3.3S, 12AT3.3S 3DT3.3S, 5DT3.3S, 9DT3.3S, 12DT3.3S

No External Components Required

New DIP Package

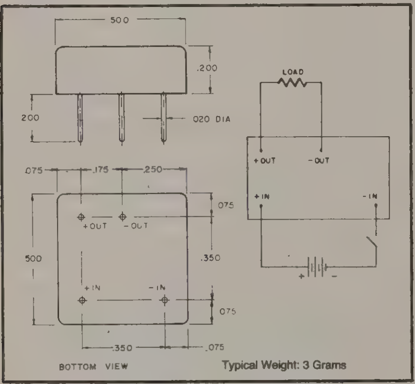
0.2″ Height Low Profile

OPTIONS AVAILABLE
- *Expanded operating temp. (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

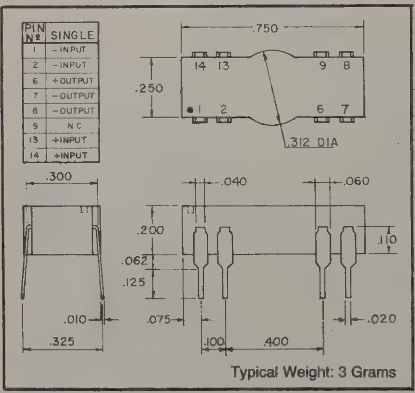
FEATURES

- Ultra-miniature, 0.200″ height
- New DIP package available
- Low current consumption
- No external components required
- 4 convenient input voltages, 3-5-9-12V DC
- Up to 0.75 watt output
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Single and dual outputs
- Isolated: 100 megohms at 500V DC
- No heat sink required

This series of unregulated DC-DC converters offer you a 0.200″ tall, package. 64 different models are available and all offer very low current consumption to operate in battery driven circuits. Isolated, single and dual outputs will operate from −25°C to +70°C with no heat sink or derating required. Built-in output capacitors and 4 convenient input voltages also help in simplifying your design, and with the addition of our new DIP package, board layout and assembly is simplified.



Typical Weight: 3 Grams



PIN Nº	SINGLE
1	−INPUT
2	−INPUT
6	+OUTPUT
7	−OUTPUT
8	−OUTPUT
9	N.C
13	+INPUT
14	+INPUT

Typical Weight: 3 Grams

SERIES AT - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	TYPICAL OUTPUT VOLT RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
3AT5S	3	5	130	0.65	66	328	0.20	35	±0.25	84.82
3AT9S	3	9	83	0.75	70	357	0.20	35	±0.30	84.82
3AT12S	3	12	63	0.75	72	347	0.20	35	±0.40	84.82
3AT15S	3	15	50	0.75	73	342	0.20	35	±0.40	84.82
5AT5S	5	5	150	0.75	69	217	0.20	25	±0.25	84.82
5AT9S	5	9	83	0.75	72	208	0.20	25	±0.30	84.82
5AT12S	5	12	63	0.75	75	200	0.20	25	±0.40	84.82
5AT15S	5	15	50	0.75	76	197	0.20	25	±0.40	84.82
9AT5S	9	5	150	0.75	70	119	0.20	8	±0.25	84.82
9AT9S	9	9	83	0.75	72	116	0.20	8	±0.30	84.82
9AT12S	9	12	63	0.75	78	107	0.20	8	±0.40	84.82
9AT15S	9	15	50	0.75	80	104	0.20	8	±0.40	84.82
12AT5S	12	5	150	0.75	71	88	0.20	8	±0.25	84.82
12AT9S	12	9	83	0.75	73	86	0.20	8	±0.30	84.82
12AT12S	12	12	63	0.75	78	80	0.20	8	±0.40	84.82
12AT15S	12	15	50	0.75	80	78	0.20	8	±0.40	84.82

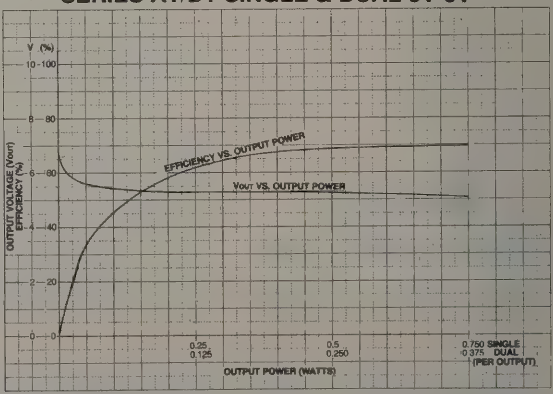
SERIES DT - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	TYPICAL OUTPUT VOLT RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
3DT5S	3	5	130	0.65	66	328	0.20	35	±0.25	84.82
3DT9S	3	9	83	0.75	70	357	0.20	35	±0.30	84.82
3DT12S	3	12	63	0.75	72	347	0.20	35	±0.40	84.82
3DT15S	3	15	50	0.75	73	342	0.20	35	±0.40	84.82
5DT5S	5	5	150	0.75	69	217	0.20	25	±0.25	84.82
5DT9S	5	9	83	0.75	72	208	0.20	25	±0.30	84.82
5DT12S	5	12	63	0.75	75	200	0.20	25	±0.40	84.82
5DT15S	5	15	50	0.75	76	197	0.20	25	±0.40	84.82
9DT5S	9	5	150	0.75	70	119	0.20	8	±0.25	84.82
9DT9S	9	9	83	0.75	72	116	0.20	8	±0.30	84.82
9DT12S	9	12	63	0.75	78	107	0.20	8	±0.40	84.82
9DT15S	9	15	50	0.75	80	104	0.20	8	±0.40	84.82
12DT5S	12	5	150	0.75	71	88	0.20	8	±0.25	84.82
12DT9S	12	9	83	0.75	73	86	0.20	8	±0.30	84.82
12DT12S	12	12	63	0.75	78	80	0.20	8	±0.40	84.82
12DT15S	12	15	50	0.75	80	78	0.20	8	±0.40	84.82

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.

Delivery—stock to one week

SERIES AT/DT SINGLE & DUAL 5V-5V



Call Toll Free 800-228-9747

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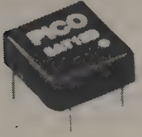


AT Low Profile .5″x.5″x.2″ ht.
. . . up to 0.75 Watts

New DIP Package

No External Components Required

DT .200″ ht. in DIP Package
. . . up to 0.75 Watts

PICO 12DT15D

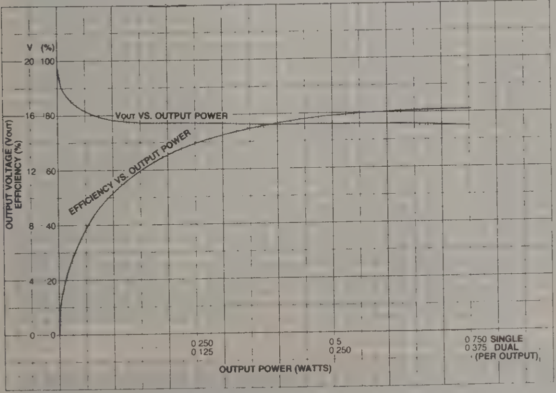
SERIES AT - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	TYPICAL OUTPUT VOLT RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
3AT5D	3	5	65	0 325	66	328	0 20	35	±0 25	95 89
3AT9D	3	9	41	0 375	70	357	0 20	35	±0 30	95 89
3AT12D	3	12	31	0 375	72	347	0 20	35	±0 40	95 89
3AT15D	3	15	25	0 375	73	342	0 20	35	±0 40	95 89
5AT5D	5	5	75	0 375	69	217	0 20	35	±0 40	95 89
5AT9D	5	[illegible]	41	0 375	72	208	0 20	25	±0 30	95 89
5AT12D	5	12	31	0 375	75	200	0 20	25	±0 40	95 89
5AT15D	[illegible]	15	25	0 375	76	197	0 20	25	±0 40	95 89
9AT5D	9	5	75	0 375	70	119	0 20	8	±0 25	95 89
9AT9D	9	[illegible]	41	0 375	72	116	0.20	8	±0 30	95 89
9AT12D	9	12	31	0 375	78	107	0 20	8	±0 40	95 89
9AT15D	9	15	25	0 375	80	104	0 20	8	±0 40	95 89
12AT5D	12	5	75	0 375	71	88	0 20	8	±0 25	95 89
12AT9D	12	9	41	0 375	78	86	0 20	8	±0 30	95 89
12AT12D	12	12	31	0 375	78	80	0 20	8	±0 40	95 89
12AT15D	12	15	25	0 375	80	78	0 20	8	±0 40	95 89

SERIES DT-DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	TYPICAL OUTPUT VOLT RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
3DT5D	3	5	65	0 325	66	328	0 20	35	±0 25	95 89
3DT9D	3	9	41	0 375	70	357	0 20	35	±0 30	95 89
3DT12D	3	12	31	0 375	72	347	0 20	35	±0 40	95 89
3DT15D	3	15	25	0 375	73	342	0 20	35	±0 40	95 89
5DT5D	5	5	75	0 375	69	217	0 20	25	±0 25	95 89
5DT9D	5	9	41	0 375	72	208	0 20	25	±0 30	95 89
5DT12D	5	15	25	0 375	76	197	0 20	25	±0 40	95 89
5DT15D	5	15	25	0 375	76	197	0 20	25	±0 40	95 89
9DT5D	9	5	75	0 375	70	119	0 20	8	±0 25	95 89
9DT9D	9	9	41	0 375	72	116	0 20	8	±0 30	95 89
9DT12D	9	12	31	0 375	78	107	0 20	8	±0 40	95 89
9DT15D	9	15	25	0 375	80	104	0 20	8	±0 40	95 89
12DT5D	12	5	75	0 375	71	88	0 20	8	±0 25	95 89
12DT9D	12	9	41	0 375	73	86	0 20	8	±0 30	95 89
12DT12D	12	12	31	0 375	78	80	0 20	8	±0 40	95 89
12DT15D	12	15	25	0 375	80	78	0 20	8	±0 40	95 89

SERIES AT/DT SINGLE & DUAL 9V-15V



Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT VOLTAGE IS DIRECTLY PROPORTIONAL TO THE INPUT VOLTAGE.

Input voltage range:
3V models 2.5 to 3.5V DC
5V models 4 to 6V DC
9V models 7 to 11V DC
12V models 9 to 14V DC

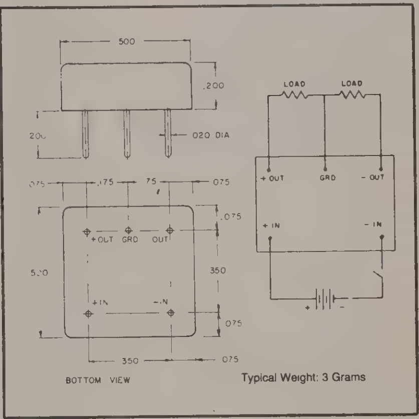
Converter frequency: 40 to 60 KHz

Output temperature coefficient: 0.05% per °C all models

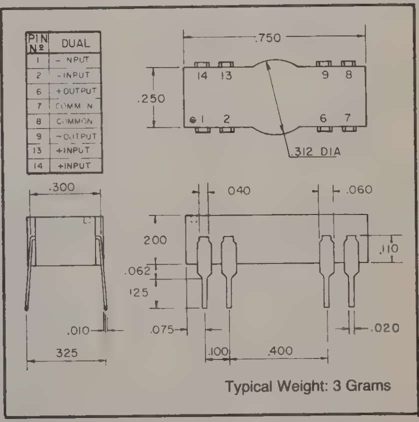
Operating temperature: −25°C to +70°C ambient. No heat sink or derating required.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 500V DC



Typical Weight: 3 Grams



PIN Nº	DUAL
1	− INPUT
2	− INPUT
6	+ OUTPUT
7	COMMON
8	COMMON
9	− OUTPUT
13	+ INPUT
14	+ INPUT

Typical Weight: 3 Grams

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES B

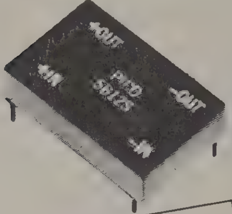
Hi Reliability Ultra-Miniature Isolated DC-DC Converters Up to 2.5 Watts

This series of unregulated DC-DC converters comes in a miniaturized encapsulated package. 68 different models are available. The units feature single and isolated dual outputs. They will operate over the temperature range of −25°C to +70°C. No heat sink is required.

FEATURES

- Up to 2.5 watt output at 70°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Ultra-miniature size (0.3″ Height)
- 5 input voltage ranges 5, 12, 24, 28 and 48V DC
- 100 megohm @ 500V DC isolation
- Single and dual isolated output
- No heat sink required

3.3 Volts Output Now Standard
for PICO Part Numbers: 5B3.3S, 12B3.3S, 24B3.3S, 28B3.3S, 48B3.3S



No Heat Sink or Electrical Derating Required

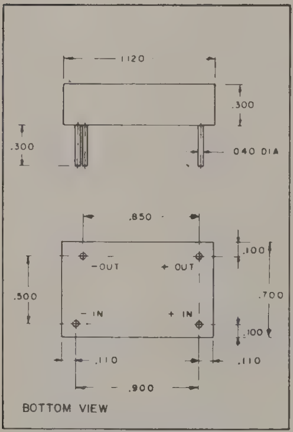
OPTIONS AVAILABLE

- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

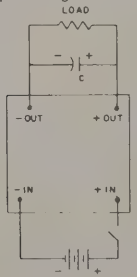
SERIES B - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5B5S	5	5	300	1.5	67	447	0.15	90	±0.25	48.19
5B9S	5	9	167	1.5	73	411	0.15	90	±0.3	48.19
5B12S	5	12	125	1.5	75	400	0.15	90	±0.4	48.19
5B15S	5	15	100	1.5	75	400	0.15	90	±0.4	48.19
5B24S	5	24	63	1.5	78	385	0.15	90	±0.5	48.19
5B28S	5	28	54	1.5	78	385	0.15	90	±0.5	48.19
5B48S	5	48	31	1.5	79	380	0.15	90	±0.7	48.19
12B5S	12	5	300	1.5	69	182	0.15	40	±0.25	48.19
12B9S	12	9	222	2.0	76	219	0.15	40	±0.3	48.19
12B12S	12	12	167	2.0	78	214	0.15	40	±0.4	48.19
12B15S	12	15	133	2.0	78	214	0.15	40	±0.4	48.19
12B24S	12	24	83	2.0	80	208	0.15	40	±0.5	48.19
12B28S	12	28	71	2.0	80	208	0.15	40	±0.5	48.19
12B48S	12	48	42	2.0	80	208	0.15	40	±0.7	48.19
24B5S	24	5	300	1.5	69	91	0.15	10	±0.25	48.19
24B9S	24	9	222	2.0	76	110	0.15	15	±0.3	48.19
24B12S	24	12	167	2.0	78	107	0.15	15	±0.4	48.19
24B15S	24	15	133	2.0	78	107	0.15	15	±0.4	48.19
24B24S	24	24	104	2.5	82	127	0.15	15	±0.5	48.19
24B28S	24	28	89	2.5	81	129	0.15	15	±0.5	48.19
24B48S	24	48	52	2.5	82	127	0.15	15	±0.7	48.19
28B5S	28	5	300	1.5	67	80	0.15	15	±0.25	48.19
28B9S	28	9	222	2.0	75	95	0.15	15	±0.3	48.19
28B12S	28	12	167	2.0	77	93	0.15	15	±0.4	48.19
28B15S	28	15	133	2.0	77	93	0.15	15	±0.4	48.19
28B24S	28	24	104	2.5	81	110	0.15	15	±0.5	48.19
28B28S	28	28	89	2.5	81	110	0.15	15	±0.5	48.19
28B48S	28	48	52	2.5	82	109	0.15	15	±0.7	48.19
48B5S	48	5	300	1.5	71	44	0.20	3	±0.25	51.70
48B9S	48	9	222	2.0	76	55	0.20	3	±0.3	51.70
48B12S	48	12	167	2.0	82	51	0.20	3	±0.4	51.70
48B15S	48	15	133	2.0	82	51	0.20	3	±0.4	51.70
48B24S	48	24	104	2.5	84	62	0.20	3	±0.5	51.70
48B28S	48	28	89	2.5	83	63	0.20	3	±0.5	51.70

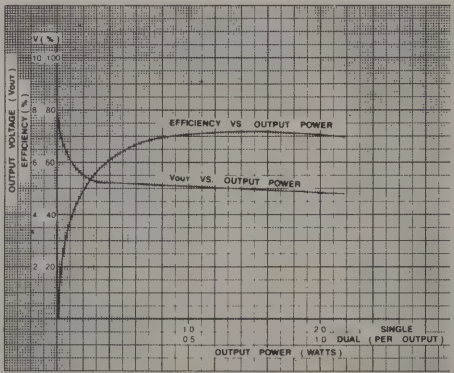
*The ripple is measured with a 22µF, 75 volt high quality tantalum capacitor which is required across the output.
Ordering Instruction: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.



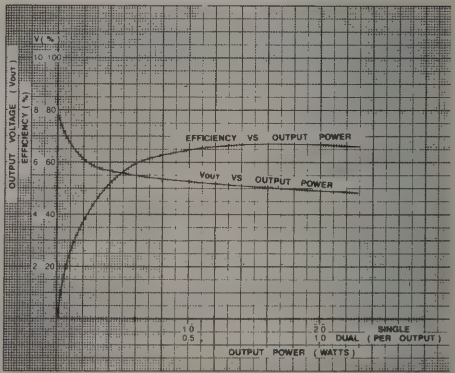
Typical Weight: 8.0 Grams



SERIES B SINGLE & DUAL 48V-5V



SERIES B SINGLE & DUAL 5V-5V



Delivery—stock to one week

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

PICO Electronics, Inc.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT.

Input voltage range:
5V models 4 to 6.5V DC
12V models 9 to 15V DC
24V models 17 to 28V DC
28V models 21 to 32V DC
48V models 25 to 50V DC

Output voltage tolerance at full load:
5V models ± 0.25V
9V models ± 0.3V
12V & 15V models ± 0.4V
24V & 28V models ± 0.5V
48V models ± 0.7V

Converter frequency: 20 to 40 KHz

Output temperature coefficient: 0.02%/°C

Operating temperature: −25°C to +70°C ambient. No heat sink is required.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 500V DC

Short circuit protection: Temporary

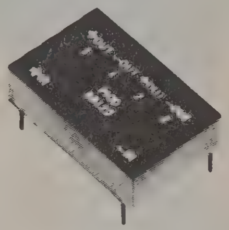
SERIES B - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5B5D	5	5	150	0.75	68	441	0.15	90	+0.25	54.46
5B9D	5	9	83	0.75	73	411	0.15	90	+0.3	54.46
5B12D	5	12	62	0.75	76	394	0.15	90	+0.4	54.46
5B15D	5	15	50	0.75	78	384	0.15	90	+0.4	54.46
5B24D	5	24	31	0.75	80	375	0.15	90	±0.5	54.46
5B28D	5	28	27	0.75	78	385	0.15	90	±0.5	54.46
5B48D	5	48	15	0.75	79	380	0.15	90	±0.7	54.46
12B5D	12	5	150	0.75	71	176	0.15	40	±0.25	54.46
12B9D	12	9	111	1.0	76	219	0.15	40	+0.3	54.46
12B12D	12	12	83	1.0	81	205	0.15	40	+0.4	54.46
12B15D	12	15	66	1.0	81	205	0.15	40	+0.4	54.46
12B24D	12	24	41	1.0	83	200	0.15	40	±0.5	54.46
12B28D	12	28	35	1.0	30	208	0.15	40	±0.5	54.46
12B48D	12	48	21	1.0	80	208	0.15	40	±0.7	54.46
24B5D	24	5	150	0.75	71	88	0.15	10	±0.25	54.46
24B9D	24	9	111	1.0	76	110	0.15	15	+0.3	54.46
24B12D	24	12	83	1.0	80	104	0.15	15	+0.4	54.46
24B15D	24	15	66	1.0	81	102	0.15	15	±0.4	54.46
24B24D	24	24	52	1.25	82	127	0.15	15	±0.5	54.46
24B28D	24	28	45	1.25	81	129	0.15	15	±0.5	54.46
24B48D	24	48	26	1.25	82	127	0.15	15	+0.7	54.46
28B5D	28	5	150	0.75	67	80	0.15	15	±0.25	54.46
28B9D	28	9	111	1.0	75	95	0.15	15	±0.3	54.46
28B12D	28	12	83	1.0	77	93	0.15	15	±0.4	54.46
28B15D	28	15	66	1.0	77	93	0.15	15	±0.4	54.46
28B24D	28	24	52	1.25	81	110	0.15	15	+0.5	54.46
28B28D	28	28	45	1.25	81	110	0.15	15	+0.5	54.46
28B48D	28	48	26	1.25	82	109	0.15	15	±0.7	54.46
48B5D	48	5	150	0.75	71	44	0.20	3	+0.25	58.45
48B9D	48	9	111	1.0	76	55	0.20	3	±0.3	58.45
48B12D	48	12	83	1.0	82	51	0.20	3	±0.4	58.45
48B15D	48	15	67	1.0	82	51	0.20	3	±0.4	58.45
48B24D	48	24	52	1.25	84	62	0.20	3	±0.5	58.45
48B28D	48	28	45	1.25	83	63	0.20	3	±0.7	58.45

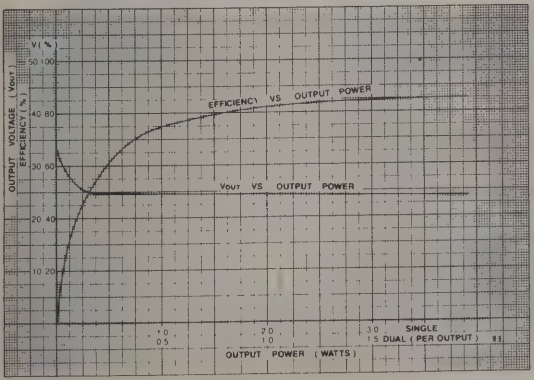
*The ripple is measured with a 22μF, 75 volt high quality tantalum capacitor which is required across each output.

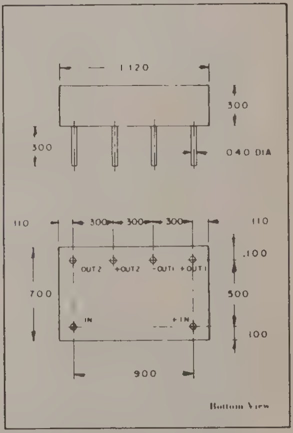
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Low Profile 0.3″ Height! Up to 2.5 Watts

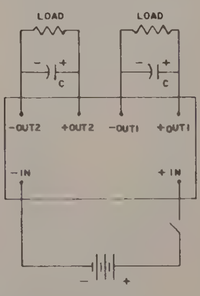


SERIES B SINGLE & DUAL 24V-24V





Typical Weight: 8.5 Grams



PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

*For immediate engineering assistance or to place an order–**Call Toll Free 800-228-9747***

Delivery— stock to one week

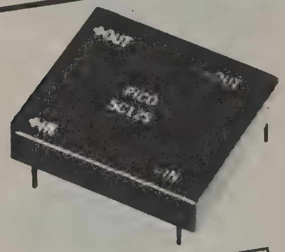
SERIES C Hi Reliability Miniature Isolated DC-DC Converters Up to 4 Watts

FEATURES

- Up to 4 watts output at 70°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Miniature-size (0.3″ Height)
- 5 input voltage ranges 5, 12, 24, 28 and 48V DC
- 100 megohm @ 500V DC
- Single and dual isolated outputs
- No heat sink required

This series of unregulated DC-DC converters are produced in an miniaturized encapsulated package. 68 different models are available. The units feature single and isolated dual outputs. They will operate over the temperature range of −25°C to +70°C. No heat sink is required.

3.3 Volts Output Now Standard
for PICO Part Numbers: 5C3.3S, 12C3.3S, 24C3.3S, 28C3.3S, 48C3.3S



OPTIONS AVAILABLE

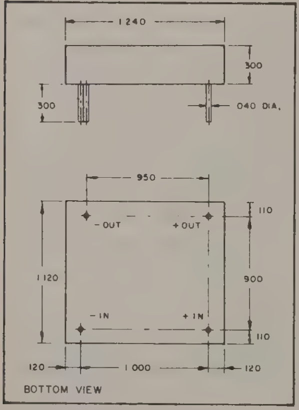
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

SERIES C - SINGLE OUTPUT

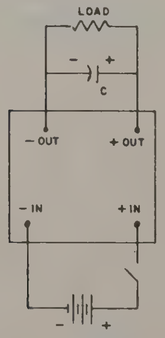
PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5C5S	5	5	500	2.5	68	735	0.20	90	±0.25	54.46
5C9S	5	9	333	3.0	72	833	0.20	100	±0.3	54.46
5C12S	5	12	250	3.0	75	800	0.20	100	±0.4	54.46
5C15S	5	15	200	3.0	77	779	0.15	100	±0.4	54.46
5C24S	5	24	125	3.0	76	789	0.15	120	±0.5	54.46
5C28S	5	28	107	3.0	76	789	0.15	120	±0.5	54.46
5C48S	5	48	63	3.0	76	789	0.15	120	±0.7	54.46
12C5S	12	5	500	2.5	67	311	0.20	45	±0.25	54.46
12C9S	12	9	333	3.0	75	333	0.20	45	±0.3	54.46
12C12S	12	12	290	3.5	77	379	0.20	40	±0.4	54.46
12C15S	12	15	266	4.0	84	396	0.15	40	±0.4	54.46
12C24S	12	24	166	4.0	81	411	0.15	45	±0.5	54.46
12C28S	12	28	143	4.0	82	407	0.15	45	±0.5	54.46
12C48S	12	48	83	4.0	81	412	0.15	45	±0.7	54.46
24C5S	24	5	500	2.5	67	155	0.20	25	±0.25	54.46
24C9S	24	9	333	3.0	73	171	0.20	25	±0.3	54.46
24C12S	24	12	290	3.5	75	194	0.20	25	±0.4	54.46
24C15S	24	15	235	3.5	79	184	0.20	25	±0.4	54.46
24C24S	24	24	166	4.0	83	200	0.20	25	±0.5	54.46
24C28S	24	28	143	4.0	83	201	0.20	25	±0.5	54.46
24C48S	24	48	83	4.0	83	201	0.20	25	±0.7	54.46
28C5S	28	5	500	2.5	67	133	0.20	25	±0.25	54.46
28C9S	28	9	333	3.0	73	147	0.20	25	±0.3	54.46
28C12S	28	12	290	3.5	75	167	0.20	25	±0.4	54.46
28C15S	28	15	235	3.5	78	160	0.20	25	±0.4	54.46
28C24S	28	24	166	4.0	82	174	0.20	25	±0.5	54.46
28C28S	28	28	143	4.0	83	172	0.20	25	±0.5	54.46
28C48S	28	48	83	4.0	83	172	0.20	25	±0.7	54.46
48C5S	48	5	500	2.5	75	69	0.25	3	±0.25	58.45
48C9S	48	9	333	3.0	76	82	0.25	3	±0.3	58.45
48C12S	48	12	290	3.5	81	90	0.25	3	±0.4	58.45
48C15S	48	15	235	3.5	81	90	0.25	3	±0.4	58.45
48C24S	48	24	166	4.0	85	98	0.25	3	±0.5	58.45
48C28S	48	28	143	4.0	83	100	0.25	3	±0.5	58.45

*The ripple is measured with a 22μF, 75 volt high quality tantalum capacitor which is required across the output.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.



Typical Weight: 14.5 Grams

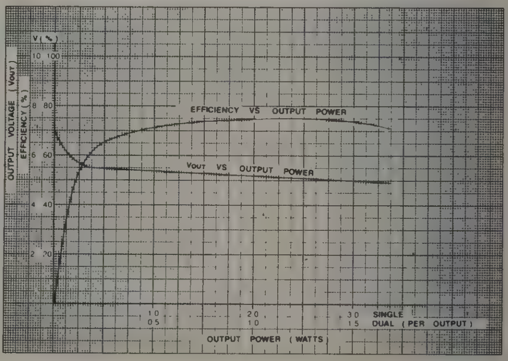


PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

SERIES C SINGLE & DUAL 48V-5V



Delivery— stock to one week

*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

TYPICAL CHARACTERISTICS: **Test conditions:** 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT.

Input voltage range:
5V models 4 to 6.5V DC
12V models 9 to 15V DC
24V models 17 to 28V DC
28V models 21 to 31V DC
48V models 25 to 50V DC

Output voltage tolerance at full load:
5V models ± 0.25V
9V models ± 0.3V
12V & 15V models ± 0.4V
24V & 28V models ± 0.5V
48V models ± 0.7V

Converter frequency: 20 to 40 KHz

Output temperature coefficient: 0.02%/°C

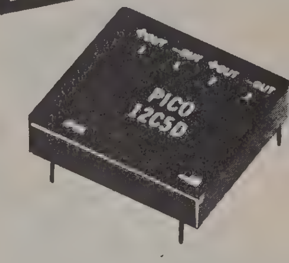
Operating temperature: −25°C to +70°C ambient. No heat sink is required.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 500V DC

Short circuit protection: Temporary

Low Profile 0.3″ Height! Up to 4 Watts



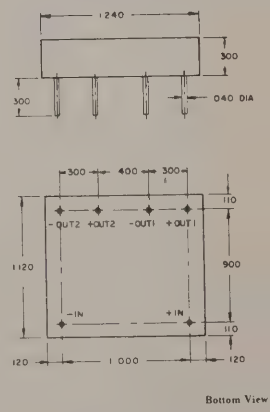
No Heat Sink or Electrical Derating Required

SERIES C - DUAL OUTPUT

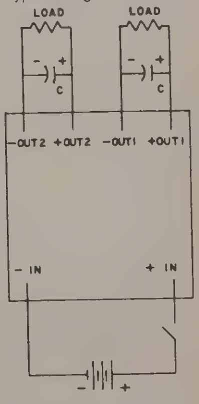
PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5C5D	5	5	250	1.25	71	704	0.20	90	±0.25	62.04
5C9D	5	9	166	1.5	72	833	0.20	100	±0.3	62.04
5C12D	5	12	125	1.5	75	800	0.20	100	+0.4	62.04
5C15D	5	15	100	1.5	77	779	0.15	110	+0.4	62.04
5C24D	5	24	62	1.5	78	769	0.15	120	±0.5	62.04
5C28D	5	28	53	1.5	76	789	0.15	120	±0.5	62.04
5C48D	5	48	31	1.5	76	789	0.15	120	±0.7	62.04
12C5D	12	5	250	1.25	69	302	0.20	45	±0.25	62.04
12C9D	12	9	166	1.5	75	333	0.20	45	±0.3	62.04
12C12D	12	12	145	1.75	80	364	0.20	40	+0.4	62.04
12C15D	12	15	133	2.0	82	406	0.15	40	±0.4	62.04
12C24D	12	24	83	2.0	83	401	0.15	45	±0.5	62.04
12C28D	12	28	71	2.0	82	407	0.15	45	±0.5	62.04
12C48D	12	48	41	2.0	81	412	0.15	45	±0.7	62.04
24C5D	24	5	250	1.25	67	155	0.20	30	±0.25	62.04
24C9D	24	9	166	1.5	73	171	0.20	30	+0.3	62.04
24C12D	24	12	145	1.75	78	186	0.20	30	+0.4	62.04
24C15D	24	15	117	1.75	79	184	0.20	25	±0.4	62.04
24C24D	24	24	83	2.0	82	203	0.20	25	±0.5	62.04
24C28D	24	28	71	2.0	83	201	0.20	25	±0.5	62.04
24C48D	24	48	41	2.0	83	201	0.20	25	±0.7	62.04
28C5D	28	5	250	1.25	67	133	0.20	30	±0.25	62.04
28C9D	28	9	166	1.5	73	147	0.20	30	±0.3	62.04
28C12D	28	12	145	1.75	75	167	0.20	30	±0.4	62.04
28C15D	28	15	117	1.75	78	160	0.20	25	±0.4	62.04
28C24D	28	24	83	2.0	82	174	0.20	25	±0.5	62.04
28C28D	28	28	71	2.0	83	172	0.20	25	±0.5	62.04
28C48D	28	48	41	2.0	83	172	0.20	25	+0.7	62.04
48C5D	48	5	250	1.25	74	70	0.25	3	±0.25	66.52
48C9D	48	9	166	1.5	76	82	0.25	3	+0.3	66.52
48C12D	48	12	145	1.75	82	89	0.25	3	±0.4	66.52
48C15D	48	15	117	1.75	82	89	0.25	3	±0.4	66.52
48C24D	48	24	83	2.0	85	98	0.25	3	±0.5	66.52
48C28D	48	28	71	2.0	83	100	0.25	3	±0.7	66.52

*The ripple is measured with a 22µF, 75 volt high quality tantalum capacitor which is required across each output.

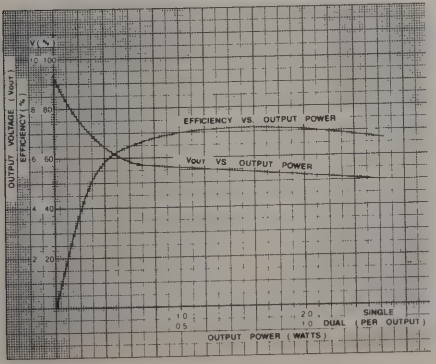
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.



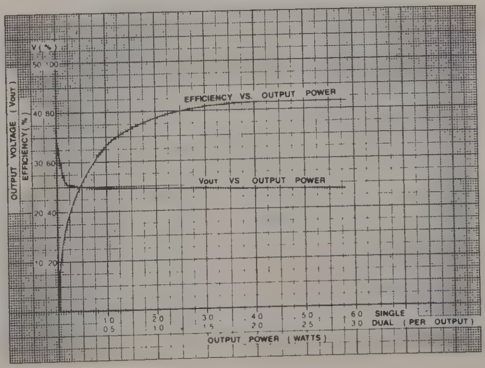
Typical Weight: 14.5 Grams



SERIES C SINGLE & DUAL 5V-5V

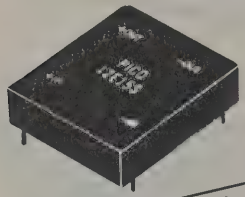


SERIES C SINGLE & DUAL 24V-24V



PICO Electronics, Inc. 453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES E Hi Reliability Miniature Isolated DC-DC Converters Up to 7 Watts



3.3 Volts Output Now Standard
for PICO Part Numbers: 5E3.3S, 12E3.3S, 24E3.3S, 28E3.3S, 48E3.3S

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, burn in

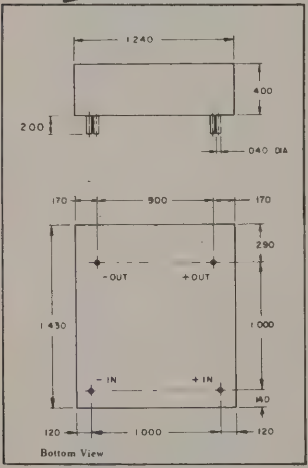
FEATURES
- Up to 7 watt output at 70°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- 5 input voltage ranges 5, 12, 24, 28 and 48V DC
- 100 megohm @ 500V DC isolation
- Single and dual isolated outputs
- No heat sink required
- Output filter included (No external capacitors required)

This series of unregulated DC-DC converters are produced in an ultra-miniature encapsulated package. 68 different models are available. The units feature single and isolated dual outputs. They will operate over the temperature range of −25°C to +70°C. No heat sink is required.

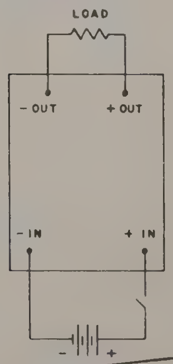
SERIES E - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5E5S	5	5	800	4	68	1176	0.3	140	±0.25	89.62
5E9S	5	9	500	4.5	73	1233	0.3	200	±0.3	89.62
5E12S	5	12	375	4.5	75	1200	0.25	200	±0.4	89.62
5E15S	5	15	300	4.5	78	1154	0.25	190	±0.4	89.62
5E24S	5	24	187	4.5	80	1125	0.25	190	±0.5	89.62
5E28S	5	28	161	4.5	79	1139	0.25	190	±0.5	89.62
5E48S	5	48	93	4.5	80	1125	0.25	190	±0.7	89.62
12E5S	12	5	800	4.0	73	456	0.3	40	±0.25	89.62
12E9S	12	9	666	6.0	80	625	0.3	45	±0.3	89.62
12E12S	12	12	541	6.5	82	660	0.25	45	±0.4	89.62
12E15S	12	15	433	6.5	83	652	0.25	40	±0.4	89.62
12E24S	12	24	281	6.75	86	654	0.25	40	±0.5	89.62
12E28S	12	28	241	6.75	86	654	0.25	40	±0.5	89.62
12E48S	12	48	141	6.75	86	654	0.25	40	±0.7	89.62
24E5S	24	5	800	4.0	69	241	0.3	22	±0.25	89.62
24E9S	24	9	666	6.0	79	316	0.3	22	±0.3	89.62
24E12S	24	12	541	6.5	81	334	0.25	22	±0.4	89.62
24E15S	24	15	433	6.5	82	330	0.25	22	±0.4	89.62
24E24S	24	24	291	7.0	88	331	0.25	17	±0.5	89.62
24E28S	24	28	250	7.0	88	331	0.25	17	±0.5	89.62
24E48S	24	48	146	7.0	88	331	0.25	17	±0.7	89.62
28E5S	28	5	800	4.0	69	207	0.3	22	±0.25	89.62
28E9S	28	9	666	6.0	80	268	0.3	22	±0.3	89.62
28E12S	28	12	540	6.5	80	290	0.25	22	±0.4	89.62
28E15S	28	15	433	6.5	82	283	0.25	22	±0.4	89.62
28E24S	28	24	291	7.0	88	284	0.25	22	±0.5	89.62
28E28S	28	28	250	7.0	88	284	0.25	20	±0.5	89.62
28E48S	28	48	146	7.0	88	284	0.25	20	±0.7	89.62
48E5S	48	5	800	4.0	75	111	0.3	6	±0.25	96.45
48E9S	48	9	666	6.0	80	156	0.3	6	±0.3	96.45
48E12S	48	12	541	6.5	84	161	0.3	6	±0.4	96.45
48E15S	48	15	433	6.5	84	161	0.3	6	±0.4	96.45
48E24S	48	24	291	7.0	89	164	0.3	6	±0.5	96.45
48E28S	48	28	250	7.0	89	164	0.3	6	±0.5	96.45

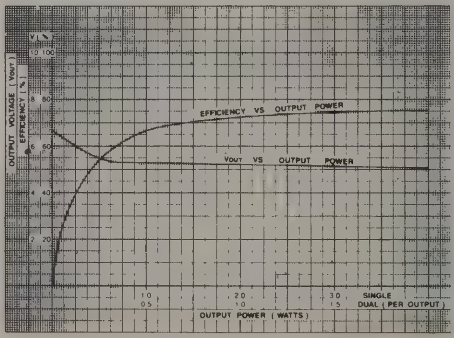
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.



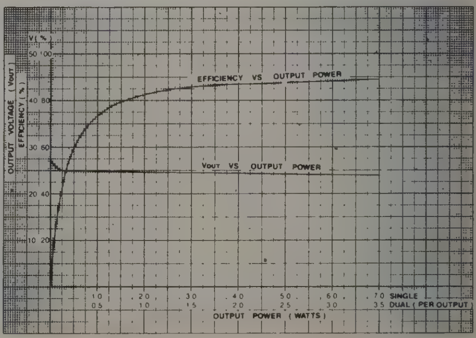
Typical Weight: 25 Grams



SERIES E SINGLE & DUAL 48V-5V



SERIES E SINGLE & DUAL 48V-24V



**Delivery—
stock to one week**

*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747*** • FAX 914-699-5565

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified.

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT.

Input voltage range:
5V models 4 to 6.5V DC
12V models 9 to 15V DC
24V models 17 to 28V DC
28V models 21 to 32V DC
48V models 25 to 50V DC

Output voltage tolerance at full load:
5V models ± 0.25V
9V models ± 0.3V
12V & 15V models ± 0.4V
24V & 28V models ± 0.5V
48V models ± 0.7V

Converter frequency: 20 to 40 KHz

Output temperature coefficient: 0.02%/°C

Operating temperature: −25°C to +70°C ambient. No heat sink is required.

Storage temperature: −55°C to +125°C

Isolation: 100 megohms min. @ 500V DC

Short circuit protection: Temporary

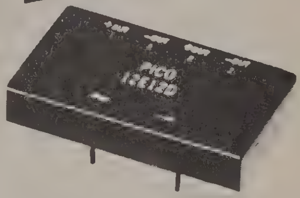
SERIES E - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5E5D	5	5	400	2.0	68	1176	0.3	200	±0.25	97.91
5E9D	5	9	250	2.25	74	1216	0.3	200	±0.3	97.91
5E12D	5	12	187	2.25	77	1168	0.25	220	±0.4	97.91
5E15D	5	15	150	2.25	79	1139	0.25	200	±0.4	97.91
5E24D	5	24	93	2.25	80	1125	0.25	200	±0.5	97.91
5E28D	5	28	80	2.25	80	1139	0.25	200	±0.5	97.91
5E48D	5	48	46	2.25	80	1125	0.25	200	±0.7	97.91
12E5D	12	5	400	2.0	75	444	0.3	40	+0.25	97.91
12E9D	12	9	333	3.0	80	625	0.3	40	±0.3	97.91
12E12D	12	12	270	3.25	83	652	0.25	40	±0.4	97.91
12E15D	12	15	217	3.25	85	637	0.25	40	+0.4	97.91
12E24D	12	24	140	3.375	86	654	0.25	40	±0.5	97.91
12E28D	12	28	121	3.375	86	654	0.25	40	±0.5	97.91
12E48D	12	48	70	3.5	88	654	0.25	40	±0.7	97.91
24E5D	24	5	400	2.0	72	231	0.3	22	±0.25	97.91
24E9D	24	9	333	3.0	79	316	0.3	22	±0.3	97.91
24E12D	24	12	270	3.25	82	330	0.25	22	+0.4	97.91
24E15D	24	15	217	3.25	85	318	0.25	22	±0.4	97.91
24E24D	24	24	145	3.5	88	331	0.25	18	+0.5	97.91
24E28D	24	28	125	3.5	88	331	0.25	18	+0.5	97.91
24E48D	24	48	73	3.5	88	331	0.25	18	±0.7	97.91
28E5D	28	5	400	2.0	69	207	0.3	25	±0.25	97.91
28E9D	28	9	333	3.0	80	268	0.3	25	±0.3	97.91
28E12D	28	12	270	3.25	80	290	0.25	22	±0.4	97.91
28E15D	28	15	217	3.25	82	283	0.25	22	+0.4	97.91
28E24D	28	24	145	3.5	88	284	0.25	20	±0.5	97.91
28E28D	28	28	125	3.5	88	284	0.25	20	±0.5	97.91
28E48D	28	48	73	3.5	88	284	0.25	20	±0.7	97.91
48E5D	48	5	400	2.0	74	113	0.3	6	±0.25	104.72
48E9D	48	9	333	3.0	80	156	0.3	6	+0.3	104.72
48E12D	48	12	270	3.25	85	160	0.3	6	±0.4	104.72
48E15D	48	15	217	3.25	85	160	0.3	6	±0.4	104.72
48E24D	48	24	145	3.5	88	166	0.3	6	+0.5	104.72
48E28D	48	28	125	3.5	89	164	0.3	6	±0.5	104.72

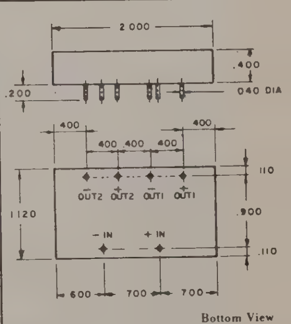
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Low Profile 0.4″ Height! Up to 7 Watts

NO EXTERNAL CAPACITORS REQUIRED

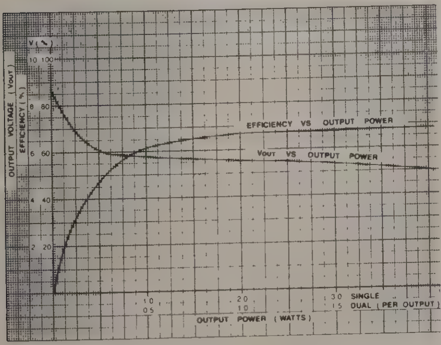


No Heat Sink or Electrical Derating Required

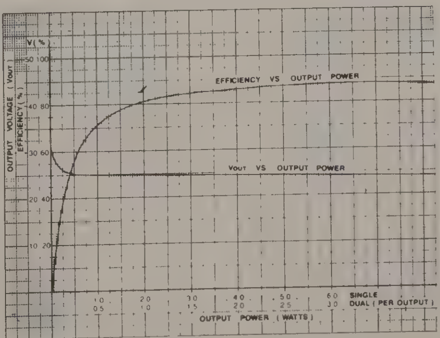


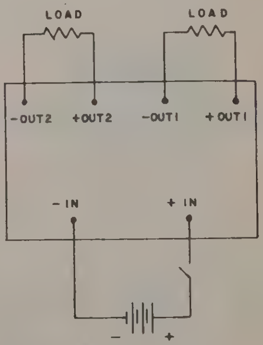
Typical Weight: 33 Grams

SERIES E SINGLE & DUAL 5V-5V



SERIES E SINGLE & DUAL 24V-24V





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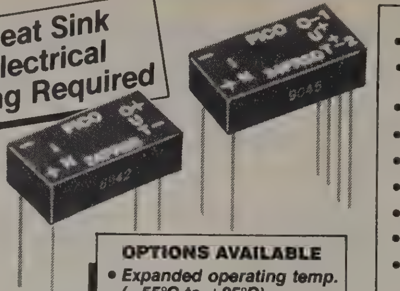
SERIES FR Hi Reliability Isolated Regulated DC-DC Converters

No Heat Sink or Electrical Derating Required



TYPICAL CHARACTERISTICS FOR ALL MODELS:

Test conditions: 25°C ambient
Output voltage tolerance: ±1% on all single/±2% dual
Line regulations: ±0.1% single/±0.2% dual
(for the input voltage range of ±10%)
Load regulation: 0.2% single/0.4% dual
Converter frequency: 20-40K Hz.
Operating temperature: −25°C to +70°C ambient
Output voltage temperature coefficient: 0.01%/°C
Storage temperature: −55°C to +125°C
Isolation: 100 megohms minimum at 500 volts DC
Short circuit protection: Temporary

OPTIONS AVAILABLE

- *Expanded operating temp. (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

FEATURES:

- Excellent voltage regulations ±0.1% single/±0.2% dual
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent load regulations 0.2% single/0.4% dual
- Up to 1.0 watts output power at 70°C ambient
- Low output ripple
- 100 megohm 500V DC isolation
- Single and dual isolated outputs
- Low profile, ultra-miniature size
- No output capacitor required
- No heat sink required

Low Profile .5"×1"×.3" ht. up to 1 Watt

This series of encapsulated converters come in 24 different models. The highly regulated output is isolated from the input. The units will operate over the temperature range of −25°C to +70°C. No heat sink is required. These units are excellent for applications where the input voltage varies ±10% and the output must be held to ±0.1% single/and ±0.2% dual. The output voltage is maintained to within 0.2% from no load to full load for single and 0.4% for dual.

SERIES FR - SINGLE OUTPUT

PICO PART NUMBER	*INPUT VOLTAGE (V dc)	OUTPUT VOLTAGE (V dc)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD AT NOMINAL INPUT VOLTAGE TYPICAL (%)	INPUT CURRENT @ FULL LOAD TYPICAL (mA) AT NOMINAL INPUT VOLTAGE	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (mVp-p) max.	INPUT CURRENT @ NO LOAD TYPICAL AT NOMINAL INPUT VOLTAGE (mA)	EFF. @ FULL LOAD TYPICAL (%) HIGH LINE	EFF. @ FULL LOAD TYPICAL (%) LOW LINE	PRICE 1-24
5FR5S	5	5	150	0.75	37	405	75	88	34	42	72.09
5FR12S	5	12	83	1 00	50	400	50	88	45	56	72.09
5FR15S	5	15	67	1.00	51	392	50	86	45	57	72 09
12FR5S	12	5	150	0.75	42	149	75	27	38	48	72 09
12FR12S	12	12	83	1.00	53	157	50	32	47	60	72 09
12FR15S	12	15	67	1 00	55	152	50	34	49	62	72.09
24FR5S	24	5	150	0.75	41	76	75	16	37	47	72 09
24FR12S	24	12	83	1.00	51	82	50	19	45	58	72 09
24FR15S	24	15	67	1.00	54	77	50	19	47	61	72 09
28FR5S	28	5	150	0.75	35	76	75	16	32	40	72 09
28FR12S	28	12	83	1 00	44	82	50	19	40	50	72.09
28FR15S	28	15	67	1.00	46	77	50	19	41	52	72.09

SERIES FR - DUAL OUTPUT

PICO PART NUMBER	*INPUT VOLTAGE (V dc)	DUAL OUTPUT VOLTAGE ISOLATED (V dc)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD AT NOMINAL INPUT VOLTAGE TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL AT NOMINAL INPUT VOLTAGE (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD PER OUTPUT (mVp-p max.)	INPUT CURRENT @ NO LOAD TYPICAL AT NOMINAL INPUT VOLTAGE (mA)	EFF. @ FULL LOAD TYPICAL (%) HIGH LINE	EFF. @ FULL LOAD TYPICAL (%) LOW LINE	PRICE 1-24
5FR5D	5	5	50	0.25	37	270	50	100	34	42	96.30
5FR12D	5	12	29	0.35	42	333	50	100	38	48	96.30
5FR15D	5	15	23	0 35	45	311	50	120	41	52	96.30
12FR5D	12	5	50	0.25	40	104	50	32	36	45	96 30
12FR12D	12	12	29	0.35	49	119	50	39	44	55	96.30
12FR15D	12	15	23	0.35	49	119	50	35	44	55	96 30
24FR5D	24	5	50	0.25	39	53	50	18	35	44	96.30
24FR12D	24	12	29	0.35	46	63	50	22	41	52	96.30
24FR15D	24	15	23	0.35	47	62	50	22	42	53	96.30
28FR5D	28	5	50	0.25	34	53	50	18	31	39	96 30
28FR12D	28	12	29	0.35	40	63	50	22	36	45	96.30
28FR15D	28	15	23	0.35	40	62	50	22	36	45	96.30

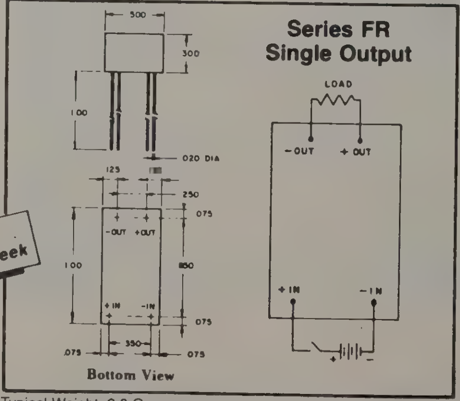
*Input voltage +/−10%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

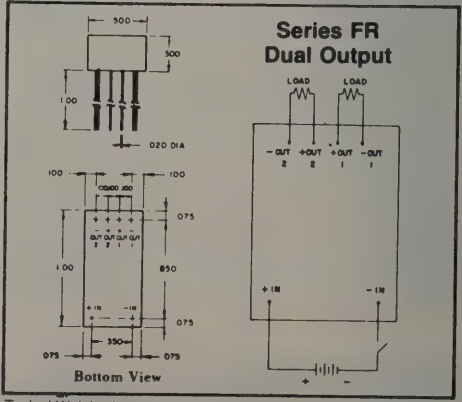
PICO Electronics, Inc.
453 N. MacQuesten Pkwy.,
Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

Delivery— stock to one week



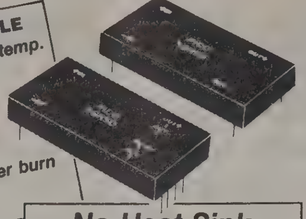
Typical Weight: 6.0 Grams



Typical Weight: 5.5 Grams

SERIES GR Hi Reliability Isolated Regulated DC-DC Converters

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)



No Heat Sink or Electrical Derating Required

Low Profile 0.35″ Height! Up to 3.5 Watts

TYPICAL CHARACTERISTICS FOR ALL MODELS:

Test conditions: 25°C ambient
Output voltage tolerance: ±1% on all units
Line regulation: ±0.1% (for the input voltage range of ±10%)
Load regulation: 0.2% (from full load to no load)
Converter frequency: 20-40K Hz.
Operating temperature: −25°C to +70°C ambient
Output voltage temperature coefficient: 0.005%/°C
Storage temperature: −55°C to +125°C
Isolation: 100 megohms minimum at 500 volts DC
Short circuit protection: Temporary

FEATURES:
- Excellent voltage regulation ±0.1%
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Excellent load regulation 0.2%
- Up to 3.5 watts output power at 70°C ambient
- Low output ripple
- 100 meghom 500V DC isolation
- Single and dual isolated outputs
- No heat sink required
- Miniature size
- No output capacitor required

This series of encapsulated converters come in 24 different models. The units feature single and isolated dual outputs. They will operate over a temperature range of −25°C to +70°C. No heat sink is required. These units are excellent for applications where the input voltage varies ±10% and the output must be held to ±0.1%. The output voltage is maintained to within 0.2% from no load to full load.

SERIES GR - SINGLE OUTPUT

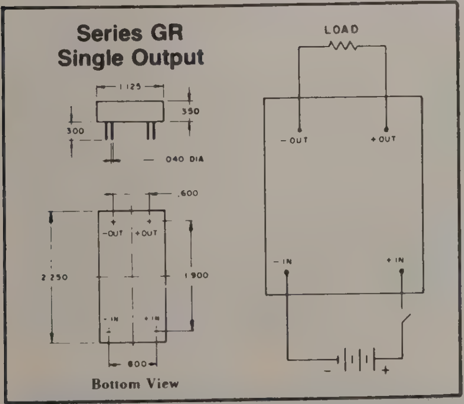
PICO PART NUMBER	* INPUT VOLTAGE (V dc)	OUTPUT VOLTAGE (V dc)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD AT NOMINAL INPUT VOLTAGE TYPICAL (%)	INPUT CURRENT @ FULL LOAD TYPICAL (mA) AT NOMINAL INPUT VOLTAGE	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (mVp–p) max.	INPUT CURRENT @ NO LOAD TYPICAL AT NOMINAL INPUT VOLTAGE (mA)	EFF. @ FULL LOAD TYPICAL % HIGH LINE	LOW LINE	PRICE 1–24
5GR5S	5	5	300	1.5	43	698	50	85	39	48	75.14
5GR12S	5	12	208	2.5	56	893	50	90	51	63	75.14
5GR15S	5	15	167	2.5	57	877	50	100	52	64	75.14
12GR5S	12	5	300	1.5	46	272	50	12	42	52	75.14
12GR12S	12	12	292	3.5	60	486	50	29	54	67	75.14
12GR15S	12	15	233	3.5	62	470	50	31	56	69	75.14
24GR5S	24	5	400	2.0	46	181	50	7	42	52	75.14
24GR12S	24	12	292	3.5	58	251	50	17	53	65	75.14
24GR15S	24	15	233	3.5	64	228	50	25	57	71	75.14
28GR5S	28	5	400	2.0	39	181	50	7	35	44	75.14
28GR12S	28	12	292	3.5	50	251	50	17	45	56	75.14
28GR15S	28	15	233	3.5	55	228	50	25	49	62	75.14

SERIES GR - DUAL OUTPUT

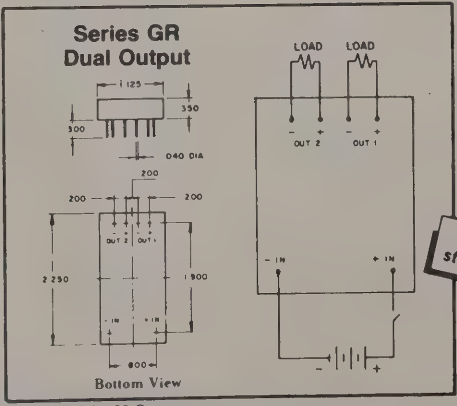
PICO PART NUMBER	* INPUT VOLTAGE (V dc)	DUAL OUTPUT VOLTAGE ISOLATED (V dc)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD AT NOMINAL INPUT VOLTAGE TYPICAL (%)	INPUT CURRENTFULL LOAD TYPICAL (mA) AT NOMINAL INPUT VOLTAGE	OUTPUT VOLTAGE RIPPLE @ FULL LOAD (mVp–p) max.	INPUT CURRENT @ NO LOAD TYPICAL AT NOMINAL INPUT VOLTAGE (mA)	EFF. @ FULL LOAD TYPICAL % HIGH LINE	LOW LINE	PRICE 1–24
5GR5D	5	5	150	0.75	43	698	50	102	39	49	89.62
5GR12D	5	12	104	1.25	55	909	50	120	50	62	89.62
5GR15D	5	15	83	1.25	56	893	50	128	50	63	89.62
12GR5D	12	5	150	0.75	46	272	50	33	41	51	89.62
12GR12D	12	12	146	1.75	59	494	50	35	53	66	89.62
12GR15D	12	15	117	1.75	61	478	50	37	55	68	89.62
24GR5D	24	5	200	1.00	46	181	50	15	42	52	89.62
24GR12D	24	12	146	1.75	58	251	50	18	52	65	89.62
24GR15D	24	15	117	1.75	64	228	50	21	58	72	89.62
28GR5D	28	5	200	1.00	39	181	50	15	35	44	89.62
28GR12D	28	12	146	1.75	50	251	50	18	45	56	89.62
28GR15D	28	15	117	1.75	55	228	50	21	49	62	89.62

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*Input voltage +/−10%



Typical Weight: 29 Grams



Typical Weight: 29 Grams

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
FAX 914-699-5565

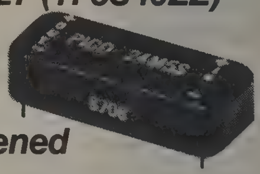
Delivery— stock to one week

For immediate engineering assistance or to place an order— Call Toll Free 800-228-9747

SERIES M PICO MILITARY DC-DC CONVERTERS

Hi Reliability Ultra-Miniature Isolated DC-DC Converters -55°C + 85°C

- *Diodes JAN TX*
- *Transformers manufactured to MIL-T-27 (TF5S40ZZ)*
- *Capacitors MIL-C-39003, S Level*
  MIL-C-55681, S Level
- *Resistors MIL-R-39008, S Level*
- *Transistors Hermetically Sealed, Screened per MIL-S-19500, Table II, JAN TXV*



Up to 500V DC Output Now Available

- *All MIL components*
- *−55°C to +85°C ambient operating temp.*
- *Selected MIL-STD-883 environmental screening available*

3.3 Volts Output Now Standard *for PICO Part Numbers: 5M3.3S, 12M3.3S, 24M3.3S, 28M3.3S*

SERIES M - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1–24
5M5S	5	5	200	1.00	65	308	0.20	65	±0.25	315.65
5M9S	5	9	139	1.25	71	352	0.15	80	±0.3	315.65
5M12S	5	12	104	1.25	74	338	0.15	80	±0.4	315.65
5M15S	5	15	83	1.25	74	338	0.12	90	±0.4	315.65
5M24S	5	24	52	1.25	77	325	0.10	90	±0.5	315.65
5M28S	5	28	45	1.25	76	329	0.10	90	±0.5	315.65
12M5S	12	5	200	1.00	67	124	0.15	40	±0.25	315.65
12M9S	12	9	139	1.25	74	141	0.15	40	±0.3	315.65
12M12S	12	12	104	1.25	76	137	0.12	40	±0.4	315.65
12M15S	12	15	83	1.25	76	137	0.12	40	±0.4	315.65
12M24S	12	24	52	1.25	78	134	0.08	40	±0.5	315.65
12M28S	12	28	45	1.25	80	130	0.08	40	±0.5	315.65
12M48S	12	48	26	1.25	80	130	0.08	40	±0.7	315.65
24M5S	24	5	200	1.00	67	62	0.15	13	±0.25	315.65
24M9S	24	9	139	1.25	74	70	0.15	15	±0.3	315.65
24M12S	24	12	104	1.25	75	69	0.10	15	±0.4	315.65
24M15S	24	15	83	1.25	78	67	0.10	15	±0.4	315.65
24M24S	24	24	52	1.25	82	64	0.10	15	±0.5	315.65
24M28S	24	28	45	1.25	79	66	0.10	15	±0.5	315.65
24M48S	24	48	26	1.25	80	65	0.07	16	±0.7	315.65
28M5S	28	5	200	1.00	68	53	0.15	12	±0.25	315.65
28M9S	28	9	139	1.25	76	59	0.15	14	±0.3	315.65
28M12S	28	12	104	1.25	78	57	0.12	14	±0.4	315.65
28M15S	28	15	83	1.25	79	57	0.10	14	±0.4	315.65
28M24S	28	24	52	1.25	81	55	0.09	14	±0.5	315.65
28M28S	28	28	45	1.25	81	55	0.09	14	±0.5	315.65
28M48S	28	48	26	1.25	80	56	0.09	15	±0.7	315.65

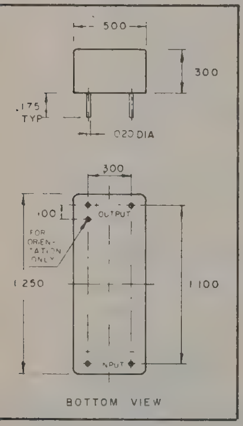
*Ripple is measured with 10µF, 75 volt high quality tantalum capacitor which is required across the output.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

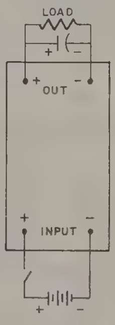
FEATURES

- Up to 1.25 watt output at 85°C ambient
- Ultra-miniature size (0.3″ Height)
- 4 input voltage ranges 5, 12, 24 and 28 V DC
- 100 megohm @ 500V DC isolation
- Input/output isolation
- Single and dual output
- No heat sink required
- Shielded
- 24 Pin Dip compatible

This series of unregulated DC-DC converters are encapsulated in an ultra-miniature 5 sided shielding package. 54 different models are available. The units feature single and dual outputs. They will operate over the temperature range of −55°C to +85°C. No heat sink is required.



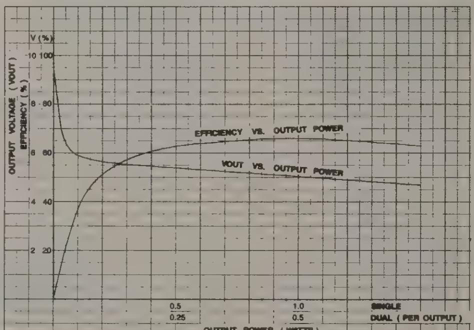
Typical Weight: 9.0 Grams



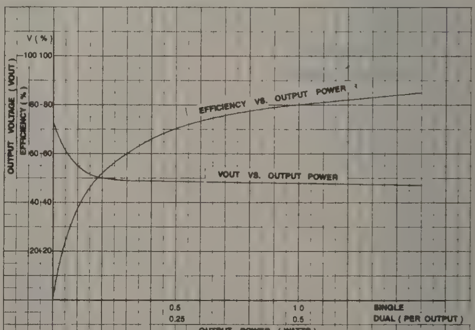
OPTIONS AVAILABLE PER MIL-STD-883

- ***Stabilization Bake***
- ***Temperature Cycle***
- ***Hi Temperature Burn In 160 Hours at Full Power***

SERIES M SINGLE & DUAL 5V-5V



SERIES M SINGLE & DUAL 12V-48V



Delivery— stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO Electronics, Inc.

PICO's MILITARY DC-DC CONVERTERS

Low Profile 1.250" x .5" x .3" ht. up to 1.25 Watts

No Heat Sink or Electrical Derating Required

OPTIONS AVAILABLE PER MIL-STD-883
- Stabilization Bake
- Temperature Cycle
- Hi Temperature Burn In 160 Hours at Full Power

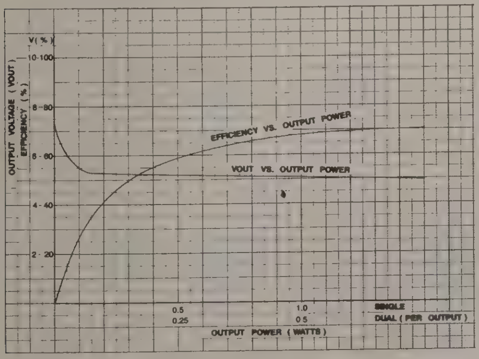
SERIES M - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE (V DC)	DUAL OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUTPUT (mA)	MAX. OUTPUT POWER PER OUTPUT (watts)	EFF. @ FULL LOAD TYPICAL (%)	INPUT CURRENT FULL LOAD TYPICAL (mA)	OUTPUT VOLTAGE RIPPLE @ FULL LOAD* (Vp-p max)	NO LOAD CURRENT TYPICAL (mA)	FULL LOAD OUTPUT VOLTAGE TOLERANCE (V DC)	PRICE 1-24
5M5D	5	5	100	0.5	65	308	0.20	65	±0.25	373.43
5M9D	5	9	69	0.625	71	352	0.15	80	±0.3	373.43
5M12D	5	12	52	0.625	74	338	0.15	80	±0.4	373.43
5M15D	5	15	42	0.625	74	338	0.12	90	±0.4	373.43
5M24D	5	24	26	0.625	77	325	0.10	90	±0.5	373.43
5M28D	5	28	22	0.625	76	329	0.10	90	±0.5	373.43
12M5D	12	5	100	0.5	67	124	0.15	40	±0.25	373.43
12M9D	12	9	69	0.625	74	141	0.15	40	±0.3	373.43
12M12D	12	12	52	0.625	76	137	0.12	40	±0.4	373.43
12M15D	12	15	42	0.625	76	137	0.12	40	±0.4	373.43
12M24D	12	24	26	0.625	78	134	0.08	40	±0.5	373.43
12M28D	12	28	22	0.625	80	130	0.08	40	±0.5	373.43
12M48D	12	48	13	0.625	80	130	0.05	40	±0.7	373.43
24M5D	24	5	100	0.5	67	62	0.15	13	±0.25	373.43
24M9D	24	9	69	0.625	74	70	0.15	15	±0.3	373.43
24M12D	24	12	52	0.625	75	69	0.10	15	±0.4	373.43
24M15D	24	15	42	0.625	78	67	0.10	15	±0.4	373.43
24M24D	24	24	26	0.625	82	64	0.10	15	±0.5	373.43
24M28D	24	28	22	0.625	79	66	0.10	15	±0.5	373.43
24M48D	24	48	13	0.625	80	65	0.07	16	±0.7	373.43
28M5D	28	5	100	0.5	68	53	0.15	12	±0.25	373.43
28M9D	28	9	69	0.625	76	59	0.15	14	±0.3	373.43
28M12D	28	12	52	0.625	78	57	0.12	14	±0.4	373.43
28M15D	28	15	42	0.625	79	57	0.10	14	±0.4	373.43
28M24D	28	24	26	0.625	81	55	0.09	14	±0.5	373.43
28M28D	28	28	22	0.625	81	55	0.09	14	±0.5	373.43
28M48D	28	48	13	0.625	80	56	0.09	15	±0.7	373.43

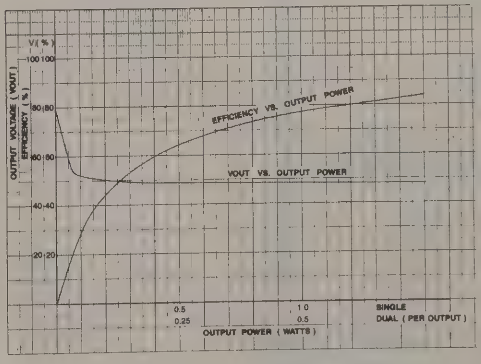
*The ripple is measured with 10μF, 75 volt high quality tantalum capacitor which is required across each output.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SERIES M SINGLE & DUAL 24V-5V



SERIES M SINGLE & DUAL 28V-48V



TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient and input voltage at nominal value unless otherwise specified

LINE REGULATION: OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT

Input voltage range:

5V models	4 to 6.5V DC
12V models	9 to 15V DC
24V models	17 to 28V DC
28V models	21 to 32V DC

Output voltage tolerance at full load:

5V models	± 0.25V
9V models	± 0.3V
12V & 15V models	± 0.4V
24V & 28V models	± 0.5V
48V models	± 0.7V

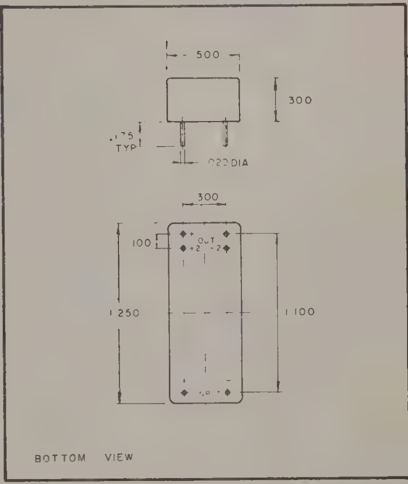
Converter frequency: 20 – 40 KHz

Output temperature coefficient:
0.05%/°C for 5V and 9V outputs.
0.02%/°C for 12, 15, 24, 28, 48V outputs.

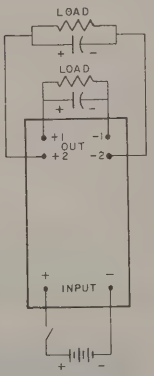
Operating temperature: –55°C to +85°C ambient.
No heat sink is required.
No electrical derating required.

Storage temperature: –55°C to +125°C

Isolation: 100 megohms min. @ 500V DC



Typical Weight: 9.0 Grams



PICO Electronics, Inc

453 North Mac Questen Pkwy
Mt. Vernon, New York 10552

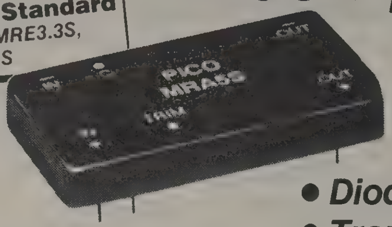
FAX 914-699-5565

Delivery—stock to one week

For immediate engineering assistance or to place an order–Call Toll Free 800-228-9747

SERIES MR

3.3 Volts Output Now Standard
for PICO Part Numbers: MRE3.3S, MRF3.3S, MRA3.3S



Wide Input–Low Profile .300″
MILITARY
DC-DC CONVERTERS

Hi Reliability
Ultra-Miniature
Fully Regulated 2.5 Watts
Isolated DC-DC Converters
−55°C to +85°C
Wide Input Range
All Units Shielded

- *Diodes JAN TX*
- *Transformers Manufactured to MIL-T-27 (TF5S03ZZ)*
- *Capacitors MIL-C 55365/4 MIL-C 39003/03 MIL-C 20/27E MIL-C 39014/05*
- *Resistors MIL-R-39017 MIL-R-22097*
- *IC Hermetically Sealed (MIL-STD-883 Screened)*

FEATURES:

- Voltage regulation over input of

	LOW	HI
MRE	5V	15V
MRF	8V	24V
MRA	18V	36V

- Load regulation (see table for typical variation at different loads
- Line regulation = Typical values
  - 5-15V DC = ±1.0%
  - 8-24V DC = ±1.0%
  - 18-36V DC = ±2.0%
- High efficiency—up to 78%
- Will operate over a temperature range of −55°C to +85°C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 Volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.

SERIES MR-SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
MRE5S	5–15	5	300	1.5	70	214	200	0.75	1.75	1.75	525.50
MRE9S	5–15	9	167	1.5	75	200	150	0.50	1.25	1.50	525.50
MRE12S	5–15	12	125	1.5	75	200	150	0.50	1.00	1.25	525.50
MRE15S	5–15	15	100	1.5	76	197	150	0.50	1.00	1.25	525.50
MRE24S	5–15	24	63	1.5	77	195	150	0.50	0.75	1.00	525.50
MRE28S	5–15	28	54	1.5	78	192	200	0.50	0.75	0.75	525.50
MRF5S	8–24	5	400	2.0	70	179	200	0.75	1.75	1.50	525.50
MRF9S	8–24	9	222	2.0	75	167	150	0.50	1.25	1.25	525.50
MRF12S	8–24	12	167	2.0	75	167	150	0.50	1.00	1.00	525.50
MRF15S	8–24	15	133	2.0	76	164	150	0.50	1.00	1.00	525.50
MRF24S	8–24	24	83	2.0	77	162	150	0.50	0.75	1.00	525.50
MRF28S	8–24	28	71	2.0	78	160	200	0.50	0.75	0.75	525.50
MRA5S	18–36	5	400	2.0	70	106	200	0.75	1.75	1.00	525.50
MRA9S	18–36	9	278	2.5	75	123	150	0.50	1.25	0.75	525.50
MRA12S	18–36	12	208	2.5	75	123	150	0.50	1.00	0.75	525.50
MRA15S	18–36	15	167	2.5	76	122	150	0.50	1.00	0.75	525.50
MRA24S	18–36	24	104	2.5	77	120	150	0.50	0.75	0.75	525.50
MRA28S	18–36	28	89	2.5	78	119	200	0.50	0.75	0.50	525.50

*Measurements taken with input voltage set at mid value.
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

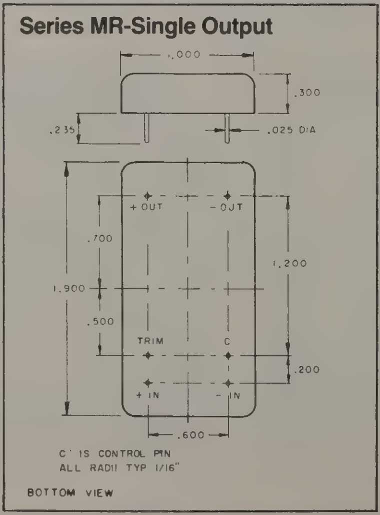
‡ 10% minimum load required.

For immediate engineering assistance
or to place an order—
Call Toll Free 800-228-9747

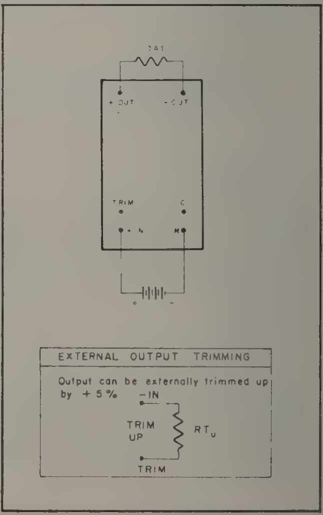
PICO
Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery—stock to one week



TYPICAL. WEIGHT. 26 Grams



Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown

Wide Input Range Isolated – Regulated

MILITARY

DC-DC CONVERTERS

Low Profile .300" up to 2.5 Watts

This series of high efficiency wide input range, encapsulated regulators come in 36 different models. Manufactured using high grade military components, this unit will operate from −55°C to +85°C with no heat sink or electrical derating required. The 6 sided shielding and 32 pin DIP compatability combined with input/output isolation and the wide input range capabilities will meet your most stringent military requirements.

No Heat Sink or Electrical Derating Required

PICO
MRA5S
IN
IN
TRIM
OUT
OUT

(1.9" x 1.0" x .300")

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −55°C to 85°C ambient
Output voltage tolerance: ±1% at typical input voltage
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.

SERIES MR-DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT (mA) PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD ‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
MRE5D	5–15	5	150	.75	70	214	200	0.75	1.75	1.75	595.00
MRE9D	5–15	9	84	.75	75	200	150	0.50	1.25	1.50	595.00
MRE12D	5–15	12	63	.75	75	200	150	0.50	1.00	1.25	595.00
MRE15D	5–15	15	50	.75	76	197	150	0.50	1.00	1.25	595.00
MRE24D	5–15	24	32	.75	77	195	150	0.50	0.75	1.00	595.00
MRE28D	5–15	28	27	.75	78	192	200	0.50	0.75	0.75	595.00
MRF5D	8–24	5	200	1.00	70	179	200	0.75	1.75	1.50	595.00
MRF9D	8–24	9	111	1.00	75	167	150	0.50	1.25	1.25	595.00
MRF12D	8–24	12	84	1.00	75	167	150	0.50	1.00	1.00	595.00
MRF15D	8–24	15	67	1.00	76	164	150	0.50	1.00	1.00	595.00
MRF24D	8–24	24	42	1.00	77	162	150	0.50	0.75	1.00	595.00
MRF28D	8–24	28	36	1.00	78	160	200	0.50	0.75	0.75	595.00
MRA5D	18–36	5	200	1.00	70	106	200	0.75	1.75	1.00	595.00
MRA9D	18–36	9	139	1.25	75	123	150	0.50	1.25	0.75	595.00
MRA12D	18–36	12	104	1.25	75	123	150	0.50	1.00	0.75	595.00
MRA15D	18–36	15	84	1.25	76	122	150	0.50	1.00	0.75	595.00
MRA24D	18–36	24	52	1.25	77	120	150	0.50	0.75	0.75	595.00
MRA28D	18–36	28	45	1.25	78	119	200	0.50	0.75	0.50	595.00

‡ 10% minimum load required

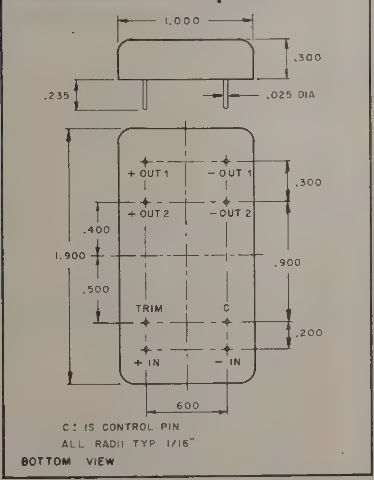
*Measurements taken with input voltage set at mid value.
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

OPTIONS AVAILABLE PER MIL-STD-883

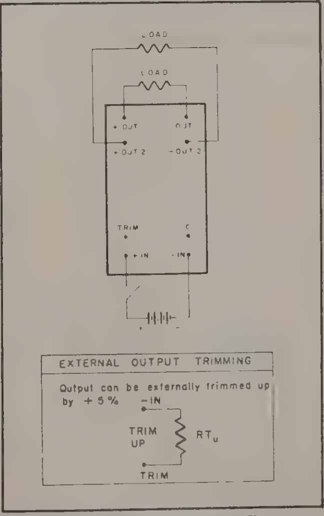
- Stabilization Bake
- Temperature Cycle
- Hi Temperature Burn In 160 Hours at Full Power

Standard Operating Temperature −55°C to +85°C

Series MR-Dual Output



TYPICAL. WEIGHT. 26 Grams



Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

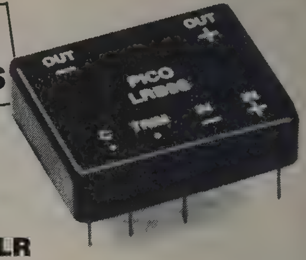
PICO Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery— stock to one week

SERIES LR
Isolated Regulated up to 5 Watt DC-DC Converters
Wide Input Range/up to 3.33:1
Fully Regulated
All Units Shielded

New 100 VDC Output Models



3.3 Volts Output Now Standard
for PICO Part Numbers: LRE3.3S, LRF3.3S, LRA3.3S, LRB3.3S, LRC3.3S

FEATURES:

- Voltage regulation over input of

	LOW	HI
LRE	5V	15V
LRF	8V	24V
LRA	18V	36V
LRB	36V	60V
LRC	18V	60V

- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads)
- Line regulation = Typical values
  5-15 V DC = ± 1.5%
  8-24 V DC = ± 1.5%
  18-36 V DC = ± 1.0%
  36-60 V DC = ± 1.0%
  18-60 V DC = ± 1.5%
- High efficiency—up to 80%
- Will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

Low Profile Less Than 0.5" ht.
For 0.3" ht.see pages D-2162 & 2163

SERIES LR SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU-LATION (±%)*	PRICE 1–24
LRE5S	5–15	5	600	3	78	385	150	0.75	1.50	2.00	117.70
LRE9S	5–15	9	444	4	78	515	125	0.50	1.25	1.50	117.70
LRE12S	5–15	12	333	4	79	505	125	0.50	1.25	1.25	117.70
LRE15S	5–15	15	267	4	79	505	125	0.50	1.25	1.25	117.70
LRE24S	5–15	24	167	4	80	500	125	0.50	1.00	1.25	117.70
LRE28S	5–15	28	143	4	80	500	125	0.50	1.00	1.00	117.70
LRE48S	5–15	48	83	4	80	500	175	0.50	1.00	1.00	117.70
LRE100S	5–15	100	40	4	80	500	200	0.50	1.00	1.00	147.13
LRF5S	8–24	5	1000	5	78	400	150	0.75	1.50	2.00	117.70
LRF9S	8–24	9	556	5	78	400	125	0.50	1.25	1.50	117.70
LRF12S	8–24	12	417	5	79	395	125	0.50	1.25	1.25	117.70
LRF15S	8–24	15	333	5	79	395	125	0.50	1.25	1.25	117 70
LRF24S	8–24	24	208	5	80	390	125	0.50	1.00	1.25	117.70
LRF28S	8–24	28	179	5	80	390	125	0.50	1.00	1.00	117.70
LRF48S	8–24	48	104	5	80	390	175	0.50	1.00	1.00	117.70
LRF100S	8–24	100	50	5	80	390	200	0.50	1.00	1.00	147.13
LRA5S	18–36	5	1000	5	76	245	100	0.75	2.00	0.75	117.70
LRA9S	18–36	9	556	5	76	245	100	0.50	2.00	0.50	117.70
LRA12S	18–36	12	417	5	77	240	100	0.50	2.00	0.50	117.70
LRA15S	18–36	15	333	5	79	235	100	0.50	1.50	0.50	117.70
LRA24S	18–36	24	208	5	80	230	100	0.50	1.50	0.25	117.70
LRA28S	18–36	28	179	5	80	230	100	0.50	1.50	0.25	117.70
LRA48S	18–36	48	104	5	80	230	150	0.50	1.00	0.25	117.70
LRA100S	18–36	100	50	5	80	230	200	0.50	1.00	0.50	147.13
LRB5S	36–60	5	1000	5	74	140	100	0.75	1.25	0.50	139.10
LRB9S	36–60	9	556	5	74	140	100	0.50	1.00	0.25	139.10
LRB12S	36–60	12	417	5	74	140	100	0.50	1.00	0.25	139.10
LRB15S	36–60	15	333	5	76	135	100	0.50	1.00	0.25	139.10
LRB24S	36–60	24	208	5	76	135	100	0.50	0.75	0.25	139.10
LRB28S	36–60	28	179	5	76	135	100	0.50	0.75	0.25	139.10
LRB48S	36–60	48	104	5	76	135	150	0.50	0.75	0.25	139.10
LRB100S	36-60	100	50	5	76	135	200	0.50	1.00	0.50	173.88
LRC5S	18–60	5	1000	5	75	170	100	0.75	2.00	1.25	149.80
LRC9S	18–60	9	556	5	75	170	100	0.50	1.00	0.75	149.80
LRC12S	18–60	12	417	5	75	170	100	0.50	1.00	0.75	149.80
LRC15S	18–60	15	333	5	77	165	100	0.50	1.00	0.75	149.80
LRC24S	18–60	24	208	5	78	165	100	0.50	0.75	0.50	149.80
LRC28S	18–60	28	179	5	78	165	100	0.50	0.75	0.50	149.80
LRC48S	18–60	48	104	5	78	165	150	0.50	0.75	0.50	149.80
LRC100S	18-60	100	50	5	78	165	200	0.50	1.00	0.50	187.50

** Measurements taken with input voltage set at mid value.*

‡ 10% minimum load required.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.

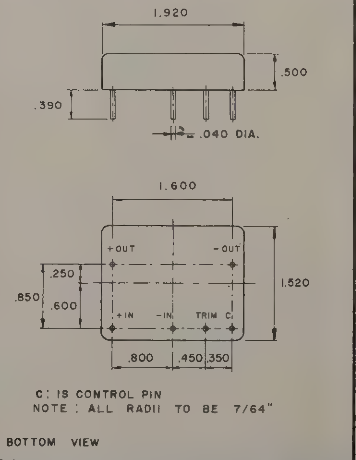
For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

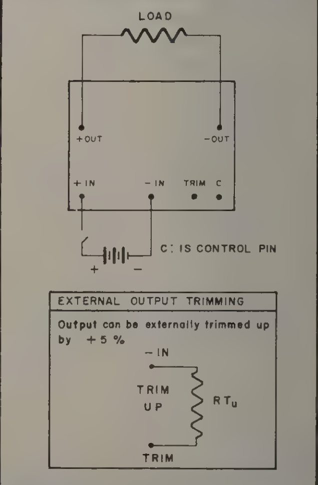
PICO
Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

Delivery—stock to one week

Series LR-Single Output



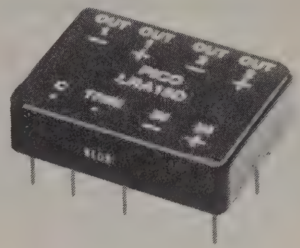


Typical Weight: 65 Grams

This series of high efficiency, wide input range, encapsulated regulators come in 75 different models. These units feature a 500 VOLT DC input to output isolation in both single and dual output models. The LR Series will operate over a temperature range of −25°C TO +70°C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −25° C to +70° C ambient
Output voltage tolerance: ± 1% at typical input voltage
Output voltage temperature coefficient: 0.02%°C
Storage temperature: −55°C to 125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.



SERIES LR - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT (mA) PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
LRE5D	5–15	5	300	1.5	78	385	150	0.75	1.50	2.00	144.45
LRE9D	5–15	9	222	2.0	78	515	125	0.50	1.25	1.50	144.45
LRE12D	5–15	12	167	2.0	79	505	125	0.50	1.25	1.25	144.45
LRE15D	5–15	15	134	2.0	79	505	125	0.50	1.25	1.25	144.45
LRE24D	5–15	24	84	2.0	80	500	125	0.50	1.00	1.25	144.45
LRE28D	5–15	28	72	2.0	80	500	125	0.50	1.00	1.00	144.45
LRE48D	5–15	48	42	2.0	80	500	175	0.50	1.00	1.00	144.45
LRF5D	8–24	5	500	2.5	78	400	150	0.75	1.50	2.00	144.45
LRF9D	8–24	9	278	2.5	78	400	125	0.50	1.25	1.50	144.45
LRF12D	8–24	12	208	2.5	79	395	125	0.50	1.25	1.25	144.45
LRF15D	8–24	15	167	2.5	79	395	125	0.50	1.25	1.25	144.45
LRF24D	8–24	24	104	2.5	80	390	125	0.50	1.00	1.25	144.45
LRF28D	8–24	28	89	2.5	80	390	125	0.50	1.00	1.00	144.45
LRF48D	8–24	48	52	2.5	80	390	175	0.50	1.00	1.00	144.45
LRA5D	18–36	5	500	2.5	76	245	100	0.75	2.00	0.75	144.45
LRA9D	18–36	9	278	2.5	76	245	100	0.50	2.00	0.50	144.45
LRA12D	18–36	12	208	2.5	77	240	100	0.50	2.00	0.50	144.45
LRA15D	18–36	15	167	2.5	79	235	100	0.50	1.50	0.50	144.45
LRA24D	18–36	24	104	2.5	80	230	100	0.50	1.50	0.25	144.45
LRA28D	18–36	28	89	2.5	80	230	100	0.50	1.50	0.25	144.45
LRA48D	18–36	48	52	2.5	80	230	150	0.50	1.0	0.25	144.45
LRB5D	36–60	5	500	2.5	74	140	100	0.75	1.25	0.50	165.85
LRB9D	36–60	9	278	2.5	74	140	100	0.50	1.00	0.25	165.85
LRB12D	36–60	12	208	2.5	74	140	100	0.50	1.00	0.25	165.85
LRB15D	36–60	15	167	2.5	76	135	100	0.50	1.00	0.25	165.85
LRB24D	36–60	24	104	2.5	76	135	100	0.50	0.75	0.25	165.85
LRB28D	36–60	28	89	2.5	76	135	100	0.50	0.75	0.25	165.85
LRB48D	36–60	48	52	2.5	76	135	150	0.50	0.75	0.25	165.85
LRC5D	18–60	5	500	2.5	75	170	100	0.75	2.00	1.25	176.55
LRC9D	18–60	9	278	2.5	75	170	100	0.50	1.00	0.75	176.55
LRC12D	18–60	12	208	2.5	75	170	100	0.50	1.00	0.75	176.55
LRC15D	18–60	15	167	2.5	77	165	100	0.50	1.00	0.75	176.55
LRC24D	18–60	24	104	2.5	78	165	100	0.50	0.75	0.50	176.55
LRC28D	18–60	28	89	2.5	78	165	100	0.50	0.75	0.50	176.55
LRC48D	18–60	48	52	2.5	78	165	150	0.50	0.75	0.50	176.55

*Measurements taken with input voltage set at mid value.

‡ 10% minimum load required.

Ordering Instructions: No minimum.
Net 30 days F.O.B. Mt. Vernon, New York.

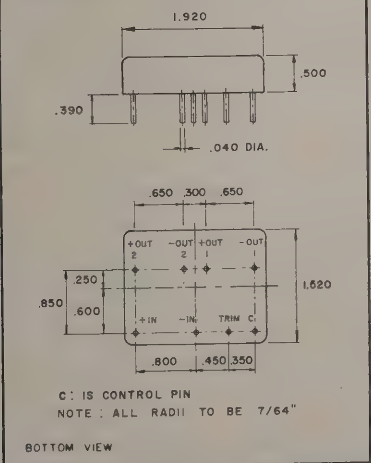
No Heat Sink or Electrical Derating Required

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

Low Profile Less Than 0.5" ht.

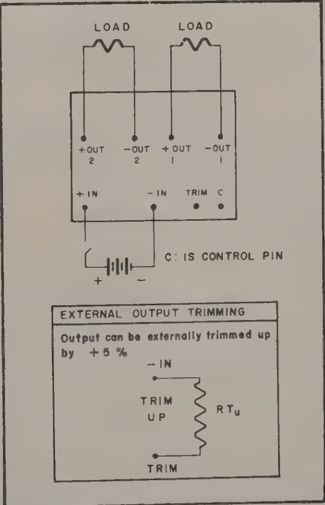
For 0.3" ht. see pages D-2162 & 2163

Series LR-Dual Output



Typical Weight: 65 Grams

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.



Output can be externally trimmed up by +5 %

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO
Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
- FAX 914-699-5565

Delivery— stock to one week

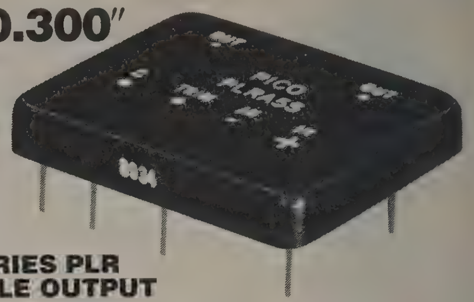
SERIES PLR- Lowest Profile Series 0.300″

Isolated Regulated up to 5 Watt DC-DC Converters

Wide Input Range/up to 3.33:1

Fully Regulated

All Units Shielded



New 100 VDC Output Models

3.3 Volts Output Now Standard
for Part Numbers: PLRE3.3S, PLRF3.3S, PLRA3.3S, PLRB3.3S, PLRC3.3S

FEATURES:

- Voltage regulation over input of

	LOW	HI
PLRE	5V	15V
PLRF	8V	24V
PLRA	18V	36V
PLRB	36V	60V
PLRC	18V	60V

- .300" Height
- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads)
- Line regulation = Typical values
  5–15 V DC = ± 1.5%
  8–24 V DC = ± 1.5%
  18–36 V DC = ± 1.0%
  36–60 V DC = ± 1.0%
  18–60 V DC = ± 1.5%
- High efficiency—up to 80%
- Will operate over a temperature range of –25˚C to +70˚C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.

OPTIONS AVAILABLE

- *Expanded operating temp (–55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (–55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

Low Profile 0.3″ Height

SERIES PLR SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU-LATION (±%)*	PRICE 1–24
PLRE5S	5–15	5	600	3	78	385	175	0.75	1.75	2.00	176.55
PLRE9S	5–15	9	444	4	78	515	125	0.50	1.50	1.50	176.55
PLRE12S	5–15	12	333	4	79	505	125	0.50	1.25	1.25	176.55
PLRE15S	5–15	15	267	4	79	505	125	0.50	1.25	1.25	176.55
PLRE24S	5–15	24	167	4	80	500	125	0.50	1.00	1.25	176.55
PLRE28S	5–15	28	143	4	80	500	125	0.50	1.00	1.00	176.55
PLRE48S	5–15	48	83	4	80	500	300	0.50	1.00	1.00	176.55
PLRE100S	5–15	100	40	4	80	500	300	0.50	1.0	1.0	220.69
PLRF5S	8–24	5	1000	5	78	400	150	0.75	1.75	2.00	176.55
PLRF9S	8–24	9	556	5	78	400	125	0.50	1.50	1.50	176.55
PLRF12S	8–24	12	417	5	79	395	125	0.50	1.25	1.25	176.55
PLRF15S	8–24	15	333	5	79	395	125	0.50	1.25	1.25	176.55
PLRF24S	8–24	24	208	5	80	390	125	0.50	1 00	1.25	176.55
PLRF28S	8–24	28	179	5	80	390	125	0.50	1.00	1.00	176.55
PLRF48S	8–24	48	104	5	80	390	250	0.50	1.00	1.00	176.55
PLRF100S	8–24	100	50	5	80	390	300	0.50	1.0	1.0	220.69
PLRA5S	18–36	5	1000	5	76	245	100	0.75	2.00	1.00	176.55
PLRA9S	18–36	9	556	5	76	245	100	0.50	2.00	0.50	176.55
PLRA12S	18–36	12	417	5	77	240	100	0.50	2.00	0.50	176.55
PLRA15S	18–36	15	333	5	79	235	100	0.50	1.50	0.50	176.55
PLRA24S	18–36	24	208	5	80	230	100	0.50	1.50	0.50	176.55
PLRA28S	18–36	28	179	5	80	230	100	0.50	1.50	0.50	176.55
PLRA48S	18–36	48	104	5	80	230	250	0.50	1.00	0.50	176.55
PLRA100S	18-36	100	50	5	80	230	300	0.50	1.0	1.0	220.69
PLRB5S	36–60	5	1000	5	74	140	100	0.75	1.75	0.50	208 65
PLRB9S	36–60	9	556	5	74	140	100	0.50	1.50	0.50	208.65
PLRB12S	36–60	12	417	5	74	140	100	0.50	1.00	0.25	208.65
PLRB15S	36–60	15	333	5	76	135	100	0.50	1.00	0.25	208.65
PLRB24S	36–60	24	208	5	76	135	100	0.50	0.75	0.25	208.65
PLRB28S	36–60	28	179	5	76	135	100	0.50	0.75	0.25	208.65
PLRB48S	36–60	48	104	5	76	135	200	0.50	0.75	0.25	208.65
PLRB100S	36-60	100	50	5	76	135	300	0.50	1.0	1.0	260.81
PLRC5S	18–60	5	1000	5	75	170	100	0.75	2.00	1.50	224.70
PLRC9S	18–60	9	556	5	75	170	100	0.50	1.50	1.00	224.70
PLRC12S	18–60	12	417	5	75	170	100	0.50	1.00	0.75	224.70
PLRC15S	18–60	15	333	5	77	165	100	0.50	1.00	0.75	224.70
PLRC24S	18–60	24	208	5	78	165	100	0.50	0.75	0.75	224.70
PLRC28S	18–60	28	179	5	78	165	100	0.50	0.75	0.75	224.70
PLRC48S	18–60	48	104	5	78	165	225	0.50	0.75	0.75	224.70
PLRC100S	18-60	100	50	5	78	165	300	0.50	1.0	1.0	280.88

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

‡ 10% minimum load required.

** Measurements taken with input voltage set at mid value.*

For immediate engineering assistance or to place an order—

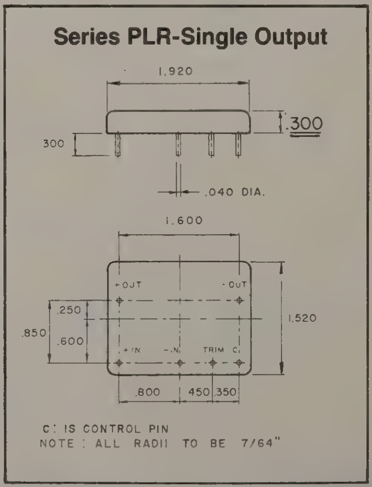
Call Toll Free 800-228-9747

PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

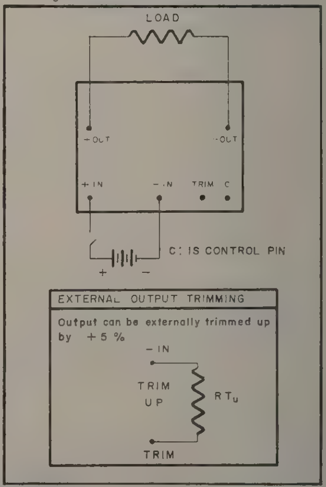
- FAX 914-699-5565

Delivery—stock to one week



Series PLR-Single Output

Each unit is supplied with an external control pin. This "C" pin when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.



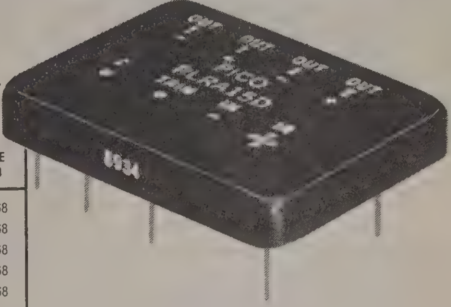
Typical Weight: 40 Grams

This series of Low Profile 0.300, high efficiency, wide input range, encapsulated regulators come in 75 different models. These units feature a 500 VOLT DC input to output isolation in both single and dual output models. The PLR Series will operate over a temperature range of -25˚C TO +70˚C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −25°C to +70°C ambient
Output voltage tolerance: ±1% at typical input voltage
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.

Lowest Profile Series 0.300″



SERIES PLR - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT (mA) PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
PLRE5D	5–15	5	300	1.5	78	385	175	0.75	1.75	2.00	216.68
PLRE9D	5–15	9	222	2.0	78	515	125	0.50	1.50	1.50	216.68
PLRE12D	5–15	12	167	2.0	79	505	125	0.50	1.25	1.25	216.68
PLRE15D	5–15	15	134	2.0	79	505	125	0.50	1.25	1.25	216.68
PLRE24D	5–15	24	84	2.0	80	500	125	0.50	1.00	1.25	216.68
PLRE28D	5–15	28	72	2.0	80	500	125	0.50	1.00	1.00	216.68
PLRE48D	5–15	48	42	2.0	80	500	300	0.50	1.00	1.00	216.68
PLRF5D	8–24	5	500	2.5	78	400	100	0.75	1.75	2.00	216.68
PLRF9D	8–24	9	278	2.5	78	400	125	0.50	1.50	1.50	216.68
PLRF12D	8–24	12	208	2.5	79	395	125	0.50	1.25	1.25	216.68
PLRF15D	8–24	15	167	2.5	79	395	125	0.50	1.25	1.25	216.68
PLRF24D	8–24	24	104	2.5	80	390	125	0.50	1.00	1.25	216.68
PLRF28D	8–24	28	89	2.5	80	390	125	0.50	1.00	1.00	216.68
PLRF48D	8–24	48	52	2.5	80	390	250	0.50	1.00	1.00	216.68
PLRA5D	18–36	5	500	2.5	76	245	100	0.75	2.00	1.00	216.68
PLRA9D	18–36	9	278	2.5	76	245	100	0.50	2.00	0.50	216.68
PLRA12D	18–36	12	208	2.5	77	240	100	0.50	2.00	0.50	216.68
PLRA15D	18–36	15	167	2.5	79	235	100	0.50	1.50	0.50	216.68
PLRA24D	18–36	24	104	2.5	80	230	100	0.50	1.50	0.50	216.68
PLRA28D	18–36	28	89	2.5	80	230	100	0.50	1.50	0.50	216.68
PLRA48D	18–36	48	52	2.5	80	230	250	0.50	1.00	0.50	216.68
PLRB5D	36–60	5	500	2.5	74	140	100	0.75	1.75	0.50	248.78
PLRB9D	36–60	9	278	2.5	74	140	100	0.50	1.50	0.50	248.78
PLRB12D	36–60	12	208	2.5	74	140	100	0.50	1.00	0.25	248.78
PLRB15D	36–60	15	167	2.5	76	135	100	0.50	1.00	0.25	248.78
PLRB24D	36–60	24	104	2.5	76	135	100	0.50	0.75	0.25	248.78
PLRB28D	36–60	28	89	2.5	76	135	100	0.50	0.75	0.25	248.78
PLRB48D	36–60	48	52	2.5	76	135	200	0.50	0.75	0.25	248.78
PLRC5D	18–60	5	500	2.5	75	170	100	0.75	2.00	1.50	264.83
PLRC9D	18–60	9	278	2.5	75	170	100	0.50	1.50	1.00	264.83
PLRC12D	18–60	12	208	2.5	75	170	100	0.50	1.00	0.75	264.83
PLRC15D	18–60	15	167	2.5	77	165	100	0.50	1.00	0.75	264.83
PLRC24D	18–60	24	104	2.5	78	165	100	0.50	0.75	0.75	264.83
PLRC28D	18–60	28	89	2.5	78	165	100	0.50	0.75	0.75	264.83
PLRC48D	18–60	48	52	2.5	78	165	225	0.50	0.75	0.75	264.83

No Heat Sink or Electrical Derating Required

OPTIONS AVAILABLE
- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

Low Profile 0.3″ Height

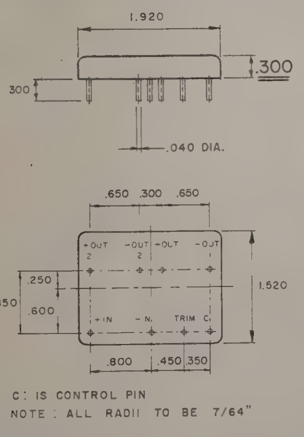
** Measurements taken with input voltage set at mid value.*

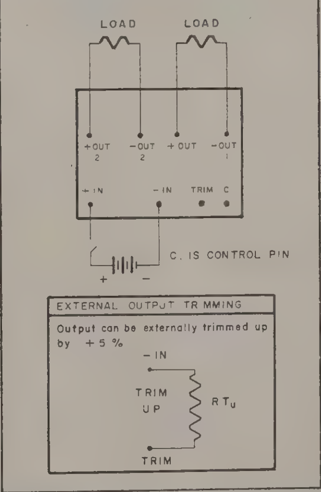
‡ 10% minimum load required

Ordering Instructions:
No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown

Series PLR-Dual Output





Typical Weight: 40 Grams

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO

Electronics, Inc.

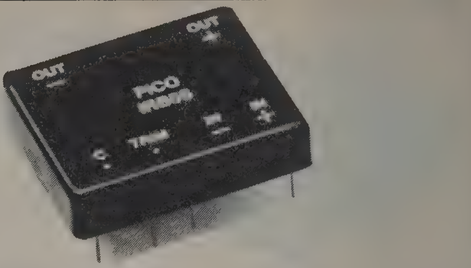
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

- FAX 914-699-5565

Delivery— stock to one week

SERIES IR

Isolated Regulated up to 10 Watt
DC-DC Converters
Wide Input Range/up to 3.33:1
Fully Regulated
All Units Shielded



New 100 VDC Output Models

3.3 Volts Output Now Standard
for PICO Part Numbers: IRE3.3S, IRF3.3S, IRA3.3S, IRB3.3S, IRC3.3S

FEATURES:

- Voltage regulation over input of

	LOW	HI
IRE	5V	15V
IRF	8V	24V
IRA	18V	36V
IRB	36V	60V
IRC	18V	60V

- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads)
- Line regulatioin = Typical values
  - 5-15 V DC = ± 1.5%
  - 8-24 V DC = ± 1.5%
  - 18-36 V DC = ± 1.0%
  - 36-60 V DC = ± 1.0%
  - 18-60 V DC = ± 1.5%
- High efficiency—up to 84%
- Will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs.
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.

OPTIONS AVAILABLE

- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

Low Profile Less Than 0.5" Height

SERIES IR - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU-LATION (±%)*	PRICE 1–24
IRE5S	5–15	5	1200	6	80	750	175	0.75	2 00	2.00	128.40
IRE9S	5–15	9	889	8	80	1000	150	0.50	1.50	1.00	128.40
IRE12S	5–15	12	667	8	78	1025	150	0.50	1 50	1.00	128.40
IRE15S	5–15	15	533	8	78	1025	150	0.50	1.50	1.00	128.40
IRE24S	5–15	24	333	8	82	975	150	0.50	0.75	1.00	128.40
IRE28S	5–15	28	286	8	83	965	200	0.50	0.50	0.50	128 40
IRE48S	5–15	48	167	8	83	965	250	0.50	0.50	0.50	128 40
IRE100S	5–15	100	60	6	80	750	300	0.50	0.50	0.75	160.50
IRF5S	8–24	5	2000	10	80	780	200	0.75	1.50	1.75	128.40
IRF9S	8–24	9	1111	10	81	770	150	0.50	0.75	1.25	128.40
IRF12S	8–24	12	833	10	78	800	150	0.50	0.75	0.75	128 40
IRF15S	8–24	15	667	10	78	800	150	0.50	0.75	0.75	128.40
IRF24S	8–24	24	417	10	83	755	150	0.50	0.75	0.75	128.40
IRF28S	8–24	28	357	10	83	755	200	0.50	0:50	0.50	128.40
IRF48S	8–24	48	208	10	84	745	250	0.50	0.50	0.50	128.40
IRF100S	8–24	100	100	10	80	780	300	0.50	0.50	0.75	160.50
IRA5S	18–36	5	2000	10	81	455	125	0.75	1.25	0.75	128.40
IRA9S	18–36	9	1111	10	83	445	100	0.50	1.00	0.50	128 40
IRA12S	18–36	12	833	10	78	475	75	0.50	1 00	0.25	128.40
IRA15S	18–36	15	667	10	78	475	75	0.50	0.75	0.25	128 40
IRA24S	18-36	24	417	10	83	445	75	0.50	0.75	0.25	128.40
IRA28S	18–36	28	357	10	83	445	100	0.50	0.75	0.25	128.40
IRA48S	18–36	48	208	10	84	440	150	0.50	0.50	0.25	128.40
IRA100S	18–36	100	100	10	81	455	250	0.50	0.50	0.50	160.50
IRB5S	36–60	5	2000	10	81	255	125	0.75	1.25	0.50	149.80
IRB9S	36–60	9	1111	10	83	250	100	0.50	0.75	0.50	149.80
IRB12S	36–60	12	833	10	83	250	75	0.50	0.75	0.25	149.80
IRB15S	36–60	15	667	10	83	250	75	0.50	0.75	0.25	149.80
IRB24S	36–60	24	417	10	83	250	75	0.50	0.75	0.25	149.80
IRB28S	36–60	28	357	10	83	250	100	0.50	0.50	0.25	149.80
IRB48S	36–60	48	208	10	84	250	150	0.50	0.50	0.25	149.80
IRB100S	36-60	100	100	10	81	255	250	0.50	0.50	0.50	187.25
IRC5S	18–60	5	2000	10	81	320	125	0.75	1.25	1.00	160.50
IRC9S	18–60	9	1111	10	83	310	100	0.50	0.75	0.75	160.50
IRC12S	18–60	12	833	10	83	310	75	0.50	0.75	0.50	160.50
IRC15S	18–60	15	667	10	83	310	75	0.50	0.75	0.50	160.50
IRC24S	18–60	24	417	10	83	310	75	0.50	0.75	0.50	160.50
IRC28S	18–60	28	357	10	83	310	100	0.50	0.50	0.50	160.50
IRC48S	18–60	48	208	10	84	305	150	0.50	0.50	0.50	160.50
IRC100S	18-60	100	100	10	81	310	250	0.50	0.50	0.75	200.63

*Measurements taken with input voltage set at mid value.

‡ 10% minimum load required.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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Electronics, Inc.

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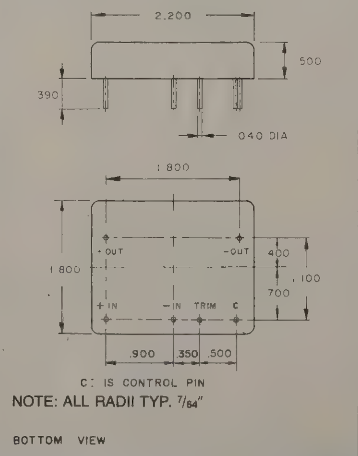
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

• FAX 914-699-5565

Delivery—stock to one week

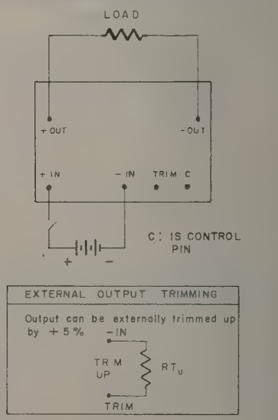
Series IR-Single Output



NOTE: ALL RADII TYP. 7/64"

BOTTOM VIEW

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.



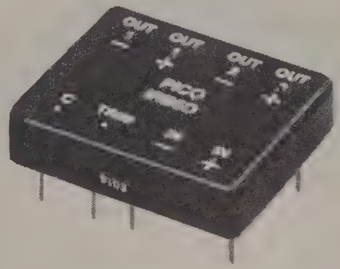
Output can be externally trimmed up by + 5%

Typical Weight: 95 Grams

This series of high efficiency, wide input range, encapsulated regulators come in 75 different models. These units feature a 500 VOLT DC input to output isolation in both single and dual output models. The IR Series will operate over a temperature range of −25°C TO +70°C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −25° C to +70° C ambient
Output voltage tolerance: ± 1% at typical input voltage
Output voltage temperature coefficient: 0.02%°C
Storage temperature: −55°C to 125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.



SERIES IR - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU- LATION (±%)*	PRICE 1–24
IRE5D	5–15	5	600	3	80	750	175	0.75	2.00	2.00	155.15
IRE9D	5–15	9	444	4	80	1000	150	0.50	1.50	1.00	155.15
IRE12D	5–15	12	333	4	78	1025	150	0.50	1.50	1.00	155.15
IRE15D	5–15	15	267	4	78	1025	150	0.50	1.50	1.00	155.15
IRE24D	5–15	24	167	4	82	975	150	0.50	0.75	1.00	155.15
IRE28D	5–15	28	143	4	83	965	200	0.50	0.50	0.50	155.15
IRE48D	5–15	48	83	4	83	965	250	0.50	0.50	0.50	155.15
IRF5D	8–24	5	1000	5	80	780	200	0.75	1.50	1.75	155.15
IRF9D	8–24	9	556	5	81	770	150	0.50	0.75	1.25	155.15
IRF12D	8–24	12	417	5	78	800	150	0.50	0.75	0.75	155.15
IRF15D	8–24	15	333	5	78	800	150	0.50	0.75	0.75	155.15
IRF24D	8–24	24	208	5	83	755	150	0.50	0.75	0.75	155.15
IRF28D	8–24	28	179	5	83	755	200	0.50	0.50	0.50	155.15
IRF48D	8–24	48	104	5	84	745	250	0.50	0.50	0.50	155.15
IRA5D	18–36	5	1000	5	81	455	125	0.75	1.25	0.75	155.15
IRA9D	18–36	9	556	5	83	445	100	0.50	1.00	0.50	155.15
IRA12D	18–36	12	417	5	78	475	75	0.50	1.00	0.25	155.15
IRA15D	18–36	15	333	5	78	475	75	0.50	0.75	0.25	155.15
IRA24D	18–36	24	208	5	83	445	75	0.50	0.75	0.25	155.15
IRA28D	18–36	28	179	5	83	445	100	0.50	0.75	0.25	155.15
IRA48D	18–36	48	104	5	84	440	150	0.50	0.50	0.25	155.15
IRB5D	36–60	5	1000	5	81	255	125	0.75	1.25	0.50	176.55
IRB9D	36–60	9	556	5	83	250	100	0.50	0.75	0.50	176.55
IRB12D	36–60	12	417	5	83	250	75	0.50	0.75	0.25	176.55
IRB15D	36–60	15	333	5	83	250	75	0.50	0.75	0.25	176.55
IRB24D	36–60	24	208	5	83	250	75	0.50	0.75	0.25	176.55
IRB28D	36–60	28	179	5	83	250	100	0.50	0.50	0.25	176.55
IRB48D	36–60	48	104	5	84	250	150	0.50	0.50	0.25	176.55
IRC5D	18–60	5	1000	5	81	320	125	0.75	1.25	1.00	187.25
IRC9D	18–60	9	556	5	83	310	100	0.50	0.75	0.75	187.25
IRC12D	18–60	12	417	5	83	310	75	0.50	0.75	0.50	187.25
IRC15D	18–60	15	333	5	83	310	75	0.50	0.75	0.50	187.25
IRC24D	18–60	24	208	5	83	310	75	0.50	0.75	0.50	187.25
IRC28D	18–60	28	179	5	83	310	100	0.50	0.50	0.50	187.25
IRC48D	18–60	48	104	5	84	305	150	0.50	0.50	0.50	187.25

*Measurements taken with input voltage set at mid value.

‡ 10% minimum load required

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

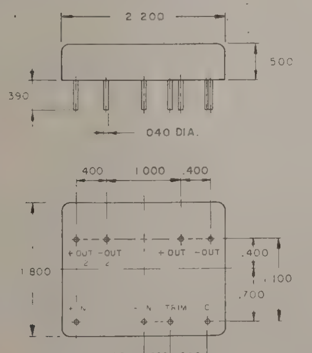
No Heat Sink or Electrical Derating Required

OPTIONS AVAILABLE

- Expanded operating temp. (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

Low Profile Less Than 0.5″ Height

Series IR-Dual Output

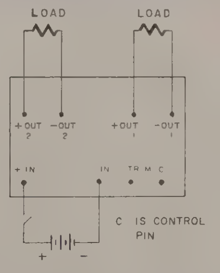


C: IS CONTROL PIN

NOTE: ALL RADII TYP. 7/64″

BOTTOM VIEW

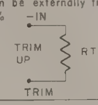
Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.



C IS CONTROL PIN

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed up by +5%



Typical Weight: 95 Grams

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

- FAX 914-699-5565

Delivery—stock to one week

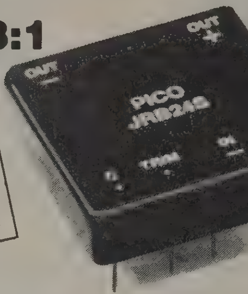
SERIES JR

Isolated Regulated 15 Watt DC-DC Converters Wide Input Range/up to 3.33:1 Fully Regulated All Units Shielded

OPTIONS AVAILABLE
- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

New 100 VDC Output Models

No Heat Sink or Electrical Derating Required



Low Profile Less Than 0.5″ Height

SERIES JR - SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU-LATION (±%)*	PRICE 1–24
JRA5S	18–36	5	3000	15	78	710	50	0.75	2.00	1.50	154.08
JRA9S	18–36	9	1667	15	78	710	40	0.50	1.50	0.50	154.08
JRA12S	18–36	12	1250	15	78	710	40	0.50	1.00	0.50	154.08
JRA15S	18–36	15	1000	15	78	710	40	0.50	1.00	0.50	154.08
JRA24S	18–36	24	625	15	83	670	40	0.50	1.00	0.25	154.08
JRA28S	18–36	28	536	15	84	660	40	0.75	0.50	0.25	154.08
JRA48S	18–36	48	313	15	84	660	50	0.75	0.50	0.25	154.08
JRA100S	18–36	100	150	15	84	660	75	0.50	0.75	0.25	192.60
JRB5S	36–60	5	3000	15	78	400	50	0.75	2.00	0 75	179.76
JRB9S	36–60	9	1667	15	78	400	40	0.50	1.50	0.50	179.76
JRB12S	36–60	12	1250	15	80	390	40	0.50	1.00	0.50	179.76
JRB15S	36–60	15	1000	15	81	385	40	0.50	1.00	0.50	179.76
JRB24S	36–60	24	625	15	83	375	40	0.50	1.00	0.25	179.76
JRB28S	36–60	28	536	15	84	370	40	0.50	0.50	0.25	179.76
JRB48S	36–60	48	313	15	84	370	50	0.50	0.50	0.25	179.76
JRB100S	36-60	100	150	15	84	370	75	0.50	0 50	0.25	224 70
JRC5S	18–60	5	3000	15	78	495	50	0.75	2.00	1.50	192.60
JRC9S	18–60	9	1667	15	78	495	40	0.50	1 50	0.75	192.60
JRC12S	18–60	12	1250	15	80	480	40	0.50	1.00	0.75	192.60
JRC15S	18–60	15	1000	15	81	475	40	0.50	1.00	0.75	192.60
JRC24S	18–60	24	625	15	83	465	40	0.50	1.00	0.50	192.60
JRC28S	18–60	28	536	15	84	460	40	0.50	0.50	0.50	192.60
JRC48S	18–60	48	313	15	84	460	50	0.50	0.50	0.50	192.60
JRC100S	18-60	100	150	15	84	460	75	0.50	0.50	0.50	240.75

*Measurements taken with input voltage set at mid value.
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

‡ 10% minimum load required.

FEATURES:

- Voltage regulation over input of

	LOW	HI
JRA	18V	36V
JRB	36V	60V
JRC	18V	60V

- Encapsulated semi-conductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads
- Line regulation = Typical values
  18–36V DC = ±1.0%
  36–60V DC = ±1.0%
  18–60V DC = ±2.0%
- High efficiency—up to 84%
- Will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 Volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.

For immediate engineering assistance or to place an order—

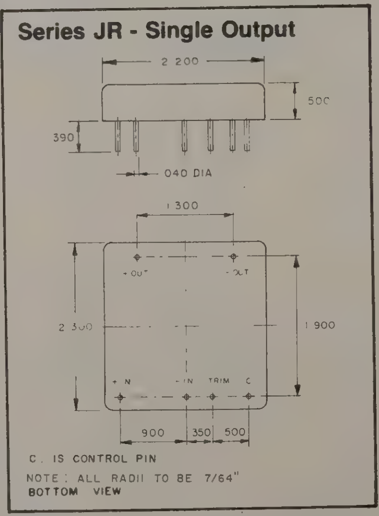
Call Toll Free 800-228-9747

PICO Electronics, Inc.

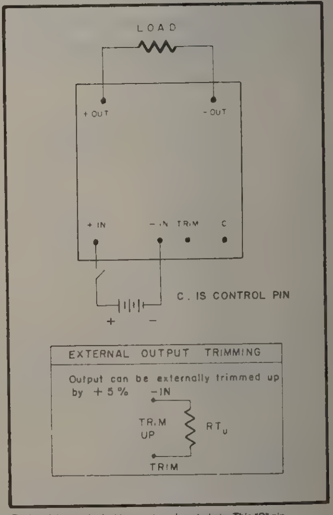
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

- FAX 914-699-5565

Delivery—stock to one week



Typical Weight: 115 Grams



Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.

This series of high efficiency, wide input range, encapsulated regulators come in 45 different models. These units feature a 500 Volt DC input to output isolation in both single and dual output models. The JR Series will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.

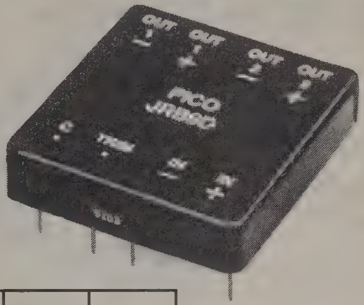
OPTIONS AVAILABLE

- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

No Heat Sink or Electrical Derating Required

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −25°C to +70°C ambient
Output voltage tolerance: ±2% at typical input voltage
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.



SERIES JR - DUAL OUTPUT

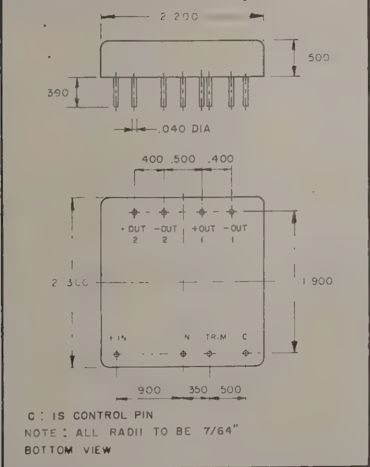
PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
JRA5D	18–36	5	1500	7.5	78	710	50	0.75	2.00	1.50	180.83
JRA9D	18–36	9	833	7.5	78	710	40	0.50	1.50	0.50	180.83
JRA12D	18–36	12	625	7.5	78	710	40	0.50	1.00	0.50	180.83
JRA15D	18–36	15	500	7.5	78	710	40	0.50	1.00	0.50	180.83
JRA24D	18–36	24	313	7.5	83	670	40	0.50	1.00	0.25	180.83
JRA28D	18–36	28	268	7.5	84	660	40	0.75	0.75	0.25	180.83
JRA48D	18–36	48	156	7.5	84	660	50	0.75	0.75	0.25	180.83
JRB5D	36–60	5	1500	7.5	78	400	50	0.75	2.00	0.75	206.51
JRB9D	36–60	9	833	7.5	78	400	40	0.50	1.50	0.50	206.51
JRB12D	36–60	12	625	7.5	80	390	40	0.50	1.00	0.50	206.51
JRB15D	36–60	15	500	7.5	81	385	40	0.50	1.00	0.50	206.51
JRB24D	36–60	24	313	7.5	83	375	40	0.50	1.00	0.25	206.51
JRB28D	36–60	28	268	7.5	84	370	40	0.50	0.50	0.25	206.51
JRB48D	36–60	48	156	7.5	84	370	50	0.50	0.50	0.25	206.51
JRC5D	18–60	5	1500	7.5	78	495	50	0.75	2.00	1.50	219.35
JRC9D	18–60	9	833	7.5	78	495	40	0.50	1.50	0.75	219.35
JRC12D	18–60	12	625	7.5	80	480	40	0.50	1.00	0.75	219.35
JRC15D	18–60	15	500	7.5	81	475	40	0.50	1.00	0.75	219.35
JRC24D	18–60	24	313	7.5	83	465	40	0.50	1.00	0.50	219.35
JRC28D	18–60	28	268	7.5	84	460	40	0.50	0.50	0.50	219.35
JRC48D	18–60	48	156	7.5	84	460	50	0.50	0.50	0.50	219.35

*Measurements taken with input voltage set at mid value.
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

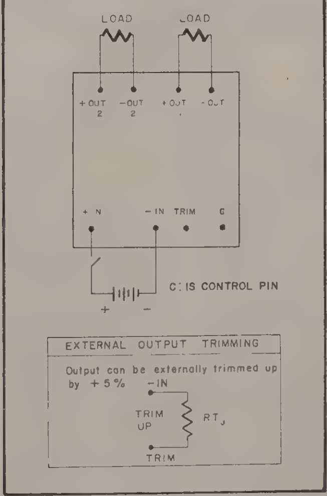
‡ 10% minimum load required.

Low Profile Less Than 0.5″ Height

Series JR - Dual Output



Typical Weight: 115 Grams



Output can be externally trimmed up by +5%

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

- FAX 914-699-5565

Delivery— stock to one week

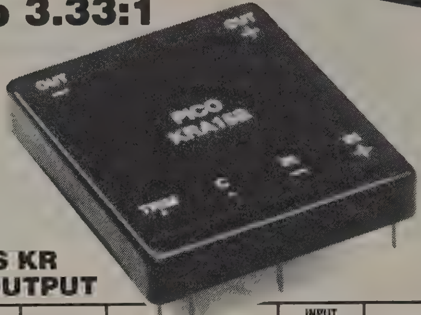
SERIES KR

Isolated Regulated 20 Watt DC-DC Converters Wide Input Range/up to 3.33:1 Fully Regulated All Units Shielded

OPTIONS AVAILABLE
- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

Low Profile Less Than 0.5″ Height

New 100 VDC Output Models



SERIES KR SINGLE OUTPUT

FEATURES

- Voltage regulation over input of

	LOW	HI
KRA	18V	36V
KRB	36V	60V
KRC	18V	60V

- Encapsulated semi-conductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads
- Line regulation = Typical values
  18–36V DC = +1.5%
  36–60V DC = ±1.5%
  18–60V DC = ±3.0%
- High efficiency—up to 84%
- Will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating
- 6 sided shielding
- Isolation—100 megohms at 500 Volts DC
- External output trimming pin standard, +5%
- Single and dual isolated outputs
- Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	VLD. REG. 25%-100% LOAD‡ (±%)*	LINE REGU-LATION (±%)*	PRICE 1–24
KRA5S	18–36	5	4000	20	78	950	60	0.75	2.50	1.50	185.11
KRA9S	18–36	9	2222	20	80	925	60	0.50	1.25	0.75	185.11
KRA12S	18–36	12	1667	20	78	950	60	0.50	1.00	0.50	185.11
KRA15S	18–36	15	1333	20	78	950	60	0.50	1.00	0.50	185.11
KRA24S	18–36	24	833	20	81	915	60	0.50	0.50	0.25	185.11
KRA28S	18–36	28	714	20	82	905	60	0.50	0.50	0.25	185.11
KRA48S	18–36	48	417	20	83	890	80	0.50	0.50	0.25	185.11
KRA100S	18–36	100	200	20	83	890	100	0.50	0.50	0.25	231.39
KRB5S	36-60	5	4000	20	78	535	60	0.75	2.50	1.00	216.14
KRB9S	36–60	9	2222	20	80	520	60	0.50	1.25	0.50	216.14
KRB12S	36–60	12	1667	20	78	535	60	0.50	1.00	0.50	216.14
KRB15S	36–60	15	1333	20	78	535	60	0.50	1.00	0.50	216.14
KRB24S	36–60	24	833	20	81	515	60	0.50	0.50	0.25	216.14
KRB28S	36–60	28	714	20	82	510	60	0.50	0.50	0.25	216.14
KRB48S	36–60	48	417	20	83	500	80	0.50	0.50	0.25	216.14
KRB100S	36-60	100	200	20	83	500	100	0.50	0.50	0.25	270.18
KRC5S	18–60	5	4000	20	78	660	60	0.75	2.50	2.00	231.12
KRC9S	18–60	9	2222	20	80	640	60	0.50	1.25	1.00	231.12
KRC12S	18–60	12	1667	20	78	660	60	0.50	1.00	0.75	231.12
KRC15S	18–60	15	1333	20	78	660	60	0.50	1.00	0.75	231.12
KRC24S	18–60	24	833	20	81	635	60	0.50	0.50	0.50	231.12
KRC28S	18–60	28	714	20	82	625	60	0.50	0.50	0.50	231.12
KRC48S	18–60	48	417	20	83	615	80	0.50	0.50	0.50	231.12
KRC100S	18-60	100	200	20	83	615	100	0.50	0.50	0.50	288.50

*Measurements taken with input voltage set at mid value.
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

‡ 10% minimum load required.

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

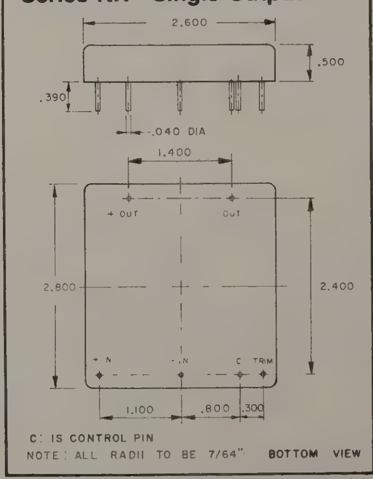
PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

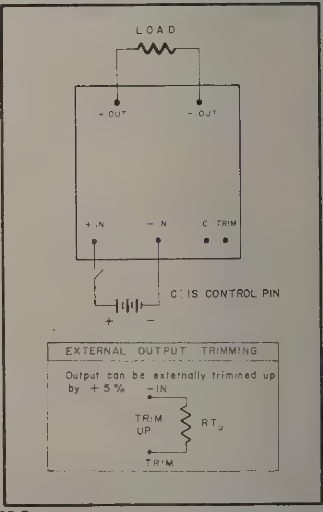
• FAX 914-699-5565

Delivery—stock to one week

Series KR - Single Output



Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (–) input, will disable the unit, allowing for remote shutdown.



Typical Weight: 165 Grams

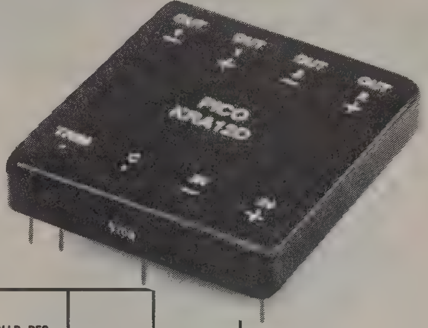
This series of high efficiency, wide input range, encapsulated regulators come in 45 different models. These units feature a 500 Volt DC input to output isolation in both single and dual output models. The KR Series will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.

TYPICAL CHARACTERISTICS:

Test conditions: 25°C ambient
Operating temperature: −25°C to +70°C ambient
Output voltage tolerance: ±3% at typical input voltage
Output voltage temperature coefficient: 0.02%/°C
Storage temperature: −55°C to +125°C
Short circuit protection: Temporary
Operating frequency: 40 Khtz, typ.

OPTIONS AVAILABLE
- Expanded operating temp (−55°C to +85°C)
- Stabilization Bake (125°C ambient)
- Temperature Cycle (−55°C to +125°C)
- Hi Temp, full power burn in (100% power, 125°C case temp)

No Heat Sink or Electrical Derating Required



SERIES KR - DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%-100% LOAD‡ (±%)*	LINE REGULATION (±%)*	PRICE 1–24
KRA5D	18–36	5	2000	10	78	950	60	0.75	2.50	1.50	211.86
KRA9D	18–36	9	1111	10	80	925	60	0.50	1.25	0.75	211.86
KRA12D	18–36	12	833	10	78	950	60	0.50	1.00	0.50	211.86
KRA15D	18–36	15	667	10	78	950	60	0.50	1.00	0.50	211.86
KRA24D	18–36	24	417	10	81	915	60	0.50	0.50	0.25	211.86
KRA28D	18–36	28	357	10	82	905	60	0.50	0.50	0.25	211.86
KRA48D	18–36	48	208	10	83	890	80	0.50	0.50	0.25	211.86
KRB5D	36–60	5	2000	10	78	535	60	0.75	2.50	1.00	242.89
KRB9D	36–60	9	1111	10	80	520	60	0.50	1.25	0.50	242.89
KRB12D	36–60	12	833	10	78	535	60	0.50	1.00	0.50	242.89
KRB15D	36–60	15	667	10	78	535	60	0.50	1.00	0.50	242.89
KRB24D	36–60	24	417	10	81	515	60	0.50	0.50	0.25	242 89
KRB28D	36–60	28	357	10	82	510	60	0.50	0.50	0.25	242.89
KRB48D	36–60	48	208	10	83	500	80	0.50	0.50	0.25	242 89
KRC5D	18–60	5	2000	10	78	660	60	0.75	2.50	2.00	257 87
KRC9D	18–60	9	1111	10	80	640	60	0.50	1.25	1.00	257.87
KRC12D	18–60	12	833	10	78	660	60	0.50	1.00	0.75	257.87
KRC15D	18–60	15	667	10	78	660	60	0.50	1.00	0.75	257.87
KRC24D	18–60	24	417	10	81	635	60	0.50	0.50	0.50	257.87
KRC28D	18–60	28	357	10	82	625	60	0.50	0.50	0.50	257.87
KRC48D	18–60	48	208	10	83	615	80	0.50	0.50	0.50	257.87

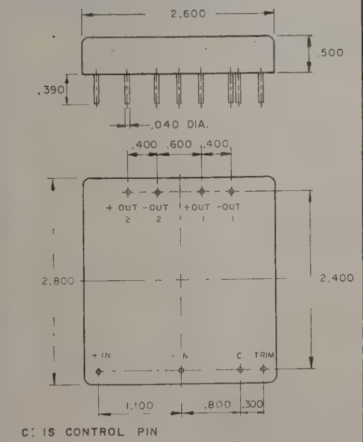
*Measurements taken with input voltage set at mid value.

‡ 10% minimum load required

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

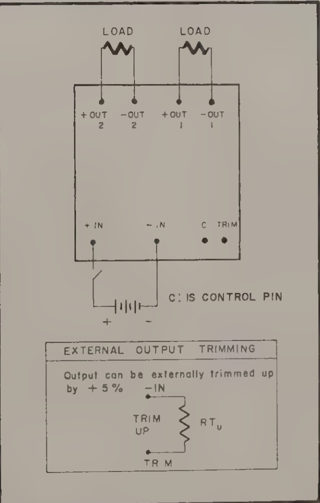
Low Profile Less Than 0.5" Height

Series KR - Dual Output



C: IS CONTROL PIN
NOTE: ALL RADII TO BE 7/64"
BOTTOM VIEW

Each unit is supplied with an external control pin. This "C" pin, when connected to the negative (−) input, will disable the unit, allowing for remote shutdown.



Typical Weight: 165 Grams

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

- FAX 914-699-5565

Delivery— stock to one week

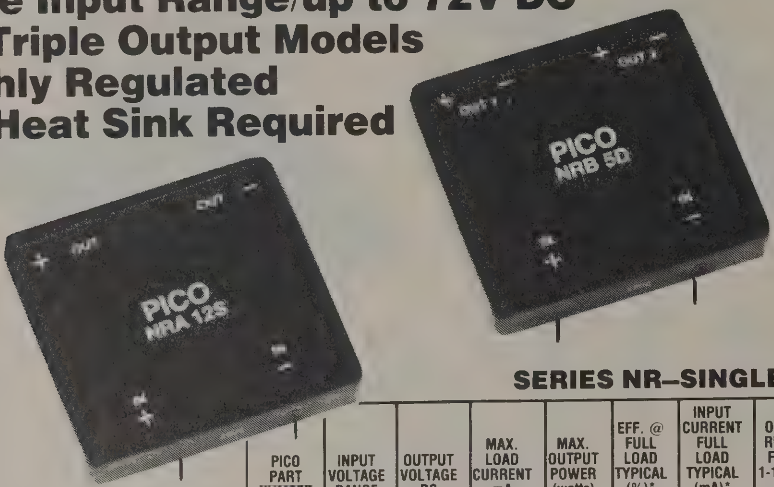
SERIES NR

Isolated Regulated up to 30 Watt DC-DC Converters
Wide Input Range/up to 72V DC
30 Triple Output Models
Highly Regulated
No Heat Sink Required

No Heat Sink or Electrical Derating Required

Low Profile Less Than 0.5" Height

- **30 Triple Output Models**
- **72 V Input Voltage**
- **0.2% Line Regulation**
- **Continuous Short Circuit Protection**


PICO NRA 12S
PICO NRB 5D
OUT
+
-
IN

FEATURES:

- 30 triple output models
- Voltage regulation over input of

	LOW	HI
NRA	18V	36V
NRB	36V	72V

- Encapsulated semiconductors, conservatively rated for maximum reliability.
- Load regulation (see table for typical variation at different loads
- Line regulation = Typical values
  18 – 36V DC = 0.2%
  36 – 72V DC = 0.2%
- High efficiency—up to 87
- Will operate over a ambient temperature range of –25°C to +70°C with no heat sink or electrical derating required.
- Short circuit protection
- Current limited
- 6 sided shielding
- Isolation–100 megohms at 500 Volts DC
- Screw inserts for mounting

SERIES NR–SINGLE OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC	MAX. LOAD CURRENT mA	MAX. OUTPUT POWER (watts)	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 10%–100% LOAD ‡ (±%)*	LINE REGULATION (±%)*	PRICE 1-24
NRA5S	18–36	5	4000	20	78	1068	50	0.5	0.3	0.2	260.00
NRA9S	18–36	9	2777	25	80	1302	50	0.5	0.2	0.2	260.00
NRA12S	18–36	12	2083	25	81	1286	50	0.5	0.2	0.2	260.00
NRA15S	18–36	15	1666	25	83	1255	50	0.5	0.2	0.2	260.00
NRA24S	18–36	24	1042	25	84	1240	50	0.5	0.2	0.2	260.00
NRA28S	18–36	28	893	25	85	1225	50	0.5	0.2	0.2	260.00
NRB5S	36–72	5	4400	22	78	588	50	0.5	0.3	0.2	289.00
NRB9S	36–72	9	2777	25	83	628	50	0.5	0.2	0.2	289.00
NRB12S	36–72	12	2083	25	83	628	50	0.5	0.2	0.2	289.00
NRB15S	36–72	15	2000	30	85	735	50	0.5	0.2	0.2	289.00
NRB24S	36–72	24	1250	30	86	727	50	0.5	0.2	0.2	289.00
NRB28S	36–72	28	1071	30	87	718	50	0.5	0.2	0.2	289.00

‡ 10% minimum load required.

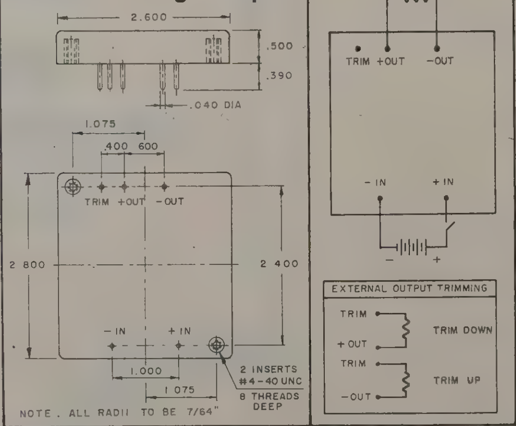
SERIES NR–DUAL OUTPUT

PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	OUT VOLT TOLERANCE (±%)*	V LD. REG. 25%–100% LOAD ‡ (±%)*	LINE REGULATION (±%)*	PRICE 1-24
NRA5D	18–36	± 5	2000	10.0	78	1068	50	0.5	0.3	0.2	310.00
NRA9D	18–36	± 9	1390	12.5	80	1302	50	0.5	0.2	0.2	310.00
NRA12D	18–36	±12	1042	12.5	81	1286	50	0.5	0.2	0.2	310.00
NRA15D	18–36	±15	833	12.5	83	1255	50	0.5	0.2	0.2	310.00
NRB5D	36–72	± 5	2200	11.0	78	588	50	0.5	0.3	0.2	339.00
NRB9D	36–72	± 9	1390	12.5	80	651	50	0.5	0.2	0.2	339.00
NRB12D	36–72	±12	1042	12.5	82	635	50	0.5	0.2	0.2	339.00
NRB15D	36–72	±15	833	12.5	84	620	50	0.5	0.2	0.2	339.00

Measurements taken with input voltage set at mid value.

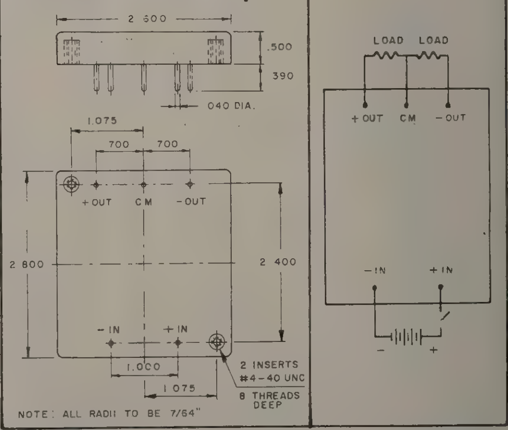
‡ 10% minimum load required.

Series NR–Single Output


2.600
.500
.390
.040 DIA
1.075
.400
600
TRIM
+OUT
-OUT
2 800
2 400
- IN
+ IN
1.000
1 075
2 INSERTS
#4-40 UNC
8 THREADS DEEP
NOTE . ALL RADII TO BE 7/64"
LOAD
TRIM +OUT -OUT
- IN
+ IN
-
+
EXTERNAL OUTPUT TRIMMING
TRIM
+ OUT
TRIM DOWN
TRIM
-OUT
TRIM UP

Typical Weight: 175 Grams

Series NR–Dual Output


2 600
.500
390
040 DIA.
1.075
700
700
+ OUT
C M
- OUT
2 800
2 400
- IN
+ IN
1.000
1 075
2 INSERTS
#4-40 UNC
8 THREADS DEEP
NOTE: ALL RADII TO BE 7/64"
LOAD
LOAD
+ OUT
CM
- OUT
- IN
+ IN
-
+

Typical Weight: 175 Grams

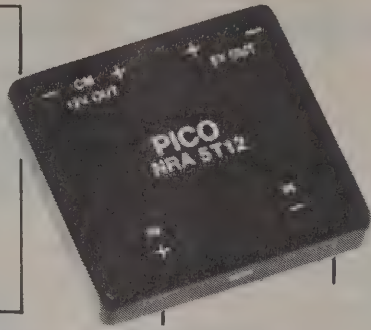
Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

This series of high efficiency wide input range, encapsulated regulators come in 50 different models including 30 Triple Output Models to ease board designs. These units feature a 500 Volt DC input to output isolation in both single, dual and triple output models. The NR Series will operate over an ambient temperature range of −25°C to +70°C with no heat sink or electrical derating. These units are excellent for applications where input voltage varies dramatically, yet a high efficiency and output voltage regulation must be maintained.



SERIES NR

TYPICAL CHARACTERISTICS:
Test conditions: 25°C ambient
Operating temperature: −25°C to +70°C, ambient
Output voltage tolerance: 0.5% main outputs
Output voltage temperature coefficient: 0.01%/°C
Storage temperature: −55°C to 125°C
Short circuit protection: Continuous
Operating frequency: 30 Khtz, typ.

SERIES NR TRIPLE OUTPUT

		MAIN OUTPUT VOLTAGE					AUXILIARY OUTPUT VOLTAGE							
PICO PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE DC OUTPUT	MAX. LOAD CURRENT mA OUTPUT	MAX. OUTPUT POWER (watts) OUTPUT	V LD. REG. 25%–100% LOAD (±%)*	OUT VOLT RIPPLE @ FULL LD. 1-1MHz BW mv p-p	OUTPUT VOLTAGE DC PER OUTPUT	MAX. LOAD CURRENT mA PER OUTPUT	MAX. OUTPUT POWER (watts) PER OUTPUT	VOLT. LOAD REG. 25%-100% LOAD ‡ (±%)*	OUT VOLT RIPPLE @ FULL LD. 1-1 MHz BW mv p-p	EFF. @ FULL LOAD TYPICAL (%)*	INPUT CURRENT FULL LOAD TYPICAL (mA)*	PRICE 1-24
NRA5T12	18–36	5	3000	15	0.2	50	±12	208	2.5	5	50	78	1068	360.00
NRA5T15	18–36	5	3000	15	0.2	50	±15	167	2.5	5	50	78	1068	360.00
NRA9T5	18–36	9	2220	20	0.2	50	± 5	500	2.5	5	50	80	1302	360.00
NRA9T12	18–36	9	2220	20	0.2	50	±12	208	2.5	5	50	80	1302	360.00
NRA9T15	18–36	9	2220	20	0.2	50	±15	167	2.5	5	50	80	1302	360.00
NRA12T5	18–36	12	1660	20	0.2	50	± 5	500	2.5	5	50	81	1286	360.00
NRA12T15	18–36	12	1660	20	0.2	50	±15	167	2.5	5	50	81	1286	360.00
NRA15T5	18–36	15	1330	20	0.2	50	± 5	500	2.5	5	50	83	1255	360.00
NRA15T12	18–36	15	1330	20	0.2	50	±12	208	2.5	5	50	83	1255	360.00
NRA24T5	18–36	24	830	20	0.2	50	± 5	500	2.5	5	50	84	1240	360.00
NRA24T12	18–36	24	830	20	0.2	50	±12	208	2.5	5	50	84	1240	360.00
NRA24T15	18–36	24	830	20	0.2	50	±15	167	2.5	5	50	84	1240	360.00
NRA28T5	18–36	28	714	20	0.2	50	± 5	500	2.5	5	50	85	1225	360.00
NRA28T12	18–36	28	714	20	0.2	50	±12	208	2.5	5	50	85	1225	360.00
NRA28T15	18–36	28	714	20	0.2	50	±15	167	2.5	5	50	85	1225	360.00
NRB5T12	36–72	5	3400	17	0.2	50	±12	208	2.5	5	50	78	588	389.00
NRB5T15	36–72	5	3400	17	0.2	50	±15	167	2.5	5	50	78	588	389.00
NRB9T5	36–72	9	2220	20	0.2	50	± 5	500	2.5	5	50	80	651	389.00
NRB9T12	36–72	9	2220	20	0.2	50	±12	208	2.5	5	50	80	651	389.00
NRB9T15	36–72	9	2220	20	0.2	50	±15	167	2.5	5	50	80	651	389.00
NRB12T5	36–72	12	1660	20	0.2	50	± 5	500	2.5	5	50	84	620	389.00
NRB12T15	36–72	12	1660	20	0.2	50	±15	167	2.5	5	50	84	620	389.00
NRB15T5	36–72	15	1667	25	0.2	50	± 5	500	2.5	5	50	85	735	389.00
NRB15T12	36–72	15	1667	25	0.2	50	±12	208	2.5	5	50	85	735	389.00
NRB24T5	36–72	24	1042	25	0.2	50	± 5	500	2.5	5	50	86	727	389.00
NRB24T12	36–72	24	1042	25	0.2	50	±12	208	2.5	5	50	86	727	389.00
NRB24T15	36–72	24	1042	25	0.2	50	±15	167	2.5	5	50	86	727	389.00
NRB28T5	36–72	28	893	25	0.2	50	± 5	500	2.5	5	50	87	718	389.00
NRB28T12	36–72	28	893	25	0.2	50	±12	208	2.5	5	50	87	718	389.00
NRB28T15	36–72	28	893	25	0.2	50	±15	167	2.5	5	50	87	718	389.00

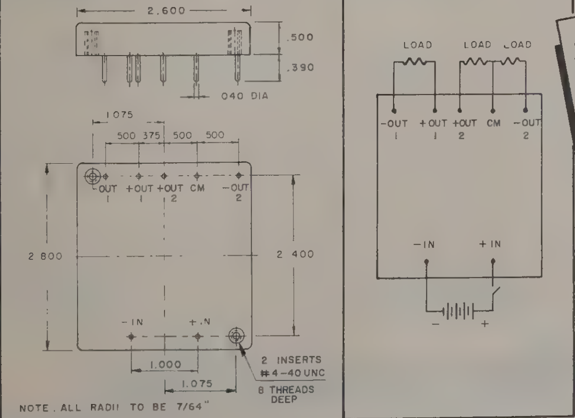
Common Characteristics
Main Output Voltage Tolerance ±0.5%*
Main Line Regulation ±0.2%*

Common Characteristics
Auxiliary Output Voltage Tolerance ±4%*
Auxiliary Line Regulation ±0.2%*

‡ 10% minimum load required.

Measurements taken with input voltage set at mid value.

Series NR–Triple Output



Typical Weight: 175 Grams

OPTIONS AVAILABLE
- *Expanded operating temp (−55°C to +85°C)*
- *Stabilization Bake (125°C ambient)*
- *Temperature Cycle (−55°C to +125°C)*
- *Hi Temp, full power burn in (100% power, 125°C case temp)*

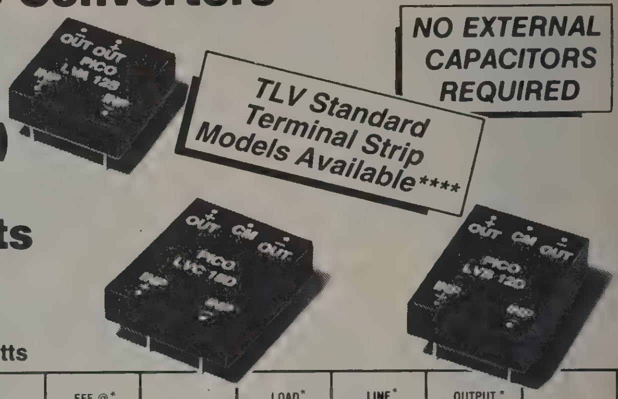
30 Triple Output Models

Delivery— stock to one week

For immediate engineering assistance or to place an order— Call Toll Free 800-228-9747

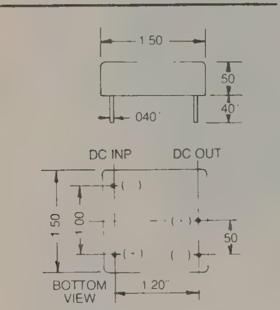
PICO
Electronics, Inc.
453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552
• FAX 914-699-5565

Series LV-Single Output-DC-DC Converters
Hi Reliability
Industrial Grade
Wide Input Voltage (36-80VDC)
Isolated 1000 VDC
Fully Regulated—up to 10 Watts
Short Circuit Protected


OUT OUT
PICO
LVA 120
OUT CM OUT
PICO
LVC 120
OUT CM OUT
PICO
LVB 120

NO EXTERNAL CAPACITORS REQUIRED

TLV Standard Terminal Strip Models Available****

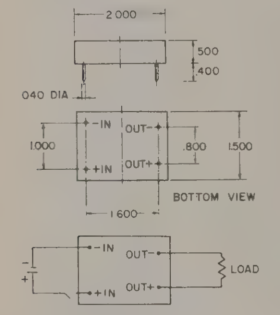

1 50
50
40
040
DC INP
DC OUT
1 50
1 00
50
BOTTOM VIEW
1 20

Series LVA-Single Output-3 Watts

* * * * PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	* * * * PRICE 1-24
LVA5S	5	600	3	64	2	2	1	20	69 00
LVA12S	12	250	3	65	2	2	1	20	69 00
LVA15S	15	200	3	65	2	2	1	15	69 00
LVA24S	24	125	3	66	2	2	1	15	69 00
LVA28S	28	107	3	66	2	2	1	15	69 00
LVA48S	48	62	3	66	2	2	1	15	69 00

*Measurements taken at nominal input voltage.
**10% minimum load required.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

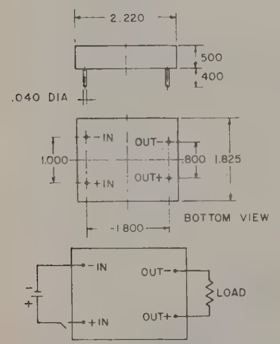

2 000
500
400
040 DIA
1.000
-IN
OUT-
.800
1.500
+IN
OUT+
BOTTOM VIEW
1 600
-IN
OUT-
LOAD
+IN
OUT+

Series LVB-Single Output-5 Watts

* * * * PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE (mv p-p)	* * * * PRICE 1-24
LVB5S	5	1000	5	68	2	2	1	50	79 00
LVB12S	12	415	5	70	2	2	1	25	79 00
LVB15S	15	330	5	70	2	2	1	25	79 00
LVB24S	24	210	5	72	2	2	1	25	79 00
LVB28S	28	175	5	72	2	2	1	25	79 00
LVB48S	48	105	5	74	2	2	1	25	79 00

*Measurements taken at nominal input voltage.
**10% minimum load required.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

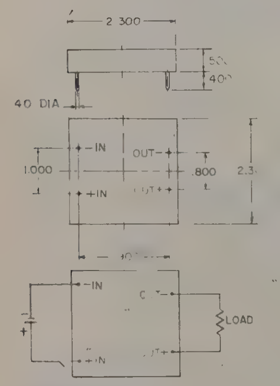

2.220
500
400
.040 DIA
-IN
OUT-
1.000
.800
1.825
+IN
OUT+
BOTTOM VIEW
1 800
-IN
OUT-
LOAD
+IN
OUT+

Series LVC-Single Output 8 Watts

* * * * PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX*** OUTPUT POWER (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE (mv p-p)	* * * * PRICE 1-24
LVC5S	5	1400	7	68	2	2	1	50	89 00
LVC12S	12	666	8	74	2	2	1	25	89 00
LVC15S	15	533	8	74	2	2	1	25	89 00
LVC24S	24	333	8	74	2	2	1	25	89 00
LVC28S	28	285	8	74	2	2	1	25	89 00
LVC48S	48	166	8	74	2	2	1	25	89 00

*Measurements taken at nominal input voltage.
**10% minimum load required.
***Max power at nominal input. At 36 volt input derate by approx 15%

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2 300
50
400
40 DIA
-IN
OUT-
1.000
.800
2.3
+IN
OUT+
-IN
LOAD
+IN

Series LVD-Single Output 10 Watts

* * * * PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX.*** OUTPUT POWER (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE (mv p-p)	* * * * PRICE 1-24
LVD5S	5	1800	9	70	2	2	1	50	99 00
LVD12S	12	833	10	74	2	2	1	25	99 00
LVD15S	15	666	10	74	2	2	1	25	99 00
LVD24S	24	416	10	74	2	2	1	25	99 00
LVD28S	28	357	10	74	2	2	1	25	99 00
LVD48S	48	208	10	74	2	2	1	25	99 00

*Measurements taken at nominal input voltage.
**10% minimum load required.
***Max. power at nominal input. At 36 volt input derate by approx. 15%.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Series LV-Dual Output-DC-DC Converters

.5″ Height

FEATURES:

- Excellent line regulation ±1% (36–80 VDC)
- Excellent load regulation, from 25% to 100%, ±2%
- Continuous short circuit protection
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Isolation: 100 megohms at 1000 VDC
- Wide input 36 VDC to 80 VDC

PICO's LV Series with wide input voltages are available in 36 different models. As switchers they accommodate a 36 to 80 VDC input, and offer both single and dual, regulated outputs. These isolated units will operate over a temperature range of −25°C to 70°C with no heat sink or electrical derating required. They are excellent for applications where the input voltage is highly variable such as in telecommunication systems.

TLV Standard Terminal Strip Models Available****

TYPICAL CHARACTERISTICS:

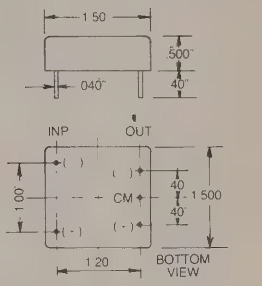
Test conditions: 25°C ambient
Input voltage: 36–80 VDC
Converter frequency: 200 KHz to 1 MHz
Operating temperature: −20°C to +70°C ambient
Storage temperature: −55°C to +105°C
Output voltage temperature coefficient: 0.02%/°C
Isolation: 1000 VDC

Series LVA-Dual Output-3 Watts

**** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	**** PRICE 1-24
LVA5D	±5	300	1.5	60	2	2	1	25	82.00
LVA12D	±12	125	1.5	65	2	2	1	25	82.00
LVA15D	±15	100	1.5	67	2	2	1	25	82.00

*Measurements taken at nominal input voltage.
**10% minimum load required

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

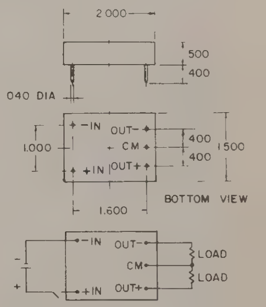


Series LVB-Dual Output-5 Watts

**** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX OUTPUT POWER PER OUT (watts)	EFF @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE (mv p-p)	**** PRICE 1-24
LVB5D	±5	500	2.5	68	2	2	1	50	92.00
LVB12D	±12	200	2.5	70	2	2	1	25	92.00
LVB15D	±15	165	2.5	70	2	2	1	25	92.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

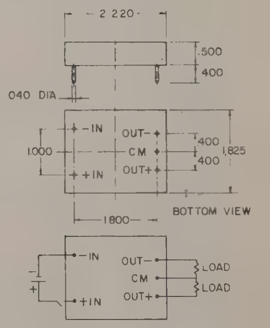


Series LVC-Dual Output 8 Watts

**** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX.*** LOAD CURRENT PER OUT. (mA)	MAX OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	**** PRICE 1-24
LVC5D	±5	700	3.5	68	2	2	1	50	102.00
LVC12D	±12	333	4	74	2	2	1	25	102.00
LVC15D	±15	266	4	74	2	2	1	25	102.00

*Measurements taken at nominal input voltage.
**10% minimum load required.
***Max. power at nominal input. At 36 volt input derate by approx. 15%.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

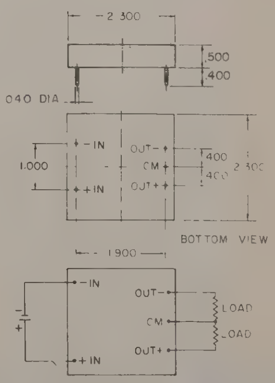


Series LVD-Dual Output 10 Watts

**** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX*** LOAD CURRENT PER OUT. (mA)	MAX OUTPUT POWER PER OUT (watts)	EFF @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)**	LINE* REGULATION @ FULL LOAD (± %)	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	**** PRICE 1-24
LVD5D	5	900	4.5	70	2	2	1	50	112.00
LVD12D	12	415	5	74	2	2	1	25	112.00
LVD15D	15	333	5	74	2	2	1	25	112.00

*Measurements taken at nominal input voltage.
**10% minimum load required.
***Max. power at nominal input. At 36 volt input derate by approx. 15%.

****For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown



PICO Electronics, Inc.

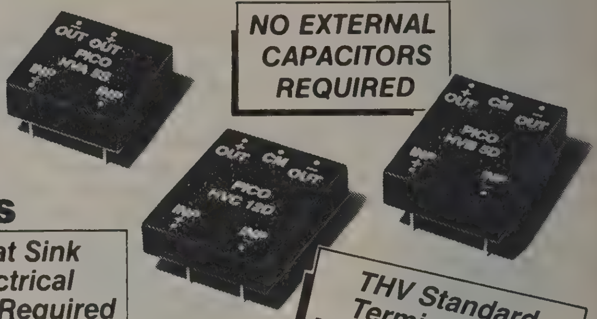
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Series HV-Single Output-DC-DC Converters

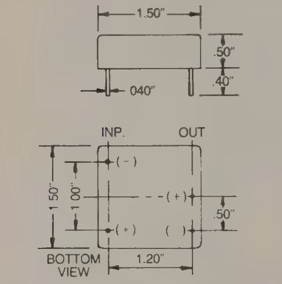
Hi Reliability
Industrial Grade
Hi Input Voltage (70–170 VDC)
Isolated 1000 VDC
Fully Regulated—up to 15 Watts
Short Circuit Protected

No Heat Sink or Electrical Derating Required

NO EXTERNAL CAPACITORS REQUIRED


OUT
OUT
PICO
HVA 5S
INP
INP
OUT
CM
OUT
PICO
HVC 12D
INP
OUT
CM
OUT
PICO
HVB 5D
INP

*THV Standard Terminal Strip Models Available****

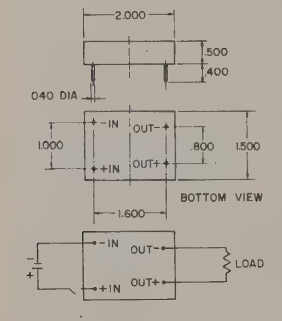

1.50"
.50"
.40"
.040"
INP.
OUT
(-)
(+)
(+)
( )
1.50"
1.00"
.50"
1.20"
BOTTOM VIEW

Series HVA-Single Output-3 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (± %)	LOAD * REGULATION 25%-100% LOAD (± %)	LINE * REGULATION @ FULL LOAD (± %) **	OUTPUT * VOLTAGE RIPPLE (mv p-p)	*** PRICE 1-24
HVA5S	5	600	3	65	2	2	0.5	50	69.00
HVA12S	12	250	3	67	2	2	0.5	25	69.00
HVA15S	15	200	3	67	2	2	0.5	25	69.00
HVA24S	24	125	3	68	2	2	0.5	25	69.00
HVA28S	28	105	3	68	2	2	0.5	25	69.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2.000
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.400
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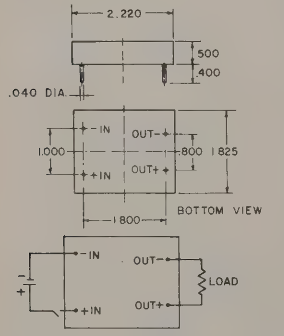
-IN
OUT-
+IN
OUT+
1.000
.800
1.500
BOTTOM VIEW
1.600
-IN
OUT-
+IN
OUT+
LOAD
-
+

Series HVB-Single Output-5 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (± %)	LOAD * REGULATION 25%-100% LOAD (± %)	LINE * REGULATION @ FULL LOAD (± %) **	OUTPUT * VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVB5S	5	600	5	70	2	2	1	50	79.00
HVB12S	12	415	5	73	2	2	1	25	79.00
HVB15S	15	330	5	73	2	2	1	25	79.00
HVB24S	24	200	5	74	2	2	1	25	79.00
HVB28S	28	175	5	74	2	2	1	25	79.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2.220
.500
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.040 DIA.
-IN
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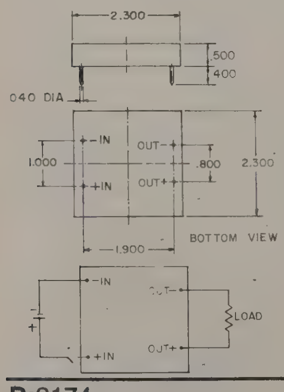
1.000
.800
1.825
BOTTOM VIEW
1.800
-IN
OUT-
+IN
OUT+
LOAD
-
+

Series HVC-Single Output-10 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (± %)	LOAD * REGULATION 25%-100% LOAD (± %)	LINE * REGULATION @ FULL LOAD (± %) **	OUTPUT * VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVC5S	5	1600	8	69	2	2	1	50	89.00
HVC12S	12	830	10	75	2	2	1	25	89.00
HVC15S	15	660	10	77	2	2	1	25	89.00
HVC24S	24	415	10	77	2	2	1	25	89.00
HVC28S	28	355	10	77	2	2	1	25	89.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown


2.300
.500
.400
.040 DIA
-IN
OUT-
+IN
OUT+
1.000
.800
2.300
BOTTOM VIEW
1.900
-IN
OUT-
+IN
OUT+
LOAD
-
+

Series HVD-Single Output-15 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT (mA)	MAX OUTPUT POWER (watts)	EFF. @ * FULL LOAD TYPICAL (%)	OUTPUT * VOLTAGE TOLERANCE (± %)	LOAD * REGULATION 25%-100% LOAD (± %)	LINE * REGULATION @ FULL LOAD (± %) **	OUTPUT * VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVD5S	5	2000	10	70	2	2	1	50	99.00
HVD12S	12	1250	15	75	2	2	1	25	99.00
HVD15S	15	1000	15	76	2	2	1	25	99.00
HVD24S	24	625	15	76	2	2	1	25	99.00
HVD28S	28	535	15	76	2	2	1	25	99.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Series HV-Dual Output-DC-DC Converters

.5" Height

FEATURES:

- Excellent line regulation ±1% (70 VDC–170 VDC)
- Excellent load regulation, from 25% to 100%, ±2%
- Continuous short circuit protection
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Isolation: 100 megohms at 1000 VDC
- Wide input 70 VDC to 170 VDC

PICO's HV Series with wide input voltages are available in 32 different models. As switchers they accommodate a 70 to 170 VDC input, and offer both single and dual, regulated outputs. These isolated units will operate over a temperature range of −25°C to +70°C with no heat sink or electrical derating required. They are excellent for applications where a rectified output from a 110 VAC source is available.

THV Standard Terminal Strip Models Available***

TYPICAL CHARACTERISTICS

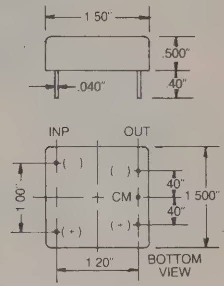
Test conditions: 25°C ambient
Input voltage: 70–170 VDC
Converter frequency: 200 KHz to 1 MHz
Operating temperature: −20°C to +70°C ambient
Storage temperature: −55°C to +105°C
Output voltage temperature coefficient: 0.02%/°C
Isolation: 1000 VDC

Series HVA-Dual Output-3 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX. OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)	LINE* REGULATION @ FULL LOAD (± %)**	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVA5D	±5	300	1.5	63	2	2	1	50	82.00
HVA12D	±12	125	1.5	65	2	2	1	25	82.00
HVA15D	±15	100	1.5	67	2	2	1	25	82.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

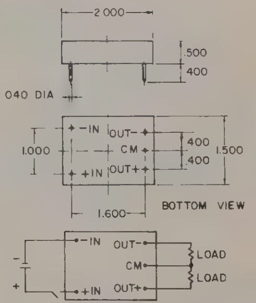


Series HVB-Dual Output-5 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX. OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)	LINE* REGULATION @ FULL LOAD (± %)**	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVB5D	±5	500	2.5	70	2	2	1	50	92.00
HVB12D	±12	200	2.5	73	2	2	1	25	92.00
HVB15D	±15	165	2.5	73	2	2	1	25	92.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

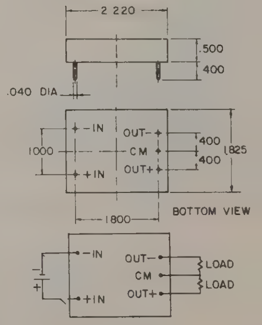


Series HVC-Dual Output-10 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX. OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)	LINE* REGULATION @ FULL LOAD (± %)**	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVC5D	±5	800	4	68	2	2	1	50	102.00
HVC12D	±12	415	5	75	2	2	1	25	102.00
HVC15D	±15	335	5	76	2	2	1	25	102.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown

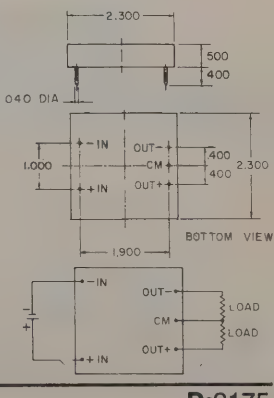


Series HVD-Dual Output-15 Watts

*** PICO PART NUMBER	OUTPUT VOLTAGE (V DC)	MAX. LOAD CURRENT PER OUT. (mA)	MAX. OUTPUT POWER PER OUT. (watts)	EFF. @* FULL LOAD TYPICAL (%)	OUTPUT* VOLTAGE TOLERANCE (± %)	LOAD* REGULATION 25%-100% LOAD (± %)	LINE* REGULATION @ FULL LOAD (± %)**	OUTPUT* VOLTAGE RIPPLE TYPICAL (mv p-p)	*** PRICE 1-24
HVD5D	±5	1000	5	69	2	5	1	50	112.00
HVD12D	±12	625	7.5	75	2	2	1	25	112.00
HVD15D	±15	500	7.5	76	2	2	1	25	112.00

*Measurements taken at nominal input voltage.
**10% minimum load required.

***For terminal strip models begin Part Number with letter T. Add $15.00 to prices shown



For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SERIES PA

Isolated Regulated 100 Watts DC-DC Converters
Wide Input Range/18-36 VDC
Fully Regulated
Short Circuit Protected
‡Parallel Operation

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

100 VDC Output Models

Fixed Frequency

Hi Density 100 Watts
2.4″×4.6″×0.5″ Ht.

The new PICO PA Series of high power DC-DC Converters, allow a wide input voltage of 18-36 VDC, while maintaining a regulated output. They are fully safeguarded for over voltage, over temperature and continuous short circuit protection.

The availability of Dual Isolated Outputs, small size, and the capability of parallel operations as standard features should reduce your design and component costs, while the fixed frequency operation helps parallel connections for higher power requirements.

This high density unit is assembled *in the USA* with PICO quality and component selection, allowing it to meet the most stringent commercial requirements.

SERIES PA SINGLE • 100 WATTS • INPUT 18–36 VDC

‡PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION (%) **		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	18–28V	28–36V			
PA3.3S	18–36	3.3	50	74	2.00	2.00	1.50	1.50	50	2.0	104.00
PA5S	18–36	5	75	76	2.00	2.00	1.50	1.50	50	2.0	104.00
PA5.2S	18–36	5.2	75	76	2.00	2.00	1.50	1.50	50	2.0	104.00
PA9S	18–36	9	100	81	1.50	1.50	1.25	1.25	50	1.5	104.00
PA12S	18–36	12	100	83	1.25	1.25	1.00	1.00	50	1.0	104.00
PA15S	18–36	15	100	84	1.00	1.00	0.75	0.75	50	1.0	104.00
PA24S	18–36	24	100	86	0.75	0.75	0.50	0.50	50	1.0	104.00
PA28S	18–36	28	100	86	0.50	0.50	0.50	0.50	50	0.50	104.00
PA48S	18–36	48	100	86	0.50	0.50	0.50	0.50	50	0.50	104.00
PA100S	18–36	100	100	85	0.50	0.50	0.50	0.50	50	0.50	104.00

10% Minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 28 VDC input

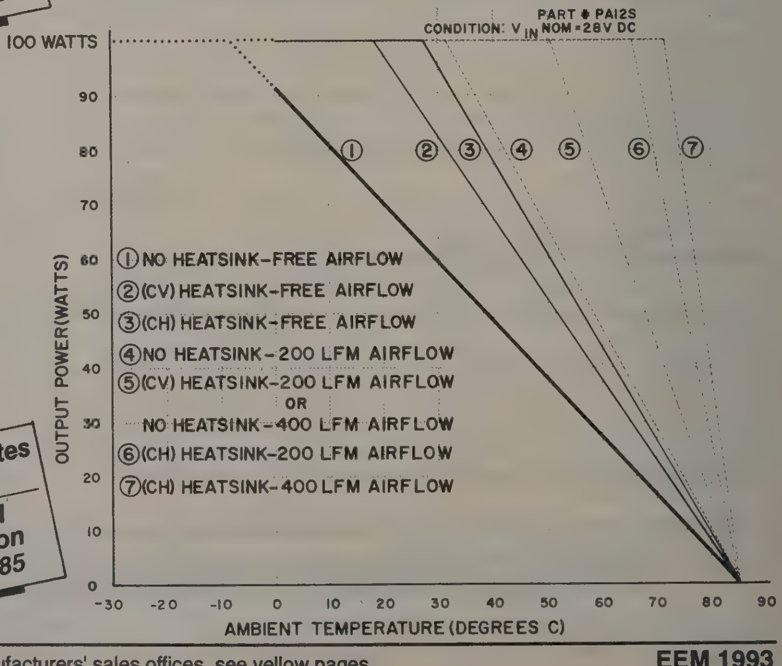
TYPICAL CHARACTERISTICS:

Frequency: 100 Khtz
Base plate: Max. +85°C
Operating Temp.: See thermal chart, Min. 0°C ambient, Max. +85°C base plate temp.
Test conditions: 25° C ambient
Isolation Base Input: 2000 VDC
Isolation Input Output: 2000 VDC
Isolation Output to Base: 1000 VDC
Storage Temp.: –55°C to +105°C

For All Variations Call Factory

‡Parallel Operation
Add Suffix P
ie: PA5SP

Full thermal analysis can be determined using application notes on Page D•2184. By using the efficiency and thermal resistance of your desired unit to the formula you can complete your evaliation.
The curves below were generated for the Part #PA12S using Application Notes on Page D•2184. Please consult factory with any questions.



For immediate engineering assistance
or to place an order—
Call Toll Free 800-228-9747

PICO
Electronics, Inc.

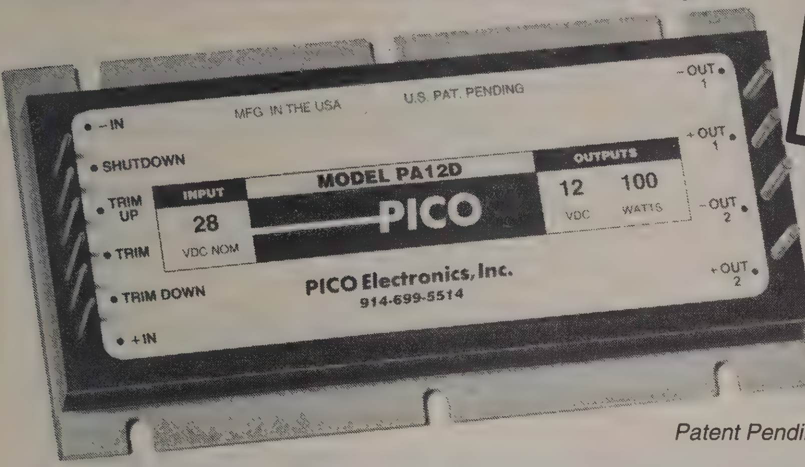
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

Application Notes
Page D•2184
Mechanical Configuration
Page D•2185

Delivery—
stock to one week

DUAL ISOLATED OUTPUTS

SERIES PA



Patent Pending

Dual Isolated Outputs

Special Voltage Combinations Available

17 Standard Models

Meets MIL STD 704 Surge Requirements

Hi Density 100 Watts 2.4″×4.6″×0.5″ Ht.

SERIES PA DUAL • 100 WATTS • INPUT 18–36 VDC

PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION *** (%)		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	18–28V	28–36V			
PA5D	18–36	5	37.5/37.5	76	2.00	2.00	1.50	1.50	50	2.0	149.00
PA9D	18–36	9	50/50	81	1.50	1.50	1.25	1.25	50	1.5	149.00
PA12D	18–36	12	50/50	83	1.25	1.25	1.00	1.00	50	1.0	149.00
PA15D	18–36	15	50/50	84	1.00	1.00	0.75	0.75	50	1.0	149.00
PA24D	18–36	24	50/50	85	0.75	0.75	0.50	0.50	50	1.0	149.00
PA28D	18–36	28	50/50	86	0.50	0.50	0.50	0.50	50	0.50	149.00
PA48D	18–36	48	50/50	86	0.50	0.50	0.50	0.50	50	0.50	149.00

10% minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 28 VDC input
*** Balance Load

FEATURES:
- Dual isolated outputs
- Short circuit protection
- Input voltage protection
- Thermal, over temp. shutdown
- Line regulation
- Load regulation
- No external components required
- Hi density, hi efficiency design
- Remote shutdown
- Trim capabilities
- Fixed frequency-100 Khtz

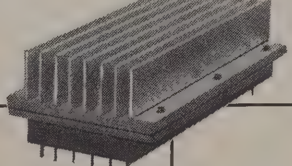
Special Output Voltages Available-Mix or Match-2 Weeks Delivery

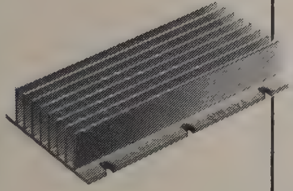
Because of Pico's unique design, there is no problem manufacturing ***special*** Output Voltages to maximize our unit to your application. Call the factory with your voltage and power requirements and receive price and delivery information immediately. ***800-228-9747***

Application Notes
Page D•2184

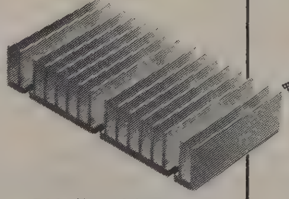
Mechanical Configuration
Page D•2185

HEAT SINKS



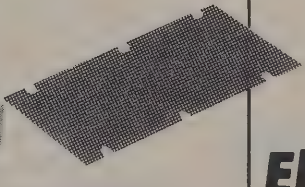


CV: Provides Vertical Cooling Fins



CH: Provides Horizontal Cooling Fins

$12.50 each. Mechanical drawing page 132



Converter to Heat Sink Thermal Interface

Part # TI:
$1.50 each

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO
Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery— stock to one week

SERIES PB

Isolated Regulated 100 Watts
DC-DC Converters
Wide Input Range/36–72 VDC
Fully Regulated
Short Circuit Protected
‡Parallel Operation

The new PICO PB Series of high power DC-DC Converters allow a wide input voltage of 36–72 VDC while maintaining a regulated output. They are fully safeguarded for over voltage, over temperature and continuous short circuit protection.

The availability of Dual Isolated Outputs, small size, and the capability of parallel operations as standard features should reduce your design and component costs, while the fixed frequency operation helps parallel connections for higher power requirements.

This high density unit is assembled *in the USA* with PICO quality and component selection, allowing it to meet the most stringent commercial requirements.

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

100 VDC Output Models

Fixed Frequency

Hi Density 100 Watts
2.4″×4.6″×0.5″ Ht.

SERIES PB SINGLE • 100 WATTS • INPUT 36–72 VDC

‡PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION (%) ** 10–50%	MAX. LOAD REGULATION (%) ** 50–100%	MAX. LINE REGULATION AT FULL LOAD (%) 36-48V	MAX. LINE REGULATION AT FULL LOAD (%) 48-72V	OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
PB3.3S	36-72	3.3	50	76	1.50	1.50	0.75	0.75	50	2.0	104.00
PB5S	36-72	5	75	78	1.00	1.00	0.75	0.75	50	1.5	104.00
PB5.2S	36-72	5.2	75	78	1.00	1.00	0.75	0.75	50	1.5	104.00
PB9S	36-72	9	100	82	1.00	1.00	0.75	0.75	50	1.0	104.00
PB12S	36-72	12	100	84	0.75	0.75	0.50	0.50	50	1.0	104.00
PB15S	36-72	15	100	85	0.75	0.75	0.50	0.50	50	1.0	104.00
PB24S	36-72	24	100	87	0.50	0.50	0.50	0.50	50	0.5	104.00
PB28S	36-72	28	100	87	0.50	0.50	0.50	0.50	50	0.5	104.00
PB48S	36-72	48	100	88	0.50	0.50	0.50	0.50	50	0.5	104.00
PB100S	36-72	100	100	87	0.50	0.50	0.50	0.50	50	0.5	104.00

10% Minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 48 VDC input

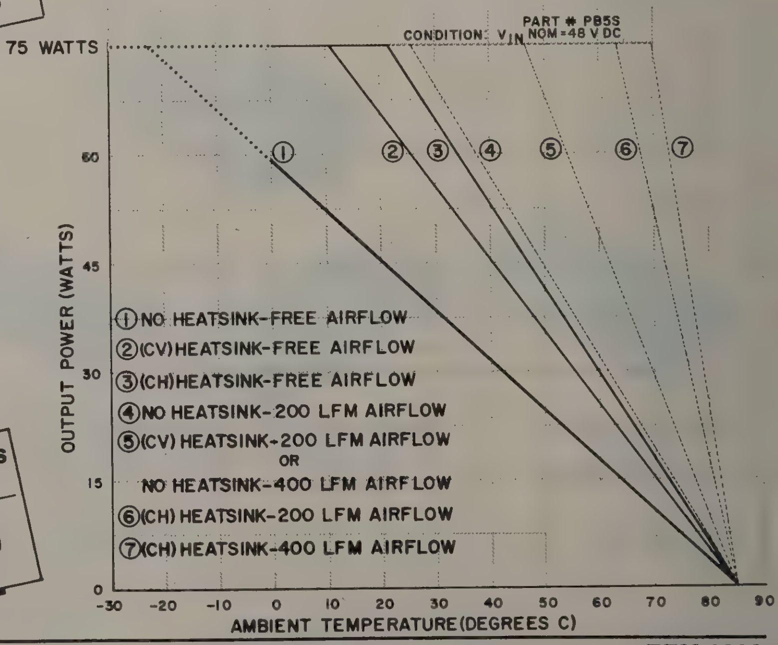
TYPICAL CHARACTERISTICS:

Frequency: 100 Khtz
Base plate: Max. +85°C
Operating Temp.: See thermal chart, Min. 0°C ambient, Max. +85°C base plate temp.
Test conditions: 25° C ambient
Isolation Base Input: 2000 VDC
Isolation Input Output: 2000 VDC
Isolation Output to Base: 1000 VDC
Storage Temp.: −55°C to +105°C

For All Variations Call Factory

‡Parallel Operation
Add Suffix P
ie: PB5SP

Full thermal analysis can be determined using application notes on Page D•2184. By using the efficiency and thermal resistance of your desired unit to the formula you can complete your evaliation.
The curves below were generated for the Part #PA12S using Application Notes on Page D•2184. Please consult factory with any questions.



For immediate engineering assistance
or to place an order—
Call Toll Free 800-228-9747

PICO
Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

Application Notes Page D•2184
Mechanical Configuration Page D•2185

Delivery—stock to one week

DUAL ISOLATED OUTPUTS

SERIES PB

– IN
SHUTDOWN
TRIM UP
TRIM
TRIM DOWN
+ IN
MFG. IN THE USA
U.S. PAT. PENDING
MODEL PB12D
INPUT
48
VDC NOM
PICO
OUTPUTS
12
VDC
100
WATTS
PICO Electronics, Inc.
914-699-5514
– OUT 1
+ OUT 1
– OUT 2
+ OUT 2

Patent Pending

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

Hi Density
100 Watts
2.4″×4.6″×0.5″ Ht.

SERIES PB DUAL • 100 WATTS • INPUT 36–72 VDC

PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION *** (%)		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	36-48V	48-72V			
PB5D	36-72	5	37.5/37.5	78	1.00	1.00	0.75	0.75	50	1.5	149.00
PB9D	36-72	9	50/50	82	1.00	1.00	0.75	0.75	50	1.0	149.00
PB12D	36-72	12	50/50	84	0.75	0.75	0.50	0.50	50	1.0	149.00
PB15D	36-72	15	50/50	85	0.75	0.75	0.50	0.50	50	1.0	149.00
PB24D	36-72	24	50/50	87	0.50	0.50	0.50	0.50	50	0.5	149.00
PB28D	36-72	28	50/50	87	0.50	0.50	0.50	0.50	50	0.5	149.00
PB48D	36-72	48	50/50	88	0.50	0.50	0.50	0.50	50	0.5	149.00

10% minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 48 VDC input
*** Balance Load

FEATURES:
- Dual isolated outputs
- Short circuit protection
- Input voltage protection
- Thermal, over temp. shutdown
- Line regulation
- Load regulation
- No external components required
- Hi density, hi efficiency design
- Remote shutdown
- Trim capabilities
- Fixed frequency-100 Khtz

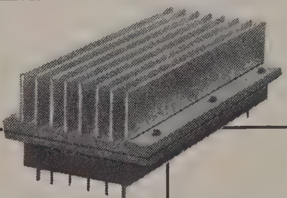
Special Output Voltages Available-Mix or Match-2 Weeks Delivery

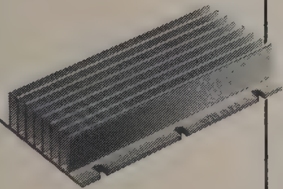
Because of Pico's unique design, there is no problem manufacturing ***special*** Output Voltages to maximize our unit to your application. Call the factory with your voltage and power requirements and receive price and delivery information immediately. ***800-228-9747***

Application Notes
Page D•2184

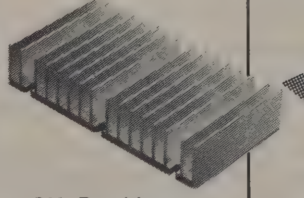
Mechanical Configuration
Page D•2185

HEAT SINKS



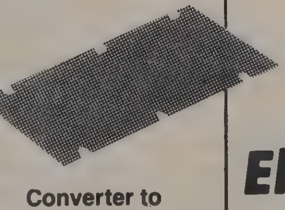


CV: Provides
Vertical
Cooling Fins



CH: Provides
Horizontal
Cooling Fins

$12.50 each. Mechanical drawing page 132



Converter to Heat Sink Thermal Interface

Part # TI:
$1.50 each

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

PICO
Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery—
stock to one week

SERIES PC

Isolated Regulated 100 Watts DC-DC Converters
Wide Input Range/100-180 VDC
Fully Regulated
Short Circuit Protected
‡Parallel Operation

The new PICO PC Series of high power DC-DC Converters allow a wide input voltage of 100–180 VDC while maintaining a regulated output. They are fully safeguarded for over voltage, over temperature and continuous short circuit protection.

The availability of Dual Isolated Outputs, small size, and the capability of parallel operations as standard features should reduce your design and component costs, while the fixed frequency operation helps parallel connections for higher power requirements.

This high density unit is assembled *in the USA* with PICO quality and component selection, allowing it to meet the most stringent commercial requirements.

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

100 VDC Output Models

Fixed Frequency

Hi Density 100 Watts 2.4″×4.6″×0.5″ Ht.

SERIES PC SINGLE • 100 WATTS • INPUT 100–180 VDC

‡PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION (%) **		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1-1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	100-150V	150-180V			
PC3.3S	100-180	3.3	50	76	1.00	1.00	0.75	0.75	50	2.0	104.00
PC5S	100-180	5	75	78	1.00	1.00	0.75	0.75	50	1.5	104.00
PC5.2S	100-180	5.2	75	78	1.00	1.00	0.75	0.75	50	1.5	104.00
PC9S	100-180	9	100	84	0.75	0.75	0.50	0.50	50	1.0	104.00
PC12S	100-180	12	100	86	0.75	0.75	0.50	0.50	50	1.0	104.00
PC15S	100-180	15	100	87	0.75	0.75	0.50	0.50	50	1.0	104.00
PC24S	100-180	24	100	88	0.50	0.50	0.30	0.30	50	0.5	104.00
PC28S	100-180	28	100	88	0.50	0.50	0.20	0.20	50	0.5	104.00
PC48S	100-180	48	100	88	0.50	0.50	0.20	0.20	50	0.5	104.00
PC100S	100-180	100	100	87	0.50	0.50	0.30	0.30	50	0.5	104.00

10% Minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 150 VDC input

TYPICAL CHARACTERISTICS:

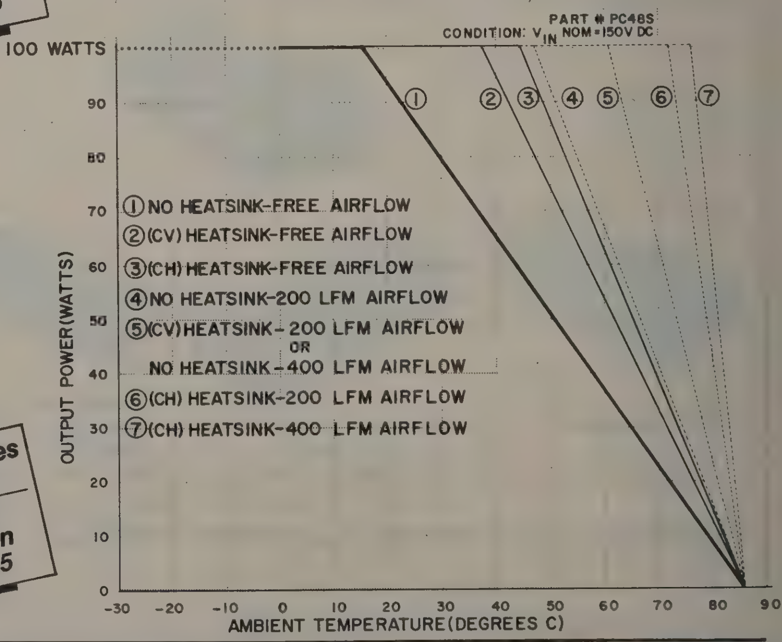
Frequency: 100 Khtz
Base plate: Max. +85°C
Operating Temp.: See thermal chart, Min. 0°C ambient, Max. +85°C base plate temp.
Test conditions: 25° C ambient
Isolation Base Input: 2000 VDC
Isolation Input Output: 2000 VDC
Isolation Output to Base: 1000 VDC
Storage Temp.: −55°C to +105°C

For All Variations Call Factory

‡Parallel Operation
Add Suffix P
ie: PC5SP

Full thermal analysis can be determined using application notes on Page D•2184. By using the efficiency and thermal resistance of your desired unit to the formula you can complete your evaliation.

The curves below were generated for the Part #PA12S using Application Notes on Page D•2184. Please consult factory with any questions.



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or to place an order—
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PICO
Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

Delivery— stock to one week

Application Notes Page D•2184
Mechanical Configuration Page D•2185

DUAL ISOLATED OUTPUTS

SERIES PC

Dual Isolated Outputs

Special Voltage Combinations Available

17 Standard Models

Hi Density 100 Watts 2.4"×4.6"×0.5" Ht.

– IN
SHUTDOWN
TRIM UP
TRIM
TRIM DOWN
+ IN
MFG IN THE USA
U.S. PAT PENDING
MODEL PC12D
INPUT
150
VDC NOM
PICO
OUTPUTS
12
VDC
100
WATTS
PICO Electronics, Inc.
914-699-5514
– OUT 1
+ OUT 1
– OUT 2
+ OUT 2

Patent Pending

SERIES PC DUAL • 100 WATTS • INPUT 100–180 VDC

PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION *** (%)		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	100-150V	150-180V			
PC5D	100-180	5	37.5/37.5	78	1.00	1.00	0.75	0.75	50	1.5	149.00
PC9D	100-180	9	50/50	84	0.75	0.75	0.50	0.50	50	1.0	149.00
PC12D	100-180	12	50/50	86	0.75	0.75	0.50	0.50	50	1.0	149.00
PC15D	100-180	15	50/50	87	0.75	0.75	0.50	0.50	50	1.0	149.00
PC24D	100-180	24	50/50	88	0.50	0.50	0.30	0.30	50	0.5	149.00
PC28D	100-180	28	50/50	88	0.50	0.50	0.20	0.20	50	0.5	149.00
PC48D	100-180	48	50/50	88	0.50	0.50	0.20	0.20	50	0.5	149.00

10% minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 150 VDC input
*** Balance Load

FEATURES:
- Dual isolated outputs
- Short circuit protection
- Input voltage protection
- Thermal, over temp. shutdown
- Line regulation
- Load regulation
- No external components required
- Hi density, hi efficiency design
- Remote shutdown
- Trim capabilities
- Fixed frequency-100 Khtz

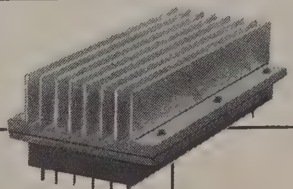
Special Output Voltages Available-Mix or Match-2 Weeks Delivery

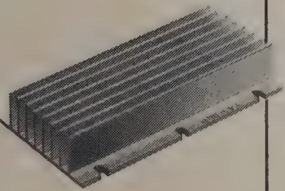
Because of Pico's unique design, there is no problem manufacturing ***special*** Output Voltages to maximize our unit to your application. Call the factory with your voltage and power requirements and receive price and delivery information immediately. ***800-228-9747***

Application Notes
Page D•2184

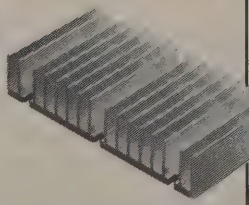
Mechanical Configuration
Page D•2185

HEAT SINKS



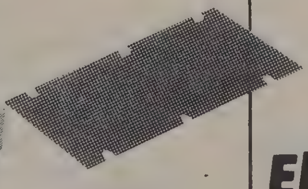


CV: Provides
Vertical
Cooling Fins



CH: Provides
Horizontal
Cooling Fins

$12.50 each. Mechanical drawing page 132



Converter to Heat Sink Thermal Interface

Part # TI:
$1.50 each

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

PICO
Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery—stock to one week

SERIES PD

Isolated Regulated 100 Watts DC-DC Converters
Wide Input Range/200-380 VDC
Fully Regulated
Short Circuit Protected
‡Parallel Operation

The new PD Series of high power DC-DC Converters allow a wide input voltage of 200–380 VDC while maintaining a regulated output. They are fully safeguarded for over voltage, over temperature and continuous short circuit protection.

The availability of Dual Isolated Outputs, small size, and the capability of parallel operations as standard features should reduce your design and component costs, while the fixed frequency operation helps parallel connections for higher power requirements.

This high density unit is assembled *in the USA* with PICO quality and component selection, allowing it to meet the most stringent commercial requirements.

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

100 VDC Output Models

Fixed Frequency

Hi Density 100 Watts
2.4″×4.6″×0.5″ Ht.

SERIES PD SINGLE • 100 WATTS • INPUT 200–380 VDC

‡PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION (%) ** 10–50%	MAX. LOAD REGULATION (%) ** 50–100%	MAX. LINE REGULATION AT FULL LOAD (%) 200-300V	MAX. LINE REGULATION AT FULL LOAD (%) 300-380V	OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
PD3.3S	200-380	3.3	50	76	1.50	1.50	1.25	1.25	50	2.0	104.00
PD5S	200-380	5	75	78	1.25	1.25	1.00	1.00	50	1.5	104.00
PD5.2S	200-380	5.2	75	78	1.25	1.25	1.00	1.00	50	1.5	104.00
PD9S	200-380	9	100	84	1.25	1.25	1.00	1.00	50	1.0	104.00
PD12S	200-380	12	100	85	1.00	1.00	0.75	0.75	50	1.0	104.00
PD15S	200-380	15	100	86	1.00	1.00	0.75	0.75	50	1.0	104.00
PD24S	200-380	24	100	87	0.75	0.75	0.50	0.50	50	0.5	104.00
PD28S	200-380	28	100	87	0.50	0.50	0.50	0.50	50	0.5	104.00
PD48S	200-380	48	100	88	0.50	0.50	0.20	0.20	50	0.5	104.00
PD100S	200-380	100	100	88	0.50	0.50	0.20	0.20	50	0.5	104.00

10% Minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 300 VDC input

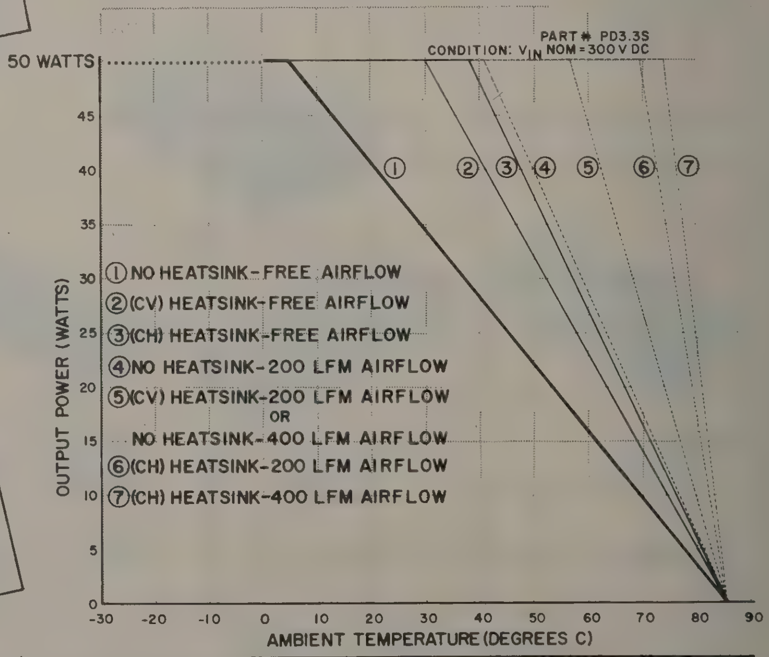
TYPICAL CHARACTERISTICS:

Frequency: 100 Khtz
Base plate: Max. +85°C
Operating Temp.: See thermal chart, Min. 0°C ambient, Max. +85°C base plate temp.
Test conditions: 25° C ambient
Isolation Base Input: 2000 VDC
Isolation Input Output: 2000 VDC
Isolation Output to Base: 1000 VDC
Storage Temp.: −55°C to +105°C

For All Variations Call Factory

‡Parallel Operation
Add Suffix P
ie: PD5SP

Full thermal analysis can be determined using application notes on Page D•2184. By using the efficiency and thermal resistance of your desired unit to the formula you can complete your evaliation.
The curves below were generated for the Part #PA12S using Application Notes on Page D•2184. Please consult factory with any questions.



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or to place an order—
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PICO
Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

Application Notes Page D•2184
Mechanical Configuration Page D•2185

Delivery— stock to one week

DUAL ISOLATED OUTPUTS

SERIES PD

– IN
SHUTDOWN
TRIM UP
TRIM
TRIM DOWN
+IN
MFG. IN THE USA
U.S. PAT. PENDING
INPUT
300
VDC NOM
MODEL PD12D
PICO
OUTPUTS
12
VDC
100
WATTS
PICO Electronics, Inc.
914-699-5514
– OUT 1
+OUT 1
– OUT 2
+OUT 2

Patent Pending

Dual Isolated Outputs
Special Voltage Combinations Available

17 Standard Models

Hi Density
100 Watts
2.4″×4.6″×0.5″ Ht.

SERIES PD DUAL • 100 WATTS • INPUT 200–380 VDC

PICO PART NUMBER	INPUT VOLTAGE RANGE (V DC)	OUTPUT VOLTAGE (V DC)	MAX. OUTPUT POWER * (W)	EFF. FULL LOAD TYPICAL ** (%)	MAX. LOAD REGULATION *** (%)		MAX. LINE REGULATION AT FULL LOAD (%)		OUTPUT VOLTAGE RIPPLE (FULL LOAD) 1–1MHz BW (MV P-P)	OUTPUT VOLTAGE TOLERANCE ** (±%)	PRICE
					10–50%	50–100%	200-300V	300-380V			
PD5D	200-380	5	37.5/37.5	78	1.25	1.25	1.00	1.00	50	1.5	149.00
PD9D	200-380	9	50/50	84	1.25	1.25	1.00	1.00	50	1.0	149.00
PD12D	200-380	12	50/50	85	1.00	1.00	0.75	0.75	50	1.0	149.00
PD15D	200-380	15	50/50	86	1.00	1.00	0.75	0.75	50	1.0	149.00
PD24D	200-380	24	50/50	87	0.75	0.75	0.50	0.50	50	0.5	149.00
PD28D	200-380	28	50/50	87	0.50	0.50	0.50	0.50	50	0.5	149.00
PD48D	200-380	48	50/50	88	0.50	0.50	0.20	0.20	50	0.5	149.00

10% minimum load required at all times
* Using proper thermal management, maximum temp. of +85°C (case)
** Reading taken at nominal 300 VDC input
*** Balance Load

FEATURES:

- Dual isolated outputs
- Short circuit protection
- Input voltage protection
- Thermal, over temp. shutdown
- Line regulation
- Load regulation
- No external components required
- Hi density, hi efficiency design
- Remote shutdown
- Trim capabilities
- Fixed frequency-100 Khtz

Special Output Voltages Available-Mix or Match-2 Weeks Delivery

Because of Pico's unique design, there is no problem manufacturing ***special*** Output Voltages to maximize our unit to your application. Call the factory with your voltage and power requirements and receive price and delivery information immediately. ***800-228-9747***

Application Notes
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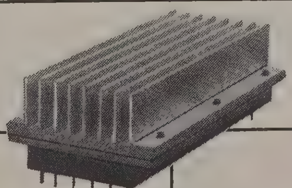
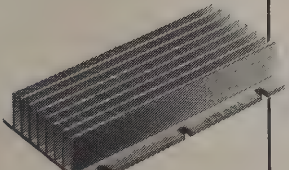
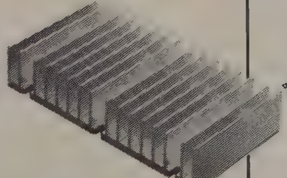
Mechanical Configuration
Page D•2185

HEAT SINKS



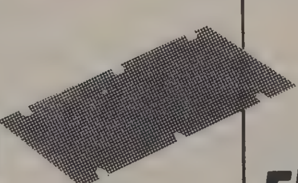


CV: Provides Vertical Cooling Fins



CH: Provides Horizontal Cooling Fins

$12.50 each. Mechanical drawing page 132



Converter to Heat Sink Thermal Interface

Part # TI:
$1.50 each

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

PICO
Electronics, Inc.

453 North MacQuesten Pkwy.,
Mt. Vernon, New York 10552
• FAX 914-699-5565

Delivery—
stock to one week

APPLICATION NOTES

PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.,
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

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THERMAL CONSIDERATIONS

To use PICO'S P Series at full power one has to get rid of dissipated losses in the modules. Although the high efficiency of these units minimizes the heat loss; The exposed area, depending on the ambient temperature, may not be enough to keep the case temperature at an acceptable value if natural convection is used. The additional heat may be removed by a heat sink, forced air, or both. Internal losses produce heat which is moved toward the case and must be removed. Depending on the thickness and the material used, there is always a temperature gradient from inside to the case which may be calculated by:

[1] $T_{ric} = \frac{T_i - T_c}{Q}$ where,

Tric = Thermal Resistance from inside to case
Ti = Inside Termperature in Degrees C
Tc = Case Temperature in Degrees C
Q = Dissipated Power in the module in watts

The specification given in the data sheet of these units are such that at 85°C case the T_i; (inside temperature of components) is acceptable for proper operation. The user of these modules then has the task to keep the case temperature at or below 85°C. The temperature rise of the case depends on how efficiently the heat is removed; If the process is very efficient the thermal resistance is low and the case to ambient temperature gradient is low. The thermal resistance from the case to the air is given by:

$$T_{rca} = \frac{T_c - T_a}{Q} \quad \text{and}$$

$$Q = P_{in} - P_{out} = P_{out} \left(\frac{1}{\eta} - 1\right)$$

[2] $T_c - T_a = \Delta T = T_{rca} \quad P_{out}\left(\frac{1}{\eta} - 1\right)$ where,

T_{rca} = Thermal Resistance of case to air
P_{out} = Output Power in watts
η = Efficiency
T_c = Case temperature in Degrees C
T_a = Ambient Temperature in Degrees C

The following table shows the thermal resistance in free air as well as with forced cooling with or without heat sinks.

Table I: Thermal resistance case to air (°C/W)

	Base Plate	Heatsink CV	Heatsink CH
Free Air	5.1	3.5	3.0
200 LFM	2.8	1.8	1.0
400 LFM	1.8	1.1	0.7
600 LFM	1.4	0.8	0.55
800 LFM	1.2	0.65	0.45
1000 LFM	1.0	0.55	0.4

NOTE: The values in Table I include the thermal resistance from heatsink to baseplate. Provided a proper contact exists between the plate and the sink.

TYPICAL EXAMPLES

Example 1: What would be the maximum output power allowed at an ambient temperature of 50°C with an efficiency of 85%

A) If the module is used in free air?

From Table I: $T_{rca} = 5.1$

Using Relation (2)

$$85 - 50 = 5.1\ P_{out}\left[\frac{1}{0.85} - 1\right]$$

$$P_{out} = \frac{35}{5.1\ [0.176]} = 39 \text{ WATTS}$$

B) If the module with heat sink (CV) is used in free air?

$$T_{rca} = 3.5$$

$$P_{out} = \frac{35}{3.5\ [0.176]} = 57 \text{ WATTS}$$

C) If the module is used in an area with forced air at 200 LFM with no heatsink?

$$T_{rca} = 2.8$$

$$P_{out} = \frac{35}{2.8\ [0.176]} = 71 \text{ WATTS}$$

Example 2: A module has an efficiency of 87%. What is the maximum ambient temperature if 100 watts of power is needed?

A) In free air?

From Table I: $T_{rca} = 5.1$

Using Relation (2)

$$\Delta T = 5.1\ (100)\left[\frac{1}{0.87} - 1\right] = 76°C$$

$$TA = 85 - 76 = 9°C$$

B) In free air with heatsink (CV)?

$$T_{rac} = 3.5$$

$$\Delta T = 3.5\ (100)\left[\frac{1}{0.87} - 1\right] = 52°C$$

$$Ta = 85 - 52 = 33°C$$

C) Forced air with 400 LFM?

$$T_{rac} = 1.8$$

$$\Delta T = 1.8\ (100)\left[\frac{1}{0.87} - 1\right] = 27°C$$

$$Ta = 85 - 27 = 58°C$$

Example 3: From relation (2), the set of curves on page 122, PA single, were generated for module PA12 with an input voltage of 28 volts DC and an efficiency of 84%. In all cases, the baseplate temperature is maintained at 85°C or less. For instance, the curves show that with the (CH) heat sink at free air a maximum ambient temperature of 28°C is allowed at full power: However, with the same heat sink and an air flow of 400 LFM an ambient of 71°C is possible.

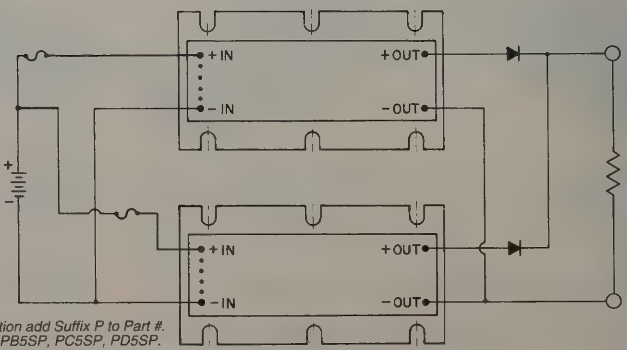
‡PARALLEL OPERATION

Special care must be exercised when operating these units in parallel, since these modules deliver comparatively high currents (especially the low voltage outputs of 3.3, 5.0, 5.2, and 12 volts.)

For parallel operation, the corresponding pins of the units must be connected together. The paths of these connections should be as direct as possible. The path to the load also should have the lowest possible resistance; otherwise unacceptable losses and load regulation will occur.

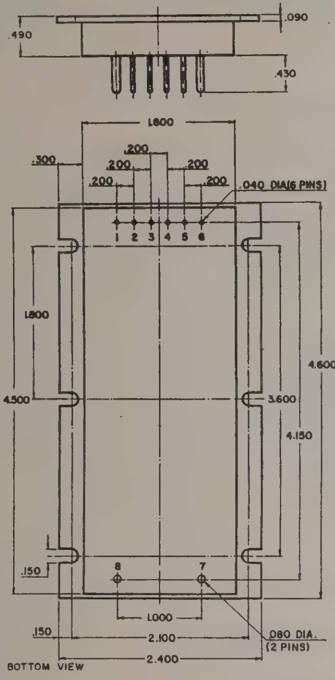
For instance, a 1 milli-ohm resistance and a 100 ampere load will cause 10 watts of line losses as well as additional load regulation.

If the parallel configuration is for redundant operation, schottky diodes should be used at the output of each module as shown in figure **.

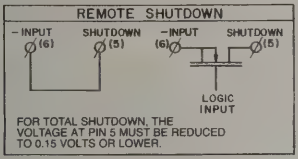


‡ For Parallel Operation add Suffix P to Part #. Example: PA5SP, PB5SP, PC5SP, PD5SP.

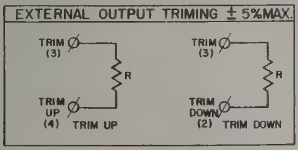
SERIES P SINGLE


.090
.490
.430
1.800
.200
.300
.200
.200
.200
.200
.040 DIA(6 PINS)
1 2 3 4 5 6
1.800
4.600
4.500
3.600
4.150
.150
8
7
1.000
.150
2.100
.080 DIA.
(2 PINS)
2.400
BOTTOM VIEW

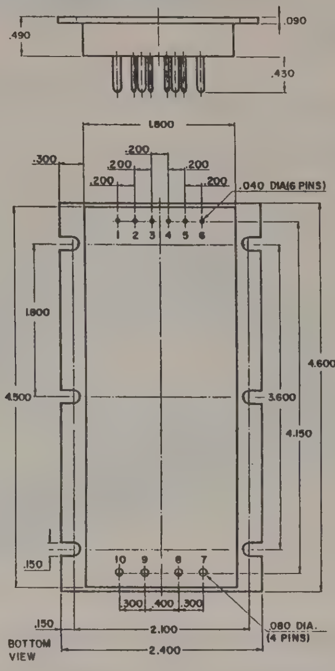
PIN Nº	SINGLE
1	+ INPUT
2	TRIM DOWN
3	TRIM
4	TRIM UP
5	SHUT DOWN
6	INPUT
7	− OUTPUT
8	+ OUTPUT


REMOTE SHUTDOWN
– INPUT
(6)
SHUTDOWN
(5)
–INPUT
(6)
SHUTDOWN
(5)
LOGIC INPUT

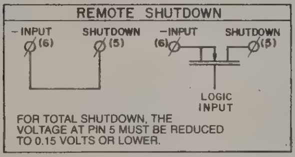
FOR TOTAL SHUTDOWN, THE VOLTAGE AT PIN 5 MUST BE REDUCED TO 0.15 VOLTS OR LOWER.


EXTERNAL OUTPUT TRIMING ± 5%MAX.
TRIM (3)
R
TRIM UP (4)
TRIM UP
TRIM (3)
R
TRIM DOWN (2)
TRIM DOWN

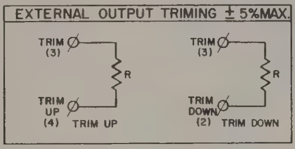
SERIES P DUAL


.090
.490
.430
1.800
.200
.300
.200
.200
.200
.200
.040 DIA(6 PINS)
1 2 3 4 5 6
1.800
4.600
4.500
3.600
4.150
.150
10 9 8 7
.300 .400 .300
.150
2.100
.080 DIA.
(4 PINS)
2.400
BOTTOM VIEW

PIN Nº	DUAL
1	+ INPUT
2	TRIM DOWN
3	TRIM
4	TRIM UP
5	SHUT DOWN
6	− INPUT
7	− OUTPUT(1)
8	+ OUTPUT(1)
9	− OUTPUT(2)
10	+ OUTPUT(2)


REMOTE SHUTDOWN
– INPUT
(6)
SHUTDOWN
(5)
–INPUT
(6)
SHUTDOWN
(5)
LOGIC INPUT

FOR TOTAL SHUTDOWN, THE VOLTAGE AT PIN 5 MUST BE REDUCED TO 0.15 VOLTS OR LOWER.


EXTERNAL OUTPUT TRIMING ± 5%MAX.
TRIM (3)
R
TRIM UP (4)
TRIM UP
TRIM (3)
R
TRIM DOWN (2)
TRIM DOWN

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.,
Mt. Vernon, N.Y. 10552

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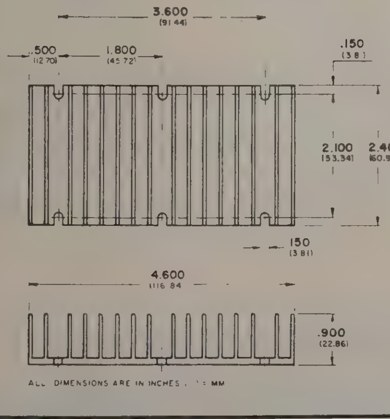
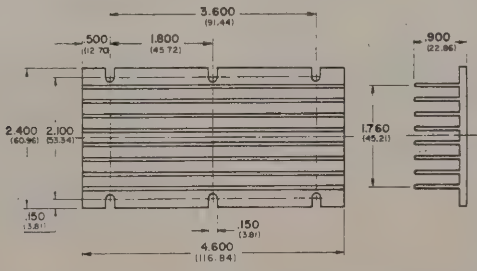
CH HEATSINK


3.600
(91.44)
.500
(12.70)
1.800
(45.72)
.150
(3.8)
2.100
(53.34)
2.400
(60.96)
.150
(3.81)
4.600
(116.84)
.900
(22.86)
ALL DIMENSIONS ARE IN INCHES ( ) = MM

CV HEATSINK


3.600
(91.44)
.500
(12.70)
1.800
(45.72)
.900
(22.86)
2.400
(60.96)
2.100
(53.34)
1.760
(45.21)
.150
(3.81)
.150
(3.81)
4.600
(116.84)

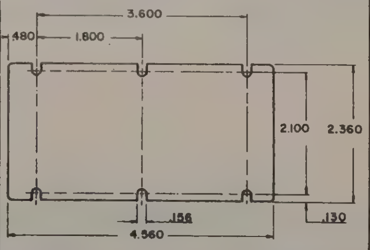
NOTE: For additional Heatsink options, consult factory.

TYPE CH	$12.50
TYPE CV	$12.50
TYPE TI	$ 1.50

PART TI = THERMAL INTERFACE

Alloy Aluminum Substrate

Thermal Conductivity, (BTU-in/hr ft² °F	1530
Coefficient of Thermal Expansion (25-100°C, 10⁻⁶ in-in/°F)	13.1
Hardness, Brinnell B	23
Endurance Limit, psi	5000
Standard Thickness (inches)	.002


3.600
.480
1.800
2.100
2.360
.156
.130
4.560

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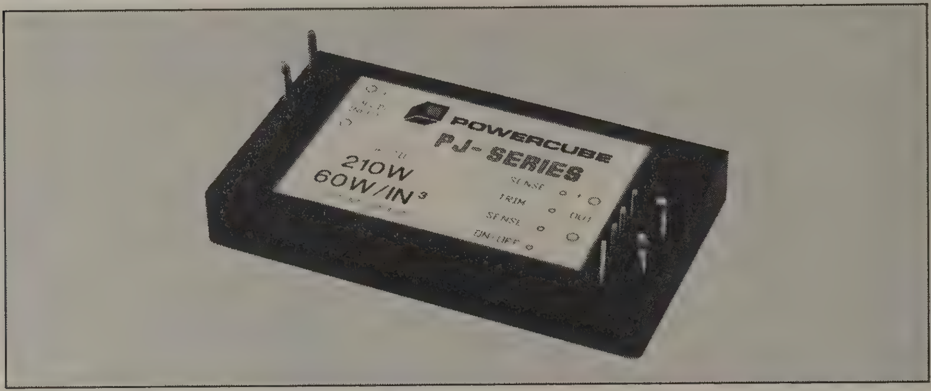
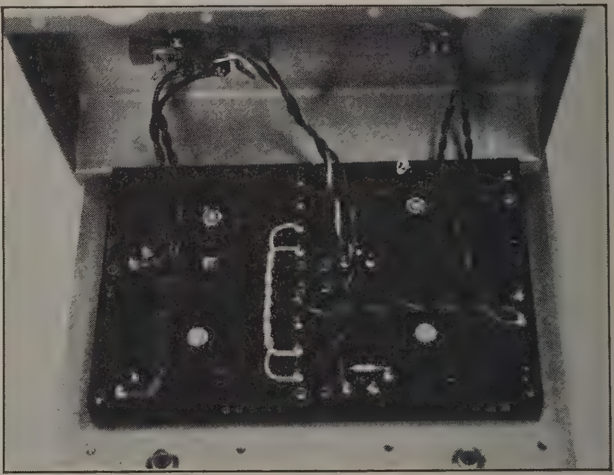
Standard, Modified Standard, and High Power Density DC to DC Converters



Custom Assemblies and Multiple Output Power Systems



Powercube is respected throughout the world for its high reliability Military and Industrial AC to DC and DC to DC converters. Powercube, founded in 1967, was one of the pioneers of encapsulated power supplies. Currently, modules provide up to 350 Watts and assemblies up to 2500 Watts of power.

Many modules may be paralleled and offer current sharing providing N + 1 redundancy if required.

Powercube power supplies have found their way into products as diverse as commercial airlines and ruggedized computers. Many of Powercube's newer products are designed and priced for industrial market applications.

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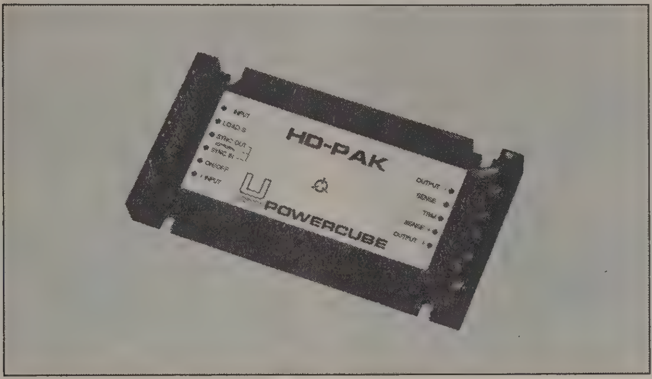
The Source for Industrial and Military Power Supplies

Powercube Corporation Eight Suburban Park Drive, Billerica, Massachusetts 01821 • Phone: (508) 667-9500 • Fax: (508) 667-6280

NEW! *Industrial High Density* DC To DC Converters

HD-PAK™ SERIES



The following four pages outline Powercube's new high density 300Watt DC to DC converters.

Designed for four specific groups of applications and utilizing the industry standard package, they offer more power over the operating temperature range, –40°C to +100°C, than any competing model.

The HD-PAK is available with input voltages of 24VDC, 48VDC, 150VDC, and 300VDC. Output voltages are 2.6VDC, 3.3VDC, 5.0VDC, 12VDC, 15VDC, 24VDC, 28VDC, and 48VDC, and the 5VDC output model is available with the standard output of 40AMP and a new Turbo model achieving 60AMPS.

Another new feature is the ability to synchronize over the range of 300 to 400KHz. I.E. 50KHz above and 50KHz below the nominal frequency of 350KHz.

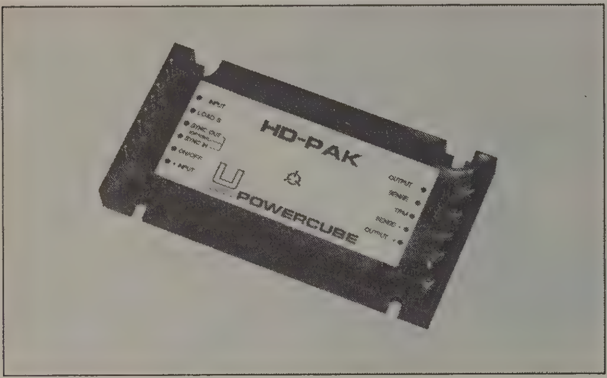
Other features include low output ripple, remote sense, remote shutdown, overtemperature shutdown, and overvoltage protection.

NEW!

Industrial High Density DC To DC Converters

48VDC Input 300 Watts Output 54W/IN³

HD-PAK™ SERIES 48VDC INPUT


HD-PAK
POWERCUBE
INPUT
LOAD S
SYNC OUT
SYNC IN
ON/OFF
+ INPUT
OUTPUT
SENSE
TRIM
SENSE
OUTPUT

Features

- High Power Density
- Maximum Efficiency 90%
- Remote Sense
- Remote Shutdown-primary side referenced
- External Trim (factory trim available)
- Current Limit Protection
- UL 1950, VDE0805, CSA-C22.2N°234
- Overvoltage Protection (auto recovery)
- Sync Pins – in and out
- Industry Standard Package
- 350KHz Fixed Operating Frequency
- Outputs 2.6, 3.3, 5, 12, 15, 24, 28 & 48VDC
- Parallel Operation
- Overtemp Shutdown (auto recovery)
- -40°C to +100°C Operation
- New 5VDC @ 60 Amps (Consult Factory)

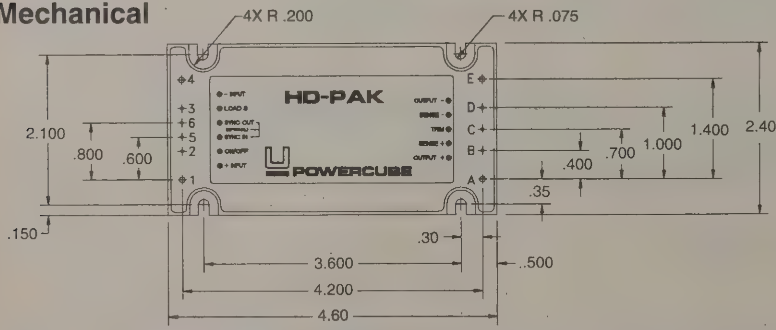
Specifications

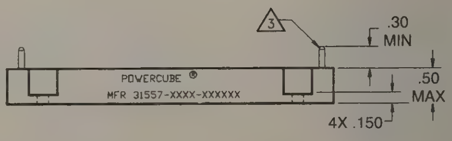
Model Number	48 HD2.6-104	48 HD3.3-132	48 HD5-200	48 HD12-300	48 HD15-300	48 HD24-300	48 HD28-300	48 HD48-300
Input Voltage (See Output Power/Current)								
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V	48V
Overvoltage Setting (Typ)	3.3V	4.3V	6.7V	14.5V	18.0V	28.5V	33.5V	57.6V
Output Current (MAX) @ Input Voltage Range								
36-76VDC (+85°C Max Base)	40A	40A	40A	25A	20A	12.5A	10.7A	6.25A
36-76VDC (+100°C Max Base)	30A	30	30A	18.8A	15A	9.4A	8.0A	4.7A
Initial Voltage Setting (MAX)	1%	1%	1%	1%	1%	1%	1%	1%
Trim Range	+10%-0%	±10%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)/°C	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Efficiency (48VDC input, FL) (Typ)	70%	75%	81%	85%	87%	89%	90%	90%
Ripple & Noise (20 MHz BW) (Typ)	1%	1%	1%	1%	1%	1%	1%	1%
Transient Response (25% Load Change) (Typ)	300µS	300µS	300µS	300µS	300µS	300µS	300µS	300µS
Sync. Range (up or down from F nominal)	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz
Over Temperature Shutdown (°C)	105-115	105-115	105-115	105-115	105-115	105-115	105-115	105-115

All specifications subject to change

Isolation – All Models
Input to Output 4242 VDC
Output to Baseplate 707 VDC
Input to Baseplate 3535 VDC

Mechanical


4X R .200
4X R .075
4
3
6
5
2
1
E
D
C
B
A
HD-PAK
- INPUT
LOAD S
SYNC OUT
SYNC IN
ON/OFF
+ INPUT
OUTPUT -
SENSE -
TRIM
SENSE +
OUTPUT +
POWERCUBE
2.100
.800
.600
.150
.400
.700
1.000
1.400
2.40
.35
.30
.500
3.600
4.200
4.60


3
.30 MIN
POWERCUBE ®
MFR 31557-XXXX-XXXXXX
.50 MAX
4X .150

All dimensions in inches
Weight 8 ozs.

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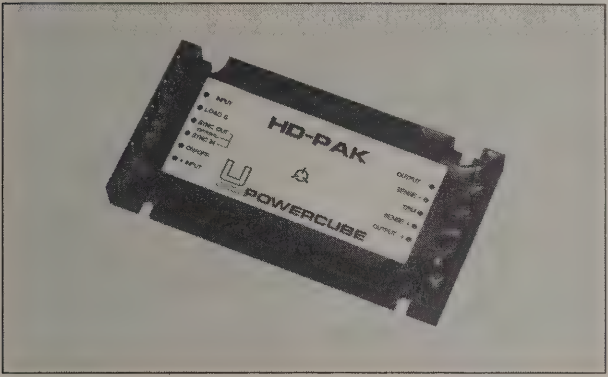
NEW!

HD-Pak™ Series

300VDC Input 300 Watts Output 54W/IN³

HD-PAK™ SERIES 300VDC INPUT


HD-PAK
POWERCUBE

Features

- High Power Density
- Maximum Efficiency 90%
- Remote Sense
- Remote Shutdown-primary side referenced
- External Trim (factory trim available)
- Current Limit Protection
- UL 1950, VDE0805, CSA-C22.2N°234
- Overvoltage Protection (auto recovery)
- Sync Pins – in and out
- Industry Standard Package
- 350KHz Fixed Operating Frequency
- Outputs 2.6, 3.3, 5, 12, 15, 24, 28 & 48VDC
- Parallel Operation
- Overtemp Shutdown (auto recovery)
- -40°C to +100°C Operation
- New 5VDC @ 60 Amps (Consult Factory)

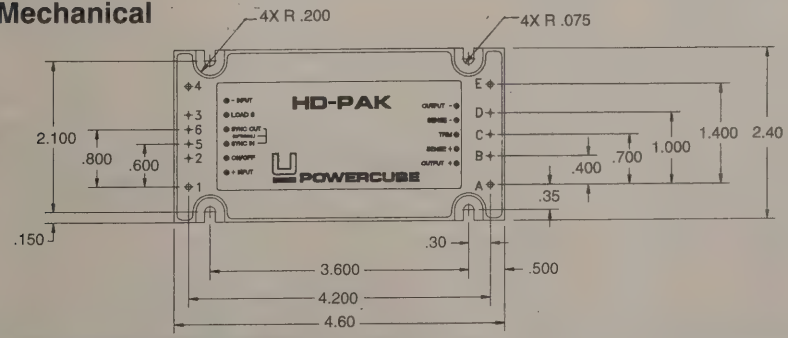
Specifications

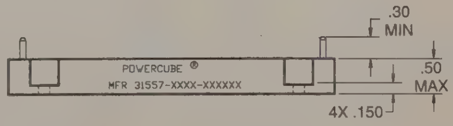
Model Number	300 HD2.6-104	300 HD3.3-132	300 HD5-200	300 HD12-300	300 HD15-300	300 HD24-300	300 HD28-300	300 HD48-300
Input Voltage (See Output Power/Current)								
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V	48V
Overvoltage Setting (Typ)	3.3V	4.3V	6.7V	14.5V	18.0V	28.5V	33.5V	57.6V
Output Current (MAX) @ Input Voltage Range								
200-400VDC (+85°C Max Base)	40A	40A	40A	25A	20A	12.5A	10.7A	6.25A
200-400VDC (+100°C Max Base)	30A	30	30A	18.8A	15A	9.4A	8.0A	4.7A
Initial Voltage Setting (MAX)	1%	1%	1%	1%	1%	1%	1%	1%
Trim Range	+10%-0%	±10%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)/°C	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Efficiency (300VDC input, FL) (Typ)	70%	75%	81%	85%	87%	89%	90%	90%
Ripple & Noise (20 MHz BW) (Typ)	1%	1%	1%	1%	1%	1%	1%	1%
Transient Response (25% Load Change) (Typ)	300µS	300µS	300µS	300µS	300µS	300µS	300µS	300µS
Sync. Range (up or down from F nominal)	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz
Over Temperature Shutdown (°C)	105-115	105-115	105-115	105-115	105-115	105-115	105-115	105-115

Isolation – All Models
Input to Output 4242 VDC
Output to Baseplate 707 VDC
Input to Baseplate 3535 VDC

All specifications subject to change

Mechanical


4X R .200
4X R .075
2.100
.800
.600
.150
3.600
4.200
4.60
.30
.500
.35
.400
.700
1.000
1.400
2.40
4
+3
+6
+5
+2
1
E
D
C
B
A
HD-PAK
POWERCUBE
- INPUT
LOAD
SYNC OUT
SYNC IN
ON/OFF
+ INPUT
OUTPUT -
SENSE -
TRIM
SENSE +
OUTPUT +


.30 MIN
.50 MAX
4X .150
POWERCUBE ®
MFR 31557-XXXX-XXXXXX

All dimensions in inches
Weight 8 ozs.

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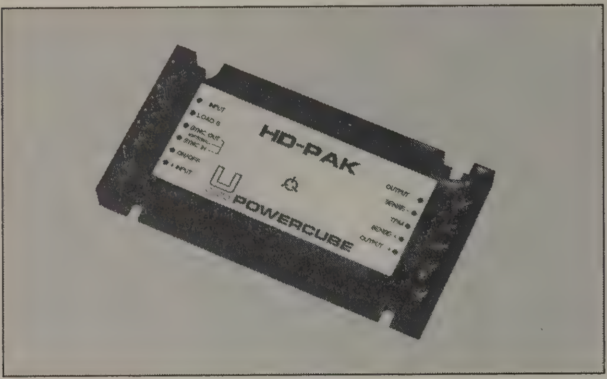
NEW!

HD-Pak™ Series

150VDC Input 300 Watts Output 54W/IN³

HD-PAK™ SERIES 150VDC INPUT


HD-PAK
POWERCUBE

Features

- High Power Density
- Maximum Efficiency 90%
- Remote Sense
- Remote Shutdown-primary side referenced
- External Trim (factory trim available)
- Current Limit Protection
- UL 1950, VDE0805, CSA-C22.2N°234
- Overvoltage Protection (auto recovery)
- Sync Pins – in and out
- Industry Standard Package
- 350KHz Fixed Operating Frequency
- Outputs 2.6, 3.3, 5, 12, 15, 24, 28 & 48VDC
- Parallel Operation
- Overtemp Shutdown (auto recovery)
- -40°C to +100°C Operation
- New 5VDC @ 60 Amps (Consult Factory)

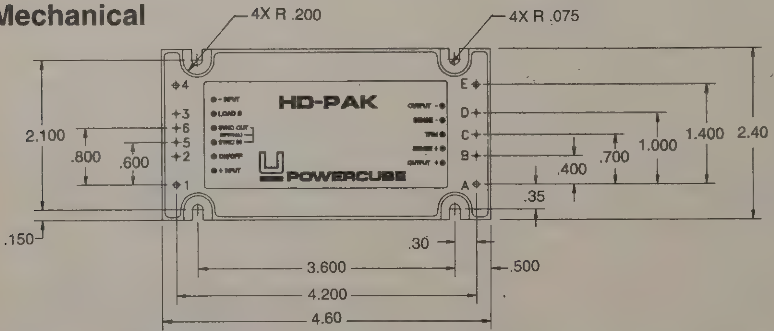
Specifications

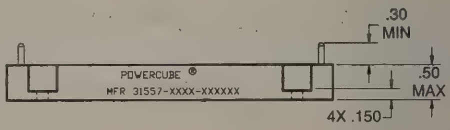
Model Number	150 HD2.6-104	150 HD3.3-132	150 HD5-200	150 HD12-300	150 HD15-300	150 HD24-300	150 HD28-300	150 HD48-300
Input Voltage (See Output Power/Current)								
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V	48V
Overvoltage Setting (Typ)	3.3V	4.3V	6.7V	14.5V	18.0V	28.5V	33.5V	57.6V
Output Current (MAX) @ Input Voltage Range								
100-200VDC (+85°C Max Base)	40A	40A	40A	25A	20A	12.5A	10.7A	6.25A
100-200VDC (+100°C Max Base)	30A	30	30A	18.8A	15A	9.4A	8.0A	4.7A
Initial Voltage Setting (MAX)	1%	1%	1%	1%	1%	1%	1%	1%
Trim Range	+10%-0%	±10%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)/°C	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Efficiency (150VDC input, FL) (Typ)	70%	75%	81%	85%	87%	89%	90%	90%
Ripple & Noise (20 MHz BW) (Typ)	1%	1%	1%	1%	1%	1%	1%	1%
Transient Response (25% Load Change) (Typ)	300µS	300µS	300µS	300µS	300µS	300µS	300µS	300µS
Sync. Range (up or down from F nominal)	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz
Over Temperature Shutdown (°C)	105-115	105-115	105-115	105-115	105-115	105-115	105-115	105-115

Isolation – All Models
Input to Output 4242 VDC
Output to Baseplate 707 VDC
Input to Baseplate 3535 VDC

All specifications subject to change

Mechanical


4X R .200
4X R .075
HD-PAK
POWERCUBE
- INPUT
LOAD
SYNC OUT
SYNC IN
ON/OFF
+ INPUT
OUTPUT -
SENSE -
TRIM
SENSE +
OUTPUT +
4
3
6
5
2
1
E
D
C
B
A
2.100
.800
.600
.150
.400
.700
1.000
1.400
2.40
.35
.30
.500
3.600
4.200
4.60


POWERCUBE ®
MFR 31557-XXXX-XXXXXX
.30
MIN
.50
MAX
4X .150

All dimensions in inches
Weight 8 ozs.

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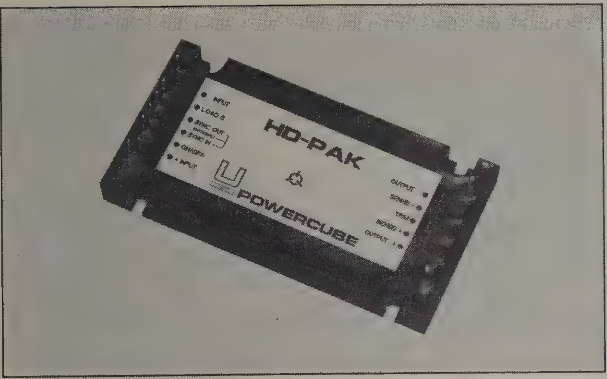
NEW!

HD-Pak™ Series

24VDC Input 300 Watts Output 54W/IN³

HD-PAK™ SERIES 24VDC INPUT


HD-PAK
POWERCUBE
INPUT
LOAD S
SYNC OUT
SYNC IN
ON/OFF
+ INPUT
OUTPUT
SENSE
TRIM
SENSE +
OUTPUT +

Features

- High Power Density
- Maximum Efficiency 90%
- Remote Sense
- Remote Shutdown-primary side referenced
- External Trim (factory trim available)
- Current Limit Protection
- UL 1950, VDE0805, CSA-C22.2N°234
- Overvoltage Protection (auto recovery)
- Sync Pins – in and out
- Industry Standard Package
- 350KHz Fixed Operating Frequency
- Outputs 2.6, 3.3, 5, 12, 15, 24, 28 & 48VDC
- Parallel Operation
- Overtemp Shutdown (auto recovery)
- -40°C to +100°C Operation
- New 5VDC @ 60 Amps (Consult Factory)

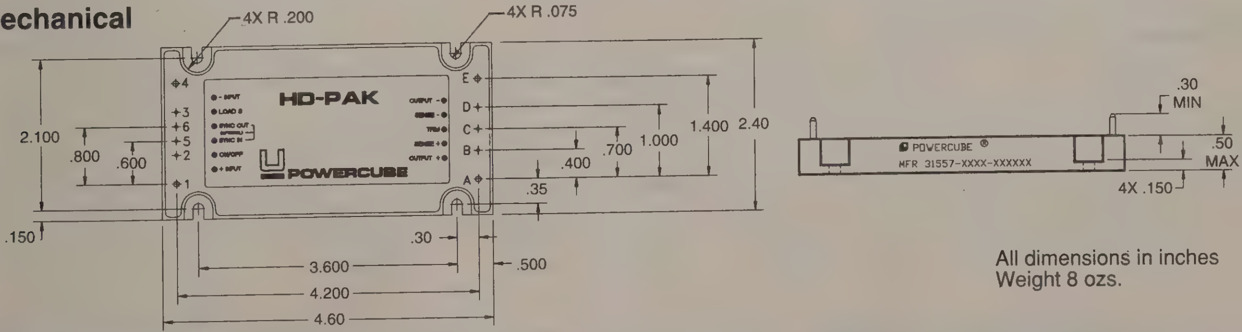
Specifications

Model Number	24 HD2.6-104	24 HD3.3-132	24 HD5-200	24 HD12-300	24 HD15-300	24 HD24-300	24 HD28-300	24 HD48-300
Input Voltage (See Output Power/Current)								
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V	48V
Overvoltage Setting (Typ)	3.3V	4.3V	6.7V	14.5V	18.0V	28.5V	33.5V	57.6V
Output Current (MAX) @ Input Voltage Range								
18-36VDC (+85°C Max Base)	40A	40A	40A	25A	20A	12.5A	10.7A	6.25A
18-36VDC (+100°C Max Base)	30A	30	30A	18.8A	15A	9.4A	8.0A	4.7A
Initial Voltage Setting (MAX)	1%	1%	1%	1%	1%	1%	1%	1%
Trim Range	+10%-0%	±10%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)/°C	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Efficiency (24VDC input, FL) (Typ)	70%	75%	81%	85%	87%	89%	90%	90%
Ripple & Noise (20 MHz BW) (Typ)	1%	1%	1%	1%	1%	1%	1%	1%
Transient Response (25% Load Change) (Typ)	300µS	300µS	300µS	300µS	300µS	300µS	300µS	300µS
Sync. Range (up or down from F nominal)	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz	300 to 400KHz
Over Temperature Shutdown (°C)	105-115	105-115	105-115	105-115	105-115	105-115	105-115	105-115

All specifications subject to change

Isolation – All Models
Input to Output 4242 VDC
Output to Baseplate 707 VDC
Input to Baseplate 3535 VDC

Mechanical


4X R .200
4X R .075
HD-PAK
POWERCUBE
4
3
6
5
2
1
E
D
C
B
A
2.100
.800
.600
.150
1.400
2.40
1.000
.700
.400
.35
.30
.500
3.600
4.200
4.60
.30
MIN
.50
MAX
4X .150
POWERCUBE ®
MFR 31557-XXXX-XXXXXX

All dimensions in inches
Weight 8 ozs.

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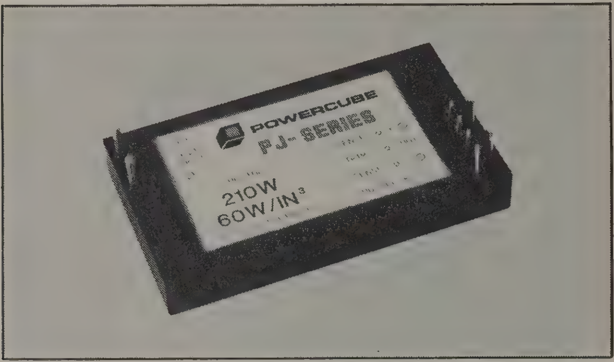
PJ Series DC-DC Converters

60W/IN³ 210 Watts 28VDC Input

PJ SERIES 28VDC INPUT


POWERCUBE
PJ- SERIES
210W
60W/IN³

Features

- 60 Watts/in³
- Efficiency up to 88%
- Output Voltage Trim
- Parallelable
- MTBF > 1,000,000 Hours
- -55°C to + 100°C Operation
- Accepts 50VDC Input Transients
- MIL-S-19500 JANTX & 883C (Available)
- Remote Shut Down
- MIL-STD-202 and MIL-STD-810

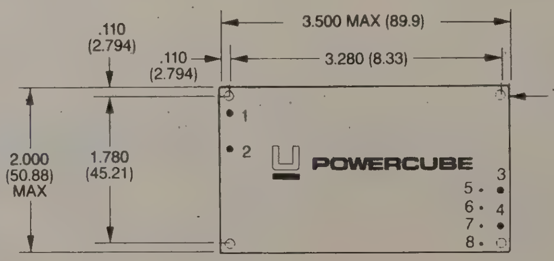
28VDC Input Modules Specifications

Part Number	28PJ2.6-50	28PJ3.3-70	28PJ5-110	28PJ12-200	28PJ15-200	28PJ24-210	28PJ28-210
Input Voltage (See Output/Current)							
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V
Overvoltage Setting (Typ)	3.3V	4.3V	6.9V	14.5V	17.5V	28.5V	33.5V
Output Current (MAX)							
(22-34Vin +85°C Max Base)	19A	21.2A	22.0A	16.7A	13.4A	8.8A	7.5A
(20-36Vin +85°C Max Base)	17.3A	19A	20.0A	15.0A	12.0A	7.5A	6.4A
(20-34Vin +100°C Max Base)	13.4A	15A	15.0A	11.7A	9.4A	5.9A	5.0A
Initial Setting (MAX)	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Trim Range	+10% - 0%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C
Efficiency (28Vin, FL) (Typ)	68%	70%	80%	84%	85%	86%	87%
Ripple & Noise (20 MHz BW) (MAX)	60mV p-p	60mV p-p	60mV p-p	80mV p-p	80mV p-p	80mV p-p	80mV p-p
Transient Response (Typ) (25% Load Change)	250mV/ 500µS	250mV/ 500µS	250mV/ 500µS	250mV/ 500µS	250mV/ 500µS	500mV/ 500µS	500mV/ 500µS

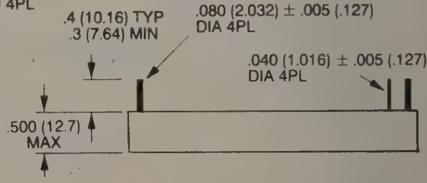
All specifications subject to change

Mechanical

Pin	Function
1	Input
2	Input RTN
3	Output
4	Output RTN
5	REM. Sense +
6	External Trim
7	REM. Sense
8	Shutdown


.110
(2.794)
.110
(2.794)
3.500 MAX (89.9)
3.280 (8.33)
.120 (3.048) DIA
THRU 4PL
2.000
(50.88)
MAX
1.780
(45.21)
1
2
POWERCUBE
3
5
6
4
7
8

Tolerances ± .005 (.127)
Dimensions are in inches (mm).
Weight: 5 ozs. max. (142 grams max.)


.4 (10.16) TYP
.3 (7.64) MIN
.080 (2.032) ± .005 (.127)
DIA 4PL
.040 (1.016) ± .005 (.127)
DIA 4PL
.500 (12.7)
MAX

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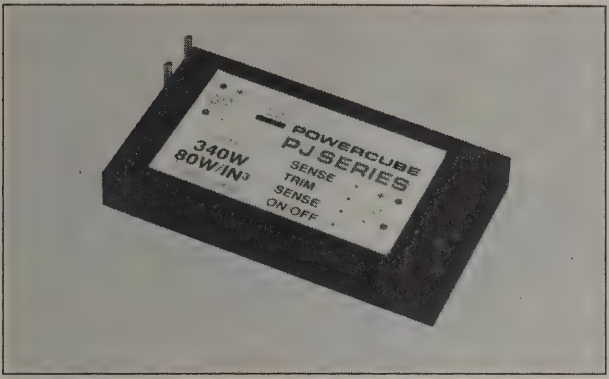
PJ Series DC-DC Converters

82W/IN³ 350 Watts 155VDC Input

PJ SERIES 155VDC INPUT


POWERCUBE
PJ SERIES
340W
80W/IN³
SENSE
TRIM
SENSE
ON OFF

Features

- HIGH POWER DENSITY 82W/IN³
- Maximum Efficiency 90%
- Remote Shutdown
- External Trim
- Current Limit Protection
- Active OVP
- Parallelable
- MTBF > 1,000,000 Hours
- -55°C to +100°C Operation
- 350 KHz Fixed Switching Frequency
- Outputs 2.6, 3.3, 5, 12, 15, 24 & 28VDC
- MIL-S-19500 JANTX & 883C (consult factory)
- Series Operation (consult factory)

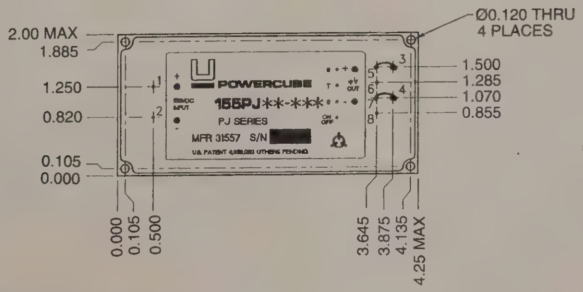
Specifications

Part Number	155PJ2.6-57	155PJ3.3-73	155PJ5-110	155PJ12-200	155PJ15-250	155PJ24-340	155PJ28-350
Input Voltage (See Output/Current)							
Output Voltage	2.6V	3.3V	5V	12V	15V	24V	28V
Overvoltage Setting (Typ)	3.3V	4.3V	6.9V	14.5V	17.5V	28.5V	33.5V
Output Current (MAX) @ Input Voltage Range 100-200VDC (+85°C Max Base) 100-200VDC (+100°C Max Base)	22A 16.5A	22A 16.5A	22A 16.5A	16.7A 12.5A	16.7A 12.5A	14.2A 11.0A	12.5A 9.4A
Initial Setting (MAX)	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Trim Range	10%-0%	±10%	±10%	±10%	±10%	±10%	±10%
Line Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Load Regulation (MAX)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Temp. Stability (MAX)	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C	0.008%/°C
Efficiency (155Vin, FL) (Typ)	64%	70%	80%	83%	85%	88%	88%
Ripple & Noise (20 MHz BW) (MAX)	100mV p-p	100mV p-p	100mV p-p	120mV p-p	120mV p-p	150mV p-p	150mV p-p
Transient Response (Typ) (25% Load Change)	250mV/ 500µS	250mV/ 500µS	250mV/ 500µS	500mV/ 500µS	500mV/ 500µS	500mV/ 500µS	500mV/ 500µS

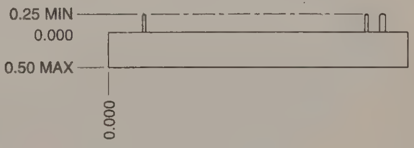
All specifications subject to change

Mechanical

Pin	Function
1	Input
2	Input Return
3	Output
4	Output Return
5	Remote Sense +
6	External Trim
7	Remote Sense -
8	Shutdown


2.00 MAX
1.885
1.250
0.820
0.105
0.000
Ø0.120 THRU
4 PLACES
1.500
1.285
1.070
0.855
0.000
0.105
0.500
3.645
3.875
4.135
4.25 MAX
POWERCUBE
155PJ**-***
PJ SERIES
MFR 31557 S/N
1
2
3
4
5
6
7
8

Tolerances ± .005 (.127)
Dimensions are inches (mm)
Weight: 6.07 ozs. max. (172 grams max.)


0.25 MIN
0.000
0.50 MAX
0.000

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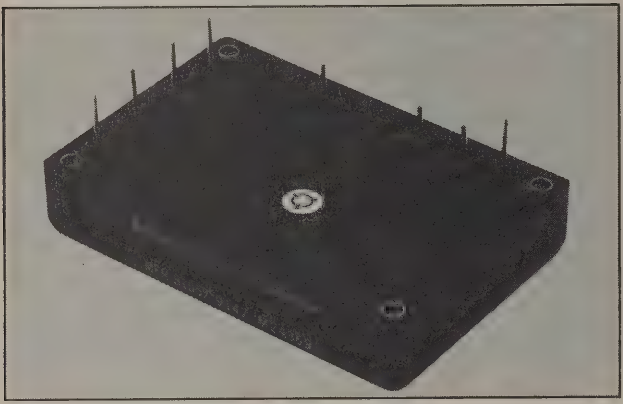
16 to 36 VDC Input *Micro-Series* Modules

15 Watts Output

CMDF, DCMDF SERIES



Features

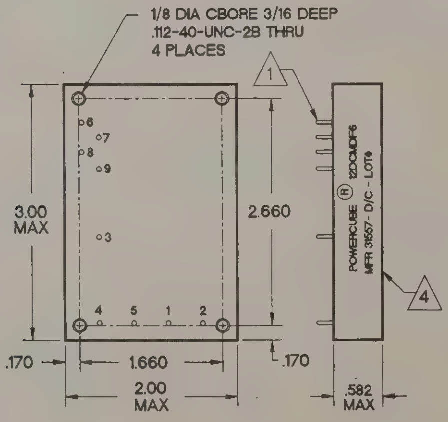
- Single and Dual Output Versions
- Output Voltage Trim ±10%
- Input/Output Isolation 500 VDC
- -55°C to +100°C Operation
- Series/Parallel Connectable Outputs
- Overload and Short Circuit Protection
- Remote On/Off Control
- Overvoltage Protection by Zener Diode
- MIL-STD-810 and MIL-STD-202
- >4 Million Hours MTBF per MIL-HDBK-217E
- Temperature Stability ±0.015%/°C
- Custom Output Voltage Modules Easily Obtainable

Specifications

	Single Output			Dual Outputs		
Part Numbers	5CMDF30A	12CMDF13A	15CMDF10A	5DCMDF15	12DCMDF6	15DCMDF5
Input Voltage Range	16-36VDC	16-36VDC	16-36VDC	16-36VDC	16-36VDC	16-36VDC
Output Voltage	5VDC	12VDC	15VDC	±5VDC	±12VDC	±15VDC
Overvoltage Setting (Typ)	6.8VDC	15VDC	18VDC	6.8VDC	15VDC	18VDC
Output Current (MAX)	3A	1.3A	1.0A	1.5A (ea)	0.63A (ea)	0.5A (ea)
Line Regulation (MAX)	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Load Regulation (MAX)	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Efficiency (Typ)	72%	75%	76%	72%	75%	76%
Ripple and Noise (p-p)	100 mV	120 mV	150 mV	100 mV	120 mV	150 mV
Operating Frequency	130 KHz	130 KHz	130 KHz	100 KHz	100 KHz	100 KHz

All specifications subject to change

Mechanical



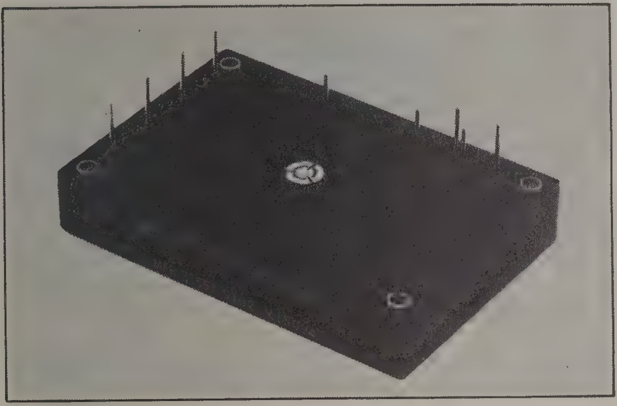
Tolerances ± .005
Dimensions in inches
Weight: 6 ozs.

Term	Function
1	+16-36VDC Input
2	16-36VDC Input Return
3	Shutdown
4	Signal Ground
5	Load Share
6	+Voltage Output
7	Common Output Return
8	-Voltage Output
9	Output Trim

100 to 185 VDC Input *Micro-Series* Modules

15 To 25 Watts Output

CMEF, DCMEF SERIES



Features

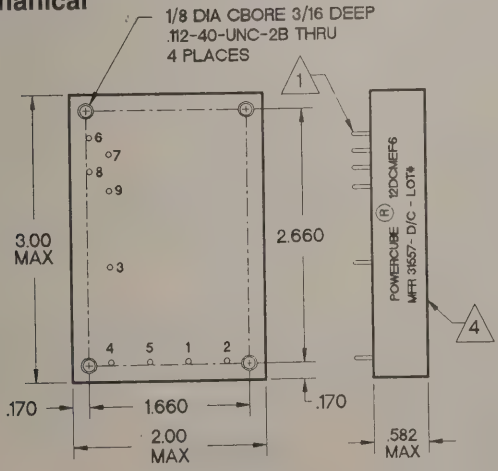
- Single and Dual Output Versions
- Input/Output Isolation 500VDC
- 4 Million Hours MTBF per MIL-HDBK-217E
- -55°C to +100°C Operation
- MIL-STD-810 and MIL-STD-202
- Series/Parallel Connectable Outputs
- Output Voltage Trim ±10%
- Overload and Short Circuit Protection
- Remote On/Off Control
- Overvoltage Protection
- Temperature Stability ±0.015%/°C
- Custom Output Voltage Modules Easily Obtainable

Specifications

	Single Output			Dual Outputs		
Part Numbers	5CMEF50A	12CMEF21A	15CMEF17A	5DCMEF15	12DCMEF6	15DCMEF5
Input Voltage Range	100-185VDC	100-185VDC	100-185VDC	100-185VDC	100-185VDC	100-185VDC
Output Voltage	5VDC	12VDC	15VDC	±5VDC	±12VDC	±15VDC
Overvoltage Setting (Typ)	6.8VDC	15VDC	18VDC	6.8VDC	15VDC	18VDC
Output Current (MAX)	5.0A	2.1A	1.7A	1.5A (ea)	0.63A (ea)	0.50A (ea)
Line Regulation (MAX)	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Load Regulation (MAX)	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Efficiency (Typ)	75%	78%	79%	78%	80%	81%
Ripple and Noise	200 mV	150 mV	150 mV	100 mV	120 mV	150 mV
Operating Frequency	130 KHz	130 KHz	130 KHz	100 KHz	100 KHz	100 KHz

All specifications subject to change

Mechanical



Tolerances ± .005
Dimensions in inches
Weight: 6 ozs.

Term	Function
1	+100-185VDC Input
2	100-185VDC Input Return
3	Shutdown
4	Signal Ground
5	Load Share
6	+Voltage Output
7	Common Output Return
8	-Voltage Output
9	Output Trim

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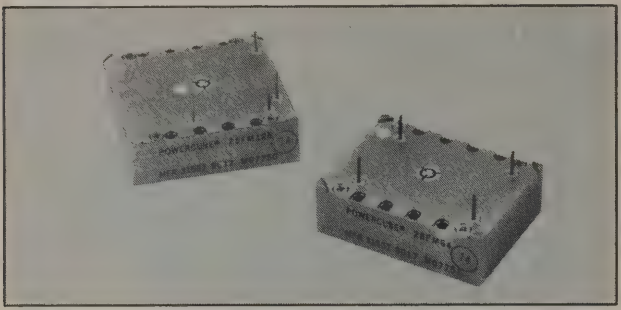
DC Input Conducted Emissions Filter Modules

64 and 128 Watts

FM SERIES



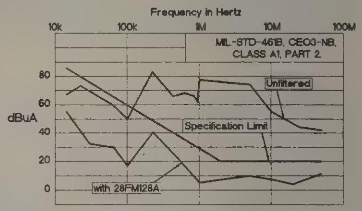
Features

- Compliant to MIL-STD-461B; CE03, CS02, CS06
- Common Mode and Differential Mode Attenuation
- 6-Sided Shield
- -55°C to +100°C Operation
- Components Derated per NAVSO P-36-41/NAVMAT P4855-1A
- Efficiency >96%
- MIL-STD-704D
- MIL-STD-810 and MIL-STD-202
- Higher Power Filters Available

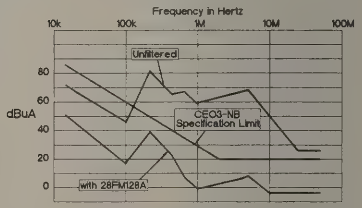
Specifications

	28FM64A	28FM128A
Rated Output Power	64 Watts	128 Watts
Rated Output Current (Ior)	3.6A	7.2A
Input/Output Voltage Drop @ for (MAX)	.55V	.72V
Efficiency	97%	96%
Isolation—pins to case	100VDC	100VDC
Capacitance—pins to case	.11µF	.21µF
In Circuit Attenuation (db):		
Differential Mode (typ)		
15 Khz	20	20
100 Khz	20	30
1 Mhz	50	60
10 Mhz	10	55
50 Mhz	5	30
Common Mode (typ)		
15 Khz	25	35
100 Khz	25	30
1 Mhz	50	55
10 Mhz	35	50
50 Mhz	20	30
Weight	2 oz.	3 oz.
Input Voltage Transient	up to 60 volts dc 50v/Sec	

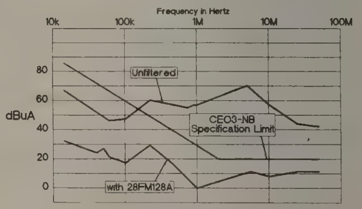
Conducted Emissions Performance Of The 28FM128A EMI Filter



Differential (Only) Mode Emissions Data



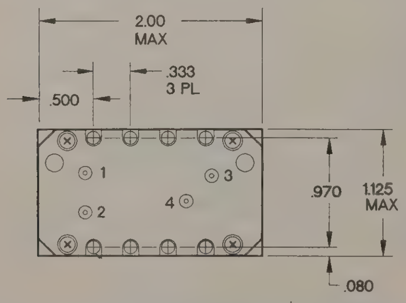
Common (Only) Mode Emissions Data



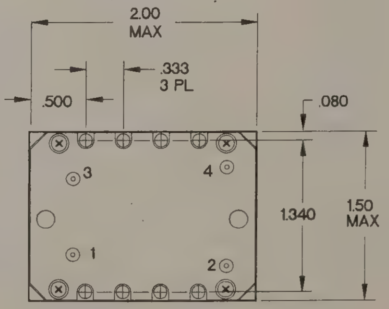
All specifications subject to change

Mechanical

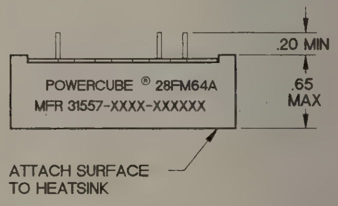
28FM64A


2.00 MAX
.500
.333 3 PL
1
2
3
4
.970
1.125 MAX
.080

28FM128A


2.00 MAX
.500
.333 3 PL
.080
3
4
1
2
1.340
1.50 MAX

Tolerance ±.005
Dimensions in inches


.20 MIN
.65 MAX
POWERCUBE ® 28FM64A
MFR 31557-XXXX-XXXXXX
ATTACH SURFACE TO HEATSINK

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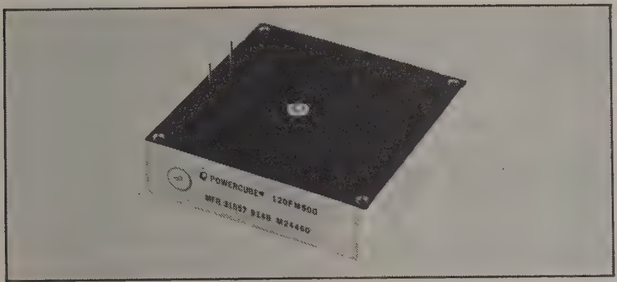
AC Input Conducted Emissions Filter Modules

100 To 500 Watts Output

FM SERIES


POWERCUBE 120FM500

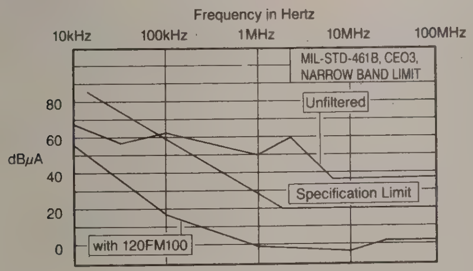
Features

- Compliant to MIL-STD-461B; CE03, CS02 and CS06
- Common Mode and Differential Mode Attenuation
- -55°C to + 100°C Operation
- Components Derated per NAVSO P-3641 NAVMAT P4855-1A Guidelines
- MIL-STD 810 and MIL-STD 202

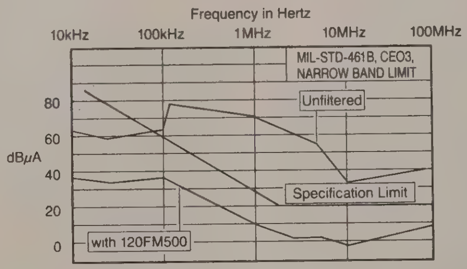
AC Input EMI Filter Modules

Part Number Power	Max Output	Use with These Module Series	Efficiency (Typ)	Max Dimensions inches (mm)	Max Weight oz (gm)
120FM100	100 Watts	Can be used with any combination of AC/DC conversion and Micro-Series DC/DC modules providing the 100 Watt rating is not exceeded.	99%	2×3×0.6 in [50.8×76.2×15.2 mm]	6.0 oz [170 gm]
120FM500	500 Watts	Can be used with any combination of AC/DC conversion providing the 500 Watt rating is not exceeded.	99%	3×3×0.8 in [76.2×76.2×20.3 mm]	9.0 oz [255 gm]

Typical Performance Curves



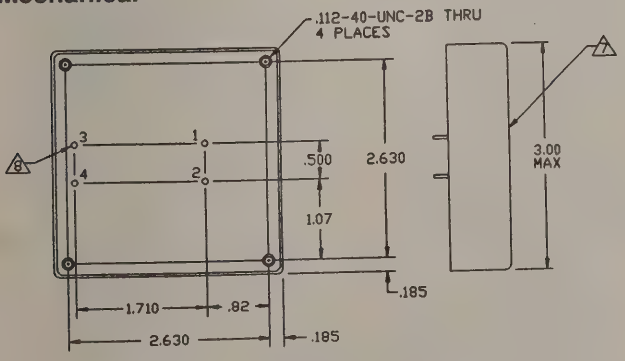
120FM100 Module Powering Four 15-Watt CMEF Modules



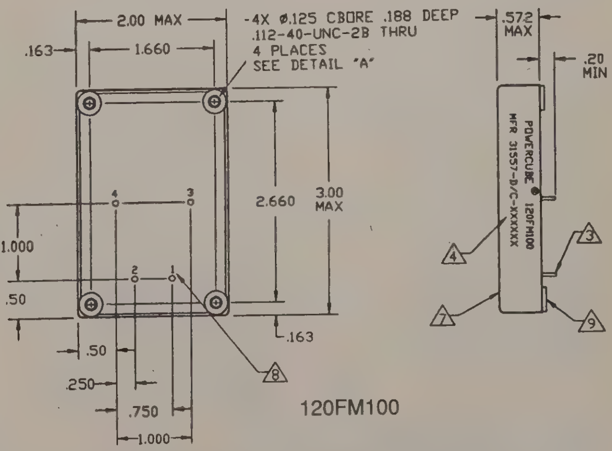
120FM500 Module

All specifications subject to change

Mechanical


.112-40-UNC-2B THRU
4 PLACES
1
2
3
4
8
7
.500
1.07
2.630
3.00 MAX
.185
1.710
.82
2.630
.185

120FM500


2.00 MAX
-4X ⌀.125 CBORE .188 DEEP
.112-40-UNC-2B THRU
4 PLACES
SEE DETAIL "A"
.572 MAX
.20 MIN
.163
1.660
4
3
2
1
2.660
3.00 MAX
1.000
.50
.163
.50
.250
.750
1.000
8
POWERCUBE 120FM100
MFR 31557-D/C-XXXXX
4
3
7
9

120FM100

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force

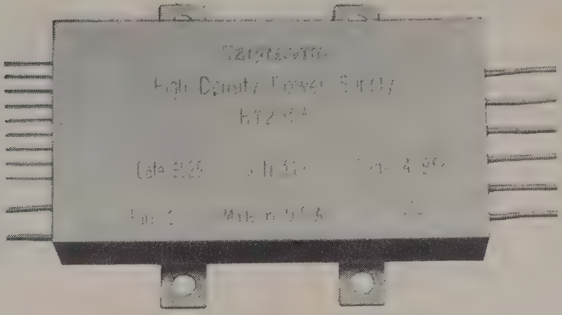
Hybrid DC/DC Converters RY2805-75 Series

Features

- 28Vdc input, 5Vdc @ 15A output
- 45W/in³ power density with low profile (fits in standard SEM-E single span format)
- Low weight: 91 grams typ.
- Full power operation from -55°C to +95°C (baseplate)
- Meets MIL-STD-461C, CS02, CS06 and narrowband emissions of CEO3 with 3 small external parts.
- NAVMAT derated with minor exceptions
- Protection features include:
  - — short circuit output current limit
  - — output overvoltage protection
  - — thermal shutdown
  - — input overvoltage shutdown
  - — input transient protection
- Other features include:
  - — synchronization for multiple units
  - — current sharing for parallel operation
  - — logic shutdown
  - — output status signal
  - — soft start
  - — fast transient response
  - — adjustable compensation
  - — junction temperature inducator

Applications

- Missile power
- Aircraft power
- Distributed power architecture for phased array radars
- Portable communications equipment
- Space-based vehicles
- Battery operated equipment



Description

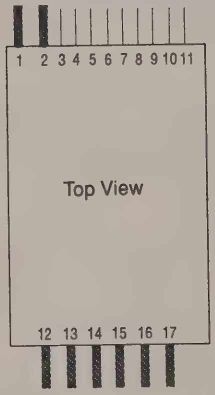
The RY2805-75 hybrid military dc/dc converter offers the highest power density of any military power converter in its power range available today. A 1 MHz switching frequency reduces the size of the magnetics and capacitors to enable their placement inside the hybrid package. Constant frequency PWM, rather than variable frequency resonant conversion, eliminates system beat-frequency problems. The use of X7R ceramic capacitors for filtering eliminates the reliability problems associated with tantalum or electrolytic capacitors and permits full power operation up to 95°C (baseplate).

The series includes two models with different input voltage ranges: 22-36Vdc and 16-50Vdc. All outputs are 5Vdc @ 15A. Additionally, custom versions with non-standard input voltage ranges or output voltages are easily produced with minor modifications. All products in the series are 100% screened to the specific tests and conditions as listed on the last page of this data sheet.

Absolute Max. Ratings

Operating Case Temperature:	125°C
±Remote Sense Voltage	±30Vdc
Lead Temperature (1/16' from case for 10 seconds):	300°C

Pin Configuration



Parameter	Conditions	Min	Typ	Max	Units
Input Charateristics					
Voltage Range					
RY2805-75-A	-55°C to +95°C, Po = 7.5W to 75W	22		36	Vdc
RY2805-75-C	-55°C to +95°C, Po = 7.5W to 75W	16		50	Vdc
Input Voltage Shutdown	% of max Vin			115	%
Output Characteristics					
Output Voltage (Vo)	25°C, Po = 7.5W to 75W, Vin (low to high line)	4.95	5.00	5.05	Vdc
	-55°C to +95°C, Po = 7.5W to 75W, Vin (low to high line)	4.90	5.00	5.10	Vdc
Output Ripple/Noise	Po = 75W, p-p, 20 MHz BW		40	50	mV
Output Power	Vo = 5Vdc, -55°C to +95°C	7.5		75	W
Output Current (Io)	Vo = 5Vdc, -55°C to +95°C	1.5		15	A
Output Current Limit	foldback at Vo = 90% Vnom			27	A
Overvoltage Protection	% of Vo			133	%
Output Capacitance	Σ (C_A =C_B)		17		µF
Isolation Characteristics					
Isolation Voltage	≥ 50MΩ	500			Vdc
Input to Output Cap.			0.45		µF
Dynamic Characteristics					
Maximum Excursion, Δ Vo Io = 10Ato 15A or 15 A to 10A	dI/dt = 5A/µs, Co = 0µF, Rc = ∞		±14		%
	dI/dt = 5A/µs, Co = 22µF, Rc = 75kΩ		±10		%
	dI/dt = .2A/µs, Co = 66µF, Rc = 27kΩ		±5		%
Clock Frequency		0.95	1.0	1.05	MHz
Soft Start Turn-On Time			60		ms
Thermal Characteristics					
Operating Temperature	baseplate	-55		+95	°C
Storage Temperature	baseplate	-65		+150	°C
Efficiency					
RY2805-75-A	Po = 75W	79	81		%
RY2805-75-C	Po = 75W	77	79		%
Mechanical Characteristics					
Weight			91	100	g

RY2805-75 Electrical characteristics: T_C = 25°C, V_{in} = 28Vdc unless otherwise noted; all temp. are baseplace

Raytheon

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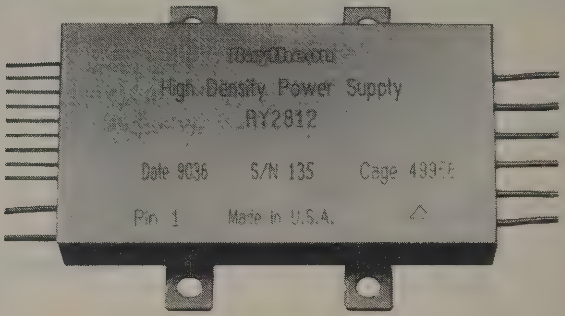
617.479.5300 FAX 617.984.4196

Hybrid DC/DC Converters RY2812-75 Series



Features

- 28Vdc input, ±12Vdc @ 6.3A total output
- 45W/in^3 power density with low profile (fits in standard SEM-E single span format)
- Low weight: 91 grams typ.
- Full power operation from -55°C to +95°C (baseplate)
- Meets MIL-STD-461C, CS02, CS06 and narrowband emissions of CEO3 with 3 small external parts.
- NAVMAT derated with minor exceptions
- Protection features include:
  - — short circuit output current limit
  - — output overvoltage protection
  - — thermal shutdown
  - — input overvoltage shutdown
  - — input transient protection
- Other features include:
  - — synchronization for multiple units
  - — current sharing for parallel operation
  - — logic shutdown
  - — output status signal
  - — soft start
  - — fast transient response
  - — adjustable compensation
  - — junction temperature inducator

Applications

- Missile power
- Aircraft power
- Distributed power architecture for phased array radars
- Portable communications equipment
- Space-based vehicles
- Battery operated equipment

Description

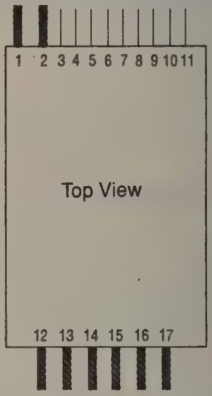
The RY2812-75 hybrid military dc/dc converter offers the highest power density of any military power converter in its power range available today. A 1 MHz switching frequency reduces the size of the magnetics and capacitors to enable their placement inside the hybrid package. Constant frequency PWM, rather than variable frequency resonant conversion, eliminates system beat-frequency problems. The use of X7R ceramic capacitors for filtering eliminates the reliability problems associated with tantalum or electrolytic capacitors and permits full power operation up to 95°C (baseplate).

The series includes two models with different input voltage ranges: 22-36Vdc and 16-50Vdc. All outputs are ±12Vdc @ 6.3A total. Additionally, custom versions with non-standard input voltage ranges or output voltages are easily produced with minor modifications. All products in the series are 100% screened to the specific tests and conditions as listed on the last page of this data sheet.

Absolute Max. Ratings

Operating Case Temperature:	125°C
±Remote Sense Voltage	±30Vdc
Lead Temperature (1/16' from case for 10 seconds):	300°C

Pin Configuration



Parameter	Conditions	Min	Typ	Max	Units
Input Charateristics					
Voltage Range					
RY2812-75-A	-55°C to +95°C, Po = 7.5W to 75W	22		36	Vdc
RY2812-75-C	-55°C to +95°C, Po = 7.5W to 75W	16		50	Vdc
Input Voltage Shutdown	% of max Vin			115	%
Output Characteristics					
Regulated Output Voltage (Vor)	25°C, Po = 7.5W to 75W, Vin (low to high line)	±11.88	±12.00	±12.12	Vdc
	-55°C to +95°C, Po = 7.5W to 75W, Vin (low to high line)	±11.76	±12.00	±12.24	Vdc
Output Ripple/Noise	Po = 75W, p-p, 20 MHz BW		50	60	mV
Total Output Power	Vo = ±12Vdc, -55°C to +95°C	7.5		75	W
Total Output Current (Io)	Vo = ±12Vdc, -55°C to +95°C	0.63		6.3	A
Total Output Current Limit	short circuit			9.4	A
Overvoltage Protection	% of Vor			120	%
Output Capacitance	Σ (C_A =C_B) for each output		3		µF
Isolation Characteristics					
Isolation Voltage	≥ 50MΩ	500			Vdc
Input to Output Cap.			0.45		µF
Dynamic Characteristics					
Maximum Excursion, Δ Vor	dI/dt = 1A/µs, Co = 0µF, Rc = ∞		±14		%
Ior, Iou = ±2A to 3A or	dI/dt = 1A/µs, Co = 2µF, Rc = 105kΩ		±10		%
±3A to ±2A, balanced loads	dI/dt = .1A/µs, Co = 5µF, Rc = 38kΩ		±5		%
Clock Frequency		0.95	1.0	1.05	MHz
Soft Start Turn-On Time			60		ms
Thermal Characteristics					
Operating Temperature	baseplate	-55		+95	°C
Storage Temperature	baseplate	-65		+150	°C
Efficiency					
RY2812-75-A	Po = 75W	83	85		%
RY2812-75-C	Po = 75W	81	83		%
Mechanical Characteristics					
Weight			91	100	g

RY2812-75 Electrical characteristics: T_c = 25°C, V_{in} = 28Vdc unless otherwise noted; all temp. are baseplace

Raytheon

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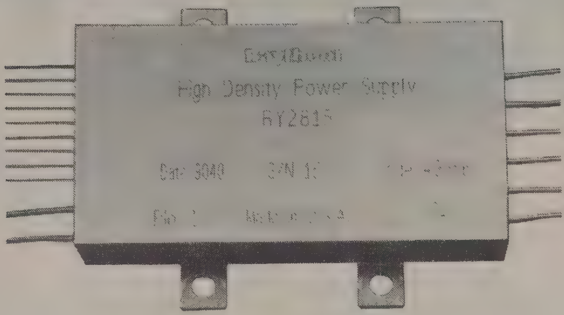
Hybrid DC/DC Converters RY2815-75 Series



Features

- 28Vdc input, ±15Vdc @ 5.0A total output
- 45W/in³ power density with low profile (fits in standard SEM-E single span format)
- Low weight: 91 grams typ.
- Full power operation from -55°C to +95°C (baseplate)
- Meets MIL-STD-461C, CS02, CS06 and narrowband emissions of CEO3 with 3 small external parts.
- NAVMAT derated with minor exceptions
- Protection features include:
  - — short circuit output current limit
  - — output overvoltage protection
  - — thermal shutdown
  - — input overvoltage shutdown
  - — input transient protection
- Other features include:
  - — synchronization for multiple units
  - — current sharing for parallel operation
  - — logic shutdown
  - — output status signal
  - — soft start
  - — fast transient response
  - — adjustable compensation
  - — junction temperature inducator

Applications

- Missile power
- Aircraft power
- Distributed power architecture for phased array radars
- Portable communications equipment
- Space-based vehicles
- Battery operated equipment

Description

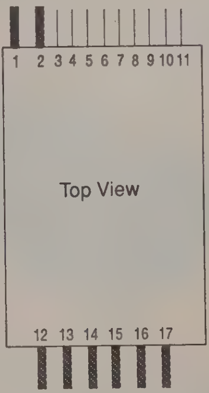
The RY2815-75 hybrid military dc/dc converter offers the highest power density of any military power converter in its power range available today. A 1 MHz switching frequency reduces the size of the magnetics and capacitors to enable their placement inside the hybrid package. Constant frequency PWM, rather than variable frequency resonant conversion, eliminates system beat-frequency problems. The use of X7R ceramic capacitors for filtering eliminates the reliability problems associated with tantalum or electrolytic capacitors and permits full power operation up to 95°C (baseplate).

The series includes two models with different input voltage ranges: 22-36Vdc and 16-50Vdc. All outputs are ±15Vdc @ 5.0A total. Additionally, custom versions with non-standard input voltage ranges or output voltages are easily produced with minor modifications. All products in the series are 100% screened to the specific tests and conditions as listed on the last page of this data sheet.

Absolute Max. Ratings

Operating Case Temperature:	125°C
±Remote Sense Voltage	±30Vdc
Lead Temperature (1/16' from case for 10 seconds):	300°C

Pin Configuration



Parameter	Conditions	Min	Typ	Max	Units
Input Charateristics					
Voltage Range					
RY2805-75-A	-55°C to +95°C, Po = 7.5W to 75W	22		36	Vdc
RY2805-75-C	-55°C to +95°C, Po = 7.5W to 75W	16		50	Vdc
Input Voltage Shutdown	% of max Vin			115	
Output Characteristics					
Output Voltage (Vor)	25°C, Po = 7.5W to 75W, Vin (low to high line)	±14.85	±15.00	±15.15	Vdc
	-55°C to +95°C, Po = 7.5W to 75W, Vin (low to high line)	±14.70	±15.00	±15.30	Vdc
Output Ripple/Noise	Po = 75W, p-p, 20 MHz BW		60	75	mV
Total Output Power	Vo = ±15Vdc, -55°C to +95°C	7.5		75	W
Total Output Current (Io)	Vo = ±15Vdc, -55°C to =95°C	0.5		5.0	A
Total Output Current Limit	short circuit			7.5	A
Overvoltage Protection	% of Vor			115	%
Output Capacitance	Σ ($C_A = C_B$) for each output		2.5		µF
Isolation Characteristics					
Isolation Voltage	≥ 50MΩ	500			Vdc
Input to Output Cap.			0.45		µF
Dynamic Characteristics					
Maximum Excursion, Δ Vor	dI/dt = 1A/µs, Co = 0µF, Rc = ∞		±14		%
Ior, Iou = ±1.7A to ±2.5A or	dI/dt = 1A/µs, Co = 2µF, Rc = 105kΩ		±10		%
±2.5A to ±1.7A, bal. loads	dI/dt = .1A/µs, Co = 5µF, Rc = 38kΩ		±5		%
Clock Frequency		0.95	1.0	1.05	MHz
Soft Start Turn-On Time			60		ms
Thermal Characteristics					
Operating Temperature	baseplate	-55		+95	°C
Storage Temperature	baseplate	-65		+150	°C
Efficiency					
RY2815-75-A	Po = 75W	83	85		%
RY2815-75-C	Po = 75W	81	83		%
Mechanical Characteristics					
Weight			91	100	g

RY2815-75 Electrical characteristics: $T_C = 25°C$, $V_{in} = 28Vdc$ unless otherwise noted; all temp. are baseplace

Raytheon

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DC-DC CONVERTERS

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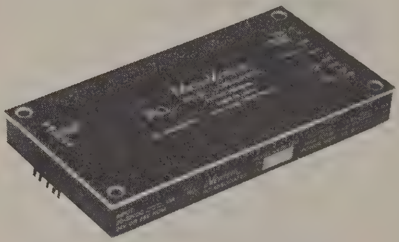
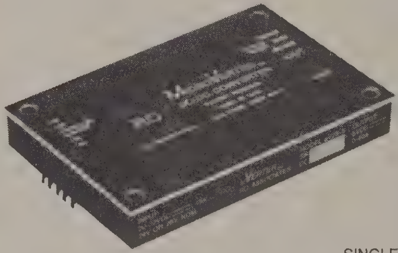
World's Most Advanced ■
Ultra High Density ■

UP TO 250 WATTS
28/48/300 VDC INPUT

SINGLE & TRIPLE OUTPUT



TRIPLE
5V @ 35A, ±12 or ±15V @ 3A
0.5" X 2.4" X 4.6"



SINGLE
5V @ 40A
0.5" X 2.4" X 3.6"

FEATURES

- Miniature Size
- High Density - up to 58 watts/in.^{3}
- Constant Frequency Operation
- Parallelable with Current Sharing
- Fault Tolerant - True n+1 Redundancy
- Extremely Low Thermal Resistance
- Output Good Signal
- Optional Sync Pin
- Hot Plug-in Capability
- 28/270 VDC Input per Mil STD 704D
- Ruggedized - Meets MIL-STD 810D
- Non-shutdown OVP
- Logic On/Off
- Suitable for PC or Chassis Mounting
- Thermal/Input OVP Protection
- Fully Automated Manufacturing

Patent Pending

SPECIFICATIONS

INPUT		MIN	TYPICAL	MAX	UNITS
Input voltage	µV28	20	24-28	32	VDC
	µV48	36	48	72	VDC
	µV300	220	300	400	VDC
Input reflected ripple (f.l. nom line)			20		%
No load power dissipation			1.5		watts
Logic disabled current (sink)			1		ma
Logic disabled power in			0.35		watts
Input ripple rejection (120 Hz)			60		dB
OUTPUT: (Singles and Main Output of Triple)					
Set point accuracy			±1	±1	%
Load regulation (0-100%)			.02	.2	%
Line regulation (over range)			.02	.2	%
Ripple (0-10 MHz)			1	3	% p-p
Trim range		±10			%
Remote Sense compensation				0.5	V total
OVP (non shutdown aut rec.)			120		%
Current Limit (aut rec.)			110-120		% f.l.
Current sharing (automatic)			±10		%
Transient response (50-100% load) Vout 1%			200		µs
Temp drift				.02	%/°C
OUTPUT: (Auxiliary Outputs of Triples)					
Set point accuracy			±0.5	±1	%
Load regulation (0-100%)			.2	.5	%
Line regulation (over range)			.01	.1	%
Ripple (0-10 MHz)			.25	.5	% p-p
Current Limit (aut rec.)			110-120		% f.l.
Transient response (50-100% load) Vout 1%			200		µs
Temp drift			.06		%/°C
CONTROL:					
Turn on time (power applied) Vout 1% (1/2 load)			20-50		ms
Logic turn on time (Vout 1%)			1		ms
ISOLATION:					
Input to output	µV28	1000			VDC
	µV48	3000			VDC
	µV300	4500			VDC
Input to case	µV28	1000			VDC
	µV48	1500			VDC
	µV300	2500			VDC
Output to case	µV28	200			VDC
	µV48	500			VDC
	µV300	500			VDC
Input to output capacity			2200		pF
THERMAL:					
Operating temperature		-40		+100	°C case
Automatic shutdown temperature		+100	+105	+110	°C case
Thermal resistance case to ambient			4.2 (singles) 3.3 (triples)		°C/w °C/w
WEIGHT:			7 (singles) 9 (triples)		oz. oz.

See Our Pages in Section 4000

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- Ultra High Density

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MICROVERTER
µV SERIES

RO
RO ASSOCIATES

UP TO 250 WATTS
28/48/300 VDC INPUT

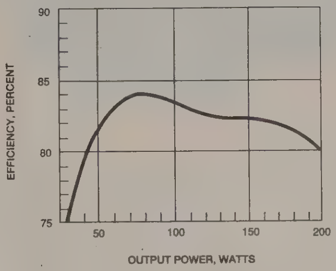
MODEL SELECTION

INPUT VOLTAGE	MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT
20-32	µV28-2	2.1V	60A
	µV28-3	3.3V	50A
	µV28-5	5V	40A
	µV28-8	8V	30A
	µV28-12	12V	20A
	µV28-15	15V	16A
	µV28-24	24V	10A
	µV28-28	28V	9A
	µV28-T512	* 5V 12V -12V	35A 3A 3A
	µV28-T515	* 5V 15V -15V	35A 3A 3A
36-72	µV48-2	2.1V	60A
	µV48-3	3.3V	50A
	µV48-5	5V	40A
	µV48-8	8V	30A
	µV48-12	12V	20A
	µV48-15	15V	16A
	µV48-24	24V	10A
	µV48-28	28V	9A
	µV48-T512	* 5V 12V -12V	35A 3A 3A
	µV48-T515	* 5V 15V -15V	35A 3A 3A
220-400	µV300-2	2.1V	60A
	µV300-3	3.3V	50A
	µV300-5	5V	40A
	µV300-8	8V	30A
	µV300-12	12V	20A
	µV300-15	15V	16A
	µV300-24	24V	10A
	µV300-28	28V	9A
	µV300-T512	5V 12V -12V	* 35A 3A 3A
	µV300-T515	5V 15V -15V	* 35A 3A 3A

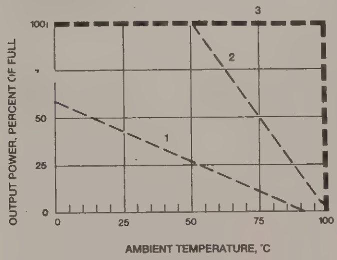
* Maximum total output power 185W
No minimum 5V load for ±12 or ±15V @ 2A

See Our Pages in Section 4000

SINGLE & TRIPLE OUTPUT EFFICIENCY - µV-48-5

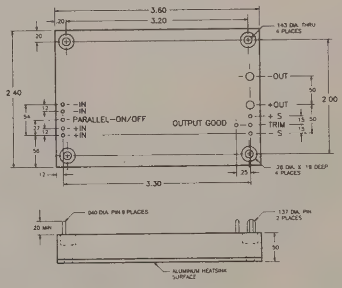


THERMAL PERFORMANCE

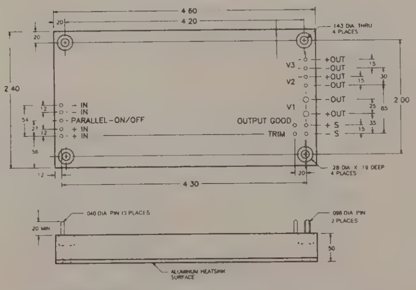


1 - NO COOLING (NATURAL CONVECTION)
2 - WITH 1°C/W HEATSINK
3 - OUTPUT POWER VS. CASE TEMP

OUTLINE DRAWINGS


3.60
3.20
.20
20
143 DIA. THRU 4 PLACES
-OUT
+OUT
+ S
TRIM
- S
OUTPUT GOOD
-IN
-IN
PARALLEL-ON/OFF
+IN
+IN
2 40
2 00
50
50
15
15
12
54
27
12
56
12
25
3.30
28 DIA. X 19 DEEP 4 PLACES
040 DIA. PIN 9 PLACES
137 DIA. PIN 2 PLACES
20 MIN
50
ALUMINUM HEATSINK SURFACE

SINGLE OUTPUT


4 60
4 20
20
20
143 DIA. THRU 4 PLACES
V3
+OUT
-OUT
V2
+OUT
-OUT
V1
-OUT
+OUT
+ S
- S
OUTPUT GOOD
TRIM
- IN
- IN
PARALLEL-ON/OFF
+ IN
+ IN
2 40
2 00
15
15
30
25
85
35
15
12
54
27
12
56
12
20
4 30
28 DIA. X 19 DEEP 4 PLACES
040 DIA. PIN 13 PLACES
098 DIA. PIN 2 PLACES
20 MIN
50
ALUMINUM HEATSINK SURFACE

TRIPLE OUTPUT

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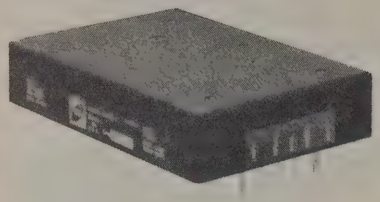
25 years experience ■
Low profile ■

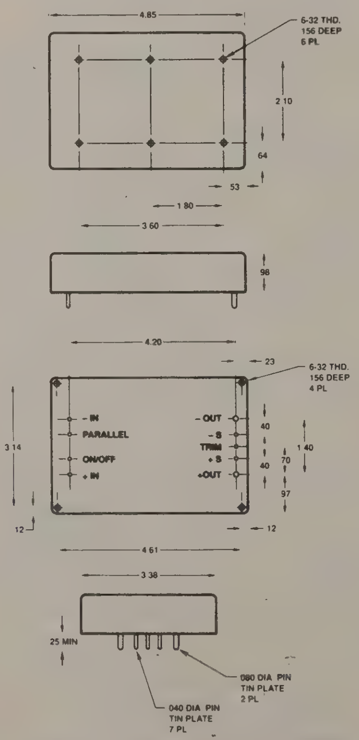
125-150 WATT HIGH DENSITY/ 48 α 300 VDC INPUT

**New -
Dual Output Available**



FEATURES

- ■ Lowest Thermal Resistance – *2.5°C/Watt*
- ■ Parallelable – Current Mode Control
- ■ Fault Tolerant – True N + 1 Redundancy
- ■ Hot Plug in Capability
- ■ Current Sharing – No Master/Slave
- ■ Compatible – Industry Standard Pin-Out
- ■ Non-Shutdown OVP
- ■ Logic ON/OFF
- ■ 5 Sided Shielding
- ■ Ruggedized Design – Meets MIL-810D
- ■ UL/CSA/VDE Compliance
- ■ Thermal Protection – Auto Reset
- ■ Input Overvoltage Protection
- ■ Optional Output Good Signal, ± 10%
- ■ .98 height - 4.85 length - 3.38 width



See Our Pages in Section 4000

SPECIFICATIONS

		RO 48 SERIES	RO300 SERIES	UNITS
INPUT:				
Input voltage		36-66	200-400	VDC
In rush charge		2.1×10^{-4}	3×10^{-6}	Coulombs
Input reflected ripple (f.l. nom line)		20	10	% P-P
No load power dissipation		3.1	6.2	watts
Logic disabled current (sink)		1	1	ma
Logic disabled power in		0.35	1.2	watts
Input ripple rejection (120Hz)		55	55	dB
Input Overvoltage (No damage to unit)		66-100	400-450	VDC
OUTPUT:				
Set point accuracy		± 1	± 1	%
Load regulation (0-100%)		10	10	mv
Line regulation (over range)		10	10	mv
Ripple (0-10MHz)		1	1	% p-p
Trim Range		± 10	± 10	%
Remote Sense compensation		0.5	0.5	V total
OVP (non shutdown auto rec.)		120	120	%
Current Limit (auto rec.)		110-120	110-120	% f.l.
Current sharing (automatic)		± 10	± 10	%
Transient response (20-80% load)	Vout 1%	200	200	µs
Transient response (LL to HL)	Vout 1%	200	200	µs
Transient response (50-100% load)	Vout 1%	200	200	µs
Temperature drift		.02	.02	%/°C
CONTROL:				
Turn on time (power applied)	Vout 1%	60	60	ms
Logic turn on time	Vout 1%	6	6	ms
ISOLATION:				
Input to output		5500	5500	VDC
Input to case		2500	2500	VDC
Output to case		500	500	VDC
Input to output capacity		2200	2200	pF
THERMAL:				
Operating temperature		−55 to 100	−55 to 100	°C case
Automatic shut down temperature		105-110	105-110	°C case
Thermal resistance case to ambient (f.l.)		2.5	2.5	°C/watt
WEIGHT:		24	24	oz.

MODEL SELECTION

INPUT VOLTAGE	OUTPUT VOLTAGE/CURRENT		MODEL
48VDC	5V	25A	RO48-5
48VDC	12V	12A	RO48-12
48VDC	15V	10A	RO48-15
48VDC	24V	6A	RO48-24
48VDC	28V	5A	RO48-28
300VDC	5V	25A	RO300-5
300VDC	12V	12A	RO300-12
300VDC	15V	10A	RO300-15
300VDC	24V	6A	RO300-24
300VDC	28V	5A	RO300-28
48VDC	±12V	8A	RO48-D12
48VDC	±15V	6A	RO48-D15
48VDC	±5V	10A	RO48-D5
48VDC	5V/12V	10A/8A	RO48-D512
300VDC	5V/12V	8A	RO300-D12
300VDC	±15V	6A	RO300-D15
300VDC	±5V	10A	RO300-D5
300VDC	5V/12V	10A/8A	RO300-D512

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DC-DC CONVERTERS

RO ASSOCIATES

- 25 years experience
- High efficiency

INFORMATION HOTLINE

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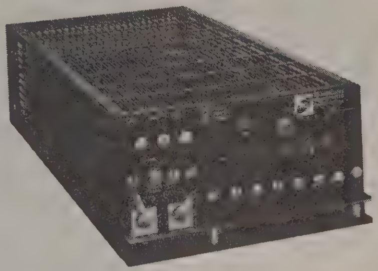
200 WATTS 24VDC/48VDC INPUT

FEATURES

- High efficiency secondaries
- Low profile (2.7″ high)
- Up to 5 outputs in one package
- Output surge capability for disk drives
- Wide input range
- 4 outputs in one package
- No minimum load



SINGLE OUTPUT – 24VDC INPUT

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
2440	5VDC	40A	10mV	±10mV	60mV p-p

MULTIPLE OUTPUT

2410	5VDC	20A	10mV	±10mV	60mV p-p
	+12VDC	4A	0.5%	±10mV	60mV p-p
	−12VDC	4A*	0.5%	±10mV	60mV p-p
	−5VDC	0.5A*	400mV	±25mV	60mV p-p
2413	5VDC	20A	10mV	±10mV	60mV p-p
	+15VDC	3A	0.5%	±10mV	60mV p-p
	−15VDC	3A*	0.5%	±10mV	60mV p-p
	−5VDC	0.5A*	400mV	±25mV	60mV p-p
2424	5VDC	20A	10mV	±10mV	60mV p-p
	+12VDC	3A	0.5%	±10mV	60mV p-p
	−12VDC	2A	0.5%	±10mV	60mV p-p
	24VDC	2A, 3A surge	0.5%	±20mV	100mV p-p
2430	5VDC	28A	10mV	±10mV	60mV p-p
	+12VDC	3A	0.5%	±10mV	60mV p-p
	−12VDC	2A	0.5%	±10mV	60mV p-p

*Note: Total current of negative outputs cannot exceed 4 amps for −12V operation (3 amps for −15V)

SINGLE OUTPUT – 48VDC INPUT

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
1140	5V	40A	10mV	±10mV	60mV p-p

MULTIPLE OUTPUT

1110	5V	20A	10mV	±10mV	60mV p-p
	+(12-15)VDC	4A @ 12V-3A @ 15V	0.5%	±10mV	60mV p-p
	−(12-15)VDC	4A* @ −12V-3A @ −15V	0.5%	±10mV	60mV p-p
	−5VDC	0.5A*	400mV	±25mV	60mV p-p
1112	5V	20A	10mV	±10mV	60mV p-p
	+12V	4A (6A surge)	10%	±1%	1% p-p
	+(12-15)VDC	3A @ 12V-2.5A @ 15V	0.5%	±10mV	60mV p-p
	−(12-15)5VDC	2A** @ −12V-1.5A @ −15V	0.5%	±10mV	60mV p-p
	−5VDC	0.5**	400mV	±25mV	60mV p-p
1124	5V	20A	10mV	±10mV	60mV p-p
	+24V	2A (3A surge)	5%	±1%	1% p-p
	+(12-15)VDC	3A @ 12V-2.5A @ 15V	0.5%	±10mV	60mV p-p
	−(12-15)5VDC	2A** @ −12V-1.5A @ −15V	0.5%	±10mV	60mV p-p
	−5VDC	0.5**	400mV	±25mV	60mV p-p
1124S	5V	15A	10mV	±10mV	60mV p-p
	+24V	3A	0.5%	±10mV	60mV p-p
	+(12-15)VDC	2A	0.5%	±10mV	60mV p-p
	−(12-15)5VDC	2A	0.5%	±10mV	60mV p-p
1130	5VDC	30A	10mV	±10mV	60mV p-p
	+12VDC	3A (6A surge)	0.5%	±10mV	60mV p-p
	−12VDC	2A	0.5%	±10mV	60mV p-p

*Note: Total current of negative outputs cannot exceed 4 amps for −12V operation (3 amps for −15V)

**Note: Total current for negative outputs cannot exceed 2 amps for −12V operation (1.5 amps for −15V)

***MINIMUM 4A load on +5V is required for auxiliary outputs to regulate

SPECIFICATIONS

Input
24 VDC nominal (19-32 VDC)
48 VDC nominal (40-70 VDC)

Operating temperature
0°C to 50°C

Protection
All outputs current limited, continuous overload and short circuit proof. 5V, 12V, 15V, 5V and ±12/15V outputs have self-recovering overvoltage protection. Thermal protection is provided.

Remote sensing
Remote sensing only on +5V

Operating temperature
0°C to 50°C

Storage temperature
−55°C to +85°C

Isolation
1000 VDC input to case
1000 VDC input to output

Efficiency
72% typical at full load

Weight
5.5 lbs. (2.5 kilograms)

Size
2.7″ × 5.25″ × 11″ max
(6.9 cm × 13.4 cm × 28 cm max)

Safety
Designed to meet UL 478 and UL 1012 and CSA 22.2. Model 1110 UL certification pending.

Temperature stability
Better than .02%/C°

See Our Pages in Section 4000

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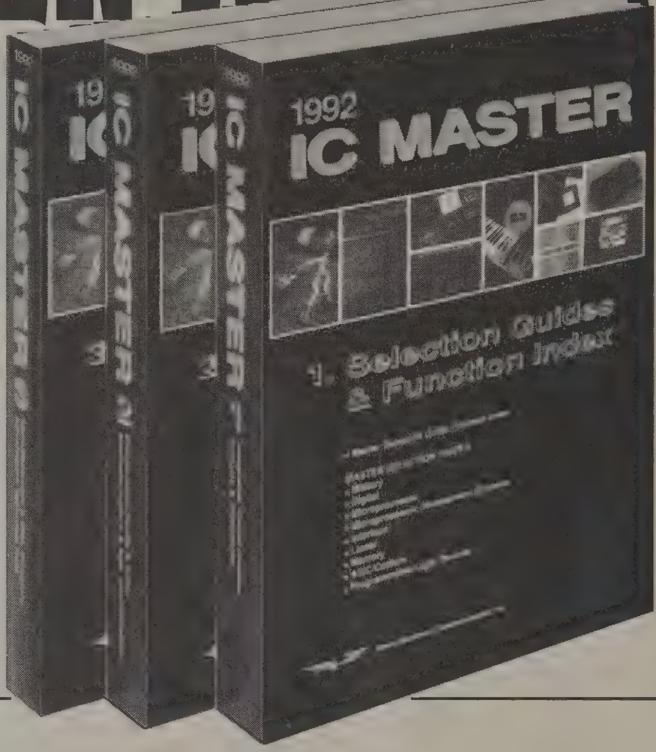
SUPER TIME SAVER!



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- We're focused: Modular Power Supplies are our only product.
- Wide range of Standard and Custom Configurations.
- Availability of Products and Direct Customer Support.

DC/DC Converters Quick Selection Table

Single Output

Output Power	Input Voltages	Output Voltages	Series
1.5-2.4W	5	5, 9, 12, 15	DP
4.5W	5, 9 - 36, 20 - 72	5, 12, 15	QA
6W	4.5 - 5.5	5, 9, 12, 15	QQA
5 - 7.5W	5, 9 - 36, 20 - 72	5, 9, 12, 15	HA/HP
15W	20 - 72	5, 12, 15 ±12, ±15	GA
15 - 40W	9 - 36 14-36 15-36	5, 12, 15	NA
15W	9 - 36, 20 - 72	5, 12, 15	J
18W, 25W	9 - 36, 20 - 72	5, 12, 15	TA

Dual Output

Output Power	Input Voltages	Output Voltages	Series
1.5-2.4W	5	±12, ±15	DP
5.4W	5, 9 - 36, 20 - 72	±12, ±15	QA
5 - 7.5	5, 9 - 36, 20 - 72	±12, ±15	HA/HP
15W	9 - 36, 20 - 72	±5, ±12, ±15	J
18W, 25W	9 - 36, 20 - 72	±12, ±15	TA

Triple Output

Output Power	Input Voltages	Output Voltages	Series
15W	9 - 36, 20 - 72	5±12, 5±15	J
18W, 25W	9 - 36, 20 - 72	5±12, 5±15	TA

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DC/DC Converters

DP Series
1.5 to 2.4 Watt Single and Dual Output

- Regulated outputs
- LC input filter
- Continuous short circuit protection
- 500 VDC I/O isolation

Input Voltage Range VDC	Output Voltage	Maximum Current (AT)			Regulation %		Case Size	Model Number
		50°C	60°C	70°C	Line ±	Load ±		
4.75 - 5.25	5 VDC	300 mA	300 mA	300 mA	0.2	0.5	1.25 x 0.8 x 0.4	DP11-030-05
4.75 - 5.25	9 VDC	200 mA	200 mA	200 mA				DP19-020-05
4.75 - 5.25	12 VDC	200 mA	175 mA	150 mA				DP12-020-05
4.75 - 5.25	15 VDC	160 mA	140 mA	120 mA				DP13-016-05
4.75 - 5.25	±12 VDC	±85 mA	±85 mA	±85 mA				DP22-017-05
4.75 - 5.25	±15 VDC	±70 mA	±70 mA	±65 mA				DP23-014-05

QA Series
4.5 Watt Single and Dual Output

- Regulated outputs
- Continuous short circuit protection
- 500 VDC I/O isolation
- Efficiency to 80%

Input Voltage Range VDC	Output Voltage	Output Current	Regulation %		Case Size	Model Number
			Line ±	Load ±		
4.5 - 5.5	5 VDC	750 mA	1.0	0.5	1.0 x 2.0 x 0.4	QA11-075-05
4.5 - 5.5	12 VDC	375 mA				QA12-037-05
4.5 - 5.5	15 VDC	300 mA				QA13-030-05
9 - 36	5 VDC	750 mA				QA11-075-18
9 - 36	12 VDC	375 mA				QA12-037-18
9 - 36	15 VDC	300 mA				QA13-030-18
20 - 72	5 VDC	750 mA				QA11-075-48
20 - 72	12 VDC	375 mA				QA12-037-48
20 - 72	15 VDC	300 mA				QA13-030-48
4.5 - 5.5	±12 VDC	± 185 mA				QA22-037-05
4.5 - 5.5	±15 VDC	±150 mA				QA23-030-05
9 - 36	±12 VDC	±185 mA				QA22-037-18
9 - 36	±15 VDC	±150 mA				QA23-030-18
20 - 72	±12 VDC	±185 mA				QA22-037-48
20 - 72	±15 VDC	±150 mA				QA23-030-48

H Series
5 to 7.5 Watt Single and Dual Output

- Regulated outputs
- Pi input filter
- Continuous short circuit protection
- MOSFET Design
- 500 VDC I/O isolation
- SMT - surface mount technology

Input Voltage Range VDC	Output Voltage	Output Current	Regulation %		Case Size	Model Number	Model Number
			Line ±	Load ±			
4.5 - 5.5	5 VDC	1000 mA	0.01	0.1	2.0 x 2.0 x 0.4 *Note*	HA11-100-05	HP11-100-05
9 - 36	5 VDC	1000 mA	0.25	1.0		HA11-100-18	HP11-100-18
20 - 72	5 VDC	1000 mA	0.25	1.0		HA11-100-48	HP11-100-48
4.5 - 5.5	9 VDC	660 mA	0.01	0.1		HA19-066-05	HP19-066-05
9 - 36	9 VDC	660 mA	0.25	1.0		HA19-066-18	HP19-066-18
20 - 72	9 VDC	660 mA	0.25	1.0		HA19-066-48	HP19-066-48
4.5 - 5.5	12 VDC	600 mA	0.01	0.1		HA12-060-05	HP12-060-05
9 - 36	12 VDC	600 mA	0.25	1.0		HA12-060-18	HP12-060-18
20 - 72	12 VDC	600 mA	0.25	1.0		HA12-060-48	HP12-060-48
4.5 - 5.5	15 VDC	500 mA	0.01	0.1		HA13-050-05	HP13-050-05
9 - 36	15 VDC	500 mA	0.25	1.0		HA13-050-18	HP13-050-18
20 - 72	15 VDC	500 mA	0.25	1.0		HA13-050-48	HP13-050-48
4.5 - 5.5	±12 VDC	±300 mA	0.01	0.1		HA22-060-05	HP22-060-05
9 - 36	±12 VDC	±300 mA	0.25	1.0		HA22-060-18	HP22-060-18
20 - 72	±12 VDC	±300 mA	0.25	1.0		HA22-060-48	HP22-060-48
4.5 - 5.5	±15 VDC	±250 mA	0.01	0.1		HA23-050-05	HP23-050-05
9 - 36	±15 VDC	±250 mA	0.25	0.1		HA23-050-18	HP23-050-18
20 - 72	±15 VDC	±250 mA	0.25	0.1		HA23-050-48	HP23-050-48

Note: HA center pin configuration
HP outer pin configuration

NA Series
15 to 40 Watt Single Output

- Ultrawide input range
- Efficiency to 85%
- Six-sided continuous shielding
- Regulated outputs
- Overvoltage protection
- Surface mount technology

Input Voltage Range	Output Voltage	Output Current	Case Sizes	Power Out	Model Number
9 - 36 VDC	5 VDC	3000 mA	2.0 x 2.0 x 0.4 and 2.5 x 3.5 x 0.83	15 Watts	NA11-300-18
15 - 36 VDC	12 VDC	1250 mA		15 Watts	NA12-125-18
9 - 36 VDC	5 VDC	3000 mA		15 Watts	NP11-300-18
14 - 36 VDC	12 VDC	1250 mA		15 Watts	NP12-125-18
9 - 36 VDC	5 VDC	8000 mA		40 Watts	NC11-800-18
14 - 36 VDC	12 VDC	3300 mA		40 Watts	NC12-330-18
9 - 36 VDC	5 VDC	8000 mA		40 Watts	NW11-800-18
14 - 36 VDC	12 VDC	3300 mA		40 Watts	NW12-330-18

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1-800-448-4SCI

49 Range Rd., Windham, NH 03087 Fax 603/893-6280

DC/DC Converters

TA Series
18 Watt Single, Dual and Triple Output

- Regulated outputs
- Remote shutdown
- Continuous short circuit protection
- MOSFET design
- 500 VDC I/O isolation
- 200 kHz switching frequency

Input Voltage Range VDC	Output Voltage	Output Current	Regulation %		Case Size	Model Number
			Line ±	Load ±		
9 - 36	5 VDC	3.5 A			2.5 x 3.0 x 0.83	TA11-350-18
20 - 72	5 VDC	3.5 A				TA11-350-48
9 - 36	12 VDC	1.5 A	0.5	1.0		TA12-150-18
20 - 72	12 VDC	1.5 A				TA12-150-48
9 - 36	15 VDC	1.2 A				TA13-120-18
20 - 72	15 VDC	1.2 A				TA13-120-48
9 - 36	±12 VDC	±750 mA				TA22-150-18
20 - 72	±12 VDC	±750 mA	0.5	1.0		TA22-150-48
9 - 36	±15 VDC	±600 mA				TA23-120-18
20 - 72	±15 VDC	±600 mA				TA23-120-48
9 - 36	+5/±12 VDC	2.0 A ±310 mA				TA34-260-18
20 - 72	+5/±12 VDC	2.0 A ±310 mA	0.5/3.0	0.5/3.0		TA34-260-48
9 - 36	+5/±15 VDC	2.0 A ±260 mA				TA35-250-18
20 - 72	+5/±15 VDC	2.0 A ±260 mA				TA35-250-48

TA Series
25 Watt Single, Dual and Triple Output

- Regulated outputs
- Six-sided shielding
- Continuous short circuit protection
- Remote shutdown
- 500 VDC I/O isolation

Input Voltage Range VDC	Output Voltage	Output Current	Regulation %		Case Size	Model Number
			Line ±	Load ±		
9 - 36	5 VDC	5000 mA			2.5 x 3.0 x 0.83	TA11-500-18
20 - 72	5 VDC	5000 mA				TA11-500-48
9 - 36	12 VDC	2000 mA	0.5	1.0		TA12-200-18
20 - 72	12 VDC	2000 mA				TA12-200-48
9 - 36	15 VDC	1600 mA				TA13-160-18
20 - 72	15 VDC	1600 mA				TA13-160-48
9 - 36	±12 VDC	±1000 mA				TA22-200-18
20 - 72	±12 VDC	±1000 mA				TA22-200-48
9 - 36	±15 VDC	±800 mA				TA23-160-18
20 - 72	±15 VDC	±800 mA				TA23-160-48
9 - 36	+5/±12 VDC	3500 mA ±750				TA34-500-18
20 - 72	+5/±12 VDC	3500 mA ±750				TA34-500-48
9 - 36	+5/±15 VDC	3500 mA ±500				TA35-450-18
20 - 72	+5/±15 VDC	3500 mA ±500				TA35-450-48

QQA Series
6 Watt Single and Dual Output

- 4:1 Ultrawide input range
- Efficiency 80% (typ.)
- 500 VDC I/O isolation
- Surface mount technology

Input Voltage Range	Output Voltage	Output Current	Input Current		Case Size	Model Number
			Min. Load	Full Load		
4.5 - 5.5 VDC	5 VDC	1000 mA	350 mA	1400 mA	1.0 x 2.0 x 0.4	QQA11-100-05
4.5 - 5.5 VDC	9 VDC	600 mA	375 mA	1500 mA		QQA19-060-05
4.5 - 5.5 VDC	12 VDC	500 mA	400 mA	1600 mA		QQA12-050-05
4.5 - 5.5 VDC	15 VDC	400 mA	400 mA	1600 mA		QQA13-040-05
9 - 36 VDC	5 VDC	1000 mA	91 mA	365 mA		QQA11-100-18
9 - 36 VDC	12 VDC	500 mA	112 mA	450 mA		QQA12-050-18
9 - 36 VDC	15 VDC	400 mA	112 mA	450 mA		QQA13-040-18
20 - 72 VDC	5 VDC	1000 mA	37 mA	150 mA		QQA11-100-48
20 - 72 VDC	12 VDC	500 mA	44 mA	175 mA		QQA12-050-48
20 - 72 VDC	15 VDC	400 mA	44 mA	175 mA		QQA13-040-48
4.5 - 5.5 VDC	±12 VDC	±250 mA	400 mA	1600 mA		QQA22-050-05
4.5 - 5.5 VDC	±15 VDC	±200 mA	400 mA	1600 mA		QQA23-040-05
9 - 36 VDC	±12 VDC	±250 mA	112 mA	450 mA		QQA22-050-18
9 - 36 VDC	±12 VDC	±200 mA	112 mA	450 mA		QQA23-040-18
20 - 72 VDC	±12 VDC	±250 mA	44 mA	175 mA		QQA22-050-48
20 - 72 VDC	±15 VDC	±200 mA	44 mA	175 mA		QQA23-040-48

GA Series
15 Watt Single and Dual Output

- Ultrawide input range
- Efficiency to 85%
- Six-sided continuous shielding
- Regulated outputs
- Overvoltage protection
- Overcurrent protection • Remote on-off

Input Voltage Range	Output Voltage	Output Current	Case Size	Ripple, P-P Max	Model Number
20 - 72 VDC	5 VDC	3000 mA	1.6 x 2.0 x 0.4	75 mV	GA11-300-48
20 - 72 VDC	12 VDC	1250 mA		75 mV	GA12-125-48
20 - 72 VDC	15 VDC	1000 mA		75 mV	GA13-100-48
20 - 72 VDC	±12 VDC	±625 mA		75 mV	GA22-125-48
20 - 72 VDC	±15 VDC	±500 mA		75 mV	GA23-100-48

Note: Requires an external capacitor across input. Semiconductor Circuits, Inc. recommends a 33mF @ 100V capacitor (Sprague Type 672D or equivalent).

J Series
15 Watt Single, Dual and Triple Output

- Regulated outputs
- Continuous short circuit protection
- MOSFET design
- 500 VDC I/O isolation

Input Voltage Range VDC	Output Voltage	Output Current	Regulation %		Case Size	Model Number	Model Number
			Line ±	Load ±			
9 - 36	5 VDC	3.0 A			2.0 x 2.0 x 0.4 ***Note***	JA11-300-18	JP11-300-18
20 - 72	5 VDC	3.0 A				JA11-300-48	JP11-300-48
9 - 36	12 VDC	1.25 A	0.25	0.25		JA12-125-18	JP12-125-18
20 - 72	12 VDC	1.25 A				JA12-125-48	JP12-125-48
9 - 36	15 VDC	1.0 A				JA13-100-18	JP13-100-18
20 - 72	15 VDC	1.0 A				JA13-100-48	JP13-100-48
9 - 36	±12 VDC	±625 mA				JA22-125-18	JP22-125-18
20 - 72	±12 VDC	±625 mA	0.25	0.25		JA22-125-48	JP22-125-48
9 - 36	±15 VDC	±500 mA				JA23-100-18	JP23-100-18
20 - 72	±15 VDC	±500 mA				JA23-100-48	JP23-100-48
9 - 36	5/±12 VDC	1.5A/±300 mA					JP34-210-18
20 - 72	5/±12 VDC	1.5A/±300 mA	0.25/2.0	0.25/3.0			JP34-210-48
9 - 36	5/±15 VDC	1.5A/±250 mA					JP35-200-18
20 - 72	5/±15 VDC	1.5A/±250 mA					JP35-200-48

Note: JA center pin configuration
JP outer pin configuration

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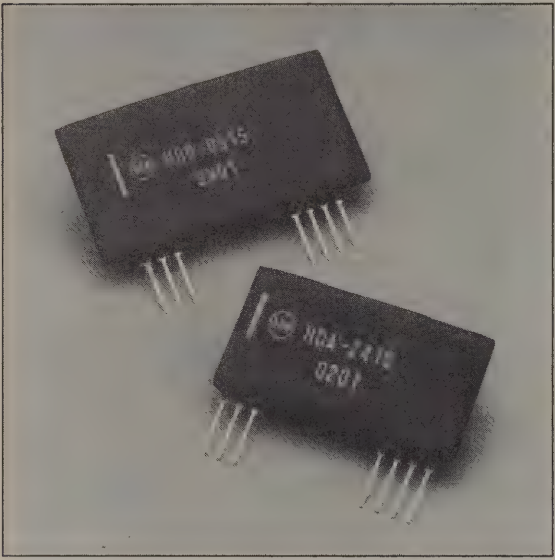
DC-DC CONVERTERS

Isolated

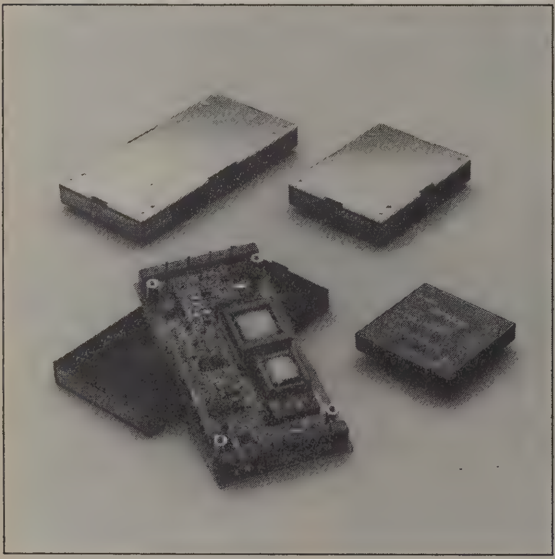


FEATURES

- Compact Footprint, Low Profile
- No Load Operation
- Light Weight Packaging
- High Reliability
- Low Cost

DESCRIPTION

- 1 Watt through 150 Watt Ratings
- 5, 12, 24 and 48 VDC Inputs
- SIP and Standard Board-Mounted Packaging
- Single, Dual and Triple Outputs
- Input/Output Isolation
- Input/Output Filters



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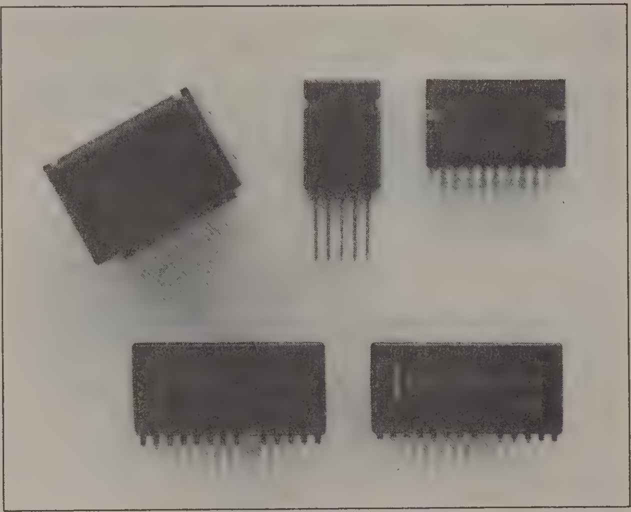
PERFORMANCE, RELIABILITY AND VALUE FOR YOUR POWER SUPPLY NEEDS

DC-DC CONVERTERS

Non-Isolated



FEATURES

- Ultra Low Cost
- Compact, Light Weight Packaging
- High Reliability (>1 Million Hours)

DESCRIPTION

- 0.6A through 6.0A Models
- Built-In Inductor (0.6A, 1.2A Models)
- Overload and Thermal Protection
- Fixed Frequency
- 5V and 12V Standard Output Voltage (Adjustable with External Potentiometer)

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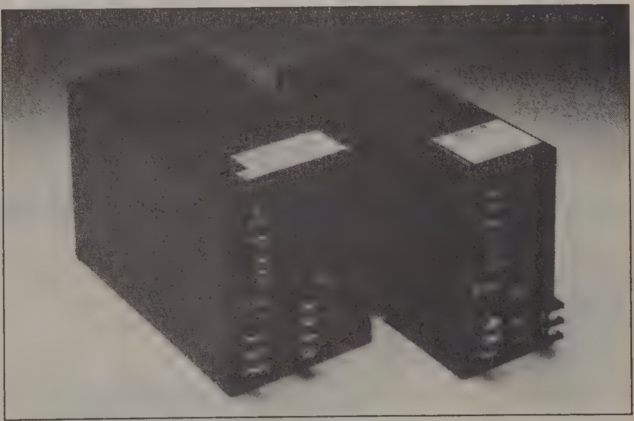

FEATURES

- High Reliability with MTBF of 300,000+ Hours
- Wide Range Input
- UL, CSA, IEC Safety Approvals
- Small Size
- Fully Enclosed with Built-In Fan

DESCRIPTION

- 24 or 48VDC Outputs Available
- 250 Watt and 500 Watt Models
- 0.99 Power Factor Meets IEC 55-2
- AC Power Fail and Power Alarm Signal
- 83% Efficiency

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DC/DC CONVERTERS

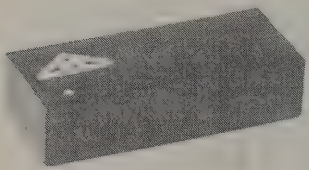
FEATURES

- *Compact Design*
- *PC Board Mounted*
- *Operating Temp: 0°C To +70°C*
- *Option For Output Shutdown*
- *Option For Output Voltage Adjustment*

APPLICATIONS

- *Distributed Power Systems*
- *Electroluminescent Display*
- *Computer Equipment*
- *Vacuum Fluorescent Display*
- *Industrial And Process Control*
- *Telecommunications Equipment*
- *Local Area Network*
- *POS Terminals*

These converters operate over a wide range of input voltages while maintaining excellent output regulation. These power supplies are capable of withstanding simultaneous and continuous short circuits across their outputs.

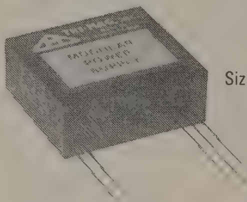


Size: 0.89 (L) x 0.39 (W) x 0.33 (H)

TDB1 SERIES

1 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
1 WATT	5	5V, 9V, 12V, 15V, 24V	500V
	12	5V, 9V, 12V, 15V	500V
	24	5V, 12V, 15V	500V

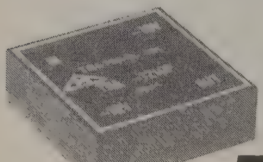


Size: 1.10 (L) x 0.34 (W) x 0.57 (H)

TSP2 SERIES

1-2 Watt, Sip Type

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
1-2 WATT	5	5V, 9V, 12V, 15V, ±12V, ±15V	500V
	12	5V, 9V, 12V, ±12V, ±15V	500V
	24	5V, 12V, 15V, ±12V, ±15V	500V

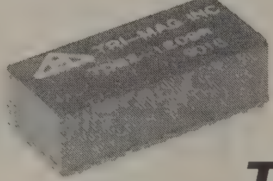


Size: 1.03 (L) x 1.30 (W) x 0.4 (H)

TDA2 SERIES

2-3 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
2-3 WATT	4.5–6.0 (5)	5V, 12V, 15V, ±12V, ±15V	2500V
	9–18 (12)	5V, 9V, 12V, 15V, ±12V, ±15V	2500V
	18–36 (24)	5V, 12V, 15V, ±12V, ±15V	2500V
	36–72 (48)	5V, 12V, 15V, ±12V, ±15V	2500V

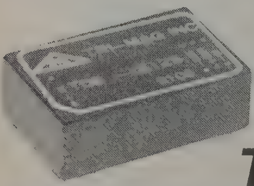


Size: 1.27 (L) x 0.6 (W) x 0.4 (H)

TDB2 SERIES

2 Watt, 24 Pin DIL Single & Dual Output

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
2 WATT	5	5V, 9V, 12V, 15V, ±5V, ±12V, ±15V	500V
	12	5V, 9V, 12V, ±12V, ±15V	500V
	24	5V, 12V, 15V, ±12V, ±15V	500V

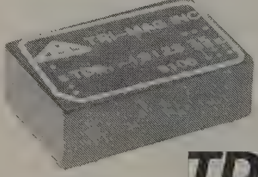


Size: 1.25 (L) x 0.80 (W) x 0.4 (H)

TDB3 SERIES

2 Watt, 24 Pin DIL Single & Dual Output

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
2 WATT	5	5V, 9V, 12V, 15V, ±5V, ±12V, ±15V	500V
	12	5V, 9V, 12V, ±12V, ±15V	500V
	24	5V, 12V, 15V, ±12V, ±15V	500V
	48	5V, 12V, 15V, ±12V, ±15V	500V



Size: 1.25 (L) x 0.80 (W) x 0.4 (H)

TDB4W SERIES

3 Watt, DIP 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
3 WATT	4.5–6.0 (5)	5V, 12V, 15V	500V
	9–18 (12)	5V, 12V, 15V	500V
	18–36 (24)	5V, 12V, 15V	500V
	36–72 (48)	5V, 12V, 15V	500V

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DC/DC CONVERTERS

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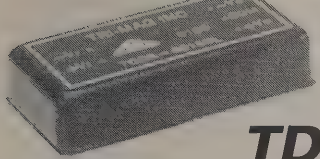
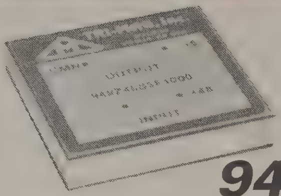


Size: 2.0 (L) x 1.0 (W) x 0.4 (H)

TDC3 SERIES

3 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
3 WATT	4.5–6.0 (5)	5V, 12V, 15V, ±12V, ±15V	500V
	9–18 (12)	5V, 9V, 12V, ±12V, ±15V	500V
	18–36 (24)	5V, 12V, 15V, ±12V, ±15V	500V
	36–72 (48)	5V, 12V, 15V, ±12V, ±15V	500V

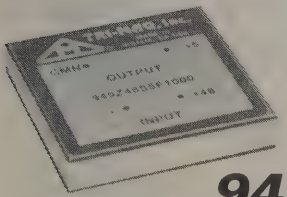


Size: 2.0 (L) x 2.0 (W) x 0.4 (H)

949ZW SERIES

5 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
5 WATT	4.5–6.0 (5)	5V, 12V, 15V, ±12V, ±15V	500V
	9–18 (12)	5V, 9V, 12V, ±12V, ±15V	500V
	18–36 (24)	5V, 12V, 15V, ±12V, ±15V	500V
	36–72 (48)	5V, 12V, 15V, ±12V, ±15V	500V

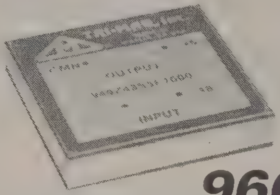


Size: 2.0 (L) x 2.0 (W) x 0.4 (H)

949ZX SERIES

5 Watt, 3:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
5 WATT	4.5–15 (5)	5V, 12V, 15V, ±12V, ±15V	500V
	9–27(12)	5V, 12V, 15V, ±12V, ±15V	500V
	22–72 (48)	5V, 12V, 15V, ±12V, ±15V	500V

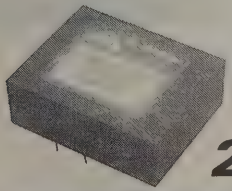


Size: 2.0 (L) x 2.0 (W) x 0.88 (H)

960ZW SERIES

10 Watt, Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
10 WATT	4.5–6.0 (5)	5V, 12V, 15V, ±12V, ±15V	500V
	9–18 (12)	5V, 9V, 12V, ±12V, ±15V	500V
	18–36 (24)	5V, 12V, 15V, ±12V, ±15V	500V
	36–72 (48)	5V, 12V, 15V, ±12V, ±15V	500V



Size: Standard; 2.5 (L) x 2.0 (W) x 0.9 (H)
Low Profile; 3.0 (L) x 2.0 (W) x 0.610 (H)

200Z SERIES

5-12 Watt, For Display & High Voltage

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
5-12 WATT SINGLE OUTPUT	+5 +12 +24 +28	+55V, +180V, +200V, +250V +55V, +120V, +130V, +180V, +190V, +200V, +350V +55V, +130V, +350V +180V, +200V	NONE
5-12 WATT DUAL OUTPUT	12 15 28	(+55V, +20V), (70V, -120V), (100V, -90V), (110V, -110V), (55V, 120V), (180V, +90V), (190V, -160V), (32V, +20V), (90V, 100V), (50V, +20), (110V, -110V) (200V, -200V) (100V, -100)	NONE
5-12 WATT FIXED OUTPUT SINGLE AND DUAL	5 12 15 20 24 28	(12V), (24V), (5V, -5V), (12V, -12V), (15V, -15V) (12V, -12V), (15V, -15V,) (18V, -18V), (100V, -100), (200V), (250V) (200V, -200V) (45V) (250V), (185V), (80V, -80V) (100V, -100)	NONE

For more Tri-Mag products see Volume A•2700 & D•4000

TRI-MAG, Inc.
® *your* POWER Specialists

1601 N. Clancy Ct • Visalia, CA 93291
(209) 651-2222
ITT Telex Number: 4994462
Cable Address: "TRIMAG"
FAX: (209) 651-0188

DC/DC CONVERTERS

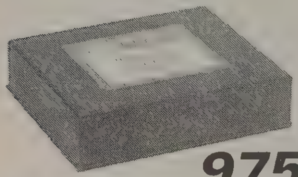
FEATURES

- *Compact Design*
- *PC Board Mounted*
- *Operating Temp: 0°C To +70°C*
- *Option For Output Shutdown*
- *Option For Output Voltage Adjustment*

APPLICATIONS

- *POS Terminals*
- *Plasma Gas Discharge Display*
- *Distributed Power Systems*
- *Electroluminescent Display*
- *Computer Equipment*
- *Vacuum Fluorescent Display*
- *Industrial And Process Control*
- *Telecommunications Equipment*
- *Battery-powered Equipment*

These converters operate over a wide range of input voltages while maintaining excellent output regulation. These power supplies are capable of withstanding simultaneous and continuous short circuits across their outputs.



Size: 3.0 (L) x 2.56 (W) x 0.83 (H)

975ZW SERIES

15 Watt, 2:1 Wide Range Input, Single Output

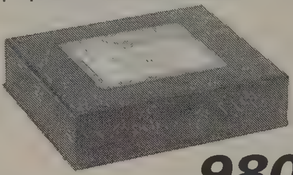
OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
15 WATT	9–18 (12)	5V, 12V, 15V	500V
	18–36 (24)	5V, 12V, 15V	500V
	36–72 (48)	5V, 12V, 15V	500V

15 Watt, 2:1 Wide Range Input, Dual Output

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
15 WATT	9–18 (12)	±12V, ±15V	500V
	18–36 (24)	±12V, ±15V	500V
	36–72 (48)	±12V, ±15V	500V

15 Watt, 2:1 Wide Range Input, Triple Output

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
15 WATT	9–18 (12)	+5V, +12V, -12V	500V
	18–36 (24)	+5V, +15V, -15V	500V
	36–72 (48)	+5V, +12V, -5V	500V

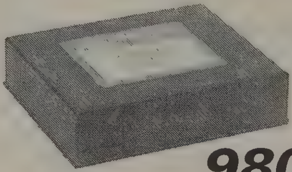


Size: 3.0 (L) x 2.56 (W) x 0.83 (H)

980ZW SERIES

30 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
30 WATT	18–36 (24)	5V, 12V, 15V	500V
	36–72 (48)	5V, 12V, 15V	500V

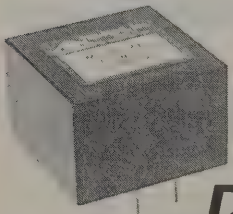


Size: 3.0 (L) x 2.56 (W) x 0.83 (H)

980ZX SERIES

30 Watt, 2:1 Wide Range Input

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
30 WATT	9–36 (24)	5V, 12V, 15V	500V
	20–72 (48)	5V, 12V, 15V	500V

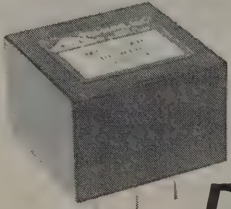


Size: Package A 1.25 (L) x 0.85 (W) x 0.95 (H)
Package B 1.01 (L) x 0.82 (W) x 0.70 (H)

DA SERIES

2 Watt, For EL Lamps

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
2 WATT	5	15V, 18V, 20V, 30V	500V
	12	15V, 18V, 20V, 30V	500V
	24	15V, 18V, 20V, 30V	500V
	48	15V, 18V, 20V, 30V	500V



Size: Package A 1.20 (L) x 1.10 (W) x 0.91 (H)
Package B 1.05 (L) x 1.43 (W) x 1.03 (H)
Package C 2.56 (L) x 2.0 (W) x 0.98 (H)

DDA SERIES

3, 6 & 12 Watt, Vacuum-Fluorescent Display

OUTPUT POWER	INPUT VOLTAGE	OUTPUT VOLTAGE(S)	ISOLATED VOLTAGE
3 WATT	5, 9, 12, 15, 24, 48 Vdc	BASED ON VOLTAGE REQUIRMENT	500V
6 WATT	5, 9, 12, 15, 24, 48 Vdc		500V
12 WATT	5, 9, 12, 15, 24, 48 Vdc		500V
12 WATT	5, 9Vdc to 7.5 Watts 12, 15, 24, 48Vdc to 12 Watts		500V

For more Tri-Mag products see Volume A•2700 & D•4000

DC/DC Converters

DC/DC Converters for LAN and Flash Memory applications.

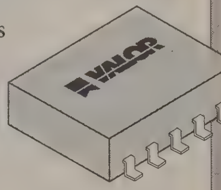
Single Output LAN DC/DC Converters

Part Number	V_{IN} (Vdc)	V_{OUT} (Vdc)	I_{OUT} (mAdc)	REG	Remote ON/OFF	Isolation (Vac)	Package
PM2102	5	9	200	UN	NO	500	B
PM6022	5	9	200	UN	NO	2000	D-1
PM6511	5	9	200	UN	NO	2000	E
PM7102	5	9	200	UN	NO	500	C
PM6044	5	9	225	SWR	YES	2000	D
PM6079	5	9	225	SWR	YES	2000	D
PM6045	5	9	225	SWR	NO	2000	D-1
PM6501	5	9	225	SWR	YES	2000	E
PM2104	12	9	200	UN	NO	500	B
PM6028	12	9	200	UN	NO	2000	D-1
PM6512	12	9	200	UN	NO	2000	E
PM7104	12	9	200	UN	NO	500	C
PM1006	12E	9	250	SWR	NO	2500	A
PM6030	12E	9	225	SWR	NO	2000	D
PM6042	12E	9	225	SWR	YES	2000	D
PM6077	12E	9	225	SWR	YES	2000	D
PM6046	12E	9	225	SWR	NO	2000	D-1
PM6502	12E	9	225	SWR	YES	2000	E

Units with input voltages of "12E" operate over the full Ethernet range of 10.2-15.75Vdc.
Above models are fully isolated and may be applied as either + or - outputs.

Features

- The industry's first 2W surface-mountable DC/DC Converter
- Up to 2W switching-regulated, linearly-regulated, and unregulated
- Isolation voltages of 500, 2000, and 2500 Vac
- DC/DC Converters for LAN products and flash memory
- Remote ON/OFF versions for *"jumperless"* solutions
- MTBFs to 2.1 million hours



Specifications

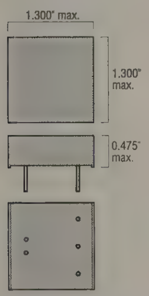
- Efficiency
  70% switching regulated (SWR)
  65% unregulated (UN)
  50% linearly regulated (LIN)
- 50-150 mVp-p output ripple (20 MHz bandwidth)
- 5% regulation (SWR, LIN)
- Three types of Remote ON/OFF logic levels available

Flash Memory DC/DC Converters

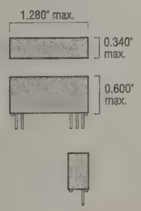
Part Number	V_{IN} (Vdc)	Output V_{OUT} (Vdc)	Output I_{OUT} (mAdc)	REG	Isolation (Vac)	Package
PM6064	+5	+12	60	SWR	NON	F
PM9006	5	12	165	LIN	500	D

Outputs with no polarity indicated are fully isolated and may be applied as either + or - outputs.
Outputs with polarity signs are dedicated in their output polarity.
Both include Remote ON/OFF.

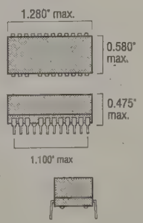
Package A



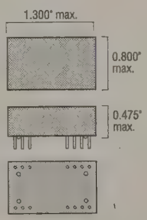
Package B



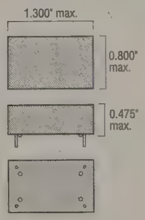
Package C



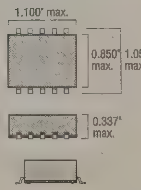
Package D



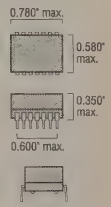
Package D-1



Package E



Package F



For information on other Valor products, see Section 2750 - Filters, Section 5600 - Pulse Transformers

For additional information on these products, please call your local Valor representative or distributor as listed in the front of this volume.

VALOR

Products and technology that make a difference.™

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Valor Europe: Valor Electronics GmbH, Steinstraße 68, 8000 München 80, Federal Republic of Germany, **Phone:** 49-89-4802823, FAX 49-89-484743

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

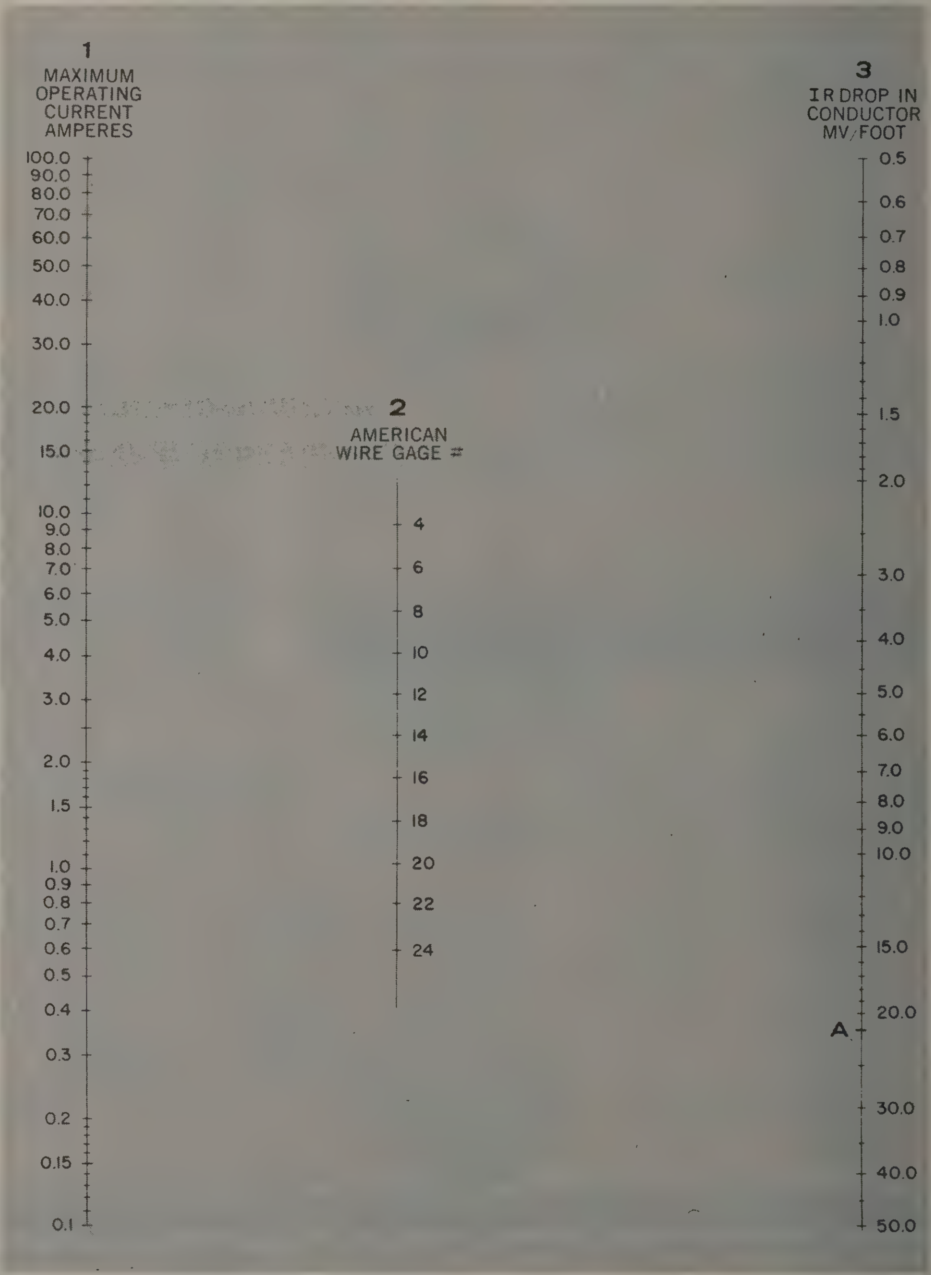
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

* *Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*

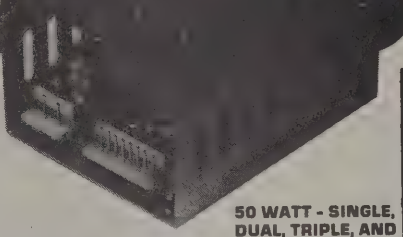


NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

VOLTEX

POWER SUPPLIES

(516) 842-2772



compact, competitive
and powerful.

50 WATT - SINGLE, DUAL, TRIPLE, AND QUAD OUTPUTS

UNIVERSAL INPUT

AC to DC switchmode power supplies

model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
VLX-82-714-1	50	5-10			
VLX-82-714-2		12-4			
VLX-82-714-3		15-3			
VLX-82-714-4		24-2			
VLX-82-713-1		5-5	12-2		
VLX-82-713-2		5-5	15-1 5		
VLX-82-713-3		12-2	12-2		
VLX-82-713-4		15-1 5	15-1 5		
VLX-82-712-1		5-5	12-1	12-1	
VLX-82-712-2		5-5	15-1	15-1	
VLX-82-712-3		5-5	12-1	24-0 5	
VLX-82-711-1		5-4	12-1	12-1	5-1
VLX-82-711-2		5-4	15-1	15-1	5-1
VLX-82-711-3		5-4	12-1	12-1	24-0 5

model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
MPX-82-706-1	150	5-30			
MPX-82-706-2		12-12			
MPX-82-706-3		15-10			
MPX-82-706-4		24-6			
MPX-82-705-1		5-15	12-6		
MPX-82-705-2		5-15	15-5		
MPX-82-705-3		12-6	12-6		
MPX-82-705-4		15-5	15-5		
MPX-82-704-1		5-15	12-3	12-3	
MPX-82-704-2		5-15	15-3	15-3	
MPX-82-704-3		5-15	12-3	24-1 5	
MPX-82-703-1		5-15	12-3	12-3	5-1
MPX-82-703-2		5-15	15-2 5	15-2 5	5-1
MPX-82-703-3		5-15	12-2 5	12-2 5	24-0 5

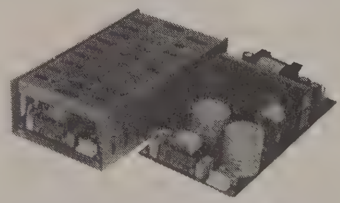
model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
LPX-82-710-1	100	5-20			
LPX-82-710-2		12-8			
LPX-82-710-3		15-7			
LPX-82-710-4		24-4			
LPX-82-709-1		5-10	12-4		
LPX-82-709-2		5-10	15-3		
LPX-82-709-3		5-10	24-2		
LPX-82-709-4		12-4	12-4		
LPX-82-709-5		15-3	15-3		
LPX-82-708-1		5-10	12-2	12-2	
LPX-82-708-2		5-10	15-1 5	15-1 5	
LPX-82-708-3		5-10	12-2	24-1	
LPX-82-707-1		5-10	12-2	12-2	5-1
LPX-82-707-2		5-10	15-1.5	15-1.5	5-1
LPX-82-707-3		5-10	12-1 5	12-1 5	24-0 5
LPX-82-707-4		5-10	15-1.5	15-1.5	24-0.5
LPX-82-707-5		5-10	12-1 5	12-1 5	12-1 5
LPX-82-707-6		5-10	15-1 5	15-1.5	15-1 5

model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
MLX-82-715-1	200	5-40			
MLX-82-715 2		12-16			
MLX-82 715-3		15-13			
MLX-82-715-4		24-8			
MLX-82-716-1		5-20	12-8		
MLX-82-716-2		5-20	15-6		
MLX-82-716-3		5-20	24-4		
MLX-82-716-4		12-8	12-8		
MLX 82 716-5		15-6	15-6		
MLX-82-717-1		5-20	12-4	12-4	
MLX-82-717-2		5-20	15-3	15-3	
MLX-82-717-3		5-20	12-4	24-2	
MLX-82-718-1		5-20	12-4	12-4	5-1
MLX-82-718-2		5-20	15-3	15-3	5-1
MLX-82-718-3		5-20	12-3	12-3	24-1
MLX-82-718-4		5-20	15-2 5	15-2 5	24-1
MLX-82-718-5		5-20	12-3	12-3	12-2
MLX-82-718-6		5-20	15-2	15-2	15-2

SINGLE, DUAL, TRIPLE, OUTPUT FOR TELE-COMMUNICATIONS, INSTRUMENTATION AND INDUSTRIAL APPLICATION

25 & 50 WATT

DC-DC CONVERTERS



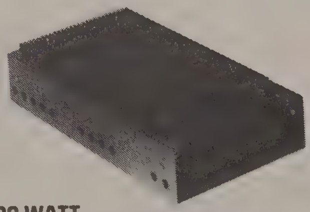
PC BOARD OR CASED

100 WATT-SINGLE, DUAL, TRIPLE, AND QUAD OUTPUTS-

DC to DC switchmode power converters

model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
DLX-82 719-1	25	5-5			
DLX-82-719-2		12-2			
DLX-82-719-3		15-2			
DLX-82-719-4		24-1			
DLX-82-720-1		5-3	12-1		
DLX-82-719-4		24-1			
DLX-82-720-1		5-3	12-1		
DLX-82-720-2		5-3	15-1		
DLX-82-720-3		12-1	12-1		
DLX-82-720-4		15-1	15-1		
DLX-82-721-1		5-3	12-0.5	12-0 5	
DLX-82-721-2		5-3	15-0 5	15-0 5	
DLX-82-722-1	50	5-10			
DLX-82-722-2		12-4			
DLX-82-722-3		15-4			
DLX-82-722-4		24-2			
DLX-82-723-1		5-5	12-2		
DLX-82-723-2		5-5	15-2		
DLX-82-723-3		12-2	12-2		
DLX-82-723-4		15-2	15-2		
DLX-82-724-1		5-5	12-1	12-1	
DLX-82-724-2		5-5	15-1	15-1	
DMX-82-725-1	100	5-20			
DMX-82-725-2		12-8			
DMX-82-725-3		15-7			
DMX-82-725-4		24-4			
DMX-82-726-1		5-10	12-4		
DMX-82-726-2		5-10	15-4		
DMX-82-726-3		12-4	12-4		
DMX-82-726-4		15-4	15-4		
DMX-82-727-1		5-10	12-2	12-2	
DMX-82-727-2		5-10	15-2	15-2	
DMX-82-728-1		5-10	12-1	12-1	24-1
DMX-82-728-2		5-10	15-1	15-1	24-1

model number	power watts	output #1 V A	output #2 V A	output #3 V A	output #4 V A
DMX-82-729-1	150	5-30			
DMX-82-729-2		12-12			
DMX-82-729-3		15-10			
DMX-82-729-4		24-6			
DMX-82-730-1		5-15	12-6		
DMX-82-730-2		5-15	15-5		
DMX-82-730-3		12-6	12-6		
DMX-82-730-4		15-5	15-5		
DMX-82-731-1		5-15	12-3	12-3	
DMX-82-731-2		5-15	15-3	15-3	
DMX-82-732-1		5-15	12-1 5	12-1.5	24-1.5
DMX-82-732-2		5-15	15-1.5	15-1 5	24-1 5
DPX-82-733-1	200	5-40			
DPX-82-733-2		12-16			
DPX-82-733-3		15-14			
DPX-82-733-4		24-8			
DPX-82-734-1		5-20	12-8		
DPX-82-734-2		5-20	15-7		
DPX-82-734-3		12-8	12-8		
DPX-82-734-4		15-7	15-7		
DPX-82-735-1		5-20	12-4	12-4	
DPX-82-735-2		5-20	15-4	15-4	
DPX-82-736-1		5-20	12-2	12-2	24-2
DPX-82-736-2		5-20	15-2	15-2	24-2



100 WATT

DC-DC CONVERTERS

SINGLE, DUAL, TRIPLE, AND QUAD OUTPUT FOR TELECOMMUNICATIONS, INSTRUMENTATION AND INDUSTRIAL APPLICATIONS.

Reliability

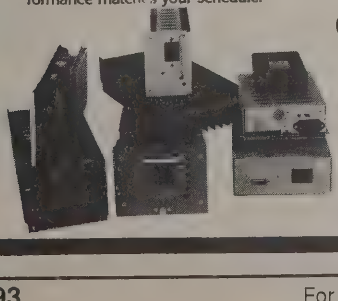
Reliability is designed into any power supply delivered by Voltex. Long, trouble free operation is assured by paying attention to all details.

Dependability

From prototype through production we endeavor to meet your requirements. A close liaison is established to make sure that our performance matches your schedule.

Capability

The entire power system is designed by Voltex. Magnetics, sheet metal, etc. are designed and fabricated in our plant. This assures you of consistent, high quality power systems. Instrumentation, such as power failed detect systems, sequencing systems, in fact all systems associated with power systems can be designed. Power related control systems, such as motor speed controls, have also been designed.



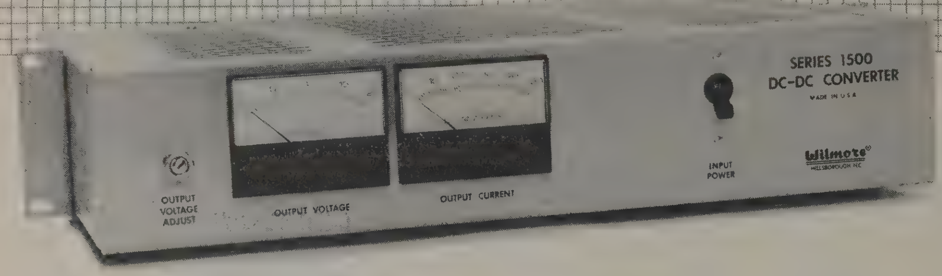
Custom Designed Power Supplies for OEM applications

VOLTEX CO., INC.

3460 Great Neck Road, North Amityville, New York 11701
(516) 842-2772 • FAX (516) 842-2991

Wilmore

DC-To-DC Power Converters



- **80% To 90% Efficient**
- **200, 400 Or 800 Watts**
- **Height 3.45″ (2 Rack Spaces)**
- **Input/Output Isolation**

The Series 1500 converters provide an isolated, regulated, adjustable dc output from station batteries or other widely fluctuating dc sources to reliably power telecommunications equipment, supervisory control systems, and other sensitive electronic equipment. Conservatively rated and very efficient, these converters will operate at any load within their rating over a wide ambient temperature range with simple convection cooling. Their minimal no-load input power (about 5 watts) and correspondingly high light-load efficiencies make them uniquely suited for applications in which extended periods of "standby" service are encountered.

Front-Panel Controls And Indicators

A combination circuit breaker and ON/OFF switch is provided for the input power. A voltmeter and ammeter display the dc output. A screwdriver-slotted potentiometer shaft with locking nut is provided to adjust the output voltage level.

Size And Weight

All converters measure 3.45″ high by 17.0″ wide. The 200-watt and 400-watt units are 13.2″ deep, and the 800-watt units measure 13.4″ deep. All units weigh less than 18 pounds.

Optional Features

Standard options for Series 1500 converters include paralleling diodes for multiple-unit redundancy applications and auxiliary Form C contacts for remote indication of improper converter output. In addition, many other input/output voltage combinations not listed in the adjacent table are available. Contact our sales department for details.

Other Rack Mounted DC-To-DC Converters

In addition to the Series 1500, Wilmore manufactures many other standard and custom, single and multiple-output rack-mounted DC-to-DC converters. Each series is isolated, regulated and highly efficient. Each is designed and manufactured in accordance with Wilmore's emphasis on conservative electrical ratings and long product life. Contact our sales department for more information.

Input Voltage Range (Vdc)	Adjustable Output Voltage Range (Vdc)	Output Current (Adc)	Model Number
20-29	12-14	0-15	**1502-24-13-15**
20-29	12-14	0-30	**1502-24-13-30**
20-29	22-26	0-8	**1502-24-24-8**
20-29	22-26	0-16	**1502-24-24-16**
20-29	44-52	0-4	**1502-24-48-4**
20-29	44-52	0-8	**1502-24-48-8**
21-29	45.5-50.5	0-16	**1560-24-48-16**
40-58	12-14	0-15	**1502-48-13-15**
40-58	12-14	0-30	**1502-48-13-30**
40-58	22-26	0-8	**1502-48-24-8**
40-58	22-26	0-16	**1502-48-24-16**
42-58	22-26	0-30	**1561-48-24-30**
40-58	44-52	0-4	**1502-48-48-4**
40-58	44-52	0-8	**1502-48-48-8**
40-58	123.5-136.5	0-1.5	**1502-48-130-1.5**
40-58	123.5-136.5	0-3	**1502-48-130-3**
42-58	123.5-136.5	0-6	**1562-48-130-6**
105-140	12-14	0-15	**1502-130-13-15**
105-140	12-14	0-30	**1502-130-13-30**
105-140	22-26	0-8	**1502-130-24-8**
105-140	22-26	0-16	**1502-130-24-16**
105-140	44-52	0-4	**1502-130-48-4**
105-140	44-52	0-8	**1502-130-48-8**
105-140	123.5-136.5	0-1.5	**1502-130-130-1.5**
105-140	123.5-136.5	0-3	**1502-130-130-3**

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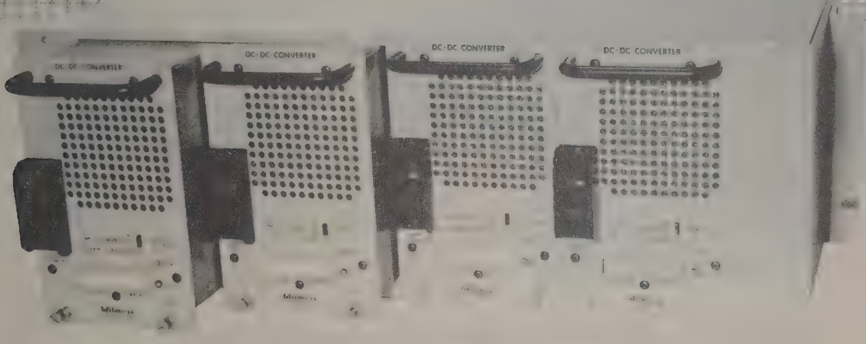
Wilmore

Modular DC-DC Converters



- **Up To 4000 Watts In Only Seven Inches Of Vertical Rack Space**
- **Front-Access Design**
- **Input-Output Isolation**
- **N + 1 Redundancy**
- **Front-Panel Ammeter And Status Indicators**

General Description

Designed for cell-site, central office, fiber-in-the-loop (FITL), power installations and other telecommunications power applications needing more power in less space, this new converter module/shelf system features two to three times greater power density than previous converters. The Series 1625 front-access converter shelf occupies only 7″ of vertical rack space and can be equipped with up to four 1000-watt plug-in converter modules, providing a maximum current capacity of 160 Amperes at 24 Volts (or 80A @ 48V or 30A @ 130V). Each converter module features an isolated, regulated, adjustable output, LED bar-graph ammeter, output-voltage test points, LED status indicators and Form C alarm contacts. Converter modules can be installed or removed without system shutdown, allowing for easy site expansion and service.

INPUT/OUTPUT

Input Voltage Range (VDC)	Adjustable Output Voltage Range (VDC)	Output Current Per Module (ADC)	Model Number
21 to 29	45.5 to 50.5	0 to 20	1625-24-48-20
42 to 58	22.7 to 25.2	0 to 40	1625-48-24-40
42 to 58	123.5 to 136.5	0 to 7.5	1625-48-130-7.5

OTHER ELECTRICAL SPECIFICATIONS

INPUT PROTECTION	Circuit breaker, reverse-polarity protection
OUTPUT REGULATION	± 3% versus line and load
OUTPUT PROTECTION	Overload, short-circuit, and overvoltage protection

ENVIRONMENTAL/MECHANICAL

OPERATING TEMPERATURE	0°C to +50°C
STORAGE TEMPERATURE	−40°C to +95°C
EFFICIENCY	80% to 85%
MODULE SIZE	4.1″ wide by 6.2″ high by 13.9″ deep
MODULE WEIGHT	11 pounds
SHELF SIZE	21.0″ wide by 6.95″ high by 15.3″ deep
SHELF WEIGHT	28 pounds

MODULE INDICATORS AND ALARMS

INPUT POWER	Green LED
ALARM CONDITION	Red LED
OUTPUT VOLTAGE	Front-panel test points
OUTPUT CURRENT	20-segment LED bar-graph ammeter
ALARM CONTACTS	One Form C

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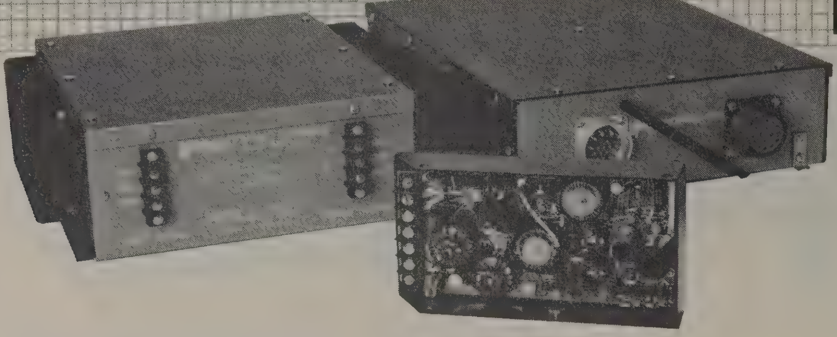
Wilmore

Mobile And Railroad/Transit DC-To-DC Converters



DC-to-DC Converters for Mobile Communications

These converters are designed primarily to power standard 12-volt and 24-volt mobile communications equipment from any vehicular electrical system that may be encountered. Units are mechanically and electrically rugged, inexpensive, and shipped from stock.

DC/DC Converters for Railroad/Transit Applications

The Railroad/Transit (RT) Series of dc-to-dc converters are especially designed to power radio transceivers, fuel management systems, ATCS equipment and other sensitive electronic equipment aboard locomotives and electric rail vehicles.

Transient Withstand Capability

High-voltage, high-energy transients on locomotive power busses will damage inadequately protected electronic equipment. Wilmore's RT Series of converters protect sensitive loads while operating through input transients commonly found on rail vehicles. These converters do not rely on gas discharge tubes, varistors, power zeners or other limited-life transient suppression devices to achieve this capability.

Custom-Designed RT Series Converters

As the use of sensitive electronic equipment on rail vehicles continues to grow and diversify, user's needs for reliable power conversion are becoming highly individualized. The majority of Wilmore's work for the rail transportation industry is the design and manufacture of custom power products. Our field-proven circuitry can be readily scaled to provide different input/output voltage combinations, output power levels, and package sizes for use on diesel-electric locomotives and electrically-powered rail transit cars. Our engineering charges for custom units are modest, and our turnaround times are short. If you have some special requirements regarding any performance criteria, our New Products Group would like to hear from you.

DC/DC Converters for Mobile Communications

Input Voltage Range (Vdc)	Nominal Output Voltage[1] (Vdc)	Output Current[2] (Adc)	Isolated/ Polarity-Reversing	Dimensions (h" x w" x d")	Efficiency[3] (Typical)	Model Number
21-32	13.5	0-15	No	4 x 9.2 x 10.4	80%	**1416-15**
21-32	13.5	0-25	No	4 x 9.2 x 10.4	80%	**1416-25**
21-32	13.5	0-35	No	4 x 9.2 x 10.4	80%	**1416-35**
10-16	13.0	0-10	Polarity-Reversing	2.5 x 7.3 x 9.8	80%	**1380**
10-16	13.0	0-15	Polarity-Reversing	2.5 x 7.3 x 9.8	80%	**1360**
20-32	13.0	0-10	No	2.5 x 7.3 x 9.8	80%	**1395**
20-32	13.0	0-15	No	2.5 x 7.3 x 9.8	80%	**1365**
10-16	26.0	0-10	No	2.5 x 7.3 x 9.8	80%	**1442**
10-16	26.0	0-15	No	2.5 x 7.3 x 9.8	80%	**1424**
11-15	13.0	0-6	Isolated	3.9 x 4.8 x 7.8	72%	**1340-13-13-6**
11-15	26.0	0-3	Isolated	3.9 x 4.8 x 7.8	72%	**1340-13-26-3**
22-30	13.0	0-6	Isolated	3.9 x 4.8 x 7.8	72%	**1340-26-13-6**
22-30	26.0	0-3	Isolated	3.9 x 4.8 x 7.8	72%	**1340-26-26-3**
30-42	13.0	0-6	Isolated	3.9 x 4.8 x 7.8	72%	**1340-36-13-6**
40-56	13.0	0-6	Isolated	3.9 x 4.8 x 7.8	72%	**1340-48-13-6**
20-56	13.0	0-6	Isolated	2.5 x 7.5 x 10.4	75%	**1475**

[1] Models 1380, 1360, 1395, 1365, 1442, and 1424 provide voltages directly proportional to input voltage. All other models provide regulated output voltages.

[2] Maximum current ratings assume an intermittent demand on a 20% duty cycle except for the Series 1340 converters. The rating given for the Series 1340 is a continuous duty rating.

[3] These are typical minimum efficiencies for one-half to full load.

DC/DC Converters for Railroad/Transit Applications

Nominal Input Voltage (Vdc)	Output Voltage (Vdc)	Output Current (Adc)	Dimensions (h" x w" x d")	Weight (Pounds)	Mounting and Connections	Model Number
36	13.6	0-7.5	1.85 x 7.0 x 9.4	3.5	Mounting flange on base accepts four #8 bolts. Input and output connections are made via barrier-strip terminal blocks.	**1620-36-13-7.5**
36	13.6	0-15	2.9 x 7.0 x 9.4	5		**1620-36-13-15**
74	13.6	0-7.5	1.85 x 7.0 x 9.4	3.5		**1620-74-13-7.5**
74	13.6	0-15	2.9 x 7.0 x 9.4	5		**1620-74-13-15**
72	13.6	0-30	3.1 x 12.0 x 15.0	14		**1554-72-13-30**
24	13.6	0-12	3.3 x 10.3 x 16.2	16	AAR rack mountable.	**1525-24-12**
72	13.6	0-12	3.3 x 10.3 x 16.2	16		**1525-72-12**
110	13.6	0-12	3.3 x 10.3 x 16.2	16		**1525-110-12**

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LINE REGULATORS/CONDITIONERS

Manufacturer	Starting EEM Page No.	Model/Series	Power Rating (VA)	Frequency (Hz)	Phase Single	Phase Multiple	Voltage Protection	Surge Protection
Advance Conversion Devices	D•2230	MIL-UPS Series	1K - 10KVA	50, 60, 400Hz	√	√	√	√
Behlman Electronics, Inc.	D•2244	BL, ACM, PA, ACP	1000VA - 120KVA	50, 60, 400	√	√	√	√
California Instruments	D•2250	1201WP	1200VA	47 - 500Hz	√		√	√
		L Series	750VA - 13.5KVA	45Hz - 5KHz	√	√		
Controlled Power Co.	D•2253	Series 700A	3KVA - 500KVA	50, 60Hz	√	√	√	√
		Series 800	250 - 50KVA	50, 60Hz	√			
Elgar	D•2257	UPLC	1, 3 & 5KVA	60Hz	√		√	√
		UXP 3000	750VA - 2250VA	350 - 999.9Hz	√	√	√	√
Georator Corp.	D•2261	Series 37	2.5 - 125KVA	50, 60Hz	√	√	√	√
Hipotronics	D•2264	PAUR Series	17KVA - 665KVA	50, 60Hz	√	√	√	√
Hltran Corp.	D•2266	UIS Series, SFR Series	500VA - 150KVA	50, 60Hz	√	√	√	√
Integrated Technologies Solutions	D•2274	IPDS-6000	50 - 1000	50, 60, 400Hz	√	√	√	√
MiNT Systems Corp.	D•2283	6200 Series	Programmable AC Source	60Hz	√		√	√
Marway Products	D•2278	MPS, MPD Series	Power distribution units	150A capacity 18 outlets	√	√	√	√
Pacific Power Source	D•2286	AMX Series	0.5 - 4.5 KVA	45 - 500Hz	√	√		
		AT Series	1.0 - 6.75KVA	47 - 500Hz	√	√		
		G Series	60 - 90KVA	47 - 500Hz	√	√		
		K Series	0.25 - 4.5KVA	47 - 500Hz	√	√		
		MS Series	62.5 - 625KVA	47 - 500Hz		√		
Polytron Devices	D•2292	*(See Section 4025)*						
Power Var	D•2297		78VA-6KVA	50, 60Hz	√	√	√	√
Pulizzi Engineering Inc.	D•2300	PC115 A & B	1440 & 2880	47 - 63	√		√	√
		PC125 (A thru G)	1440 - 5760	47 - 63	√		√	√
		TPC115-8	1440 - 3840	47 - 63	√		√	√
		TPC115-10/MTD	1440 - 3840	47 - 63	√		√	√
		PC874	1440 - 5760	47 - 63	√		√	√
		PC726	8640	47 - 63		√	√	√
		PC300/MTD	5760	47 - 63		√		√
		PC585/MTD	2880	47 - 63	√			√
		TPC884	Variable	47 - 63	√			√
		PC420 (A thru G)	1440 - 5760	47 - 63	√		√	√
		PC500	5760	47 - 63	√		√	√
Xentek Inc.	D•2308	EIT	250 - 15K	50, 60Hz	√	√		√
		Life-Guard	125 - 2500	60	√			

UPS SYSTEMS

Manufacturer	Starting EEM Page No.	Model/Series	Output (VA)	Output Frequency (Hz)	Phase Single	Phase Multiple
Abacus Controls Inc.	D•2223	Bi-Mode Series	3000 - 10,000VA	50, 60Hz	√	
		SB	600 - 2000VA	50, 60H	√	
Advance Conversion Devices	D•2230	MIL-UPS	1 - 10KVA	50, 60, 400	√	√
Avionic Instruments	D•2232	8A Series	1000VA - 2500VA	50, 60, 400	√	√
Behlman Electronics, Inc.	D•2202	H Series	1KVA - 5KVA	50, 60, 400	√	√
Controlled Power Co.	D•2253	LT Series	700VA - 2.1KVA	50, 60Hz	√	
Elgar	D•2257	UPS 102-1B & 302-1B	1KVA	50 & 60Hz	√	
		GUPS 2400	2400	60Hz	√	
		GUPS 1200	1200VA	60Hz	√	
Energy Ltd.	D•2260	DA 50 1H - DAX 1000 2H	50VA - 1000VA	50 & 60Hz	√	
Hitran Power	D•2266	HD Series	5000 - 20000	60Hz	√	
Instrumentation & Control Systems	D•2272	Electro-Pac E Series	2KVA - 20KVA	50, 60Hz	√	
		Lifeline Series	20VA, 600VA	60Hz	√	
Marway Products	D•2278	UPS 600	600VA	50, 60Hz	√	
		UPS 600 IEC	600VA	50, 60Hz	√	
		UPS 1250	1250VA	50, 60Hz	√	
		UPS 1250 IEC	1250VA	50, 60Hz	√	
		UPS 2000	2000VA	50, 60Hz	√	
		UPS 2000 IEC	2000VA	50, 60Hz	√	
Nova Electric	D•2284	Galaxy	1KVA - 10KVA	50, 60Hz	√	
Pacific Power Source	D•2286	UG	6 - 90KVA	47 - 500Hz	√	√
		UMS	62.5 - 625KVA	47 - 500Hz		√
Wilmore Electronics	D•2306	1400, 1600	50VA - 1KVA	50, 60Hz	√	

FREQUENCY CONVERTERS

Manufacturer	Starting EEM Page No.	Model/Series	Output (VA)	Output Frequency (Hz)	Phase	
					Single	Multiple
Abacus Controls Inc.	D•2223	Various	500VA - 50,000VA	50, 60, & 400Hz	√	√
Abbott Technologies	D•2228	KN, PN, LN, TN	30VA - 320 VA	50 - 60 Hz	√	
Advance Conversion Devices	D•2230	MIL-UPS	1K - 10KVA	50, 60, 400	√	√
Avionic Instruments	D•2232	4A/4B Series	1000VA - 42KVA	50, 60Hz	√	√
Avtel/Unitron	D•2241	Flat-Pak Series Econo-Span Series PS Series	40KVA - 60KVA 50KVA - 360KVA 1250VA - 15000VA	400Hz 400Hz 50, 60, 400Hz		√ √ √
Behlman Electronics, Inc.	D•2244	BL, ACM, ACP, PA	100KVA - 120KVA	45 - 10KHz	√	√
California Instruments	D•2250	FCS Series	18KVA - 54KVA	45Hz - 1KHz	√	√
Compact Power Co.	D•2256	TITAN	165VA - 6KVA	45Hz - 20KHz	√	√
Elgar	D•2257	EL Series GPS 1000 SX Series SL Series & B Series	1.2 - 15KVA 117VAC 50VA - 15,750VA 120 - 36000VA	47 - 500Hz 60Hz 45Hz - 1KHz 45Hz - 5KHz	√ √ √ √	√ √ √
Georator Corp.	D•2261	Series 30, 33, 37, 39	250-125KVA	50, 60, 400Hz	√	√
Industrial Test Equipment	D•2234	C	80 - 3000	10 - 100000	√	√
Integrated Technologies Solutions	D•2274	IPDS-3000	10 - 1000VA	35 - 35KHz	√	√
KGS Electronics	D•2276	SPC	2250	400Hz	√	√
Nova Electric	D•2284	Galaxy	125VA - 60KVA	50, 60, 400Hz	√	√
Pacific Power Source	D•2286	AMX Series MS Series G Series AT Series K Series	0.5 - 4.5KVA 62.5 - 625KVA 6 - 90KVA 1.0 - 6.75 0.25 - 4.5KVA	45 - 500Hz 47 - 500Hz 20 - 5000Hz 47 - 500Hz 20 - 2000	√ √ √ √	√ √ √ √ √
Panel Components	D•2291	85510500, -510, -520	1000VA	47 - 500Hz	√	

STATIC INVERTERS

Manufacturer	Starting EEM Page No.	Model/Series	Output (VA)	Output Frequency (Hz)	Phase	
					Single	Multiple
Abacus Controls Inc.	D•2223	400 & 4000 Series	500VA - 50KVA	50, 60, & 400Hz	√	√
Abbott Electronics	D•2226	SN, S Series	180, 5-120 Watts (VA) Sine Wave	400-1600Hz	√	
Advance Conversion Devices	D•2230	ACE	36 - 8KVA	50, 60, 400Hz	√	√
Avionic Instruments	D•2232	18, 2A, 3A, 2C	50VA - 30KVA	50, 60, 400Hz	√	√
Behlman Electronics, Inc.	D•2202	BL, ACM, H, PA, ACP	100VA - 120KVA	50, 60, 400Hz	√	√
Compact Power Co.	D•2256	TITAN	165VA - 6KVA	45Hz - 20KHz	√	√
Elgar	D•2257	DMAC	18KVA - 216KVA	0.1 - 999.9Hz	√	√
Energy Ltd.	D•2260	DA Series	50VA-1KVA	60Hz	√	√
Hitran Corp.	D•2266	HD Serries	5000 - 25000	60Hz	√	
Instrumentation & Control Systems	D•2272	E	.5 - 20KVA	50, 60Hz		
Integrated Technologies Solutions	D•2274	IPDS-9000	50 - 1000VA	45 - 5000	√	√
KGS Electronics	D•2276	SPC & SPS	50VA - 1200VA	60, 400Hz	√	√
LZR Electronics	D•2277	LZINV Series	150VA	50, 60Hz	√	
Nova Electric	D•2284		125VA - 50KVA	50, 60Hz		
Wilmore Electronics	D•2306	1400 & 1600	50VA - 1KVA	50, 60Hz	√	

abacus controls inc.

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SOMERVILLE, NJ 08876
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UNINTERRUPTIBLE POWER SUPPLIES SINGLE PHASE 50Hz/60Hz 330VA-10KVA RACKMOUNT AND FREE STANDING SYSTEMS

- **Innovative Bi-Mode UPS**
- **Eliminates Half of Power Parts**
- **High MTBF**
- **Cost Effective Power Protection**
- **Free Standing & Rack Style**

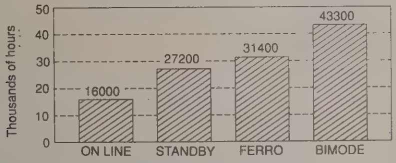
The Bi Mode family of UPS products introduced by Abacus Controls offers the reliability and simplicity of a standby UPS while fully protecting the critical load against all forms of power problems.

The Bi Mode UPS uses the same isolation transformer and power components for inverting when the utility is not present and for rectifier-battery charging when the utility is present.

Unlike other on-line products there is no switch, either electromechanical or static device between the dual mode bridge circuit and the load. This permits synchronized transfers from the utility to the bridge instantaneously in either direction.

The advantages of this technology include cost, reliability, size, weight & audible noise.

RELIABILITY ANALYSIS FOR FOUR MODEL 933-4 UPS
Mean Time Between Failures



Look to the BIMODE UPS from Abacus Controls inc. Model 933-4, 3KW

Model 933-4

BI-MODE SERIES

Model	Output Power (VA)	Output Frequency	Dimensions (Inches) H	W	D	Wt. (Lbs.)	Battery
533-3	3000	50	8.75	19	20	105	External
533-4	3000	60	8.75	19	20	105	External
933-3	3000	50	31.25	15.2	22.2	390	Internal
933-4	3000	60	31.25	15.2	22.2	390	Internal
553-3	5,000	50	12.25	19	20	170	External
553-4	5,000	60	12.25	19	20	170	External
953-3	5000	50	42	18.1	25.7	750	Internal
953-4	5000	60	42	18.1	25.7	750	Internal
514-3	10,000	50	51	22	30	410	External
514-4	10,000	60	51	22	30	410	External

BI-MODE SPECIFICATIONS

Input Voltage: 120/208/240 VAC ± 10%
Input Frequency: 50Hz or 60Hz
Output Voltage: 120/208/240 VAC
Voltage Regulation: ± 2%
Wave Form: Sinewave 2% THD
Efficiency: 90%
Temperature Range: 0–40°C
Humidity: 95% Non-condensing
Circuit Protection: CKT BKR: Fuse; By Pass Switch
Overload Capability: 150% PEAK

Model 913-4RS

SB SERIES

Model	Output Power (VA)	Output Frequency	Dimensions (Inches) H	W	D	Wt. (Lbs.)
962-4	600	60	6.6	4.7	14.2	28
992-4	900	60	9.1	6.9	17.8	43
9122-4	1250	60	9.1	6.9	17.8	50
923-4	2000	60	18	6.9	17.8	112

Above models are available in 19" rack mount style. 230VAC, 50Hz are also available. Contact factory.

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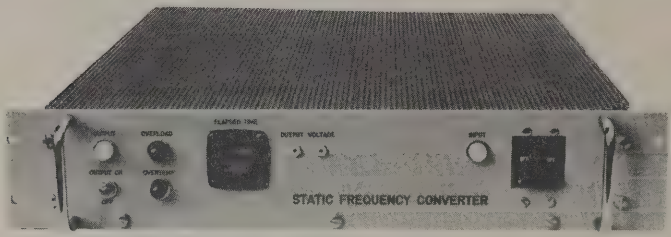
- **POWER FREQUENCY CONVERTERS**
- **SOLID-STATE INVERTERS**
- **UNINTERRUPTIBLE FREQUENCY CONVERTERS**



Model 152-1 (60Hz to 400Hz)

- **Digital Sinewave Generator**
- **77% Efficiency**
- **Low Cost**
- **Light Weight**
- **Proven Reliability**
- **Switching Power Transistors**
- **Useable as AC Power Supply**
  - **Motor Controller**
  - **Power Oscillator**
  - **Power Converter**
  - **Lab AC Source**

FREQUENCY CONVERTERS
50-60-400 Hz

Input Voltage: 115V AC, ±10%, single-phase for units 2000VA and below. 208V AC, ±10%, three-phase for units above 2000VA. 220V AC, ±10%, 50Hz is a no charge option. Other inputs available on a custom basis.

Input Frequency: 47 to 65Hz. 380 to 420Hz input is a no charge option.

Output Voltage: Adjustable 100 to 130 volts. Voltage adjust is internal for fixed frequency models, on the front panel for adjustable frequency models. (Other ranges available, consult factory.)

Voltage Regulation: Less than ±2% for combined no load to full load change and rated input voltage change.

Load Power Factor: 0.7 lead to 0.7 lag. Continuous zero lead to zero lag at full rated output without damage.

Output Waveshape: Sinewave less than 4% THD, 3% max any single frequency.

Protective Circuits: All models are equipped with automatic overload protection, including short circuit. Automatic reset upon overload removal. Circuit breaker on the input and fuse on the output. Automatic shutdown for input overvoltage, undervoltage.

Meters: Output voltmeter ammeter, and frequency meter offered as options.

Output Frequency: Rated output frequency for each model is shown on chart. For adjustable frequency models, adjustment is on the front panel. Internal frequency adjust is a no charge option.

Frequency Stability: Oscillator included in the unit base price. Fixed frequency oscillators are crystal controlled with a stability of ±0.05%. Adjustable oscillators are RC controlled and have a stability of ±0.25%.

Efficiency: Between 70 to 80 percent (typical 75%). At least 70% from 40% of full load to full load.

Peak Output Current: 150% of full rated current is available for three-cycles. Unit is set to current limit at 120% after three cycles.

SINGLE PHASE — 50/60 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
152-3	500	50	3½	19	20	50
152-4	500	60	3½	19	20	50
152-5	500	45-65	3½	19	20	50
113-3	1000	50	8¾	19	20	70
113-4	1000	60	8¾	19	20	70
113-5	1000	45-65	8¾	19	20	70
223-3	2000	50	12¼	19	20	130
223-4	2000	60	12¼	19	20	130
223-5	2000	45-65	12¼	19	20	130
233-3	3000	50	21	19	20	180
233-4	3000	60	21	19	20	180
233-5	3000	45-65	21	19	20	180
243-3	4000	50	21	19	20	240
243-4	4000	60	21	19	20	240
243-5	4000	45-65	21	19	20	240
263-3	6000	50	51	22	30	590
263-4	6000	60	51	22	30	590
263-5	6000	45-65	51	22	30	590
214-3	10000	50	63	22	30	775
214-4	10000	60	63	22	30	775
214-5	10000	45-65	63	22	30	775
224-3	20000	50	63	44	30	1500
224-4	20000	60	63	44	30	1500
224-5	20000	45-65	63	44	30	1500

THREE PHASE — 50/60 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
117-3	1000	50	8¾	19	20	75
117-4	1000	60	8¾	19	20	75
117-5	1000	45-65	8¾	19	20	75
118-3	1600	50	12¼	19	20	110
118-4	1600	60	12¼	19	20	110
118-5	1600	45-65	12¼	19	20	110
238-3	3000	50	17½	19	20	170
238-4	3000	60	17½	19	20	170
238-5	3000	45-65	17½	19	20	170
268-3	6000	50	51	22	30	590
268-4	6000	60	51	22	30	590
268-5	6000	45-65	51	22	30	590
219-3	10000	50	63	22	30	750
219-4	10000	60	63	22	30	750
219-5	10000	45-65	63	22	30	750
2158-3	15000	50	63	22	30	1100
2158-4	15000	60	63	22	30	1100
2158-5	15000	45-65	63	22	30	1100
239-3	30000	50	63	44	30	2250
239-4	30000	60	63	44	30	2250
239-5	30000	45-65	63	44	30	2250
259-3	50000	50	80	60	42	3300
259-4	50000	60	80	60	42	3300
259-5	50000	45-65	80	60	42	3300

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FAX (908) 526-6866

FREQUENCY CONVERTERS

SINGLE PHASE — 400 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
152-1	500	400	3½	19	20	40
152-2	500	350-450	3½	19	20	40
162-1	600	400	3½	19	20	45
162-2	600	350-450	3½	19	20	45
113-1	1000	400	8¾	19	20	70
113-2	1000	350-450	8¾	19	20	70
223-1	2000	400	12¼	19	20	130
223-2	2000	350-450	12¼	19	20	130
233-1	3000	400	21	19	20	180
233-2	3000	350-450	21	19	20	180
243-1	4000	400	21	19	20	210
243-2	4000	350-450	21	19	20	210
263-1	6000	400	51	22	30	550
263-2	6000	350-450	51	22	30	550
283-1	8000	400	63	22	30	650
283-2	8000	350-450	63	22	30	650
214-1	10000	400	63	22	30	775
214-2	10000	350-450	63	22	30	775
224-1	20000	400	63	44	30	1400
224-2	20000	350-450	63	44	30	1400

THREE PHASE — 400 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
117-1	1000	400	8¾	19	20	70
117-2	1000	350-450	8¾	19	20	70
118-1	1600	400	12¼	19	20	95
118-2	1600	350-450	12¼	19	20	95
228-1	2500	400	12¼	19	20	140
228-2	2500	350-450	12¼	19	20	140
238-1	3500	400	17½	19	20	180
238-2	3500	350-450	17½	19	20	180
268-1	6000	400	51	22	30	590
268-2	6000	350-450	51	22	30	590
278-1	7500	400	51	22	30	650
278-2	7500	350-450	51	22	30	650
219-1	10000	400	63	22	30	750
219-2	10000	350-450	63	22	30	750
2158-1	15000	400	63	22	30	1000
2158-2	15000	350-450	63	22	30	1000
239-1	30000	400	63	44	30	2100
239-2	30000	350-450	63	44	30	2100
259-1	50000	400	80	60	42	3000
259-2	50000	350-450	80	60	42	3000

STATIC INVERTERS
DC TO 50-60-400 Hz

- **85% Efficiency**
- **Low Cost**
- **Light Weight**
- **Proven Reliability**

Input Voltage: 100 to 140V DC. Other input voltage ranges, 28V DC, 48V DC, 60V DC and 200V DC Sunverter.

Output Voltage: Set for 117V. Internal adjustment from 110V to 120V. 220V AC for 50Hz models.

Voltage Regulation: Less than 2% for single phase units, less than 5% for three phase units, for combined load and input voltage changes.

Output Waveshape: Sinewave less than 4% THD, 3% max any single frequency.

Protective Circuits: All models are equipped with automatic overload protection, including short circuit. Automatic reset upon overload removal. Circuit breaker on the input and fuse on the output. Automatic shutdown for input overvoltage, undervoltage.

STATIC INVERTERS

SINGLE PHASE

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
452-1	500	400	* 3½	19	20	40
452-3	500	50	* 3½	19	20	45
452-4	500	60	* 3½	19	20	45
413-1	1000	400	* 7	19	18	60
413-3	1000	50	* 7	19	18	65
413-4	1000	60	* 7	19	18	65
423-1	2000	400	12¼	19	20	90
423-3	2000	50	12¼	19	20	110
423-4	2000	60	12¼	19	20	110
433-1	3000	400	12¼	19	20	140
433-3	3000	50	12¼	19	20	160
433-4	3000	60	12¼	19	20	155
443-1	4000	400	12¼	19	20	170
443-3	4000	50	12¼	19	20	220
443-4	4000	60	12¼	19	20	210
463-1	6000	400	63	22	30	350
463-3	6000	50	63	22	30	400
463-4	6000	60	63	22	30	390
483-1	8000	400	63	22	30	400
483-3	8000	50	63	22	30	440
483-4	8000	60	63	22	30	430
414-1	10000	400	63	22	30	470
414-3	10000	50	63	22	30	540
414-4	10000	60	63	22	30	510
424-1	20000	400	63	44	30	969
424-3	20000	50	63	44	30	1080
424-4	20000	60	63	44	30	1020

THREE PHASE

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt. (Lbs.)
			H	W	D	
417-1	1000	400	8¾	19	20	60
417-3	1000	50	8¾	19	20	70
417-4	1000	60	8¾	19	20	70
418-1	1600	400	12¼	19	20	90
418-3	1600	50	12¼	19	20	100
418-4	1600	60	12¼	19	20	100
438-1	3500	400	17½	19	20	160
438-3	3500	50	17½	19	20	180
438-4	3500	60	17½	19	20	170
468-1	6000	400	63	22	30	350
468-3	6000	50	63	22	30	400
468-4	6000	60	63	22	30	390
488-1	8000	400	63	22	30	395
488-3	8000	50	63	22	30	475
488-4	8000	60	63	22	30	430
419-1	10000	400	63	22	30	470
419-3	10000	50	63	22	30	540
419-4	10000	60	63	22	30	520
429-1	20000	400	63	44	30	990
429-3	20000	50	63	44	30	1090
429-4	20000	60	63	44	30	1090
439-1	30000	400	63	44	30	1310
439-3	30000	50	63	44	30	1490
439-4	30000	60	63	44	30	1490
459-1	50000	400	63	44	30	2070
459-3	50000	50	63	44	30	2380
459-4	50000	60	63	44	30	2290

* Panel Height dependent on D.C. input requirement—CONSULT FACTORY

abbott
MILITARY POWER SUPPLIES

28 VDC to AC Sine Wave

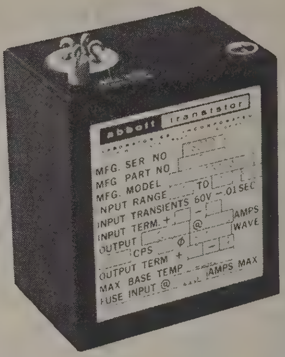
MODEL S

SPECIFICATIONS

Input Voltage Range: 24 to 30 volts DC. Other input ranges are available.
Load Regulation: ±1.0% from ½ to full load.
Frequency Stability: ±1.0%
Voltage Adjustment Range: 12% by screwdriver adjustment.
Reliability: Up to 340,600 Hrs. MTBF per MIL-HDBK-217C.
Input Transient Protection: In accordance with MIL-STD-704A, Limit 1, Fig. 9 (80 volts for 0.1 seconds).
Environment: +212°F max. at mtg. base using adequate heat sink. −65°F min. at mounting base. Encapsulated to meet the environmental requirements of MIL-STD 810C and MIL-E 5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Input Voltage Range	Output Frequency (Hertz)	Output Voltage Range	Output Power (Volt-Amps)	Harmonic Distortion (%)	Size (See Below)	Weight (Lbs.)	Model Number
24-30	400	25.4-28.6	5	2.0	4	1.6	S05D-27A-400
			10	2.5	4C	1.7	S1D-27A-400
			20	2.5	4B	2.3	S2D-27A-400
			30	2.5	6A	2.4	S3D-27A-400
			60	3.0	12	4.8	S6D-27A-400
			120	4.0	14	9.1	S12D 27A-400
24-30	400	108-122	5	2.0	4	1.6	S05D-115A-400
			10	2.5	4C	1.7	S1D-115A-400
			20	2.5	4B	2.3	S2D-115A-400
			30	2.5	6A	2.4	S3D-115A-400
			60	3.0	12	4.8	S6D-115A-400
			120	4.0	14	9.1	S12D-115A-400
24-30	800	25.4-28.6	5	2.0	4	1.6	S05D-27A-800
			10	2.5	4C	1.7	S1D-27A-800
			20	2.5	4B	2.3	S2D-27A-800
			30	2.5	6A	2.4	S3D-27A-800
			60	3.0	12	4.8	S6D-27A-800
			120	4.0	14	9.1	S12D-27A-800
24-30	800	108-122	5	2.0	4	1.6	S05D-115A-800
			10	2.5	4C	1.7	S1D-115A-800
			20	2.5	4B	2.3	S2D-115A-800
			30	2.5	6A	2.4	S3D-115A-800
			60	3.0	12	4.8	S6D-115A-800
			120	4.0	14	9.1	S12D-115A-800

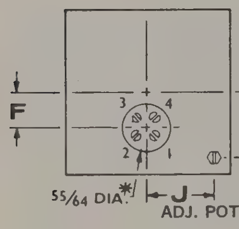
Output frequencies up to 1600 Hz available as standard models. Contact our nearest office for information.

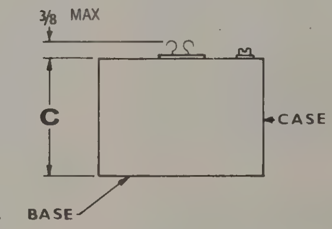


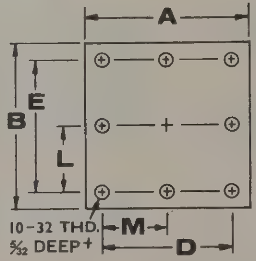
Sine Wave — 1 Ø 400 to 1600 Hz

- Operating temperature range: −55°C to +100°C.
- High reliability. Up to 340,600 hrs. MTBF per MIL-HDBK-217C.
- Encapsulated and hermetically sealed per MIL-STD-810C and MIL-E-5400P.

CASE DIMENSIONS FOR ABBOTT MODELS W, WW, C, CC, B AND S







* Models CC and WW use special 8 pin header.
Size of special headers is 1¹⁄₁₆ dia. by ⁹⁄₁₆ high.
† 6-32 Thd, ³⁄₁₆ deep on case size 1B.

Size	A	B	C	D	E	F	J	K	L	M
1	1½	2¾	3	1.00	2.25	⁹⁄₁₆	½	1⅛	—	—
1A	1½	2¾	2¾	1.00	2.25	⁹⁄₁₆	½	1⅛	—	—
1B	1½	2	2	1.00	1.50	0	½	¾	—	—
2	1⅞	2¾	3¼	1.37	2.25	¾	¹¹⁄₁₆	1⅛	—	—
2C	2	2¾	2⅛	1.50	2.25	0	¾	1⅛	—	—
2D	2	3	3½	1.50	2.50	¾	¾	1¼	—	—
2E	2⅛	3¼	3¼	1.62	2.75	⅞	¹³⁄₁₆	1⅜	—	—
3	2¾	2¾	3	2.25	2.25	¾	1⅛	1⅛	—	—
3A	2¾	2¾	2¾	2.25	2.25	¾	1⅛	1⅛	—	—
4	2¼	2¾	3¼	1.75	2.25	¾	⅞	1⅛	—	—
4B	2½	3	3¾	2.00	2.50	¾	1	1¼	—	—
4C	2¼	2¾	3½	1.75	2.25	¾	⅞	1⅛	—	—
4D	2½	3½	3½	2.00	3.00	0	1	1½	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	1⅛	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	1⅛	1¼	—	—
6A	2¾	3	4	2.25	2.50	¾	1⅛	1¼	—	—
6B	2¾	3⅛	3⅝	2.25	2.62	¾	1⅛	¹⁵⁄₁₆	—	—
7	2¾	2¾	4	2.25	2.25	¾	1⅛	1⅛	—	—
7A	2⅞	3⅜	4½	2.37	2.87	¾	1³⁄₁₆	1⁷⁄₁₆	—	—
8B	2⅝	3½	2⅞	2.12	3.00	¾	1¹⁄₁₆	1½	—	—
9A	2¾	4¾	3¾	2.25	4.25	0	1⅛	2⅛	—	—
9B	2¾	4¾	3½	2.25	4.25	0	1⅛	2⅛	—	—
9C	2½	4⅜	3⅛	2.00	3.87	1	1	1¹⁵⁄₁₆	—	—
9D	2⅝	4¾	3⅝	2.12	4.25	1	1¹⁄₁₆	2⅛	—	—
10A	3	5	4	2.50	4.50	0	1¼	2¼	—	—

Size	A	B	C	D	E	F	J	K	L	M
10B	2⅞	4¼	4⅜	2.37	3.75	1⅜	1³⁄₁₆	1⅞	—	—
10C	3⅜	3⅜	3¾	2.87	2.87	¾	1⁷⁄₁₆	1⁷⁄₁₆	—	—
10D	3½	3½	4	3.00	3.00	¾	1½	1½	—	—
10G	3½	5½	2½	3.00	3.50	**	**	**	—	—
10H	4	5½	2⅝	3.50	3.50	**	**	**	—	—
11	3	5½	3¼	2.50	5.00	2⅛	1¼	2½	2.50	—
11C	4¼	5¼	4	3.75	4.75	0	1⅞	2⅜	2.37	—
11D	4	4⅞	3⅞	3.50	4.37	1⅜	1¾	2³⁄₁₆	—	—
11E	3¾	4½	4¼	3.25	4.00	¾	1⅝	2	—	—
11F	2¾	6¼	2¾	2.25	5.75	1	1⅛	2⅞	2.87	—
11K	3⅝	8¹³⁄₁₆	2⅝	2.55	4.31	**	**	**	—	—
12	3	5½	4	[illegible].50	5.00	2⅛	1¼	2½	2.50	—
12A	4½	6	4	4.00	5.50	0	2	2¾	2.75	—
12C	3⅞	6¼	2¾	3.37	5.75	1½	1¹¹⁄₁₆	2⅞	2.87	—
12G	5⅛	8¾	2⅝	4.62	6.56	**	**	**	3.28	—
13A	5½	6½	4½	5.00	6.00	0	2½	3	3.00	2.50
14	6	6	4	5.50	5.50	2⅜	2¾	2¾	2.75	2.75
14C	5½	5½	3⅝	5.00	5.00	1⅞	2½	2½	2.50	2.50
14D	6	6¼	3⅞	5.50	5.75	1¼	2¾	2⅞	2.87	2.75
14E	5¾	6¼	2¾	5.25	5.75	1¼	2⅝	2⅞	2.87	2.62
16A	6¾	7½	4¼	6.25	7.00	2¾	3⅛	3½	3.50	3.12

DIMENSIONAL TOLERANCES: FRACTIONS ±¹⁄₃₂; DECIMALS .XX ±0.015.

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When
Reliability is
Imperative.

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European Office
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Tel: 0233 623404
Fax: 0233 641777

abbott
MILITARY POWER SUPPLIES

28 VDC to AC Sine Wave

SN

SPECIFICATIONS:

Input: 24 to 30 V dc. Other inputs available. (See Option H.)

Efficiency: 55% minimum at 27 V dc input and full load.

Line Regulation: Within 0.5% for full input change 24 V dc to 30 V dc with load constant.

Load Regulation: Within 1.0% for load change of one half to full load with line constant.

Wave Form: Sinusoidal with a maximum harmonic distortion into a resistive load of 4%.

Frequency Stability: ±1% drift with time (within 8 hours after 30 seconds warm-up).

Frequency Accuracy: ±0.5% is initial setting tolerance.

Load Power Factor: Derate linearly from 100% rated power at unity to 70% rated power at 0.7 power factor lagging or leading.

Isolation Voltage: 200 V dc input to case, 750 V dc output to case and input to output.

Insulation Resistance: 50 megohms minimum between input and output, input and case, output and case when measured at 50 V dc.

Temperature Range: Operating −55°C to +100°C baseplate temperature; storage temepratute −65°C to +125°C ambient.

Temperature Coefficient: 0.06% / °C from −55°C to +100°C, voltage change, frequency change, 1% maximum.

Input Transient Protection: In accordance with MIL-STD-704A, Figure 9, Limit 1 (80 V dc for 0.1 second).

Load Transient Response: Output voltage returns to regulation limits within 5 cycles for a load change of no load to full load.

Load Transient Overshoot: 10% maximum from nominal voltage set point.

Short Circuit Protection: Completely protected against short circuit of any duration. Unit must be recycled to restore output to normal.

Reliability: The MTBF calculated per MIL HDBK-217D, under operating conditions of 50°C baseplate temperature, maximum operating input voltage and full rated output power is 156,366 hours for ground benign and 15,722 hours for air inhabited transport environments. With Enhanced Reliability Option (-ER) ground benign is 907,070 hours; air inhabited transport is 93,030 hours.

Environment: Hermetically sealed and encapsulated to meet the environmental requirements of MIL-STD-810C.

Maintainability: Units are repairable at depot level.

OPTIONAL FEATURES

The following standard options are available on the SN Series inverters. Please refer to option section of this catalog for detailed information.

Special Connectors: A military-type hermetically sealed connector is provided as **Option A** in place of our standard header to extend out the top surface. (To order, replace "D" in model number with "A", i.e., SN180A-27A-400.)

Severe Shock, Acceleration and Vibration: Special encapsulation, **Option E**, enables all units to withstand 60 g's shock, 50 g's acceleration and 30 g's vibration. (To order, add "E" after "D" in model number, i.e., SN180DE-27A-400).

Wide Input Voltage: Option H recenters the input voltage to provide alternate inputs from 18 V dc to 32 V dc. Call an Abbott Sales Office for output current derating. (To order, add "H" after the "D" in model number and specify input voltage range in parentheses after the entire model number, i.e., SN180DH-27A-400 (18-30).)

Remote Turn On/Off: Option L provides isolated terminals to turn outputs on/off with TTL logic signal. (To order, add "L" to character preceding first dash in model number, i.e. SN180DL-27A-400.)

Remote Output Adjustment: With **Option R**, an adjustment potentiometer can be remotely located to adjust the output voltage. (To order, add "R" after "D" in model number, i.e., SN180DR-27A-400.)

Frequency Adjustment: Option -4 enables output frequency to be adjusted ±5% by means of an external potentiometer. (To order, add "-4" at the end of the entire model number, i.e., SN180D-27A-400-4.)

Enhanced Reliability: -ER Option provides increased reliability by using higher levels of military-grade components. (To order, add "-ER" at the end of the entire model number, i.e., SN180D-27A-400-ER.)

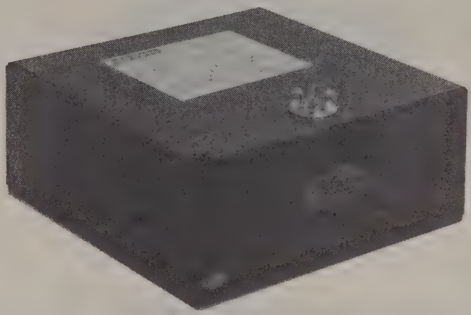
6 Standard Models

Output Frequency (Hertz)	Output[1] Voltage Range	Output Amps (Resistive Load) Continuous	Harmonic Distortion (%)	Size (See Dwg.)	Weight[2] lbs.)	Weight[2] (Kgs.)	Model Number
400	25.4-28.6	6.667	4.0	14H	5.5	2.5	SN180D-27A-400
	108-122	1.565	4.0	14H	5.5	2.5	SN180D-115A-400
800	25.4-28.6	6.667	4.0	14H	5.5	2.5	SN180D-27A-800
	108-122	1.565	4.0	14H	5.5	2.5	SN180D-115A-800
1600	25.4-28.6	6.667	4.0	14H	5.5	2.5	SN180D-27A-1600
	108-122	1.565	4.0	14H	5.5	2.5	SN180D-115A-1600

1. Output voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer.
2. Weights are ±5%.

Model Numbering System

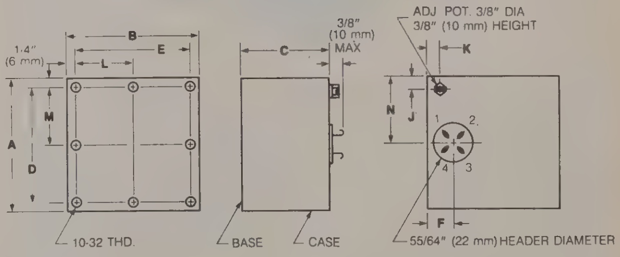
Product Line Series	Output Power Watts	Header Type	Options	Dash	Output Voltage AC	A	Dash	Frequency Hz
SN	180	D		—	27	A	—	400



Sine Wave - 1ϕ 400 to 1600 Hz

- High Density 2 w/in^3 180-Watt Inverter
- Operating temperature range: −55°C to +100°C.
- High reliability. Up to 907,070 hrs. MTBF per MIL-HDBK-217D.
- Encapsulated and hermetically sealed per MIL-STD-810C and MIL-E-5400P.

CASE DRAWINGS


B
E
L
1.4″ (6 mm)
A
M
D
10-32 THD.
C
3/8″ (10 mm) MAX
BASE
CASE
ADJ POT. 3/8″ DIA 3/8″ (10 mm) HEIGHT
K
N
J
1
2.
4
3
F
55/64″ (22 mm) HEADER DIAMETER

CASE DIMENSIONS

Model	Case Size	A	B	C	D	E	F	J	K	L	M	N
SN180	14H	6	6	2½	5.50	5.50	¾	¼	¼	2.75	2.75	3
		152	152	64	139.7	139.7	19	6	6	69.8	69.8	76.2

Tolerances: If English unit is a fraction, ±1/32 inch (0.8 mm); if English unit is a decimal, ±.015 inc. (0.4 mm).

Material: Base – Aluminum 6061-T6, Case – Steel

Finish: Black flat lacquer per FED-STD-595. Color 37038.

Mounting: 10-32 THD inserts
5/32″ minimum depth are provided in baseplate. Steel 10-32 bolts American Standard, unified national fine series, slotted studs are supplied with each unit. Metric hardware and inserts available as a special order.

INPUT CURRENT (Amps)

Load	24V Input	30V Input
100%	12A	12A
75%	9A	9.1A
50%	6A	6.1A

abbott
When
Reliability is
Imperative.

Western Office
2727 S. La Cienega Blvd.
Los Angeles, CA 90034
Tel: (310) 202-8820
Fax: (310) 836-1027

Southwest Office
275 W. Campbell Road
Suite 227
Richardson, TX 75080
(214) 437-0697
Fax: (214) 437-0698

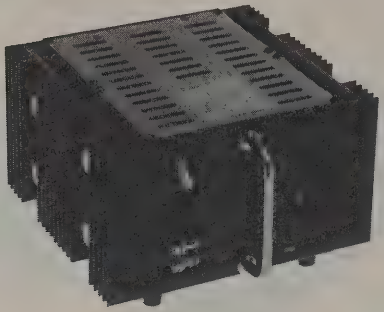
Eastern Office
520 Main St.
Suite 301
Fort Lee, NJ 07024
(201) 461-4411
Fax: (201) 461-2936

European Office
Ashford, Kent, England
Tel: 0233 623404
Fax: 0233 641777

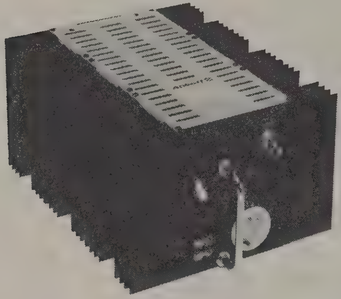
Abbott
TECHNOLOGIES, INC.

Sine Wave Inverters

MODELS
KN-PN
LN-TN



Standard Models: KN, PN, LN, TN
Cases K2, F2, J2



11 to 54 VDC Input
30 to 320 VA Output

- A wide range of standard models.
- 50 Hz or 60 Hz output.
- Surge current capabilities up to 3 times rated output power.
- Exceptional reliability. Typical MTBF: 90,586 hours for model LN8.
- High efficiency provided by sine wave. Conserves power.
- Saves motors by reducing overheating.
- Low distortion. 2% typical.
- Salt spray package.
- Compact. Lightweight.
- Switchable 115 VAC 60 Hz/230 VAC 50 Hz.
- Wide temperature range: −20°C to +55°C ambient operation.
- Special models available.
- 2-year warranty.

Abbott's sine wave inverters convert dc battery power to regulated clean ac. They are used to provide uninterrupted power to operate computers, motors, lamps, digital processors, TV broadcast equipment and telecommunication electronics.

Our inverters have become the industry standard by providing dependable performance in such rugged applications as marine radar, railway signal and communications, security electronics, and mobile test equipment.

11 to 15 VDC Input

Output Power (VA)	Case	Weight (Lbs.)	Single Output 115 VAC 60 Hz	Single Output 220 VAC 50 Hz	Switchable Output 115V 60 Hz/220V 50 Hz
30	K2	16	KN3T-115-60	KN3T-220-50	KN3T-50/60
30	G2	27	KS3R-115-60	KS3R-220-50	NA
60	F2	18	KN6T-115-60	KN6T-220-50	KN6T-50/60
60	G2	27	KS6R-115-60	KS6R-220-50	NA
120	J2	30	KN12T-115-60	KN12T-220-50	KN12T-50/60

29 to 38 VDC Input

Output Power (VA)	Case	Weight (Lbs.)	Single Output 115 VAC 60 Hz	Single Output 220 VAC 50 Hz	Switchable Output 115V 60 Hz/220V 50 Hz
80	K2	16	LN8T-115-60	LN8T-220-50	LN8T-50/60
80	G2	27	LS8R-115-60	LS8R-220-50	NA
160	F2	18	LN16T-115-60	LN16T-220-50	LN16T-50/60
160	G2	27	LS16R-115-60	LS16R-220-50	NA
320	J2	30	LN32T-115-60	LN32T-220-50	LN32T-50/60

22 to 30 VDC Input

Output Power (VA)	Case	Weight (Lbs.)	Single Output 115 VAC 60 Hz	Single Output 220 VAC 50 Hz	Switchable Output 115V 60 Hz/220V 50 Hz
60	K2	16	PN6T-115-60	PN6T-220-50	PN6T-50/60
60	G2	27	PS6R-115-60	PS6R-220-50	NA
120	F2	18	PN12T-115-60	PN12T-220-50	PN12T-50/60
120	G2	27	PS12R-115-60	PS12R-220-50	NA
240	J2	30	PN24T-115-60	PN24T-220-50	PN24T-50/60

42 to 54 VDC Input

Output Power (VA)	Case	Weight (Lbs.)	Single Output 115 VAC 60 Hz	Single Output 220 VAC 50 Hz	Switchable Output 115V 60 Hz/220V 50 Hz
80	K2	16	TN8T-115-60	TN8T-220-50	TN8T-50/60
80	G2	27	TS8R-115-60	TS8R-220-50	NA
160	F2	18	TN16T-115-60	TN16T-220-50	TN16T-50/60
160	G2	27	TS16R-115-60	TS16R-220-50	NA
320	J2	30	TN32T-115-60	TN32T-220-50	TN32T-50/60

Also see listing for Power Supplies in this Volume Pages **D**•1512-1515 and Transformers in Volume **A**, Pages **A**•2234-2253.

ABBOTT TECHNOLOGIES, INC.
Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395
Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC.

Sine Wave Inverters

MODELS
KN-PN
LN-TN

SPECIFICATIONS

INPUT VOLTAGE RANGE:
KN, KS: 11 to 15 VDC
PN, PS: 22 to 30 VDC
LN, LS: 29 to 38 VDC
TN. TS: 42 to 54 VDC

OUTPUT VOLTAGE: 115 or 220 VAC ±2% at full load and nominal input voltage.

OUTPUT FREQUENCY: 50 Hz or 60 Hz.

LINE REGULATION: 3% for specified input voltage range with load constant.

LOAD REGULATION: 3% for load change of half load to full load with line constant; 6% for change of no load to full load.

WAVE FORM: Sine wave with 2% typical, 5% maximum distortion.

POWER FACTOR: Fully rated output VA, from unity to 0.7 power factor lagging or leading.

EFFICIENCY: At full load with nominal input voltage
40% minimum on KN, KS
50% minimum on PN, PS
58% minimum on LN, LS
60% minimum on TN, TS

OPERATING TEMPERATURE RANGE: (KN, PN, LN and TN): −4°F to +131°F (−20°C to +55°C) ambient air temperature. Humidity 0 to 90% (non condensing) at 25°C.

OPERATING TEMPERATURE RANGE: (KS, PS, LS and TS): −4°F to +131°F (−20°C to +55°C) ambient air temperature. G2 case is submersible (10 feet, 2 minutes).

INPUT TRANSIENT PROTECTION: 45 VDC for 0.1 second transient deviation and recovery (for change of 50%) of rated (load).

ALTITUDE: 10,000 feet above sea level (KN, PN, LN, TN) 50,000 feet above sea level (KS, PS, LS, TS).

PROTECTIVE FEATURES

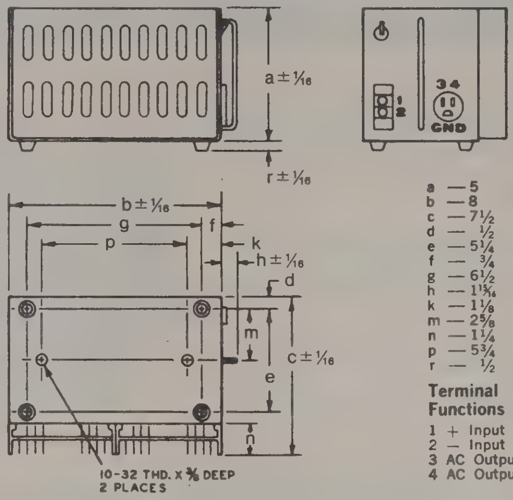
OVERLOAD PROTECTION: Magnetic type circuit breaker. Reverse polarity protection.

HIGH RELIABILITY

Model LN8T-115-60: MTBF 90,586 hours at 25°C ambient, ground benign environment per MIL-HDBK-217. Model TN8T-115-60: MTBF 74,733 hours at 50° ambient.

2-YEAR WARRANTY/ALL MODELS.

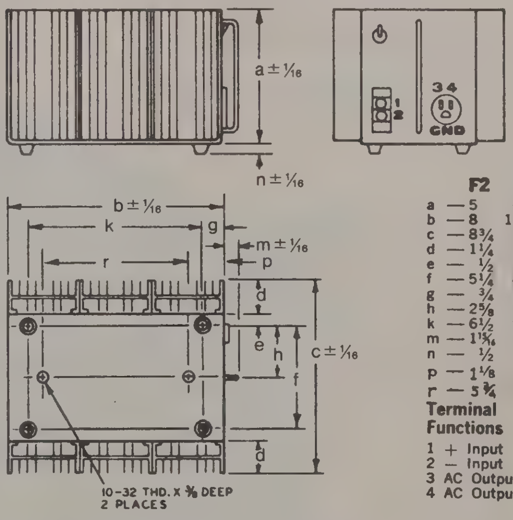
Case K2 Dimensions in inches.



a	5
b	8
c	$7\frac{1}{2}$
d	$\frac{1}{2}$
e	$5\frac{1}{4}$
f	$\frac{3}{4}$
g	$6\frac{1}{2}$
h	$1\frac{15}{16}$
k	$1\frac{1}{8}$
m	$2\frac{5}{8}$
n	$1\frac{1}{4}$
p	$5\frac{3}{4}$
r	$\frac{1}{2}$

Terminal Functions
1 + Input
2 − Input
3 AC Output
4 AC Output

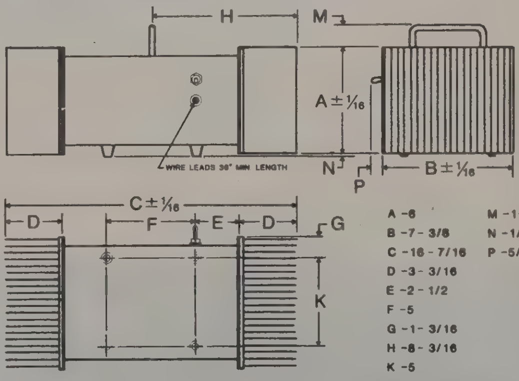
Cases F2, J2 Dimensions in inches.



	F2	J2
a	5	$6\frac{1}{2}$
b	8	12
c	$8\frac{3}{4}$	$9\frac{3}{4}$
d	$1\frac{1}{4}$	$2\frac{1}{8}$
e	$\frac{1}{2}$	$\frac{3}{8}$
f	$5\frac{1}{4}$	$1\frac{3}{4}$
g	$\frac{3}{4}$	$1\frac{1}{4}$
h	$2\frac{5}{8}$	$2\frac{3}{8}$
k	$6\frac{1}{2}$	$9\frac{1}{2}$
m	$1\frac{15}{16}$	$1\frac{15}{16}$
n	$\frac{1}{2}$	$\frac{1}{2}$
p	$1\frac{1}{8}$	$1\frac{1}{4}$
r	$5\frac{3}{4}$	$9\frac{1}{2}$

Terminal Functions
1 + Input
2 − Input
3 AC Output
4 AC Output

Case G2 Dimensions in inches.



WIRE FUNCTIONS	
RED	+ INPUT
BLACK	− INPUT
WHITE	AC OUTPUT
BROWN	AC OUTPUT

A -6
B -7- 3/8
C -16 - 7/16
D -3 - 3/16
E -2 - 1/2
F -5
G -1- 3/16
H -8 - 3/16
K -5
M -1- 1/4
N -1/8
P -5/8

Note: Dimensional tolerances are all ±1/16".

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ACDCo Power WHERE you need it!

Inverters-Uninterruptible Power Systems -Battery Chargers-Frequency Changers-Power Supplies

ACDCo Power Equipment is designed to meet high reliability and performance standards providing maximum life with minimum maintenance to protect all system circuits that require dependable, high quality power.

PRODUCT

Inverters, Power – DC to AC Output: Fixed-base, portable, mobile and marine.

Uninterruptible AC Power Systems: 36 VA to 5 KVA.

Frequency Converters – AC to DC: 50/60 Hz, 60/50 Hz, 50/400 Hz and 60/400 Hz.

TYPICAL SPECIFICATIONS

Input: ±15% from nominal.

Output: Sine wave, 120 Volts RMS, 60 Hz.

Voltage Regulation: 2% over full input and load range.

Frequency Regulation: 1% over full input and load range.

Power Factor: .9 Lead to .8 Lag.

Efficiency: Over 80% at nominal input.

Distortion: Less than 5%.

Overload: Within specifications for ONE MINUTE at 140% load.

Overload Protection: No damage from short to open circuit, reversal of input, or input voltage to 140% nominal.

DESIGN FEATURES

Ruggedized construction, no moving parts, completely solid state, easy servicing – sides fold down, plug-in transistors and I/C's on Printed Circuit Boards, all P/C boards plug-in removable.

STATIC INVERTER MODELS

Rating	12VDC	24VDC	32VDC	48VDC	120VDC
36VA	A12-1	A13-1	A19-1	A14-1	A16-1
72VA	A22-1	A23-1	A29-1	A24-1	A26-1
125VA	A32-1	A33-1	A39-1	A34-1	A36-1
250VA	A42-1	A43-1	A49-1	A44-1	A46-1
500VA	A52-1	A53-1	A59-1	A54-1	A56-1
1000VA		A63-1	A69-1	A64-1	A66-1

Three Phase Models Available up to 15KVA

ACDCo. inverters are used in one of the roughest of Marine Environments on the U.S. Coast Guard's Rescue Life Boats to power their Navigation and Communication equipment.
ACDCo. has versions of power equipment available to meet military specifications.
ACDCo. static inverters are used by major Public Utility companies throughout the United States.

ACE SERIES

SINE WAVE INVERTER

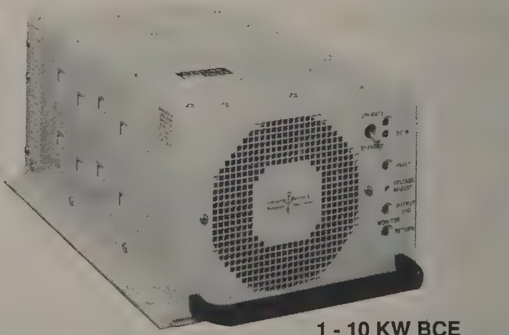
1kVA TO 10kVA **1 & 3-PHASE**

COMPACT LIGHTWEIGHT & RUGGED

1% THD SINUSOIDAL OUTPUT

50/60/400HZ MODELS

MOBILE, AIRBORNE & SHIPBOARD



1 - 10 KW BCE
BATTERY CHARGERS

ADVANCE CONVERSION DEVICES

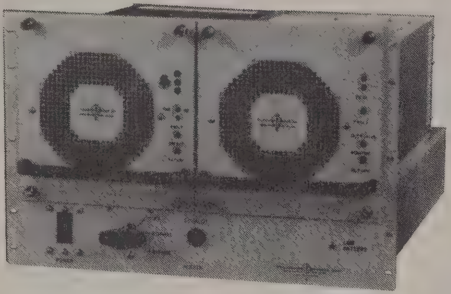
A UNIT OF

Transistor Devices Inc.
85 HORSEHILL RD., CEDAR KNOLLS, NJ 07927 PHONE: (201) 267-1900 FAX: (201) 267-2047

ACDC POWER WHERE YOU NEED IT

RUGGEDIZED MIL-UPS POWER SYSTEMS FOR MILITARY & HOSTILE ENVIRONMENTS

- On-Line System Provides Seamless Power Transfer
- "Sine Shaping" Inverter with 0 Lead 0 Lag Load Power Factor
- Wide Input Range Provides Immunity to AC Line Voltage and Frequency Fluctuations

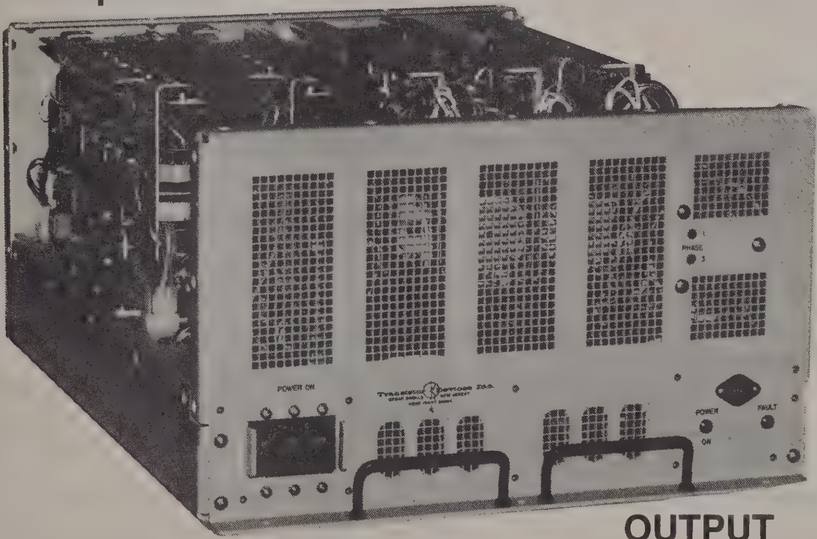


- Can Meet High Shock, Vibration, Humidity, Salt, and EMI Specifications
- Field Replaceable LRU's Enhance System Up-time
- US, Euro, and Mil Power Single and Three Phase, 50, 60 & 400 Hz Models
- 1 KVA to 10 KVA

1 - 10 KW FREQUENCY CONVERTERS

400 Hz to 60 Hz
1 or 3 Phase Output

Low Harmonic Distortion
Airborne/Military



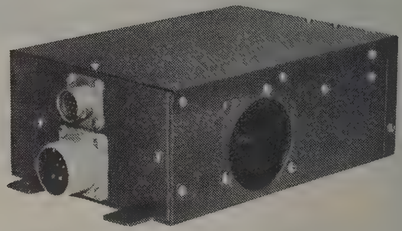
INPUT
115/200 VAC
350 - 700Hz, 3 Phase
Per MIL-STD-704C, and
DOD-STD-1399/300

OUTPUT
120/208 VAC 60 Hz 3 Phase
or
120 VAC 60 Hz 1 Phase
(Internal switch selectable)

ADVANCE CONVERSION DEVICES
A UNIT OF
Transistor Devices Inc.
85 HORSEHILL RD., CEDAR KNOLLS, NJ 07927 PHONE: (201) 267-1900 FAX: (201) 267-2047

Avionic Instruments, Inc.

GSA LISTED!



Lightweight 50, 60, 400 Hz Static Inverters/Frequency Converters for Aerospace, Military, Commercial

- *50 VA-42 KVA*
- *Less than 10 lbs/KVA*
- *Parallelable*
- *Single phase or three phase*
- *50-60-400 Hz configurations*
- *Custom design capability*
- *High efficiency 80% typical*
- *300 microsecond dynamic load response*
- *No spikes—no surges*
- *Sinewave distortion 0.75% typical*
- *Meets military standards for severe hostile environments*

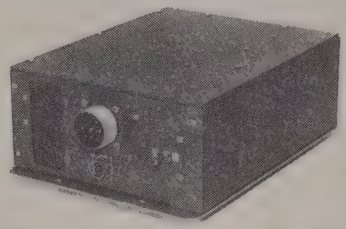
AVIONIC INSTRUMENTS INC. (AI^2) Power Conversion products feature an advanced power processing technique that virtually eliminates the limitations inherent in traditional power conversion designs.

These advanced designs include a high frequency DC to DC converter/regulator and a three-state (bridge) inverter regulator. The sinusoidal output voltage is achieved from the bridge section through use of a spectrum controlled modulation system utilizing advanced switching circuitry. Heavy baseband magnetic components are eliminated resulting in an extremely lightweight, efficient, and high reliable inverter design.

Each section of this advanced design utilizes a patented, current controlled, closed loop system which is inherently stable, providing excellent steady state and dynamic response characteristics evidenced by no output voltage excursions outside the regulation band under any conditions of load application and removal. This includes non-linear loads such as half wave recitifiers. Protection circuitry includes input over/under voltage, overtemperature, output overvoltage and over/under frequency shutdown as well as 200 percent of rated current under short circuit conditions.

Avionic's modular design allows interconnection of units for increased power output and for multi-phase systems. Reliable custom designed units for non-standard frequencies and voltages are made easy by Avionic's two-stage design.

Avionic Instruments Inc., 1414 Randolph Ave., Avenel, NJ 07001. FAX: (908) 382-4996
Telephone: (908) 388-3500, Cable Address: Reainta, Rahway, Telex: WU844-413 Reaintl Rway



GSA LISTED!

General Performance Specifications

(Consult factory for exact data on specific models)

Input Voltage
Static Inverters:
28VDC ±10V.
48 VDC Option Available
Frequency Converters:
115/200 VAC ±10%, 400 Hz.

Output Power
50VA to 42kVA.

Output Voltage
115 or 230 VAC RMS ±1%, 1Ø.
26VAC optional secondary output.
115/200VAC wye RMS ±1%, 30.

Output Frequency
50/60/400Hz ±1.0% for all conditions of line, load, and temperature.

Waveshape
Sinewave 0.75% THD, typical.
Less than 0.1VDC component per MIL STD 704C.

Efficiency
80% typical at full rated output.

Overload
110% rated output for 2 hours.
150% load current for 5 minutes, nominal conditions per TSO-C73.

Short Circuit Current
200% for five minutes minimum.

Power Factor
0.7 lead to 0.7 lag.
Not damaged by any power factor.

Protection
Cannot be damaged by any short circuit.
Input under/over voltage.
Output overvoltage.
Output under/over frequency.
Thermal overheat.
Reverse polarity.
Fault indicator.

Qualifications
FAA TSO-C73.
RTCA DO-160A
Cat.F2B/RTY/EXXXFXXZAZZ.
MIL-STD-810

Environmental
RTCA DO-160A for severe, hostile environments.

Altitude
55,000 feet, operating.

EMI
RTCA DO-160A Cat. Z for conducted, radiated and susceptibility.

Temperature Range
–55°C to +71°C, operating.
–65°C to +85°C, storage and shipment.

Vibration
10g's; 5Hz-2000Hz.

Shock
15g's; each axis.

Humidity
95%, 10 days; 71°C.

Explosion
DO-160A Cat. E.

Salt Spray
DO-160A Cat. S.

Sand and Dust
DO-160A Cat. D.

Fungus
DO-160A Cat. F.

Quality Assurance
MIL-I-45208A
MILQ-9858A upgrade in process
ISO-9000 (Pending)

APPLICATIONS

Radio/Communications
RPVs and Drones
Robots
Stability Augmentation
Space Shuttle Systems
Surveillance Equipment
SATCOM Terminals
Shelters
Shipboard Communication
Autopilots
Appliances
Business Equipment
CRT Displays
Computers/Tactical
Environmental Systems
Fire Control Systems
Flight Test Equipment
Aircraft
Vans and Jeeps
Security Systems
TV Systems
Trainers/Simulators
Telemetry
UPS
Underwater Systems
X-Ray Systems
Guidance & Gyros
Lasers
Laboratory Equipment
MEDEVAC/EMS
AIREVAC
Microwave Relay
OMEGA/VLF
Radars
Night Vision Devices
Hospitals

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Telephone: (908) 388-3500, Cable Address: Reainta, Rahway, Telex: WU844-413 Reaintl Rway

Avionic Instruments, Inc.

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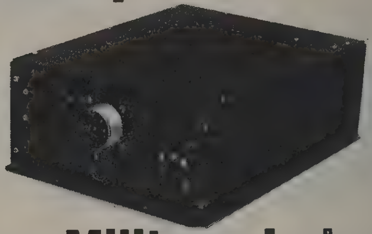
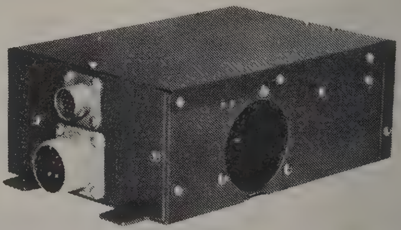


Frequency Converters for Aerospace, Military, Industry

	Model	Output		Dimensions	Weight
400 Hz 3Ø to 60 Hz	4A1000-1HP	1000VA	115 VAC	12.0" x 8.5" x 4.1"	15.5 lbs./7.1 kgs.
	4A2000-1B-1-HRP	2000VA	115 VAC	16.0" x 10.0" x 9.3"	44.0 lbs./20.0 kgs.
	4A3000-1B-HRP	3000VA	115 VAC	16.0" x 13.9" x 9.3"	59.0 lbs./26.8 kgs.
	4A3000-1C-HRP	3000VA	115/200 VAC	16.0" x 13.9" x 9.3"	59.0 lbs./26.8 kgs.
	4A4000-1B-HRP	4000VA	115 VAC	14.8" x 17.8" x 9.3"	78.0 lbs./35.5 kgs.
400 Hz 3Ø to 50 Hz	4A1000-1GP	1000VA	115 VAC	12.0" x 8.5" x 4.1"	15.5 lbs./7.1 kgs.
	4A2000-1C-1-HRP	2000VA	115 VAC	16.0" x 10.0" x 9.3"	44.0 lbs./20.0 kgs.
	4A3000-1A-HRP	3000VA	115 VAC	16.0" x 13.9" x 9.3"	59.0 lbs./26.8 kgs.
	4A1000-1C-IP	1000VA	230 VAC	16.0" x 10.0" x 9.3"	40.0 lbs./18.2 kgs.
	4A2000-1A-1-HRP	2000VA	230 VAC	16.0" x 10.0" x 9.3"	44.0 lbs./20.0 kgs.
	4A4000-1A-HRP	4000VA	230 VAC	14.8" x 17.8" x 9.3"	78.0 lbs./35.5 kgs.



Static Inverters: Lightweight, High Performance, Rugged and Reliable

	Model	Output		Dimensions	Weight
28 VDC to 400 Hz Single-Phase	1A50-1B-1	50VA	115/26 VAC	7.0" x 5.0" x 2.8"	4.2 lbs./2.0 kgs.
	1A125-1B-1	125VA	115/26 VAC	7.0" x 5.0" x 2.8"	4.2 lbs./2.0 kgs.
	1B250-1D-1	250VA	115/26 VAC	7.0" x 5.0" x 2.8"	4.5 lbs./2.1 kgs.
	1B350-1B-1	350VA	115/26 VAC	7.0" x 5.0" x 2.8"	4.5 lbs./2.1 kgs.
	1A500-1A-1	500VA	115 VAC	12.5" x 5.8" x 6.3"	12.0 lbs./5.5 kgs.
	*1B800-1G	800VA	115/26 VAC	12.0" x 8.5" x 4.1"	13.5 lbs./6.1 kgs.
	*1B1000-1G	1000VA	115/26 VAC	12.0" x 8.5" x 4.1"	13.5 lbs./6.1 kgs.
	*1B1100-1G	1100VA	115/26 VAC	12.0" x 8.5" x 4.1"	13.5 lbs./6.1 kgs.
	*1A1600-1A-1-HR	1600VA	115 VAC	16.0" x 10.0" x 9.3"	37.0 lbs./16.8 kgs.
	*1A2000-1A-1-HR	2000VA	115 VAC	16.0" x 10.0" x 9.3"	37.0 lbs./16.8 kgs.
	*1A2400-1B-HR	2400VA	115 VAC	16.0" x 13.9" x 9.3"	55.0 lbs./25.2 kgs.
	*1A3000-1B-HR	3000VA	115 VAC	16.0" x 13.9" x 9.3"	55.0 lbs./25.2 kgs.
	*1A4000-1A-HR	4000VA	115 VAC	14.8" x 17.8" x 9.3"	74.0 lbs./33.7 kgs.
28 VDC to 400 Hz Three-Phase	3PH150-1A	150VA	115/200 VAC	295 Cu. Inches	14.0 lbs./6.4 kgs.
	3PH375-1A	375VA	115/200 VAC	295 Cu. Inches	14.0 lbs./6.4 kgs.
	1A750-1A	750VA	115/200 VAC	12.5" x 5.8" x 9.0"	18.3 lbs./8.3 kgs.
	1A1050-1A	1050VA	115/200 VAC	12.5" x 5.8" x 9.0"	18.3 lbs./8.3 kgs.
	3PH1500-1A	1500VA	115/200 VAC	590 Cu. Inches	30.0 lbs./13.6 kgs.
	*1A2400-1A-HR	2400VA	115/200 VAC	16.0" x 13.9" x 9.3"	55.5 lbs./25.2 kgs.
	*1A3000-1A-HR	3000VA	115/200 VAC	16.0" x 13.9" x 9.3"	55.5 lbs./25.2 kgs.
	*3PH4800-1A	4800VA	115/200 VAC	2502 Cu. Inches	84.5 lbs./38.4 kgs.
	*3PH6000-1A	6000VA	115/200 VAC	2502 Cu. Inches	84.5 lbs./38.4 kgs.
	*3PH9000-1A	9000VA	115/200 VAC	2680 Cu. Inches	125.5 lbs./57.0 kgs.
	*3PH12000-1A	12000VA	115/200 VAC	4905 Cu. Inches	165.5 lbs./75.2 kgs.

* Also available in 48VDC input configurations.

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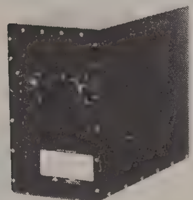

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Static Inverters: Lightweight, High Performance, Rugged and Reliable

	Model	Output		Dimensions	Weight
28 VDC to 60 Hz Single-Phase	2A50-1B-1	50VA	115 VAC	7.0" x 5.0" x 2.8"	4.0 lbs./1.9 kgs.
	2A125-1B-1	125VA	115 VAC	7.0" x 5.0" x 2.8"	4.0 lbs./1.9 kgs.
	2A250-1B-1	250VA	115 VAC	7.0" x 5.0" x 2.8"	4.3 lbs./2.0 kgs.
	2A350-1B-1	350VA	115 VAC	7.0" x 5.0" x 2.8"	4.3 lbs./2.0 kgs.
	2A500-1A-1	500VA	115 VAC	12.5" x 5.9" x 6.3"	12.0 lbs./5.5 kgs.
	*2A800-1G	800VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	*2A1000-1G	1000VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	*2A1100-1G	1100VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	*2A1600-1A-1-HR	1600VA	115 VAC	16.0" x 10.0" x 9.3"	37.0 lbs./16.8 kgs.
	*2A2000-1A-1-HR	2000VA	115 VAC	16.0" x 10.0" x 9.3"	37.0 lbs./16.8 kgs.
	*2A2400-1B-HR	2400VA	115 VAC	16.0" x 13.9" x 9.3"	53.0 lbs./24.0 kgs.
	*2A3000-1A-HR	3000VA	115 VAC	16.0" x 13.9" x 9.3"	53.0 lbs./24.0 kgs.
	*2A4000-1A-HR	4000VA	115 VAC	14.8" x 17.8" x 9.3"	70.0 lbs./31.8 kgs.
28 VDC to 60 Hz Three-Phase	3PH150-2A	150VA	115/200 VAC	295 Cu. Inches	13.0 lbs./5.9 kgs.
	3PH375-2A	375VA	115/200 VAC	295 Cu. Inches	13.0 lbs./5.9 kgs.
	2A750-1A	750VA	115/200 VAC	12.2" x 5.9" x 9.0"	17.5 lbs./8.0 kgs.
	2A1050-1A	1050VA	115/200 VAC	12.5" x 5.9" x 9.0"	17.5 lbs./8.0 kgs.
	3PH1500-2A	1500VA	115/200 VAC	590 Cu. Inches	29.0 lbs./13.2 kgs.
	*2A2400-1A-HR	2400VA	115/200 VAC	16.0" x 13.9" x 9.3"	55.5 lbs./25.2 kgs.
	*2A3000-1B-HR	3000VA	115/200 VAC	16.0" x 13.9" x 9.3"	55.5 lbs./25.2 kgs.
	*3PH4800-2A	4800VA	115/200 VAC	2502 Cu. Inches	78.5 lbs./35.7 kgs.
	*3PH6000-2A	6000VA	115/200 VAC	2502 Cu. Inches	78.5 lbs./35.7 kgs.
	*3PH7200-2A	7200VA	115/200 VAC	3680 Cu. Inches	116.5 lbs./53.0 kgs.
	*3PH9000-2A	9000VA	115/200 VAC	3680 Cu. Inches	116.5 lbs./53.0 kgs.
	*3PH12000-2A	12000VA	115/200 VAC	4905 Cu. Inches	152.5 lbs./70.0 kgs.
	Model	**Output**		**Dimensions**	**Weight**
28 VDC to 50 Hz Single-Phase	3A50-1B-1	50VA	115 VAC	7.0" x 5.0" x 2.8"	4.0 lbs./1.9 kgs.
	3A125-1B-1	125V A	115 VAC	7.0" x 5.0" x 2.8"	4.0 lbs./1.9 kgs.
	3A250-1B-1	250VA	115 VAC	7.0" x 5.0" x 2.8"	4.3 lbs./2.0 kgs.
	3A350-1B-1	350VA	115 VAC	7.0" x 5.0" x 2.8"	4.3 lbs./2.0 kgs.
	*3A800-1G	800VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	*3A1000-1G	1000VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	*3A1100-1G	1100VA	115 VAC	12.0" x 8.5" x 4.1"	12.5 lbs./5.7 kgs.
	3A250-1A-1	250VA	230 VAC	12.5" x 5.9" x 6.3"	12.5 lbs./5.7 kgs.
	3A500-1A-1	500VA	230 VAC	12.5" x 5.9" x 6.3"	12.1 lbs./5.5 kgs.
	SR700-3A	700VA	230 VAC	195 Cu. Inches	9.0 lbs./4.1 kgs.
	*3A800-1D-1-HR	800VA	230 VAC	16.0" x 10.0" x 9.3"	36.0 lbs./16.4 kgs.
	*3A1000-1D-1-HR	1000VA	230 VAC	16.0" x 10.0" x 9.3"	36.0 lbs./16.4 kgs.
	*3A1600-1A-1-HR	1600VA	230 VAC	16.0" x 10.0" x 9.3"	36.0 lbs./16.4 kgs.
	*3A2000-1A-1-HR	2000VA	230 VAC	16.0" x 10.0" x 9.3"	36.0 lbs./16.4 kgs.
	*3A4000-1A-HR	4000VA	230 VAC	14.8" x 17.8" x 9.3"	70.0 lbs./31.8 kgs.
	*SP6000-3A	6000VA	230 VAC	2460 Cu. Inches	77.0 lbs./35.0 kgs.
	*SP4000-3A	4000VA	230 VAC	1635 Cu. Inches	50.0 lbs./22.7 kgs.
	*SP8000-3A	8000VA	230 VAC	3280 Cu. Inches	104.0 lbs./47.3 kgs.

* Also available in 48VDC input configurations.

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Avionic Instruments, Inc.

Static Inverter
1C 1000-(   )
21.5 lbs.
12.60"L x 7.52"W x 7.65"H

Specifications

Input Voltage
28VDC ± 10VDC.

Output Voltage
115VAC ± 5VAC.

Output Frequency
400Hz ± 5Hz.
50, 60 Hz available.

Output Power
1000VA.

Overload
1500VA linear load, 5 minutes.

Distortion
5% THD maximum.
1.5% THD typical.

Efficiency
82% minimum at full load.

Power Factor
0.8 lag to 0.9 lead.
Not damaged by any power factor.

Temperature Range
–55°C to +71°C.

Short Circuit Current
25 Amps minimum.

Qualified for use on the following Boeing Aircraft:

737	757
747-400	767

Consult AI2 for details on retrofit program

Qualification

Shock
Vibration
EMI
Temperature
Altitude
Fungus
Humidity
Explosion Atmosphere
Lightning Transients
HERF

Features

- Military Components
- High MTBF
- Remote on/off
- Short Circuit Protection
- Overvoltage Protection
- 300us response time
- Reverse polarity Protection
- ARINC 600 design

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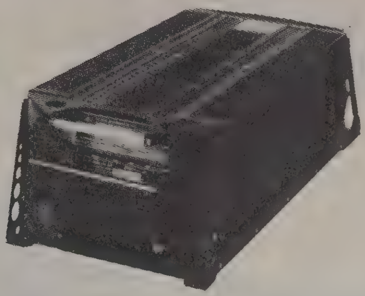
Telephone: (908) 388-3500, Cable Address: Reainta, Rahway, Telex: WU844-413 Reaintl Rway

Avionic Instruments, Inc.

Static Inverter
1C 2500-(   )
32 lbs.
20.4"L x 9.0"W x 6.0"H



***Qualified for use on Army Shelter Applications requiring 7500VA Three phase or single phase.**

Features

- Military Components
- Overvoltage Protection
- Fault Bit
- 25ms Turn On
- Lightning Protection

Specifications

Input Voltage
28VDC ± 10VDC.

Output Voltage
115VAC ± 2.3VAC.
Single phase.

Output Power
2400VA continuous (MD-11).
2500VA continuous (Std Product).

Overload
3000VA for 5 minutes.

Output Frequency
400Hz ± 4Hz.
50, 60 Hz available.

Distortion
3% THD. maximum at full load.

Efficiency
75% minimum at full load
and input voltage > 21VDC.

Power Factor
0.8 lag to 0.9 lead.
Not damaged by any power factor.

Temperature Range
–55°C to +71°C.

Short Circuit Current
44 Amps minimum.

Qualification

Altitude
FAA TSO-C73.
RTCA DO-160A, Para. 5.0
MIL-STD-810D, Method 520.

Shock
FAA TSO-C73.
RTCA DO-160A, Para. 7.2.
MIL-STD-810D, Method 516.

Vibration
FAA TSO-C73.
RTCA DO-160A, Para. 8.3.1 and 8.4.
MIL-STD-810D, Method 514.3, Cat. 8.

EMI
MIL-STD-461A, various categories.
IAW RTCA DO-160-B.

Lightning Transients
RTCA DO-160C, Para. 22.0.

Voltage Spike
RTCA DO-160A, Para. 17.3.

Voltage Transient
FAA TSO-C73.
RTCA DO-160A, Para. 17.4.

Temperature
FAA TSO-C73.
RTCA DO-160A, Para. 4.8 and 5.0.
MIL-STD-810D, Methods 501.2, 502.2 & 503.2.

Explosion Proof Atmosphere
RTCA DO-160A, Para. 9.0 Cat. E.
MIL-STD-810D, Method 511.2, Proc. I.

Fungus Resistance
RTCA DO-160A, Para. 13.0 Cat. F.
MIL-STD-810D, Method 508.3.

Sand and Dust
RTCA DO-160A, Para. 12.0 Cat. D.
MIL-STD-810D, Method 510.2.

Humidity
FAA TSO-C73.
RTCA DO-160A, Para. 6.3.2 Cat. B-1.
MIL-STD-810D, Method 507.2.3.

*Consult AI2 for details on DC-10 retrofit program.

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Avionic Instruments, Inc.

50/60 Hz Frequency Converter 2000/3500VA

GSA LISTED!

General Specifications

Input Voltage
115/200VAC ± 10%.
Three phase WYE.

Input Frequency
400Hz ± 20 Hz.

Output Voltage
±3% , single phase.

Output Frequency
± 1.0%

Waveshape
1.0%, typical.
5.0%, maximum.
DC content < 0.1VDC.
Crest factor 1.41 ± .04.

Efficiency
85% at full load, typical.

Power Factor
0.75 lag to 0.8 lead.

Temperature Range
-55 to +71degrees C, operating.
-65 to +85 degrees C, storage.

Overload
4300VA for 5 minutes.

Qualification

RTCA DO-160A
Environmental conditions. Airborne electronic equipment.

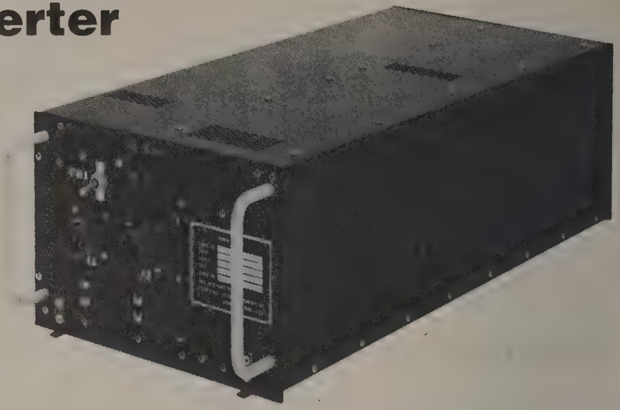
MIL-E-5400T
General specification, airborne equipment.

MIL-STD-461
Electromagnetic interference characteristics.

MIL-STD-810C
Environmental test methods.

MIL-STD-704D
Input power quality.

Environmental
High temperature.
Low temperature.
Temperature variation.
Temperature shock.
Humidity.
Altitude.
Vibration.
Shock.
Explosion.
Fungus.
Salt spray.
Sand and dust.
Explosive atmosphere.



AI2 developed the model 4B3500-1A frequency converter for the USAF C-17A airlifter (NSN pending). The converter provides 60Hz power for critical medical emergency equipment. At 43 lbs., the converter is the lightest in its class. Mechanical and electrical interfaces were optimized in order to achieve a direct replacement for existing government stock equipment (NSN 6130-00-421-5314).

Direct NSN Replacement:

Model 4B2000-1A is a direct replacement for NSN 6130-01-035-9254.
Model 4B3500-1A is a direct replacement for NSN 6130-00-421-5314.

Protection

- Input under/overvoltage
- Output overvoltage
- Output over/under frequency
- Loss of phase
- Thermal overheat
- Input circuit breaker

Features

- Current mode control
- Low input harmonics
- Internal fan cooling
- 300 µS response
- ARINC or baseplate mounting
- Three phase, parallel capability.

Data shown below represents typical performance. Consult the factory for exact data.

Model No.	Output Voltage (RMS)	Output Current (Amps)	Output Frequency (Hz)	Input Current (Amps/phase)		Short Circuit Current (Amps)	Efficiency (%) @ Full Load	Weight (lbs.)	Multiple Unit Capability		
				No Load	Full Load				Parallel*	Three Phase**	Phase Synch. ***
4B2000-1A	115	17	60	1.0	7.0	31.0	82	37			
4B2000-2A	115	17	60	1.0	7.0	31.0	82	37	x	x	x
4B2000-2B	230	9	60	1.0	7.0	15.5	82	37	x	x	x
4B2000-3A	230	9	50	1.0	7.0	15.5	82	37	x	x	x
4B2000-3B	115	17	50	1.0	7.0	31.0	82	37	x	x	x
4B3500-1A	115	30	60	1.0	12.3	54.0	85	43			
4B3500-2A	115	30	60	1.0	12.3	54.0	85	43	x	x	x
4B3500-2B	230	15	60	1.0	12.3	27.0	85	43	x	x	x
4B3500-3A	230	15	50	1.0	12.3	27.0	85	43	x	x	x
4B3500-3B	115	30	50	1.0	12.3	54.0	85	43	x	x	x

* Parallel configuration - Up to 5 modules per multiple unit system.
** Three phase configuration - Up to 5 modules per phase (15 modules per system).
*** Phase synchronization - Phase locking at various intervals between 0° and 180°.

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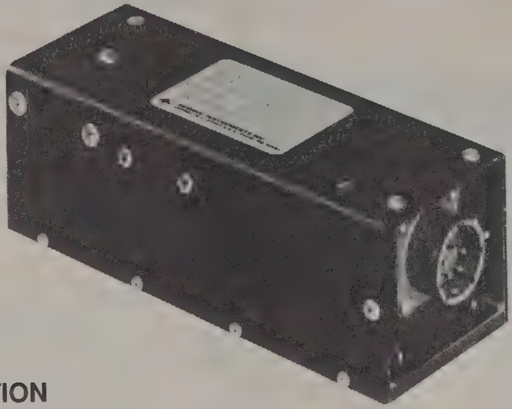
Avionic Instruments, Inc.

DC LIGHT DIMMER
Regulated DC to DC Converter

Form, Fit and improved Function replacement for various older technology light dimmers.



General Specifications

Input Voltage
28VDC Nominal
20-40VDC Normal
18-40VDC Abnormal

Output Voltage
LDP Version: Adjustable with external 5K Ohm 1/2 W Rheostat
LDV Version: Adjustable with external voltage control

Regulation
1.5% for line, 1.5% load, 1% temperature

Output Ripple
25 MVp-p

Efficiency
75% Typical

Temperature Range
-55°C to +71°C continuous operation
-65°C to +85°C storage

Cooling
Natural Convection/Conduction

Dimensions
5.75"L x 2.25"W x 1.99"H

Weight
1.49 lbs. maximum

QUALIFICATION
Designed to meet or exceed FAA standards
RTCA D0-160C

ENVIRONMENTAL
Humidity
Shock
Vibration
Explosion
Waterproofness
Fluid susceptibility
Sand and dust
Fungus
Salt spray
EMI
Magnetic effect
Power input

PROTECTION
- Input under voltage
- Input reverse polarity
- Output overvoltage

FEATURES
- Low cost
- MTBF in excess of 50,000 hours
- High efficiency
- Surface mount components
- Adjustable output voltage
- Low weight

Model No.	Output Voltage (VDC)	Output Power (Watts)	Input Current (A)			Efficiency (%) @ Full Load
			No Load	Full Load	Maximum	
LDP50-5	0-5	50@5V	0.1	2.4	4.0	73
LDP70-12	0-12	70@12V	0.1	3.2	5.6	75
LDP100-28	0-28	100@28V	0.1	4.5	8.0	78
LDV50-5	0-5	50@5V	0.1	2.4	4.0	73
LDV70-12	0-12	70@12V	0.1	3.2	5.6	75
LDV100-28	0-28	100@28V	0.1	4.5	8.0	78

Please consult factory for exact specifications and qualification data.

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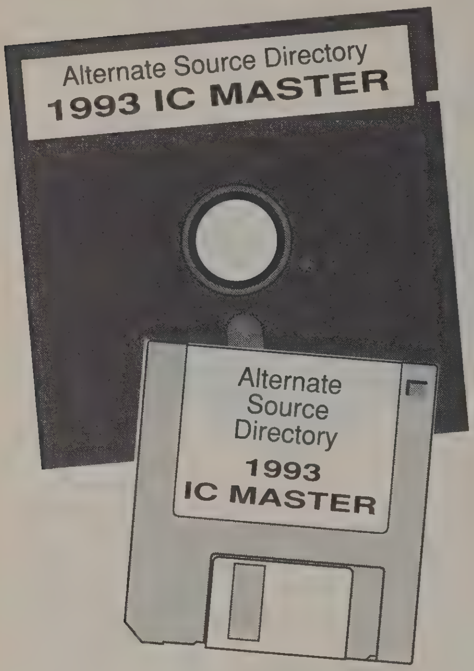
Hearst Engineering Software

ICMASD

Alternate Source Directory



The all new 1993 ICMASD-IC Alternate Source Directory on Disk is identical to the Alternate Source Directory Section contained in Volume Two of the printed version of the 1993 IC Master. All you need is an IBM XT/AT or 100% compatible personal computer with hard drive.

ICMASD is the most comprehensive and reliable guide available to all ICs known to have a realistic replacement or alternative. The 1993 version contains over 106,000 listings to help you find the functional equivalents for both current and discontinued parts.

The electronic ICMASD is fast, convenient...and can be customized for your specific needs!

ENHANCED FLEXIBILITY

ICMASD is organized in a similar fashion to the printed version in the IC MASTER. The database is arranged by manufacturer, showing the manufacturer's original basic part number. All known replacements for that part are listed in alphanumeric order.

The enhanced flexibility of the electronic ICMASD allows you to add comments, up to 19 digits long, to any device listing in the system. These comments can be part numbers, project notes, prices, or any information unique to your application.

USER FRIENDLY

ICMASD is very user friendly. There are no tricky commands to learn. The software is completely menu driven. ICMASD comes complete with documentation that is brief and to the point. It can be ordered on five 51/4" double-sided, double-density disks OR on one 51/4" high-density disk OR on one 31/2" high-density disk.

Published annually in March

FAST AND CONVENIENT

ICMASD includes a complete Manufacturers & Distributors Directory listing the addresses and phone numbers of every manufacturer in the IC industry. With this complete directory any manufacturer or distributor is just a phone call away.

To order your 1993 ICMASD, contact your local IC MASTER distributor or, send your purchase order and check for $179.50 plus tax* to:

Marie Botta
Hearst Business Publishing
645 Stewart Avenue
Garden City, NY 11530
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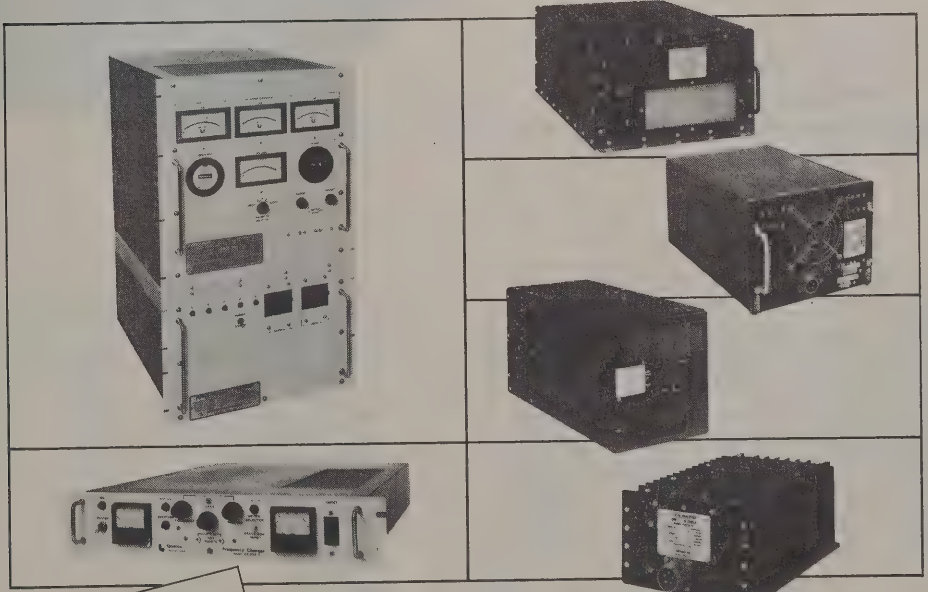
Frequency Converters

Beginning in 1960, Unitron, Incorporated has concentrated on the design and development of solid-state frequency conversion equipment. This single point concentration has resulted in Unitron becoming the supplier of one of the largest variety of 50/60 Hz to 400 Hz and 400 Hz to 50/60 Hz converters to both the defense aerospace and industrial markets. We invite your inquiries.

PS Series	400 Hz to 50/60 Hz	1.25 kVA to 15.0 kVA
CR Series	50/60 Hz to 400 Hz	7.5 kVA to 15 kVA
GFC Series	50/60 Hz to 400 Hz	15 kVA to 360 kVA



NOW AVAILABLE!
Ultra-lightweight highly efficient mobile power carts for support of aircraft in maintenance hangars and on ramps.

Unitron

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AVTEL

FREQUENCY CONVERTERS
1.25 TO 15.0 KVA SINE WAVE
400 Hz to 50/60* Hz

Unitron

Unitron, the leader in ac power supplies for the medical evacuation industry, now offers new, lightweight 400 Hz to 50/60 Hz frequency converters for airborne, shipboard, shelter & ground power environments.

Unitron, with over 18,000,000 hours of field proven experience now provides its new **PS–92 SERIES** converters. This new series incorporates the latest state–of–the–art technology to meet the low input current distortion demands of Boeing and McDonnell Douglas aircraft in a small, lightweight package.

General Specifications :

Input

Voltage : 115/200V RMS ± 10%
Frequency : 400 Hz ± 10%
Current Distortion : < 5%
Power Factor : > .98

Output

Voltage : 115V ± 1%
Frequency : 60 Hz ± 0.01%
Harmonic Distortion : 1% typical; 5% max for non–linear loads
Power Factor : 0.5 lag to 0.5 lead

Other

Efficiency : 85% minimum
Temperature : –55° C TO +70° C
Vibration : RTCA/DO–160C, Section 8
Shock : RTCA/DO–160C, Section 7
RFI : RTCA/DO–160C, Section 20

PS–92 SERIES, 1Ø OUTPUT, 115V ± 1%

OUTPUT POWER	HEIGHT	WIDTH	DEPTH	WEIGHT **
1250 VA	6″	9″	22″	35 lbs.
2500 VA	6″	9″	22″	45 lbs.
3750 VA	10″	9″	22″	60 lbs.
5000 VA	10″	9″	22″	70 lbs.
7500 VA	6″	30″	26″	148 lbs.
10000 VA	10″	20″	26″	150 lbs.
15000 VA	10″	30″	26″	225 lbs.

PS–92 SERIES, 3Ø OUTPUT, 115/200V ± 1%

OUTPUT POWER	HEIGHT	WIDTH	DEPTH	WEIGHT **
7500 VA	6″	30″	26″	148 lbs.
11250 VA	10″	30″	26″	198 lbs.
15000 VA	10″	30″	26″	225 lbs.

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* Also available with 400 Hz output. Contact factory for details.

** May vary depending on options.

AVTEL

FREQUENCY CONVERTERS
7500 VA to 360 KVA SINE WAVE
50/60 Hz to 400 Hz

Unitron

Unitron offers the largest variety of 400 Hz solid–state power systems in today's marketplace. From 19″ rack mountable units to large central power systems Unitron's frequency converters incorporate field–proven design with the latest solid–state devices. Applications include test labs, hangars, flight lines, shipboard, shelters, simulators and airframe manufacturing.

General Specifications :

Input

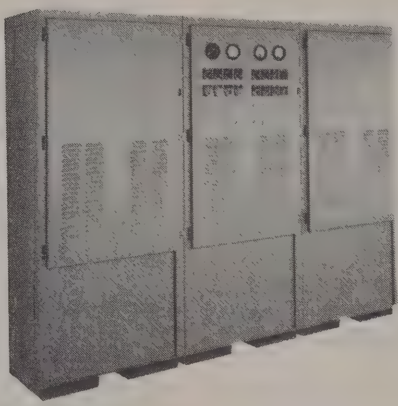
Voltage : 480V ± 10%
Frequency : 60 Hz ± 10%
Voltage Distortion : < 2%
Power Factor : 0.9 to unity

Output

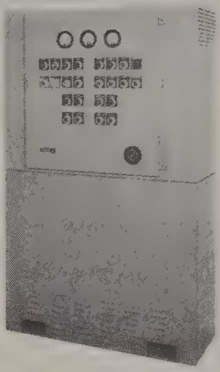
Voltage : 120/208V ± 1%
Frequency : 400 Hz ± 1%
Harmonic Distortion : 2% typical
Power Factor : 0.8 lag to unity

Other

Efficiency : 92% typical at full load
Temperature : –40° C to +50° C
No Load Losses : Typically less than 5% of output KW rating



ECONO–SPAN SERIES
(Expandable for higher power)



FLAT–PAK SERIES
("FLAT" profile for limited space applications)

ECONO–SPAN SERIES

OUTPUT POWER	HEIGHT	WIDTH	DEPTH	WEIGHT *
50 KVA	72″	43″	24″	900 lbs.
62.5 KVA	72″	43″	24″	900 lbs.
75 KVA	72″	43″	24″	1100 lbs.
90 KVA	72″	43″	24″	1250 lbs.
125 KVA	72″	73″	24″	1800 lbs.
150 KVA	72″	73″	24″	2200 lbs.
180 KVA	72″	73″	24″	2500 lbs.
225 KVA	72″	103″	24″	3300 lbs.
270 KVA	72″	103″	24″	3750 lbs.
300 KVA	72″	133″	24″	4400 lbs.
360 KVA	72″	133″	24″	5000 lbs.

* May vary depending on options.

FLAT–PAK SERIES

OUTPUT POWER	HEIGHT	WIDTH	DEPTH	WEIGHT *
15 KVA	66″	32″	17.5″	575 lbs.
25 KVA	66″	32″	17.5″	650 lbs.
37.5 KVA	66″	32″	17.5″	725 lbs.
40 KVA	66″	41″	17.5″	800 lbs.
50 KVA	66″	41″	17.5″	925 lbs.
60 KVA	66″	41″	17.5″	1000 lbs.

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BL SERIES

AC POWER SOURCE

- 1350 VA in a 3½" chassis under 40 pounds

6.00
BEHLMAN

FEATURES

- Stackable for additional power and/or 3 phase output.
- Unique overload protection prevents output distortion.
- Remote DC programming for voltage and frequency.
- True RMS readout of voltage and current.
- Low cost without compromising features or performance.

APPLICATIONS

- Aerospace
- Motor Generator Replacements
- Power Supply Testing
- General Laboratory Support
- Motor Testing
- Transformer Testing
- Magnetics Testing
- Military System Diagnostics
- Missile Testing
- Electromechanical Testing
- Ground Support
- QC/QA, Reliability Testing

ORDERING INFORMATION

MODEL #	INPUT VOLTAGE	OUTPUT VOLTAGE	POWER
BL1350A-1	115V	0-135V	1350VA
BL1350B-1	115V	0-135V 0-270V	1350VA
BL1350B-2	115V	0-135V 0-34V	1350VA
BL1350C-1	115/230V	0-135V	1350VA
BL1350C-2	115/230V	0-135V 0-270V	1350VA
BL1350C-3	115/230V	0-135V 0-34V	1350VA

NOTES:
1. All models have isolated outputs except BL1350A, BL1350B.

OPTIONS

E Extended Frequency
L Locking Pots
T 0-150V, 0-300V (with B-1 or C2)
A Safety Sockets
I IEEE 488 Interface
S Slides

SPECIFICATIONS

INPUT

Voltage: 115V or 115/230V, ±10%, single phase.
Frequency: 47-440Hz.

OUTPUT

Voltage: See ordering information.
Maximum Power: 1350 VA
Current Crest Factor: 3:1.
Distortion: 0.5% Maximum THD Typical.
Efficiency: 80% Typical.
Frequency: 45-500Hz (Optional 45-1000Hz).
Maximum Current: 30 Amps 0-34V Range; 10 Amps 0-135V Range; 5 Amps 0-270V Range.
Line Regulation: ±0.1% for ±10% Line change.
Load Regulation: ±0.7% No Load to Full Load.
Power Factor: 100% of rated output into any power factor load.

PROTECTIVE CIRCUITS

Input Protection: Fast acting main circuit breaker.
Constant Current Mode: Overload causes voltage foldback to provide maximum current without distorting output waveform.
Thermal Protection: Internal temperature sensor.
Short Circuit Protection: Electronically latches output open.

CONTROL INPUTS

Voltage/Frequency: 0-10 volts DC programming—voltage/frequency.
External Sync: Synchronizes AC output with external input.

FRONT PANEL DISPLAY

Digital readout (3½ digits)–True RMS voltage/ currents, frequency.

MECHANICAL SPECIFICATIONS

Dimensions: High strength 19" rack mounted chassis, 3.5" high by 22" deep.
Weight: BL1350A-1–40 lbs. Other BL1350 models under 55 lbs.
Operating Temperature: 0 to 55°C.

MOTOR TESTER BL1350 MT

Motor friendly design offers the ability to drive motors with pure sinewaves, even during startup. Running currents are 14 Amps (the foldback current limit is set at 15 Amps) at a 50% duty cycle. Capable of starting motors which normally require 140 Amp locked rotor starting currents.

The BL1350 MT offers a "Soft Start" by folding back voltage and slowly increasing it as the motor starts to accelerate. "Soft Start" eliminates the need for high input current service, as well as the need to restrain the motor during production testing.

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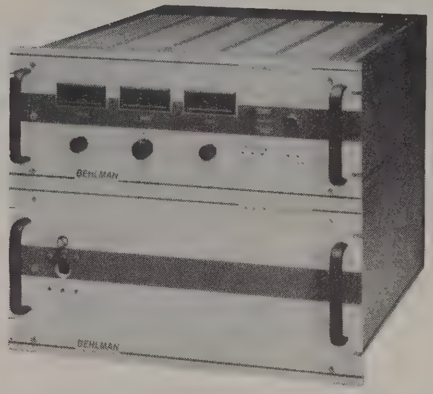
BL SERIES 10000/20000
AC POWER SOURCE



FEATURES

- Compact and rack mountable, 67% smaller than competitive units.
- Low cost per VA.
- Configurable in either single or three phases.
- Computer controlled waveform switching delivers smooth, efficient power.
- Multi pulse input transformer offers low harmonic distortion.
- Available with an IEEE488/RS232 interface.
- Lab Windows compatible.

APPLICATIONS

- Aerospace
- Motor Generator Replacements
- Power Supply Testing
- General Laboratory Support
- Motor Testing
- Transformer Testing
- Magnetics Testing
- Military System Diagnostics
- Missile Testing
- Electromechanical Testing
- Ground Support
- QC/QA, Reliability Testing

ORDERING INFORMATION

MODEL #		INPUT	OUTPUT	
BL10000	C-1	120/208	0-135	3Ø
	C-2	220/380	0-135	3Ø
	C-3	277/480	0-135	3Ø
	C-4	200 Delta	0-135	3Ø
	C-5	346/600	0-135	3Ø
	C-6	230/400	0-135	3Ø
BL20000	C-1	120/208	0-135	3Ø
	C-2	220/380	0-135	3Ø
	C-3	277/480	0-135	3Ø
	C-4	200 Delta	0-135	3Ø
	C-5	246/600	0-135	3Ø
	C-6	230/400	0-135	3Ø

OPTIONS

E	Extended Frequency
L	Locking Pots
T_{10}	0-300 L-N, Add 7" to Chassis BL10000
T_{20}	0-300 L-N BL20000
S	Slides
I	IEEE 488 Interface
K	Single Phase Output

SPECIFICATIONS

INPUT

Voltage: (see ordering information).
Frequency: 47-440Hz.

OUTPUT

Voltage: (see ordering information).
Current Crest Factor: 3:1.
Distortion: 0.5% Maximum THD Typical.
Efficiency: 85-90%.
Frequency: 45-500Hz (Optional 45-1000Hz).
Maximum Current: BL10000/25 Amps/Phase
BL20000/50 Amps/Phase
Line Regulation: ±0.1% for+10% Line change.
Load Regulation: ±0.7% No Load to Full Load.
Power Factor: 100% of rated output into any power factor load.

PROTECTIVE CIRCUITS

Input Protection: Fast acting main circuit breaker.
Constant Current Mode: Overload automatically causes voltage foldback to provide maximum current without distorting output waveform.
Thermal Protection: Internal temperature sensor prevents heat damage.
Short Circuit Protection: Electronically latches output open to protect load. Power restored by recycling circuit breaker.

CONTROL INPUTS

Voltage/Frequency: 0–10 volts DC programming—voltage/frequency.
External Sync: Synchronizes AC output with external input.

FRONT PANEL CONTROLS

Power On/Off circuit breaker.
Output On/Off toggle switch.
Frequency and amplitude control (optional locking controls).
Digital readout (3½ digits)—True RMS voltage/true RMS current/frequency.

MECHANICAL SPECIFICATIONS

	BL10000	BL20000
Dimensions:	2 19" Rack Mtd. Chassis 7" & 8 3/4" x 22" Deep	Rack Cabinet 30.3"H x 32.7" D x 24.2" W
Weight:	350 lbs.	500 lbs.

Output Connectors: Rear Mtd. Barrier Strip

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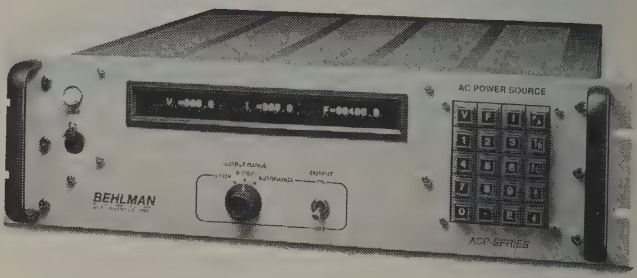
ACP SERIES 250VA to 9kVA
AC POWER SOURCE



FEATURES
- Extended frequency and low voltage ranges.
- 200% peak short-term current capability.
- Computer interface reduces ATE system complexity.
- Microcomputer-based crystal referenced, synthesized sinewave.
- Built-in measurement system reduces support equipment.
- Very low EMI/RFI Linear Power Amplifier.
- Smaller, lighter–saves rack space.
- Complete input and output transformer isolation.

APPLICATIONS
- MIL-STD-704 testing
- Military systems
- EMI/RFI test systems
- Aerospace systems testing
- Power supply testing
- Acceptance testing
- Motor testing

PROGRAMMABILITY
- IEEE-488
- Output voltage and frequency
- Output phase angle on three-phase models
- Current limit
- Transient and MIL-STD-704 Testing

OUTPUT MEASUREMENTS
- Voltage, Average responding (TRMS optional)
- Current, Average responding (TRMS optional)
- True power, Watts (optional)
- Power factor (optional)
- Frequency

GPIB PROGRAMMABLE SINGLE AND THREE PHASE

Behlman's ACP Series precision AC power source is designed for wide usage in ATE systems, laboratories, production lines, test facilities, and many other applications. They are small in size and weight, increasing ease of handling and minimizing valuable rack space required.

Used in various computer controlled applications, Behlman's ACP Series AC power source provides truly independent and simultaneous output measurements while tests are in progress. This makes testing easier and faster because expensive voltmeters, ammeters, frequency counters or power meters are eliminated.

Built in MIL-STD-704D tests and a new Front Panel Controlled Transient Generator make the ACP the right choice for all types of product testing.

Programming is accomplished by the front panel keyboard or the IEEE-488 host interface computer, allowing for incrementing and decrementing of the output values with user definable resolution. On command, measurements are reported over the computer interface and the front panel, easy-to-read, display.

ACP SERIES TECHNICAL SPECIFICATIONS

GENERAL: Specifications subject to change without notice. Below are standard models. Optional models are available to 50 kVA.

MODEL NO.	TOTAL POWER (VA) OUTPUT[2]	CURRENT OUTPUT[3]		WEIGHT (LBS)	DIMENSIONS	NO. OF RACK MNT. CHASSIS
		135V RANGE	270V RANGE			
Single Phase Output Models						
ACP-250	335	2.5	1.3	40	5.25"Hx22"Dx19"W	1
ACP-500	675	5.0	2.5	63	7.00"Hx22"Dx19"W	1
ACP-750	1000	7.5	3.8	69	7.00"Hx22"Dx19"W	1
ACP-1000	1350	10.0	5.0	90	8.75"Hx24"Dx19"W	1
ACP-1500	2025	15.0	7.5	126	14.00"Hx22"Dx19"W	2
ACP-2000	2700	20.0	10.0	153	14.00"Hx22"Dx19"W	2
ACP-3000	4050	30.0	15.0	189	21.00"Hx22"Dx19"W	3
Three Phase Output Models						
ACP-3X100	400	1.0	0.5	45	5.25"Hx24"Dx19"W	1
ACP-3X350	1425	3.5	1.8	116	14.00"Hx22"Dx19"W	2
ACP-3X500	2025	5.0	2.5	153	14.00"Hx22"Dx19"W	2
ACP-3X750	3050	7.5	3.8	174	14.00"Hx22"Dx19"W	2
ACP-3X1500	6075	15.0	7.5	294	33.25"Hx19"Dx19"W	5
ACP-3X2000	8100	20.0	10.0	342	35.00"Hx19"Dx19"W	5
ACP-3X3000	12,150	30.0	15.0	410	42.00"Hx22"Dx19"W.	5[1]

1. All models are in 19" rack mounting enclosures. Models noted with (1) above come installed in a 51.3"Hx32.7"Dx24.2"W cabinet.
2. Rated/Maximum total Volt-Ampere (VA) output. VA output per phase is one third the total VA output on three phase models.
3. Rated/Maximum Amperes per phase. Rated current available from 50% to 100% of voltage output range.

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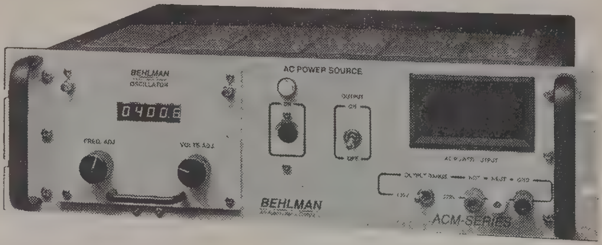
ACM SERIES 100VA to 9kVA
AC POWER SOURCE



FEATURES

- Very low EMI/RFI Linear Power Amplifier.
- Smaller, lighter–saves rack space.
- Tight regulation, low distortion.
- Overload protection with instantaneous recovery.
- Complete input/output transformer isolation.
- 0.01% frequency accuracy.
- 200% peak short-term current capability.
- Extended frequency ranges.

APPLICATIONS

- Motor generator replacements
- Power supply testing
- Relay testing
- Avionics and missile test systems
- General laboratory support
- Motor testing
- Transformer testing
- Military test systems
- Automatic test equipment
- Acceptance testing
- Airborne, marine, ground support

MANUAL CONTROL
SINGLE AND THREE PHASE

Behlman's ACM Series AC power source is a uniquely efficient linear power amplifier driven by plug-in oscillators, or an external synchronization source. These units are used in a wide variety of applications such as calibration facilities, laboratories, production lines and other test requirements where manually controlled AC power is required.

Incorporating an entirely unique design concept in linear power amplifiers, Behlman's units greatly increase stability into low power factor loads while reducing circuit complexity. This design is combined with advanced magnetics reducing size and weight, saving in valuable rack space and easing equipment handling.

The ACM Series is unparalleled, generating virtually no EMI/RFI emission, either conducted or radiated. To further decrease electronic noise and increase flexibility, both the input and output are coupled by isolation transformers. The output can be left floating or one side grounded. Complete overload, short circuit protection is provided by a combination of instantaneous automatic recovery circuitry and fast acting circuit breaker.

The ACM Series front panel is well organized with easily accessible control and digital readout on variable frequency models.

ACM SERIES TECHNICAL SPECIFICATIONS

GENERAL: Specifications subject to change without notice. Below are standard models. Optional models are available to 50 kVA.

MODEL NO.	TOTAL POWER (VA) OUTPUT(2)	CURRENT OUTPUT(3)		WEIGHT (LBS)	DIMENSIONS	NO. OF RACK MNT. CHASSIS
		135V RANGE	270V RANGE			
Single Phase		**Per Phase**	**Per Phase**			
ACM-250	335 VA	2.5	1.3	40	5.25"Hx15"Dx19"W	1
ACM-500	675 VA	5.0	2.5	63	5.25"Hx19"Dx19"W	1
ACM-750	1000 VA	7.5	3.8	69	7.00"Hx19"Dx19"W	1
ACM-1000	1350 VA	10.0	5.0	90	8.75"Hx19"Dx19"W	1
ACM-1500	2025 VA	15.0	7.5	126	14.00"Hx19"Dx19"W	2
ACM-2000	2700 VA	20.0	10.0	153	14.00"Hx19"Dx19"W	2
ACM-3000	4050 VA	30.0	15.0	189	21.00"Hx19"Dx19"W	3
Three Phase						
ACM-3X100	400 VA	1.0	0.5	45	5.25"Hx19"Dx19"W	1
ACM-3X250	1000 VA	2.5	1.3	76	7.00"Hx19"Dx19"W	1
ACM-3X350	1425 VA	3.5	1.8	116	8.75"Hx22"Dx19"W	1
ACM-3X500	2025 VA	5.0	2.5	153	14.00"Hx19"Dx19"W	2
ACM-3X1000	4050 VA	10.0	5.0	210	28.00"Hx19"Dx19"W	4
ACM-3X1500	6075 VA	15.0	7.5	294	28.00"Hx19"Dx19"W	4
ACM-3X2000	8100 VA	20.0	10.0	342	35.00"Hx19"Dx19"W	5
ACM-3X3000(1)	12,150 VA	30.0	15.0	410	42.00"Hx22"Dx19"W	5

1. All models are in 19" rack mounting enclosures. Models noted with (1) above come installed in a 51.3"Hx32.7"Dx24.2"W cabinet.
2. Rated/Maximum total Volt-Ampere (VA) output. VA output per phase is one third the total VA output on three phase models.
3. Rated/Maximum Amperes per phase. Rated current available from 50% to 100% of voltage output range.

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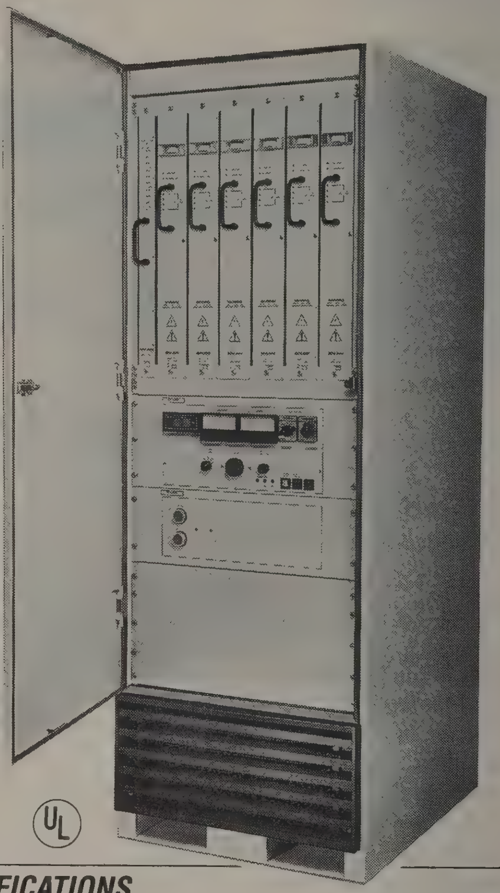
PA SERIES UP to 120kVA FREQUENCY CONVERTER



FEATURES

- Lowers operational cost. High efficiency of 88-90%.
- Small footprint saves up to 50% over the space of competitive units.
- Soft-start ramp-up eliminates input power line surges and the need for oversized utility service.
- Low input distortion using 36-phase rectification per MIL-STD-1399, Section 300.
- Self-diagnostics and module level replacement of electronics allow rapid and easy servicing.
- Redundant power circuits allow system operation in case of individual power device failure.
- Easy installation, no special connections.
- Workplace compatible with low audible noise.
- Expandable models using plug-in modules eliminate obsolescence.
- Precision output provides precisely controlled power into extremely complex loads.
- Very cost effective at all VA levels.
- Input isolation provided by power transformers.
- Versatile voltage ratings offer wide range of input and output combinations in Wye or Delta configurations.
- Optional IEEE-488 interface allows user control and monitoring for remote applications.

APPLICATIONS

- Automatic test equipment.
- Computer programmable power.
- Facilities power.
- Avionics support testing.
- Motor generator replacements.
- 50Hz power requirements.
- 400Hz military power.
- Variable frequency testing, 45 to 500 Hz.
- Flightline power.
- Electronic product burn-in and testing.
- Dock-side marine power.
- International power requirements.

ORDERING INFORMATION

MODEL #	INPUT	OUTPUT
PA3111	20 kVA	1Ø Expandable to 40 kVA
PA3131	20 kVA	1Ø Expandable to 60 kVA 3Ø
PA3311	60 kVA	3Ø
PA6331	60 kVA	3Ø Expandable to 120 kVA 3Ø
PA6631	100 kVA	3Ø

SPECIFICATIONS

INPUT	
Voltage:	All models are provided with a multi-tapped input transformer which accommodates most forms of 3-phase power (Specify when ordering).
Frequency:	47-440 Hz.
Current Distortion:	per MIL-STD-1399, Section 300.
Power Factor:	0.98 Typical.
Soft-Start	Limits input surge currents on start-up.
Efficiency:	Typically 88-90%.
OUTPUT	
Power:	Single and Three-Phase through 120kVA.
Voltage:	Adjustable from 0 to140VAC L-N. Configurable in Wye or Delta outputs. Higher voltages are also standard.
Load Regulation Adjustment:	0 to +10%.
Frequency:	Fixed or variable frequencies from 45 to 2500Hz.
Repetitive Peak: Rating:	250% of nominal at 60Hz. 200% of nominal at 400Hz.
Distortion:	2% THD at 60Hz. 4% THD at 400Hz.
Phase Separation:	120 degrees ±1 degree.
Load Imbalance:	100% load imbalance acceptable.
MECHANICAL	
Dimensions:	77"H x 26.5"W x 33.5"D. Incorporates fork lift base.
Weight:	1600 to 1800 lbs., depending on model.

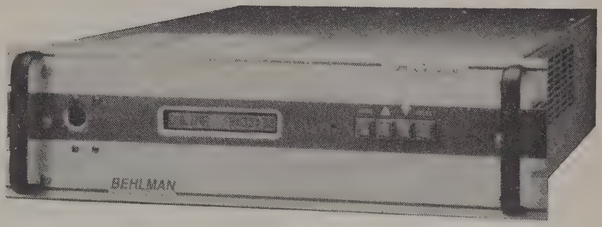
BEHLMAN

An Astrosystems Company

TOLL FREE
(800) 456-2006

2021 Sperry Avenue, Suite 18
Ventura, California 93003
Phone: (805) 642-0660
U.S.A. (800) 456-2006
FAX: (805) 642-0790

HBL SERIES
1.5kVA to 5kVA UPS
UNINTERRUPTABLE POWER SUPPLY



FEATURES

- Rugged, instrument quality, rack mountable.
- True on-line UPS.
- Delivers high quality sine wave with very low distortion.
- Multiparameter display provides power status.
- High peak current to drive switching power supplies.
- Event recording via optional IEEE488/RS232 interface.
- Windows, Lab Windows and Novell compatible.

FRONT PANEL DISPLAY

Any of the following parameters can be selected for front panel display by the control buttons.

- Time-of-day
- Date
- Status indications
- Time-of-failure
- Voltage
- Current
- Battery Status
- Duration-of-failure

APPLICATIONS

- Mobile communications
- Transportable shelters
- Process control
- ATE consoles
- Laboratory instrumentation
- Factory automation
- Remote facility/site
- Telecommunications
- Militarized versions available

DIMENSIONS

MODEL #	OUTPUT VA	INCHES		
		HEIGHT	DEPTH	WIDTH
HBL1500	1500	5¼	24	19
HBL 3000	3000	8¾	24	19
HBL 5000	5000	8¾	24	19

RUGGED, INSTRUMENT QUALITY UPS PROTECTS SENSITIVE EQUIPMENT.

Behlman's new HBL Series is a true on-line UPS that continuously conditions incoming power, providing a high quality sine wave with very low distortion. In the event of a power loss, batteries provide up to 20 minutes of power for an orderly shutdown.

This rugged UPS continuously monitors and stores power data, including: time-of-day and date, status indications, time-of-failure, duration-of-failure, battery status, voltage and current. Events can be front panel display or communicated to a computer via a built IEEE488/RS232 interface. The HBL is also Windows, LAB Windows and Novell software compatible.

This rugged, compact, rack mounted unit is ideal for process control, ATE, industrial computers, scientific instrumentation, telecommunications equipment and other power sensitive devices.

SPECIFICATIONS

INPUT

Input: 120 Vac ± 10%, 50 or 60 Hz 1Ø.
230 Vac ±10%, 50 or 60 Hz 1Ø.
Power Factor: 0.75 Nominal.
In-rush Current: Limited to nominal input current.

OUTPUT

System Output: True on-line sinewave output.
Load Regulation ±1% no load to full rated load.
Distortion: 2-4% THD.
Frequency: Locked to input line or free running.
Line Synchronization: ±3 Hz.
Lock Range: ±5 Hz with 1% increase in output distortion.
Frequency Regulation: ±0.1 Hz during line loss or free running.
Load Power Factor: 100% of rated output into any power factor load.
Current Crest Factor: 3:1.
Overload Capacity: 110% of nominal rating.
Efficiency (AC to AC): 85% at full rated resistive load with fully charged batteries.

BATTERY CHARACTERISTICS

Type: Sealed, maintenance free lead-acid.

COMMUNICATION/CONTROL

IEEE/RS232 two way communication, status of power parameters (see Front Panel Display).
Novell Compatible (software available)

California Instruments

L SERIES – A NEW GENERATION OF AC POWER PRODUCTS

The L Series is the most compact and versatile series of AC Power Sources in the testing industry.

California Instruments offers:

- Model 751L; 850VA, 1Ø
- Model 1501L; 1650VA, 1Ø, 5 1/4 In. Ht.
- Model 1503L; 550VA/Ø, 3Ø, 5 1/4 In. Ht.
- Model 4500L; 1650VA/Ø, 3Ø or 5000VA 1Ø, 10 1/2 In. Ht.
- Parallel capability up to 27,000VA, 1Ø or 3Ø

The built-in Manual Controller has Frequency and Amplitude adjustment plus range and single or three-phase switch control.

The built-in Programmable Controller has programming and measurement capability of voltage, current, power, phase angle, frequency and current limit. It also has the added feature of being able to ramp the programmable functions. (See controller information below)

Exclusive Features:

Full Output Volts-Amps, Zero to Unity Power Factor

Simple Calibration
- Cover on, via GPIB or Keypad

Smallest front panel height per power level
- Save up to 50% Rack Space

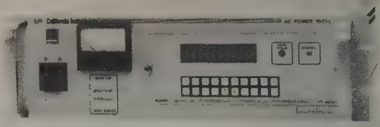
Greater than 80% efficient
- Much less heat dissipated

Versatility for Your Applications
- 5000VA Models can be programmed for 1Ø or 3Ø outputs

Crest Factor of 2.5
- Drive off-line switchers

Programmable dropout feature
- Test for ride-through

16 Linking Memory Registers for *any* Test Sequence
- User designed test sequences in non-volatile memory



Additional Features:

- Automatic firmware calibration
- Complete self test with module status (programmable controller).
- Display/Bus reporting of load parameters:
  - Volts RMS
  - Frequency
  - VA
  - Amps RMS
  - Phase Angles
  - Power Factor
  - Watts
- 26V regulated, 5V unregulated output option (not all models)
- MIL-STD-704D AC test option
- Output Relay standard all units (except 751L)
- Output voltage 135V/270V standard. Optional ranges available from 67.5V to 400V.

CONTROL RELATED SYSTEM SPECIFICATIONS

	Manual Control (-M)	Programmable Control (-P)	LDS Control (-PT)
OUTPUT:			
Total Harmonic Distortion (to 300kHz, linear load)	1% to 2kHz 2% to 5kHz	1% to 2kHz 2% to 5kHz	1% to 550Hz
Line Regulation	0.02% for 10% line change	0.02% for 10% line change	2.0% for 10% line change
Load Regulation	0.05% no load to full load	0.05% no load to full load	0.5% to 100Hz, 2.0% to 550Hz
Voltage Accuracy	Variable control	0.1% 135V range, 0.2% 270V range	0.5 % of range at 50Hz, 60Hz, 400Hz 1.0% of range - all other frequencies
Frequency Accuracy	0.005% of set value	0.001% of set value	0.001% of set value
Phase Angle Accuracy	±3°	±2° to 2kHz ±3° to 5kHz	±2°
CONTROL:			
Voltage	Panel Variable Control	Independent Output Programmable, 0 to 100%	Independent Output Programmable, 0 to 100%
Voltage Range	2-Position Switch 0-135V, 0-270V	Programmable 0-135V, 0-270V	Programmable 0-135V, 0-270V
Frequency	Rotary Switches	Programmable, 45Hz to 5kHz	Programmable, 45Hz to 550Hz
Phase Angle	N/A (Fixed 120° between phases)	Independent Output Programmable, 0° to 360°	Independent Output Programmable, 0° to 360°
Current Limit	Panel Control	Independent Output Programmable, 0 to Max Current	Independent Output Programmable, 0 to Max Current
Current Limit Delay	N/A	N/A	Programmable, 0 to 1 Sec.
Ramp/Sweep	N/A	Voltage, Frequency, Phase, Current Limit	Voltage, Frequency, Phase, Current Limit
Sine Wave Start Point	N/A	Programmable, 0 -360°	Programmable, 0-360°
Harmonic Distortion	N/A	N/A	Independent Output Programmable, 0 to 20%
Dropout	N/A	Independent Output Programmable, any phase angle from .001 Sec to 2 Hr. or 0 to 5 Cycles	Independent Output Programmable, any phase angle from .001 Sec to 2 Hr. or 0 to 5 Cycles
Surge	N/A	Independent Output Programmable, any phase angle from .001 Sec to 2 Hr.	Independent Output Programmable, any phase angle from .001 Sec to 2 Hr.

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California Instruments Corp.

9025 Balboa Avenue
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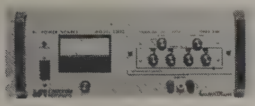
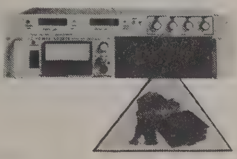
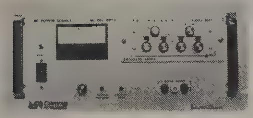
California Instruments

AC POWER SYSTEMS

T SERIES POWER AMPLIFIERS

- Low Distortion - High Regulation Linear Amplifier
- Single and Multi-Phase
- 50 Model Selection
- Modular Design
- 100 to 36000VA
- Voltage Ranges to 400V
- 20-20kHz Optional

Model	Std. Voltge	F.P.F.R.①	Std Input Voltage	Panel Ht.
101T	1 Range	45-10kHz	115V, 1Ø	3.5"
251T	3 Ranges	45-20kHz	115V, 1Ø	5.25"
351TC	0-120, 0-240	45-5kHz	115V, 1Ø	5.25"
501TCA	0-135, 0-270	45-5kHz	115V, 1Ø	7.0"
1001TC	0-130, 0-260	45-5kHz	230V, 1Ø	8.75"
1501TCA	4 Ranges	45-5kHz	230V, 1Ø	14.0"
3001TCA	4 Ranges	45-2kHz	208V L-L, 3Ø	15.75"

① Full Power Frequency Range

T SERIES PLUG-IN OSCILLATORS AND CONTROLLERS

Manual Oscillators

Model 850T
- 45Hz - 9999Hz
- 0.001% Accuracy
- Crystal Control
- Amplitude/Current Servo

PRECISION OSCILLATOR
SERIES 850T
RANGE
AMPLITUDE
X100
X10
X1
FREQUENCY Hz
California Instruments

Programmable Controllers

Model 849TA
- Control-Remote/Local
- IEEE-488 GPIB (Listen/Talk)
- Independent Phase Control
- Store Variable Sweeps & Ramps

POWER CONTROLLER
849TA
VIEW
REMOTE

NOTE: Consult Factory for full line of Manual and Programmable Oscillators/Controllers

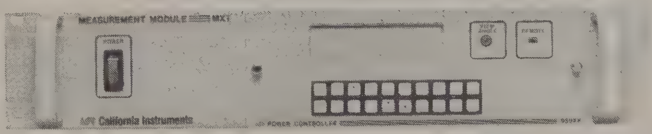
LDS SERIES

LINE DISTURBANCE SIMULATION

Programmable AC Power to simulate power line dropouts, spikes, sags and distortion.

LDS Series will consist of:
- Model 959XPT Controller
  Model MXT10 Interface Module
  Any California Instruments Model T Series
  AC Power Amplifier
- Self-contained in L Series Models

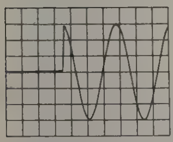
Features:
- Full IEEE-488 Listener/Talker
- 16 Linking Memory Registers
- Variable Speed Up/Dn Keys
- Bus or Keypad calibration

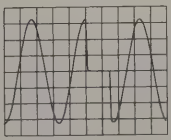


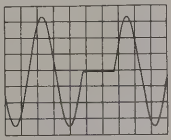
The MXT10 provides California Instruments T & XP Series AC Power Amplifiers and many competitive model AC power amplifiers with the capability to program and measure output parameters, including current limit.

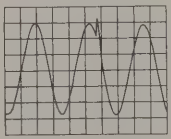
Program to control, display and report RMS Volts and Amps, Watts, VA, Pf, Phase Angles and Frequency. Can be used from 100VA to 36kVA in single and multiple phase configurations.

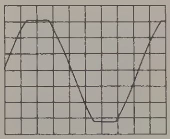
IEEE-488 or Front Panel Keyboard control to program Line Distortion Simulations like those shown below...or specify your particular line distortion.

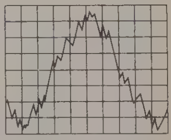

Programmable start


½ cycle dropouts


10 ms dropout at 0° (or any angle)


2 ms surge (at any angle)


Programmed distortion (0-20%)


Custom waveshape to customer requirement

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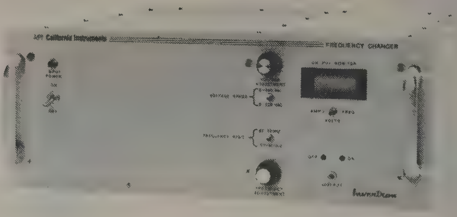
California Instruments Corp.

9025 Balboa Avenue
San Diego, CA 92123
(619) 279-8620

Fax: 619-279-8139
Telex: 695047
Toll Free 800-422-7693

California Instruments

AC POWER SYSTEMS
Model 1201WP
WORLD AC POWER AT YOUR FINGERTIPS



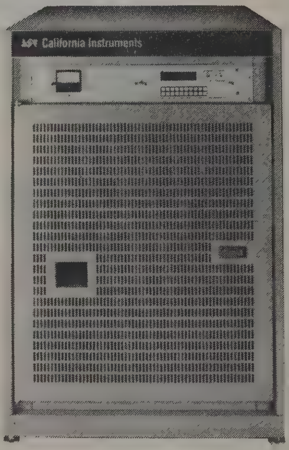
Features:
- Test for Worldwide Power Requirements
- Simple to Operate
- Fault Protected
- Portable
- Eliminate Exhibition Power Conflicts

Provides a low cost, convenient source of international power for testing products which are exported to countries with different voltage and frequency requirements than those at the manufacturing site.

Output voltage is adjustable from 5 to 260 volts at frequencies of 47Hz to 500Hz.

Specifications:
- **Output Voltage**
  5 to 130VAC
  5 to 260VAC
  (Switch selected)
- **Output Frequency**
  47Hz to 150Hz
  150Hz to 500Hz
  (Switch selected)
- **Output Current (RMS)**
  1200VA/Output Voltage
  9.2A RMS max. 130V Range
  4.6A RMS max. 260V Range
- **Peak Repetitive Output Current**
  23A, 130V Range
- **Power Factor**
  0 to 1 Pf at full output voltage and current
- **Input Voltage:**
  115 or 230VAC (±10%)
- **Input Frequency**
  45Hz to 440Hz
- **Efficiency**
  75%
- **Monitor Accuracy**
  0.25%
- **EMI**
  Meets FCC Part 15, Class A
- **Weight**
  55 lbs. (22.8Kg)
- **Dimensions**
  7"H x 19"W x 17"D
  (17.8cm) x (48.3cm) x (43.2cm)

PRECISION MODULAR AC POWER SYSTEMS FCS SERIES
18KVA to 54KVA; 45Hz to 1KHz



Features:
- 1-Phase, 3-Phase Operation, Switchable
- Remote Sense for High Voltage Accuracy
- Parallel Capability for Higher Power
- Automatic Shutdown Protection
- 135V Full Scale Range, Optional to 312V
- Measurement Functions with Programmable Controller
- 16 Storage Registers, Calibration and Sync Output with Programmable Controller
- Analog Input available with Manual Controller

The new FCS Series modular design for high-power systems range from 18kVA to 54kVA. This series is specifically engineered to provide precision power where rotary and frequency converters cannot maintain accuracies suitable for testing precision equipment. Individual 6kVA modules are front panel loaded and can be taken off-line in case of failure. The system can continue to operate with reduced output power.

The FCS Series is available in two configurations; 1) a fully computer-controlled system with complete measurement capability, and 2) a lower-cost unit which is manually controlled, designed primarily where fixed 50Hz, 60Hz or 400Hz power is required.

With -704D Option, the FCS Series AC Power System can perform all the MIL-STD-704D AC power tests on command for full production line testing capability.

All Programmable Controllers include automatic remote calibration. Calibration is via firmware control from the front panel.

Cabinet is fitted with casters for mobility and includes forklift high-strength pads.

Size: 30"W x 36"D x 45"H
(6.2 cm) x (91.4cm) x (114.3cm)
Weight: 750 lb. (341.7Kg)

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Fax: 619-279-8139
Telex: 695047
Toll Free 800-422-7693

CONTROLLED POWER COMPANY

1955 STEPHENSON HIGHWAY, TROY, MICHIGAN 48083 1-313-528-3700 FAX 1-313-528-0411

UNINTERRUPTIBLE POWER SYSTEMS LT SERIES - MD SERIES - HV SERIES

Uninterruptible Power Systems by Controlled Power Company provide 100% power protection for mission critical computer applications. These applications are LAN systems, massive WAN systems, midrange and mainframe computers, all of which have become a focal point of operations. Each of these systems require hardware protection from power line disturbances. Managers of these systems must protect valuable data from utility power loss.

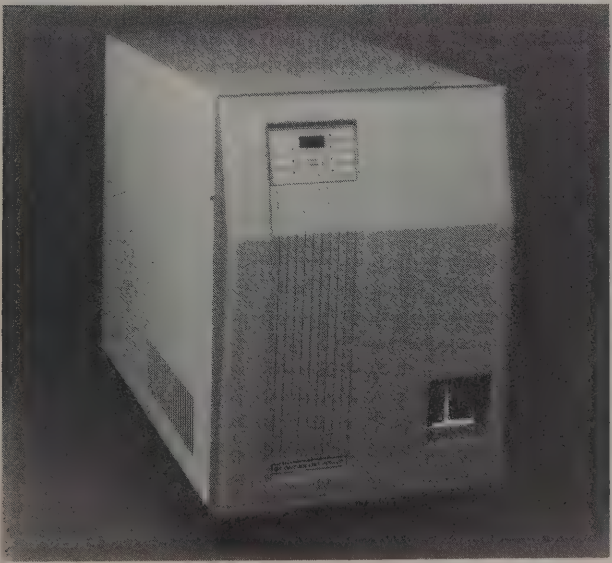
Controlled Power company offers a wide range of power expandable sizes. Each product size has been designed for compatibility and ease of installation with today's computer systems and their environments. Future computer system growth is accommodated through easily installed hardware and software option upgrades.

Controlled Power Company ... Solutions for electrical power problems since 1968.

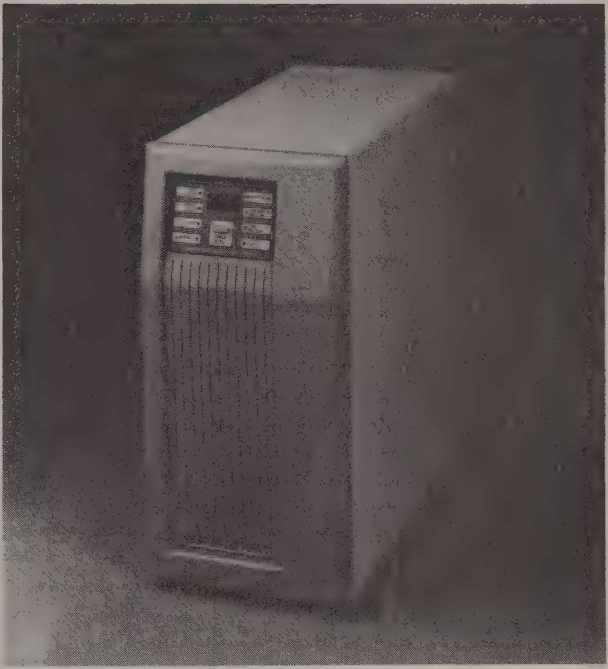
SPECIFICATIONS

- **Power Output**
  Rated for computer type loads with switch mode power supplies that represent power factor of 0.7

  LT Series - 700 VA to 2.1 KVA,
  MD Series - 3.1 KVA to 7.5 KVA
  HV Series - 7.5 KVA to 25 KVA
- **Line voltage regulation**
  Output voltage ±3% with input voltage from 0% to +110% of nominal. Uses "Fuzzy Ranging" to optimize usable input line voltage without use of battery power. Range without battery consumption to 61% of nominal input voltage. Fuzzy Ranging saves valuable battery back-up and improves battery life.
- **Load regulation**
  Output voltage ±3% when output is taken from no load to full load
- **Combined line and load regulation**
  Meets Computer Business Equipment Manufacturer's Association (CBEMA) standards under any line or load condition
- **Response to Non-linear loading**
  K factor rated - K 30 or better



POWER SALES NETWORK
1-800-521-4792
POWER INFORMATION CENTER
1-800-642-9624 FAX 1-800-642-9625



- **Lightning and surge protection**
  Exceeds lightning and surge protection tests established by ANSI/IEEE C62.42-45 with more than 3000:1 attenuation
- **Common-mode noise attention:** 120 dB
- **Transverse-mode noise attenuation:** 70 dB
- **Power factor**
  Self correcting to > .95 (approaching unity), meets FAA-G-201e power factor specifications
- **Harmonic attenuation**
  Load generated harmonics are attenuated 400% at the input
- **Communications Interface**
  Status and alarm RS/232 port used for data protection and automatic unattended shutdown. Full duplex ASCII, RS/232 serial port available for remote system status monitoring and customer programming of system operating conditions.
- **Input/Output Voltage**
  LT & MD Series - Input Voltage 120/208/240 VAC at 60 HZ, 220 VAC at 50 HZ. Output voltage 120 or 120/208 or 120/240 VAC at 60 HZ. 220 or 110/220 at 50 HZ

  HV Series - Input Voltage 208/240 VAC at 60 HZ, 220 VAC at 50 HZ. Output Voltage 120/208 and 120/240 at 60 HZ. 220/110 at 50 HZ.
- **Reliability MTBF**
  Total system - 100,000 hours MIL Spec standard 217E
  Transformer - 200,000 hours
  Battery - 5 year projected life, 10 year available
- **Operating temperature**
  0 to 40 degrees celsius
- **Safety**
  UL listed 1778 standard for UPS equipment, CSA certified

CONTROLLED POWER COMPANY

1955 STEPHENSON HIGHWAY, TROY, MICHIGAN 48083 1-313-528-3700 FAX 1-313-528-0411

POWER SALES NETWORK
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POWER INFORMATION CENTER
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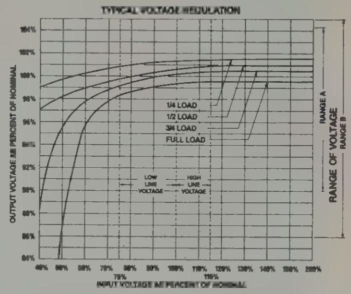
SERIES 800 POWER PURIFICATION SYSTEMS

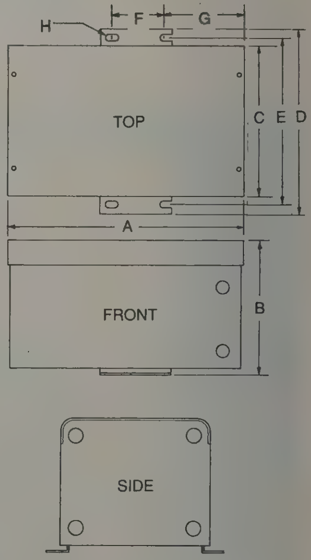
Series 800 Power Purification Systems protect sensitive electronic equipment loads from extremely unstable, highly distorted electrical power. This enhanced ferroresonant transformer design automatically regulates and conditions raw utility power, even in the harshest industrial environments where heavy equipment loads constantly interfere with your building's electrical system. This highly reliable product line is ideal for applications where computerized control systems are integrated into the industrial environment.

SPECIFICATIONS



- **Line voltage regulation**
  Series 800 regulation performance is superior to any other ferroresonant product available in today's market. The voltage regulation graph illustrates typical operating characteristics of our design.
- **Protection against extreme voltage fluctuations**
  The Series 800 will protect equipment when voltage drops to 50% of nominal or rises to 200% of nominal. Over this range, with the system loaded approximately 75%, the output voltage will be regulated to within usable limits.
- **Unique ride through capability**
  The output of the Series 800 does not go to zero with the loss of input power for a 1/4 cycle (4msec), a 1/2 cycle (8.3msec) or even for a complete cycle (16.6msec), depending on the percentage of load.
- **Immunity to distortion of input sinewave**
  With input voltage harmonic distortion content of 0% to 40% (THD), the output voltage contains a maximum harmonic content of 4%.
- **Load regulation**
  -2.5% maximum from no load to full load.
- **Electrical isolation**
  Primary windings are fully isolated from secondary windings, newly derived neutral on secondary is grounded to enclosure chassis and grounding terminal.
- **Common-mode noise attenuation:** 140db
- **Transverse-mode noise attenuation:** 120db
- **Reliability**
  All passive component electronic construction, MTBF- 200,000 Hrs.
- **Efficiency**
  90% at full load, decreasing slightly as load decreases.
- **Operating temperature**
  -20 degrees C to +40 degrees C
- **Enclosure**
  NEMA type 1, industrial
- **Safety**
  UL 1012 listed standard for power supplies

Power Rating VA	*Input	*Output	Weight Pounds	Dimensions								Model #
				A	B	C	D	E	F	G	H	
250	120/240	120	36	10.5	8.00	5.75	7.5	6.75	4.13	2.19	.31	5GAX-250-P
250	240/480	120	36	10.5	8.00	5.75	7.5	6.75	4.13	2.19	.31	5HAX-250-P
500	120/208/240	120	57	12	10	7.38	9	8.13	5.63	3.06	.38	5BGAX-500-P
500	240/480	120	57	12	10	7.38	9	8.13	5.63	3.06	.38	5HAX-500-P
750	120/208/240	120	70	12	10	7.38	9	8.13	5.63	3.06	.38	5BGAX-750-P
1000	120/208/240	120	83	12	10	7.38	9	8.13	5.63	3.06	.38	5BGAX-1K-P
1000	240/480	120	83	12	10	7.38	9	8.13	5.63	3.06	.38	5HAX-1K-P
1500	120/208/240	120	110	16.5	11.00	10.5	12.75	11.75	3	5.19	.44	5BGAX-1.5K-P
1500	240/480	120	110	16.5	11.00	10.5	12.75	11.75	3	5.19	.44	5HAX-1.5K-P
2000	120/208/240	120	116	16.5	11.00	10.5	12.75	11.75	3.88	5.19	.44	5BGAX-2K-P
2000	240/480	120	116	16.5	11.00	10.5	12.75	11.75	3.88	5.19	.44	5HAX-2K-P
2500	120/208/240	120	125	16.5	11.00	10.5	12.75	11.75	5.25	5.19	.44	5BGAX-2.5K-P
2500	240/480	120	125	16.5	11.00	10.5	12.75	11.75	5.25	5.19	.44	5HAX-2.5K-P
3000	120/208/24	120/240	137	16.5	11.00	10.5	12.75	11.75	5.25	5.19	.44	5BGGX-3K-P
3000	240/480	120/240	137	16.5	11.00	10.5	12.75	11.75	5.25	5.19	.44	5HGX-3K-P
5000	208/240	120/240	336	35	25	33.5						5BGGX-5K-I
5000	240/480	120/240	336	35	25	33.5						5HGX-5K-I
8000	240/480	120/240	460	35	25	33.5						5HGX-8K-I
10,000	240/480	120/240	536	35	25	33.5						5HGX-10K-I
15,000	240/480	120/240	920	41.5	27.5	39						5HGX-15K-I
20,000	240/480	120/240	1100	41.5	27.5	39						5HGX-20K-I
25,000	240/480	120/240	1425	56.5	32.5	48						5HGX-25K-I



CONTROLLED POWER COMPANY

1955 STEPHENSON HIGHWAY, TROY, MICHIGAN 48083 1-313-528-3700 FAX 1-313-528-0411

POWER SALES NETWORK
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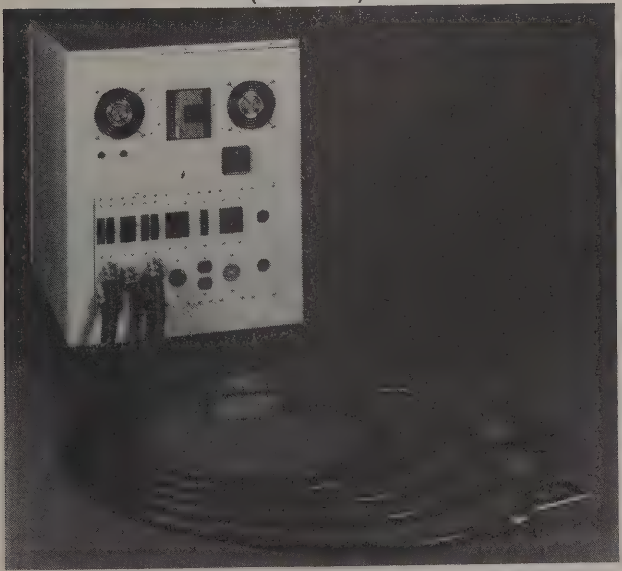
POWER INFORMATION CENTER
1-800-642-9624 FAX 1-800-642-9625

SERIES 700A POWER LINE CONDITIONER
Now available with K factor rating

Series 700A Power Line Conditioners protect sensitive electronic equipment loads from electrical utility AC power line disturbances. These compact, highly efficient models correct for power surges and sags by automatically regulating output voltage to within ±5.5% quickly and completely within one AC cycle... even when the raw utility sinewave fluctuates +10% to -40%. For protection against transient noise impulses, units include a multi-shielded Max-E-Isolation Transformer with primary transient voltage suppression and secondary mounted electronic noise filter circuits. The 700A is available in single and three phase sizes. Units can be configured with output branch circuit distribution and other value added options that increase overall cost effectiveness to install and operate.

kVa	Phase	Output Distribution	Cabinet Dimensions
5, 8 10,15,20 25	Single	Patch Panels	21.5"W x 29"D x 30"H
6,10,15	Three	Patch Panels	21.5"W x 29"D x 30"H
25, 30	Three	Patch Panels	21.5"W x 29"D x 44"H
45, 50 75, 100 125, 150	Three	Hard Wired	45"W x 29"d x 44"H
225, 300, 500	Three	Hard Wired	56"W x 41.5"D x 77"H

Input voltages available are: 208, 240, 480, 600
Output voltage for single phase units: 120/240
Output voltage for three phase units: 208/120 wye



Commercial Style Enclosure
(Rear View)

SPECIFICATIONS:

Standard Regulation:

Input Line	Typical Output Line	Maximum Output Line
+10%, -20%	±2.5%	±3%

Optional Extended Regulation Range:

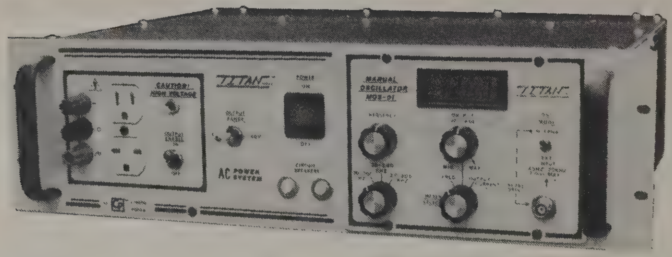
Input Line	Typical Output Line	Maximum Output Line
+10%, -40%	±5.5%	±6%

- **Load Regulation:** -2% maximum from no load to full load
- **Response Time:** 1/4 cycle
- **Correction Time:** 1 cycle for 100% correction
- **Efficiency:** 95% to 97% typical
- **Operating Frequency:** 60 Hertz ±3 Hz, or 50 hertz ± 3 Hz
- **Operating Temperature:** 0° to 40°C
- **Transverse Mode Noise attenuation**
  3 db down to 1000 Hertz, 40 dB per decade to well below 50 dB with resistive load.
- **Common Mode Noise attenuation:** 140 dB
- **Audible Noise:** 40 dB to 50 dB depending on size
- **Technology**
  Microprocessor based, zero current switching, seven tap system
- **Overload Rating**
  500% for one cycle, 200% for 10 seconds
- **Load power factor range**
  0.6 leading to 0.6 lagging
- **Enclosure**
  NEMA Type 1, (industrial or commercial)
- **Safety**
  UL listed 1012 standard for power supplies, CSA certified

OPTIONAL EQUIPMENT

- Regulator bypass switch
- Branch circuit cables with receptacle termination
- Flush mounted output receptacles
- Branch circuit cables with field wired termination
- Over/Under voltage detector with auto or manual restart
- Others

WATCH OUT FOR THE TITAN™ SERIES



AC POWER SOURCES

HALF

PRICE, SIZE, WEIGHT

TWICE

BANDWIDTH, RUGGEDNESS, FLEXIBILITY

HIGH PEAK CURRENT UNITS AVAILABLE NOW!

NEW TECHNOLOGY—HERE TODAY!

GENERAL:

- Ideal for operating or testing avionics, synchros, gyros, triac and SCR phase controllers, motors, fans, transducers, shaker tables, transformers, power supplies, relays, AC line-operated equipment for either foreign or domestic use; or any other system requiring a precision AC power source.
- Conveniently designed and small enough for easy use on either bench-top or fixed rack-mount installations.
- 70%-82% efficiency *across the full output voltage range* means low power consumption and cool operation at *any* output level.
- Comprehensive "soft-start" circuitry removes all supply-line and power supply output current and voltage surges.
- Whisper quiet operation.
- High power to weight ratio, results in excellent portability and decreased freight costs.
- Lightest and most efficient AC power source on the market today.
- Latest amplifier technology using "Pulse Width Modulation" (PWM) and patented, thick-film, power hybrid circuitry.

INTERFACE:

- Full digital metering of frequency, voltage, and current.
- Use internal sinewave oscillator or external input source.
- Convenient, front panel mounted 130V/260V voltage range switch, three-way binding posts and standard NEMA AC receptacles.
- Inputs and outputs both completely isolated and floating with respect to ground.

OUTPUT CAPABILITY:

- 165 VA, 500 VA, 1 KVA, 2 KVA, 3 KVA, 4 KVA, 5 KVA, and 6 KVA systems available.
- Use multiple 1 KVA mainframes with single master oscillator for power up to 6 KVA.
- Bandwidth: usable 45 Hz-20 KHz, full output 45 Hz-15 KHz.
- Stable, full output voltage and current without derating into *any* reactive load with power factor from unity to zero, leading or lagging.
- Full-current output at *any* output voltage with *no* confusing derating curves.
- Low sinewave distortion, excellent load and line regulation.
- High peak current rated units available.

PROTECTION:

- Output is completely overload and short-circuit-proof, with automatic and smooth recovery.
- Unit can operate safely and continuously into *any* type of symetrical AC load without derating, overheating, or shutdown.
- In the event of an internal fault, a self-diagnostic fault-isolation system will completely shut the unit down and prevent any catastrophic failures.
- Thermal protection will shut down unit if ventillation is choked off.

SERVICE:

- Totally modular design allows for easy service, if required.
- Immediate Availability.
- One year warranty.

COMPARE OUR SPECS ✱

MODEL	DESCRIPTION	MINIMUM OUTPUT		SIZE•INCHES			WT. LBS.	PRICE
		VOLTS•RMS	AMPS•RMS	H	W	D		
MAC-01	1 KVA MAINFRAME	0→130/260	8.0/4.0	5.25	19	13.5	56	$2,250
MAC-02	500 VA MAINFRAME	0→130/260	4.0/2.0	5.25	19	13.5	38	$1,450
MAC-03	165 VA MAINFRAME	0→130/260	1.4/0.7	5.25	19	13.5	27	$1,050
MOS-01	Precision 20 Hz-20 KHz sinewave oscillator with digital readout of frequency, voltage, and current. Also accepts external inputs and drives additional mainframes through EIM-01.			6.7″ × 5.0″ FRONT PANEL PLUG-IN			1.0	$ 400
EIM-01	External input module with level control and BNC input. Can slave additional mainframes from MOS-01 or IPDS-3000 oscillators.						.5	$ 70
IPDS-3000	IEEE-488/RS-232 Buss controlled oscillator with 1, 2, & 3 phase outputs, local or remote control.			1.75	19	12.0	8.0	$2,350

CALL OR WRITE FOR COMPLETE DETAILS TODAY!

TITAN™ SERIES AC POWER SYSTEMS SINCE 1981 by

CP™ **COMPACT POWER CO.**
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YORBA LINDA, CA 92686 (714) 996-5826

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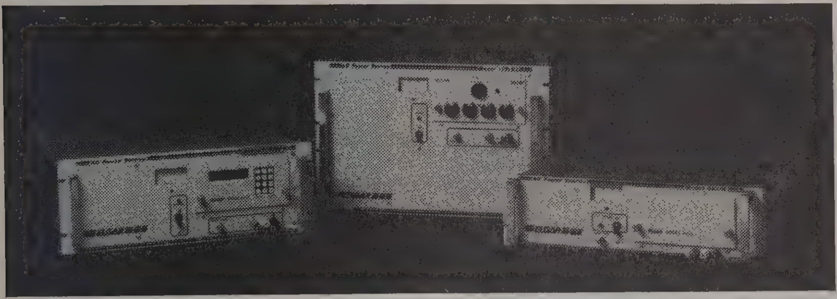
SL/SX Series AC Power Sources



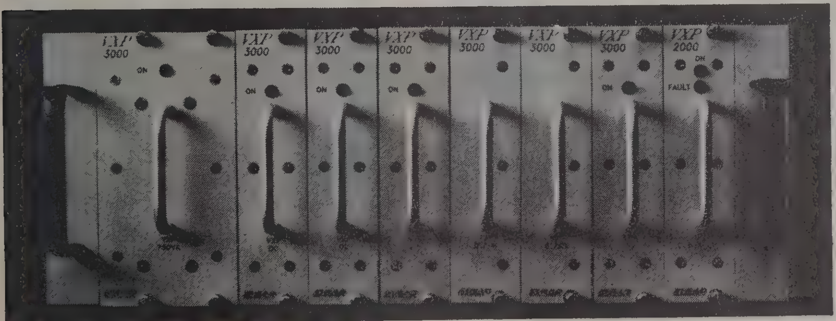
Elgar's SL Series solid-state frequency changers are small and lightweight in design. These linear power sources save critical panel space and money because they can provide up to 50% more power density and weigh nearly one-third less than most competitive models.

The SL Series is ideal for general purpose test applications, as well as ATE systems and avionics testing.

Elgar's SX Series AC linear power sources are designed to drive non-linear, rectifier loads. They meet all the electrical power requirements for the testing of modern switch-mode DC power supplies.

The 4:1 (or greater) crest factor capability which provides repetitive peak current up to 70A, makes the SX Series ideal for testing any equipment that causes a peak load on the AC power line.

VXP3000 Programmable Power System



Elgar's VXP3000 Programmable Power System is the state-of-the-art solution for test systems where high power density, small size and flexibility are the key priorities.

The unique chassis design employs 1.8 inch wide slots which accept one controller module and up to eight power modules or three 750VA AC modules. The ability to provide both AC and DC power in one chassis and at one GPIB address is further enhanced by an Auxiliary Drive Module (ADM). This module allows the VXP controller to program external bulk or high power DC power supplies as if they were standard VXP power modules.

CONTROLLERS
IEEE-488 controller With ABLE or CIIL (MATE) syntax
Slave controller For use with expansion chassis or as an interface to a VXP1000 power programmer located in a VXI chassis

DC POWER MODULES
Output voltage range 0-7, 10, 14, 20, 32, 40, 60, 100 and 200 VDC 1.8" standard width (up to 8 modules per chassis)
Full rated output power 200 W for 10, 14, 20, 32, 40, 60, 100 and 200 VDC modules; 140 W for 7 VDC module. 1.5 KW, 4-side module available at 100 VDC
Parallelable For load sharing (available for 140W and 200W modules)
Series connectable Up to 400 VDC

AC POWER MODULES
Full rated output power 750 VA
Output voltage range 0-135 VAC, 3.6" double-wide size
Frequency range 350-999.9 Hz (45-350Hz with reduced specifications)
Configurable For up to 2250 VAC single-phase or up to 6750 VA three-phase
Parallelable For higher power requirements by using the special plug-in VXP-LSM module
Auxiliary output A 0-26 VAC/2 A output proportional to the main output voltages provided. An optional 5 VAC/5A auxiliary output is available.
Fast current limit protection Against short circuits
Efficiency Over 80%

Digitally Modulated AC Power Systems

Elgar/Ling Digitally Modulated AC (DMAC) power systems with"linear" specifications offer unmatched efficiency and flexibility in a wide range of switching AC applications. They can be used for upgrading or replacing motor generators and their quiet operation means they can be located next to test stands or in control rooms without disturbing operators.

With optional Elgar Plug-In Programmers (PIP), DMAC's can serve as powerful Automatic Test Equipment (ATE) tools. A PIP can be installed in a DMAC to furnish full IEEE listener/talker capabilities and allow complete control of voltage on any phase, frequency or phase angle.

Modular construction produces a low MTTR and an extremely wide range of single and three-phase systems in 6 KVA steps from 18 to 260 KVA. DMAC's have the output purity standard normally found in a linear supply of 0.5% Total Harmonic Distortion (THD).

DMAC Series AC power sources drive any load from zero to unity power factor and can provide uninterruptible power for UPS applications when ordered with optional battery backup. With higher efficiency at all load levels, DMAC's use less commercial power and generate less heat, resulting in significant operating cost savings.

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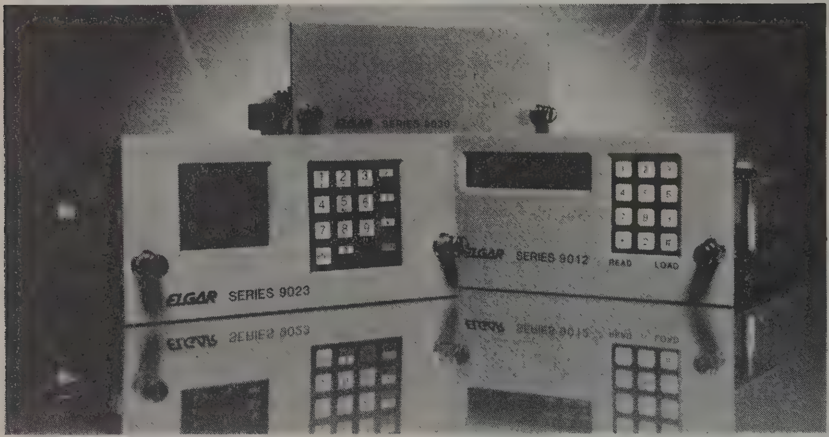
VXP1000

Elgar's VXP1000 Power Programmer allows the user full integration of Elgar AC & DC Power Systems and loads into the VXIbus environment. The VXP1000 is an interface card which co-resides in any VXI instrument chassis, slot 1-11. The PowerProgrammer operates with slightly modified versions of Elgar's standard AC Programmable SL/SX, DC Programmable AT8000 and VXP3000 PowerSystems.

Size: C Module
Interface Capability of three AC or DC power systems
from one card

In addition to the standard AC & DC Programmable features, the VXP1000 provides the user exceptional capability for automatic calibration, timed-based event programming and continuous power source monitoring.

Plug in Programmers



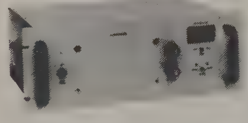
Programmable Oscillators
Plug-in Programmable oscillators (PIP's) which provide the interface between a computer and any Elgar AC Power Source System, are available for programming frequency, voltage amplitude, and phase angle in multi-phase systems. Elgar's PIP's are microprocessor controlled and offer more power options than ever before. Our latest PIP provides programmable current limiting and is CIIL compatible to meet Air Force MATE/TMA specifications.

Elgar's Atlas Based Language Extension (ABLE) makes programming simple via IEEE-488 (GPIB). Most PIP models provide keypad and LED read-out for convenient local control. And with Elgar's PIP, rack space is cut to a bare minimum since it is designed as a plug-in component for AC Power Sources.

PIP704 Transient Generator
The PIP704 Plug-In Programmable Transient Generator is designed to meet the MIL-STD-704 (revisions A through D) "Aircraft Electrical Power Characteristics" test requirements for 400Hz power. It's also an effective tool for Bu-Ships 1399 testing and for general purpose testing that requires AC transient generation.

The PIP704 can be programmed and monitored locally or remotely for simultaneous or independent transients including 704D ramps, voltage surges/sags, frequency deviation, voltage phase differentiation and waveform distortion in any single-phase or in all three phases. Standard frequency range is 45Hz to 1 KHz with voltage dropouts from 1 millisecond to 222.2 seconds.

The EL Series AC Frequency Changers



Now You Can Meet Smaller Power Conversion Applications That Do Not Require Critical Test and Measurement Standards

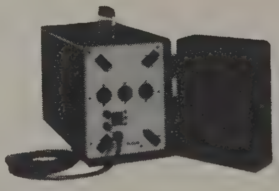
The Elgar El Series utilizes switching technology. These frequency changers are specially designed to power electronic equipment, motors and other high current-consuming loads.

We offer a wide selection of fixed and variable frequencies with a full or narrow range voltage control.

The output of all models is transformer isolated. The frequency is either fixed or continuously variable. On fixed frequency models, the output voltage is fixed at 115VAC or 230VAC. On variable frequency models, the output is adjustable from 0-130VAC or 0-260VAC.

Features:
- 1.2-15KVA
- Peak current to 3.0 X RMS
- Zero to unity power factor
- 200 microseconds response time for 100% load changes
- Soft start circuit prevents power line disruptions
- Available in 6 models - single and three phase

Convert Any Voltage/Frequency to 117VAC/60Hz



Elgar's 1.0 KVA portable AC power source converts unstable, "dirty" AC power anywhere, worldwide into regulated 117VAC, 60 Hz sinewave power without range switching or other adjustments.

The GPS 1000 can accept 45-450Hz with voltage ranging from 85VAC to 140VAC and 170VAC to 280VAC.

Three convenient outlets are included. Optional input adapter cables are available for plug-in power anywhere in the world. The GPS1000 weighs only 44 pounds. Efficiency is 80%; operation is quiet and cool.

Applications include powering of:
- Data processing, communications or other sensitive electronic equipment.
- Unstable generator outputs at construction sites.
- Other remote sites anywhere in the world.

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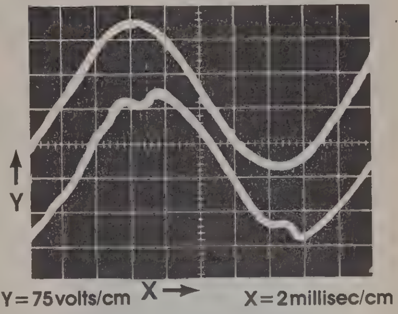
Ultra Precision Line Contitioners

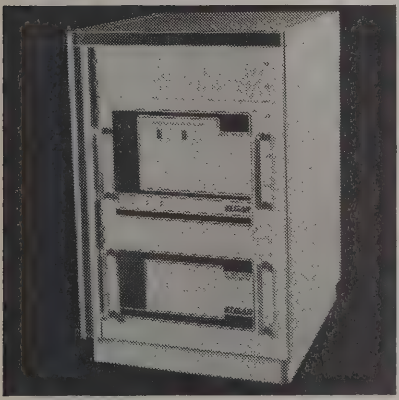
Elgar's Ultra Precision AC Line Conditioners provide precise, clean AC power to critical loads by eliminating high-speed AC line and load transients and distortion as well as providing precise regulation. These versatile instruments have response times 5,000 times faster than the fastest conventional AC line regulators and line isolation of 70 to 100dB, far superior to mere isolation transformers. All Elgar AC line conditioners are designed for continuous operation and are contained in rack-mount enclosures. Front panel controls include meters to monitor input and output voltages and output load current, an overload indicator and an input circuit breaker.

WAVEFORM COMPARISION CHART



The lower trace shows a very distorted input AC line waveform with a 75 volt peak spike riding on it. The upper trace shows the output of the Elgar AC Line Conditioner which shows no trace of the AC input anomalies.

On-line Uninterruptible Power Systems



1 and 3 KVA Cabinet System

Elgar solid-state, non-ferroresonant Uninterruptible Power Systems (UPS) combine a battery charger, battery bank, solid-state inverter and bypass switch to provide clean, continuous power to critical loads. Elgar UPS's are on-line systems so that power is continuously supplied through an inverter. Upon power failure, the battery automatically supplies the load with no switching.

In case of overload, or in the unlikely event of a component failure within the Uninterruptible Power System, the bypass switch is activated. The critical load automatically transfers to the input AC line or bypass input AC. All Elgar solidstate UPS's are available with a static bypass switch (SBS) that can make the transfer with less than 1ms interruption.

Elgar's 102-1B and 302-1B UPS's are rugged, reliable rack-mount units with excellent dynamic characteristics and an extremely wide (+10% /-20%) AC input voltage range.

The UPS 102-1B is a 1 KW, 1 KVA, 60Hz system, while the UPS 302-1B is a 3 KW, 3 KVA, 60 Hz system. All other specifications are the same.

NEW Global Uninterruptible Power Systems

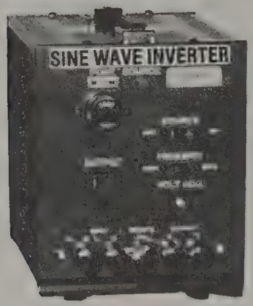
Elgar's Global Uninterruptible Power System (GUPS) product line is the ideal international power conversion system for computers, communication systems, and a broad range of other electronic equipment that must be able to operate from standard US power anywhere in the world under diverse conditions.

- **Universal input.** Automatically selects input range without operator intervention.
- **Universal output.** Switchable 115 VAC/60 Hz or 230 VAC/50 Hz available on GUPS 2400 U.
- **Rugged and transportable.** Meets MIL-STD-810C, Method 516.2 requirements.
- **Small size.** 7" H x 19" W, ideal for transport cases or 19" rack.
- **Battery backup.** Internal battery provides 5 minutes of backup at full rated load.
- **External rack-mounted battery packs.** Backup time can be extended with optional battery packs.
- **DC input available.** In the GUPS 2400AD, a 24/28V DC to DC converter is provided in lieu of an internal battery.

	GUPS 1200	GUPS 2400 (A, AD and U Models)
Maximum output rating	1.2kVA	2.4kVA
Output voltage	120 VAC±2%	115VAC/230 VAC3%
Output frequency	60 Hz±0.1%	60 Hz/50 Hz±0.1%
Input frequency	45 to 450 Hz	45 to 450 Hz
Input voltage	95 to 140 VAC	85 to 140 VAC
	190 to 280 VAC	170 to 280 VAC
	24 to 37 VDC	Optional: 18 to 32 VDC (GUPS 2400AD only)
Battery	30V, 16 AH	Available with internal battery module (GUPS 2400A) or external rack- mounted battery packs
Weight	97 lbs.	126 lbs. (GUPS 2400A and U, with internal batteries) 78 lbs. (GUPS 2400AD- no internal battery module)
Dimensions	21"Lx19"Wx7"H	21"Lx19"Wx7"H

ENERGY LTD

4714 UPSHUR STREET, BLADENSBURG, MARYLAND 20710
301/699-1144 • FAX: 301/699-8107



DC to AC INVERTERS—SILENT AC POWER ANYWHERE

ENERGY, LTD. presents a superior line of Pure Sine Wave, solid state inverters from 50VA to 1KVA. Our state-of-the-art inverters supply precise frequency control, are virtually noise-free, and provide sine wave, alternating current power from a direct current source.

Provide Inversion of DC Power to Pure Sine Wave AC Power with the market's finest inverters.

PORTABLE SINE WAVE INVERTERS

Model	Output Power (VA)	Input Voltage (DC)	Input Voltage Variation	Input Amps (Max)	Output Voltage	Output Voltage Regulation	Output Amps	No Load Amps	Output Frequency (Hz)	Frequency Regulation (Hz)	Efficiency (Approx.)	Cooling Method	Size HxWxD (in.)	Weight (Lbs.)
DA50-1H DA50-2H	50	12 24	10-15 20-30	7.2 3.6	115/230	±3%	.4	.3 .4	50/60*	±.1	>65% >68%	Self	3x6x7	6
DA100-1H DA100-2H	100	12 24	10-15 20-30	14.5 7.2	115/230	±3%	.9	.7 .4	50/60*	±.1	>65% >68%	Self	7x6x8.5	12
DA200-1H DA200-2H	200	12 24	10-15 20-30	29.2 14.6	115/230	±3%	1.7	.8 .5	50/60*	±.1	>65% >68%	Self	7x6x8.5	14

PORTABLE CRYSTAL CONTROLLED SINE WAVE INVERTERS

Model	Output Power (VA)	Input Voltage (DC)	Input Voltage Variation	Input Amps (Max)	Output Voltage	Output Voltage Regulation	Output Amps	No Load Amps	Output Frequency (Hz)	Frequency Regulation (Hz)	Efficiency (Approx.)	Cooling Method	Size HxWxD (in.)	Weight (Lbs.)
DAX200-1H DAX200-2H	200	12 24	10-15 20-30	29.2 14.6	115/230	±3%	1.7	1.0 .8	50/60*	±.0001	>65% >68%	Self	7x7x11	20
DAX300-1H DAX300-2H	300	12 24	10-15 20-30	40.8 20.4	115/230	±3%	2.6	1.3 .7	50/60*	±.0001	>65% >68%	Self	7x7x16.5	28
DAX500-1H DAX500-2H	500	12 24	10-15 20-30	70.0 32.0	115/230	±3%	4.4	5.0 2.0	50/60	±.0001	>65% >68%	Fan	9x14x14	46
DAX1000-2H	1000	24	20-30	64.0	115/230	±3%	8.7	3.0	50/60	±.0001	>68%	Fan	10x17x18.5	84

TECHNICAL INFORMATION—ALL MODELS:

Overload	To 125% for 5 minutes
Operating Temperature	–5° to +45°C
Max. Operating Humidity	90%
Max. dB Noise Level	-0-
Output Surge Capacity	150% for 15 seconds
Rating	Continuous
Input Protection Method	Fuse or Circuit Breaker
Output Waveform	Sinusoidal
Total Harmonic Distortion	<5%
Load Power Factor	.7 Lead or Lag

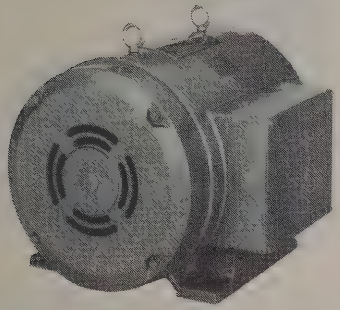
Sizes from 50VA to 1KVA
Specify output voltage
Rack-mount models available
Specify output frequency

Portable models convert to fixed-base inverters by use of mounting rails.
***Selectable using front panel switch**

GEORATOR

Frequency Conversion

SERIES 30
60 to 400/50 to 400 Hz

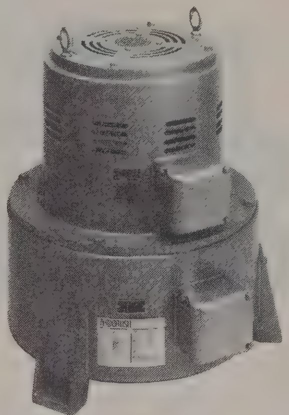


Provides a clean, reliable source of nominal 400 Hz power. Inherent regulation provides excellent voltage and frequency stability. Exceptional MTBF with minimal maintenance. Compact and quiet. 5 year warranty.

Specifications

Power Ratings: 150 VA to 3 KVA
Motor Type: Induction
Alternator Type: Permanent magnet excitation
(Variable output frequency available.)

SERIES 33
60 to 400/50 to 400 Hz

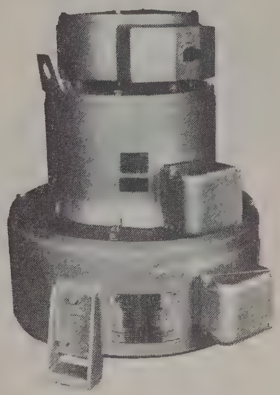


Provides a clean, reliable source of nominal 400 Hz power. Inherent regulation provides excellent voltage and frequency stability. Exceptional MTBF with minimal maintenance. Quiet operation. 5 year warranty.

Specifications

Power Ratings: 2.5 to 20 KVA
Motor Type: Induction
Alternator Type: Permanent magnet excitation
Waveform: THD less than 4%
(Variable output frequency available.)

SERIES 39
400 Hz, Voltage Regulated

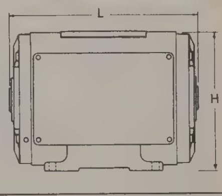
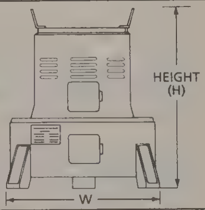
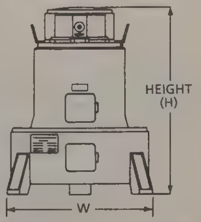


Supplies a clean, regulated source of nominal 400 Hz power. All units include a voltage regulator which maintains output at ±1%, from NL to FL. 5 year warranty.

Specifications

Power Ratings: 5 to 15 KVA
Motor Type: Induction
Alternator Type: Permanent magnet excitation
Waveform: THD less than 4%

PRODUCT DATA TABLE

OUTPUT				INPUT				Dimensions (in.)				
Model	KVA	Full Load (Voltage)	ø	Voltage	ø	Full Load (Amperes)	Motor HP	L	W	H	Weight (lbs)	Outline Drawings
SERIES 30												 L H
30-001	0.25	115	1	115/230	1	6.6/3.3	1/2	11	10	8	40	
30-003	1.0	115	1	115/230	1	24/12	1 1/2	15	14	12	120	
30-011	0.5	115	1	220/440	3	3.2/1.6	3/4	11	10	8	50	
30-026	1.5	115/200	3	115/230	1	30/15	2 1/4	15	14	12	130	
30-006	0.75	115/200	3	220/440	3	5.2/1.6	1 1/10	11	10	8	50	
30-008	3.0	115/200	3	220/440	3	12.6/6.3	4 1/2	15	14	12	150	
SERIES 33												 HEIGHT (H) W
33-001	2.5	115	1	220/440	3	15.2/7.6	5	—	20	21	200	
33-003	5.0	115	1	220/440	3	21.1/10.5	7.5	—	20	21	245	
33-004	5.0	115/200	3	220/440	3	21.1/10.5	7.5	—	20	21	215	
33-005	7.5	115/200	3	220/440	3	36/18	12	—	20	22	265	
33-006	10.0	115/200	3	220/440	3	40/20	15	—	20	22	280	
33-154	20.0	115/200	3	220/440	3	78/39	30	—	24	27	500	
SERIES 39												 HEIGHT (H) W
39-002	5	115	1	220/440	3	21.1/10.5	7.5	—	22	20	290	
39-001	5	120/208	3	220/440	3	30/15	7.5	—	22	20	280	
39-004	6.5	120/208	3	220/440	3	30/15	10	—	22	20	305	
39-015	15	120/208	3	220/440	3	68/34	25	—	30	26	530	

NOTES: 1) Representative sampling only.
2) Non-standard I/O voltages available.
3) 50 Hz input models available.

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GEORATOR

Frequency Conversion

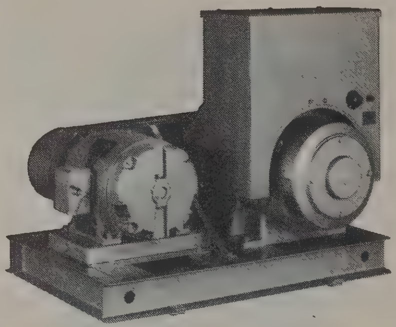
400 Hz, Exact

Ideal for applications requiring a clean, reliable source of exact 400 Hz power, NL to FL. Both voltage regulated and standard models available. 5 year warranty.

Specifications

Power Ratings: 2.5 to 10 KVA
Motor Type: Synduction
Alternator Type: Permanent magnet excitation
Waveform: THD less than 4%

SERIES 37
400 Hz, High Power

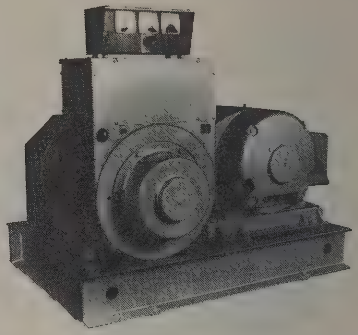


Designed for applications requiring higher output ratings of 400 Hz power. Provides accurate, reliable power and complete isolation from voltage fluctuations, switching transients, and line noise.

Specifications

Power Ratings: 25 to 125 KVA
Motor Type: High efficiency induction
Alternator Type: Synchronous rotating rectifier with voltage regulator mounted.
Waveform: THD less than 1%
(Variable output frequency available.)

SERIES 37
50 to 60/60 to 50 Hz

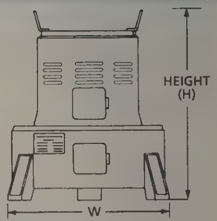
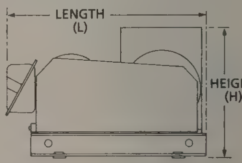
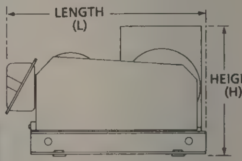


Provides accurate and stable output power, as well as complete isolation from switching transients, voltage fluctuations, and line noise. Units allow for compatibility between U.S. and International power standards.

Specifications

Power Ratings: 2.5 to 125 KVA
Motor Type: High efficiency induction (Synduction optional on 2.5 to 25 KVA)
Alternator Type: Synchronous rotating rectifier with voltage regulator mounted.
Waveform: THD less than 5%
(Variable output frequency available.)

PRODUCT DATA TABLE

OUTPUT				INPUT				Dimensions (in.)			Weight (lbs)	Outline Drawings
Model	KVA	Full Load (Voltage)	ø	Voltage	ø	Full Load (Amperes)	Motor HP	L	W	H		
400 Hz Exact												
Standard Units												
33-XXX	5.0	115	1	208-220/440	3	32/16	7.5	—	26	27	480	
33-184	10	115/200	3	208-220/440	3	60/30	15	—	24	29	485	
Regulated Units												
39-017	5.0	115/230	1	220/440	3	32/16	7.5	—	27	31	505	
39-016	7.5	115/200	3	240/480	3	56/28	15	—	27	31	510	
39-014	10	120/208	3	220/440	3	66/33	15	—	27	31	515	
SERIES 37/400 Hz												
37-600	25	115/200	3	230/460	3	82/41	40	42	30	33	1050	
37-601	37.5	115/200	3	230/460	3	112/56	60	54	39	34	1700	
37-602	50	115/200	3	230/460	3	146/73	75	56	42	34	1800	
37-604	75	115/200	3	230/460	3	212/106	100	59	45	41	2650	
37-605	100	115/200	3	460	3	145	125	60	48	41	3000	
37-606	125	115/200	3	460	3	174	150	60	48	41	3300	
SERIES 37/50-60, 60-50 Hz												
37-500	2.5	115/230	1	230/460	3	12/6.0	5	36	24	24	490	
37-510	6.25	115/230	1	230/460	3	26/13	10	37	25	31	700	
37-521	12.5	220/380	3	230/460	3	40/20	20	40	28	33	850	
37-540	25	115/230	1	230/460	3	90/45	40	42	30	33	1050	
37-550	37.5	220/380	3	230/460	3	112/56	60	54	39	34	1700	
37-560	62.5	220/380	3	230/460	3	180/90	100	56	45	36	2650	
37-561	75	220/380	3	230/460	3	212/106	100	59	45	41	2650	
37-573	125	220/380	3	460	3	174	150	60	45	41	3000	

NOTES:
1) Representative sampling only.
2) Non-standard I/O voltages available.
3) 50 Hz input models available.

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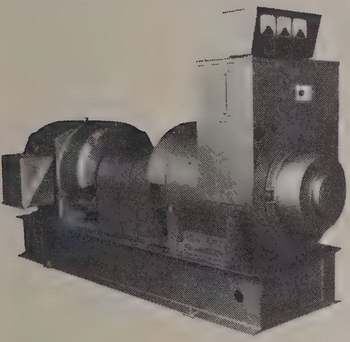
GEORATOR

Power Conditioning/PMA's

SERIES 37
Line Isolators

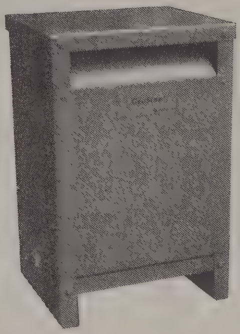


Provides complete isolation between the load and input power, eliminating voltage fluctuations, switching transients and line noise. Maintains approx. 100 milliseconds of ride-through during power outages.

Specifications

Power Ratings: 2.5 to 125 KVA
Motor Type: High efficiency induction (Synduction optional on 2.5 to 25 KVA)
Alternator Type: Synchronous rotating rectifier with voltage regulator mounted.
Waveform: THD less than 5%

SERIES 104
GeoSine Harmonic Line Conditioner

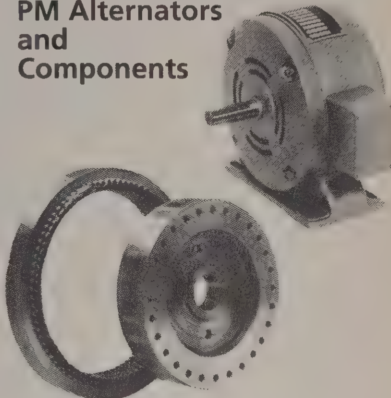


Corrects harmonic distortion caused by non-linear loads, such as adjustable speed motor drives and switching power supplies. Reduces both current and voltage distortion by a factor of 5 or greater. Eliminates the need for K-rated transformers. A more versatile solution than harmonic filters or traps. Standard models as well as units built to customer specs.

Specifications

Input: 480V 60 Hz 3 Phase Delta
Output: Voltage drop at maximum current less than 5%.
(50 Hz, 400 Hz, and non-standard voltages also available)

SERIES 36 AND 38
PM Alternators and Components



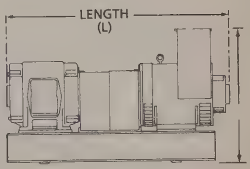
Permanent magnet technology makes these alternators ideal for use in special industrial applications, main generator pilot excitation or tachometer feedback, and high voltage isolation or wherever rotational mechanical energy is available for conversion into DC or high-frequency AC power. Standard models as well as units built to customer specs.

Specifications

Power Ratings: .25 to 20 KVA
Frequency: Up to 1000 Hz

PRODUCT DATA TABLE

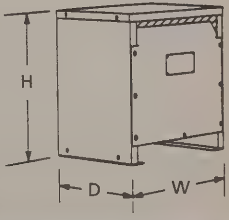
SERIES 37
Line Isolators

OUTPUT				INPUT				Dimensions (in.)			Weight (lbs)	Outline Drawings
Model	KVA	Full Load (Voltage)	ø	Voltage	ø	Full Load (Amperes)	Motor HP	L	W	H		
37-504	2.5	115/230	1	230/460	3	12/6.0	5	44	18	22	360	
37-515	6.25	120/208	3	230/460	3	24/12	10	44	19	34	650	
37-524	12.5	115/230	1	230/460	3	46/23	20	52	20	34	850	
37-544	25	115/230	1	230/460	3	90/45	40	56	24	34	1100	
37-554	37.5	120/208	3	230/460	3	112/56	60	66	27	31	1550	
37-555	50	120/208	3	230/460	3	146/73	75	67	27	31	1595	
37-565	75	120/208	3	230/460	3	212/106	100	77	30	36	2350	
37-575	125	120/208	3	460	3	174	150	76	35	44	2950	

NOTES: 1) Representative sampling only. 2) Non-standard I/O voltages available. 3) 50 Hz input models available.

SERIES 104

Model	Maximum Current	Approximate Dimensions W x D x H	Approximate Weight
104-6007-D	12	24 x 18 x 6	150
104-6015-D	25	18 x 18 x 30	205
104-6025-D	40	18 x 18 x 30	240
104-6040-D	60	18 x 18 x 30	290
104-6060-D	85	26 x 18 x 30	475
104-6100-D	130	26 x 18 x 30	635
104-6150-D	200	36 x 18 x 35	900
104-6250-D	340	36 x 23 x 45	1270



NOTES: 1) Representative sampling only.

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SI UNITS

RELATIVE QUANTITY SYMBOLS

≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u, υ	ms^{-1}	—	distance/time
velocity, angular	ω	second^{-1}	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

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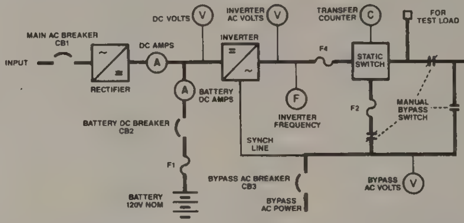
Key source for reliable magnetic components, power supplies and control systems for over 40 years.

500VA TO 20KVA POWER PROTECTION SYSTEMS

Also see our catalog pages under DC POWER SUPPLIES and TRANSFORMERS.

HD SERIES — UNINTERRUPTIBLE POWER SYSTEMS



STANDARD HD SERIES UPS, 120V, SINGLE PHASE, 60Hz, TWO-WIRE OUTPUT									
Continuous Output (KVA)	Part Number	Input Voltage 3Ph, 3W	Maximum Input* (Amperes)	Inverter Input Volts DC Nominal	Continuous Output (Amperes)	System Full Load Efficiency	Nominal Battery Discharge Constant** (KW)	Dimensions (inches) H x W x D	Approx. Shipping Weight (lbs)
5	BA0277-00	480V	11	120V	41 6	80%	4.81	68 46 30	1,125
5	BA0277-00	208V	26	120V	41 6	80%	4.81	68 46 30	1,125
7.5	BA0278-00	480V	17	120V	62.5	80%	7.22	68 46 30	1,275
7.5	BA0278-00	208V	38	120V	62.5	80%	7.22	68 46 30	1,275
10	BA0279-00	480V	22	120V	83.3	80%	9.60	68 46 30	1,425
10	BA0279-00	208V	51	120V	83.3	80%	9.60	68 46 30	1,425
15	BA0280-00	480V	33	120V	125 0	80%	14.21	68 46 30	1,750
20	BA0281-00	480V	44	120V	166.6	80%	18.94	68 46 30	2,175

**Includes battery-charging requirements and 125% overload capacity with 0.8 power factor load.*
***Nominal with ac load at 0.8 power factor for 120Vdc nominal inverter input.*

The ultimate in line conditioning equipment for heavy duty use in industrial applications, the Hitran HD Series UPS eliminates power outages, line interruptions, brownouts and short term transients such as line spikes and sags. It protects the load against line disturbances resulting from switching in the transmission system, clearing of line faults, starting of motor loads and even lightning strikes.

The Hitran HD Series is intended for critical process and/or manufacturing control computer installations which cannot tolerate power interruption either in an emergency or even for normal maintenance of the UPS or batteries.

Every effort has been made to build a family of systems which offer the highest levels of reliability and, at the same time, are safe and easy to test, service, and maintain without ever disrupting power to the critical load.

Hitran HD series uninterruptible power systems are three phase input/single phase output. They are intended for 120V, 60Hz loads with either sinusoidal or nonsinusoidal current wave form characteristics and excessive surge current requirements.

Electrical Characteristics & System Requirements

Rectifier/Battery Charger

- Input Voltage Variations: ±10%
- Input Frequency: ±5%
- Transient Protection: As high as 4000V for 10 microseconds with 40 ohms or greater transient source impedance.
- Walk-in: 3 seconds from zero to full load.

Inverter

- Overload Design Capability: 125% of full load current for 10 minutes; 150% for 30 seconds; 200% for 0.1 seconds.
- Output Voltage Regulation: ±3% of output voltage steady state for line, load and temperature.
- Output Voltage Transient Response and Recovery: Less than ±15% with recovery to ±3% within 5 cycles
- Output Harmonic Distortion: <5%
- Output Power Rating: Rated KVA from 0.8 lag to 0.8 lead power factor range.
- Frequency Stability: 0.25%
- Output Frequency Regulation: 1.0%

Static Transfer Switch

- No-break forward or reverse transfer capability in less than ¼ cycle

Manual Maintenance Bypass Switch

- Manual, no-break, forward and reverse transfer capability
- Isolates the static switch and inverter from the bypass line and load

Test Load Terminals

- For testing all functions of inverter without interrupting output

Noise Level

Less than 65dBA sound power level at a distance of five feet from enclosure

Ventilation

Natural convection

Control Panel—Status/Alarm/Command

The control panel shows the complete status of the system at a glance via:

- LED indicators for circuit status of all major system operating parameters
- Digital panel meters for critical voltages, amperages and frequencies
- LED alarm indicators for all critical system conditions. Alarms are also audible and can be connected to remote annunciators via a terminal block.

Commands may be entered through the control panel to transfer load to bypass or inverter, cancel and reset audible alarms, reset inverter, test indicator LEDs and to reset the transfer counter display. For security, load transfer commands may be disabled by an internal switch.

System Options

- Remote status alarm panel
- Special input/output voltages

Batteries, Racks & Accessories

Twenty-year lead-calcium batteries are normally supplied mounted in a separate two-tier steel rack. Other battery types are available on request.

Designs and specifications subject to change without notice.

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Also see our catalog pages under DC POWER SUPPLIES and TRANSFORMERS.

SFR SERIES — SINUSOIDAL FERRORESONANT REGULATOR

The SFR provides low distortion, sinusoidal, computer grade power. It provides a high degree of electrical noise rejection as well as output voltage regulation. Designed to eliminate power line problems caused by brownouts, short term transients and electrical noise, the SFR protects against switching disturbances, clearing of line faults, starting of motor loads and lightning strikes.

Standard Features

- Computer grade sinusoidal output - less than 5% harmonic distortion.
- Electrical noise rejection - Common Mode: greater than 120dB, 1 KHz to 1MHz. - Transverse Mode: greater than 60dB, 10KHz to 1MHz.
- Wide input voltage range - +10%, −20% of nominal input
- Tightly regulated output - ±1% of nominal output voltage.
- Input to Output Coupling Capacitance - Less than 0.005pF.
- Operating Temperature - 0-50°C.

Electrical Specifications

Input

- Nominal Standard Voltages - 1ϕ: 120, 208, 240, 480 (+10, −20%)
- Frequency - 60Hz or 50Hz ±2Hz.

Output

- 1ϕ - 120/240V ±1%
- Frequency - Same as Input.
- Regulation - Static: ±1%; Dynamic: ±4% with recovery to ±1% in 50ms.
- Load PF - 0.8 lagging
- Overload Recovery - Automatic within 50ms.
- Ride Through - Continuous power during line outages lasting as long as 25ms (1.5 cycles).
- Protection - Self current limiting
- Efficiency - Greater than 90%

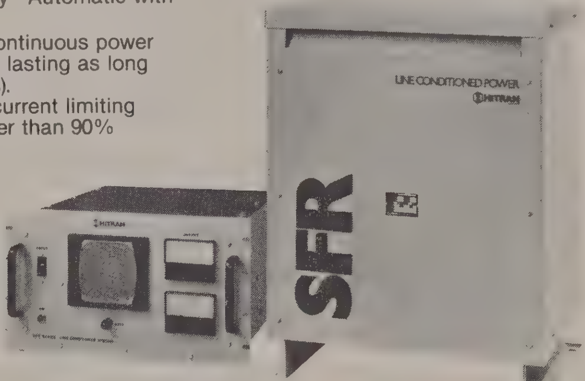
Complete Line Conditioner Systems

The SFR Series is also available as a Complete Line Conditioner System. It includes all the standard features listed plus the following accessories:

- *Output Ammeter and Voltmeter*
- *Input Circuit Breaker*
- *Input Power "ON" Indicating Light*
- *Output Fusing and Receptacles*
- *Input Receptacles or Line Cord*
- *19-inch Rack Mount or Free-Standing Assembly*

SFR SERIES – SINGLE PHASE	60 Hz • 600V CLASS • 220°C INSULATION CLASS • NEMA I ENCLOSURE					
	KVA	DIMENSIONS IN INCHES* H	W	D	APPROX. WT. LBS.	TYPE MOUNTING
	0.5	22	18	17	75	Floor/Wall
	1	22	18	17	100	Floor/Wall
	2	22	18	17	160	Floor/Wall
	3	33	24	20	225	Floor (W)
	5	33	24	20	350	Floor (W)
	7.5	33	24	20	490	Floor (W)
	10	43	36	26	600	Floor
	15	43	36	26	815	Floor
	20	43	36	26	1070	Floor

(W) Wall mounting brackets available.



SFR Series

UIS SERIES — ULTIMATE ISOLATION SYSTEM

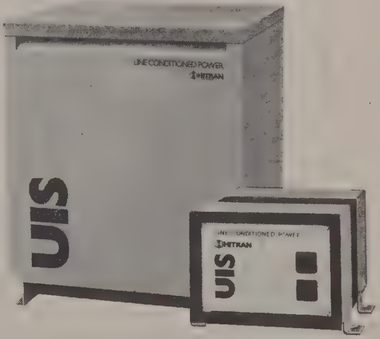
The UIS effectively eliminates common-mode and transverse-mode power line noise in transformer applications for computers, programmable controllers and sensitive instruments.

Standard Features

- High degree of electrical noise rejection,- Common-mode: greater than 140dB, 1KHz to 1Mhz; Transverse-mode: greater than 60db, 10KHz to 1MHz.
- Input to output capacitance coupling - 0.001pF
- DC insulation resistance - 10,000MΩ
- Dielectric strength - 4000Vac min.
- Operating Temperature - 0-50°C
- Efficiency - 97% min. at full load.
- Line Cord & Output Receptacles - Standard on 120V single phase models up through 2.4KVA.

Electrical Specifications

	KVA	INPUT (V)	Hz	OUTPUT (V)
1ϕ	0.5-2.4	120	50/60	120
	2.5	120/208-240	50/60	120/240
	5-20	120/208-240 or-480	60	120/240
3ϕ	3	208Y/120	60	208Y/120
	7.5	208Δ or 240Δ	60	208Y/120
	15 & 22.5	208Δ, 240Δ, or 480Δ	60	208Y/120
	30-150	208-240/480Δ	60	208Y/120 or 480Y/277



UIS Series

UIS SERIES – SINGLE PHASE	50/60 Hz • 600V CLASS • 220°C INSULATION CLASS • NEMA I ENCLOSURE					
	KVA	DIMENSIONS IN INCHES* H	W	D	APPROX. WT. LBS.	TYPE MOUNTING
	0.5	4.9	7.2	9.5	25	Floor/Wall
	1	6.8	9	10.2	40	Floor/Wall
	2.4	6.8	9	12.8	60	Floor/Wall
	2.5	6.8	9	12.8	60	Floor/Wall
	5	9.2	12	15	90	Floor/Wall
	7 5	9 2	12	15	145	Floor/Wall
	10	13	14	20	235	Floor/Wall
	15	13	14	22	280	Floor/Wall
	20	13	14	24	355	Floor/Wall

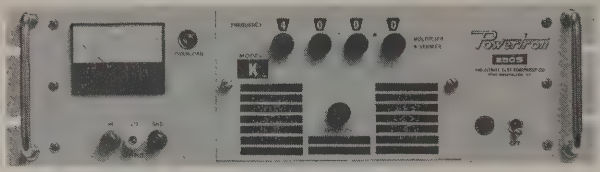
*Dimensions listed are not to be used for construction purposes.

UIS SERIES – THREE PHASE	60 Hz • 600V CLASS • 220°C INSULATION CLASS • NEMA I ENCLOSURE					
	KVA	DIMENSIONS IN INCHES* H	W	D	APPROX. WT. LBS.	TYPE MOUNTING
	3	9.2	39	10 2	140	Floor
	7.5	9.2	39	12.2	205	Floor
	15	9.2	39	14.8	300	Floor
	22.5	36	28	18	470	Floor
	30	36	28	18	825	Floor
	45	43	32	26	1000	Floor
	60	43	32	26	1200	Floor
	75	48	36	30	1600	Floor
	100	48	48	32	1900	Floor
	130	60	54	40	2400	Floor
	150	60	54	40	2700	Floor

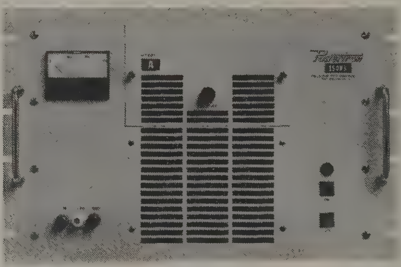
362 Highway 31 • Flemington, New Jersey 08822 • Tel: 908/782-5525 • Fax: 908/782-9733

INDUSTRIAL TEST EQUIPMENT COMPANY, INC.

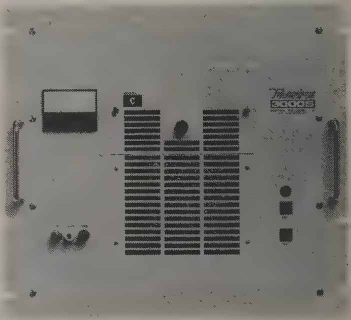
Powertron® 10-100,000 Hz AC Voltage Sources



5.25"



12.25"



17.5"

GENERAL SPECIFICATIONS:

(request catalog for complete specifications)

(linear circuitry)
stackable for
2 0r 3 phase use

Output : Fully isolated by transformer

Distortion: 0.5% typical

Load Regulation: Adjustable to perfect

Line Regulation: 0.1%

External signal and synch inputs provided

Input Power: 120V/240V single phase or 3 phase 208V/480V

MODEL	WATTS	RACK HT.	FREQUENCY	VOLTAGE RANGES (Zero to:)
80S	80	5.25"	20-20,000 Hz	17, 30, 65, 130, & 260
250S	250	5.25"	20-20,000 Hz	17, 30, 65, 130, & 260
250HF	250	5.25"	10-100,000 Hz	21, & 130
500S	500	5.25"	45-5,000 Hz	17, 30, 65, 130, & 260
1500S	1,250	12.25"	45-3,500 Hz	65, 130, 260 & 300
3000S	3,000	17.50"	45-2,500 Hz	65, 130, 260 & 300
3000HF	3,000	17.50"	350-25,000 Hz	130, 260

*0-480 volt and 0-600 volt built-in output transformers available

THE "STANDARD" OF THE INDUSTRY SINCE 1929

CONSULT FACTORY FOR SELECTION OF OSCILLATORS

21 YENNICOCK AVENUE, PORT WASHINGTON, NY 11050 • (516) 883-1700 • 1-800-548-0904 • FAX (516) 883-7155

INDUSTRIAL TEST EQUIPMENT COMPANY, INC.

Powertron® AC Current Sources

Constant Current AC Supplies

In addition to constant voltage amplifiers a full line of constant current amplifiers is available. The inherent ability of these amplifiers to maintain a preset current through a load whose impedance may vary makes them ideally suited tot he testing of ammeters, wattmeters, relays circuit breakers, current transformers, and other current sensitive devices. These amplifiers may be driven by the plug-in oscillators. All amplifiers are protected for open load circuit conditions.

GENERAL SPECIFICATIONS:

Output Frequency: Determined by plug-in oscillator.

Current Regulation: ± 1% for loads ranging from short circuit to maximum rate load impedance for the respective amplifier.

Output Distortion: Less than 1%

Constant current amplifiers may be used with similar outputs in parallel when it is desired to increase the current capacity. Constant current supplies may also be used for 3ϕ wye connected load applications. As the standard output transformers may not always provide the optimum current range and compliance voltage, special output transformers may be supplied to meet user requirements.

MODEL	CURRENT AMPS	NUMBER OF RANGES	COMPLIANCE VOLTS
250S-1-CR	0–15	five	7.0
500S-1-CR	0–3	five	7.0
1000S-1-CR	0–8	three	50.0
3000S-1-CR	0–24	three	50.0
250S-1-CRH	0–200	four	0.5
1000S-1-CRH	0–400	four	1.0
3000S-1-CRH	0–1000	one	1.2

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CONSULT FACTORY FOR SELECTION OF OSCILLATORS

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INDUSTRIAL TEST EQUIPMENT COMPANY, INC.

Powertron® Sine Wave Power Supply

POWER
Powertron 5900
INDUSTRIAL TEST EQUIPMENT
POWER OSCILLATOR
OUTPUT
FREQUENCY
AMPLITUDE
RANGE
ADJUST

Model 5900 Portable

GENERAL SPECIFICATIONS

Output:	Low Range	0 to 8.5 V @ 8.2 A
	Middle Range	0 to 38 V @ 1.8 A
	High Range	0 to 130 V @ .53 A
Power:	Max	70 VA
	Continuous	50 VA
Frequency:	Low Range	45 to 2 KHz
	Middle Range	2K to 19.99 KHz
	Also available with fixed frequency output.	
Distortion		0.3% typ.
Power Requirements		120 V 50 to 400Hz
Dimensions (inches)		12-1/4 x 5-1/4 x 12-1/2
Weight		23 lbs.

Available on Special Order

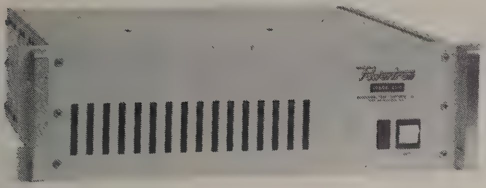
- With Fixed Frequency
- With 260 V Output

Available in 10 and 20 Watt versions.

21 YENNICOCK AVENUE, PORT WASHINGTON, NY 11050 • (516) 883-1700 • 1-800-548-0904 • FAX (516) 883-7155

INDUSTRIAL TEST EQUIPMENT COMPANY, INC.

Powertron® Frequency Converters



Convert the AC line frequency to other frequencies for aviation and foreign equipment power.

GENERAL SPECIFICATIONS:

Input power	115/230 V @ 50 Hz, 60 Hz, or 400 Hz
Distortion	Less than 1%
Output Voltage	Adjustable 110 – 130 V AC 220 – 260 V AC on request
Protection	Short Circuit, overheat

MODEL #	INPUT POWER
80C–*	120 or 240 Volts 50, 60 or 400 Hz Single Phase
250C–*	
500C–*	
1000C–*	
1500C–*	3 Phase 208 VOLTS 50 or 60 Hz
2000C–*	
3000C–*	

The model # designates the output watts. The " * " designates the output frequency. (The "C" signifies "converter".)

For example, model # 250C-400 is a converter with a 250 watt, 400 Hz output.

THE "STANDARD" OF THE INDUSTRY SINCE 1929

21 YENNICOCK AVENUE, PORT WASHINGTON, NY 11050 • (516) 883-1700 • 1-800-548-0904 • FAX (516) 883-7155

INSTRUMENTATION & CONTROL SYSTEMS, INC. **ICS**

INSTRUMENTATION & CONTROL SYSTEMS, INC.
520 Interstate Rd. Addison, IL 60101
Phone 708-543-6200 FAX 708-543-6244

UPS

All *ICS* - Built Power Systems are Made in The United States of America

ELECTRO-PAC®

Uninterruptible Power Systems

Continuous Regulated AC Power

ELECTRO-PAC Series E power systems are reliable, ferroresonant designs providing true uninterruptible AC power for critical control and communication applications. The system consists of an electronically regulated battery charger, sine wave inverter, a fast acting static power switch and a storage battery bank. The Series E system protects against outages and blackouts; voltage sags, surges, spikes and transients; electrical noise; frequency deviation and wave form distortion. The design also provides inherent protection from momentary overloads and short circuits. A storage battery bank is specified to match the back-up time required by the application.

Quality Features

- *Pure sine wave output.*
- *Regulates, filters & conditions power . . . continuously.*
- *Standard capacities 1 - 20 kVA.*
- *Regulation ±2%.*
- *Up to 85% inverter efficiency.*
- *High output battery charger.*
- *Soft-start charger circuitry.*
- *Overload and short circuit protected.*
- *High quality meters.*
- *Input circuit breakers.*
- *Seven operation indicator lights.*
- *Five alarm contacts.*
- *Full accessibility for service.*
- *Reliable convection cooling.*
- *Class H insulation on magnetics.*

SPECIFICATIONS: E Series Conventional UPS

Power Rating	OUTPUT (1 Ø)		INPUT			Approx. Weight (Lbs.)	Size (Inches) H x W x D	UPS Model Number
	Voltage AC①	Current Full Load	Battery Voltage②	Line Voltage	Phase			
5.0 kVA	120	42 AMPS	120	240	1	1,400	75 X 36 X 30	UP5.0E120-3-1-CDLTW
7.5 kVA	120	63 AMPS	120	240	1	1,750	75 X 36 X 30	UP7.5E120-3-1-CDLTW
10 kVA	120	83 AMPS	120	240	3	2,150	75 X 48 X 30	UP10.0E120-5-1-CDLTW
15 kVA	120	125 AMPS	120	240	3	2,900	75 X 66 X 30	UP15.0E120-5-1-CDLTW
20 kVA	120	167 AMPS	120	480	3	3,500	75 X 72 X 30	UP20.0E120-6-1-CDLTW

① All models also available with 240 Volt output. ② Battery back-up time specified by customer.

INSTRUMENTATION & CONTROL SYSTEMS, INC. ICS

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520 Interstate Rd. Addison, IL 60101
Phone 708-543-6200 FAX 708-543-6244

UPS

All *ICS* - Built Power Systems are Made in The United States of America

Lifeline® Uninterruptible Power

Always on-line with regulated, clean power.

LIFELINE® UPS Systems provide economical, no-break AC power, offering protection from power outages, line noise and voltage fluctuations which cause data losses. Applications include uninterruptible power for micocomputers, communications systems, security systems. UL Listing to UL1481 standard & UTRZ listing category applied for. This listing refers to a 600VA UPS with four hours back-up time.

Power Conditioner built-in.

LIFELINE delivers filtered, conditioned, regulated AC sine wave all the time, not just when the utility power is out. Patented circuit gives you full featured UPS at an affordable price.

Quality Features

- *Instant response. No power break.*
- *Up to 90% efficiency.*
- *Capacities from 200 VA or 600 VA.*
- *Maintenance-Free internal battery.*
- *Operates from standard office outlets.*
- *Illuminated status indicators.*
- *Input Voltage: 120 VAC, +10%, -15%, 60 Hz.*
- *Output Voltage: 120 VAC, ±3%, 60 Hz.*

Additional hours of run time can be achieved with external batteries, and/or chargers.

Power Rating	OUTPUT				INPUT		Approx. Weight (Lbs.)	Size (Inches) H x W x D	UPS Model Number
	Voltage AC	Current Full Load	Battery Back-Up Time①	Battery Voltage	Line Voltage	Phase			
LIFELINE® I and II On-line UPS, Sine wave output. *U.S. Patents 3,229,111 & 3,991,319.*									
200 VA	120	1.6 AMPS	7 Min.	12	120	1	62	20 X 16 X 6.5	M95-200
600 VA	120	5.0	15	48	120	1	140	24 X 20 X11.5	M95-600

① At full load, Unity Power Factor (200W, 600W)

INVERTERS

Sinewave, solid state control circuitry, special design to assure excellent regulation, low harmonics, line synchronization. Available with optional electromechanical or static transfer switch.

STATIC TRANSFER SWITCHES

Designed to automatically transfer the load to the secondary power source within 4 ms of the primary power source failure. Manual by-pass switch and output voltage regulator available. 0.5 kVA to 20 kVA.

DISTRIBUTED PRODUCTS/ON-LINE UNINTERRUPTIBLE POWER SYSTEMS

	INPUT		OUT PUT			INTERNAL BATTERY
POWER RATINGS	VOLTAGE	FREQ.	VOLTAGE	FREQ.	(RMS) CURRENT	BACK-UP FULL LOAD
500 VA, 750 VA, 1000 VA Ⓐ⑦	120, 1Ø	60/50 HZ ①	120, 1Ø ④	60/50 HZ ②	4.2 A, 6.3 A, 8.3 A	10 MIN ③
2 KVA, 3 KVA, 5 KVA Ⓑ⑤⑦	120 208/240, 1Ø	60/50 HZ	120 ④ 208, 240 1Ø	60/50 HZ ②	16.7 A, 25 A, 41.7 A	10 MIN ③
7.5 KVA, 10 KVA, 15 KVA	208/240V, 1∅	60/50 HZ	208/120V 1∅ ④ 240/120V 1∅	60/50 HZ	36A, 48A, 72A	10 MIN③
10 KVA, 15 KVA, 20 KVA 30 KVA, 50 KVA, 75 KVA	208, 3∅ 480, 600, 3∅ OPTIONAL	50/60 HZ	208, 120, 3∅	50/60 HZ	28A, 42A, 56A	BATTERY CABINET

Ⓐ 14.5" H x 7" x 20" D 48-64 LBS.
29.5" H X 15.0" W X 27.6" D 452 LBS.
Ⓑ 22.8" H x 9.8" W x 22.8" D 187 LBS, 27.6" H x 11.6" W x 27.6" D 264 LBS,
① 47.5-63 HZ
② JUMPER SELECTABLE
③ ADDITIONAL BACK-UP TIME AVAILABLE; MAINTENANCE FREE BATTERIES
④ WAVEFORM: SINEWAVE, PWM, LESS THAN 3% THD
⑤ AS/400® INTERFACE; RS 232, ASCII OPTIONAL
⑥ EXTERNAL BATTERY CABINET
⑦ UL LISTED, IEEE 587, FCC CLASS A.

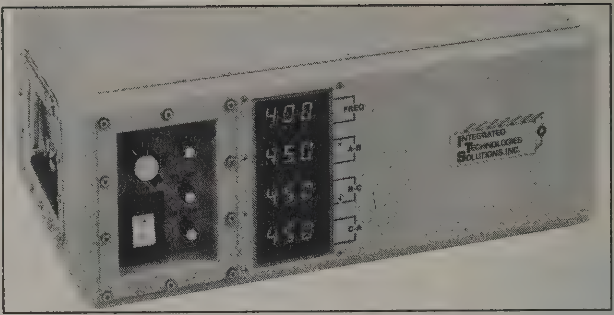
IPDS* Series 3000 Programmable AC Voltage and Current Sources

General Specifications:

- Linear design with high frequency response
- GPIB 488/RS232 control talker/listener
- Data Acquisition provides feedback
- LED Meters for frequency, voltage and phase
- Remote and local control
- Frequency accuracy 50 PPM
- Frequency range 20–25000Hz
- Harmonic distortion 0.5% typical
- Frequency and voltage sweep capabilities
- Individual phase adjustment to .1 degree resolution/accuracy
- Load regulation .5% typical, with external adjustment to .1%
- Short circuit protection
- Thermal overheat automatic shut down

Options:

- Phase angle shift/sweep
- Various programmable wave shapes, arbitrary AC wave available
- Spikes, drop-out, transients and fault simulation capabilities
- Input power 120/220 VAC single or 208/380 VAC



AC VOLTAGE SOURCES

Model	Power	Ranges	n=# phases	Notes
IPDS-3050V-n	50VA	17, 30, 65, 130, 260	1–3	Consult factory for other ranges
IPDS-3100V-n	100VA	17, 30, 65, 130, 260	1–3	
IPDS-3250V-n	250VA	17, 30, 65, 130, 260	1–3	
IPDS-3500V-n	500VA	17, 30, 65, 130, 260	1–3	

Call for frequency converters

AC CURRENT SOURCES

Model	Power	Compliance	n=# phases	Notes
IPDS-3100C-n	100VA	7V	1–3	Consult factory for other ranges
IPDS-3250C-n	250VA	Please consult factory for other compliance requirements	1–3	
IPDS-3500C-n	500VA		1–3	

IPDS*-3300 Powerline Fault Simulator, Tester and Calibrator

Voltage and Frequency Monitor Tester (VFMT)

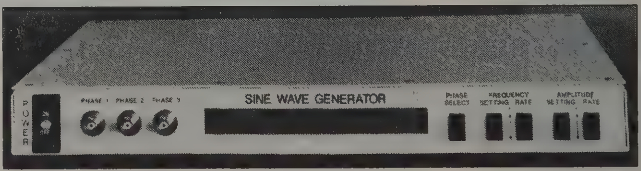
For testing and calibrating back-up AC power sources/generators. The user creates fault conditions on the input of the monitoring sensing device of the generator/AC source. The generator can be calibrated until it reacts properly to the fault condition.

Three phase, 600 VAC @ 100 MA power output line to line, 50–500 Hz, LED display for each phase and frequency. Overload, as well as thermal protection. The tester is a rugged, small unit (19" x 8" x 13") shipped in a water resistant carrying case with cables and manuals.

IPDS*-3010 Three Phase Programmable Sine Wave Generator

An IPDS-3000 controller packaged in a low profile 19" rack mount enclosure

- 1.75" x 19" x 12"
- Weight 8 lbs.
- IEEE488, RS232 and front panel control
- LCD display,
- Frequency range 20–25000Hz
- Frequency accuracy 50 PPM
- Selectable output voltage to 5VAC
- Distortion less than .01%



**** Intelligent Power Delivery Systems***

We offer expert custom design and engineering to handle your application. Inquiries are welcome.

INTEGRATED
TECHNOLOGIES
SOLUTIONS, INC.

262A Eastern Parkway
Farmingdale, NY 11735
Tel: (516) 420-9401
FAX: (516) 420-0453

IPDS*-2000 Series Multi-Phase Arbitrary DC and AC Power Source

A complete DC and AC modular power delivery system for a wide range of test applications.

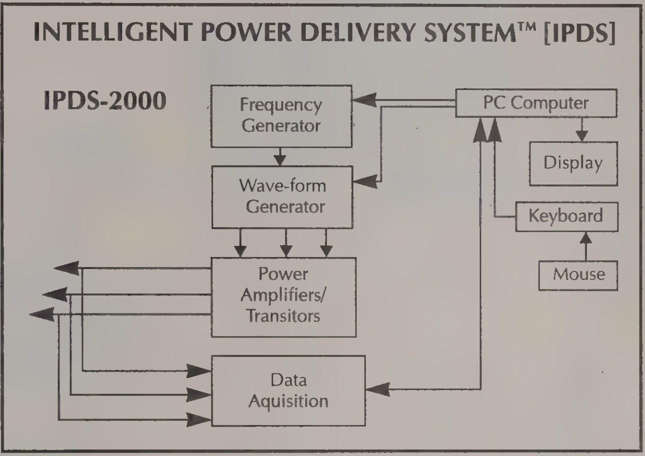
Use IPDS-2000 to load one of the pre-programmed test profiles from the Library (built into IPDS-2000), or create your own, with our easy to use editing tools. Then you can play the test profile to drive your Device Under Test (DUT) and read the test results on a color monitor.

The IPDS-2000 System is a source for:

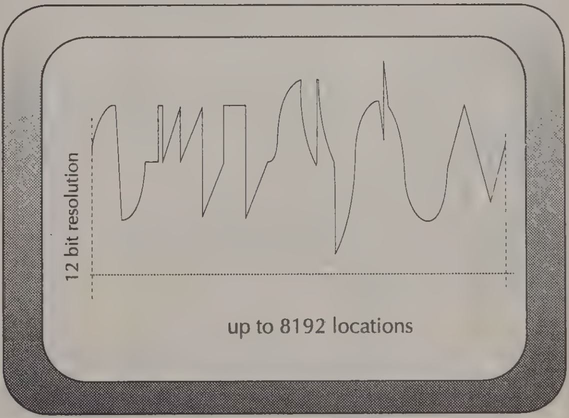
- Power source emulator/simulator DC as well as AC
- Harmonics generator
- Transient generator
- Audio/sonar simulator
- And much more...

General Specifications:

- PC platform with color graphics for edit and control
- Menu driven system with extensive capabilities for wave editing and control
- User friendly interface (windows/mouse)
- Library of test profiles
- GPIB/RS232 control
- External intervention and control via event's interrupt for start/stop
- Frequency and voltage sweep
- 12 bit data acquisition
- 12 bit resolution, 8192 locations wave-form generators
- Frequency range DC-500Khz


INTELLIGENT POWER DELIVERY SYSTEM™ [IPDS]
IPDS-2000
Frequency Generator
PC Computer
Display
Wave-form Generator
Keyboard
Mouse
Power Amplifiers/ Transitors
Data Aquisition

Send for demo diskette.


12 bit resolution
up to 8192 locations

The IPDS*-2000 series can be customized as turn-key Automated Test Equipment (ATE) to become a:

- Power supply tester
- Motor and drive tester
- Q.C. and Life Cycle tester
- Destructive tester
- Relay tester (see our ad)
- Gyro tester

IPDS-2000 SERIES: DC AND AC POWER OPTIONS

Model	Power	Ranges	n=# channels	Notes
IPDS-2050V-n	50VA	+/-50, 100	1–6	Consult factory for other ranges or more synchronized channels
IPDS-2100V-n	100VA	+/-50, 100	1–6	
IPDS-2250V-n	250VA	+/-50, 100	1–6	
IPDS-2500V-n	500VA	+/-50, 100	1–6	

Note: The linear amplifier output is DC coupled, providing a wide range of usage and frequencies.

** Intelligent Power Delivery Systems*

Call us with your requirements. We may have a solution that fits your needs.

INTEGRATED TECHNOLOGIES SOLUTIONS, INC.

262A Eastern Parkway
Farmingdale, NY 11735
Tel: (516) 420-9401
FAX: (516) 420-0453

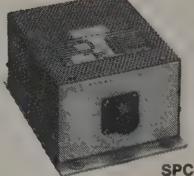
K.G.S.
electronics, inc.

kgs electronics A GAR Enterprises Co.

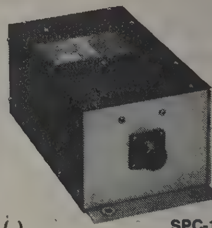
418-A E. Live Oak Avenue • Arcadia, CA 91006 USA • Telephone 818-574-1175 • FAX 818-574-0553

TSO'D 400 Hz STATIC INVERTER

The KGS ELECTRONIC'S static inverter utilizes solid state circuitry to convert 28 VDC to 115 VAC, 400 Hz sine wave power. Design features include sine to sine or square to sine wave power conversion permitting lightweight and reliable operation.



SPC-5 ( )



SPC-10 (F)

GENERAL SPECIFICATIONS

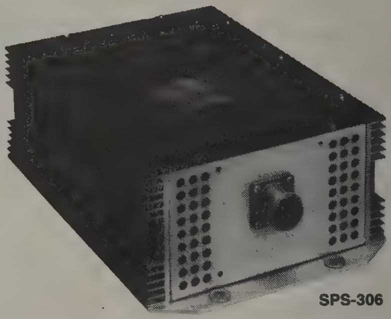
Input Voltage:	20 to 32 VDC
Output Voltage:	115 VAC and/or 26 VAC
Phase/Waveform:	Single/Sine Wave
Frequency:	400 Hz ± 1%
Ampl. Distortion:	Less than 7% (3% typical)
Power Factor:	0.8 to −0.95
Input Overvoltage:	Operates up to 37 VDC input while supplying full rated VA output power. Output voltage under this condition is 115 VAC +5%, −7%
Input Transient:	Withstands transients of 88 volts lasting 1 millisecond on the 28 VDC input line
Overload & Short-Circuit Protection:	Withstands transient damage or degradation load exceeding 150% of rated output to an output dead short. Inverter delivers rated output on removal of above condition
Altitude:	45,000 ft.
Temperature:	−65°F to +160°F (−55°C to +71°C)
Humidity:	Tested to greater than 95% for 10 days, temperature was cycled between 75°F to 160°F
Environmental:	Meets RTCA Paper DO-160 Env. Cat. D2BREXXXXSXBBBA

MODEL	OUTPUT VOLTAGE VAC/VAC	OUTPUT POWER VA 115/26/5	INPUT CURRENT ADC	EFFICIENCY PERCENT TYPICAL	FEATURES	WEIGHT LBS. (KG.)	SIZE (INCH) W x L x H
SPC-5( )	115/26	50/30	2.6	67 to 72	PWM to SINE	3.0 (1.3)	4.1 x 6.5 x 2.7
SPC-5(B)	115/26	50/30	2.7	67 to 72	Fault Monitor	3.1 (1.4)	4.1 x 6.5 x 2.7
SPC-10( )	115/26	100/60	4.8	75 to 78	PWM to SINE	5.2 (2.4)	4.5 x 8.3 x 3.5
SPC-10(F)	115/26	250/150	10.6	82 min.	Phase Lock	5.3 (2.3)	4.5 x 8.3 x 3.5
SPC-10(H)	115/26	350/150	16	80	PWM to SINE	5.5 (2.5)	4.5 x 8.3 x 3.5
SPC-30(A)	115/26	300/75	16	70	SINE to SINE	7.6 (3.5)	6.0 x 11.0 x 3.2
SPC-38(B)	115/26	375/75	16	84	PWM to SINE	8.0 (3.6)	6.0 x 11.0 x 3.2
SPC-60(A)	115/26	600/125	31	70	SINE to SINE	14.0 (6.4)	7.7 x 12.0 x 4.0
SPC-60(E)	115/26	750/150	38	70	SINE to SINE	14.2 (6.5)	7.7 x 12.0 x 4.0
SPC-75(B)	115/26/5	750/150/30	32	83	PWM to SINE	14.0 (6.4)	8.0 x 12.0 x 4.0
LC-1000	115/26	1000/150	42	85	PWM to SINE	12.5 (5.7)	8.0 x 12.0 x 4.0
SE25	115/200 3Ø	250	10.7	81	PWM to SINE	8.4 (3.8)	4.75 X 9.25 X 6.0

TSO'D 60 Hz/50 Hz STATIC INVERTER

These inverters are applicable as a source of 60 Hz power for the operation of Projectors, Tape Records, TV systems, Typewriters, on Aircraft that have a 28 Volt DC electrical system. For applications requiring greater power, these inverters can be paralleled for higher output.

Inverters available in various voltages, frequency and power are listed in the table below.



SPS-306

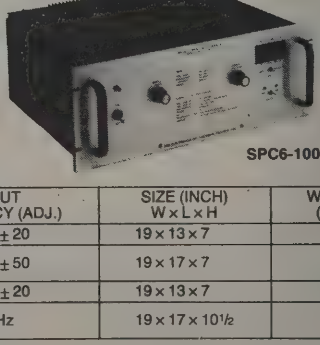
GENERAL SPECIFICATIONS

Input voltage:	1. 28 VDC ± 2 Volts, 14 VDC for SPS-316 2. Withstands 88 Volt Transient for 1 millisecond
Power Factor:	0.8 to 1.0
Amplitude Distortion:	Less than 7%
Wave Form:	Sine
Phase:	Single
Short-Circuit:	Withstand for 1 minute or longer
Temperature:	−65°F to +160°F (−55°C to +70°C)
Altitude:	45,000 ft.

MODEL	OUTPUT				INPUT		WEIGHT	SIZE (INCH)
	VOLTAGE	POWER VA	WAVESHAPE	FREQ. Hz	VOLTS	AMPS	LBS. (KG)	W x L x H
SPS-206	115 VAC	200	SINE	60 ± 1	28 VDC	10.5 DC	14.5 (6.6 Kg)	7¾ x 12 x 4
SPS-306B	115 VAC	375	SINE	60 ± 1	28 VDC	18.5 DC	18.0 (8.2 Kg)	7¾ x 12 x 4
SPS-3052	230 VAC	270	SINE	50 ± 1	28 VDC	15.8 DC	18.0 (8.2 Kg)	7¾ x 12 x 4
SPS-316	115 VAC	300	SINE	60 ± 1	14 VDC	32.0 DC	18.0 (8.2 Kg)	7¾ x 12 x 4
LS-1000	115 VAC	1000	SINE	60 ± 1	28 VDC	42.0 DC	11.0 (5.0 Kg)	8 x 12 x 4
SPS-750	115 VAC	750	CLIPPED SINE	60 ± 1	28 VDC	33.0 DC	21.0 (9.55 Kg)	7¾ x 14 x 4
SPS-1607	115 VAC	1200	CLIPPED SINE	60 ± 1	28 VDC	64.0 DC	25 (11.5 Kg)	7¾ x 14 x 4

FREQUENCY CHANGER
MODEL SPC-6-( ) SERIES 50 to 60 Hz to 400 Hz

KGS ELECTRONICS' solid state frequency changer converts 115 VAC 50 to 60 Hz to 115 VAC 400 Hz sine wave power. These frequency changers are suitable for use on test benches or labs to check radars, compasses, gyros, synchros, fuel flow gauges, etc. SPC-6-750 is single phase output. SPC-6-1000-3ϕ is three (3) phase output. Output is monitored via analog meter and is adjustable from 105 to 126 VAC line to neutral. Amplitude distortion is typically 2%.
For SPC-2250-3pH the input is 3 phase 47 to 440 Hz and the output is 3 Phase WYE 400 Hz fixed voltage and frequency.



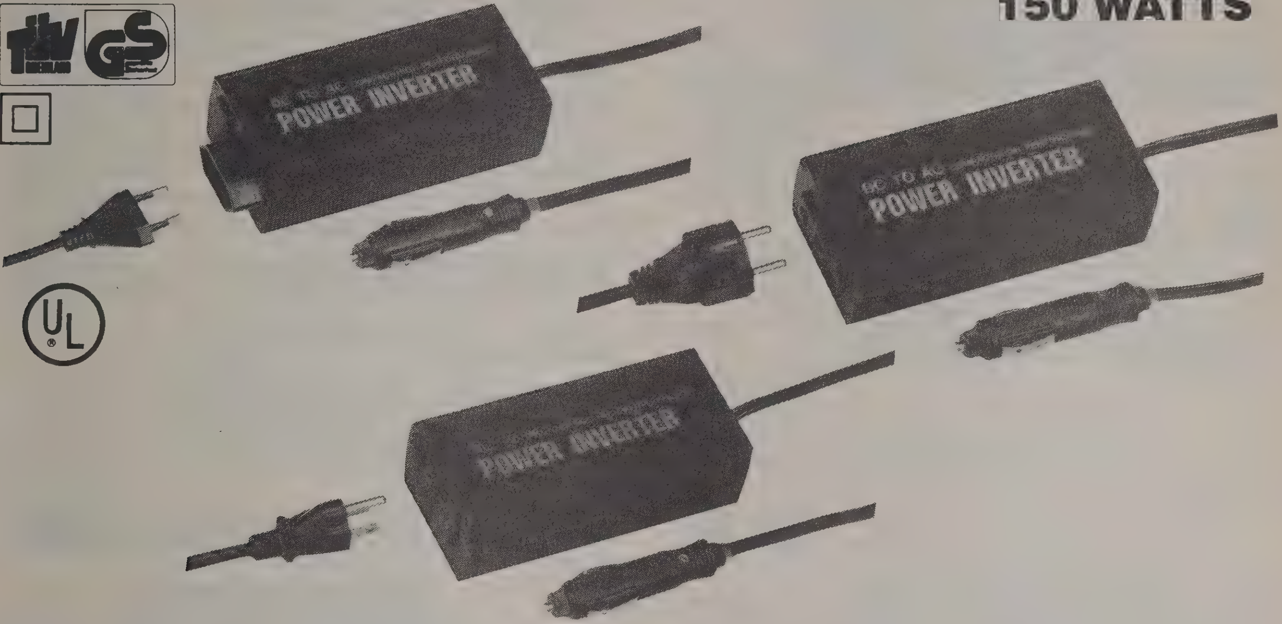
SPC6-1001

MODEL	*INPUT	OUTPUT OUTPUT VA	OUTPUT FREQUENCY (ADJ.)	SIZE (INCH) W x L x H	WEIGHT (LBS.)
*SPC-6-750A	115 VAC 50 to 60 Hz	115 VAC/750 VA, 26 VAC/500 VA	400 Hz ± 20	19 x 13 x 7	30
*SPC-6-1001	115 VAC 50 to 60 Hz	115 VAC/1000 VA, 26 VAC/250 VA (ADJ. 0–130 VAC)	400 Hz ± 50	19 x 17 x 7	34
*SPC-6-1000-3pH	115 VAC 50 to 60 Hz	120/208 L-L/1000 VA	400 Hz ± 20	19 x 13 x 7	36
SPC-2250-3pH	115/200 or 230/400 VAC 57 to 440 Hz	120/208 WYE/2250 VA	400 Hz	19 x 17 x 10½	71

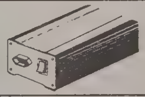
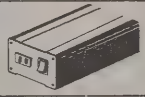
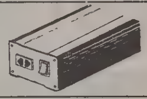
*For 115/230 VAC, 50/60 Hz DUAL INPUT MODEL, ADD SUFFIX TO "C". EXAMPLE SPC-6-750C.

PORTABLE INVERTERS DC TO AC OUTPUT

150 WATTS



MODEL LIST

MODEL NO.	SPECIFICATIONS			SAFETY	DIMEN. L x W x H	OUTPUT SOCKET TYPE
	INPUT	OUT. VOLT.	OUT. FREQ.			
LZINV150ET	12VDC	230 VAC	50HZ	TUV	154x73x42	
LZINV150ET2	24VDC	230 VAC	50HZ	TUV	154x73x42	
LZINV150UL	12VDC	115 VAC	60HZ	UL	154x73x42	
LZINV150UL2	24VDC	115 VAC	60HZ	UL	154x73x42	
LZINV150E	12VDC	230 VAC	50HZ	—	154x73x42	
LZINV150E2	24VDC	230 VAC	50HZ	—	154x73x42	

SPECIFICATION

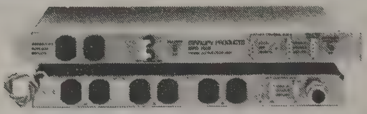
All Specifications Are At Nominal Line, Half Load And 25 Deg C Unless Otherwise Noted.

Description	12 VDC Input Models	24 VDC Input Models
Input Voltage	12 VDC	24 VDC
Input Voltage Range	10-15 VDC	20-28 VDC
Standby Input Current	0.24A	0.24A
Output Regulation	±10%	±10%
Output Freq., Accuracy	±5%...Max.	±5%...Max.
Output Waveform	Modified Sinewave	
Constant Output Power	150 VA	150 VA
Peak Output Power	200 VA (5 Minutes)	
Surge Output Power	400 VA	400 VA
Efficiency	90%	90%
Low Battery Alarm	10.8±0.5 VDC	21.5±0.8 VDC
Low Battery Shutdown	10±0.5 VDC	20±0.8 VDC
Thermal Protection	80±5 Deg C	
Overload Protection	Yes	
Short Circuit Protection	Yes	
Weight	Approx. 500 g	

LZRelectronics,inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301)921-9440 Fax (301)670-0436 **LZR**

COMPUTER POWER SOURCES

SINGLE PHASE POWER UNITS



MPD-100

- Rating is 120V 1ø 12A
- 8 Unswitched Outlets, 2 on Face & 6 on Rear
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

MPD-100-002

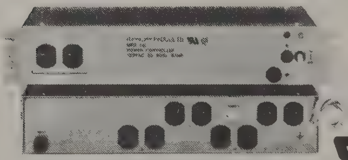
- Rating is 120V 1ø 16A
- 8 Unswitched Outlets, 2 on Face & 6 on Rear
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

MPD-100-003

- Rating is 120V 1ø 24A
- 8 Unswitched Outlets, 2 on Face & 6 on Rear
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

MPD-100R

- Rating is 120V 1ø 12A
- Remote On/Off Control
- 6 Switched Outlets on Rear for On/Off Control
- 2 Unswitched Outlets on Rear for Auxiliary Equipment
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

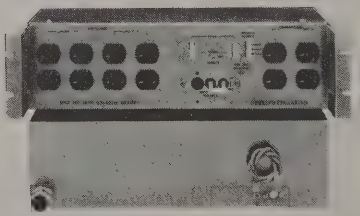


MPD-110

- Rating is 120V 1ø 15A
- 10 Unswitched Outlets, 2 on Face & 8 on Rear
- Size is 3 1/2 x 19 x 8 Inches Flush Mount

MPD-110R

- Rating is 120V 1ø 15A
- Remote On/Off Control
- 8 Switched Outlets on Rear for On/Off Control
- 2 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 3 1/2 x 19 x 8 Inches Flush Mount



MPD-115

- Rating is 120V 1ø 24A
- Remote On/Off Control
- 8 Switched Outlets on Face for On/Off Control
- 4 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 5 1/4 x 19 x 8 Inches Recessed

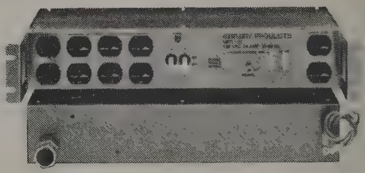
Power Protection, Distribution and Control For Rack Mount Systems

Marway provides a convenient solution for power to computer racks. The Marway power unit provides a single point of entry for AC power to the rack. EMI filtering, transient suppression and overload protection support the entire rack. Power distribution outlets furnish AC to each system component in the rack. As an option on many models, remote ON/OFF control allows system power up from a single system switch.

Warranty

Marway provides a 10-year limited warranty on all AC power distribution equipment, with a pass-through provision through the OEM to the end user.

SINGLE PHASE POWER UNITS

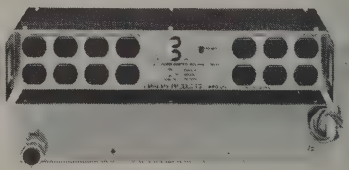


MPD-125

- Rating is 120V 1ø 24A
- Remote On/Off Control
- 8 Switched Outlets on Face for On/Off Control
- 2 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Recessed

MPD-125A

- Rating is 120V 1ø 12A
- Remote On/Off Control
- 8 Switched Outlets on Face for On/Off Control
- 2 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Recessed



MPD-250

- Rating is 240V 1ø 16A
- Remote On/Off Control
- 12 Switched Outlets on Face for On/Off Control
- 2 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Recessed

MARWAY

PRODUCTS INC.

FOR CONVENIENCE, MANY STANDARD MODELS ARE AVAILABLE FOR NEXT-DAY SHIPMENT TO ESTABLISHED CUSTOMERS.

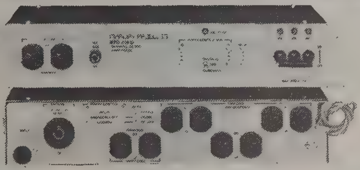
311 No. Clara Street, Santa Ana, CA 92703 **Call Toll Free: 1-800-4MARWAY** FAX: 714-973-2931 Phone: 714-973-1800

EMI FILTERING • TRANSIENT SUPPRESSION • OVERLOAD PROTECTION

Engineering To Unique Specifications

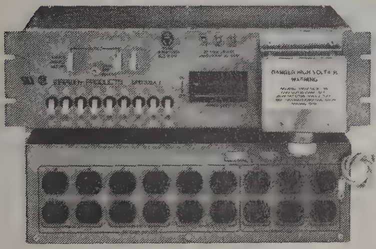
Marway will design and manufacture a power distribution model to OEM engineers' specifications. Or an OEM engineer can design and Marway will manufacture to OEM drawings and specifications. If desired, Marway can obtain UL, CSA or TUV approval for the model. Marway can generally design, manufacture, and obtain UL, CSA or TUV approval at appreciably less cost than an OEM, and in less time. To put Marway capability to work on your application, contact the factory and discuss specifications with a Marway engineer.

THREE PHASE POWER UNITS



MPD-208B

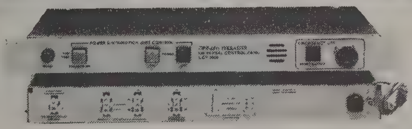
- Rating is 120/208V 3ø 12A/ø
- Remote On/Off Control
- 6 Switched 1ø Outlets on Rear for On/Off Control
- 4 Unswitched 1ø Outlets, 2 on Face and 2 on Rear, for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Flush Mount



MPD-208A

- Rating is 120/208V 3ø 24A/ø
- Remote On/Off Control
- 12 Switched 1ø Outlets on Rear for On/Off Control
- 6 Unswitched 1ø Outlets on Rear for Auxiliary Equipment
- Size is 5 1/4 x 19 x 8 Inches Flush Mount

UNIVERSAL CONTROL PANEL



UCP-3000 — COMPLETE POWER CONTROL FOR YOUR SYSTEM. Compatible with any Marway MPD power distribution unit which has the remote ON/OFF feature.

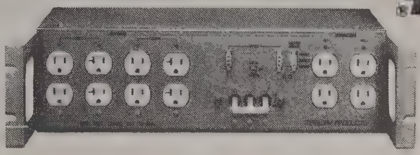
FUNCTIONS:
- System Power Breaker On indicator
- Control Panel Lamp/Alarm Horn Test
- Power ON/OFF Control & Indicator
- Emergency Power Off Control
- EPO Indication and Reset
- EPO Alarm Horn (Optional)

Catalog Available

Over 700 models of power distribution equipment have been designed and built by Marway Products. Some are shown here. Phone for our catalog .

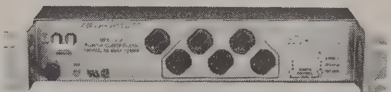
DEC COMPATIBLE SYSTEMS

Direct replacement for the DEC model. Complete mechanical, electrical and DEC bus control compatibility. All have remote ON/OFF Control.



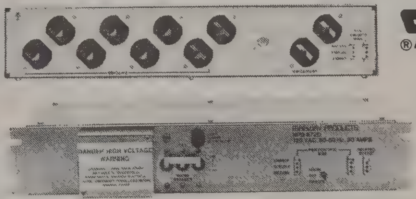
MPD-861C

- Rating is 120V 1ø 24A
- 8 Switched Outlets on Face for On/Off Control
- 4 Unswitched Outlets on Face for Auxiliary Equipment
- Size is 5 1/4 x 19 x 8 Inches Recessed



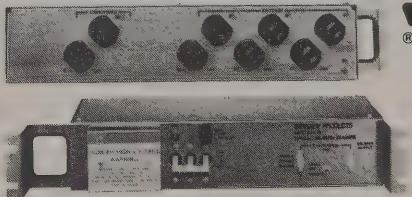
MPD-871A

- Rating is 120V 1ø 12A
- 5 Switched Outlets on Face for On/Off Control
- 1 Unswitched Outlet on Face for Auxiliary Equipment
- Size is 3 1/2 x 19 x 5 7/8 Inches Recessed



MPD-872C

- Rating is 240V 1ø 16A
- 8 Switched Outlets on Rear for On/Off Control
- 2 Unswitched Outlets on Rear for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Flush Mount



MPD-874D

- Rating is 120V 1ø 24A
- 6 Switched Outlets on Rear for On/Off Control
- 2 Unswitched Outlets on Rear for Auxiliary Equipment
- Size is 3 1/2 x 19 x 6 Inches Recessed

DEC is a trademark of Digital Equipment Corporation

SEE INTERNATIONAL MODELS ON NEXT PAGE.

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INTERNATIONAL POWER EQUIPMENT

Marway International Models

Shown on this page are several power distribution models Marway has designed for American OEM's marketing product internationally. Like other Marway models, these provide a single point of entry for AC power to the rack, and offer EMI filtering, transient suppression and overload protection for system components on the rack.

Computer Power Models

Most of the models here are rack mount in a standard 19 inch rack or cabinet. Most have IEC receptacles. All make provision for use of local power. All have TUV and some have other agency approvals as well. To accomodate local power, four of the models (MPD-100 IEC, MPD-100R IEC, MPD-110 IEC, and MPD-320) use for input a 16 amp power cord with an IEC connector on one end and a plug for the country of intended use on the other. For convenience Marway stocks such power cords for most European and Asian countries where American companies export.

INTERNATIONAL POWER DISTRIBUTION

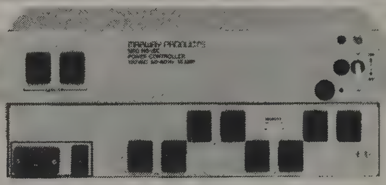
MPD-100 IEC

- Rating is 115 or 230V 1ø 16A
- 10 Unswitched IEC Outlets, 2 Face and 8 Rear
- IEC Input Receptacle on Rear
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

MPD-100R IEC

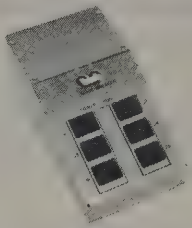
- Rating is 115 or 230V 1ø 16A
- Remote On/Off Control
- 8 Switched IEC Outlets on Rear for On/Off Control
- 2 Unswitched IEC Outlets on Face for Auxiliary Equipment
- IEC Input Receptacle on Rear
- Size is Convenient 1 3/4 x 19 x 8 Inches Flush Mount

INTERNATIONAL POWER DISTRIBUTION



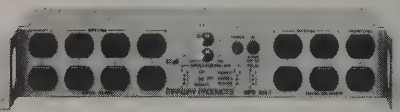
MPD-110 IEC

- Rating is 115 or 230V 1ø 12A
- 10 Unswitched IEC Outlets, 2 on Face and 8 on Rear
- IEC Input Receptacle on Rear
- Size is 3 1/2 x 19 x 8 Inches Flush Mount



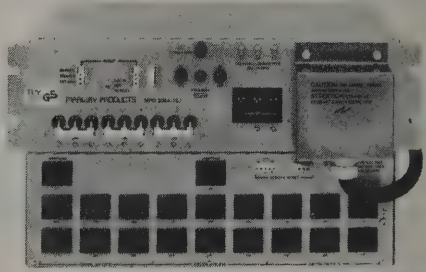
MPD-320

- Rating is 220V 1ø 12A
- 6 Unswitched IEC Outlets on Face
- IEC Input Receptacle may be on Top or Rear
- Size is 3 1/2 x 4 1/2 x 9 1/2 Inches Table Top or Flange Mount



MPD-250T

- Rating is 230V 1ø 16A
- Remote On/Off Control
- 12 Switched NEMA 6-20R Outlets on Face for On/Off Control
- 2 Unswitched NEMA 6-20R Outlets on Face for Auxiliary Equipment
- 15 Foot Power Cord with Non-Terminating End
- Size is 3 1/2 x 19 x 10 1/2 Inches Recessed



MPD-208A-107

- Rating is 220/380V 3ø 20A/ø
- Remote On/Off Control
- 18 Switched IEC Outlets on Rear for On/Off Control
- 2 Unswitched IEC Outlets on Rear for Auxiliary Equipment
- 10 Foot Power Cord with 3 ø International Plug, On Front
- Size is 5 1/4 x 19 x 8 Inches Flush Mount

SEE DOMESTIC MODELS ON PREVIOUS TWO PAGES.

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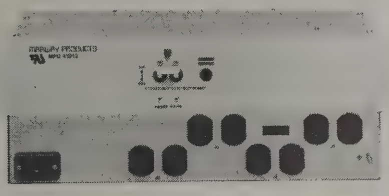
COMPUTER POWER SOURCES

TRANSFORM AND DISTRIBUTE POWER

The MPD-41912 transforms local AC power of 220 or 230 volts obtained on site in another country to 115 volt AC power suitable for use by typical American-made computer equipment, and distributes the power to components in the rack. The unit has an IEC input receptacle on the rear, and uses a 16 amp Marway power cord for input power, with an IEC connector on one end and the plug for the country of intended use on the other.

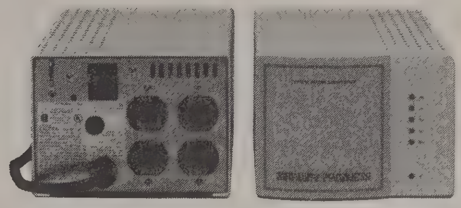


MPD-41912

- Rating is 230V 1ø Input with 115V 1ø Output at 16A
- 8 NEMA 5-15R Outlets on Rear
- IEC 320 Input Receptacle on Rear
- Size is 5 1/4 x 19 x 16 Inches Flush Mount

POWER CONDITIONING

Because power line brownouts can cause computer malfunction and are commonplace in some environments, Marway designed a line of power conditioning equipment. The models are aimed mainly at the power needs of personal computers. The power conditioning models offer EMI filtering, transient and surge protection, and overload protection as well as voltage regulation to automatically correct brownouts and overvoltages.



Model	Rating	Size	Agencies
MPC 600	120V1ø7A	5 x 7 x 9 in.	UL, CSA
MPC 600 IEC	230V1ø4A	5 x 7 x 9 in.	TUV
MPC 1250	120V1ø12A	5 x 7 x 9 in.	UL, CSA
MPC 1250 IEC	230V1ø8A	5 x 7 x 9 in.	TUV

RACKMOUNT UPS SYSTEMS

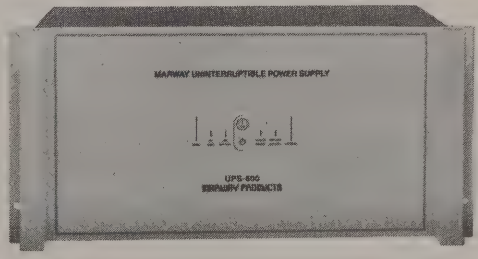
The UPS from Marway is a rack-mount uninterruptible power supply designed to keep a file server operating throughout a power failure of several minutes duration. The unit is recommended for file servers in racks and cabinets that operate outside of a computer room UPS system, and yet in an environment where power is sometimes erratic and computer data files must be protected. To avoid the expense of lost data, corrupted files, and possible damage to hardware just once in the life of a rack more than compensates for the cost of the UPS. In reality an unprotected rack is typically at risk several times a year, not once in the life of the rack.

Typical run-times of the UPS-600 and UPS-1250 at power failure vary with the file server hardware and the operating load of volts times amps drawn. The chart here may be helpful in making estimates.

FILE SERVER		UPS 600	UPS 1250
SYSTEM	LOAD (va)	TYPICAL RUN-TIMES in minutes	
Portable 386	75	113	250
IBM PS/2 30 monochrome	100	85	210
IBM PS/2 30w/VGA, SparcStation 1 w/mon.	150	55	160
PS/2 55sx w/VGA, SparcStation 1PC w/mon.	200	38	120
Compaq 386/25e w/VGA	250	26	90
Compaq 386/33 w/VGA	300	20	70
PS/2 80 server w/VGA	350	17	50
PS/2 95 server w/XGA	375	15	44
386/33 w/19" mon.	400	14	38
RS/6000 320 w/19" mon.	450	11	32
Compaq SystemPro	500	9	27
DECstation 5000	600	6	22
Two PS/2 80 file servers	700	—	17
IBM AS/400 mini	800	—	14
DEC MicroVax	900	—	12
HP 9000 834	1200	—	7

The UPS also contains power conditioning features. A power booster will boost power 12% if utility current is down 15-20%, to save the battery of the unit during brownouts and yet supply constant current. Thus, the operating time of the unit in an emergency can be extended providing longer holdup time when needed. Additionally, the UPS provides EMI filtering, transient and overload protection against noise, surges and spikes.

Two software packages may be used with the UPS to increase operator control over power to the rack. PowerChute Plus is available for Novell and Unix platforms, and PowerDoctor operates on DOS-based systems. Both provide automatic shutdown capabilities as well as diagnostic information about the power to the rack. In the event of a power failure and subsequent draining of the UPS batteries, the software will provide safe and automatic shutdown of the file server. Diagnostic information is routinely available through the software to aid in evaluating power quality to the rack. Both PowerChutes Plus and PowerDoctor software are available from Marway.



Model	Rating	Size (H x W x D)	Agencies
UPS 600	117V1ø7A	8.7 x 19 x 7.25 in.	UL, CSA
UPS 600 IEC	230V1ø3A	8.7 x 19 x 7.25 in.	TUV
UPS 1250	117V1ø14A	8.7 x 19 x 7.25 in.	UL, CSA
UPS 1250 IEC	230V1ø5A	8.7 x 19 x 7.25 in.	TUV
UPS 2000	117V1ø22A	18 x 19 x 7.25 in.	UL, CSA
UPS 2000 IEC	230V1ø12A	18 x 19 x 7.25 in.	TUV

MARWAY
PRODUCTS INC.

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MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

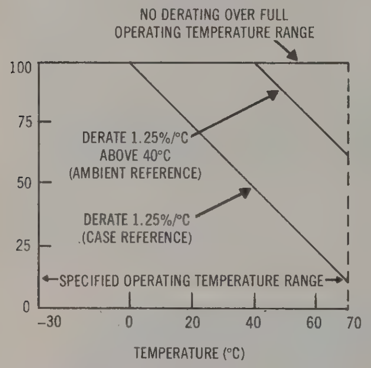


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

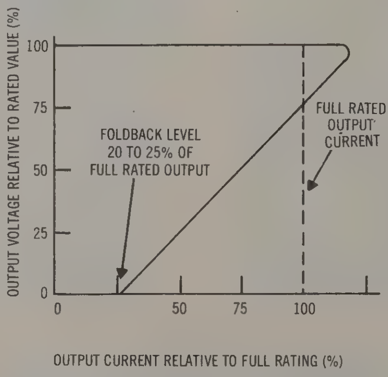


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

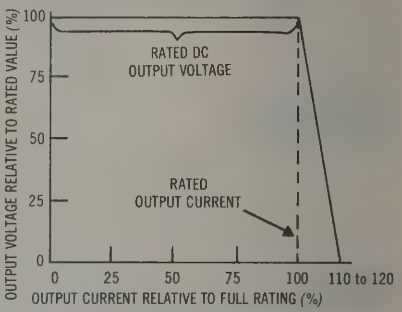


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

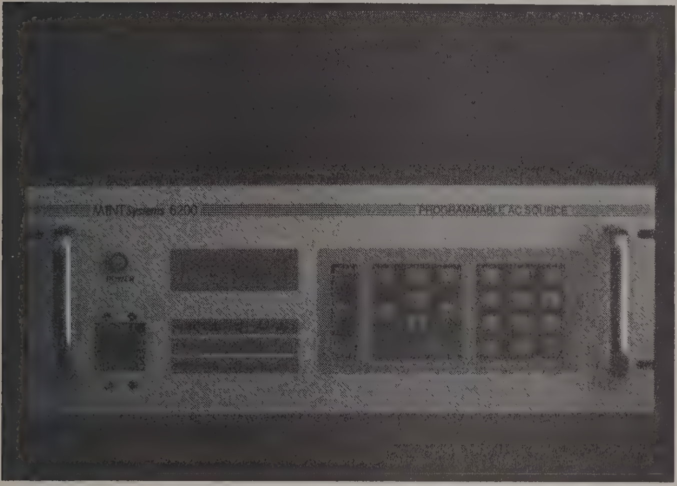
Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

MiNT Systems®

Designed for Versatility



Programmable AC Source

6200 SERIES

- **Smallest & lightest 2KVA Unit**
- **Advanced PWM & PFC electronics**
- **Automatic true RMS voltage and current measurement**
- **Unique self diagnostic routine protects against overload, overpower, and overtemperature**
- **IEEE-488 and Front Panel Keypad Interface**

Programming Functions

☑ Voltage Range
☑ Transition Phase
☑ Frequency
☑ Output Enable/Disable
☑ Voltage Ramping Up and Down
☑ Frequency Ramping Up and Down
☑ Repeated Sequence
☑ Cascade Sequence

Measurement Functions

☑ RMS Voltages
☑ RMS Current
☑ Peak Current
☑ Frequency
☑ Power
☑ Power Factor
☑ Crest Factor
☑ Surge Current

MiNT Systems 6220(2KVA) Specifications

OUTPUT RATINGS

Continuous Power: 2KVA
Number of Phases: 1
Voltage:
  Range: 0-140V/0-260V/Auto
  Accuracy: 0.2%
  Resolution: 0.1V
  Distortion: 0.3%
  Line Regulation: 0.02%
  Load Regulation: 0.02%
  Temp Coefficient: 0.02% per °C
Current: 20A/10A max.
Peak Current: 70A/35A min.
Frequency:
  Range: 45-500Hz
  Accuracy: 0.01%
  Resolution: 0.1Hz
Load Power Factor: 0 to 1 (lead or lag)
Efficiency: 80% min.

INPUT RATINGS

Voltage: 190-254V/95-120V/Custom
Frequency Range: 45-63Hz
Current: 14A max.

MEASUREMENT

Voltage
  Range: 0-140V/0-280V
  Accuracy (r.m.s.): 0.15% of FS
  Resolution: 0.1V
Current
  Range (r.m.s.): 0-70A
  Accuracy (r.m.s.): 0.2% of FS
  Resolution: 0.01A
Power Meter
  Accuracy: 1%
  Resolution: 0.1 Watt
Frequency Meter
  Range: 45-500Hz
  Accuracy: 0.01% + 1 count
  Resolution: 0.1Hz

GENERAL INFORMATION

Protection: OPP,OLP, OTP
Environment:
  Working: 5 to 40°C/10-90% RH
  Storage: -40 to 85°C/10-90% RH
Size: 19"(W) x 7"(H) x22"(D)
Weight: 50 lb.

Ordering Information

Model: MiNT Systems 6200 - Custom Programmable AC Source
MiNT Systems 6206 - 600VA with Low Noise transformer isolation
MiNT Systems 6210 - 1KVA AC Source
MiNT Systems 6215 - 1KVA with Low Noise transformer isolation
MiNT Systems 6220 - 2KVA AC Source
MiNT Systems 6225 - 2 to 6KVA AC Source with parallel and 3ø capability

Please see other MINT Systems' products in section 2900 on pages D•1300 - 1301 of this catalog.
To place an order or to obtain more information on any of our products
call (408) 262-7171 or fax (408) 262-5387

Modular iNstruments and Test Systems

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BERGENFIELD, NEW JERSEY 07621
FAX 201-385-0702

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UPS, INVERTERS, FREQUENCY CONVERTERS

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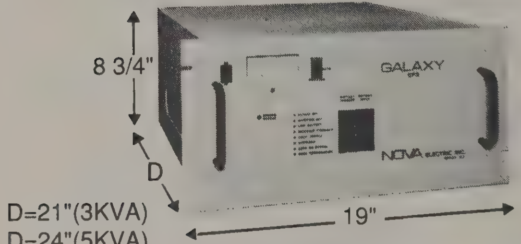
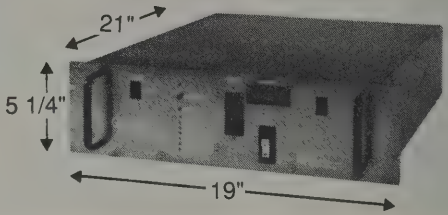
HIGH RELIABILITY RACK MOUNT ON-LINE UPS SYSTEMS

1KVA to 5KVA



3 & 5KVA UPS



1 to 2KVA UPS

COMPACT RACK-MOUNT SYSTEMS
- 3 & 5 KVA Units: 8 3/4" High
- 1, 1 1/2 & 2KVA Units: 5 1/4" High
- 1 & 1 1/2KVA Units include 10 minute battery back-up
- Additional battery packs in 5 1/4" or 7" High racks

NEW

RELIABLE
- MTBF: 40,000 Hrs
- MTTR: Less than 30 Minutes

TRANSFER SWITCHES
- Available with solid state 1/4 cycle transfer switch

MILITARY DESIGNS
- MIL-STD-810D
- MIL-STD-704
- MIL-STD-1399
- MIL-STD-461C for Class 4A Equipments
- EMP Protection
- Operate from field generators

OEM DESIGNS
- International models automatically accept common global voltages & frequencies
- Can fit in your computer cabinet
- Custom configurations

GALAXY™ UPS SYSTEMS HAVE BEEN SELECTED BY MAJOR DEFENSE CONTRACTORS AND OEM's FOR CRITICAL TACTICAL AND COMMERCIAL PROGRAMS

GALAXY™ CABINET MODEL UPS SYSTEMS

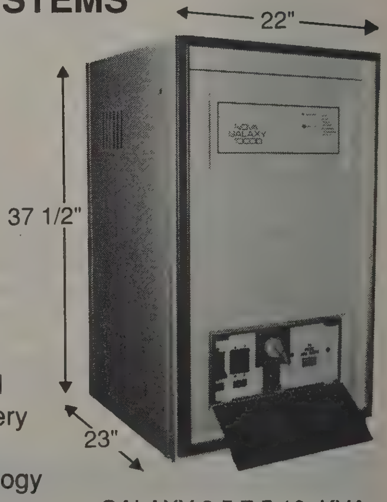
3KVA TO 10KVA

Galaxy UPS systems include all the features that usually cost you much more. NO SURPRISES!

Supply uninterrupted conditioned, transient-free power to computers, process control equipment, emergency lighting and communications systems.

Employ modern PWM transistor technology. Nova systems features high efficiency and quiet operation.

- No limit on back-up time
- Backed by world wide service
- Smallest 3-10KVA cabinet models available
- Cabinet models include up to 60 min. internal battery back-up
- Three phase input available
- Slide out draws available
- Small
- Casters
- Receptale panels
- Maintenance Bypass Switch
- Front access controls
- Up to 60 min. internal no maintenance battery system
- Proven PWM technology
- Up to 90% efficient



GALAXY 3,5,7.5,10, KVA

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UPS, INVERTERS,
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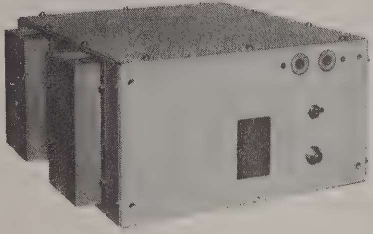
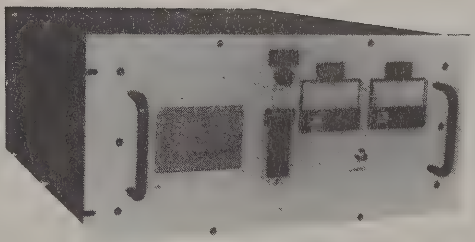
SOLID STATE SINE WAVE INVERTERS



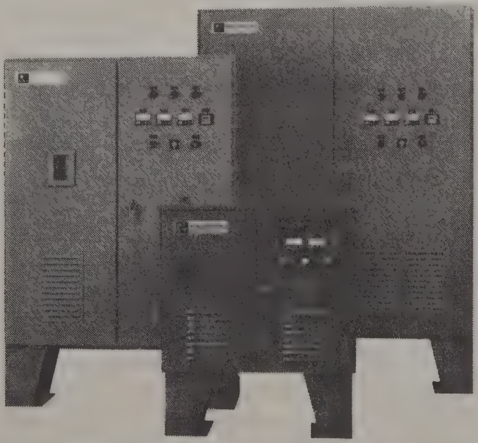
- Input from 10 VDC to 800 VDC
- Output power: 125VA to 90KVA
- 12 VDC inverters for mobile use
- 24 VDC inverters for communications and security systems
- 48 VDC inverters for TELECOMMUNICATIONS
  .5KVA to 3KVA
  Optional solid state transfer switch
- 125 VDC inverters for electric utilities
- 240 VDC inverters for steel mills
- 600 VDC inverters for rapid transit
- Rated for operation to 50°C.
- NEMA 12 enclosures available



1KVA to 5KVA

SOLID STATE SINE WAVE FREQUENCY CONVERTERS

- 50 Hz, 60 Hz, 400 Hz Output
- Single Phase from 125VA to 15KVA
- Three Phase from 5KVA to 120KVA
- 400 Hz systems for Aviation and Avionics
  - Up to 96% Efficiency
  - Self Diagnostics
  - Paralleling
- Rated for continuous operation at 100% loading
- Input Frequency Range 47-440 Hz
- Operate from field generators
- All output voltages in use anywhere in the world.



7.5KVA to 60KVA

High Performance AC Power Sources

PACIFIC
POWER SOURCE CORP.

AC to AC Converters for Power Test Applications, High Quality Laboratory Power, and Frequency Conversion

PAGE 1

- **Manual and Programmable AC Test Power up to 625kVA**
- **20 - 5000 Hertz Frequency Changers**
- **Power Supply Testing**
- **Facility Power Frequency Conversion**

Product Line Overview -- Pacific Power Equipment covers the range from 250VA to 625kVA. All of Pacific's products feature excellent load regulation, fast response to load transients and very low waveform distortion. The benefit of this performance is the ability to supply high quality power to loads that utilize high frequency switching regulators or multiple pulse rectification. Pacific equipment is unconditionally stable into any power factor load. Each phase is independently regulated and has no load balance restrictions.

Pacific Equipment Series

Each equipment series has application capabilities based on technology and design. For example, Pacific's G-Series is highly modularized, flexible, field expandable, and is serviceable with absolutely minimum spares or logistic support. When driven by an internally mounted 301-E Transient/Signal Generator, G-Series Test systems are unsurpassed in the Power Range of 6-90kVA. Tables I and II provide assistance in selecting the best series for your application. Please call your Pacific Representative, or the Factory direct if you would like to discuss your requirements.

TABLE I – Key Specifications By Series

	Power Range (kVA)	Output Freq. (Hz)	Output Reg. (%)	Transient Response (Microsec.)	Harmonic Distortion (%)
Programmable Test Power					
3060 MS-Series	62.5-625	47-500	1.0	<250	1.0
330-3450 G-Series/GO Modules	6-90	47-500	0.1	<50	0.75
330-3450 G-Series/GR Modules	6-90	47-5000	0.1	<10	0.75
AMX-Series (UPC)	0.5-4.5	20-5000	0.25	<15	0.75
AT-Series (Type E)	1.0-6.75	47-5000	0.25	<15	0.75
310-HE	1.0	20-2000	0.25	<50	1.0
Conditioner & Freq. Changer					
3060 MS-Series	62.5-625	47-500	1.0	<250	1.0
330-3450 G-Series/GO Modules	6-90	47-500	0.1	<50	0.75
330-3450 G-Series/GR Modules	6-90	20-5000	0.1	<10	0.75
AMX-Series (UMC)	0.5-4.5	45-500	0.25	<15	0.75
AT-Series (Type-M)	1.0-6.75	47-500	0.25	<15	0.75
103-345 K-Series	0.25-4.5	47-500	0.5	<30	0.75
Uninterruptible Power Source					
330-3450 UG-Series	6-90	47-500	0.1	<50	0.75
3060-3600 UMS-Series	62.5-625	47-500	1.0	<250	1.0

TABLE II – Product Application Selector

Product Applications	Product Series								
General	UMS	UG	MS	G/GO	G/GR	AT	AMX	HE	K
Test Power – GPIB			X	X	X	X	X	X	
Voltage Converter – Facility	X	X	X	X	X				
High Frequency, Dynamic Load Testing				X	X	X	X		
Frequency Conversion – Facility	X	X	X	X	X				
Frequency Converter – Laboratory			X	X	X	X	X	X	
UPS – Universal, Modular, Field Expandable	X	X							
Rackmount, Benchtop Compatible						X	X	X	X
Parallelable	X	X	X	X	X	X			
Linear Technology		X		X	X	X	X	X	X
Switching Technology	X		X						
Very High Efficiency			X						
Test Power									
Power Supply Testing				X	X	X	X	X	X
Transient Simulation			X	X	X	X	X	X	
Envelope Transients			X	X	X	X	X	X	
Cycle Based Transients				X	X		X		
Time Based Transients						X	X	X	
Embedded Waveshapes						X	X		
Editable Waveshapes							X		

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Maximum Control/Minimal Effort

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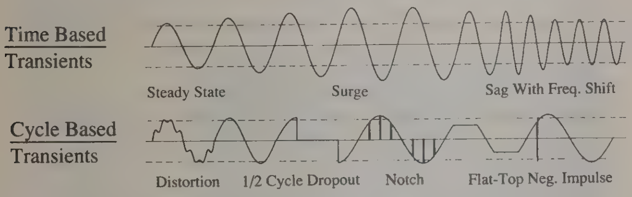
AC Power Technology Was Never So Easy To Use

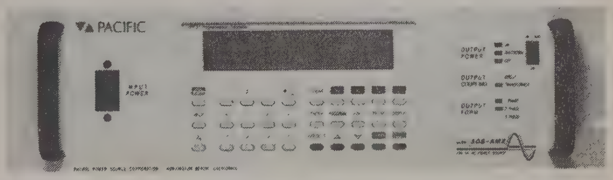
PAGE
2

Pacific's full range of oscillators offer precise, intelligent control of both steady state and transient AC sinewaves to drive our power amplifiers. Use the Table below to find the right oscillator/controller for your application.

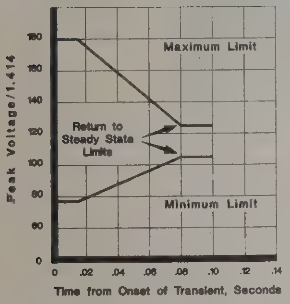
Function Ability	Power Amplifier Family													
	AMX-Series		AT-Series		K-Series				HE-Series	G-Series			MS-Series	
	UPC	UMC	Type-E	Type-M	3V	3F	1V	1F		301-E	301-C	301-F	STD	With 301-E
Manual		X		X	X	X	X	X			X	X	X	
Programmable	X		X						X	X				X
Fixed Freq.		X		X		X		X			X	X	X	
Variable Freq.	X	X	X	X	X		X		X	X	X		X	X
1 Phase	X	X	X	X			X	X		X	X	X		
3 Phase	X	X	X	X	X	X			X	X	X	X	X	X
Freq = 47-500 Hz		X		X	X	X	X	X	X	X	X		X	X
Freq > 500 Hz	X		X						X	X				
External Input	X	X	X	X			X			X	X	X	X	X
Transients:														
Envelope	X		X						X	X				X
Cycle based	X		X							X				
Wave forms	X		X											

Using Pacific's AMX-Series UPC Controller's waveform edit capability, you can quickly create any steady state or transient condition you can draw.

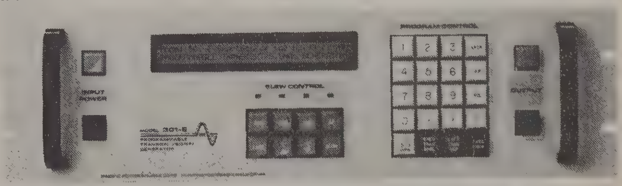




UPC Software commands provide simple to use, yet powerful control over all AMX-Series output parameters.

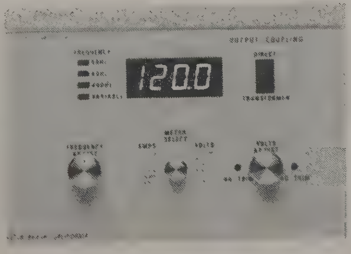


G-Series AC Test Power is provided by the precise, intelligent control of the 301-E Transient/Signal Generator.



The 301-E Transient/Signal Generator is a high performance signal source that provides both steady state and transient AC sinewaves to drive Pacific's G-Series equipment.

Manual Control with Maximum Versatility
Pacific's Manual Controllers provide voltage, phase, and frequency drive signals for our AMX and AT - Series Power Amplifiers.



AMX-Series - UMC-31 Controller

Key Features:

- Digitally synthesized, high quality sinewave
- One, two, or three phase operation
- Fixed or manually variable frequency
- Metering for output volts, amps and frequency

Product Applications

- Laboratory frequency, phase, and voltage converters
- Low impedance power for DC supply testing
- ATE stands where fixed high quality power is required

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High Quality AC Test Power

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Flexible AC Test Power Systems

PAGE
3

- Power Supply Testing
- Mil-Std Testing
- Powerline Disturbance Tests
- Lab/Rack Power
- Burn-in Testing
- Product Qualification

AMX Series – AC Power Solutions
From 500 VA to 4.5 kVA, 20 to 5000 Hz

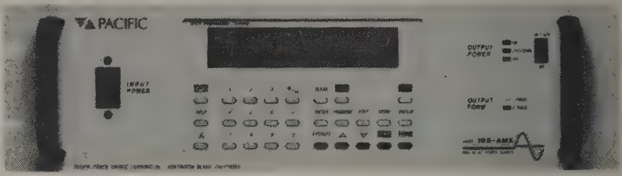
Combine Pacific's latest power amplifier series with your choice of power controllers for the ideal AC Test Power System.

Pacific's AMX-Series meets your AC Test Power needs with the following standard features:

- Manual and programmable models for application flexibility
- Multiple output ranges for voltage limit testing
- High peak current capability (Crest Factor) for electronic load testing
- Three phase/single phase switch selectable models for project flexibility
- High efficiency, quiet, rackmountable units for ATE applications

Programmable Controller

- Total program control over output voltage, frequency, phase angle, waveshape, and current limit
- Stored waveform library offers waveshape selection and total waveform edit capability
- Quickly create your own waveform to simulate distortion, clipping, etc.



Perform cycle or time based transients with Pacific's UPC-31 Programmable Controller.

Manual Controller

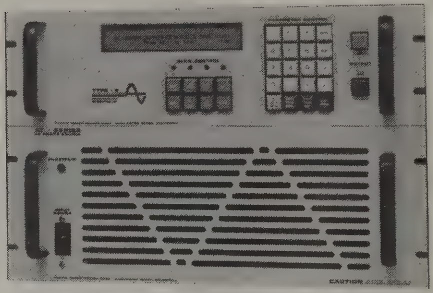
- Select single phase or three phase operation
- Select accurate fixed or variable frequency output
- Clearly visible, digital metering of output parameters.

AT-Series High Performance AC Power
From 1.0 to 6.75 kVA, 47 to 5000 Hz

These high performance, high efficiency power sources provide 2.25 kVA of very high quality power in 12.25 inches of rack space. Three units are field parallelable to achieve 6.75 kVA of single or three phase power.

Key features of this equipment are:

- 6:1 peak current (crest factor)
- Programmable controller
- Output power forms include:
  - 0-132 VAC direct coupled
  - 0-264 VAC direct or transformer coupled
  - 1, 2, or 3 phase output
- Automatic range changing
- Remote voltage sensing with disable
- No load power factor restrictions for output stability
- Electronic current limiting with auto recovery



- 0.1% load regulation with 10% line change
- 0.25% load regulation
- 0.75% total harmonic distortion
- Bandwidth, full power
  - ±0.1 db, 47-500 Hz
  - ±0.25 db, 20-5000 Hz
- Less than 15 microsecond response time to a step load transient

Programmable Controller

Pacific's Type E Controller provides total control over output voltage, current limit, phase, and frequency from the front panel or GPIB BUS. Up to 99 steady state and one transient program may be stored for execution. Up to 32 programmed waveforms simulating distortion, rectifier loads, squarewaves, etc., are easily accessed for the most stringent test application. Other features include full monitoring, steady state and transient sync signals, and an auxiliary input to superimpose harmonics on the output.

Manual Controller

Pacific's Type M Manual Controller is designed for applications requiring either fixed or manually variable AC output power. This cost effective controller provides a low distortion sinewave for both single phase and three phase power systems. It offers excellent control flexibility as well as accurate front panel monitoring of output voltage, frequency, and current parameters.

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HE and K Series

Variable Bench or Rack Mount
AC Power Equipment

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POWER SOURCE CORP.

Applications

PAGE
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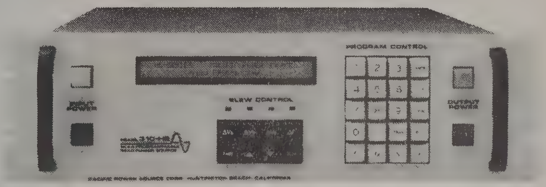
- Power Supply Testing
- Bench/Production Test
- Gyro Testing
- Motor Testing
- Power Burn-in
- Motor Controls
- Transient Simulation

The 310-HE With Smart Source™ Interpreter

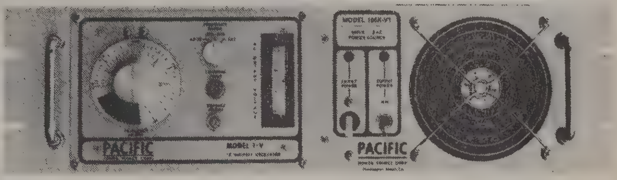
This three phase programmable power source is better by design. High efficiency and superior performance are brought neatly together in a compact package that is competitively priced. Rack mount or benchtop, these 5 1/4" high units combine high power and low profile – delivering 1000 VA from 20-2000 Hz into any power factor load. An IEEE-488 interface enhances application flexibility by providing a variety of talker/listener capabilities which allow the HE to interface into just about any ATE setup. The 310-HE uses its own 20-2000 Hz integrated controller and does not require an optional oscillator.



K-Series – Cost effective power sources from 250 VA to 4.5 kVA

The K-Series family covers the power range 250 to 4.5 kVA, single and three phase, in lightweight one-man portable units. A variety of plug-in oscillators are available for adaptation to either laboratory variable or fixed parameter OEM applications. Key features are:

- High Quality Power: Less than 0.75% distortion from 20-1000 Hz.
- 300% Peak Current Capability: Additional current capability for driving electronic power supply loads that draw current at the peak of the sinewave.
- Excellent Regulation: Less than 0.5% at amplifier output.
- Fast Transient Response: Less than 30 microseconds.
- No Power Factor Restrictions: Output is unconditionally stable into any power factor load.
- Short Circuit Protection: Output automatically recovers from an output short.
- Over 90 Standard Models cover most applications.



Model	Output kVA	Chassis
1xxK - xx	.25 - 1.5	5.25/10.5"
2xxK - xx	.43 - 2.6	5.25/10.5"
3xxK - xx	.75 - 4.5	5.25/10.5"

R - 0 to 125V output
T - 0 to 250V output
Oscillator type
Product Series
Output power (x100VA)
1 - single phase
2 - three phase DELTA
3 - three phase WYE

Oscillator Types

Type	Function	Frequency Range	Metering	Frequency Control
V	Variable frequency	47-500	± 3% analog	Dial. ± 3%
F	Fixed frequency	20-2000	± 3% analog	Preset ± .25%

Note: K-Series models are configured in 250 or 750 VA increments. For example a 315K-VR is a three phase WYE model with an output of 1500VA, a variable frequency analog oscillator and 0-125V output.

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High Quality AC Frequency Conversion

PACIFIC
POWER SOURCE CORP.

Frequency Changers and High Power Test Sources for:

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5

- Facility Power
- Burn-in Power
- AC Motor Testing
- Power Supply Testing
- Avionics/Marine
- Power Line Disturbance Simulation

The G-Series - The Ultimate in Linear Power System Flexibility From 6 to 90 kVA

AC power sources utilize high performance linear technology to provide the ultimate in a clean waveform. Key features of this equipment are:

- Modular design/expandable/flexible/easy maintenance
- Fail safe circuitry with built-in diagnostics
- Delivers peak currents to 300% of rated capacity
- Fast 50 microsecond transient response time
- Less than 0.75% total harmonic distortion
- ± 0.1% output regulation at sense point
- No power factor or load balance restrictions
- All standard input power forms
- Many standard options
- Convertible to UPS

Model	Output Power (kVA)	Cabinets	Output Power Form
330-G	6	1 ea. 330-G	120/208 Direct Coupled.
390G-12	12	1 ea. 390-G	
390G	18	1 ea. 390-G	
3120-G	24	2 ea. 390-G	All Std. US & INTL Power Forms with Magnetics.
3150-G	30	2 ea. 390-G	
3180-G	36	2 ea. 390-G	
3210-G	42	3 ea. 390-G	
3240-G	48	3 ea. 390-G	1 Phase or 3 Phase User Switch Selectable.
3270-G	54	3 ea. 390-G	
3360-G	72	4 ea. 390-G	
3450-G	90	5 ea. 390-G	

Systems may be configured to provide fixed, variable programmable frequency, voltage, and phase. Frequency range from 20 to 5000 Hz.

Control and Power Options
301-F Universal Control Module

- Provides for selection of three different control options:
  1. Internal oscillator at fixed frequencies of 50, 60, 400 Hz
  2. External signal generator
  3. Input from the 301-E programmable transient/signal generator from 20-5000 Hz
- Provides for selection of the ouput power form:
  1. Single phase operation or
  2. Three phase operation
- Provides control of the mainframe output contactor to turn output power on and off

301-E Transient/Signal Generator

- Provides total control of the output signal from either the front panel keypad or from a remote computer via the IEEE bus.
  1. Frequency
  2. Frequency transients
  3. Phase angle separation
  4. Phase transients
  5. Amplitude
  6. Amplitude transients

Power Modules

- 120-GO; Standard modules for applications from 45-500 Hz
- 120-GR; Enhanced modules for applications requiring motor starting, high short circuit current, frequencies to 5000 Hz and fast transient and harmonic reproduction

MS-Series High Efficiency, High Power Systems From 62.5 to 625 kVA

Pacific's MS-Series equipment is a family of high performance Line Conditioners/Frequency Converters designed to provide highly flexible yet reliable AC Power from 62.5 to 625 kVA.

Pacific's MS-Series Power Systems Feature:

- Maximum mission reliability with master/slave selection
- Rugged, powerful output of 350 A pulse current
- Facility/test power flexibility of variable/fixed frequency selection
- Simple yet informative display and diagnostics
- Operator safety assured with third party ETL approval

Each 3060-MS cabinet is capable of operating as either the master or slave in a paralleled system up to 10 cabinets.

ETL Listed

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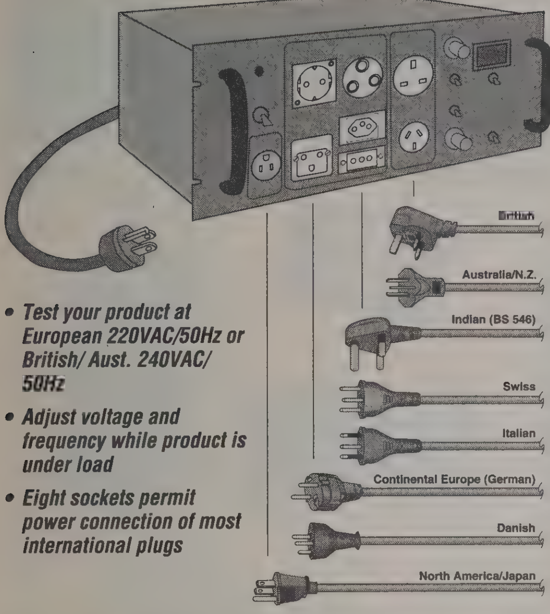
Interpower™ International Power Source



- *Test your product at European 220VAC/50Hz or British/ Aust. 240VAC/ 50Hz*
- *Adjust voltage and frequency while product is under load*
- *Eight sockets permit power connection of most international plugs*

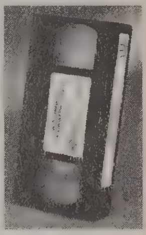
Test your export product...

The Interpower™ International Power Source provides a low-cost, convenient source of 50 Hz power which is important for testing many products that are exported. Output power is delivered through one of eight standard international sockets so that products configured with international power plugs can be conveniently powered during development or just prior to shipment. Output voltages are adjustable in the 0-260VAC range and frequencies can be adjusted in the 47-500Hz range while under load. This flexibility permits testing of products with varying input voltages and frequencies in order to simulate real-world power mains conditions. The power rating of the International Power Source is 750VA or 1KVA, depending on model.

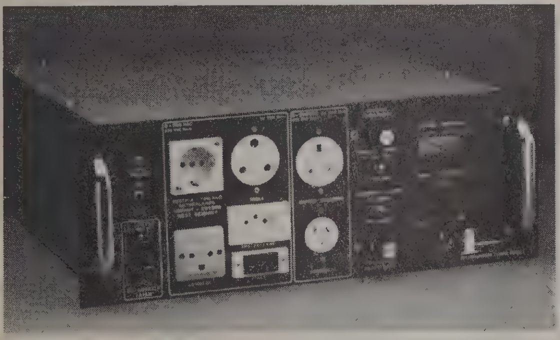
Three models are designed to accommodate U.S. input voltages of either 120V (supplied through a NEMA 5-15P or 5-20P plug) or 230V (NEMA 6-15P plug).

At 50 pounds, the unit can be easily moved between work stations or lab positions as needed. Dimensions: 19" wide x 7" tall x 19" deep behind the panel.

Delivery: stock to six weeks; call PCC Customer Service Department for stock level. ***Rental units are available.***



Call or FAX for a FREE VIDEO TAPE which shows how to use the International Power Source



Three models accommodate different U.S. input voltages:

#85510500: Interpower™ International Power Source converts North American voltage and frequency (120VAC/60Hz) to international voltages and frequencies, typically 220-240VAC/50Hz, single phase. Digital output monitor displays RMS voltage, current, frequency.

> **Input voltage:** 120VAC/60Hz (supplied through NEMA 5-15P plug)
> **Output voltage:** Variable voltage from 0-260VAC
> **Output frequency:** Switch allows range of 47-150Hz or 150-500Hz
> **Output capability:** 750VA

#85510510: Input voltage 20A/105-125V (NEMA 5-20P plug); 1KVA output capability.
#85510520: Input voltage 20A/210-250V (NEMA 6-15P plug); 1KVA output capability.

The sockets included on the International Power Source are listed below, as well as the standard single-phase test voltage/frequencies and maximum socket rating:

Socket	Volt./Freq.	Rating
Continental Eur. German CEE 7/7	220-230VAC/50Hz*	16A
Australia/New Zealand AS 3112 (Also People's Rep. of China)	240VAC/50Hz	10A
British BS 1363	240VAC/50Hz	13A
Denmark Afsnit 107-2-01	220-230VAC/50Hz*	10A
India (old British BS 546)	220VAC/50Hz	15A
Italy CEI 23-16/VII	220-230VAC/50Hz*	10A
Switzerland SEV 1011	220-230VAC/50Hz*	10A
North America NEMA 5-15R	120VAC/60Hz	15A
(also Japan)	100VAC/50& 60Hz	15A

* Note: European standard voltage will be changed from 220V to 230V by 1995.

SPECIFICATIONS:

Input Voltage:	#85510500: 115 VAC – NEMA 5-15P plug #85510510: 115 VAC – NEMA 5-20P plug #85510520: 230 VAC – NEMA 6-15P plug
Input Frequency:	45 to 65 Hz
Output Voltage:	0 to 130 VAC or 0 to 260 VAC; set from front panel potentiometer
Output Frequency:	47–150Hz or 150–500Hz; set from the front panel potentiometer
Output VA:	#85510500: 750 VA , single phase #85510510/520: 1 KVA, single phase
RMS Output Current:	
#85510500:	130 VAC range: 750 ÷ output volts, 7.5 amps max. below 100 VAC 260 VAC range: 750 ÷ output volts, 5A RMS max. below 200 VAC
#85510510/520:	130 VAC range: 1000 ÷ output volts, 10A RMS max. below 100 VAC 260 VAC range: 1000 ÷ output volts, 3.75A RMS max. below 200 VAC
Monitor Accuracy:	0.25%
Peak Output Current:	2 x RMS (standard models)
Line & Load Reg.:	2% to 100Hz, 3.5% 100-500Hz
Frequency Stability:	0.25%
Efficiency:	75% with full linear load
Harmonic Distortion:	Less than 1% into full linear load
Power Factor:	0 to 1
Response Time:	200 µsec with 100% load change
Output Protection:	Automatic peak current limiting; automatic RMS current shutdown; automatic thermal shutdown; automatic shorted output shutdown
Operating Temp.:	-10°C to + 40°C
Storage Temp.:	-40°C to +75°C

DESIGNING FOR EXPORT? WE MAKE IT EASY! See also EEM Sections 2100 • 4300 • 5600 • 6000

PANEL COMPONENTS CORPORATION

featuring interpower™ products

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FAX (515) 672-2078

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Toll-free Telephone (800) 662-2290
Toll-free FAX (800) 645-5360

TW SERIES
1.8W-3W

REGULATED DC/DC CONVERTERS
24 PIN DIP

FEATURES:

See section 4000 pages D•1882-1884 for AC/DC power supplies.

- HIGH PERFORMANCE TT INPUT FILTER
- SINGLE AND DUAL OUTPUTS
- HIGHLY REGULATED ISOLATED OUTPUTS
- 100% BURN IN
- HIGH EFFICIENCY
- HIGH RELIABILITY
- NO EXTERNAL COMPONENTS

FROM STOCK
TW412D5
POLYTRON
TW412D12

SPECIFICATIONS:

- **OUTPUT VOLTAGE STABILITY**
  0.02%/°C Max.
- **OUTPUT VOLTAGE ACCURACY**
  ±5%
- **REGULATION**
  Line: ±0.5% Max.
  Load: ±1% Max.
- **RIPPLE AND NOISE**
  50 mVP-P Max.
- **INPUT-OUTPUT ISOLATION**
  500 VDC Min.
- **OPERATING TEMPERATURE**
  −25°C to + 71°C
- **STORAGE TEMPERATURE**
  −40°C to +100°C
- **EFFICIENCY**
  55% Min.

	INPUT VOLTAGE (VDC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (mA)	MODEL NUMBER	PRICE 1-9 QTY
SINGLE VOLTAGE UNITS	5 (4.75-5.25)	5	360	TW1.8-5S5	23.00
		5	600	TW3-5S5	29.00
		9	250	TW1.8-5S9	23.00
		9	334	TW3-5S9	29.00
		12	150	TW1.8-5S12	23.00
		12	250	TW3-5S12	29.00
		15	120	TW1.8-5S15	23.00
		15	200	TW3-5S15	29.00
	12 (11.40-12.60)	5	360	TW1.8-12S5	23.00
		5	600	TW3-12S5	29.00
		9	250	TW1.8-12S9	23.00
		9	334	TW3-12S9	29.00
		12	150	TW1.8-12S12	23.00
		12	250	TW3-12S12	29.00
		15	120	TW1.8-12S15	23.00
		15	200	TW3-12S15	29.00
	24 (22.80-25.20)	5	360	TW1.8-24S5	23.00
		5	600	TW3-24S5	29.00
		9	250	TW1.8-24S9	23.00
		9	334	TW3-24S9	29.00
		12	150	TW1.8-24S12	23.00
		12	250	TW3-24S12	29.00
		15	120	TW1.8-24S15	23.00
		15	200	TW3-24S15	29.00
	28 (26.60-29.40)	5	360	TW1.8-28S5	23.00
		5	400	TW2-28S5	25.00
		5	600	TW3-28S5	29.00
		9	250	TW1.8-28S9	23.00
		9	334	TW3-28S9	29.00
		12	150	TW1.8-28S12	23.00
		12	250	TW3-28S12	29.00
		15	120	TW1.8-28S15	23.00
		15	200	TW3-28S15	29.00
	48 (45.60-50.40)	5	360	TW1.8-48S5	23.00
		5	600	TW3-48S5	29.00
		9	250	TW1.8-48S9	23.00
		9	334	TW3-48S9	29.00
		12	150	TW1.8-48S12	23.00
		12	250	TW3-48S12	29.00
		15	120	TW1.8-48S15	23.00
		15	200	TW3-48S15	29.00

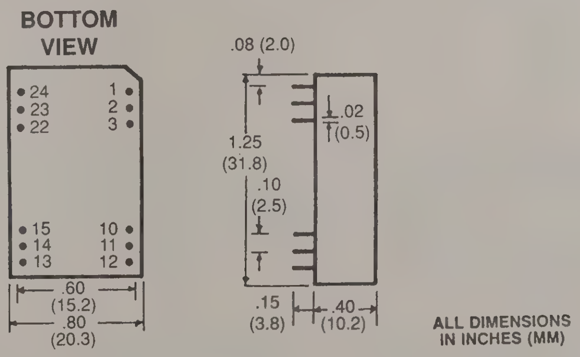
POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 **FAX: (201) 345-1264**

24-PIN DIP DC/DC CONVERTERS (continued)

DUAL VOLTAGE UNITS

INPUT VOLTAGE (VDC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (mA)	MODEL NUMBER	PRICE 1-9 QTY
5 (4.75-5.25)	±5	±180	TW1.8-5-5	29.00
	±5	±300	TW3-5-5	34.00
	±9	±100	TW1.8-5-9	29.00
	±9	±167	TW3-5-9	34.00
	±12	±75	TW1.8-5-12	29.00
	±12	±125	TW3-5-12	34.00
	±15	±60	TW1.8-5-15	29.00
	±15	±100	TW3-5-15	34.00
12 (11.40-12.60)	±5	±180	TW1.8-12-5	29.00
	±5	±300	TW3-12-5	34.00
	±12	±75	TW1.8-12-12	29.00
	±12	±125	TW3-12-12	34.00
	±15	±60	TW1.8-12-15	29.00
	±15	±100	TW3-12-15	34.00
24 (22.80-25.20)	±5	±180	TW1.8-24-5	29.00
	±5	±300	TW3-24-5	34.00
	±12	±75	TW1.8-24-12	29.00
	±12	±125	TW3-24-12	34.00
	±15	±60	TW1.8-24-15	29.00
	±15	±100	TW3-24-15	34.00
28 (26.60-29.40)	±5	±180	TW1.8-28-5	29.00
	±5	±300	TW3-28-5	34.00
	±12	±75	TW1.8-28-12	29.00
	±12	±125	TW3-28-12	34.00
	±15	±60	TW1.8-28-15	29.00
	±15	±100	TW3-28-15	34.00
48 (45.60-50.40)	±5	±180	TW1.8-48-5	29.00
	±5	±300	TW3-48-5	34.00
	±12	±75	TW1.8-48-12	29.00
	±12	±125	TW3-48-12	34.00
	±15	±60	TW1.8-48-15	29.00
	±15	±100	TW3-48-15	34.00



Pin Connections

PIN	SINGLE OUTPUT	DUAL OUTPUT
1	+V INPUT	+V INPUT
2	N.C.	−V OUTPUT
3	N.C.	COMMON
10	−V OUTPUT	COMMON
11	+V OUTPUT	+V OUTPUT
12	−V INPUT	−V INPUT
13	−V INPUT	−V INPUT
14	+V OUTPUT	+V OUTPUT
15	−V OUTPUT	COMMON
22	N.C.	COMMON
23	N.C.	−V OUTPUT
24	+V INPUT	+V INPUT

POLYTRON DEVICES, INC.

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TWA SERIES 1.5W-3W

REGULATED DC/DC CONVERTERS 24 PIN DIP PACKAGE WIDE INPUT RANGE

See section 4000 pages D•1882-1884 for AC/DC power supplies.

FEATURES:

- WIDE INPUT RANGE
- INPUT/OUTPUT ISOLATION: 500 VDC
- EFFICIENCY TO 76% @ FL
- SHORT CIRCUIT PROTECTION
- NO EXTERNAL COMPONENTS

POLYTRON
TWA1.8-48S1S

SPECIFICATIONS:

All specifications are typical at nominal line, full load and 25°C unless otherwise noted.

INPUT

INPUT VOLTAGE RANGE

12 VDC Nominal	9-18 VDC
24 VDC Nominal	18-36 VDC
48 VDC Nominal	36-72 VDC
Input Filter	Pi Network

OUTPUT

Voltage Accuracy	±3% Max.
Temperature Coefficient	±0.02%/°C Max.
Ripple and Noise (20Mhz BW)	0.5-1% P-P Max.
Line and Load Regulation	±1% Max.
Voltage Stability (24 Hour)	±0.05% Max.
Short Circuit Protection	10 SEC Max.

GENERAL

Isolation Voltage	500 VDC Min.
Isolation Resistance	10^9 Ohms Min.
Isolation Capacitance	300pF
Switching Frequency	25 KHz Min.

ENVIRONMENTAL

Operating Temperature Range	-25°C to + 71° C
Storage Temperature Range	-55°C To +105°C
Derating	None
Cooling	Free Air Convection
Humidity	20-95% RH Non-Condensing

PHYSICAL SPECIFICATIONS

Weight	0.5oz.(14.3 grams)
Case Material	Non-Conductive Black Plastic
Dimensions	1.25"x 0.80"x 0.50"

POLYTRON DEVICES, INC.

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DC/DC CONVERTERS-1.5W-3W WIDE INPUT RANGE (continued)
SELECTION GUIDE 1.5W DC/DC CONVERTER

	INPUT VOLTAGE (VDC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (MA)	INPUT CURRENT (mA) NO LOAD	INPUT CURRENT (mA) FULL LOAD	MODEL NUMBER	PRICE (1-9 QTY.)
SINGLE VOLTAGE	12 (9-18)	5	300	25	195	TWA1.8-12S5	35.00
		12	125	25	190	TWA1.8-12S12	35.00
		15	100	25	190	TWA1.8-12S15	35.00
	24 (18-36)	5	300	15	95	TWA1.8-24S5	35.00
		12	125	15	90	TWA1.8-24S12	35.00
		15	100	15	90	TWA1.8-24S15	35.00
	48 (36-72)	5	300	15	52	TWA1.8-48S5	35.00
		12	125	15	46	TWA1.8-48S12	35.00
		15	100	15	47	TWA1.8-48S15	35.00

3W DC/DC CONVERTER

SINGLE VOLTAGE	12 (9-18)	5	500	25	320	TWA3-12S5	39.00
		12	250	25	370	TWA3-12S12	39.00
		15	200	25	370	TWA3-12S15	39.00
	24 (18-36)	5	500	15	170	TWA3-24S5	39.00
		12	250	15	186	TWA3-24S12	39.00
		15	200	15	182	TWA3-24S15	39.00
	48 (36-72)	5	500	15	85	TWA3-48S5	39.00
		12	250	15	94	TWA3-48S12	39.00
		15	200	15	94	TWA3-48S15	39.00

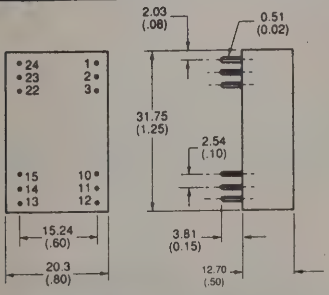
1.5W DC/DC CONVERTER

DUAL VOLTAGE	12 (9-18)	± 5	± 150	25	195	TWA1.8-12-5	39.00
		± 12	± 60	25	190	TWA1.8-12-12	39.00
		± 15	± 50	25	190	TWA1.8-12-15	39.00
	24 (18-36)	± 5	± 150	15	95	TWA1.8-24-5	39.00
		± 12	± 60	15	90	TWA1.8-24-12	39.00
		± 15	± 50	15	90	TWA1.8-24-15	39.00
	48 (36-72)	± 5	± 150	15	52	TWA1.8-48-5	39.00
		± 12	± 60	15	46	TWA1.8-48-12	39.00
		± 15	± 50	15	47	TWA1.8-48-15	39.00

3W DC/DC CONVERTER

DUAL VOLTAGE	12 (9-18)	± 5	± 250	25	320	TWA3-12-5	43.00
		± 12	± 125	25	370	TWA3-12-12	43.00
		± 15	± 100	25	370	TWA3-12-15	43.00
	24 (18-36)	± 5	± 250	15	170	TWA3-24-5	43.00
		± 12	± 125	15	186	TWA3-24-12	43.00
		± 15	± 100	15	182	TWA3-24-15	43.00
	48 (36-72)	± 5	± 250	15	85	TWA3-48-5	43.00
		± 12	± 125	15	94	TWA3-48-12	43.00
		± 15	± 100	15	94	TWA3-48-15	43.00

DIMENSION: BOTTOM VIEW



ALL DIMENSIONS IN MM (INCHES)

Pin Connections		
PIN	SINGLE OUTPUT	DUAL OUTPUT
1	+ V INPUT	+ V INPUT
2	N.C	- V INPUT
3	N.C	COMMON
10	- V OUTPUT	COMMON
11	+ V OUTPUT	+ V OUTPUT
12	- V INPUT	- V INPUT
13	- V INPUT	- V INPUT
14	+ V OUTPUT	+ V OUTPUT
15	- V OUTPUT	COMMON
22	N.C.	COMMON
23	N.C.	- V OUTPUT
24	+ V INPUT	+ V INPUT

POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 *FAX: (201) 345-1264*

REGULATED DC/DC CONVERTERS

WIDE INPUT VOLTAGE RANGE 15W

See section 4000 pages D•1882-1884 for AC/DC power supplies.

FEATURES:

- WIDE INPUT RANGE
- INPUT/OUTPUT – ISOLATION
- EFFICIENCY UP TO 87% @ FL
- OVER CURRENT PROTECTION • SIX SIDED SHIELDING
- SHORT CIRCUIT CURRENT LIMITING • COMPACT SIZE

POLYTRON DEVICES INC
PATERSON, N.J.
DC/DC
CONVERTERS

APPLICATIONS:

- BATTERY OPERATED EQUIPMENT
- TELECOMMUNICATIONS
- PROCESS CONTROL
- INSTRUMENTATION
- ROBOTICS

SPECIFICATIONS:

Typical @ 25°C Under Full Load and Nominal Input Voltage Unless Otherwise Specified.

INPUT

INPUT VOLTAGE RANGE
12VDC Input Model. . . . . .9-18 VDC
24VDC Input Model. . . . . .18-36 VDC
48VDC Input Model. . . . . .36-72 VDC
INPUT FILTER . . . . .LC Filter

OUTPUT

Voltage Accuracy . . . . ± 10%
Line Regulation . . . . ± 0.1%
Load Regulation. . . . . ± 0.5%
Ripple and Noise (20 MHz BW) 50 mV P-P Max
Transient Response . . . . .250 usec Max

GENERAL

Efficiency. . . . . .Up to 87%
Isolation Voltage . . . . .500 VDC Min
Isolation Resistance . . . . .100 Mohms
Switching Frequency . . . . .From 100 KHz

ENVIRONMENTAL

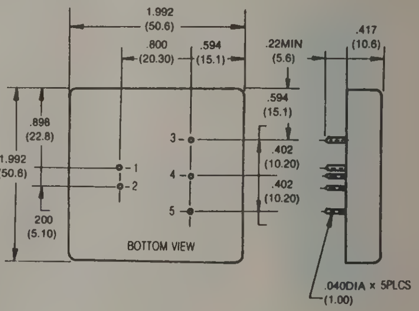
Operating Temperature . . . . . – 25°c to + 70°c
Storage Temperature . . . . . . – 50°c to + 105°c
Temperature Coefficient . . .Under 185 PPM/°c
Humidity .20-95% RH
Cooling. . . . . .Free Air Convection
EMI/RFI/FCC . . .Five Sided Continuous Shield
Six Sided Continuous Shield (optional)

PHYSICAL

Case Material. . . . . .Metal Case
Dimensions . . . . .1.992″ × 1.992″ × .417″
(50 × 50 × 10.6mm)
Weight. 100g

	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF %	MODEL NUMBER	PRICE 1-9 QTY
SINGLE VOLTAGE	12 VDC (9-18)	5 VDC	3000 ma	80%	KW15-12S5	89.00
		12 VDC	1250 ma	81%	KW15-12S12	89.00
		15 VDC	1000 ma	84%	KW15-12S15	89.00
		24 VDC	625 ma	84%	KW15-12S24	89.00
	24 VDC (18-36)	5 VDC	3000 ma	82%	KW15-24S5	89.00
		12 VDC	1250 ma	84%	KW15-24S12	89.00
		15 VDC	1000 ma	86%	KW15-24S15	89.00
		24 VDC	625 ma	87%	KW15-24S24	89.00
	48 VDC (36-72)	5 VDC	3000 ma	81%	KW15-48S5	89.00
		12 VDC	1250 ma	82%	KW15-48S12	89.00
		15 VDC	1000 ma	83%	KW15-48S15	89.00
		24 VDC	625 ma	84%	KW15-48S24	89.00

	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF %	MODEL NUMBER	PRICE 1-9 QTY
DUAL VOLTAGE	12 VDC (9-18)	± 5 VDC	± 1500 ma	78%	KW15-12-5	98.00
		± 12 VDC	± 625 ma	79%	KW15-12-12	98.00
		± 15 VDC	± 500 ma	81%	KW15-12-15	98.00
		± 24 VDC	± 313 ma	81%	KW15-12-24	98.00
	24 VDC (18-36)	± 5 VDC	± 1500 ma	80%	KW15-24-5	98.00
		± 12 VDC	± 625 ma	82%	KW15-24-12	98.00
		± 15 VDC	± 500 ma	84%	KW15-24-15	98.00
		± 24 VDC	± 313 ma	85%	KW15-24-24	98.00
	48 VDC (36-72)	± 5 VDC	± 1500 ma	80%	KW15-48-5	98.00
		± 12 VDC	± 625 ma	81%	KW15-48-12	98.00
		± 15 VDC	± 500 ma	81%	KW15-48-15	98.00
		± 24 VDC	± 313 ma	82%	KW15-48-24	98.00



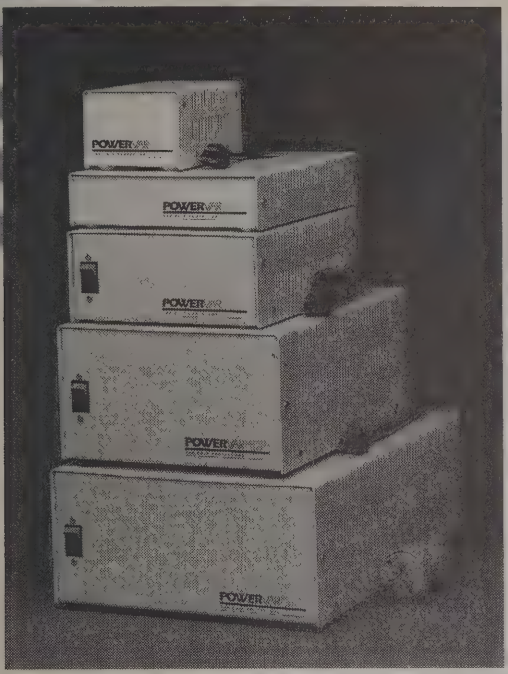
ALL DIMENSIONS IN INCHES (M.M.)

Pin Connections		
Pin No.	Pin Function	
	Single Voltage	Dual Voltage
1	+ Input	+ Input
2	− Input	− Input
3	+ Output	+ Output
4	N.C.	Common
5	− Output	− Output

***OUTPUT POWER UP TO 100W AVAILABLE**

POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 **FAX: (201) 345-1264**



POWER CONDITIONERS

78VA TO 6kVA
SINGLE PHASE

Power Line Noise. It's one of the last problems you want to worry about when it's your job to keep sensitive electronic equipment on line and operational.

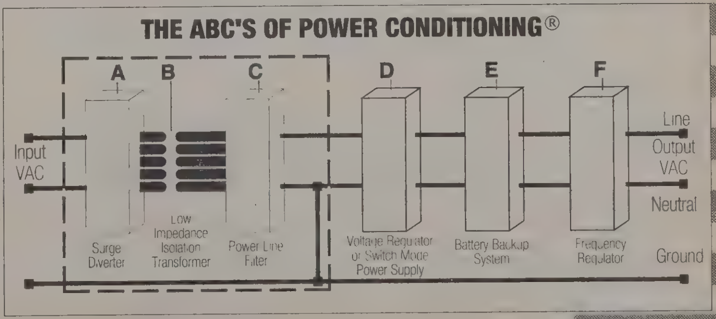
Powervar Power Conditioners are designed for use with switch mode power supplies found in today's sensitive electronic equipment. They provide low impedance isolation from both line and load generated noise disturbances.

A wide range of standard models and configurations are available to fit virtually any power conditioning application. Line cord/receptacle models are standard with a wallmount option in the smaller power sizes. Larger VA ratings feature both line cord/receptacle models as well as hardwired models. There is a wide range of input and output voltage configurations to match virtually every load connection need.

Keep control of the power to your sensitive equipment! For providing the protection you need from power line disturbances, it's Powervar–*the electronic system power specialists!*

FEATURES:

- *LOW IMPEDANCE ISOLATION TRANSFORMER*
  designed for use with loads using modern switch mode power supplies
- *BIDIRECTIONAL NOISE ABSORPTION*
  eliminates both line and load generated noise
- *WIDE RANGE OF MODELS*
  meet virtually all input/output and mounting requirements
- *SAFETY AGENCY LISTED UL, CSA, VDE, TUV*
  approvals fit world-wide applications
- *FIVE YEAR WARRANTY*
  provides unsurpassed reliability



THE ABC'S OF POWER CONDITIONING®

A
B
C
D
E
F
Input VAC
Surge Diverter
Low Impedance Isolation Transformer
Power Line Filter
Voltage Regulator or Switch Mode Power Supply
Battery Backup System
Frequency Regulator
Line Output VAC
Neutral
Ground

POWERVAR
THE ELECTRONIC SYSTEM POWER SPECIALISTS

28457 NORTH BALLARD DRIVE ▪ SUITE C
LAKE FOREST, ILLINOIS 60045
708-816-8585 ▪ 800-369-7179
FAX: 708-816-8988

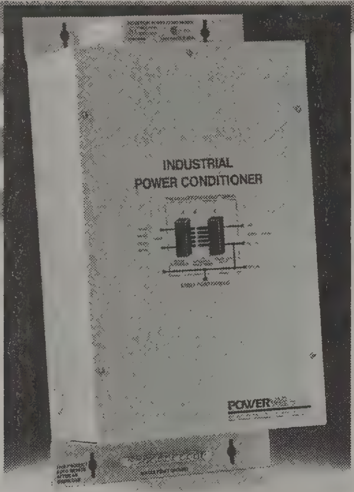
UL544 LISTED

MEDICAL POWER CONDITIONERS

78VA TO 2400VA

FEATURES:

- *UL 544 LISTED/CSA 22.2 No.125 CERTIFIED MODELS* for use in medical applications
- *BIDIRECTIONAL NOISE ABSORPTION* eliminates both line and load generated noise
- *LOW IMPEDANCE TRANSFORMER ISOLATION* provides less than 100 µA leakage current
- *HOSPITAL GRADE PLUG/RECEPTACLES* as required for use in the medical environment
- *OPTIONAL GCX MOUNTING CAPABILITY* provides a wide range of applications
- *FIVE YEAR WARRANTY* provides unsurpassed reliability

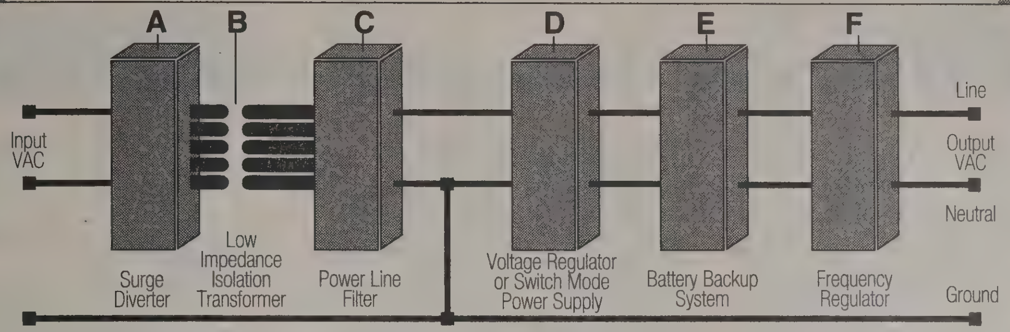


INDUSTRIAL POWER CONDITIONERS

360VA TO 1500VA

FEATURES:

- *FIELD SELECTABLE INPUT VOLTAGE* eliminates need for stepdown transformer and adapts easily to 480, 240, 208, or 120VAC input power
- *LOW IMPEDANCE TRANSFORMER ISOLATION* designed for use with modern PLC and DCS power supplies without oversizing
- *AUTORESETTING THERMAL SWITCH* eliminates inadvertant tripping of breakers
- *SINGLE POINT GROUND BUS* provides multiple equipment grounding re-quired by industrial systems
- *BIDIRECTIONAL NOISE ABSORPTION* eliminates both line and load generated noise
- *SPLASHPROOF WALLMOUNT ENCLOSURE* allows installation in any position or location



THE ABC'S OF POWER CONDITIONING®

A THE SURGE DIVERTER:

This most common "solution" protects your equipment from voltages over 250V, shorting out in the presence of these high intensity impulses. This component acts as a shield against the single destructive event–the ubiquitous lightning bolt–but does little to guard against the daily barrage of noise caused by switch mode power supplies, copying machines, maintenance equipment, air conditioners, elevators or the like. Surge Diverters are unable to correct for ground line disturbances because they do not contain an isolation transformer.

B THE LOW IMPEDANCE ISOLATION TRANSFORMER:

Low Impedance Isolation Transformers protect against common mode voltages: the errant noise and spikes which occur in all office, industrial or commercial buildings. This device blocks disturbances by establishing the vital connection between neutral and ground required by the National Electrical Code. This ensures that no voltage can appear between neutral and ground at the output of the low impedance isolation transformer.

C THE POWER LINE FILTER:

The Power Line Filter component attenuates low voltage impulses, thus providing a higher degree of normal mode noise protection than the Surge Diverter and Isolation Transformer between hot and neutral. The Power Line Filter is a piece that's often missing from power treatment systems. And its absence can often be the source of mysterious glitches and trouble calls, the reasons for which are never discovered.

D THE VOLTAGE REGULATOR:

This piece of the puzzle brings voltages to within the level required by the load for proper operation. Most computers, due to their switch mode power supplies, don't require voltage regulation. However, for equipment which uses a linear power supply, a Voltage Regulator may be recommended by your POWERVAR representative. In those cases, we'll probably suggest a tapswitching type. This prevents the introduction of new transients which can occur with the use of ferroresonant voltage regulators.

E THE BATTERY BACKUP SYSTEM:

This component provides continuing power in the event of a utility power outage. The most common backup system is a standby uninterruptible power system. These operate in a standby mode and turn on when a power outage is detected. The majority of battery backup systems provide limited, if any, ABCD power line noise protection.

F THE FREQUENCY REGULATOR:

Frequency Regulation is accomplished through the use of an on-line uninterruptible power system. The on-line inverter provides constant power to the sensitive load by continually regenerating the AC waveform from a DC source. When a utility power failure occurs, power is continued to the load through the use of the UPS battery.

POWERVAR

THE ELECTRONIC SYSTEM POWER SPECIALISTS

28457 NORTH BALLARD DRIVE ▪ SUITE C
LAKE FOREST, ILLINOIS 60045
708-816-8585 ▪ 800-369-7179
FAX: 708-816-8988

Z-LINE® power distribution and control systems.

GENERAL SPECIFICATIONS COMMON TO ALL Z-LINE® POWER DISTRIBUTION AND CONTROL SYSTEMS

TRANSIENT VOLTAGE SPIKE PROTECTION
Multi stage voltage clamping devices have been incorporated for maximum transient protection. 150V A.C. RMS clamping. Transient peak current, 6500 A (8x20 µs). Transient energy to 80 joules (10x1000 µs). Response time approx. 50 nanoseconds.

SPIKE AND SURGE PROTECTION:
LINE TO LINE, LINE TO GROUND, AND NEUTRAL TO GROUND.

RUGGED, 16 A.W.G. STEEL CONSTRUCTION.
Zinc Plated with black silkscreening.
GSA, FSS: 92704-PUL-001
GOV. FSCM #70513

SAFETY PROTECTION
Most components:
- **UL Recognition**
- **CSA Certification**
- **VDE Approval**

*As well as other European agency approvals.

AGENCY FILE NUMBERS FOR PULIZZI ENGINEERING, INC.
- **UL Recognition #E94081**
- **CSA Certification #LR63198**
- **TUV File # Varies by Model**
- **UL Recognized #E148245**

EMERGENCY SHUTDOWN PROTECTION
Allows easy interfacing with your mechanical, electronic or thermo-switching devices thru the remote power control bus connectors (all but TPC 884 & TPC 115-8.)

EMI/RFI FILTER SPECIFICATIONS
Rated Voltage:115/250 VAC
Operating Frequency: 50/60 HZ
Operating Temperature: -10° C to 60° C
Dielectric withstanding voltage:
2250 VDC (Line-Case)
(1 minute duration)1450 VDC (Line-Line)
Maximum Leakage current:
.5mA @ 250 VAC, 60 HZ
(each line to ground)

PC 874 Series and PC 125 C-F

Typical Common Mode Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
20dB	25dB	37dB	46dB	60dB
Typical Differential Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
17dB	22dB	32dB	42dB	46dB

PC 726 and PC 300 Series, 3 Phase

Typical Common Mode Insertion Loss				
.15MHz	.25MHz	.50MHz	1.0MHz	2.0MHz
16dB	25dB	40dB	58dB	60dB
Typical Differential Insertion Loss				
.15MHz	.25MHz	.50MHz	1.0MHz	2.0MHz
19dB	23dB	29dB	36dB	50dB

POWER CONTROL BUS
Mating Plug, AMP #1-480305-0
Mating Contact, AMP #60620-1

OVERLOAD CIRCUIT BREAKER PROTECTION
Precision electromagnetic breaker provides manual switching and opens automatically under overload conditions.

PC 125 A&B, PC 420 A&B, TPC 981-A&B, TPC 115-8 A&B, TPC 115-10/MTD™ A&B, TPC 884

Typical Common Mode Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
12dB	18dB	30dB	50dB	50dB
Typical Differential Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
8dB	12dB	41dB	42dB	35dB

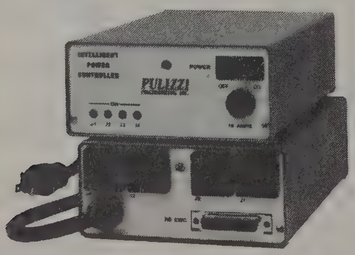
PC-500, TPC 115-8 C-D, TPC 115-10/MTC™ C-D, PC 420 C-F, TPC 981 C-F

Typical Common Mode Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
20dB	21dB	25dB	30dB	52dB
Typical Differential Insertion Loss				
.15MHz	.20MHz	.50MHz	1.0MHz	2.0MHz
7dB	8dB	15dB	45dB	60dB

Leakage current at 220 V, 50Hz max. 2x0.2 mA
at 115 V, 60Hz max. 2x0.13 mA

NEW PRODUCT

IPC-3100*



•Patent Pending

INTELLIGENT POWER IPC 3100 SPECIFICATIONS

The **IPC-3100*** is a **micro processor** based AC power distribution system. It can be operated remotely with a switch, or via a modem to power up less accessible equipment or computers.

This unit is 5 3/4" W by 2 1/2" H by 9" D and weighs 2 1/2 lbs. Four NEMA 5-15R outlets, a NEMA 5-15P input plug, 15 amp resettable circuit breaker and indicator lights are provided.

Operation is via an on / off switch and rear-mounted RS 232 serial port. When the unit is turned on, all four outlets power on in sequential order, via the serial port, any or all of the outlets can be turned on or off by a fixed command syntax. The unit is also capable of pre-programmed timed responses. Optional features such s "WATCH DOG" function to monitor communication link, which can also re-boot the system, EMI/RFI filtering and spike and surge protection are available. The basic concept of the IPC can also be packaged for rack-mount applications.

OUTPUTS:
4 NEMA 5 - 15R
INDIVIDUALLY SELECTED
VIA COMMUNICATIONS PORT

INPUT AC POWER:
AC VOLTAGE - 95 / 130
MAX CURRENT 15 AMP

INDICATORS:
LIGHTED ON / OFF ROCKER SWITCH
4 GREEN LED"S, 1 FOR EACH OUTLET

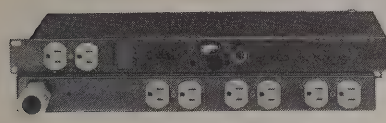
COMMUNICATIONS PORT:
RS 232 - C
CONFIGURED DTE
DBM 25PIN FEMALE
8 BIT DATA, 1 STOP BIT, NO PARITY
2400 BAUD RATE

PROTECTION:
15 AMP RESETABLE PUSH BUTTON
CIRCUIT BREAKER

PULIZZI ENGINEERING INC.

3260 S. Susan Street, Santa Ana, CA 92704-6865 (714) 540-4229, FAX: (714) 641-9062

TPC 115-8



Ask about
48 hour
delivery

RACK MOUNTED

Designed to fit standard 19" wide EIA STD.
Rack 1¾" high, 5" deep.
Weight: A&B 7 lbs. C-F 8 lbs.

EMI/RFI FILTER

Dual Protection:
Common mode, line to ground.
Differential mode, line to line.

8 OUTLETS

6 mounted on the rear for easy access to other instruments in the cabinet, 2 additional outlets on the front panel.

OPTIONAL REMOTE FEATURES:

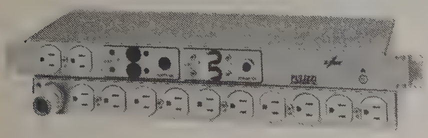
Low voltage remote:
Pins 1 & 4 are for remote on/off with 24VAC between the pins. Pins 2 & 4 are for a remote indicator light with 24VAC between the pins. (Add "RL" to end of standard part number.)

INDICATOR LIGHT

Power to controller switched "ON"

NOTE:
Specifications listed below for models A through D only. Models A, B & C are both UL & CSA. Model D is UL only.

TPC 981



RACK MOUNTED

Designed to fit standard 19" wide EIA STD.
Rack 1¾" high, 7.0" deep.
Weight: A&B 7 lbs. C-F 8 lbs.

EMI/RFI FILTER

Dual Protection:
Common mode, line to ground.
Differential mode, line to line.

INDICATOR LIGHT

Power to controller switched "ON."

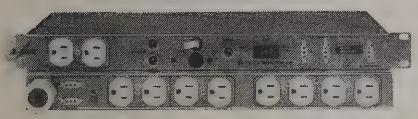
12 OUTLETS SWITCHED

10 mounted on the rear for easy access to other instruments in the cabinet and 2 additional outlets on the front panel.
Optional: The 2 outlets can be unswitched and the 10 outlets remain switched.

NOTE:
Specifications listed below for models A through F only. Models A, B, C & F are both UL & CSA. Model D is UL only.*
*Models with optional breaker do not carry agency approvals.

TPC 115-10
TPC 115-10/MTD™

PENDING



Ask about
48 hour
delivery

RACK MOUNTED

Designed to fit standard 19" wide EIA STD.
Rack 1¾" high, 8" deep.
Weight: 14 lbs.

EMI/RFI FILTER

Dual Protection:
Common mode, line to ground.
Differential mode, line to line.

10 OUTLETS

8 outlets switched, 2 outlets unswitched, always "ON" for convenient AC Power requirements.

INDICATOR LIGHT

Power to controller.
Power to switched 1 outlets.
Power to switched 2 outlets.

TIME DELAY, POWER UP (MTD™)

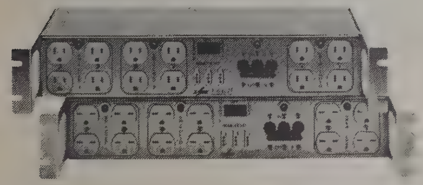
Multiple Time Delay®, approximately 4 seconds between switched outlets 1 and switched outlets 2, provides sequential power up through the 8 switched outlets. Time delay remote power up.

REMOTE POWER CONTROL BUS

5 Remote I/O connectors for either;
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment.
D) Sequencing power up of additional equipment with MTD™

NOTE:
Specifications listed below for models A through D only. Models A, B & C are both UL & PENDING CSA. Model D is UL only.

PC 125
DEC® COMPATIBLE WITH
MODEL 871, MODEL 861



RACK MOUNTED

Designed to fit standard 19" wide EIA STD.
Rack 3½" high, 6" deep (excluding recess brackets). Front panel recessed 2½" with convenient side cut outs for cable routing.
Weight: 19 lbs.

EMI/RFI FILTER

Triple noise protection:
Both common mode and differential mode, plus high frequency ground isolation.

NOTE:
Specifications listed below for models A through F only. Models A, B, C & F are both UL & CSA. Model D is UL only.

12 OUTLETS

8 outlets switched, 4 outlets unswitched, always "ON" for added convenience.

INDICATOR LIGHT

Power to controller. Power to unswitched outlets. Power to switched outlets.

REMOTE POWER CONTROL BUS

3 Remote I/O connectors for either:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment down line.

DEC is a trademark of Digital Equipment Corporation

SPECIFICATIONS FOR MODEL NUMBER: TPC 115-8 A-D, TPC 115-10/MTD™ A-D, TPC 115-10 A-D, TPC 981 A-F, PC125 A-F

MODEL	A	B	C	D	F
A.C. VOLTAGE INPUT	90/135	180/270	90/135	90/135	180/270
A.C. VOLTAGE OUTPUT	90/135	180/270	90/135	90/135	180/270
HERTZ	47-63	47-63	47-63	47-63	47-63
CURRENT	12 AMPS	12 AMPS	24 AMPS	24 AMPS	24 AMPS
FULL LOAD-VOLT AMPS	1440 VA	2880 VA	2880 VA	2880 VA	3840 VA
CIRCUIT BREAKER	20 AMPS	20/20 AMPS	20/20 AMPS	20/20 AMPS	20/20/30 AMPS
FILTER EMI/RFI	20 AMPS	20 AMPS	30 AMPS	30 AMPS	30 AMPS
OPERATING TEMPERATURE	0 TO 60°C	0 TO 60°C	0 TO 60°C	0 TO 60°C	0 TO 60°C
STORAGE TEMPERATURE	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C
ALTITUDE-MAXIMUM	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.
RELATIVE HUMIDITY	95% MAX.	95% MAX.	95% MAX.	95% MAX.	95% MAX.
POWER CABLE: AWG & LENGTH	14/3 9'	14/3 9'	10/3 15'	10/3 15'	12/3 15'
INPUT PLUG-NEMA	5-15P	—	L5-30P	L5-30P	—
MATING RECEPTACLES-NEMA	5-15R	N/A	L5-30R	L5-30R	N/A
OUTLETS-NEMA	5-15R	6-15R	5-15R	5-20R	6-15R

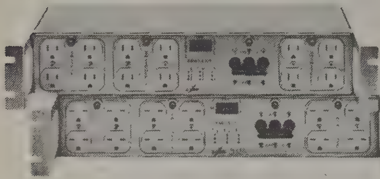
— NOT PROVIDED

Z-LINE® **PULIZZI ENGINEERING INC.**

3260 S. Susan Street, Santa Ana, CA 92704-6865 (714) 540-4229, FAX (714) 641-9062

PC 420 (Replaces PC230 & PC861)

DEC® COMPATIBLE
WITH MODEL 861



RACK MOUNTED

Designed to fit standard 19" wide EIA STD. Rack 3½" high, 6" deep (excluding recess brackets).
Front panel recessed 2½" with convenient side cut outs for cable routing.
Weight: 19 lbs.

EMI/RFI FILTER

Triple noise protection:
Both common mode and differential mode, plus high frequency ground isolation.

12 OUTLETS

8 outlets switched (time delay standard)
4 outlets unswitched always "on" for convenient AC power requirements.

INDICATOR LIGHT

Power to controller.
Power to switched outlets.
Power to unswitched outlets.

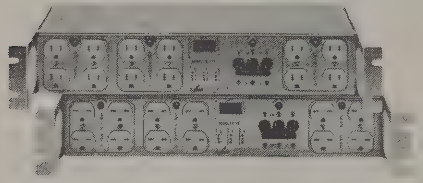
TIME DELAY, POWER UP

Time delay approximately 4 seconds between switched outlets 1 and switched outlets 2.
Models A-F only are UL approved.

REMOTE POWER CONTROL BUS

3 Remote I/O connectors for either:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment down line with a 4 second delayed remote.

PC 585/MTD™
POWER DISTRIBUTION
AND CONTROL SYSTEM



RACK MOUNTED

Designed to fit standard 19" wide EIA STD. Rack 3½" high, 6" deep (excluding recess brackets).
Front panel recessed 2½" with convenient side cut outs for cable routing.
Weight: 19 lbs.

EMI/RFI FILTER

Triple noise protection:
Common mode and differential mode, plus high frequency ground isolation.

12 OUTLETS

4 outlets for each of the three switched sections.

INDICATOR LIGHT

Power to controller.
Power to switched 1 outlets.
Power to switched 2 outlets.
Power to switched 3 outlets.

TIME DELAY, POWER UP

MTD systems incorporate Multiple Time Delay power up and down between the switched sections. This is approximately 4 seconds between switched outlets 1, 2 and 3 powering up and powering down. 1/MTD system incorporate Multiple Time Delay power up between the switched sections only. 585 systems without MTD do not incorporate Multiple Time Delay. All three switched sections power up at one time.

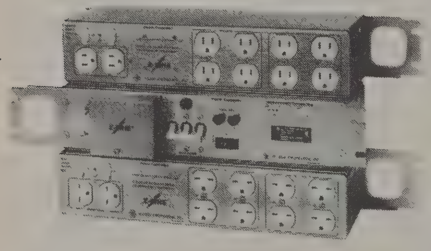
REMOTE POWER CONTROL BUS

3 Remote I/O connectors for either:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment.

NOTE:
Specifications are listed below for models C through F.

PC 874

DEC® COMPATIBLE
WITH MODEL 874
SUN MICROSYSTEMS COMPATIBLE
CATALYST PROGRAM



RACK MOUNTED

Designed to fit standard 19" wide EIA STD. Rack 3½" high, 6¾" deep.
Weight: A&B 15 lbs., C-F 18 lbs.

OPTIONAL

Front panel recessed 2½" with convenient side cut out for cable routing.

EMI/RFI FILTER

Triple noise protection:
Both common mode and differential mode, plus high frequency ground isolation.

10 OUTLETS

8 outlets switched, 2 outlets unswitched always "ON" for convenient AC power requirements.

INDICATOR LIGHT

Power to controller.
Power to switched 1 outlets.
Power to switched 2 outlets.

TIME DELAY, POWER UP

Time delay approximately 4 seconds between switched outlets 1 and switched outlets 2 (models C-F).

REMOTE POWER CONTROL BUS

4 Remote I/O connectors for either:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment down line.

MTBF
(MEAN TIME BEFORE FAILURE)

Per MIL-HDBK-217E
PC 874-C 108,897 Hrs.
PC 874-F 116,414 Hrs.

NOTE:
Specifications listed below for models A through F only. Models C & F are both UL and CSA, Models A, B & D are UL only.

SPECIFICATIONS FOR MODEL NUMBERS: PC 874 A-F, PC 420 A-F, PC 585 C-F, PC 585-1/MTD C-F, PC 585/MTD C-F

MODEL	A	B	C	D	F
A.C. VOLTAGE INPUT	90/135	180/270	90/135	90/135	180/270
A.C. VOLTAGE OUTPUT	90/135	180/270	90/135	90/135	180/270
HERTZ	47-63	47-63	47-63	47-63	47-63
CURRENT	12 AMPS	12 AMPS	24 AMPS	24 AMPS	24 AMPS
FULL LOAD-VOLT AMPS	1440 VA	2880 VA	2880 VA	2880 VA	5760 VA
CIRCUIT BREAKER	20 AMPS	20/20 AMPS	20/20/30	20/20/30	20/20/30
FILTER EMI/RFI	20 AMPS	20 AMPS	30 AMPS	30 AMPS	30 AMPS
OPERATING TEMPERATURE	0 TO 60°C	0 TO 60°C	0 TO 60°C	0 TO 60°C	0 TO 60°C
STORAGE TEMPERATURE	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C
ALTITUDE-MAXIMUM	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.
RELATIVE HUMIDITY	95% MAX.	95% MAX.	95% MAX.	95% MAX.	95% MAX.
POWER CABLE: AWG & LENGTH	14/3 9'	14/3 9'	10/3 15'	10/3 15'	12/3 15'
INPUT PLUG-NEMA	5-15P	—	L5-30P	L5-30P	—
MATING RECEPTACLES-NEMA	5-15R	N/A	L5-30R	L5-30R	N/A
OUTLETS-NEMA	5-15R	6-15R	5-15R	5-20R	6-15R

— NOT PROVIDED

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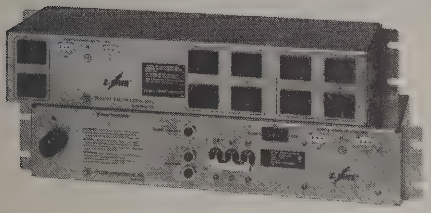
PC 500
SUN MICROSYSTEMS COMPATIBLE – CATALYST PROGRAM



RACK MOUNTED

Designed to fit standard 19" wide EIA STD. Rack 3½" high, 6¾" deep, with 1" inset mount. Weight: 18 lbs.

EMI/RFI FILTER

Triple noise protection:
Both common mode and differential mode, plus high frequency ground isolation.

10 OUTLETS

8 outlets switched, 2 outlets unswitched, always "ON" for convenient AC power requirements. IEC 320 rated at 10 AMPS/250VAC (VDE) or 15 AMPS/250VAC (UL/CSA).

PLUGS ARE OPTIONAL

TUV: Pin and sleeve 220-240V, 32A. IEC 309.
UL/CSA: Pin and sleeve 250V, 30A. IEC 309.
NEMA L6-30P 250V, 30A.

INDICATOR LIGHT

Power to controller.
Power to switched 1 outlets.
Power to switched 2 outlets.

TIME DELAY, POWER UP

Time delay approximately 4 seconds between switched outlets 1 and switched outlets 2, provides sequential power up through the 8 switched outlets.

REMOTE POWER CONTROL BUS

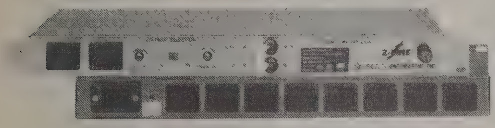
4 Remote I/O connectors for either:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment.

NOTE:
Specifications are listed below.

SPECIFICATIONS FOR MODEL NUMBERS PC 500	1050	1106	501	429
AGENCY	TUV	TUV	UL/CSA	UL/CSA
A.C. VOLTAGE INPUT	220-240	220-240	220-240	220-240
A.C. VOLTAGE OUTPUT	220-240	220-240	220-240	220-240
HERTZ	47-63	47-63	47-63	47-63
CURRENT	24 AMPS	24 AMPS	24 AMPS	24 AMPS
FULL LOAD-VOLT AMPS	5760 VA	5760 VA	5760 VA	5760 VA
CIRCUIT BREAKER	20/20/30 AMP	20/20/30 AMP	20/20/30 AMP	20/20/30 AMP
FILTER EMI/RFI	30 AMP	30 AMP	30 AMP	30 AMP
OPERATING TEMPERATURE	0 TO 60°	0 TO 60°	0 TO 60°	0 TO 60°
STORAGE TEMPERATURE	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C
ALTITUDE-MAXIMUM	10,000	10,000	10,000	10,000
RELATIVE HUMIDITY	95% MAX.	95% MAX.	95% MAX.	95% MAX
POWER CABLE/AWG & LENGTH	3x4.00 mm² 15'	3x4.00 mm² 15'	12/13 15'	12/3 15'
INPUT PLUG-NEMA	IEC 309 32A.	—	L6-30P	—
MATING RECEPTACLES	IEC 309 32A.	—	L6-30R	—
OUTLETS	IEC 320 10A.	IEC 320 10A.	IEC 320 15A.	IEC 320 15A.

— NOT PROVIDED

TPC 884
VOLTAGE SELECTABLE INTERNATIONAL SYSTEM



ASK ABOUT
48 HOUR
DELIVERY

■ The IEC Advantage

Equipment can be manufactured utilizing the IEC 320 inlet regardless of final destination.

RACK MOUNTED

Designed to fit standard 19" wide EIA STD. Rack 1¾" high, 7" deep. Weight: 8 lbs.

EMI/RFI FILTER

Dual Protection: Common mode, line to ground. Differential mode, line to line.

10 OUTLETS

8 on the rear and 2 on the front panel-switched, always on for convenient AC power requirements. IEC 320: rated at 10 AMPS/250VAC (VDE) or 15 AMPS/250VAC (UL/CSA) as well as 15 AMPS/125VAC (UL/CSA).

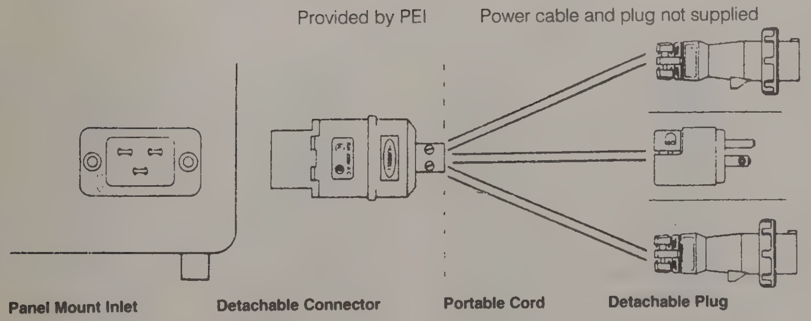
INDICATOR LIGHT

Power available to the 120VAC. System
Power available to the 240VAC. System

VOLTAGE SELECTABLE

Select to operate on 120VAC input: 15 AMP or 20 AMP
Select to operate on 220-240VAC input 15 AMP, 16 AMP or 20 AMP.
Please verify that the power input matches what you have selected.

NOTE
Specifications are determined via the input power you provide and the voltage selection switch. Please note the configurations listed below.



3-Wire 20A. 250VAC. IEC 309 plug for the North American Market.

3-wire 15A. 250VAC. NEMA 6-15P
3-wire 20A. 250VAC. NEMA 6-20P
3-wire 20A. 250VAC. NEMA L6-20P
3-wire 15A. 125VAC. NEMA 5-15P
3-wire 20A. 125VAC. NEMA 5-20P
3-wire 20A. 125VAC. NEMA L5-20P

3-wire 16A. 220-240VAC. IEC 309 plug for the International Market.

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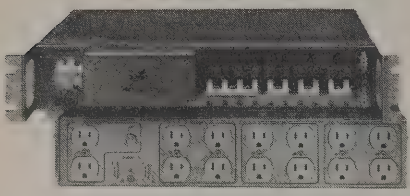
PC 300 and PC 300 MTD™

3-PHASE INPUT,
SINGLE PHASE OUTPUT



RACK MOUNTED
Only 3½" high, 14½" deep and 19" rack mounted. Recessed 2½" to either the front or back panel. Flush mounted panels are also available. Weight: 29 lbs.

EMI/RFI FILTER
30 amps per phase, triple noise protection. Both common mode and differential mode, plus high frequency ground isolation.

14 OUTLETS
Located on the back panel. 4 switched receptacles allotted per phase plus two utility outlets.

INDICATOR LIGHT
1 light to indicate "power on" to system. 3 additional lights to indicate "switched power on" to all phases (X,Y,Z).

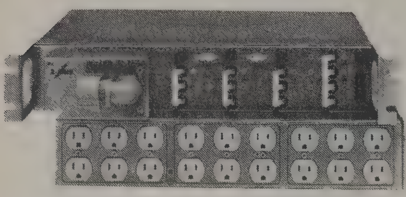
TIME DELAY, POWER UP
Time delay approximately 4 seconds between phase X, Y and Z provides Multiple Time Delay™ power up through the 12 switched outlets. (MTD models only)

REMOTE POWER CONTROL BUS
4 bussed remote I/O connectors allows for:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment down line.

NOTE:
Specifications listed below for models C, C/MTD, D, D/MTD.

PC 726 and PC 726 MTD™

3-PHASE INPUT,
SINGLE PHASE OUTPUT



RACK MOUNTED
Only 3½" high, 14½" deep and 19" rack mounted. Recessed 2½" to either the front or back panel. Flush mounted panels are also available. Weight: 29 lbs.

EMI/RFI FILTER
30 amps per phase, triple noise protection. Both common mode and differential mode, plus high frequency ground isolation.

18 OUTLETS
Located on the back panel. 6 switched receptacles allotted per phase.

INDICATOR LIGHT
1 light to indicate "power on" to system. 3 additional lights to indicate "switched power on" to all phases (X,Y,Z).

TIME DELAY, POWER UP
Time delay approximately 4 seconds between phase X, Y and Z provides Multiple Time Delay™ power up through the 18 switched outlets.

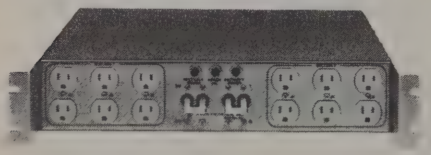
REMOTE POWER CONTROL BUS
2 bussed remote I/O connectors allows for:
A) Remote Power On/Off
B) Emergency shutdown with a mechanical, electronic or Thermo switching device.
C) Power up additional equipment down line.

NOTE:
Specifications listed below for models C, C/MTD, D, D/MTD. Models C & C/MTD are both UL and CSA. Models D & D/MTD are UL only.

SPECIFICATIONS FOR MODEL NUMBERS	PC 300, PC 300 MTD™		PC 726, PC 726 MTD™	
MODEL	C	D	C	D
A.C. VOLTAGE INPUT	120/208	120/208	120/208	120/208
A.C. VOLTAGE OUTPUT	90/135	90/135	90/135	90/135
HERTZ	47-63	47-63	47-63	47-63
CURRENT	24 AMPS	24 AMPS	24 AMPS	24 AMPS
FULL LOAD-VOLT AMPS	8640 VA	8640 VA	8640 VA	8640 VA
CIRCUIT BREAKER MASTER	4 POLE, 30 AMPS	4 POLE, 30 AMPS	4 POLE, 30 AMPS	4 POLE, 30 AMPS
CIRCUIT BREAKER–SECONDARIES	2 POLE, 20 AMPS	2 POLE, 20 AMPS	2 POLE, 20 AMPS	2 POLE, 20 AMPS
FILTER EMI/RFI	30 AMP/3 PH	30 AMP/3 PH	30 AMP/3 PH	30 AMP/3 PH
OPERATING TEMPERATURE	+5 TO +50°C	+5 TO +50°C	+5 TO +50°C	+5 TO +50°C
STORAGE TEMPERATURE	-40 TO +66°C	-40 TO +66°C	-40 TO +66°C	-40 TO +66°C
ALTITUDE-MAXIMUM	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.
RELATIVE HUMIDITY	90% MAX.	90% MAX.	90% MAX.	90% MAX
POWER CABLE: AWG & LENGTH	10/5 15'	10/5 15'	10/5 15'	10/5 15'
INPUT PLUG-NEMA	L21-30P	L21-30P	L21-30P	L21-30P
MATING RECEPTACLES–NEMA	L21-30R	L21-30R	L21-30R	L21-30R
OUTLETS–NEMA	5-15R	5-20R	5-15R	5-20R

SDC 1559

STEP DOWN VOLTAGE CONTROLLER



RACK MOUNTED
Designed to fit standard 19" wide IEC STD.
3.5" high. 17" deep.
Front panel recessed 2.5".

STEP DOWN VOLTAGE
Plug the SDC 1559 into European current and plug 125V equipment into the SDC 1559. This unit can be configured for step-up voltage applications. Contact factory for more information.

EMI/RFI FILTER
Common and Differential mode SDC 1559-C, & SDC 1559-D are filtered & have spike & surge protection.

12 OUTLETS
Six outlets in section 1 and six in section 2.

INDICATOR LIGHT
Power to controller.
Power to section 1.
Power to section 2.

SPECIFICATIONS FOR MODEL NUMBER SDC 1559 (A-D)				
MODEL	A	B	C	D
A.C. VOLTAGE INPUT	180/270	180/270	180/270	180/270
A.C. VOLTAGE OUTPUT	90/135	90/135	90/135	90/135
HERTZ	47-63	47-63	47-63	47-63
RATED CURRENT	24 AMPS	12 AMPS	24 AMPS	12 AMPS
FULL LOAD VOLT/AMPS	2880 VA	1440 VA	2880 VA	1440 VA
CIRCUIT BREAKER	20/20	20/20	20/20	20/20
EMI/RFI FILTER	—	—	30 AMPS	20 AMPS
OPERATING TEMPERATURE	0-60°C	0-60°C	0-60°C	0-60°C
STORAGE TEMPERATURE	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C	-40 TO +70°C
ALTITUDE MAXIMUM	10,000 FT.	10,000 FT.	10,000 FT.	10,000 FT.
RELATIVE HUMIDITY	95%	95%	95%	95%
POWER CABLE: AWG/LENGTH	3 x 4mm² 9'	3 x 2.5mm² 9'	3 x 4mm² 9'	3 x 2.5mm² 9'
NEMA INPUT POWER PLUG	—	—	—	—
NEMA OUTLETS	5-15R	5-15R	5-15R	5-15R
WEIGHT	65 lbs.	40 lbs.	65 lbs.	40 lbs.

— NOT PROVIDED

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eem

MINIGLOSSARY
CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

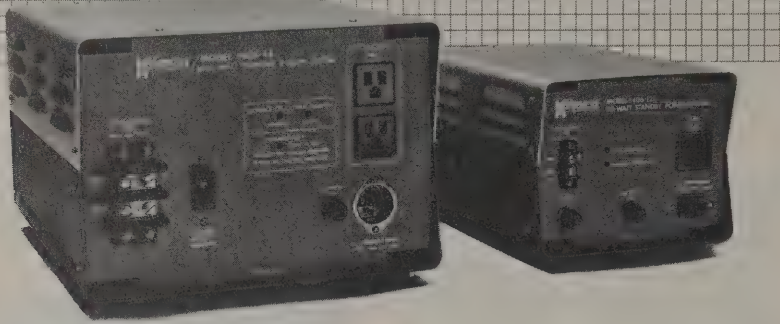
Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

Wilmore



DC-To-AC Inverters And UPS/Standby Power Systems

- **Power Ratings From 50 To 1000 Volt-Amperes**
- **Standard Input Voltages 12, 24, 48 Volts**
- **Highly Efficient**

Inverters and Standby Power Systems described on this page provide a three-level step waveshape output having peak, average and rms voltages that approximate those of a pure sine wave while maintaining high operating efficiencies comparable to square-wave output inverters. They are suitable for powering most sensitive electronic loads including personal computers, chart recorders, communications equipment, and test instruments. Most models also provide a 2:1 output-power surge capability for powering loads with high inrush current demands, such as small motors, heating elements, lighting, and small power tools. All models have excellent frequency stability (±0.15 Hz), wide operating ambient temperature range (–20˚C to 55˚C), and low idle-current demand.

DC-to-AC Inverters

Table 1 details the characteristics of Wilmore's heavy-duty portable inverters. Please note that only the 12-volt (or 24-volt for 1000-VA power level) input versions appear on the table. Other versions may be specified for 24-volt nominal and 48-volt nominal inputs. Simply replace the "12" in the model number with the desired nominal input voltage. Also, please note that 230-volt, 50-Hertz versions are available for all models. Replace "115" with "230" and "60" with "50" in the model number to specify such models. For example, a 1000-VA, 48-volt input, 230-Vac, 50-Hz output model would have the following number, Model 1404-48-230-50.

Standby Power Systems

Each Wilmore Standby Power System consists of a dc-to-ac inverter, a battery charger and sensing/transfer circuitry. In normal operation, commercial power is presented directly to the load and the System float charges the user's battery and monitors the ac line. When commercial power is interrupted, the sensing circuitry detects the loss of power and transfers the load to the inverter. This sensing and load transfer takes less than 15 milliseconds. When the commercial power returns, the sensing circuitry will sample the ac line for a period of 5 to 7 seconds to ensure that proper ac voltage is maintained. The reverse transfer from inverter operation to normal ac operation is then accomplished, also in less than 15 milliseconds. With the load again being supplied directly from the commercial line, the battery charger begins to recharge the user-supplied batteries.

Table 1. DC-to-AC Inverters

Output Power (Volt-Amps)	Nominal Input Voltage (Vdc)	Nominal Output Voltage And Frequency (Vac/Hz)	Dimensions (h" x w" x d")	Weight (Pounds)	Efficiency (Typical)	Model Number
50	12	115/60	4.2 x 5.2 x 7	6	60%	**1401-12-115-60**
250	12	115/60	7.7 x 9 x 12	31	80%	**1402-12-115-60**
300	12	115/60	7.4 x 11 x 8.7	25	80%	**1057-12-115-60**
500	12	115/60	8.7 x 12.7 x 11	44	80%	**1403-12-115-60**
1000	24	115/60	8.7 x 12.7 x 11	47	80%	**1404-24-115-60**

Table 2. Standby Power Systems

Output Power (Volt-Amps)	Battery Input Voltage (Vdc)	Battery Charger Current (Adc max)	Nominal Output Voltage And Frequency (Vac/Hz)	Dimensions (h" x w" x d")	Weight (Pounds)	Model Number
50	12	3	115/60	6.3 x 8.5 x 11.5	15	**1406-12-115-60**
50	24	2	115/60	6.3 x 8.5 x 11.5	15	**1406-24-115-60**
250	12	3	115/60	8.7 x 12.7 x 11	42	**1407-12-115-60**
250	24	2	115/60	8.7 x 12.7 x 11	42	**1407-24-115-60**
500	12	6	115/60	8.7 x 12.7 x 16	56	**1408-12-115-60**
500	24	3	115/60	8.7 x 12.7 x 16	56	**1408-24-115-60**
1000	24	3	115/60	8.7 x 12.7 x 16	60	**1408-24-115-60**

NEW

The first products in our economical Series 1630 inverters are now available.

- **Rack Mounted**
- **Regulated**
- **Stepped Quasi Sinewave**

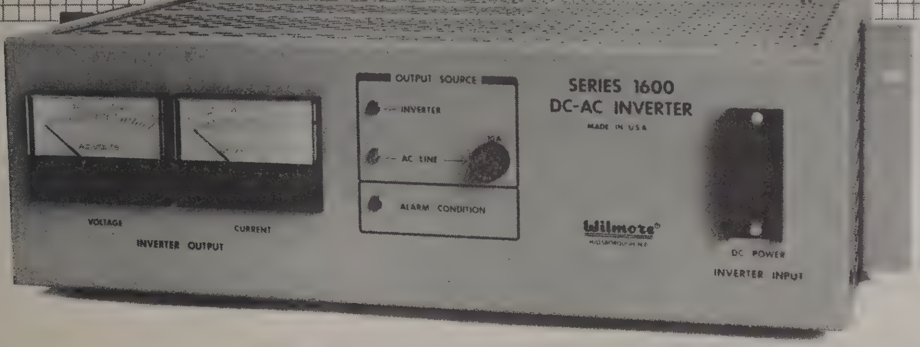
For more information, request Bulletin 3062

WILMORE ELECTRONICS CO., INC.

P.O. Box 1329, Hillsborough, N.C. 27278 • Telephone: (919) 732-9351
FAX: (919) 732-9359

Wilmore

Sine-Wave DC-To-AC Inverters



- **Sine-Wave Output**
- **Power Levels Starting At 500-VA**
- **24, 48, Or 130-Vdc Input**
- **Small, Lightweight**
- **78%-85% Efficient**

Wilmore Electronics introduces a completely new type of dc-to-ac power inverter for telecommunications and industrial applications. The sine-wave-output Series 1600 inverters are true "four-quadrant" power sources. That is, they can provide rated voltage and current regardless of the phase relation of these two power components. Not only are they well-suited to powering waveshape-sensitive equipment; these rack-mount inverters are compatible with many loads normally considered difficult for solid-state power inverters. High surge, nonlinear, high crest factor, and even half-wave-rectified loads can be powered by the Series 1600. In addition there are no practical limitations on allowable load power factor.

Inverter Specifications

The Series 1600 inverters have nominal dc input voltages of 24, 48, or 130 volts. The output waveform is a pure sine wave with very low total harmonic distortion (1-3%). Excellent frequency stability (±0.01 Hz) and a well-regulated output voltage (±1.5% versus dc input line and ±2.5% versus load) are additional features of these highly efficient inverters.

The 500-VA, 120-Vac output inverter measures 5.20″ high x 17.00″ wide x 13.25″ deep. (Weight is approximately 23 lbs.) All versions are designed for 19-inch or 23-inch rack mounting.

Optional Transfer Circuitry

These dc-to-ac inverters are available with optional internal high-speed transfer circuits to provide inverter-to-line or line-to-inverter automatic load transfer. ("Line" refers to commercial ac power.)

In the inverter-preferred configuration, the load power is normally provided by the inverter. However, if the inverter output is interrupted, an internal transfer switch automatically transfers the load from the inverter to commercial ac power. Because the transfer time between inverter and line is short (2 msec. typical) and because the inverter is automatically synchronized in both frequency and phase to the commercial power line, such transfers are normally not detected by even highly sensitive loads. Upon restoration of inverter power, there is a delay of approximately four seconds, during which frequency and phase synchronization are gradually re-established, and then transfer back to inverter power automatically takes place.

In the line-preferred configuration, the load power is normally provided by the commercial ac line and the inverter operates in the standby mode.

Protection

Protection against overloads and short circuits on the output is provided electronically. Recovery to normal operation is automatic upon removal of the fault.

Electronic protection is also provided for undervoltage or overvoltage on the input. Return to normal operation is automatic.

Protection against accidental reversal of the input-voltage polarity during installation is provided by a shunt diode working in conjunction with the front-panel circuit breaker.

Series 1600 New Product Development

The Series 1600 is a rapidly expanding line of rack-mount dc-to-ac sine-wave inverters, beginning with the 500-VA, 120-Vac output version. New versions, varying in power level, input voltage, output voltage and frequency are continually being added.

Please contact Wilmore's sales department for the availability of inverters meeting your power requirements.

Custom-Designed Sine-Wave Power

The majority of our work is designing and manufacturing custom power conversion equipment. If you have an application requiring a low-distortion, well-regulated ac power source, our unique sine-wave power circuitry can make it lighter, smaller and electrically rugged. Whether you would like a quotation on your completed specification or just want to discuss your application, our New Products Group would like to hear from you.

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Xentek
EXTREME ISOLATION TRANSFORMERS

FEATURES

- Commercial, industrial and medical applications
- Guaranteed to stop noise problems
- Eliminates power and system ground loops
- Up to 160dB common-mode rejection
- UL listed
- CSA approved
- VDE certified models
- TWO-YEAR WARRANTY

SPECIFICATIONS

Input:
Nominal voltage ±15% (1 KVA and up); ±10% (750 VA and below); 50-60 Hz.

Load Regulation:
±3% of input voltage, no load to full resistive load.

Common Mode Rejection:
160dB (-3x models); 140dB (-2x models); 120dB (-1x models).

Normal Mode Rejection: 60dB.

Isolation:
Resistance: 10,000 MΩ.
Capacitance: 0.0001pf (-3x models); 0.001pf (-2x); 0.005pf (-1x).

Leakage Current:
≤50μA (EIT, TRI and VDE Series).
≤10μA (LGT Series).

Dielectric Strength:
2500VAC (all EIT, TRI and LGT);
3750VAC (all VDE Series).

Efficiency: Greater than 92%.

Operating Temperature:
Full load up to 40°C ambient.

Approvals:
UL 1012; CSA 22.2-066 and UL 544 (ordinary patient care) on all models.
VDE 0550 on VDE prefix models.
UL 544 (patient connected) on all LGT Series.

250 - 750 VA SINGLE PHASE MINI-ISOs

INPUT	OUTPUT	250 VA	500 VA	750 VA
115V	115V	EIT 250-11	EIT 500-11	EIT 750-11
230V	230V	EIT 250-12	EIT 500-12	EIT 750-12
230V	115V	EIT 250-15	EIT 500-15	EIT 750-15
115V	230V	EIT 250-16	EIT 500-16	EIT 750-16

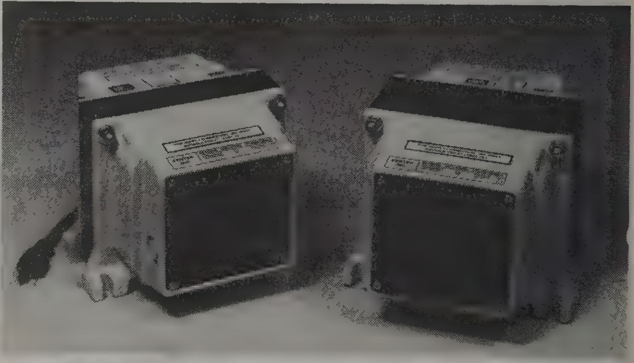
Note: all models are equipped with 6.5' line cord and duplex receptacles.

1.0 - 5.0 KVA SINGLE PHASE

INPUT	OUTPUT	1.0 KVA	2.5 KVA	5.0 KVA
115/230V[1]	115/230V[1]	EIT 1.0K-20	EIT 2.5K-20	EIT 5.0K-20
115V[2]	115V[3]	EIT 1.0K-21	EIT 2.5K-21	
230V	230V	EIT 1.0K-22	EIT 2.5K-22	
115V	115/230V	EIT 1.0K-23	EIT 2.5K-23	
230V	115/230V	EIT 1.0K-24	EIT 2.5K-24	
230V	115V	EIT 1.0K-25	EIT 2.5K-25	
115V	230V	EIT 1.0K-26	EIT 2.5K-26	
Universal[4]	120/240	EIT 1.0K-27 VDE 1.0K-27	EIT 2.5K-27 VDE 2.5K-27	EIT 5.0K-27 VDE 5.0K-27
Universal	120V	EIT 1.0K-28	EIT 2.5K-28	EIT 5.0K-28
Universal	240V	EIT 1.0K-29	EIT 2.5K-29	EIT 5.0K-29

Note: models shown are rated for 140dB CMR. For 160dB CMR, replace the "-2" in the model number suffix with "-3", e.g., for 1.0 KVA, 115VAC input/output with 160dB CMR, specify model EIT 1.0K-31.

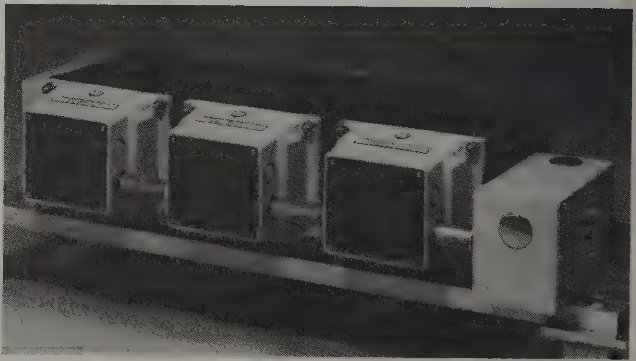
[1] All multiple voltage input and output connections are via barrier strip.
[2] All single voltage input connections are via 6.5' line cord.
[3] Single voltage output connections: 1KVA – duplex receptacle; 2.5KVA – single Twistlok receptacle.
[4] Universal input: 100/120/200/220/240VAC.



3.0 - 15 KVA THREE PHASE

INPUT	OUTPUT	3.0 KVA	7.5 KVA	15.0 KVA
208Y/120	208Y/120	TRI 3.0K-20	TRI 7.5K-20	TRI 15K-20
240 Delta	208Y/120	TRI 3.0K-21	TRI 7.5K-21	TRI 15K-21
480 Delta	208Y/120	TRI 3.0K-22	TRI 7.5K-22	TRI 15K-22

Note: models shown are rated for 140dB CMR. For 160dB CMR, replace the "-2" in the model number suffix with "-3", e.g., for 3.0 KVA, 208Y/120 input/output with 160dB CMR, specify model TRI 3.0K-30.



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Life-Guard™ Medical Isolation Transformers

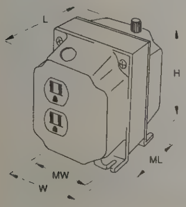
FEATURES

- UL 544 Listed for isolated patient connected applications
- Leakage Current less than 10µA
- Hospital Grade line cord and receptacles on most models
- TWO-YEAR WARRANTY

Special care must be taken in medical and dental applications to *isolate* the equipment from common-mode noise and ground-loops and *insulate* the equipment against potentially harmful leakage currents.

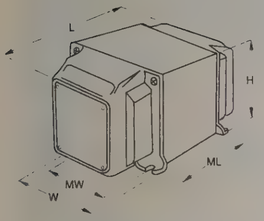
All Xentek extreme isolation transformers comply with UL544 leakage requirements for non-patient connected equipment. And Xentek Life-Guard extreme isolation transformer models comply with UL544 requirements for isolated patient connection.

Xentek Life-Guard extreme isolation transformers offer the ultimate in leakage current protection. These top-quality units are fully certified under UL544 for isolated, patient connected applications. Leakage current is limited to under 10µA. And all LGT Series models provide complete protection against common-mode noise and transients.



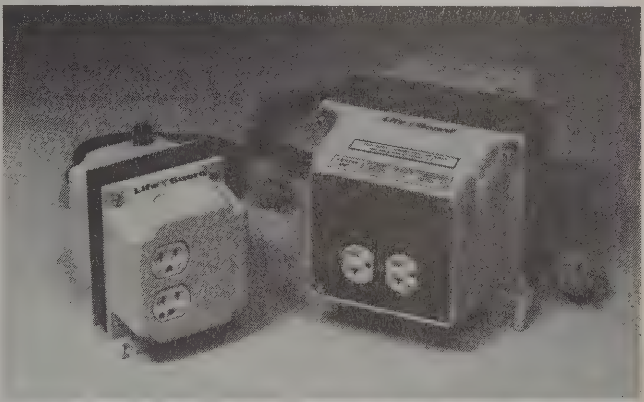
DIMENSIONS

		Size (in)			Mounting	
Series	VA	H	W	L	MW	ML
LGT	125	5.75	4.38	6.00	3.50	2.75
EIT	250	5.75	4.38	6.00	3.50	2.75
LGT	250	5.75	4.38	6.75	3.50	3.50
EIT	500	5.75	4.38	6.75	3.50	3.50
EIT	750	5.75	4.38	8.00	3.50	4.75



DIMENSIONS

		Size (in)			Mounting	
Series	VA	H	W	L	MW	ML
LGT	500	6.50	8.50	9.75	7.25	3.50
LGT	750	6 50	8.50	10.75	7.25	4.50
EIT	1.0K	6.50	8.50	9.75	7.25	3.50
VDE	1.0K	6.50	8.50	9.75	7.25	3.50
LGT	1.3K	6.50	8.50	11.50	7.25	5.25
EIT	2.5	6.50	8.50	11.50	7.25	5.25
VDE	2.5	6.50	8.50	11.50	7.25	5.25
LGT	2.5	6.50	8.50	16.25	7.25	10.0
EIT	5.0K	6.50	8.50	16.25	7.25	10.0
VDE	5.0K	6.50	8.50	16.25	7.25	10.0



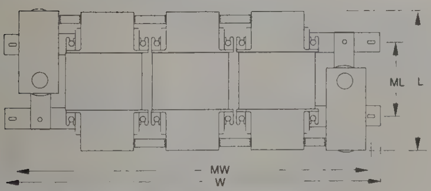
125 VA - 2.5 KVA MEDICAL ISOLATORS

INPUT: 120VAC **OUTPUT: 120VAC**

RATING	MODEL	INPUT	OUTPUT
125 VA	LGT 125-11	Hospital Grade Cord[1]	Hosp. Grade Duplex Recep.
250 VA	LGT 250-11	Hospital Grade Cord	Hosp. Grade Duplex Recep.
500 VA	LGT 500-21	Hospital Grade Cord	Hosp. Grade Duplex Recep.
750 VA	LGT 750-21	Hospital Grade Cord	Hosp. Grade Duplex Recep.
1.3 KVA	LGT 1.3K-20	Barrier	Barrier
2.5 KVA	LGT 2.5K-20	Barrier	Barrier

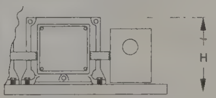
Note: models shown with "-2" in the model number suffix are rated for 140dB CMR. For 160dB CMR, replace "-2" with "-3", e.g., for 750 VA with 160dB CMR, specify model LGT 750-30.

[1] Models from 125VA to 750VA are equipped with hospital grade 6.5' line cord and duplex receptacles.



TRI SERIES DIMENSIONS

	Size (in)			Mounting	
KVA	H	W	L	MW	ML
3.0	7.50	38.5	9.75	36.5	3.50
7.5	7.50	38.5	11.5	36.5	5.25
15.0	7.50	38.5	16.25	36.5	10.0



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MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
0000	0	8-1	① NUL	② DLE	③ DS	④	⑤ SP	⑥ &	⑦ -	⑧					⑨	⑩	⑪	⑫ 0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	
				11				11				11	11	11		11	11	11	Zone Punches
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

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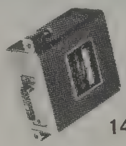
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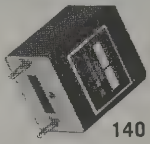
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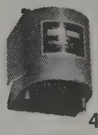
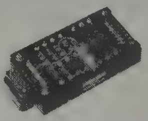

416-3


916 (Flat Pack)

980-1

	MODEL	Output Power	Output Voltage	Output Frequency	Input Signal Frequency	Input Impedance	Gain	Power Required	Temperature Range
AMPLIFIERS FOR A.C. SERVO MOTORS	200-HP	3.5 W	40 VCT	400 Hz	400 Hz	10K	2,500	28 VDC	—55°C + 125°C
	200-5	3.5 W	40 VCT	400 Hz	400 Hz	10K	5,000	28 VDC	—55°C + 125°C
	930	3.5 W	40 VCT	400 Hz	400 Hz	250K	2,000	28 VDC	—55°C + 125°C
	200-8	3.5 W	40 VCT	400 Hz	400 Hz	10K	2,500	115 V 400 Hz	—55°C + 125°C
	216B	6 W	40 VCT	60 Hz	60 Hz	10K	1,000	28 VDC	—55°C + 85°C
	140	6 W	40 VCT	400 Hz	400 Hz	50K	1,000	28 VDC	—55°C + 125°C
	141	6 W (90°)	40 VCT	400 Hz	400 Hz	30K	1,000	28 VDC	—55°C + 125°C
	416-3	16 W	40 VCT	400 Hz	400 Hz	10K	1,000	28 VDC	—55°C + 71°C
	416A/D	16 W (0°/90°)	40 VCT	400 Hz	400 Hz (2)	10K	1,000	28 VDC	—55°C + 100°C
	416M	16 W (90°)	40 VCT	400 Hz	DC (2)	10K	200	28 VDC 115 V 400 Hz	—55°C + 125°C
	159	16 W	40 VCT	60 Hz	60 Hz	10K	1,000	28 VDC	—55°C + 100°C
	159A/D	16 W (0°/90°)	40 VCT	60 Hz	DC	100K	1,000	28 VDC	—55°C + 100°C
	174	40 W (90°)	40 VCT	60 Hz	60 Hz	20K	1,000	28 VDC	
	956B	40 W (90°)	40 VCT	400 Hz	400 Hz	10K	1,000	28 VDC	—55°C + 100°C
	956C	40 W (90°)	40 VCT	400 Hz	DC	10K	500	28 VDC 115 V 400 Hz	—55°C + 100°C
	170-1	100 W (90°)	40 VCT	400 Hz	400 Hz	10K	100	28 VDC	—55°C + 85°C
	170-3	180 W (90°)	36 VCT	400 Hz	400 Hz	10K	1,000	28 VDC	—55°C + 85°C
	MODIFICATIONS to gain, input impedance, signal frequency, and power level are available. Matching transformers for driving motors at other volatages in stock.								
LINEAR D.C. POWER AMPS	941	50 W (Short Proof)	±10V	DC to 1 KHz	DC to 1 KHz	10K	100 (ADJ)	12 VDC	—55°C + 85°C
	916	110 W	±20V	↓	↓	↓	3 x 10^5	28 VDC —15 VDC	—55°C + 100°C
	987-17	200 W ↓	±20V	↓	↓	↓	10	28 VDC ±15VDC	—55°C + 71°C
	980-1S	500 W ↓	±50V	↓	↓	↓	100	115 V 50-400 Hz	—55°C + 71°C
	980-28	1350 W ↓	±52V	↓	↓	↓	100	50-400 Hz 3 Phase (1 Phase Available.)	—55°C + 71°C
	980-27	3000 W ↓	±95V	↓	↓	↓	100	105 VDC and AC Fan Power	
	MODIFICATIONS to gain, input impedance, signal frequency, power level, and operating temperature.								
SYNCHRO AMPLIFIERS	180-1	5W	11.8V Synchro	400 Hz	400 Hz SIN/COS	50K	3'	±15 VDC	—55°C + 100°C
	180-2	5W	90V Synchro	400 Hz	400 Hz SIN/COS	50K	3'	±15 VDC	—55°C + 100°C
	180-3	5W	90V Synchro	50/60 Hz	50/60 Hz SIN/COS	50K	3'	±15 VDC	—55°C + 100°C
MODULATORS AND DEMODULATORS	312	Full Wave	10V	DC	60 Hz	10K	10	28 VDC 115V Reference	—55°C + 125°C
	334-1	Full Wave	50V	DC	400 Hz	10K	180	28 VDC 115V 400 Hz	—55°C + 125°C
	334-2	Full Wave	30V	DC	400 Hz	125K	1	115V 400 Hz	—55°C + 71°C
	312-1	Full Wave	10V	DC	600 to 5000 Hz	10K	10	28 VDC 115V Reference	—55°C + 125°C
	350-1	Full Wave	15V	DC	400 Hz	10K	10	28 VDC 115V 400 Hz	—55°C + 125°C
	MODIFICATIONS to gain, output voltage and input impedance available.								

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CONTROL TECHNOLOGY ELECTRONICS, CTC CANADA LTD., 434 Isabey St., St. Laurent, Quebec, H4T 1V3 • 514-733-3279 • FAX 514-733-2132

DIGITAL • ANALOGUE CONTROL SYSTEMS

STANDARD AND CUSTOM DESIGNED

CTC
SERVO ELECTRONICS • INDICATORS • SPECIAL SYSTEMS • ACTUATORS

Servo Indicators
Servo Actuators
Servo Repeaters
Two Speed Servos
Servo Computers
Data Transmission Systems

Computer Interface Systems
Analogue to Digital Converters
Process Controllers
Microprocessor based Control Systems

- Units available which will meet applicable MIL Specifications
- Devices designed to operate with A.C., D.C., synchro or resolver command signals.
- Units now in use on numerous systems involving:

Simulators	Ground Support	Aircraft instrumentation
Fire Control	Missile Tracking	Missile instumentation
ASW	High Accuracy Positioning	Stable Platforms

- **Digital Signal Level Converters Available:**
  - RS-232C TO MIL-STD-422
  - MIL-STD-188C TO RS-422
  - RS-422 TO MIL-STD-188C
  - RS-422 TO RS-232C
- Special systems can be designed in accordance to your detailed specifications. CTC will also design "Interface" equipment to integrate major control systems.

INDICATORS

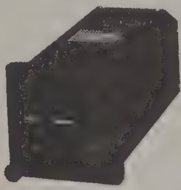
SYNCHRO AND SERVO REPEATERS

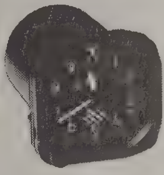
MS-33639 Case (1 in.)

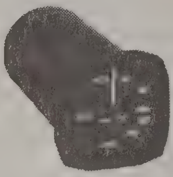
MS-33639 Case (2 in.)

MS-33638 Case (3 in.)

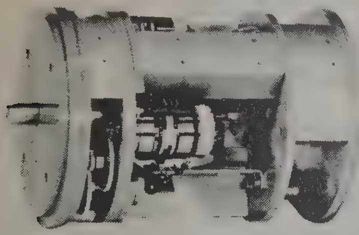
SIMULATOR INSTRUMENTS

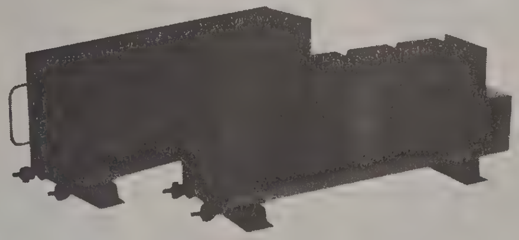

Mach Air Speed

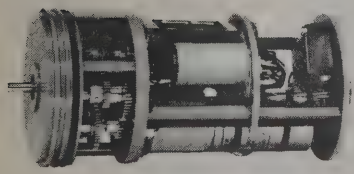

Altimeter

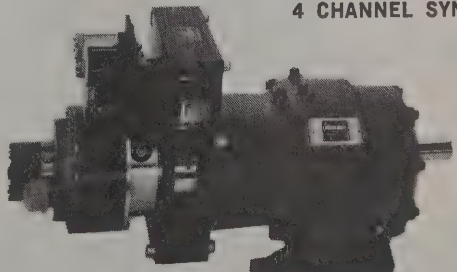

Air Speed

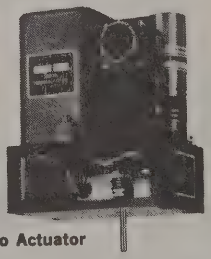
SERVO ACTUATORS


CS-202-2 300 lb. in. actuator


4 CHANNEL SYNCHRO AMPLIFIER


CS-198 250 oz. in. 0.1% accuracy actuator


Antenna Pedestral Azimuth Servo Drive

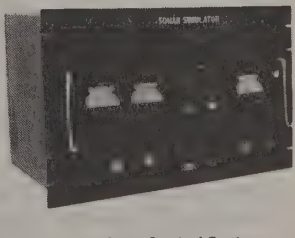

Custom Servo Actuator

SPECIAL CONTROL SYSTEMS

WIND SPEED AND DIRECTION INDICATOR
Diagnostic Test Equipment

Shipboard Weapon Control System

GYRO SELECT
REPEATER SELECT
Shipboard Gyro Select Control Box



Simulator Control System

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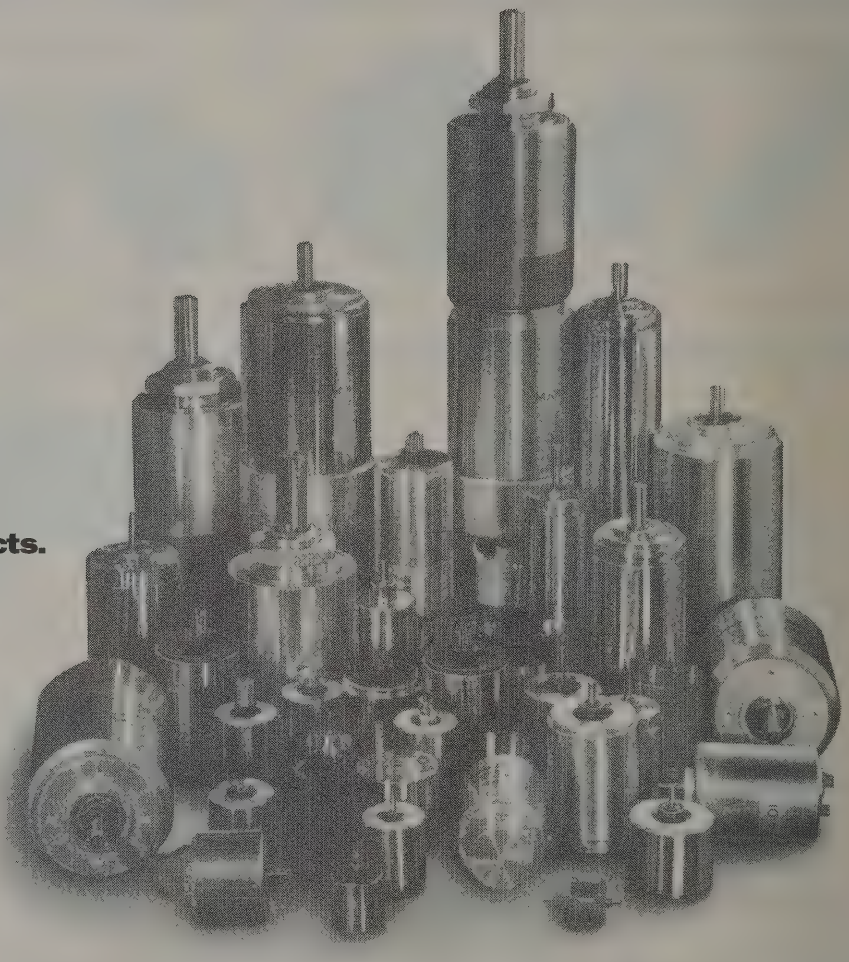

If you specify components for:
- Sampling systems.
- Asbestos pumps.
- Loggers & monitors.
- Respirators
- Gas analyzers.
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- Vacuum pumps.
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- Size: 3/8" - 4 3/4" diameters (10mm - 120 mm).
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- Double shafts.
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TS PRODUCTS ➡ *Motion Products*

LINEAR/ROTARY ACTUATORS FOR MICRO-POSITIONING
CLOSED/OPEN-LOOP CONTROLLERS FOR IRONLESS-CORE DC-MOTORS
CUSTOM MOTION SYSTEMS • OEM CONFIGURATIONS

µ-PROCESSOR CONTROLLERS

CONTROL2 *SMARTBOX*

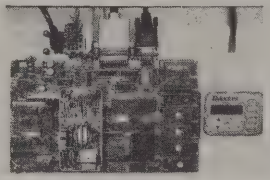
Primarily-designed for Linear and Rotary Actuators, **CONTROL2** links most DC motors to any computer via RS-232/IEEE-488. Closing the position loop through A-QUAD-B encoders, it provides position control by a pseudo-PID-type algorithm operating through an external velocity servo. With programmable start and stop ramps to accommodate various motor dynamics and loads, a comprehensive ASCII command structure provides operational flexibility. A JOYSTICK with programmable response controls six axes from front-panel or optional remote location.

Continuously augmented from user suggestions, **CONTROL2** features zero overshoot on point-to-point movements and high stability in the presence of external loads.

FEATURES

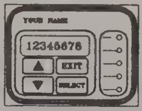
- Simultaneous 2/4/6 axes.
- Built-in progmble Joystick.
- Jog/Slew functions.
- Backlash compensation.
- Triple encoder filtering.
- Limit detection/backoff.
- Emerg STOP functions.
- Power condition outputs.
- Motionless power ON/OFF.
- Rackmount option.
- Accepts ext motor pwr.
- Watchdog timer.
- Remote E-Stop inputs.
- Int non-volatile memory.
- External STOP input.
- Concurrent comms.
- Programmable ramps.
- Vel mod during movement.
- Conditional movement.
- H/P HCTL-2000 Counters.
- 16/32/48 TTL inputs.
- 8 TTL outputs.
- Motion condition outputs.
- Int/Ext Status Indicators.
- 1/2/4X counting factors.
- External limit switches.
- Power OFF coord retention.
- 1ms-2.4hr Delay.
- EMI shielding option.
- Remote Terminal option.

CONTROL3



Stand-alone, programmable multi-axis DC-motor/A-QUAD-B encoder Controller in 10"x12"x2" modules with Remote Panel and built-in Servo for OEM environments. Designed to be *customized* and installed into small spaces. Controls Linear/Rotary Actuators as well as many types of DC motors. Executes an internally-stored program or ASCII commands from RS-232/IEEE-488 Host computer.

- 32 axes Master/Slave.
- Written in "C" for customization.



Remote Panel manages menu information.

IRONLESS-CORE DC-MOTORS

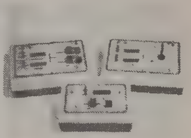
Our components feature formed cylinder and flat armature configurations with *high acceleration and deceleration* due to absence of moving heavy iron laminations or magnets.

BENEFITS High torque/size (weight) ratio • low acoustic/electronic noise • long brush life • vibrationless • straight-line torque/velocity response

MANUAL CONTROLLERS

1000-SERIES

INTEGRATED [1000INT]



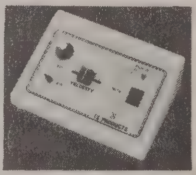
Controlling one or two DC motors, the 1000INT-1, -2, -J are our smallest, lowest-cost, open-loop Controllers with position display and built-in velocity servo. • Joystick version • 6-digit Position Display for each axis • 2x/4x Encoder Counting • 10:1 Slewing and Jogging Range • Limit indicators • Computer interface option

MODULAR [1000MOD]

These Controllers handle 1, 2, and 3 DC motors constructed from modules — Speed Controller • Joystick • Position Display • Position Entry • Mainframe • Remote Control • Power Supply

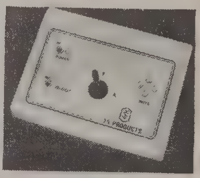
1200-SERIES

4-AXIS SPEED CONTROLLER



A simple DC-Motor mover for open-loop control, the 1200SC controls 1 out of 4 motors — 10:1 Slewing speed range • Direction selection • Limit sensing with backoff • Small step JOG function • 1200SCC computer-interface • 1200-OEM version.

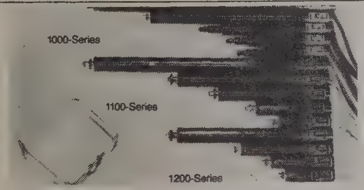
2-AXIS JOYSTICK



Simultaneously controlling two-axes, the 1200J's joystick feels elegant with fast/slow ranges. With a simple computer-interface, the 1200JC, duplicates all front panel functions. Built on a single PCB, the 1200J-OEM version economically fits into your system.

ACTUATORS

LINEAR

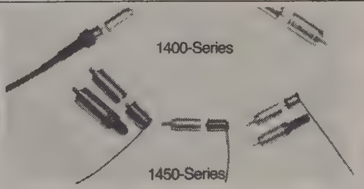


1000-Series High-quality, high-precision for semiconductors, optics, metrology, medicine. • Non-rotating plunger • Position encoder • .5"-6" travel • 100 lb thrust max • 15mm/sec max • 2.5nm resolution min • 2µm/in accuracy • Integral velocity servo • limit-of-travel/torque sensor • Axial/Side cable discharge.

1100-Series Smaller, with encoder for closed-loop operation • Half length of 1000-series • .25"-12" travel • Visual position display • Push/pull adapter • Axial or side cable discharge.

1200-Series Smallest, simple mover • .25"-18" travel • Open-loop operation • Push/pull adapter option • Many custom options.

ROTARY



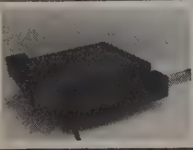
1400-Series

- Built-in encoder for *closed-loop* applications.
- Up to 640,980 counts per revolution.
- Smooth velocity from .04 to 1300 RPM.
- Torques to 2514 in-lb.
- 18 gearratios available.

1450-Series

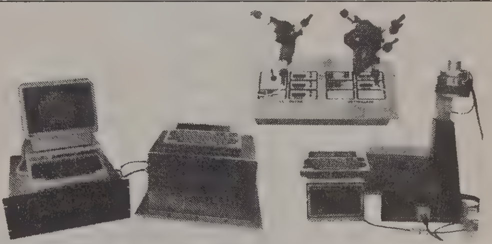
- Similar to 1400-series but 3/4" shorter.
- Encoderless for *open-loop* applications.

SLIDES—TABLES—STAGES



1300-Series ROTARY Heavy-duty, high-accuracy, robust construction for abusive environments • 6" dia • 4" dia.
1500-Series ROTARY Compact; closed-loop and open-loop.
1600-Series LINEAR Ultra-Compact, low-profile, single axis with integral leadscrew • gang into X/Y/Z • closed-loop operation.
CUSTOM STAGE ASSEMBLIES Linear/rotary motion subsystems assembled to your specifications from new design or our vendors.

CUSTOM MOTION SYSTEMS



Using our own or other technologies, we meet your complete motion, mechanical fit, and delivery time specifications. For a quick solution, we use our **CONTROL2**. Instead of complex cams and open-loop control, we use **CONTROL3** for programmable synchronized movement. Replace bulky, inefficient movements with our compact, cost-effective designs.

TS PRODUCTS welcomes the opportunity to supply high-quality motion-producing and motion-controlling products. Although we pay special attention to one-of-a-kind needs, we emphasize OEM configurations of our standard products. Please talk to one of our applications sales engineers about your special needs. Qualifying OEMs receive a quantity discount. Request our dimensional catalog.

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SI UNITS

RELATIVE QUANTITY SYMBOLS

≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

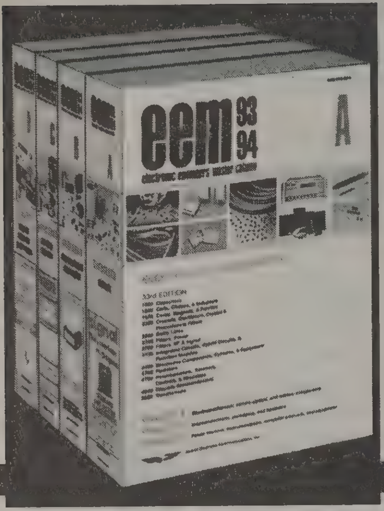
PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2m\upsilon^{2}$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	$J\ kg^{-1}$	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	$moles/dm^3$
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	$H\ m^{-1}$	—	henry/metre
permeability, vacuum	μ_o	$H\ m^{-1}$	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	$F\ m^{-1}$	—	farad/metre
permittivity, vacuum	ε_o	$F\ m^{-1}$	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	$J\ s^{-1}$
pressure	p	pascal	Pa	$N\ m^{-2}$: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u, υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	$m\ s^{-1}$	—	—
velocity of sound	υ	$m\ s^{-1}$	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	$kg\ m\ s^{-2}$ or mg



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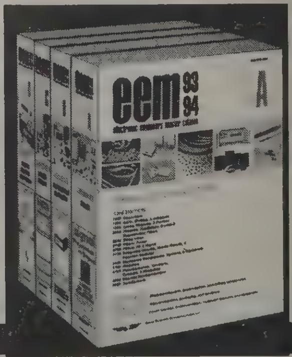

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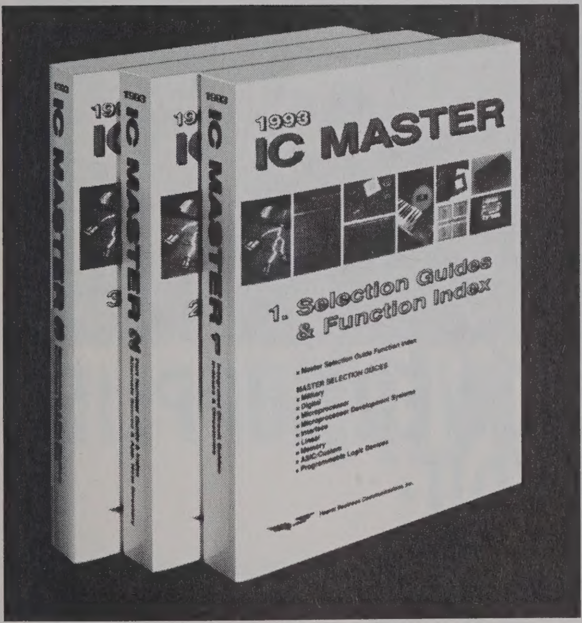
SSSSSUPER
TTTTTIME
SSSSSAVER!



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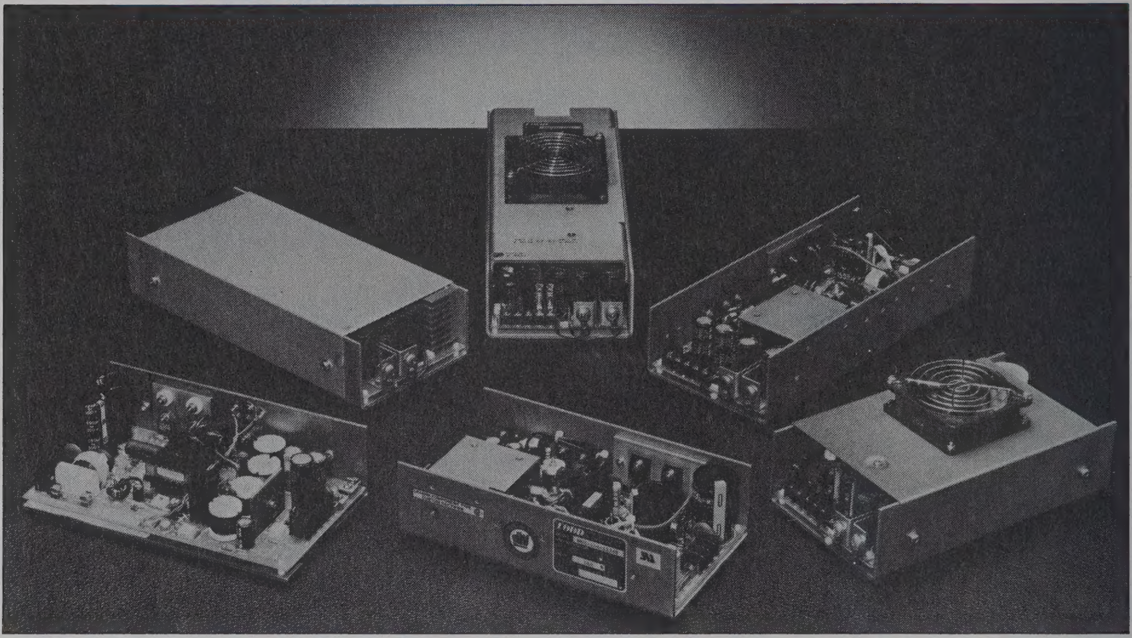

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